7th SEERC Workshop

Navigating Spatial, Environmental and Siting Challenges in Electric Power Facility Development

Spatial, Environmental and Siting Issues in Electric Transmission Facility Development in Turkey

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Headlines

- SPATIAL AND SITTING ISSUES FOR THE PLACEMENT OF ELECTRIC TRANSMISSION FACILITIES
  - Site Selection
  - Acquisition of Land and City Approvals
  - Spatial and Urban Plans
  - Fitting The Location of the Building into the Spatial Situation
  - City Approvals for Submarine Cables
  - Access Roads
  - Architectural Appearance of the Building
  - Transformation of Existing Land into Construction
- ENVIRONMENTAL ISSUES FOR THE PLACEMENT OF ELECTRIC TRANSMISSION FACILITIES
  - Electromagnetic Fields
  - Environmental Impact Study
- CHALLENGES IN ELECTRIC TRANSMISSION FACILITY DEVELOPMENT
  - Environmental Impact Study
  - Spatial and Urban Plans
  - Land Acquisition
  - City Approvals

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SPATIAL AND SITTING ISSUES FOR THE PLACEMENT OF ELECTRIC TRANSMISSION FACILITIES

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Site Selection

At least 3 alternative location options

Opinions of relevant institutions and organizations (forest, roads, waterways, mining, cultural properties etc.)

Preliminary meeting about planning and design with approving authorities

Land properties

- Zoning status
- Security situation
- Nearby pollution elements (like stonepit, cement factories, iron and steel facilities)
- Meeting possible additional space demands in the future
- Ground structure
- Natural disaster situations (like earthquake, landslide)

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Site Selection

- When planning overhead lines, it is tried to choose the shortest possible distance between two points and the route that best suits the texture of the city.

- When planning underground cables, it is tried to pass through zoned areas and the roadsides as much as possible.

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Acquisition of Land and City Approvals

In agricultural lands

- Permission to allocate for non-agricultural purposes is obtained.

In forest lands

- The right of way through forest lands is taken.

In pasture lands

- Permission to change pasture features is obtained.

In public lands

- Easement is taken for the life of line or building

In lands belonging to other public institutions

- Land is acquired by paying the fee.

In zoned areas

- Preparation/change of zoning plan is done.

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Spatial Plans

- According to the legislation regarding zoning, it is forbidden to use lands other than those specified in the zoning plan.
- For this reason, when planning energy transmission facilities, the zoning plans given below are used/prepared in line with the requests of the approval authorities.

1/100000 Scale Territorial Plan

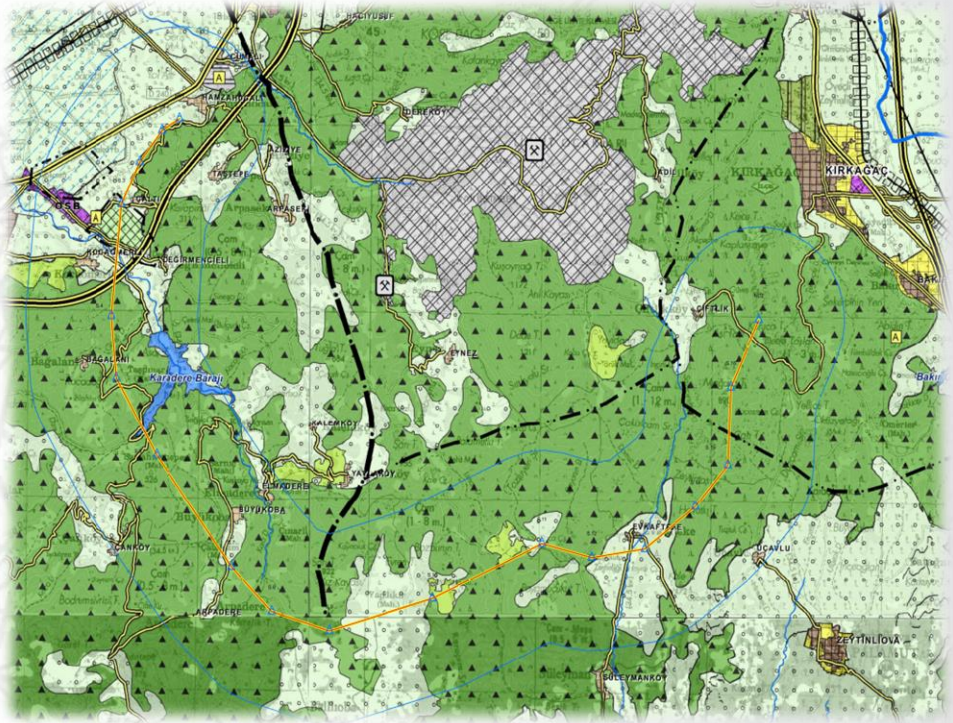
1/5000 Scale Master Development Plan

1/1000 Application Zoning Plan

Spatial Plans

-1/100000 Territorial Plan

- 1/100000 Territorial Plan is prepared at the regional, basin or provincial level that is similar in terms of geographical, social, economic, administrative, spatial and functional qualities.
- In energy transmission facilities, if the approval authorities give a positive opinion, master and implementation zoning plans can be prepared without the need for territorial plan changes.



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Urban Plans

Master development plans and implementation zoning plans are obtained from municipalities and provincial administrations.

The facilities to be constructed are added to the zoning plans obtained and plan notes are prepared.

Institution/Organization opinions regarding the zoning plans are obtained.

The prepared zoning plan amendments are submitted to the authorities for approval.

The implementation zoning plan approval process cannot begin until the master development plans are approved.

It is important to specify the building approach distance, zoning application conditions, etc. in the plan notes

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Fitting the Location of the Building into the Spatial Situation

In case of the planning in areas with an existing zoning plan, It is important that;

- Consistence with the construction conditions previously determined in the plan notes,
- Paying attention to the approach distances between neighboring parcels,
- In accordance with High Current Facilities Regulation, paying attention to the approach distances for activity areas such as housing, pipelines, highways, power plants etc.

If these issues are not taken into consideration, legal problems may occur.

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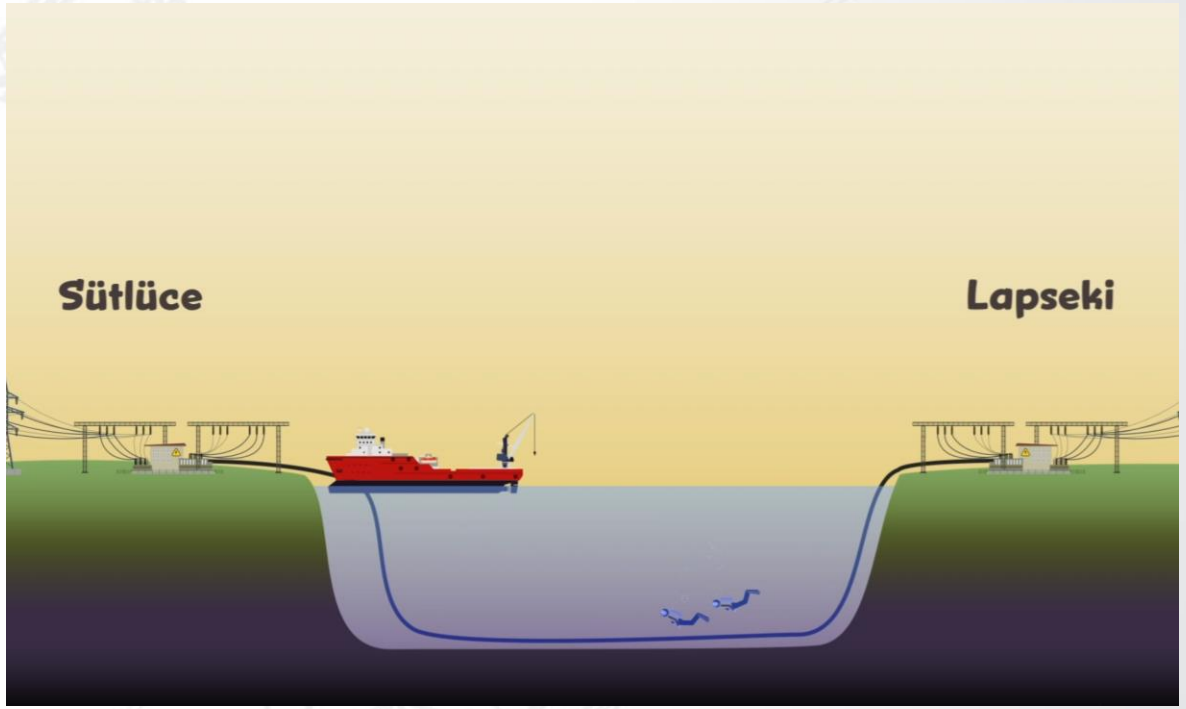
City Approvals for Submarine Cables

- Before laying the submarine cable, permissions are taken from Turkish Naval Forces and relevant ministries.
- In addition, the governorship and municipalities are informed about the project.
- After the project is completed, the Navy is informed to add into existing maps.



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Access Roads

If there is a zoning plan

Existing roads are preserved

The building is positioned according to existing roads.

If there is no zoning plan

After the appropriate location is determined, it is planned together with the approval authority institutions.

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Architectural Appearance of the Building

- Unless there is a special request by other institutions, it is constructed according to type projects.
- In urban residential areas, Gas Insulated Substations are preferred in regards to space saving and urban aesthetics.

Transformation of Existing Land into Construction

- Harvest Periods
- Spawning periods of wildlife
- Bird migration periods (in power transmission lines)
- Climatic conditions (at the end of winter in places where winter conditions are severe; at the end of summer in tourist areas)

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ENVIRONMENTAL ISSUES FOR THE PLACEMENT OF ELECTRIC TRANSMISSION FACILITIES

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Effects of Electromagnetic Field

Regulation on Precautions to Protect the Environment and Public Health from the Adverse Effects of Non-Ionizing Radiation *(Date: 24.07.2010)*

Limit values for 50 Hz frequency;

- For electric field strength 15 kV/m
- For magnetic field strength 160 A/m
- For magnetic flux density 200 µT

Ek-1

Tablo-1: 0 Hz- 300 GHz Frekans Bantlarındaki Elektrik, Manyetik ve Elektromanyetik Alanlar İçin Limit Değerler

Frekans Aralığı f(Hz)	Elektrik Alan Şiddeti E(V/m)	Manyetik Alan Şiddeti H (A/m)	Manyetik Akı Yoğunluğu B (µT)	Eşdeğer Düzlem Dalga Güç Yoğunluğu Seq (W/m^2)
1Hz'e kadar	-	32 000	40 000	-
1 Hz-8 Hz	10 000	$32\,000/f^2$	$40\,000/f^2$	-
8 Hz-25 Hz	10 000	4 000/f	5 000/f	-
0.025 kHz-0.8 kHz	750/f	8/f	10/f	-
0.8 kHz-3 kHz	250/f	5	6.25	-
3kHz-150kHz	87	5	6.25	-
0.15 MHz - 1 MHz	87	0,73/f	0,92/f	-
1 MHz -10 MHz	$87/f^{1/2}$	0,73/f	0,92/f	-
10 MHz - 400 MHz	28	0,073	0,092	2
400 MHz - 2000 MHz	$1,375\ f^{1/2}$	$0,0037\ f^{1/2}$	$0,0046\ f^{1/2}$	f/200
2 GHz -300 GHz	61	0,16	0,20	10

Frekans (f); frekans aralığı sütununda belirtildiği gibidir.(Formülde frekans değeri yazılırken, frekans aralığı sütununda belirtilen frekans birimi dikkate alınacaktır.)

Effects of Electromagnetic Field

	Turkish Legislation	International Commission on Non-Ionizing Radiation Protection (ICNIRP) (General Public Exposure)	International Commission on Non-Ionizing Radiation Protection (ICNIRP) (Occupational Exposure)
E-field strength E (kV/m)	15	5	10
Magnetic field strength H(A/m)	160	160	800
Magnetic flux density B (μT)	200	200	1000

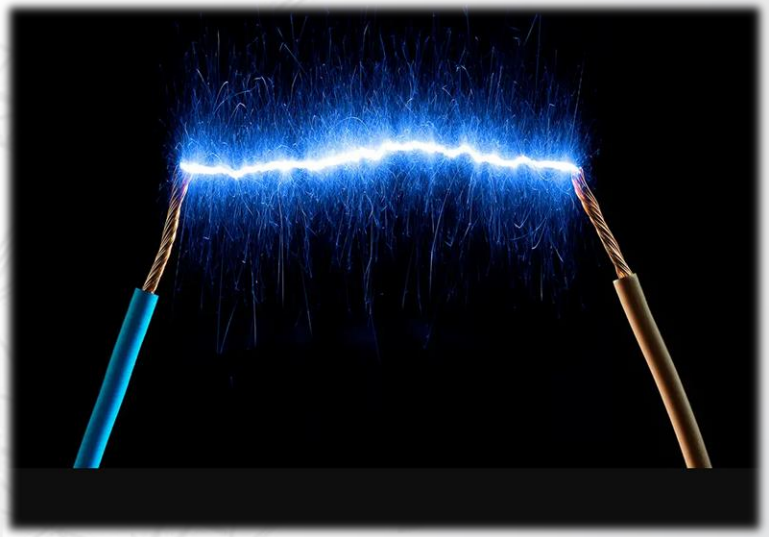
Effects of Electromagnetic Field

-Overhead Lines And Open Substations

	E- Field Strength (kV/m)	Limit Values of E- Field Strength (kV/m)	Magnetic flux density (µT)	Limit Values of Magnetic flux density (µT)
400 kV Energy Transmission Line	0,39-9,76	15	1,23-10,96	200
154 kV Energy Transmission Line	0,25-0,48	15	1,23-4,75	200
400 kV Substation	0,19-12,42	15	7,37-47,95	200
154 kV Substation	0,083-3,87	15	10,24-18,1	200

(TUBITAK UME, 2015)

Under busbar



Effects of Electromagnetic Field

-Gas Insulated Substations

Measurement Location	Explanation	Maximum Measured E- Field Strength (Emax) (kV/m)
Control Building	3-4 meters to the transformer	**4,50**
Near Transformer	4 meters to the transformer	**3,68**
Edge of Switchyard	18 meters to the transformer	**1,56**

Measurement Location	Explanation	Maximum Measured M- Field Intensity (Hmax) (A/m)
400 kV GIS	2 meters to GIS Building 13 m meters to the transformer	**41,2**
154 kV GIS	2 meters to GIS Building 13 m meters to the transformer	**2,35**
34,5 kV metal clad building	Inside of the building	**2,67**

(Küçükbakkalköy GIS (İstanbul), 2014)

Limit values for 50 Hz frequency;

- For electric field strength 15 kV/m
- For magnetic field strength 160 A/m

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Effects of Electromagnetic Field

During the periodic controls carried out on the line route, it has been observed that;

- There is no change in the development and diversity of natural vegetation.
- Grain crops, vegetables and meadow grasses, grown under and away from the line, grow at their normal rate.

Environmental Impact Assessment (EIA)

- For electrical energy transmission lines with a voltage of 154 kV and above and a length over 15 km ➡ EIA Positive Decision,
- For electrical energy transmission lines with a voltage above 154 kV and a length between 5 and 15 km ➡ EIA not Required Decision

is taken.

❗ In accordance with national legislation, construction activities cannot start until the EIA Process is completed.

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Environmental Impact Assessment (EIA)

- Substations and
- Energy transmission lines shorter than 5 km

are exempt from EIA.

Externally Financed Projects

- In Externally Financed Projects, environmental and social documents are prepared even if the projects are exempt from the National EIA Regulation.
- Additionally, environmental monitoring studies are carried out during the construction period.

In Externally Financed Projects, the construction process cannot start until the environmental processes are completed.

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CHALLENGES IN ELECTRIC TRANSMISSION FACILITY DEVELOPMENT

Environmental Impact Assessment

- Route changes due to nearby areas protected by special law (like archeological sites)
- Since the positive opinion of the relevant institutions is required, the time taken to meet the demands of these institutions (If the line is in more than one province, the number of institution opinions to be obtained increases)
- Prolonging the process of preparing scientific reports (ornithological evaluation reports and ecological evaluation reports)

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Spatial and Urban Plans

- Long approval processes (especially due to transmission lines passing through more than one province)
- Due to the growth of cities, substations remain within the city over time and this situation is difficult and costly to change.
- Due to the connection of many energy transmission lines to substation, local governments do not favor new overhead connection lines in order not to affect the city's aesthetics and visuality more.

Especially in city centers;
Open Substation → GIS
Overhead lines → Underground cables

Land Acquisition

- In the expropriation process, first of all, it is tried to agree with the public on the market price. If an agreement cannot be reached, the property acquisition is completed by determining the price through litigation.

- If there is an urgency in terms of the interconnected system, urgent expropriation can be made.

- Complaints received from the public:
  - Financial issues,
  - Electromagnetic field,
  - Not wanting his own land to be used, etc.

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City Approvals

- Long time for city permits to be approved

The construction process does not start until the approval processes regarding land acquisition are completed.

THANK YOU..

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