SC C6

Active Distribution Systems And
Distributed Energy Resources

Paper ID_10858

Analysis Of The Effect Of Solar Power Plants On Technical Losses In The Grid; Case Study: Kahramanmaras Region in Turkey

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Motivation

- In this study, the technical loss values that will occur in case of unplanned integration of the solar power plants in the Kahramanmaraş region to the electricity distribution network in this region are examined.

Method/Approach

- At the work, the analysis of the technical loss of the network over a pilot feeder, on which many solar power plants are connected, was carried out with the help of the network analysis program DIgSILENT Power Factory.

Objects of investigation

- The aim of this study is to examine how the changes in technical losses in the distribution network are shaped.

Experimental setup & test results

- According to the analysis results; in the event that the generation plants produce at a higher level than the energy consumed in the region, an increase in technical losses has been observed as a result of sending the produced energy back to the transformer center before it can be consumed.

Discussion

- It is very important in terms of technical losses to realize the integration of small power and few production facilities in the region where the consumption level is low, and to realize the integration of production facilities with capacities close to this consumption level in places where the consumption is high.

Conclusion

- The generation facility and load situation in the region play an important role in the integration of solar power plants into the grid.

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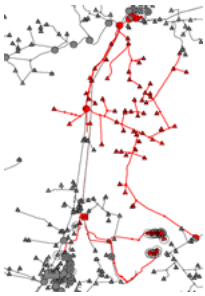
Scope of work

- Firstly, a pilot feeder connected to the electricity distribution grid was selected in Kahramanmaras
- This pilot feeder is 85.494 km long and has 69 load transformers with 6844 kW installed power and 18 solar power plant transformers with 17033 kW installed power.
- Then, transformer and line losses that change under different production conditions are calculated on this model.



Technical analysis

- Due to the seasonal/hourly variation in the generation level of solar power plants, technical loss calculations were carried out under different scenarios.
- And the following scenarios were evaluated:

✓ Production and consumption at full capacity,

✓ Production and consumption at half capacity

✓ Production at full, consumption at half capacity,

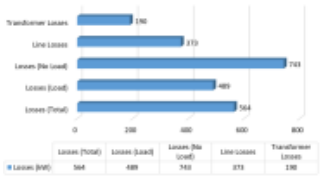
✓ Consumption at full, production at half capacity,

✓ No consumption, production at full capacity,

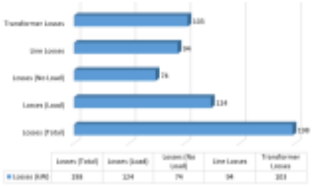
✓ No production and consumption at full capacity,

✓ No production and consumption at half capacity.

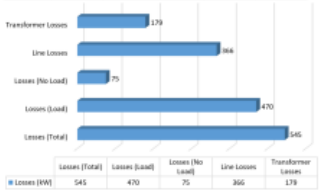
Simulation study



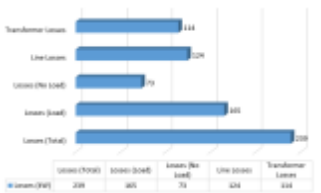
Production and consumption at full capacity



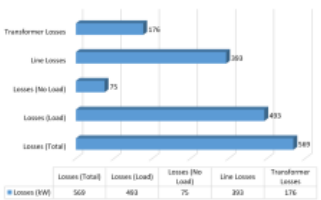
Production and consumption at half capacity



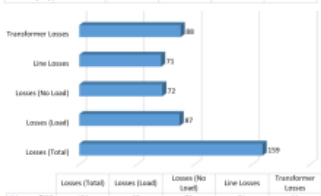
Consumption at half, production at full capacity



Consumption at full, production at half capacity



No consumption and production at full capacity



No production and consumption at full capacity

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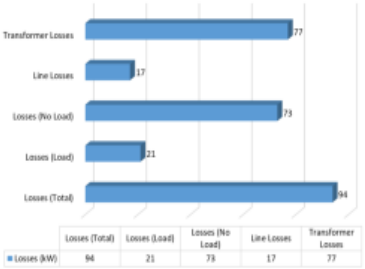
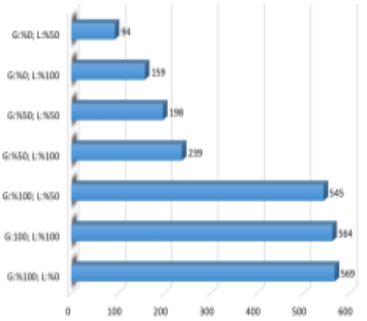
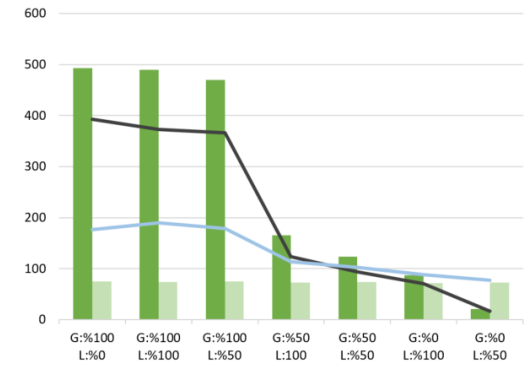
Simulation results



Optimal condition in the region: no production and half capacity of consumption



Technical loss situations in different production and consumption conditions



Distribution of technical losses

Conclusions

- According to the analysis results; If the production facilities produce more than the energy consumed in the region, technical losses increase as a result of sending the produced energy back to the transformer center without being consumed.
- In order to minimize the technical losses discussed within the scope of the study, the most appropriate location of the generation plants to be established within that location is of critical importance.
- It is important to realize the integration of small power and few production facilities in places where the consumption level is low in the region, and to realize the integration of production facilities with capacities close to this consumption level in places where the consumption level is high.
- Thus, instead of supplying the high levels of energy produced by a large number of generation plants to the grid from a single point, the same power will be distributed and applied, and in this case, significant improvements can be seen in the technical losses of the grid.