Combinatorial Problem Solving (CPS)

Laboratory. Linear Programming. Power Generation.

A number of power stations are committed to meeting the following electricity load demands over a day:

12 p.m.	to	6 a.m.	15000 MW
6 a.m.	to	9 a.m.	30000 MW
9 a.m.	to	3 p.m.	25000 MW
3 p.m.	to	6 p.m.	40000 MW
6 p.m.	to	12 p.m.	27000 MW

There are three types of generating units available: 12 of type 1, 10 of type 2, and 5 of type 3. Each generator has to work between a minimum and a maximum level. There is an hourly cost of running each generator at minimum level. In addition there is an extra hourly cost for each MW at which a unit is operated above minimum level. To start up a generator also involves a cost. All this information is given in the table below:

	Minimum level	Maximum level	Cost per hour at minimum	Cost per hour per MW above minimum	Start up cost
Type 1	850 MW	2000 MW	1000 €	2 €	2000 €
Type 2	1250 MW	1750 MW	2600 €	1.3 €	1000 €
Type 3	1500 MW	4000 MW	3000 €	3 €	500 €

In addition to meeting the estimated load demands there must be sufficient generators working at any time to make it possible to meet an increase in load of up to 15%. This increase would have to be accomplished by adjusting the output of generators already operating within their permitted limits.

Which generators should be working in which periods of the day to minimize total cost? Construct a mixed integer program (MIP) to answer this question.

Note: the minimum cost is 988540 €.