

EX1 Spinning Reserve

The generation capacity of an area is 1500 MW and the load 1000 MW. Import to the area is 500 MW and export 800 MW. How large a spinning reserve there must be in addition to the fixed generation if a 30% margin is required.

EX2 Electrical Load

The load in a power system varies during 24 hours as follows:

$$P = 2 + 2e^{\frac{-(t-9)^2}{8}} \text{ GW}$$

Calculate maximum power, its time and average power.

EX3 Electrical Vehicles

Compare the annual energy costs and CO₂ emissions of EVs and gasoline (ICE) cars. Data: Consumption 15 kWh/100km or 7 liters/100km. Power price 15 c/kWh, gasoline price 1,4 €/litra. CO₂ –emissions 140g/kWh and for ICE car 150g/km. Driving amount 20000 km per annum. What is the reason for differences?

EX4 Power Transmission

The reactance between two three phase busbars is 0.5 Ω. The voltage in both is 10 kV and the angle between the busbars is 10 degrees. How big power is transmitted between the busbars? How increasing the voltage affects the power? How increasing the angle affects the power? What is the maximum power that theoretically can be transmitted between the busbars using 10 kV voltage?