

BENEFIT ANALYSIS IN POWER GENERATION DISPATCH USING DYNAMIC LINE RATINGS ON TRANSMISSION LINES

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THERMAL LINE RATINGS

The maximum admissible temperature, which guarantees safe operation and the integrity of the conductor material, limits the capacity of the conductors of the power lines. If the conductor temperature exceeds the thermal limit, the system is at risk, which must not be allowed.

STATIC LINE RATING (SLR)

Calculates the line rating using values based on weather conditions assumed in a conservative way, is calculated based on unfavorable conditions for the carrying capacity of power lines.

Ambient temperature = 26 °C
Wind speed = 0.6 m/s
Solar radiation = 1000 W/m²

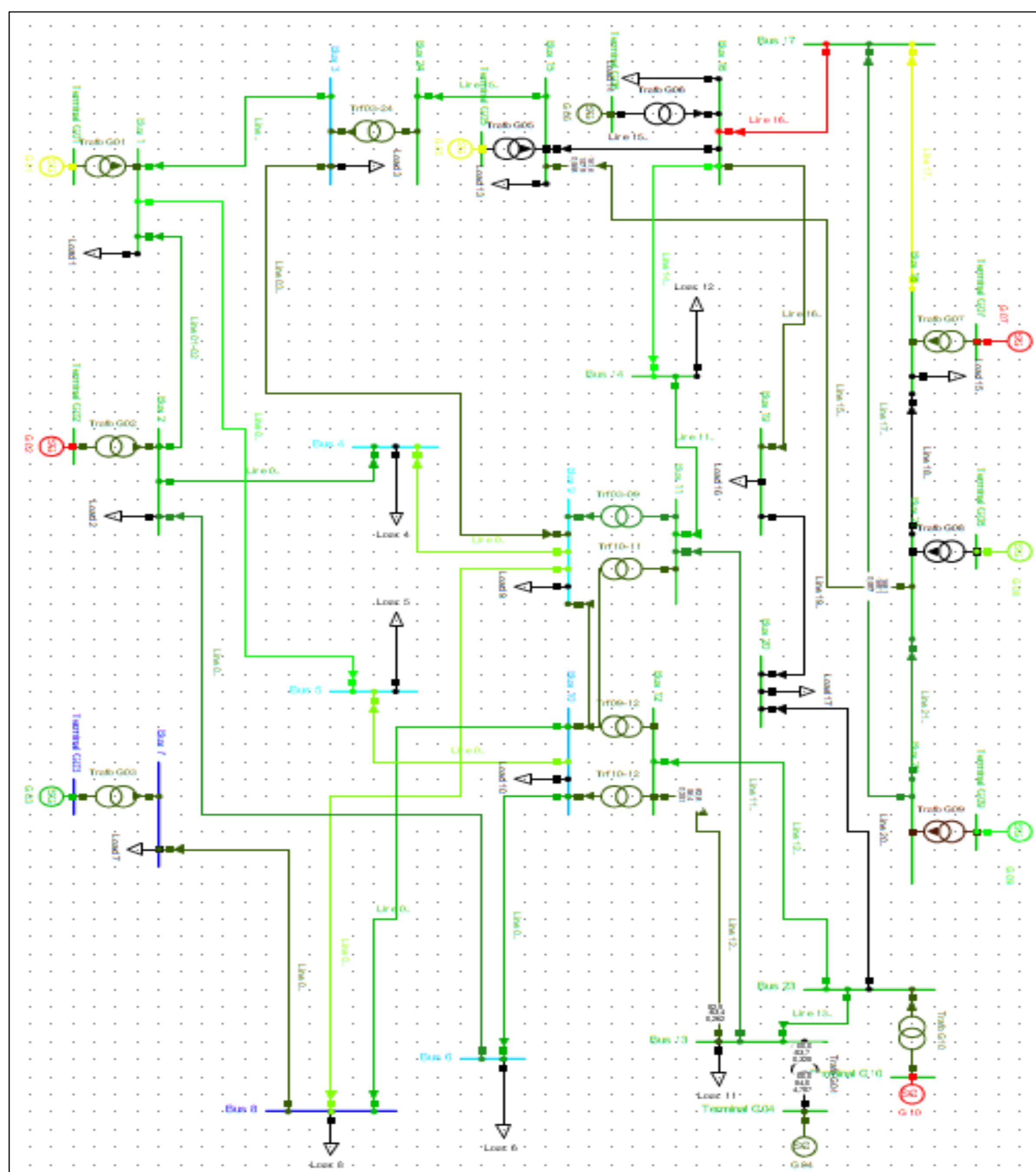
DYNAMIC LINE RATING (DLR)

The maximum current capacity that a conductor is capable of carrying based on the ambient conditions and the temperature of the conductors in real time.

Monitoring systems installed on the lines and weather stations near the lines provide data.

STUDY CASE DLR IN IEEE 24-BUS SYSTEM

- Wind farms: Generator in node 16 and in node 7. The wind generation data has been obtained from REE data.
- The system load data has been modified by obtaining a full week's demand data.
- Scenario 1: measured ampacity.
- Scenario 2: predicted ampacity values with a risk of 2.5%.
- Scenario 3: static ampacity values with a risk of 2.5%.
- Scenario 4: predicted ampacity values with a risk of 10%.
- Scenario 5: static ampacity values with a risk of 10%.



IEEE 24 SIMULATION

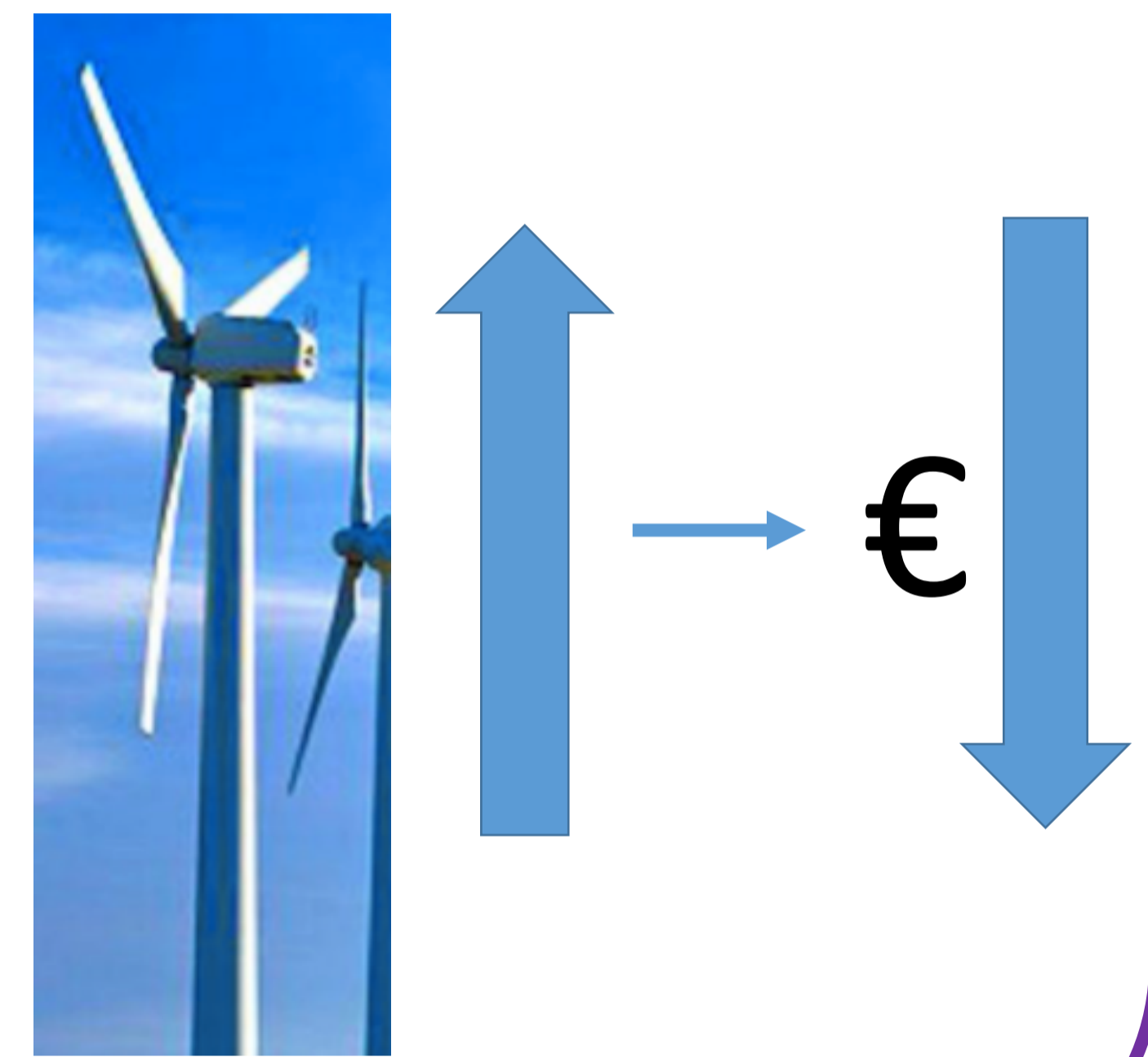
BENEFITS OF DLR

Increased wind power generation

At times of high wind generation, the capacity of the lines near to the wind farms increased.

Economic benefits

Using DLR systems cheaper generators can supply the system.



RESULTS

Energy generation and system cost for energy dispatch in one week

	Ampacity	Cost (€)
Scenario 1	Measured data	7077414,93
Scenario 2	Prediction 2,5% risk level	7104835,46
Scenario 3	Static 2,5% risk level	7116731,07
Scenario 4	Prediction 10% risk level	7072547,36
Scenario 5	Static 10% risk level	7082440,03

Wind energy production

	Ampacity	Wind power (MWh)
Scenario 1	Measured data	142311,88
Scenario 2	Prediction 2,5% risk level	141354,75
Scenario 3	Static 2,5% risk level	140969,327
Scenario 4	Prediction 10% risk level	142505,036
Scenario 5	Static 10% risk level	142085,141

CONCLUSIONS

- A week's energy dispatch is done for less cost when the lines make better use of their capacity, with ampacity values obtained by predictions.
- The increased use of renewable generation, such as wind power in this case, makes it possible to reduce emissions from other types of power plants.