CVX Exercise - Scheduling Power Plant Production

This exercise is written to give the student practice with CVX. The exercise is designed to show how the problem can be posed very intuitively in CVX.

Description of the problem

In this exercise we consider the plant shown in Figure 1

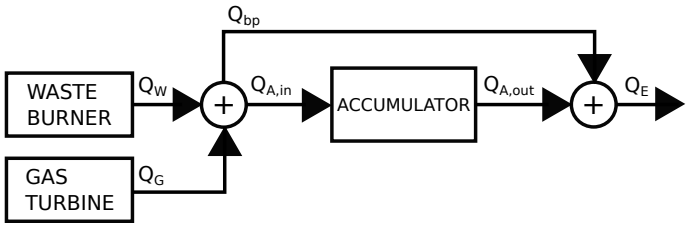

Figure 1: Diagram of the plant, with Q_G the power produced by the gas turbine, Q_W the power produced by the waste burner, $Q_{A,in}$ the power feed into the accumulator, Q_{bp} the power bypassing the accumulator, $Q_{A,out}$ the power leaving the accumulator, and Q_E the power leaving the plant. The units of power is megawatt [MW]

Where the power flow of the plant is constrained by

$$Q_W + Q_G = Q_{bp} + Q_{A,in} \qquad Q_E = Q_{bp} + Q_{A,out} \tag{1}$$

$$0 \leq Q_W \leq 40, \quad 0 \leq Q_G \leq 20, \quad 0 \leq Q_{A,in} \leq 50, \quad 0 \leq Q_{A,out} \leq 25 \tag{2}$$

and the dynamics of the accumulator is

$$E_A[k+1] = E_A[k] + (Q_{A,in}[k] - Q_{A,out}[k])T_s \tag{3}$$

with T_s the sampling time in hours [h], and $E_A[k]$ the energy stored at the accumulator at sample k. It is assumed that the accumulator is constrained by

$$0 \leq E_A \leq 200 \tag{4}$$

The objective of the exercise is to optimize the profit from running the plant, by scheduling the power production using knowledge of the plant and future prices of energy. If we let P_G, P_E, and P_W denote the (known) price pr MWh, [DKK/MWh], of gas, electricity and waste burning respectively, then the profit over the horizon L can be expressed as

$$\sum_{k=1}^{L} \Big(P_E[k]Q_E[k] - (P_G[k]Q_G[k] + P_W[k]Q_W[k]) \Big) T_s \qquad [DKK]$$

For the exercise 2 Matlab files will be provided: one file generating prices and one "preamble" file specifying various data.