OPTIMISATION AND OPERATIONS RESEARCH II: PROJECT HANDOUT 4

1. The Unit Commitment Problem

The previous problem — the *economic dispatch problem* — considered allocation of power generation from a set of power plants, but assumed that all power plants were used, *i.e.,* that they produced at least their minimum output.

We now consider the *unit commitment problem*, which considers which power plants to "commit" to the problem, *i.e.,* which power plants to switch on.

The setting is as before. However, now we have the choice of six power plants to generate our power. The six generating units have limits and linear approximations described in Table 1. They are connected to the electrical power system, with the expected peak load, or forecast demand of 2000 MW.

Table 1. Characteristics of thermal generating units.

Generating Unit	Energy Source	Input-Output Characteristic (MW)	Output Limits (MW) $P_{\min}$	$P_{\max}$	Start-up Cost ($)
R	Thermal coal	$H_R(P_R) = 272.0 + 2.64P_R$	300	900	240,000
S	Natural gas	$H_S(P_S) = 148.0 + 2.36P_S$	250	750	180,000
T	Natural gas	$H_T(P_T) = 136.0 + 2.40P_T$	200	600	150,000
U	Natural gas	$H_U(P_U) = 160.0 + 2.24P_U$	160	400	120,000
V	Diesel oil	$H_V(P_V) = 96.0 + 1.80P_V$	80	240	60,000
W	Diesel oil	$H_W(P_W) = 80.0 + 1.80P_W$	60	160	40,000

Mixed integer linear programming. The previous tasks presumed that all generators would be used. Here, we might consider some generators being ON and others being OFF. Assuming the fuel prices given in the first handout, frame a MILP to optimise the cost of providing power with some subset of these generators. This is called the *unit commitment* problem, as you need to decide which power generators – *i.e.,* "units" – to commit to generating power. A generating unit providing zero power has been decommitted.

You may then use Matlab's `intlinprog` to solve the unit commitment problem. Check your solutions are valid.

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