Project no.:	2021_0067
Employer:	AS Augstsprieguma tikls Elering AS
Consultant	Skepast&Puhkim OÜ Laki põik 2, 12915 Tallinn Telefon: +372 664 5808; e-post: info@skpk.ee Registrikood: 11255795;
Date	17.12.2021

RIGHT-OF-WAY STUDIES ON THE MAIN LAND ROUTE CORRIDORS

Final report

SKEPAST & PUHKIM

Version	**3**
Date	**17.12.2021**
Authors:	**Anni Konsap, Kati Kraavi, Sander Lõuk, Raivo Damkevics**
Photo credits:	**Sven Zacek**
Project no.	**2021_0067**

SKEPAST&PUHKIM OÜ
Laki põik 2
12915 Tallinn
Registrikood 11255795
tel +372 664 5808
e-mail info@skpk.ee
www.skpk.ee

Contents

Annexes

Annex 1. Online application with spatial data:
https://gis.skpk.ee/portal/apps/MapSeries/index.html?appid=e55f17b56ac74c38a6870231f9238bd4 (version dated 17.12.2021)

Introduction

This report gives an overview of the work to be done to determine the main land route corridors of the electricity transmission grid from Lihula, Sindi and Kilingi-Nõmme substations in Estonia and from Ventspils, Dundaga, Tume, Užava and Aloja substations in Latvia toward the Baltic Sea and an overview of the initial corridor descriptions. This report is the final report for right-of-way studies on the main land route corridors and presents designing of alternatives for corridors based on the methodology, analysis to identify the most appropriate route corridors based on data available from public sources, presents options for preferred corridors based on comparative criteria and gives recommendations for future processes.

The final alternatives of the route corridors and their suitability must be specified during public procedure within an inclusive (planning) process and a preparation of a detailed impact assessment. During this, data used (eg areas with building design conditions, land use, etc.) during the initial analyses must be updated so that the final conclusions drawn are appropriate and applicable.

An integral part of this analysis is an online application with spatial data and the results of the analyses.

1. Description of the methodology

The following methodology gives an overview of the work to be done to determine the main land route corridors of the electricity transmission grid in Estonia from Lihula, Sindi, Kilingi-Nõmme and in Latvia from Ventspils, Dundaga, Tume, Užava and Aloja substations toward the Baltic Sea. The aim of the transmission grid is to create necessary preconditions for an offshore wind park to be planned in close cooperation of Estonia and Latvia.

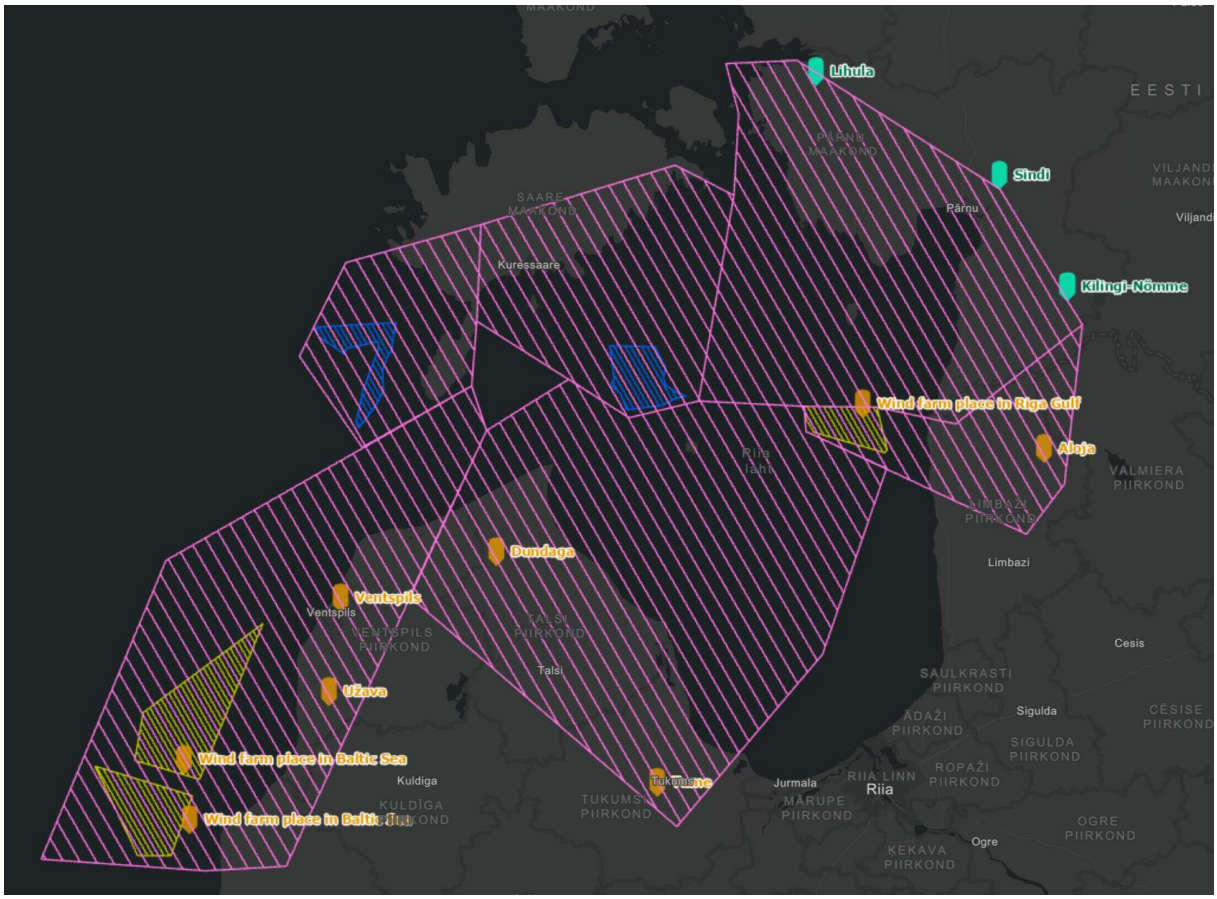


Figure 1. Substations of Latvia and Estonia and area of interest for possible route corridors.

In the course of the work, it is necessary to describe possible alternatives for the route corridors (see paragraph 2), assess their initial suitability and create a preference for the most suitable route corridor. Among other things, the transition points of the underground cable to the overhead cable (coming from sea to land) must be defined.

The width of the corridor to be sketched and analysed is 120 meters. The width consists of the protection zone of the high voltage line, which is 40 meters on both sides of the route axis (see Figure 2) and a buffer zone of 20 meters on both sides of the protection zone, giving the necessary room for adjusting the corridor in the next steps of the planning process.

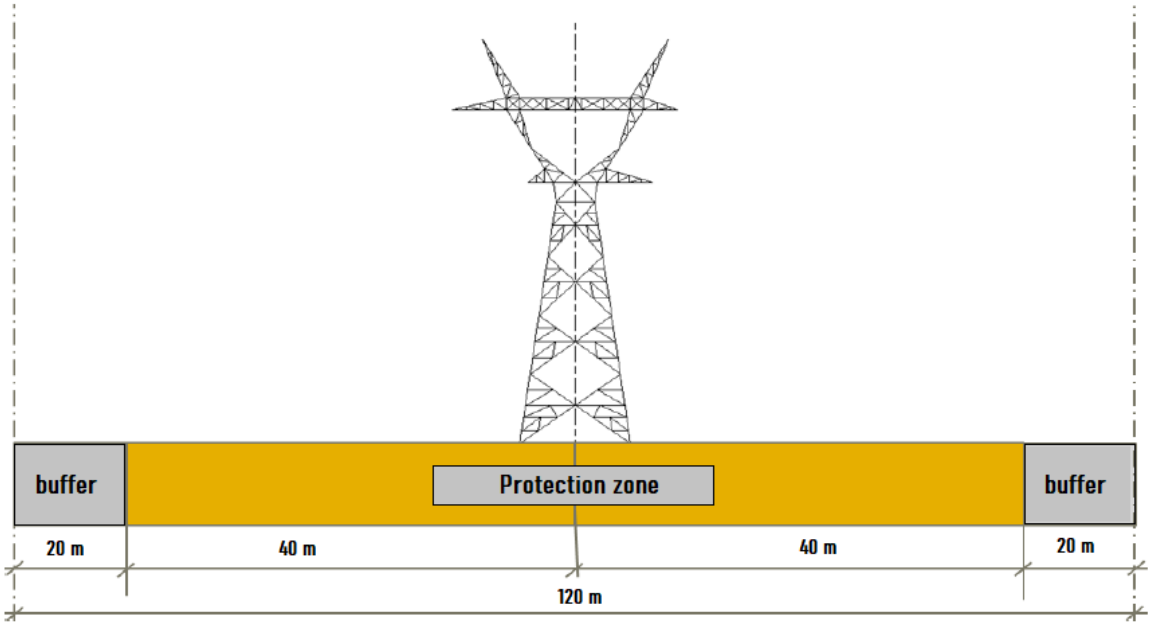


Figure 2. Description of route corridor with protection and buffer zones.

Exclusion method is used to describe possible route corridors - exclusion of unsuitable areas based on agreed criteria (see Chapter 1.1.). This results in areas where potential corridors could be located. Within these areas, route corridors are outlined, which then are compared based on qualitative and quantitative criteria (see Chapter 1.2.).

As a result of the comparison of route corridors, preferences regarding route corridors are formed. As a result of the work, the preference for the most suitable route corridor location is presented from each substation, which needs to be supplemented and specified in the subsequent planning and impact assessment process.

2. Route description

2.1. Criteria for route description

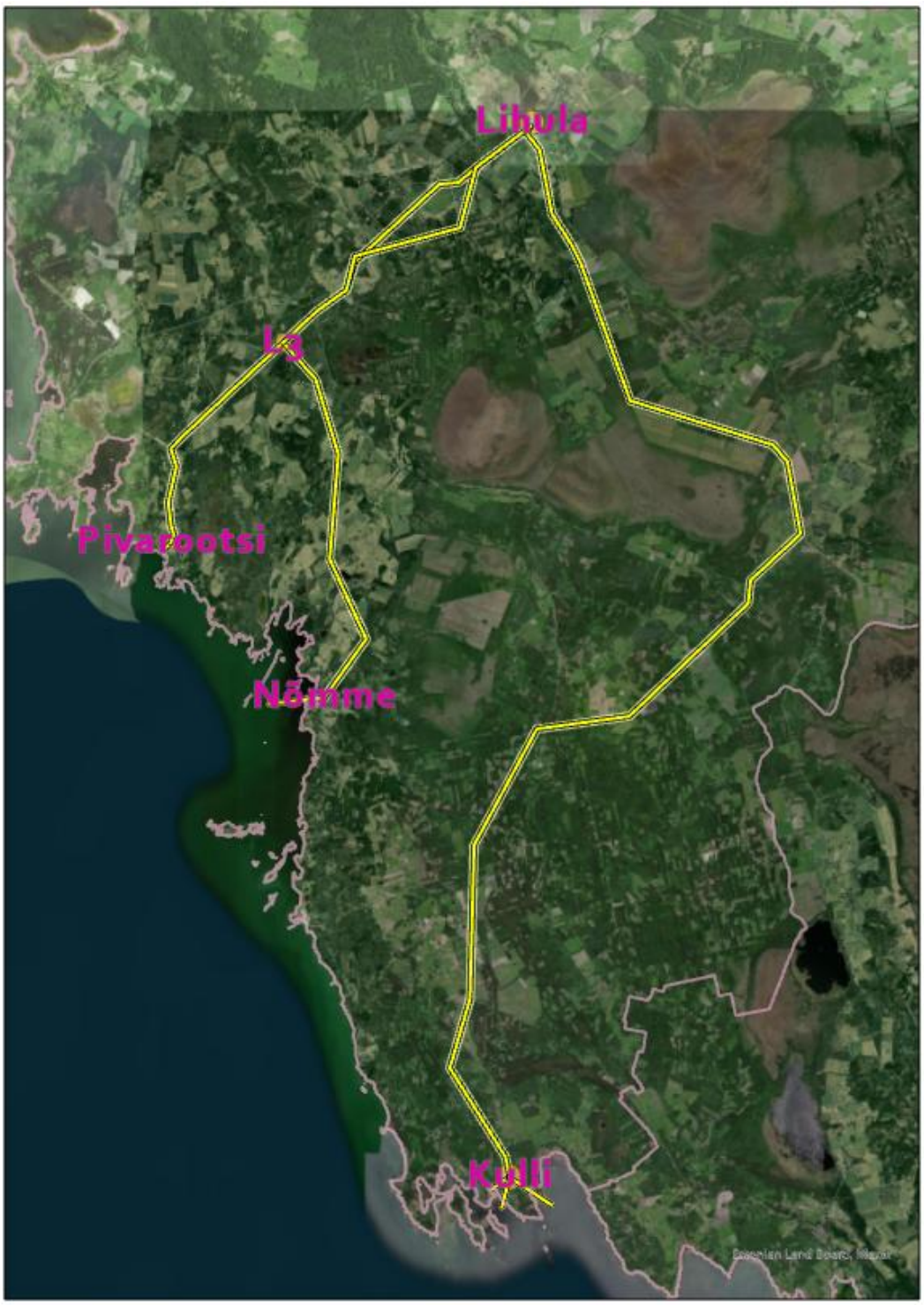
The following selection criteria were used as the exclusion method for sketching the corridors:

- No residential or public buildings within the corridor and 100 meters from the edge of the corridor.
- No auxiliary and industrial buildings within the corridor.
- The route corridor must not pass through a densely populated area.
  The criteria may be specified as a result of further drafting of the corridors. If no other alternatives can be outlined or the densely populated area proves to be the most appropriate, the possibility of constructing an underground cable through the densely populated area should be considered.
- The route corridor must not pass through mining allocations.
- The route corridor must not pass through cemeteries.
- The route corridor must not pass through milieu areas.
  The criteria may be specified as a result of further drafting of the corridors. If no other alternatives can be outlined or the milieu area proves to be the most appropriate, the possibility of constructing an underground cable through the milieu area should be considered.
- No cultural monuments and their protection zones within the corridor.
- No churches and shrines within the corridor.
- The corridor must not overlap with habitats of species in protection categories I and II.

In Natura bird areas and at a distance of 100 meters from them, the underground cable corridor is considered as a route corridor. The route corridors shown in this work, which pass through (incl. as an underground cable) or are adjacent to Natura sites, must be assessed in the next stages of the impact assessment of the route corridor. Based on this, it may be necessary to shift the route corridors, relocate or take other necessary measures.

2.2. Route descriptions

2.2.1. Possible routes from Lihula substation



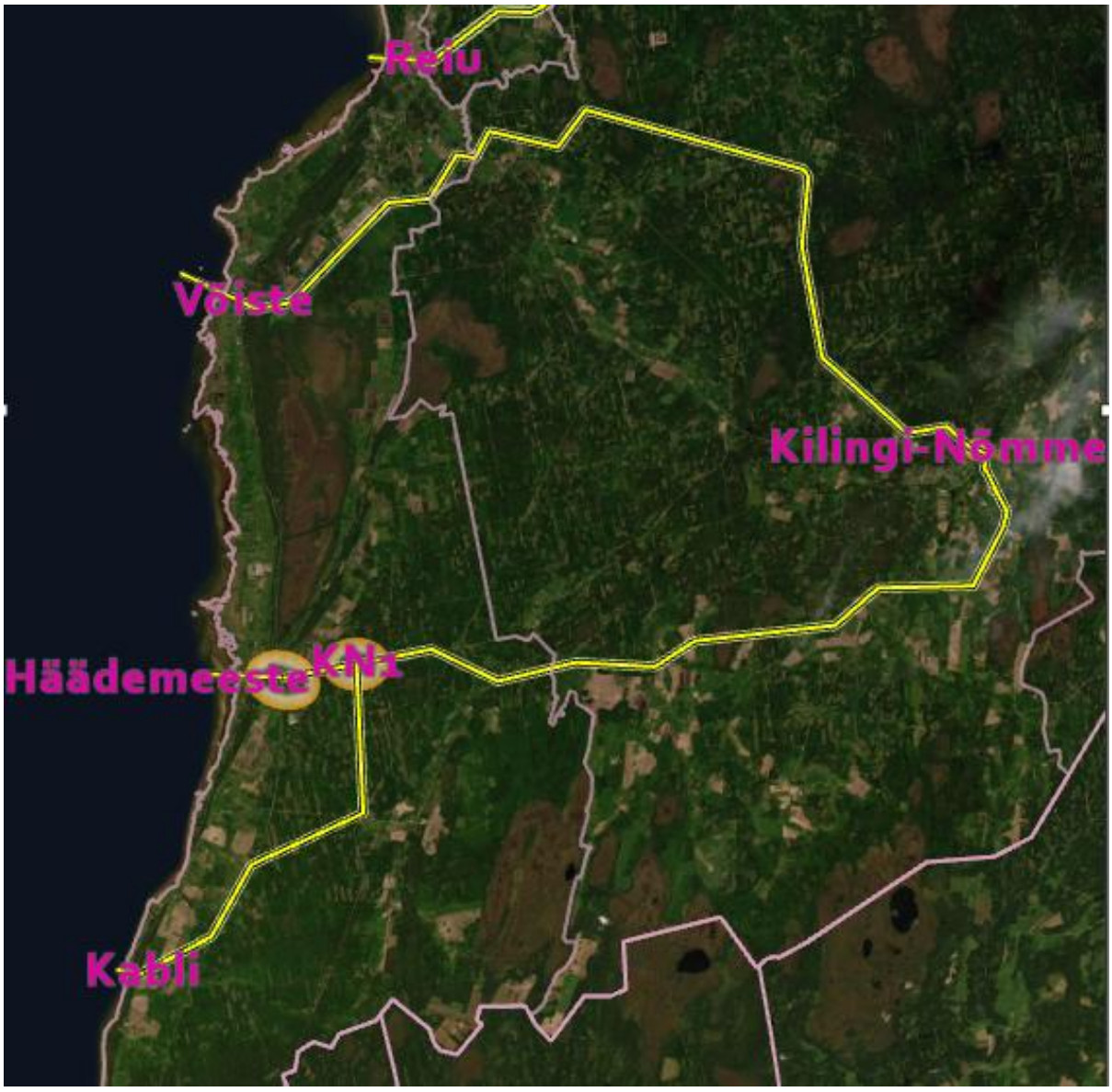
Name	Description
Lihula-L3-1	Line can be placed inside existing 110 kv line corridor in the Lihula part of the corridor but the existing corridor is not wide enough for 330 kv corridor and it is situated in the protection zone of residential buildings
Lihula-L3-2	Ca 2 km of the line corridor can be placed inside the existing 110 kV line corridor. Corner posts can be placed nead existing roads and on state owned/municipal land.
L3-Pivarootsi	Line corridor is very close to and runs parallel to Natura 2000 bird area.
Cable-Pivarootsi	Transmission can be built near existing road, 250m from coastline and from Natura 2000 area
L3-Nõmme	Corner posts can be built near existing road.
Cable-Nõmme	Transmission can be built near the existing road.
Lihula-Kulli	65 km can be placed inside existing 330 kV overhead line corridor. Corridor is situated between 2 Natura 2000 bird areas
Cable-Kulli 1	One of the ways to go underground in the Kulli control point
Cable-Kulli 2	One of the ways to go underground in the Kulli control point
Cable-Kulli 3	One of the ways to go underground in the Kulli control point

2.2.2. Possible routes from Sindi substation

Name	Description
Pärnu-P1.1	Line corridor is as straight as possible but crosses existing 100 kV line corridor and 5 km of the corridor will be placed within an active mining area.
Pärnu-P1.2	One of the alternatives for crossing a mining area. Line crosses existing 110 kV electrical line many times. Line corridor avoids residential building protection zones, but the impact to the airport landing zone must be evaluated.
P1-P2	This part of a line corridor is avoiding residential building protection zones as much as possible, line corridor is crossing existing 110 kV electrical line
P2-Lao	Line is crossing an active mining area. Corner posts can be placed near existing road on a state-owned land
P2-P3-Lao	Corner posts can be placed near an existing road. Corridor is not crossing any protected areas. Corridor is between two Natura 2000 areas and an alternative to crossing mining areas.

P2-P3-Kavaru	Corner posts can be placed near an existing road. Corridor is not crossing any protected areas.
Cable-Lao	Transmission area can be built on non-private land, near existing road.
Cable-Kavaru	Transmission area can be built on non-private land, near existing road.
Pärnu-Reiu	Approx 46 km of existing 330 kV overhead line corridor can be used. Many corner posts can be placed near the existing road on a land that is state-owned.
Cable-Reiu	Cable must be built under high density residential area

2.2.3. Possible routes from Kilingi-Nõmme substation



Name	Description
Kilingi-Nõmme-Võiste	33,4 km of existing 330 kV overhead line corridor can be used. Many corner posts can be placed near the existing road on a land that is state-owned.
Cable-Võiste	Cable must be built under high density residential area
Kilingi-Nõmme-Häädemeeste	Approx 3,3 km can be placed inside existing 330 kV line corridor. Corridor is near Natura 2000 protection zone. Transition point can be built near existing road. Many corner posts are near existing road.
Cable-Häädemeeste	Cable must be built under high density residential area
Cable-Kabli	600 m from coastline, transmission can be placed near an existing road

2.2.4. Possible routes from Aloja substation

Name	Description
Aloja-Salacgriva 1	Mostly parallel to existing 110 kV electricity line. Overhead to cable transmission point is outside high density residential area.
Aloja-Salacgriva 2	Approx 56 km of the 330 kV line corridor can be placed parallel to and existing 110 kV corridor. Corner posts are near an existing road. Transmission to underground cable is near the location shown in Latvian MSP and is not in conflict with Natura 2000 areas and is away from existing high density residental areas.
Aloja-Salacgriva(MSP5)	Corridor alternative as planned in Latvian MSP. Mostly parallel to an existing 110 kV line corridor.
Cable-Svetciems	1,2 km from coastline, transmission can be placed near an existing road

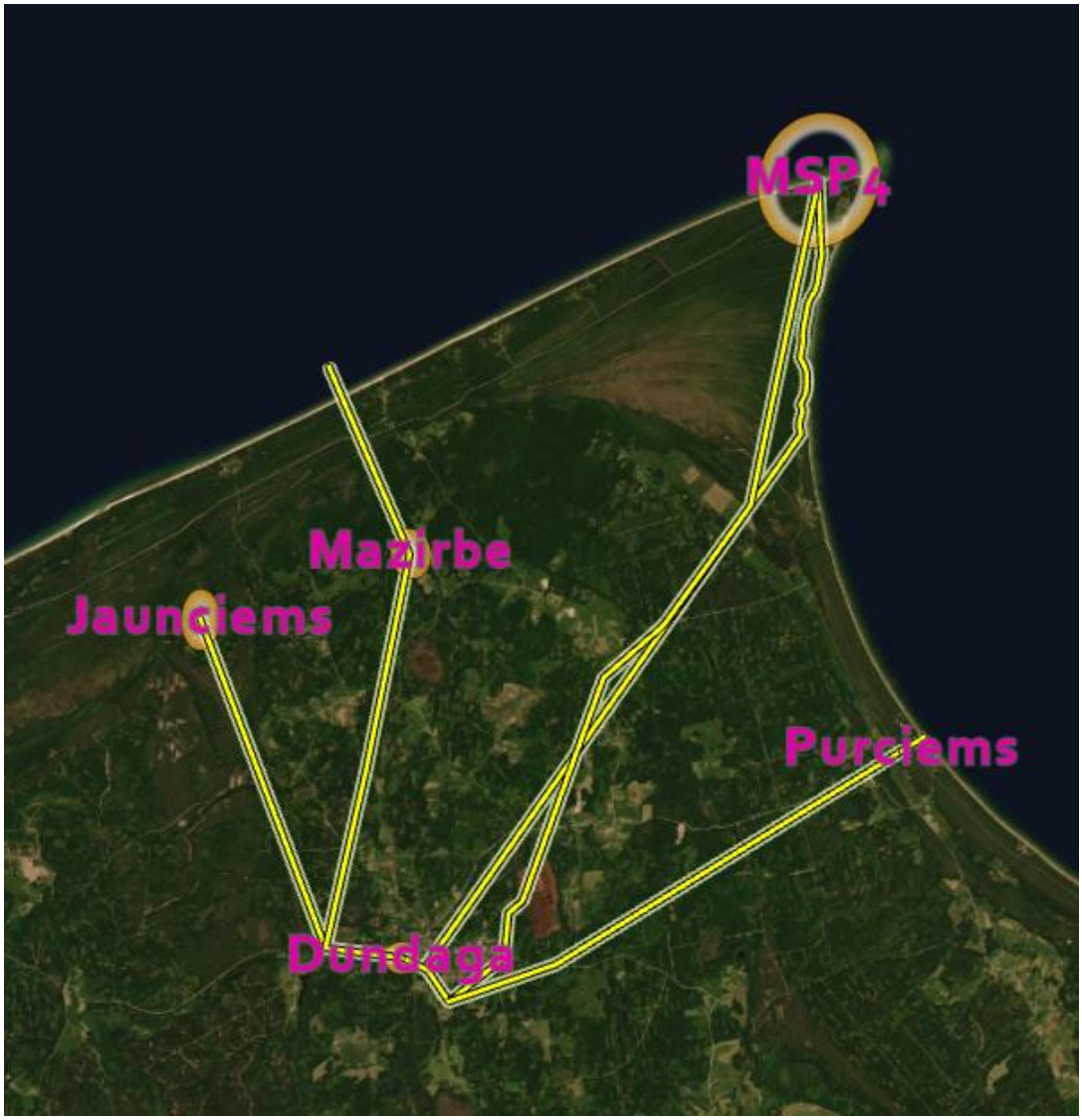
Cable-Salacgriva(MSP5)	Corridor alternative as planned in Latvian MSP. The corridor passes through a high density residental area.

2.2.5. Possible routes from Tume substation

Name	Description
Tume-Apsuciems 1	Approx 8,5 km can be placed inside an existing 330 kV Line corridor. Corner posts are near an existing road.

Tume-Apsuciems 2	Corridor is crossing an existing 110 kv line corridor, the effect of an airport must be assessed, many corner posts can be placed near an existing road.
Cable - Apsuciems	290 m from coastline, corner posts remain near existing road.

2.2.6. Possible routes from Dundaga substation



Name	Description
Dundaga-MSP4original	Corridor alternative as planned in Latvian MSP. On the coast, the corridor follows an existing road. Near the Dundaga station the corridor is drawn straight through a high-density residential area.
Dundaga-MSP4	The corridor is specified according to protection zones of buildings, so the corridor can be as straight as possible. Electrical line near Dundaga can mostly be placed

	inside the existing 330 kV overhead line corridor. Natura 2000 area is 9 km from the coast; therefore the underground part is relatively long.
Dundaga-Jaunciems	Electrical line near Dundaga can mostly be placed inside the existing 330 kV overhead line corridor. Natura 2000 area is 5 km from the coast, therefore the underground part is relatively long.
Dundaga-Purciems	Electrical line near Dundaga can mostly be placed inside the existing 330 kV overhead line corridor.
Dundaga-Mazirbe	Electrical line near Dundaga can mostly be placed inside the existing 330 kV overhead line corridor. Natura 2000 area is 6 km from the coast, therefore the underground part is relatively long.
Cable-Purciems	Touches Natura 2000 areas on sea.

2.2.7. Possible routes from Ventspils substation

Name	Description
Ventspils-MSP3-1	Line follows existing 110 kv corridor, which must be widened. The extension might not be possible because of the protection zones of buildings.
Ventspils-MSP3-2	1,7 km from the Ventspils station, can be placed inside existing 330 kV electrical corridor. New corner posts can be placed near the existing roads, no Natura 2000 area on the coastline. Corridor is crossing an existing 110 kV corridor, to describe it as straight as possible.

2.2.8. Possible routes from Uzava substation

Name	Description
Cable-Uzava	Corridor is close to a corridor planned in the Latvian MSP corridor, but does not cross a protection zone of buildings. 1,5 km passes through a Natura 2000 area.
Cable-Vendzavas	Ca 1 km from coastline, corner posts near existing road
Cable-Osvalki	230 m from coastline, corner posts near existing road
Cable-Uzava (MSP2)	Original line from Latvian MSP, 1,8 km is inside Natura 2000 area.

Uzava-Uzava (MSP2)1	Corridor alternative as planned in Latvian MSP. This corridor needs to be specified due to the station location and building protection zones.
Uzava-Uzava (MSP2)2	Line corridor is very close to Natura 2000 area, corner posts can be placed near the existing road. The transmission on the coastline is as planned in Latvian MSP
Uzava-Vendzavas	Line corridor is very close to Natura 2000 area, corner posts can be placed near the existing road.
Uzava-Osvalki	4 km of existing 330 kV overhead cable corridor can be used. The rest of the corridor goes around Natura 2000 area.

3. Criteria for route comparison

The results of the comparison of route alternatives described in paragraph 2 are compared and presented by groups of comparison criteria:

- **Socio-economic criteria**
  - **Residential land plots with residential buildings (ha)**
    Takes into account the extent (ha) to which the route corridor passes through the residential land. The less residential land passed the better.
  - **Residental land plots without residental buildings (ha)**
    Takes into account the extent (ha) to which the route corridor passes through residential land. The choice of the route corridor is based on the principle that any passage of residential land is worse than passing land with other intended land use.
  - **Residential or public buildings**
    The location of the route corridor closer than 100 m from residential buildings is excluded. When comparing, the number of dwellings up to 250 m from the axis of the corridor shall be assessed. An alternative is preferred in which there are fewer dwellings in the vicinity of the corridor or they are located further away from dwellings in the vicinity of other alternatives.
  - **Valuable landscapes, places with beautiful views and road sections**
    Takes into account the extent to which (length, m) the route corridor passes through areas of valuable landscapes determined by county and general plans. It is also assessed that in many cases the route corridor may interfere with the visibility of places with a beautiful view marked in the county and general plan.
  - **Passage of recreational areas (m)**
    Takes into account the extent to which (m) the alternative route corridor passes through the recreation areas determined by the general plans or other public information. An alternative that does not pass through recreation areas or passes through them to a lesser extent is preferred over other alternatives.
  - **Deforestation of private forests (ha)**
    Takes into account the area of private forests to be deforested (ha). It is based on the principle that a private forest in the protection zone must be compensated to the owner. The longer the route corridor passes through a private forest, the less suitable the alternative is.
  - **Deforestation of state forests (ha)**
    Takes into account the area of deforested state forest (ha). When calculating the forest area, it has been taken into account whether the route corridor is located on the route of the existing line (smaller clearable area) or in a new route corridor (larger clearable area). It is based on the principle that the state forest remaining in the protection zone must be compensated to the state. Passing through a state forest is preferable to passing through a private forest, as it is estimated that it is easier and cheaper to reach agreements.
  - **Passage of mineral deposits (m)**
    Takes into account the extent to which (length, m) the alternative route corridor passes through mineral deposits. The excavation of mineral resources must not be hindered in the area of the deposit, therefore the mineral resources must be mined in advance upon construction there. Mining is a separate process that increases the cost of time and money.
  - **Agricultural land use (ha)**
    The location of the route on agricultural land is preferred over forest land.
  - **Land plots with established detailed plans**
    A route alternative that does not pass through areas with a detailed plan is preferred.
  - **Land plots with building design specifications**
    A route alternative that does not pass through areas with issued design conditions is preferred.
  - **Privately owned cadastral units (ha)**
    Smaller area of privately owned land impacted by the corridor is preferred.
  - **Publicly owned cadastral units (ha)**
    Publicly owned land is preferred.

Additional criteria which are initially exclusive, but which must be considered in the absence of other viable alternatives:

- **Densely populated areas**
  Takes into account the extent to which (length, m) the route corridor passes through densely populated areas determined by the general plans. When densely populated areas cannot be avoided, an underground cable must be considered.

- **Environmental criteria**
  - **Impact on protected areas (Natura 2000 sites, protected areas, conservation areas)**
    Impact on national parks, nature and landscape protection areas has been assessed if the route corridor passes through it or passes close to it. A precondition for the selection of alternatives is the compliance of the proposed activity with the protection rules and the management plan. The less the alternative relates to the protection objective pursued, the more prefered it is.
  - **Species in protection category III**
    The impact on the habitats in the protection category III will been assessed. The less the alternative is exposed to habitats in category III, the more preferred the alternative.
  - **Other protected environmental objects**
    Impacts on protected environmental objects (excluding protected areas) have been assessed, such as valuable habitats, individual objects without protection categories, etc. The less the alternative comes into contact with the object under protection, the more preferred the alternative is.
  - **Fragmentation of green network**
    The impact on the green network areas due to the deforestation of the route corridor will be assessed. The less the alternative reduces green corridors, the more preferred it is.
  - **Projected protected species and protected areas**
    The impact on projected protected species and protected areas will be assessed. The less the alternative is in contact with the habitat or protected area, the more preferred it is.

- **Cultural criteria**
  - **Cultural heritage (cultural heritage sites, rural heritage, military heritage, etc.)**
    A route corridor with as few cultural heritage sites as possible is preferred.
  - **Areas and objects based on local protection**
    A route corridor with as few local protection sites and areas as possible is preferred.

Additional criteria which are initially exclusive, but which must be considered in the absence of other viable alternatives:

- **Milieu areas**
  Takes into account the extent (length, m) of the route corridor passing through the areas of milieu areas determined by the general plans. Passage through milieu areas is generally excluded. If there are no other alternatives, an underground cable in milieu areas must be considered.

- **Technical criteria**
  - **Length of the corridor (km)**
    The route corridor that is the shortest is preferred.
  - **Cost of the corridor (eur)**

The cost of the corridor is directly related to the length of the corridor and the length of the underground cable and overhead line in the corridor. The cost of building a 1 km overhead line is estimated at 425,000 euros, and the cost of an underground cable is 1.2 times higher.

- **Complexity of construction and maintenance**
  The need to build anchor masts is considered. It is estimated that an anchor mast must be located every 5 kilometers and an access road must be provided.
- **Use of existing corridors (m)**
  A route corridor that uses the existing route corridor for as long as possible is preferred.
- **Intersections with existing infrastructure elements**
  The route corridor with the smallest number of intersections with existing infrastructure elements is preferred.

4. Comparison of alternatives for route corridors

The corridors will be compared on a scale of "strong preference", "weak preference" and "non-preference" within each criterion. The same scale is used to give an overall grade to a group of criteria. Preferences are marked as follows:

STRONG PREFERENCE	Best route corridor in terms of comparable criteria.
WEAK PREFERENCE	There are disadvantages compared to the strongly preferred route corridor, but it is still recommended.
NON-PREFERENECE	Non-prefered route corridor in terms of comparable criteria.
NO PREFERENCE	There are no significant differences between corridors in terms of criteria and no preference is created.

Both quantitative and qualitative (based on expert opinion) methods will be used to form the preference. In case of quantitative criteria (eg number of dwellings in the corridor), the preference is based on numerical indicators - eg a smaller number is better. In the case of qualitative criteria, the basis for the formation of preference is an expert assessment (if the assessment is possible considering the level of accuracy of given work). For all criteria, preference is formed through comparing route alternatives to each other.

The following principles will be considered when forming the final preference:

- If all corridors are equal according to the criterion, no preference will be given to any of the corridors.
- The technical preference has been developed in cooperation with the Customers.
- The construction cost is approximate and is presented according to the level of detail of current study.
- In case of environmental criteria, a strong preference means a situation where, due to significant effects in one or more of the criteria, the implementation of the alternative has more negative effects.
- For natural environment criteria, low preference means a situation where both options are acceptable, but one option is preferred due to either smaller negative effects or larger positive effects.
- The final preference is formed through summing and weighing the preferences of different criteria.

4.1. Presentation of results

The outputs of the work are:

- A written report explaining the corridor description criteria, the comparison results, the preferred corridor and proposals for upcoming planning and impact assessment process.
- Map layers with alternative route corridors and data collected during the study that are not available in public databases.
- Schematic maps in .pdf format, for example described route corridors, extracts from the vicinity of densely populated areas, etc.

5. Comparison of alternatives for mainland route corridors

The following alternative comparisons are presented without data and information on cadastral units. The results of route comparisons are updated, after data is received from Latvian State Land Service (expected 7th January 2022).

5.1. Corridor alternatives from Aloja substation

There are three corridor alternatives compared from Aloja substation:

- Aloja – Salacgriva MSP corridor sketched in Latvian MSP.
- Aloja – Salacgriva 1 sketched in this report.
- Aloja – Salacgriva 2 sketched in this report.

Figure 3. Corridor alternatives compared from Aloja substation

From Salacgriva, two possible cable directions to the sea are possible – to Svetciems or to Salacgriva. The latter is also drawn in Latvian MSP. The final direction depends on the corridor alternative chosen. Independently, the endpoint for the corridor (and starting point for the cable) in Svetciems is preferred, because it is away from densely populated areas and Natura 2000.

Figure 4. Cable directions from Salacgriva to the sea.

5.1.1. Technical criteria

According to the technical criteria the most preferred corridor is the one drawn in Latvian MSP – Aloja – Salacgriva MSP alternative combined with Aloja – Salacgriva 1 corridor for cable transmission.

Criteria	Aloja-Salacgriva 1	Aloja-Salacgriva 2	Aloja-Salacgriva (MSP5)
Length of the corridor	33,41	32,53	32,72
The number of possible turns in the corridor	15	6	22
The need to build anchor masts	1	5	0
The cost of the corridor (eur)[1]	14200249	13827258	13906426
Length of excisting 110 and 330 kV corridors used	27,6	5,4	29,8
Number of crossings with other engineering structures	**24**	**28**	**27**
Number of crossings with local roads	21	26	24
Number of crossings with state roads	3	2	3
Number of crossings with existing electricity lines	0	0	0

The main conclusions from route comparison are following:

- Aloja – Salacgriva MSP corridor is shortest and therefore has the lowest building cost.
- Aloja – Salacgriva MSP corridor follows the existing 110 kV corridor approx. 30 km (overall length of the corridor approx. 32 km). Although the existing corridor is stongly preferred, the corridor runs through residential areas, where proximity of houses to the corridor becomes very narrow (see Figure 3).

[1] The cost of building a 1 km overhead line is estimated at 425,000 euros, and the cost of an underground cable is 1.2 times higher

Figure 5. Narrow conditions between residential buildings for Aloja-Salacgriva alternatives in existing 110 kV corridor

- Aloja-Salacgriva MSP corridor has more turns than Aloja-Salacgriva corridors 1 and 2, increasing its building cost.
- In terms of crossings with existing engineering structures, the corridor alternatives are quite similar. Aloja-Salacgriva 1 gets a small advantage for number of crossings with roads.

Even though the Aloja-Salacgriva MSP alternative has more turns than other alternatives, and therefore might be more expensive, the landscape and the visual impact for these locations is already impaired by the existing overhead line, making it supposedly more acceptable for local residents to build a parallel overhead line to an existing corridor, rather than clearing forests or other land elsewhere.

In future planning and building, the Aloja - Salacgriva MSP corridor together with Aloja – Salacgriva 1 corridor should be explored. The Aloja – Salacgriva 1 corridor follows also the existing 110 kV corridor but ends in Svetciems instead of Salacgriva. In Svetciems the transmition to cable is more preferred as it is away from densely populated areas (Salacgriva).

5.1.2. Environmental criteria

For environmental criteria, preference is given to Aloja-Salacgriva 2 corridor alternative.

Criteria	Aloja-Salacgriva 1	Aloja-Salacgriva 2	Aloja-Salacgriva (MSP5)
Conflicts with Natura 2000 area	Crosses Natura 2000 area. New possible corridor is near existing 110 line corridor, which is inside Natura 2000 area.	no	Crosses Natura 2000 area. New possible corridor is near existing 110 line corridor, which is inside Natura 2000 area.
Conflicts with protected areas	Completely inside protected site	Completely inside protected site	Completely inside protected site
Number of habitat sites in conflict with the corridor	39	45	45
Trees under protection in the corridor	2	0	2
Number of cultural monuments in the corridor	2	2	3

The main conclusions from route comparison are following:

- Aloja – Salacgriva MSP alternative and Aloja – Salacgriva 1 alternative, following the existing 110 kV corridor towards Salacgriva and the sea, extend into Natura 2000 areas. Even though it is an existing corridor, building a new overhead line in Natura 2000 area might not be in accordance with the protection goals of the Natura site. In future building and planning processes, should these alternatives be chosen as preferred corridors, impacts on Natura 2000 must be assessed and if necessary, the corridor be moved north from the Natura 2000 site (see Figure 6). Aloja – Salacgriva 2 alternative has no conflicts with Natura 2000 areas.

Figure 6. Possible conflicts with Niedraju-Pilkas Natura 2000 site (light blue polygon) for Aloja - Salacgriva MSP and Aloja - Salacgriva 1 alternatives in existing 110 kV corridor (yellow line).

- For other compared criteria, the differences between corridor alternatives are minor and can be mitigated through necessary measures in the next steps of the planning and design process.

5.1.3. Socioeconomic criteria

For socioeconomic criteria, preference is given to Aloja-Salacgriva MSP corridor alternative.

Criteria	Aloja-Salacgriva 1	Aloja-Salacgriva 2	Aloja-Salacgriva (MSP5)
Deforestation of forests (total)	**703655,56**	**2263549,77**	**606189,5**
Deforestation of private forests	373491,44	258020,39	272596,33
Deforestation of State-owned forest (LVM)	330164,12	2005529,38	333593,17
Passage of mineral deposits (m2)	0	0	0

The main conclusions from route comparison are following:

- Overall need for deforestation for Aloja – Salacgriva 2 corridor alternative in comparison to Aloja – Salacgriva 1 and MSP alternatives are so extensive that the interplay between state-owned and privately held forests does not play a role in the comparison results. More than 1,5 mil m^2 of deforestation needs make Aloja – Salacgriva 2 alternative strongly not preferred compared to other alternatives.
- For passage of mineral deposits, all corridors are the same.

5.1.4. Preferred corridor alternative for Aloja substation

For Aloja substation, the most preferred corridor is the one drawn in Latvian MSP – Aloja – Salacgriva MSP alternative combined with Aloja – Salacgriva 1 corridor for cable transmission in Svetciems.

Figure 7. Preferred coridor alternative for Aloja substation

The corridor follows the existing 110 kV line and causes narrow conditions in few places between residential buildings and touches Natura 2000 site in the middle part of the corridor but can be repaired through more detail planning and impact assessment procedures.

5.2. Corridor alternatives from Dundaga substation

There are five corridor alternatives compared from Dundaga substation:

- Dundaga MSP (original) corridor sketched in Latvian MSP.
- Dundaga MSP corridor sketched in Latvian MSP and specified in this report.
- Dundaga – Jaunciems sketched in this report.
- Dundaga – Mazirbe sketched in this report.
- Dundaga – Purciems sketched in this report.

Cable corridors are foreseen from Purciems, Mazirbe and Januciems because of Natura 2000 areas on shore.

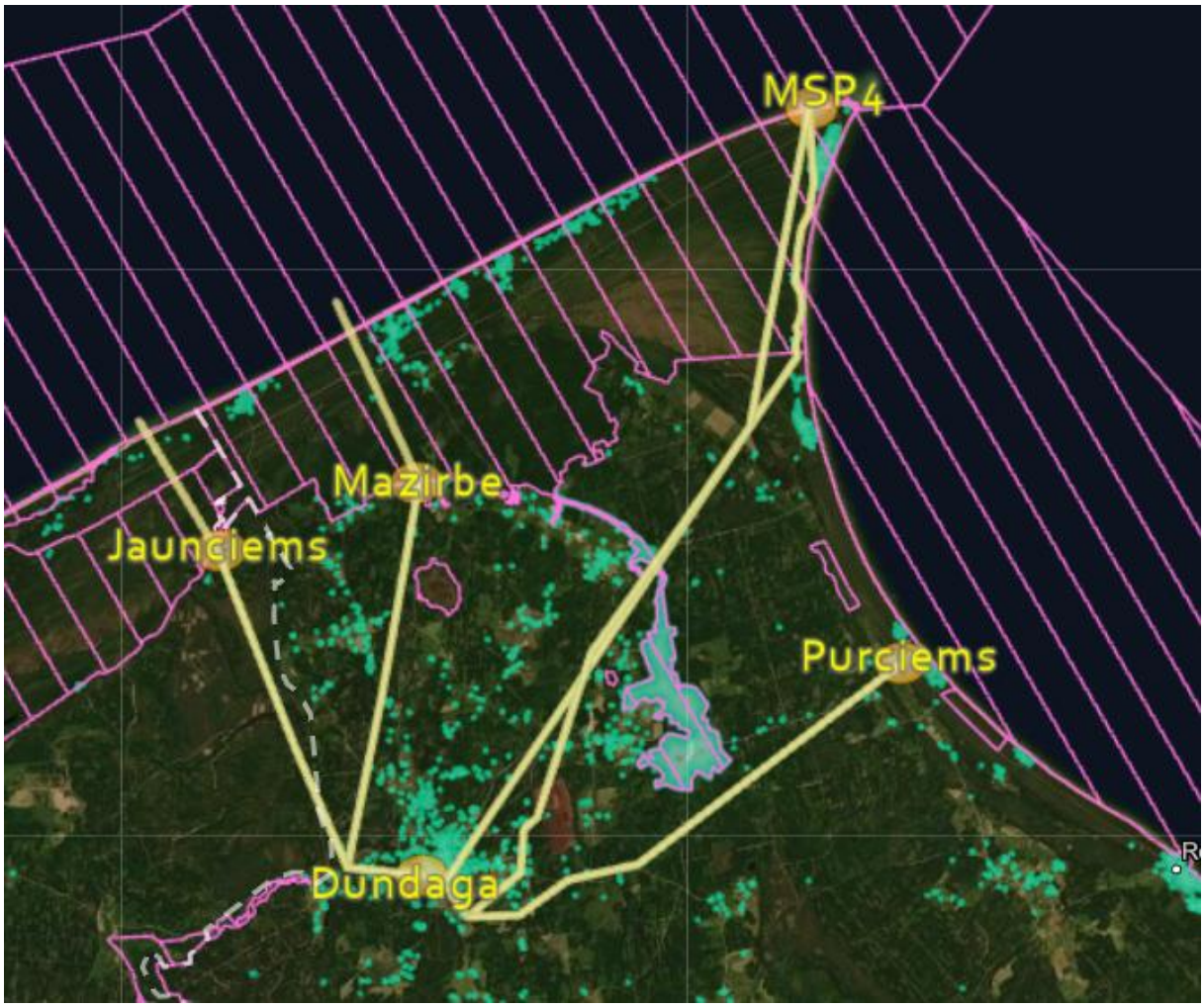


Figure 8. Corridor alternatives compared from Dundaga substation

5.2.1. Technical criteria

According to the technical criteria the most preferred corridor is Dundaga – Jaunciems.

Criteria	Dundaga-Jaunciems	Dundaga-Mazirbe	Dundaga MSP (specified)	Dundaga MSP (original)	Dundaga-Purciems
Length of the corridor	15,46	17,33	35,88	32,9	19,15
The number of possible turns in the corridor	4	3	9	Original MSP corridor on coast is unclear. 39 turns is not realistic.	4
The need to build anchor masts	1	2	3		2
The cost of the corridor (eur)[2]	6570500	7365250	15249000	13982500	8138750
Length of excisting 110 and 330 kV corridors used	2,8	2,8	1,4	no	1,4
Number of crossings with other engineering structures	**10**	**9**	**13**	**17**	**9**
Number of crossings with local roads	10	8	12	15	8
Number of crossings with state roads	0	1	1	2	1
Number of crossings with existing electricity lines	no	no	no	no	no

The main conclusions from route comparison are following:

- Dundaga – Jaunciems alternative is most preferred in almost every comparison criteria – it is the shortest possible corridor (even with the cable corridor from Jaunciems to sea), therefore with the lowest cost, it is one of the straightest line with crossings with local roads – no state roads or existing electricity lines.
- Dundaga – Jaunciems enables the use of existing 330 kV overhead cable corridor for approx. 3 km for the beginning of the corridor. The same applies for Dundaga – Mazirbe corridor.
- Dundaga – Mazirbe is the straightest line from Dundaga substation to the shore with 3 turns for the corridor.
- The corridors drawn in Latvian MSP and specified with this report are both widely unpreferred corridors – they are the longest, need most turns and have the highest number of crossings with other engineering structures.

5.2.2. Environmental criteria

For environmental criteria, preference is given to Dundaga – Purciems corridor alternative.

[2] The cost of building a 1 km overhead line is estimated at 425,000 euros, and the cost of an underground cable is 1.2 times higher

Criteria	Dundaga-Jaunciems	Dundaga-Mazirbe	Dundaga MSP (specified)	Dundaga MSP (original)	Dundaga-Purciems
Conflicts with Natura 2000 area	174 m to the nearest Natura 2000 area.	Line ends on the border of Natura 2000 area and is transformed into cable.	33 098,97 m2 crossing Natura 2000 area.	31 910,98 m2 crossing Natura 2000 area	no
Conflicts with protected areas	<Null>	<Null>	1 microreservation area, Northern part inside protected site.	1 microreservation area, Northern part inside protected site.	2 microreservation area
Number of habitat sites in conflict with the corridor	41	23	212	179	30
Trees under protection in the corridor	0	0	2	5	1
Number of cultural monuments in the corridor	<Null>	<Null>	3	8	1

The main conclusions from route comparison are following:

- Dundaga – Purziems corridor alternative is the only corridor that does not have a conflict with Natura 2000 areas, as Natura 2000 does not reach inland as widely as it does for corridor alternatives in west.
- Dundaga – Jaunciems and Dundaga – Mazirbe corridors do not have direct conflict with Natura 2000 areas, but transmission areas near Natura 2000 areas might result in negative effects for Natura areas. These locations must be assessed in future planning and design phases and if necessary, found mitigation measures for negative impacts.
- Corridors drawn in Latvian MSP go directly through Natura 2000 areas, which means they are not preferred as corridors.
- In other criteria, Dundaga – Jaunciems and Dundaga – Mazirbe, get clear advantages as conflicts with habitats and nature protection objects and areas are smallest. Latvian MSP corridors (both original and specified) have high conflicts with habitats.

5.2.3. Socioeconomic criteria

For socioeconomic criteria, preference is given to Dundaga - Mazirbe corridor alternative.

Criteria	Dundaga-Jaunciems	Dundaga-Mazirbe	Dundaga MSP (specified)	Dundaga MSP (original)	Dundaga-Purciems
Deforestation of forests (total m^2)	**2017665,2**	**1729009,49**	**2339403,79**	**2675132,28**	**2589987**
Deforestation of private forests	611265,85	346453,65	489425,12	582157,77	481752,9

Deforestation of State-owned forest (LVM)	1406399,36	1382555,85	1849978,66	2092974,51	2108233,867
Passage of mineral deposits (m2)	0	0	182 684,33	0	0

The main conclusions from route comparison are following:

- Overall need for deforestation for Dundaga - Mazirbe corridor alternative in comparison to other alternatives are so extensive that the interplay between state-owned and privately held forests does not play a role in the comparison results.
- For passage of mineral deposits, all corridors, except the specified Latvian MSP corridors, are the same. The specified MSP corridor follows through a mineral deposit, making it a non-preferred corridor based on socioeconomic criteria.

5.2.4. Preferred corridor alternative for Dundaga substation

For Dundaga substation, the most preferred corridor is Dundaga – Mazirbe corridor combined with cable transmission in Mazirbe.

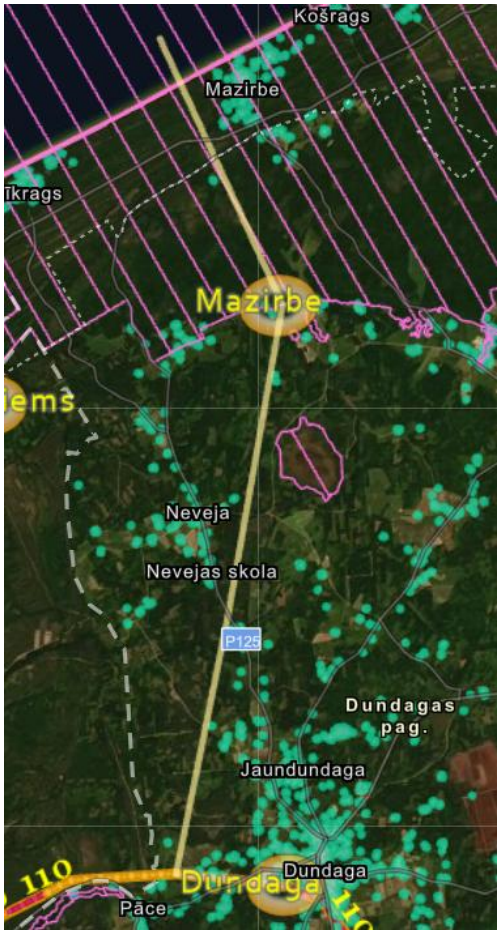


Figure 9. Preferred coridor alternative for Dundaga substation

The corridor follows the existing 330 kV line at the beginning of the corridor. The overhead line transmits to a cable on the boarder of the Slitere National Park on the shore. Detail impact assessment must be carried out at the next phases of planning and designing to fix the transmission

place from overhead line to cable and minimize or exclude negative impacts to Slitere National Park. This also includes assessment of visual impacts.

5.3. Corridor alternatives from Tume substation

There are two corridor alternatives compared from Tume substation:

- Tume-Apsuciems 1 sketched in this report (western corridor).
- Tume-Apsuciems 2 sketched in this report (eastern corridor).

Cable corridor is foreseen from Apsuciems to sea due to Natura 2000 area on shore.

Figure 10. Corridor alternatives compared from Tume substation

5.3.1. Technical criteria

According to the technical criteria the most preferred corridor is Tume-Apsuciems 1 alternative.

Criteria	Tume-Apsuciems 1	Tume-Apsuciems 2
Length of the corridor	15,46	17,33
The number of possible turns in the corridor	17	10
The need to build anchor masts	0	0
The cost of the corridor (eur)[3]	6571403,4	7364499,3
Length of existing 110 and 330 kV corridors used	8,4	no
Number of crossings with other engineering structures	**30**	**30**
Number of crossings with local roads	27	27
Number of crossings with state roads	3	3
Number of crossings with existing electricity lines	no	Crossing with 110 kv - 2 places and 330 kv - 1 place

The main conclusions from route comparison are following:

- Tume - Apsuciems 1 alternative gets high preference mainly due to the possibility to use an existing overhead line corridor for half the corridor alternative length – 8,4 km.
- Tume-Apsuciems 1 alternative is also shorter and does not cross with existing electricity lines. Tume-Apsuciems 2 alternative crosses with 110 kV line twice and 330 kV line once.
- Tume-Apsuciems 1 alternative has more turns, but this is probably compensated by the already impaired landscape, making it supposedly more acceptable for local residents to build a parallel overhead line to an existing corridor, rather than clearing forests or other land elsewhere.

5.3.2. Environmental criteria

For environmental criteria, slight preference is given to Tume-Apsuciems 1 corridor alternative, mainly due to longer distance from the transmission area from Natura 2000 area.

Criteria	Tume-Apsuciems 1	Tume-Apsuciems 2
Conflicts with Natura 2000 area	409 m to the nearest Natura 2000 area.	61 m to the nearest Natura 2000 area.

[3] The cost of building a 1 km overhead line is estimated at 425,000 euros, and the cost of an underground cable is 1.2 times higher

Conflicts with protected areas	<Null>	<Null>
Number of habitat sites in conflict with the corridor	33	22
Trees under protection in the corridor	0	0
Number of cultural monuments in the corridor	1 monument site is partly in the corridor	<Null>

The main conclusions from route comparison are following:

- Tume-Apsuciems 2 corridor gets slight preference for conflicts with habitats and for not having cultural monuments within the corridor.
- Natura 2000 is the biggest conflict for overhead lines, so the further the transmission area from overhead line to cable, the higher the preference for the corridor. As no conflict with Natura 2000 areas can be good, alternatives can not get high preference in environmental criteria.

5.3.3. Socioeconomic criteria

For socioeconomic criteria, preference is given to Tume-Apsuciems 2 corridor alternative.

Criteria	Tume-Apsuciems 1	Tume-Apsuciems 2
Deforestation of forests (total m^2)	**1439543**	**1031531**
Deforestation of private forests	25077,71	120752,24
Deforestation of State-owned forest (LVM)	1414465,6	910778,26
Passage of mineral deposits (m2)	0	0

The main conclusions from route comparison are following:

- Overall need for deforestation for Tume-Apsuciems 2 corridor alternative is more extensive The interplay between state-owned and privately held forests does not play a role in the comparison results.
- For passage of mineral deposits, all corridors are the same.

5.3.4. Preferred corridor alternative for Tume substation

For Tume substation, the most preferred corridor is Tume-Apsuciems 1 corridor combined with cable corridor to sea.

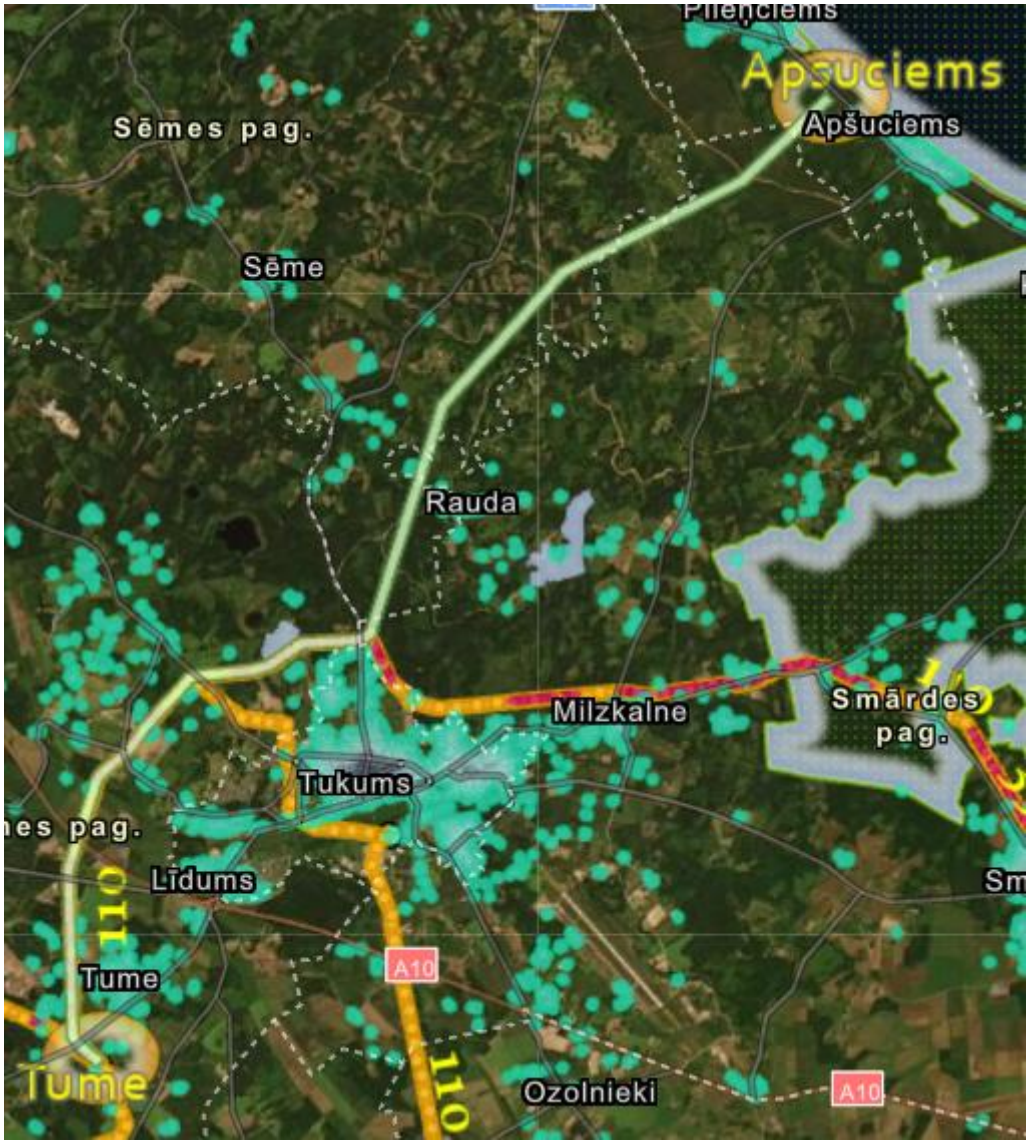


Figure 11. Preferred coridor alternative for Tume substation

Even though the alternative is not preferred for environmental and social criteria, the technical criteria give definite preference to the corridor, mainly because of possibility to use existing overhead line corridor in the existing environment. Detail impact assessment must be carried out at the next phases of planning and designing to fix the transmission place from overhead line to cable.

5.4. Corridor alternatives from Uzava substation

There are four corridor alternatives compared from Uzava substation:

- Uzava – Uzava MSP original corridor alternative sketched in Latvian MSP.
- Uzava – Uzava MSP specified corridor alternative sketched in Latvian MSP.
- Uzava – Osvalki corridor alternative sketched in this report.
- Uzava – Vendzavas corridor alternative sketched in this report.

Figure 12. Corridor alternatives compared from Uzava substation

Overhead line transmission areas to cables are possible in Osvalki, Vendzavas and Uzava. The latter is also drawn in Latvian MSP. The final direction depends on the corridor alternative chosen. Independently, the endpoint for the corridor (and starting point for the cable) in Uzava is not preferred, because it follows through Natura 2000 area. In future building and planning processes, should the overhead line alternatives ending in Uzava be chosen as preferred corridors, impacts on Natura 2000 must be assessed.

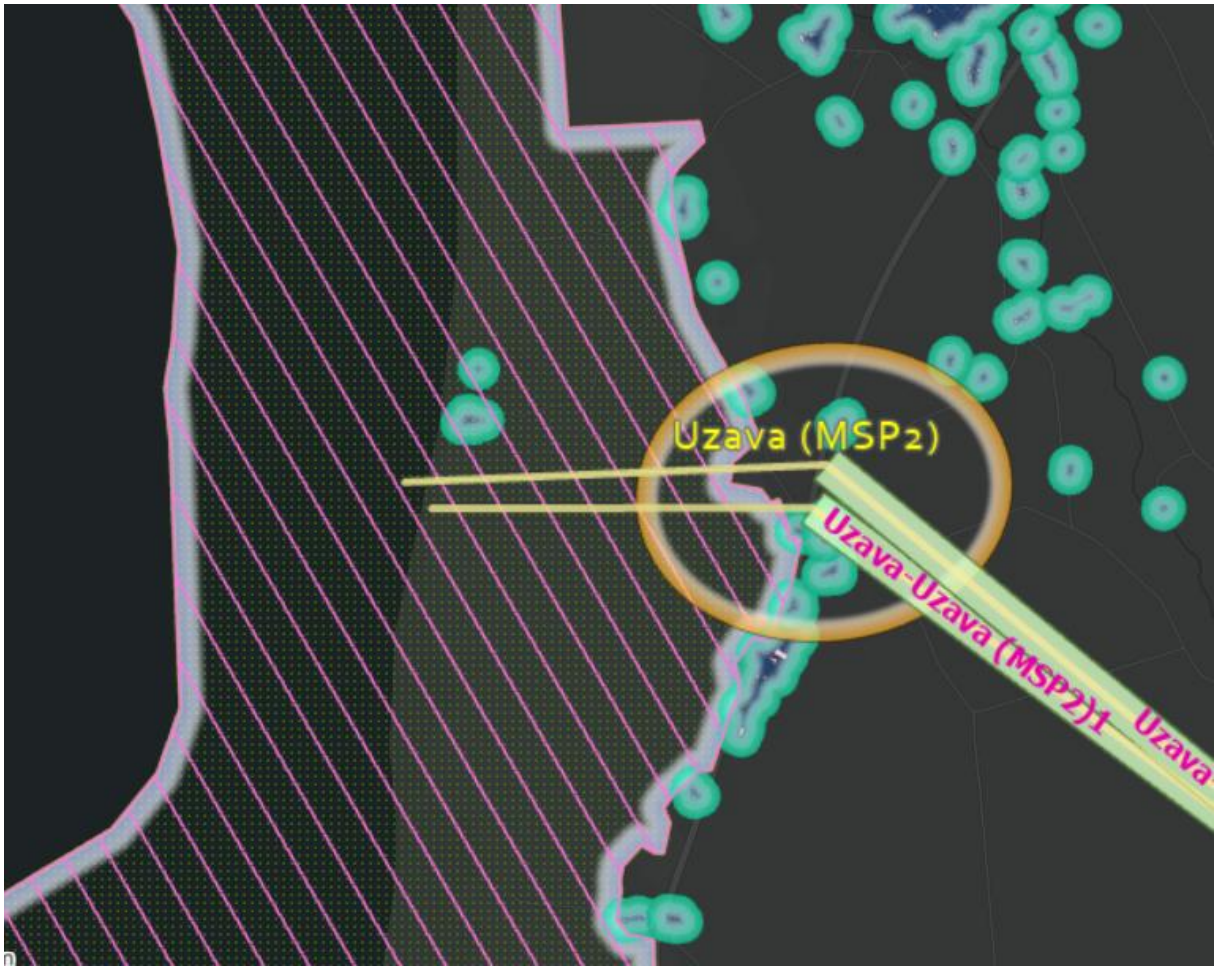


Figure 13. Cable directions from Uzava to the sea.

5.4.1. Technical criteria

According to the technical criteria the most preferred corridor is the one drawn in Latvian MSP and also the one specified based on Latvian MSP.

Criteria	Uzava-Osvalki	Uzava-Uzava MSP original	Uzava-Uzava MSP specified	Uzava-Vendzavas
Length of the corridor	14	9,11	9,27	10,6
The number of possible turns in the corridor	3	1	3	3
The need to build anchor masts	1	1	0	<Null>
The cost of the corridor (eur)[4]	5950000	3871750	3939750	4505000

[4] The cost of building a 1 km overhead line is estimated at 425,000 euros, and the cost of an underground cable is 1.2 times higher

Length of excisting 110 and 330 kV corridors used	4,4 km of existing line corridor can be used.	no	no	no
Number of crossings with other engineering structures	**7**	**11**	**10**	**12**
Number of crossings with local roads	6	10	9	11
Number of crossings with state roads	1	1	1	1
Number of crossings with existing electricity lines	no	no	no	no

The main conclusions from route comparison are following:

- Both corridor alternatives stemming from Latvian MSP are the shortest, so the cheapest overall.
- The original MSP corridor alternative has the smallest number of turns, affecting the cost of the corridor.
- Uzava – Osvalski corridor gets high preference due to the possibility to use existing line corridor in the middle part of the corridor for approx. 4,4 km. As the corridor itself is much longer than the alternatives stemming from Latvian MSP, the preference coming from possible use of existing overhead line corridor, is questionable.
- Uzava – Vendzavas corridor is not strongly preferred in any criteria. The overall length of the corridor is close to the MSP alternatives, but other criteria – such as turns of the corridor and number of crossings – make it less preferable.

5.4.2. Environmental criteria

For environmental criteria, preference is given to original Latvian MSP corridor alternative.

Criteria	Uzava-Osvalki	Uzava-Uzava MSP original	Uzava-Uzava MSP specified	Uzava-Vendzavas
Conflicts with Natura 2000 area	Conflict with Natura area. Line goes inside existing corridor.	71 m to the nearest Natura 2000 area.	7 m to the nearest Natura 2000 area.	41 m to the nearest Natura 2000 area.
Conflicts with protected areas	1 microreserve, 7414 m2 conflict with Natura 2000 area	<Null>	0	0
Number of habitat sites in conflict with the corridor	6	5	6	13
Trees under protection in the corridor	0	0	0	0

Number of cultural monuments in the corridor	0	0	0	0

The main conclusions from route comparison are following:

- Uzava-Osvalki corridor alternative, following the existing overhead line corridor towards the sea, extend into Natura 2000 areas. Even though it is an existing corridor, building a new overhead line in Natura 2000 area might not be in accordance with the protection goals of the Natura site. In future building and planning processes, should these alternatives be chosen as preferred corridors, impacts on Natura 2000 must be assessed and if necessary, the corridor be moved north from the Natura 2000 site (see Figure 14). Other corridors do not have clear conflicts with Natura areas.

Figure 14. Possible conflicts with Natura 2000 site (light blue polygon) for Uzava-Osvalki alternative in existing 110 kV corridor (yellow line).

- For other compared criteria, the differences between corridor alternatives are minor and can be mitigated through necessary measures in the next steps of the planning and design process.

5.4.3. Socioeconomic criteria

For socioeconomic criteria, preference is given to Aloja-Salacgriva MSP corridor alternative.

Criteria	Uzava-Osvalki	Uzava-Uzava MSP original	Uzava-Uzava MSP specified	Uzava-Vendzavas
Deforestation of forests (total)	**767459,23**	**0**	**0**	**219516,3**
Deforestation of private forests	18664,46	0	0	5043,1
Deforestation of State-owned forest (LVM)	748794,77	0	0	214473,2
Passage of mineral deposits (m2)	0	0	0	0

The main conclusions from route comparison are following:

- Overall need for deforestation is absent for MSP alternatives so they have a clear preference compared to other corridors.
- For passage of mineral deposits, all corridors are the same.

5.4.4. Preferred corridor alternative for Uzava substation

For Uzava substation, the most preferred corridor is the original corridor drawn in Latvian MSP combined with cable corridor also drawn in MSP. The starting point for the cable in Uzava is not preferred, because it follows through Natura 2000 area. In future building and planning processes, should the overhead line alternatives ending in Uzava be chosen as preferred corridors, impacts on Natura 2000 must be assessed.

Figure 15. Preferred coridor alternative for Uzava substation

5.5. Corridor alternatives from Ventspils substation

There are three corridor alternatives compared from Ventspils substation:

- Original MSP corridor sketched in Latvian MSP.
- MSP corridor 1 alternative specified in this report.
- MSP corridor 2 alternative specified in this report.

Figure 16. Corridor alternatives compared from Ventspils substation

In current report, Latvian MSP corridor alternative is taken as a bases for corridor direction and specified it mainly due to location of residential building. The area is very densely populated. Overhead line is a possibility around residential areas. Should the straightest line be preferred, a cable must be considered (approx. 4 km straight to the shore).

5.5.1. Technical criteria

According to the technical criteria the most preferred corridor is the specified MSP corridor alternative 2.

Criteria	Ventspils-MSP3-1	Ventspils-MSP3-2	Ventspils-MSP3-3
Length of the corridor	10,339	5,286819261	6,900052657
The number of possible turns in the corridor	5	6	8

The need to build anchor masts	0	0	<Null>
The cost of the corridor (eur)[5]	4394075	2246898,186	2932522,379
Length of excisting 110 and 330 kV corridors used	6,6 km (100 % inside 110 kv existing line corridor)	1,7 km	2,9 km
Number of crossings with other engineering structures	**13**	**12**	**12**
Number of crossings with local roads	9	7	10
Number of crossings with state roads	4	5	2
Number of crossings with existing electricity lines	There might be crossings near the Ventspils substation depending on the design solution.	There might be crossings near the Ventspils substation depending on the design solution.	1 crossing with 110 and 330 kv corridor. There might be crossings near the Ventspils substation depending on the design solution.

The main conclusions from route comparison are following:

- The modified MSP corridor 2 is the shortest corridor from Ventspils substation to sea compared to other alternatives in this section. This also results in lower building costs.
- Although the original MSP corridor has lower number of turns, the specified MSP corridor 2 is similar in terms of turns in the corridor. These corridors are therefore quite similar. As the original MSP corridor is twice the length of MSP alternative 2 corridor.
- The original MSP corridor follows existing 110 kV corridor, which must be extended. The extension might not be possible because of the protection zones of existing buildings.

Figure 17. Narrow conditions between residential buildings for Ventspils original MSP alternative in existing 110 kV corridor

[5] The cost of building a 1 km overhead line is estimated at 425,000 euros, and the cost of an underground cable is 1.2 times higher

- In terms of crossings with existing engineering structures, the corridor alternatives are quite similar.

5.5.2. Environmental criteria

For environmental criteria, no corridor alternative gets preference.

Criteria	Ventspils-MSP3-1	Ventspils-MSP3-2	Ventspils-MSP3-3
Conflicts with Natura 2000 area	no	no	no
Conflicts with protected areas	0	0	0
Number of habitat sites in conflict with the corridor	0	0	0
Trees under protection in the corridor	0	0	0
Number of cultural monuments in the corridor	<Null>	<Null>	<Null>

5.5.3. Socioeconomic criteria

For socioeconomic criteria, preference is given to original MSP corridor (Ventspils-MSP3-1) alternative.

Criteria	Ventspils-MSP3-1	Ventspils-MSP3-2	Ventspils-MSP3-3
Deforestation of forests (total)	**102519,29**	**147156,78**	**148458,19**
Deforestation of private forests	0	0	0
Deforestation of State-owned forest (LVM)	102519,29	147156,78	148458,19
Passage of mineral deposits (m2)	0	0	0

The main conclusions from route comparison are following:

- Overall need for deforestation is least for original MSP corridor.
- For passage of mineral deposits, all corridors are the same.

5.5.4. Preferred corridor alternative for Ventspils substation

For Ventspils substation, the most preferred corridor is the specified MSP alternative 2 as it is shorter than the original MSP corridor and has less areas of conflicts with existing buildings.

Figure 18. Preferred coridor alternative for Ventspils substation

The corridor follows the existing 110 kV line and causes narrow conditions in few places between residential buildings. As the original MSP corridor follows the existing overhead line between residential building and areas, fitting into narrow conditions without disturbing further residential areas or conflicting with them, the specified MSP alternative 2 is preferred.

5.6. Corridor alternatives from Lihula substation

There are three corridor alternatives compared from Lihula substation:

- Lihula – Kulli corridor alternative sketched in this report.

- Lihula – Nõmme corridor alternative sketched in this report (includes divisions between Lihula and L3 control points Lihula–L3-1 and Lihula-L3-2).
- Lihula – Pivarootsi corridor alternative sketched in this report (includes divisions between Lihula and L3 control points Lihula–L3-1 and Lihula-L3-2).

Figure 19. Corridor alternatives compared from Lihula substation

From Kulli, Nõmme and Pivarootsi, cable corridors to the sea are possible. The final direction depends on the corridor alternative chosen. Kulli corridor is in most densely populated area, which requires thorough assessment for the right passage of the corridor causing minimum impact on residential areas. Environmental restrictions are high for every cable corridor. Natura 2000 areas cover the coast, requiring environmental impact assessment in next steps of corridor planning to find the best possible locations for cables with minimum impacts on the environment.

Figure 20. Cable directions from Kulli to the sea.

Figure 21. Cable directions from Nõmme to the sea.

Figure 22. Cable directions from Pivarootsi to the sea.

5.6.1. Technical criteria

According to the technical criteria the most preferred corridor is Lihula – Pivarootsi corridor combined with L3-1 route division.

Criteria	Lihula – L3-1 – Pivarootsi	Lihula – L3-1 - Nõmme	Lihula – Kulli
Length of the corridor	20,43	25,32	47,74
The cost of the corridor (eur)[6]	8680873,29	15736715,82	20291375,92
The number of possible turns in the corridor	13,00	11,00	18,00
The need to build anchor masts	1,00	0,00	4,00
Length of excisting 110 and 330 kV corridors used	4	4	19

[6] The cost of building a 1 km overhead line is estimated at 425,000 euros, and the cost of an underground cable is 1.2 times higher

Number of crossings with existing electricity lines	<Null>	<Null>	23,00
Number of crossings with roads	18	19,00	80,00

The main conclusions from route comparison are following:

- Lihula - Pivarootsi corridor is shortest and therefore has the lowest building cost.
- Lihula - Pivarootsi corridor is also the straightest, bringing the overall building cost of the alternative down even more compared with other corridors between Lihula and the sea.
- Lihula - Kulli gets high preference for following existing cable corridor for 19 kilometres. As the existing corridor touches Natura 2000 areas in Tuhu küla, future planning and design projects must address this possible conflict.
- For all route corridors, close cooperation with Lääneranna municipality is recommended, to analyse necessities of their plans with ongoing renewable energy projects.

5.6.2. Environmental criteria

For environmental criteria, preference is given to Lihula - Nõmme corridor alternative.

Criteria	Lihula – L3-1 – Pivarootsi	Lihula – L3-1 - Nõmme	Lihula – Kulli
Conflicts with Natura 2000 area	Conflict with 2 Natura areas - space between areas is not wide enough to pass.	30m distance Natura area on coast, other nearest Natura areas are 176 m and 200 m from the corridor.	Corridor is ca 120 m from Natura area, In mid part, Natura is 200 m and 300 m from the corridor. In northern part, corridor is between 2 Natura areas.
Conflict with I and II category protected species	no	no	Conflict with II category protected plant region ca 5500 m2.
Conflict with III category protected species	8 species, 60448 m2 land affected	14 species, 253624 m2 land affected	44 species, 314551m2 land affected
Conflicts with other protected areas	<Null>	<Null>	<Null>

The main conclusions from route comparison are following:

- For Natura 2000 advantage is given to Lihula – Nõmme corridor, although the preferences is small. Every corridor has some conflict with Natura 2000 areas – mainly on coast, but also near existing line corridors. For Lihula – Pivarootsi corridor, the line must go through a narrow space between areas of Väinamere bird area. In future developments impacts on Natura 2000 must be assessed thoroughly and if necessary, transmitted the overhead line to cable further from coast.
- Lihula – Pivarootsi and Lihula - Nõmme corridors do not have conflicts with I and II category protected species.

- For III category protected species, clear preference is given to Lihula - Pivarootsi corridor. Even though the negative impacts on these species can be mitigated through impact assessment results in next stages, the differences between Kilingi-Nõmme – Häädemeeste corridor and Kilingi-Nõmme – Võiste corridor are undisputable.

Figure 23. Lihula - Pivarootsi corridor conflict with Natura 2000 areas.

Figure 24. Lihula - Kulli corridor conflicts between and on the border of Natura 2000 areas

5.6.3. Socioeconomic criteria

For socioeconomic criteria, preference is also given to Kilingi-Nõmme - Häädemeeste corridor alternative.

Criteria	Lihula – L3-1 – Pivarootsi	Lihula – L3-1 - Nõmme	Lihula – Kulli
Cadastral unit with residential land use	336,59	362,51	9028,39
Cadastral unit with residential land use and existing buildings	<Null>	<Null>	<Null>
Residential buildings within 250 m	33,00	34,00	40,00
Non-residential buildings within 250 m	75,00	79,00	85,00
Forest in corridor (ha)	160,52	219,98	457,71

Mining area in corridor (ha)	0,00	0	4,80
Mining allotment in corridor (ha)	0,00	0	4,78
Cultivated land (ha)	198,27	212,94	378,54
Cadastral units with detailed plans	<Null>	<Null>	<Null>
Cultural monuments	3	<Null>	<Null>
Cemeteries and churches	<Null>	<Null>	<Null>
Privately held land plots	1 970 113,4 m2	3 023 332,64 m2	7 612 997,78 m2

The main conclusions from route comparison are following:

- For impacts with residential functions and land use, Lihula - Pivarootsi corridor gets clear preference. For future planning and design processes, it must be kept in mind that the end point of the overhead line in Pivarootsi has clear conflicts with Natura 2000 areas.
- For cultural monuments, all corridors are the same. Avoidance of churches and cemeteries is a base criterion, and these areas are excluded in the first stage, when drawing the corridors.

5.6.4. Preferred corridor alternative for Lihula substation

For Lihula substation, the most preferred corridor is Lihula – Nõmme corridor alternative. Even though it does not get high preference for any criteria category, it does not have intensive conflicts with the most important components – Natura 2000, residential areas. For technical criteria, it comes out as average. So, the preference in Lihula substation is not formed based on criteria categories, rather than specific criteria itself.

Figure 25. Preferred corridor alternative for Lihula substation

5.7. Corridor alternatives from Sindi substation

There are three corridor alternatives compared from Sindi substation:

- Sindi – Reiu corridor alternative sketched in this report.
- Sindi – Kavaru corridor alternative sketched in this report (includes divisions between Sindi and Audru (Sindi – P1.1 and Sindi P1.2)).
- Sindi – Lao corridor alternative sketched in this report (includes divisions between Sindi – P1.1 and Sindi P1.2 and P2 – Lao and P2-P3-Lao).

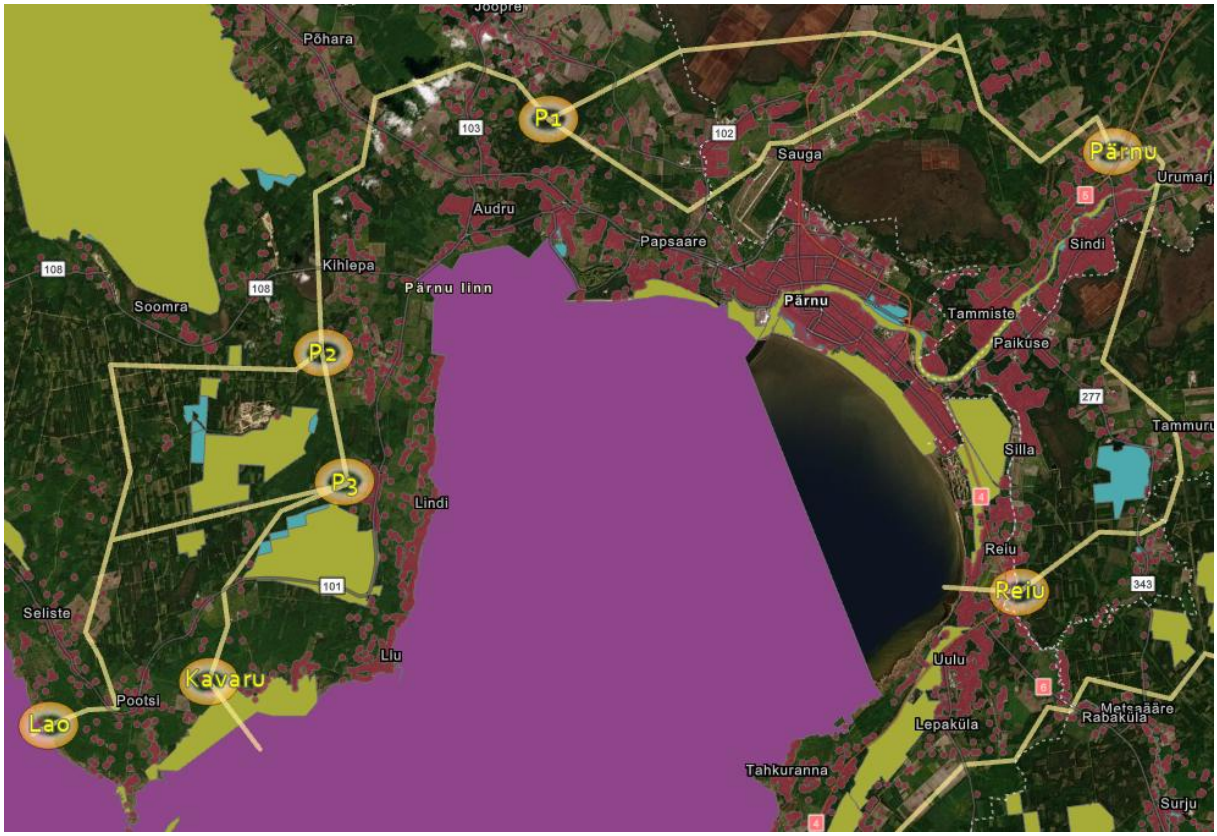


Figure 26. Corridor alternatives compared from Sindi substation

From Lao, Kavaru and Reiu, cable corridors to the sea are possible. The final direction depends on the corridor alternative chosen. Reiu corridor is in densely populated areas, which requires thorough assessment for the right passage of the corridor causing minimum impact on residential areas. Environmental restrictions are smaller in Reiu and Lao. For Kavaru, Natura 2000 areas cover the coast, requiring environmental impact assessment in next steps of corridor planning to find the best possible locations for cables with minimum impacts on the environment.

Figure 27. Cable directions from Lao to the sea.

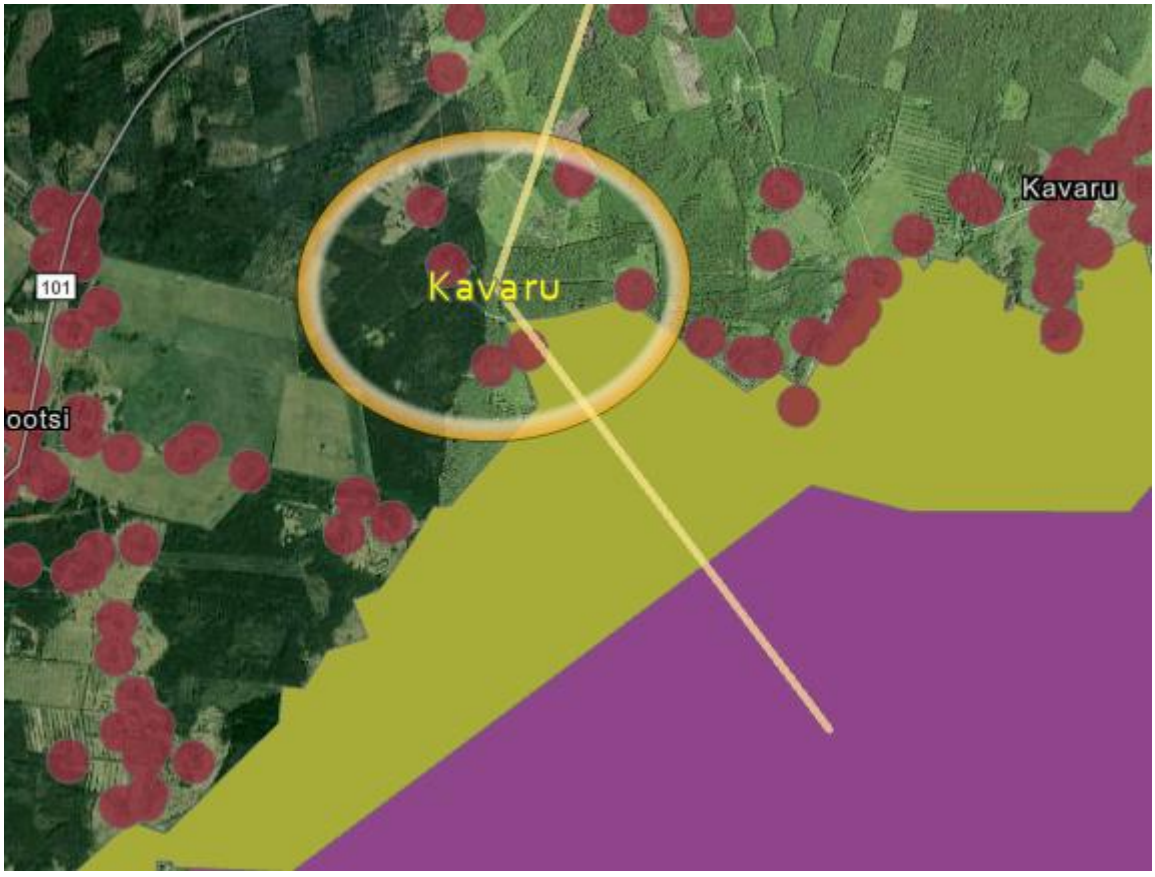


Figure 28. Cable directions from Kavaru to the sea.

Figure 29. Cable directions from Reiu to the sea.

5.7.1. Technical criteria

According to the technical criteria the most preferred corridor is Pärnu – Reiu corridor alternative.

Criteria	Pärnu - Reiu	Pärnu – P2 – Lao	Pärnu – P3 - Lao	Pärnu - Kavaru
Length of the corridor	20,62	43,77422552	58,96	35,62
The cost of the corridor (eur)[7]	8764463,40	28150006,9	25057808,76	24686195,49
The number of possible turns in the corridor	11,00	15	20,00	13
The need to build anchor masts	1,00	2	3,00	0
Length of excisting 110 and 330 kV corridors used	5	0	0	0
Number of crossings with existing electricity lines	1	1	1	1

[7] The cost of building a 1 km overhead line is estimated at 425,000 euros, and the cost of an underground cable is 1.2 times higher

Number of crossings with roads	10	24	31	29

The main conclusions from route comparison are following:

- Pärnu – Reiu corridor alternative is the shortest, therefore its building costs are lowest.
- Pärnu – Reiu corridor enables the use of existing line corridor for 5 km, which is not much overall, but still more than other corridors.
- Crossing Rail Baltic railway must be considered in the next steps for Pärnu – Reiu corridor.

5.7.2. Environmental criteria

For environmental criteria, preference is given to Pärnu – P3 – Lao corridor alternative.

Criteria	Pärnu - Reiu	Pärnu – P2 – Lao	Pärnu – P3 - Lao	Pärnu - Kavaru
Conflicts with Natura 2000 area	Crossing over Natura 2000 area. Closest Natura 2000 area is ca 350m.	Has a conflict with Natura 2000 area, ca 400 m along the corridor.	Nearest Natura 2000 area is in 136 m on one side and on 250 m on the other side. Line is situated between two Natura areas.	Ca 3 800 m2 is in conflict with Natura 2000 area. Other parts of the same Natura 2000 area are close to the corridor (ca 30m).
Conflict with I and II category protected species	18 440 m2 conflict with II cat species	Small conflict with 1 species of II category	Small conflict with 1 species of I cat species	no
Conflict with III category protected species	10 species, 27 119 m2 land affected	26 species, 66705 m2 land affected	4 species, 32 006 m2 land affected	4 species, 39347 m2 land affected
Conflicts with other protected areas	0	0	0	0

The main conclusions from route comparison are following:

- Pärnu – P2 – Lao corridor alternative gets preference for Natura 2000. Although the area is also in conflict with Natura 2000, the conflicts for other corridors are more intense.
- For other compared criteria, the differences between corridor alternatives are minor and can be mitigated through necessary measures in the next steps of the planning and design process.

Figure 30. Pärnu - P2 - Lao corridor possible conflict with environmental restrictions

5.7.3. Socioeconomic criteria

For socioeconomic criteria, preference is given to Pärnu – Kavaru corridor alternative. Close preference is given to Pärnu – P2 – Lao corridor alternative.

Criteria	Pärnu - Reiu	Pärnu – P2 – Lao	Pärnu – P3 - Lao	Pärnu - Kavaru
Cadastral unit with residential land use	54831,61	0	18644,91	0
Cadastral unit with residential land use and existing buildings	1 unit near the existing line corridor	0	0,00	0
Residential buildings within 250 m	12,00	12	14,00	13
Non-residential buildings within 250 m	85,00	40	39,00	34
Forest in corridor (ha)	178,30	464	606,91	323,71
Mining area in corridor (ha)	32,41	106,48	159,61	106,36
Mining allotment in corridor (ha)	0,00	104,13	102,39	102,39

Cultivated land (ha)	127,67	215,58	325,13	193
Cadastral units with detailed plans	<Null>	1 unit with building design specifications	1 unit with building design specifications	<Null>
Cultural monuments	0	0	0	0
Cemeteries and churches	0	0	0	0
Privately held land plots	1825456 m2	3548371 m2	6613516 m2	4520938 m2

The main conclusions from route comparison are following:

- The main preference for Pärnu – Kavaru corridor is given through land units with residential use – no such units are placed in Pärnu – Kavaru corridor.
- In addition, Pärnu – Kavaru corridor does not have land units with building design specifications (ehitusõigus) in its corridor. Pärnu – Reiu is also missing this, but as Pärnu – Reiu follows through several residential land units near Pärnu and near Reiu, preference to this corridor can not be given.
- For cultural monuments, all corridors are similar. As this was a precondition for corridors, it has been met.

5.7.4. Preferred corridor alternative for Sindi substation

For Sindi substation, two corridors are given preference to: Pärnu – Reiu for technical preferences, Pärnu – Kavaru for socioeconomic preferences.

Figure 31. Preferred corridor alternatives for Sindi substation

5.8. Corridor alternatives from Kilingi-Nõmme substation

There are three corridor alternatives compared from Kilingi-Nõmme substation:

- Kilingi-Nõmme – Võiste corridor alternative sketched in this report.
- Kilingi-Nõmme – Häädemeeste corridor alternative sketched in this report.
- Kilingi-Nõmme – Kabli corridor alternative sketched in this report.

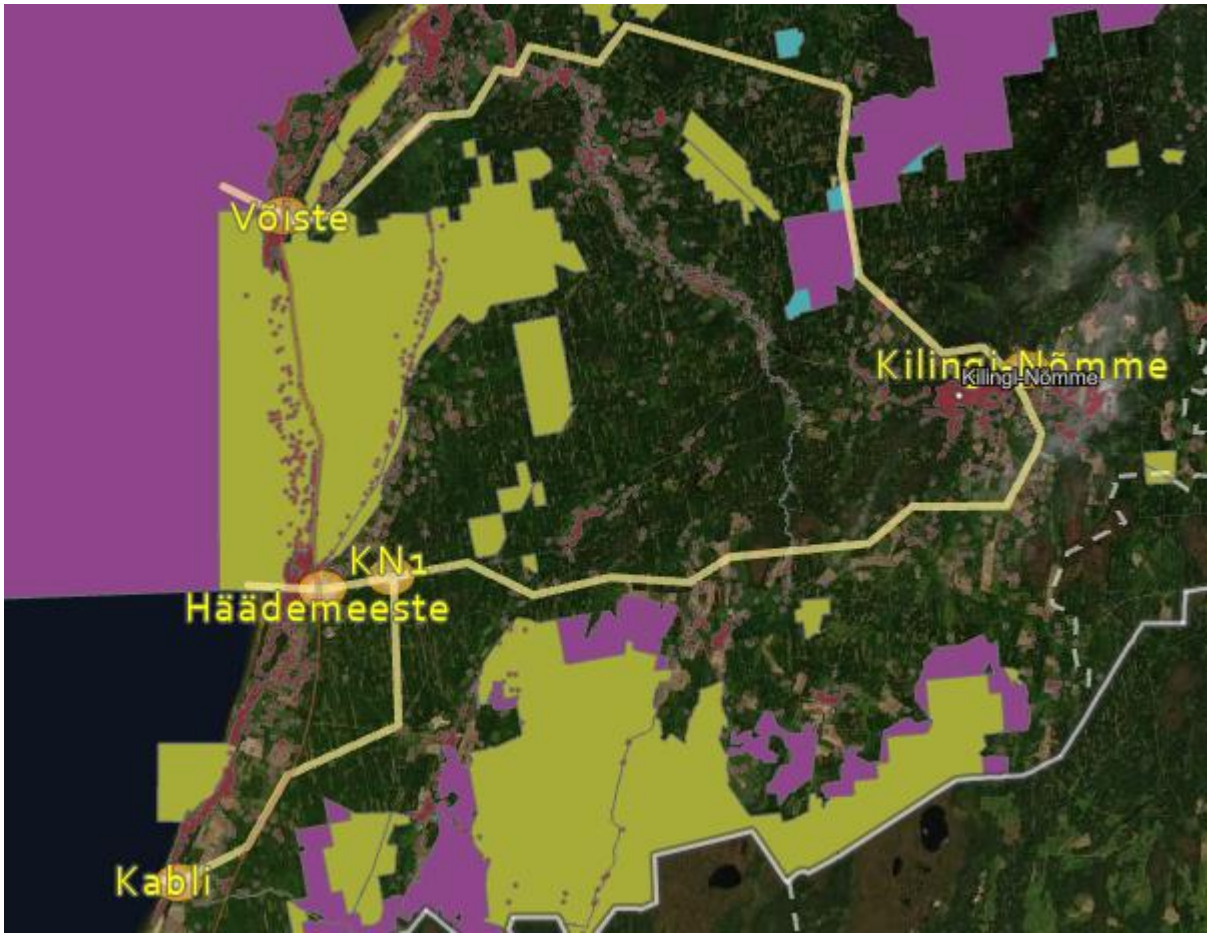


Figure 32. Corridor alternatives compared from Kilingi-Nõmme substation

From Kabli, Häädemeeste and Võiste, cable corridors to the sea are possible. The final direction depends on the corridor alternative chosen. All cable corridors are in densely populated areas, which requires thorough assessment for the right passage of the corridor causing minimum impact on residential areas. Environmental restrictions are smaller in Kabli. For Häädemeeste and Võiste, Natura 2000 areas cover the coast, requiring environmental impact assessment in next steps of corridor planning to find the best possible locations for cables with minimum impacts on the environment.

Figure 33. Cable directions from Kabli to the sea.

Figure 34. Cable directions from Häädemeeste to the sea.

Figure 35. Cable directions from Võiste to the sea.

5.8.1. Technical criteria

According to the technical criteria the most preferred corridor is the one drawn in Kilingi-Nõmme – Häädemeeste alternative combined with Häädemeeste cable corridor for cable transmission.

Criteria	Kilingi-Nõmme – Võiste	Kilingi-Nõmme – Häädemeeste	Kilingi-Nõmme - Kabli
Length of the corridor	42,50	35,33	49,81
The cost of the corridor (eur)[8]	18062049,59	15013916,63	21169464,18
The number of possible turns in the corridor	17,00	16,00	19,00
The need to build anchor masts	2,00	1,00	2,00
Length of excisting 110 and 330 kV corridors used	33,4	3,3	2
Number of crossings with existing electricity lines	8 lines	5 lines	5 lines

[8] The cost of building a 1 km overhead line is estimated at 425,000 euros, and the cost of an underground cable is 1.2 times higher

Number of crossings with roads	76	48	85

The main conclusions from route comparison are following:

- Kilingi-Nõmme - Häädemeeste corridor is shortest and therefore has the lowest building cost.
- Kilingi-Nõmme - Häädemeeste corridor is also the straightest, bringing the overall building cost of the alternative down even more compared with other corridors between Kilingi-Nõmme and the sea.
- Kilingi-Nõmme – Võiste gets high preference for following existing cable corridor for 33 kilometres. As the existing corridor goes through Natura 2000 areas, this preference is quickly turned into a disadvantage as building new lines inside existing corridors is in conflict with Natura 2000 goals.
- For all route corridors, technical solution for crossing with the planned Rail Baltic railway corridor, must be considered in future planning and design stages.

From Häädemeeste to the sea, the cable corridor must be developed in an densely populated area and Natura 2000 areas on the shore. This requires thorough assessment for the right passage of the corridor causing minimum impact on residential areas. Natura 2000 areas cover the coast, requiring environmental impact assessment in next steps of corridor planning to find the best possible locations for cables with minimum impacts on the environment.

5.8.2. Environmental criteria

For environmental criteria, preference is given to Kilingi-Nõmme - Häädemeeste corridor alternative.

Criteria	Kilingi-Nõmme – Võiste	Kilingi-Nõmme – Häädemeeste	Kilingi-Nõmme - Kabli
Conflicts with Natura 2000 area	Passing in between Natura 2000 areas. Crossing over Natura 2000 area (river) and has a conflict near the existing line corridor.	Crossing over Natura 2000 area (river)	Crossing over Natura 2000 area (river)
Conflict with I and II category protected species	1 II cat bird near the existing line corridor	no	1 I cat and 1 II cat protected species (small conflict with area)
Conflict with III category protected species	98 species, 828307 m2 land affected	10 species, 18754 m2 land affected	18 species, 272219 m2 land affected
Conflicts with other protected areas	2 plots with permanent habitat	small conflict with permanent habitat	<Null>

The main conclusions from route comparison are following:

- For Natura 2000 small advantage is given to Kilingi-Nõmme – Häädemeeste and Kilingi-Nõmme – Kabli corridor alternatives. Kilingi-Nõmme – Võiste corridor has two specific conflicts with Natura 2000 areas – when following the existing line through Kikepera bird area and near Võiste – a new line following through Uulu-Võiste and Luitemaa areas. The alternative can be considered if now other option is available.

- Kilingi-Nõmme – Häädemeeste corridor does not have conflicts with I and II category protected species.
- For III category protected species, clear preference is also given to Kilingi-Nõmme – Häädemeeste corridor. Even though the negative impacts on these species can be mitigated through impact assessment results in next stages, the differences between Kilingi-Nõmme – Häädemeeste corridor and Kilingi-Nõmme – Võiste corridor are undisputable.

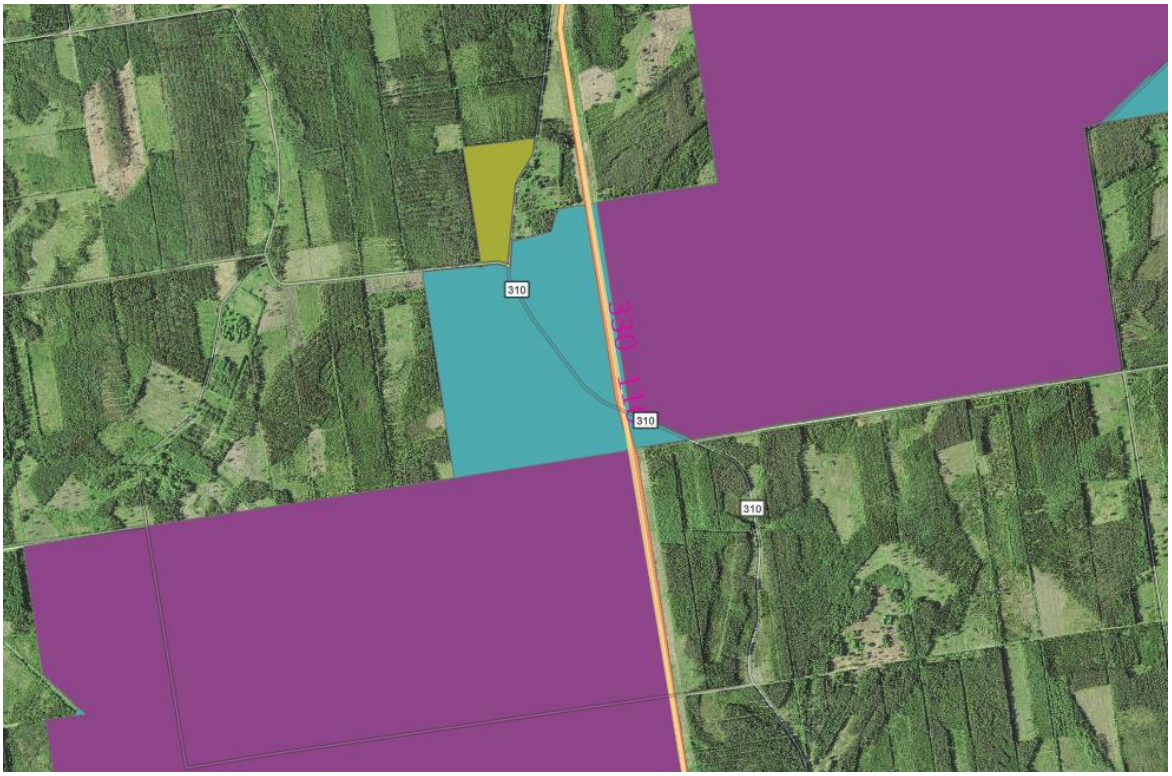


Figure 36. Kilingi-Nõmme - Võiste corridor conflict with Natura 2000 areas inside existing overhead corridor

Figure 37. Kilingi-Nõmme - Võiste corridor conflict between Natura 2000 areas

- For other compared criteria, the differences between corridor alternatives are minor and can be mitigated through necessary measures in the next steps of the planning and design process.

5.8.3. Socioeconomic criteria

For socioeconomic criteria, preference is also given to Kilingi-Nõmme - Häädemeeste corridor alternative.

Criteria	Kilingi-Nõmme – Võiste	Kilingi-Nõmme – Häädemeeste	Kilingi-Nõmme - Kabli
Cadastral unit with residential land use	46439,10	9103,18	22850,06
Cadastral unit with residential land use and existing buildings	1 unit near the existing line corridor	<Null>	<Null>
Residential buildings within 250 m	35,00	23,00	30,00
Non-residential buildings within 250 m	65,00	54,00	62,00
Forest in corridor (ha)	472,53	424,32	663,25

Mining area in corridor (ha)	4,05	<Null>	<Null>
Mining allotment in corridor (ha)	3,64	0,00	0,00
Cultivated land (ha)	151,75	189,47	219,95
Cadastral units with detailed plans	<Null>	<Null>	<Null>
Cultural monuments	<Null>	<Null>	<Null>
Cemeteries and churches	<Null>	<Null>	<Null>
Privately held land plots	155 plots and 3 641 143,66 m2	155 plots and 4 481 413,15 m2	189 plots and 5 001 966,60 m2

The main conclusions from route comparison are following:

- For impacts with residential functions and land use, Kilingi-Nõmme – Häädemeeste corridor gets clear preference. For future planning and design processes, it must be kept in mind that the end point of the overhead line must be before Häädemeeste, a densely populated area. If also cable corridors are considered, Häädemeeste with its population density, might not be preferred. Cable mitigates the conflict from overhead line.
- For cultural monuments, all corridors are the same. Avoidance of churches and cemeteries is a base criterion, and these areas are excluded in the first stage, when drawing the corridors.

5.8.4. Preferred corridor alternative for Kilingi-Nõmme substation

For Kilingi-Nõmme substation, the most preferred corridor is Kilingi-Nõmme – Häädemeeste alternative combined with cable corridor for Häädemeeste.

Figure 38. Preferred corridor alternative for Kilingi-Nõmme substation

6. Recommendations for suitable spatial planning and impact assessment procedure for planning the route

6.1. Future planning process for Latvia

In Latvia, the precondition for developing the lines is for the corridors to be added to municipality territorial plans. This can either be done voluntarily by the municipalities or through Cabinet of Ministers if the project is of national importance. The precondition for the corridor to be added to territorial plans, is going through the process of EIA.

The requirement of EIA is set by the Law on Environmental Impact Assessment[9] of Latvia. In its annex – Objects Requiring Impact Assessment - par 26 state high-voltage electric lines the length of which is more than 15 kilometres and the voltage of which is 110 kilovolts or more as an object requiring impact assessment. Therefore, impact assessment must be carried out for the lines, if it meets the requirements set in law. For the EIA process to be carried out properly and fast, it is essential to know technical parameters, proposed solutions and alternatives. The corridors mainly affect protected territories on coast.

After EIA procedure and detailed planning is done, designing the structure can begin.

6.2. Future planning process for Estonia

In Estonia, the options for planning the line and/or cable corridor and assessing its environmental, social and economic impacts can be done through three possible procedures – national designated spatial plan, local municipality comprehensive plan with building design specifications and a local municipality detailed plan with environmental impact assessment.

6.2.1. National designated spatial plan

The compilation of a national designated spatial plan is divided into two stages - the pre-selection stage for the corridor(s) and the subsequent stage of compiling a detailed solution. During the pre-selection phase, the most suitable alternative for establishing a line corridor is found. For that, possible location alternatives for the corridors are outlined, they are compared based on quantitative and qualitative indicators, and the location alternative that is most favourable for establishing a line corridor is decided. Sector studies and impact assessment (environmental, social, economic) provide important input for the choice of the preferred route alternative, especially in the context of environmental restrictions – Natura 2000 and other restricted areas. By the end of the site pre-selection phase, a decision is made to proceed with the best possible line corridor or corridors to which a detailed plan is prepared, which determines the building rights of the envisaged construction work.

In the second stage of the plan - compiling a detailed solution - the construction right is determined for the most suitable line corridor alternative selected in the pre-selection stage and other tasks provided in the Planning Act are solved, including traffic management conditions, landscaping requirements, easements, etc. Thus, in the second stage, a plan is prepared in the level of a detailed plan, which is the basis for the preparation of the construction project. In parallel with the preparation of the detailed solution, a design project will be prepared for the most suitable alternative to the line

[9] https://likumi.lv/ta/en/en/id/51522-on-environmental-impact-assessment

and an impact assessment will be carried out. The purpose of the impact assessment here is to assess the effects of a specific technical solution and to develop mitigation measures.

National designated spatial plan is prepared by Ministry of Finance. The planning area of a national designated spatial plan is not limited to a territory of a single municipality but allows for a wider look for line corridor alternatives – for example the areas around all substations or multiple municipalities. Havin Ministry of Finance in charge of the planning process, means not having to conduct several procedures with different municipalities. This results in reduced time spent on the planning and SEA procedures.

National designated spatial plan, if conducted too general, might leave local municipalities and residents uninvolved in the process. At the same time, they are the most impacted by the line itself. Therefore, should national designated spatial plan be chosen as the appropriate planning procedure for future planning of the overhead line, much emphasis must be put to involvement of local municipalities and residents, even though it is not thoroughly required by Planning Act.

6.2.2. Municipality comprehensive plan and building design specifications

Possible line corridors analysed in this report are located on the territories of municipalities in the middle of their comprehensive planning processes. Comprehensive plan of a municipality enables to carry out an integrated planning process for line corridor planning that considers not only the necessities of the line itself, but also other spatial requirements stemming from other tasks of the municipality – residential areas, recreation need, business environment etc. Most of the municipality comprehensive plans are in development and currently in different stages, so if comprehensive plan will be chosen as the most appropriate planning level for the line corridors, thorough cooperation must be made with municipalities for joining the procedures.

For comprehensive plans, strategic environmental assessment is compulsory. For line corridors, impacts on Natura 2000 must be assessed to finalise the right solution for overhead lines and transmission areas. This complicates the comprehensive planning and its SEA process, as a new topic will be brought on the table. For the line corridor to be assessed and planned in the comprehensive planning process, specific needs of the line corridor must be presented to the municipality.

Comprehensive planning is done by municipalities. Municipality governments adopt the plans, which means that for the plan to become legally binding, municipalities have the final say. If there are disputes or arguments between parties, municipalities can stall the adoption process to turn the result in their favour. At the same time, municipalities are known in their communities and if municipalities lead the process, the result might be more acceptable by residents.

There are four municipalities affected by the line corridors. Different municipalities work in different pace and have different approaches and needs for spatial development. Therefore, it is necessary to manage four different comprehensive planning procedures for line comparison and selection.

Comprehensive plan is not bases for construction project. After comprehensive plan is adopted by the municipality, building design specifications must be applied for from the municipality and/or Consumer Protection and Technical Regulatory Authority. During this, public consultations will also be carried out, to talk over the details that were left unclear during the comprehensive planning process.

If comprehensive planning procedures go well and municipalities are keen on taking on planning and assessment of corridors, comprehensive planning and building design specifications are the fastest way for corridor planning.

It must be kept in mind that municipalities have contracts with planning consultants and environmental experts to carry out the comprehensive planning process. Assessment of preferred corridors and their impacts on Natura 2000 area are usually not foreseen in the consultancy contracts.

6.2.3. Municipality detailed plan and environmental impact assessment

Detailed plan is done for a certain area of municipality's territory needed to build the line and other necessary structures for it to work. For line corridors on the coast of Pärnumaa, an impact assessment is also necessary, due to proximity of Natura 2000 areas. If the line is longer than 15 kilometres, impact assessment is also required by law[10].

Detailed planning is also done by municipalities. Municipality governments adopt the plans, which means that for the plan to become legally binding, municipalities have the final say. If there are disputes or arguments between parties, municipalities can stall the adoption process to turn the result in their favour. At the same time, municipalities are known in their communities and if municipalities lead the process, the result might be more acceptable by residents.

Detailed plan is bases for construction project. After the plan is adopted by the municipality, building right is granted and designing the corridor can start.

The complication for detailed planning procedures come from the fact that overhead lines cross municipality borders which again means different legal procedures in four different municipalities, for an object that must be handled as one for it to function properly. If one municipality stalls the process, the whole development at risk.

As the line corridors are planned for cross border activities, the need for cross border SEA and/or EIA will arise and might be necessary in the building and planning procedures of the line corridors.

[10] Par 6 of the Environmental Impact Assessment and Environmental Management System Act defines construction of an overhead electrical power line with a voltage of 220 kV or more and a length of more than 15 km as an activity with significant environmental impact.