Economic Dispatch

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June 1, 2017

In a very simplistic manner, a power system consists of a set of generating units g (each of which has a maximum capacity $\overline{p}_g$ and a marginal cost c_g) and a electricity demand d_t for each time period t (which can be shed at a cost equal to c^s). The economic dispatch problem determines the generated quantity by each unit g and time period t to minimize the total cost of satisfying demand, and can be formulated as the following linear programming problem:

$$\underset{p_{gt}, s_t}{\text{minimize}} \quad \sum_t \left(\sum_g c_g p_{gt} + c^s s_t \right) \tag{1a}$$

subject to

$$\sum_g p_{gt} + s_t = d_t \quad \forall t \tag{1b}$$

$$0 \leq p_{gt} \leq \overline{p}_g \quad \forall g, t \tag{1c}$$

$$0 \leq s_t \leq d_t \quad \forall t \tag{1d}$$

where p_{gt}, s_t are the decisions variables and represent, respectively, the generating quantities and the shed load. Objective function (1a) minimizes the total operating costs. The balance between supply and demand is enforced by (1b) for each time period t. Constraints (1c) and (1d) impose limits on the generating quantities and the shed load variables for each time period t. More details about the economic dispatch problem can be found in [1].

References

[1] A Gomez-Exposito, A J Conejo, and C Canizares. *Electric Energy Systems: Analysis and Operation*. Electric Power Engineering Series. CRC Press, 2008.