# Project No. 1

## Constructing of load diagram, a line of duration of power output and production line and determination of load indicators of Electric Power System (EPS).

## Dividing of power output and electric production among 3 power plants based on minimizing of the total costs.

**Task:**

Load duration of the part of EPS in dependence on time and relative costs of 3 power plants are given by the values in table below.

**Specify:**

- The total amount of produced electricity needed annually (solve it numerically by both ways mentioned in lectures)
- The annual time of usage of maximum
- Load factor
- Medium power output
- The annual time of full losses (you have to construct a graph $P^2 = f(t)$ for graphic solution, solve it numerically by both ways mentioned in lectures and seminars)

**Solve:**

a) graphically from load diagram and graph $P^2 = f(t)$ (by hand on a graph paper – **you have to specify scales of axis** $W$, $z$, $t_{(per\ year)}$ as a precondition that mentioned daily load is repeated every day in a year (daily diagram is same like annual diagram) => find in diagram **directly annual** values $W_c$, $T_m$ and $T_z$.

b) numerically from the specified load values (according to the notes above)

c) compare graphical and numerical results, discuss a deviation and write a conclusion



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Further consider that the power output and the production of electricity needed for this part of the ES will be covered by 3 types of plants (basic, half-peak and peak) which have following cost equations:

$$N_{c1} = n_{st1} \cdot P_1 + n_{pr1} \cdot W_1$$

$$N_{c2} = n_{st2} \cdot P_2 + n_{pr2} \cdot W_2$$

$$N_{c3} = n_{st3} \cdot P_3 + n_{pr3} \cdot W_3$$

and divide a production and power output among the plants, so the total cost of production will be minimal. To achieve good results is necessary to exclude a power output and production ($P_3$ and $W_3$) of peak plant from the calculation while editing total cost equation. Summarize the results in conclusion.

**Set values for solution:**

| Power load duration of the part of ES | | | | | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| ***t [hour]*** | **0, 24** | **1** | **2** | **3** | **4** | **5** | **6** | **7** | **8** | **9** | **10** | **11** | **12** | **13** | **14** | **15** | **16** | **17** | **18** | **19** | **20** | **21** | **22** | **23** |
| ***P[MW]*** | **50** | **45** | **45** | **45** | **50** | **50** | **60** | **80** | **75** | **75** | **65** | **60** | **70** | **70** | **80** | **90** | **80** | **75** | **70** | **55** | **55** | **50** | **50** | **50** |

| Relative costs of power plants | | | | | |
|---|---|---|---|---|---|
| $n_{st1}$ | $n_{pr1}$ | $n_{st2}$ | $n_{pr2}$ | $n_{st3}$ | $n_{pr3}$ |
| 800 | 0,1 | 400 | 0,15 | 200 | 0,2 |