

## Keeping up the Quality

The manager of a colliery has contacted the University of Leicester for advice on how to optimize their production and meet their customers demand. The University of Leicester has appointed you and your teams as consultants and has asked you to help this industrial partner.

The manager has informed you that the colliery produces 20,000 tonnes of coal a week, but that it is currently experiencing quality problems. Their main customer, a local power station, requires coal with a minimum calorific value (CV, which corresponds to the energy content) of 24 gigajoules per tonne (Gj/t). Unfortunately, the colliery can only produce coal at 23Gj/t.

To address this issue, the manager plans to buy in better quality coal (so-called “sweetener”) and to mix (blend) it with their own. The blended product can be sold to the power station for £1.20/Gj, less a transport cost of £2.00/tonne. The manager points out that coal is usually sold by the Gj, not by the tonne, as it is the energy content that the customer wants, and that other costs, such as transport, usually depend on the weight. To pursue this sweetening strategy, the manager needs advice on which provider to buy the sweetener from. The options are:

Option	Source	Grade	CV (Gj/t)	Cost (£/Gj)	Transport (£/t)
1	Colliery A	Washed smalls	25.0	1.20	1.20
2	Colliery A	Singles	27.6	1.40	1.20
3	Colliery B	Washed smalls	25.5	1.20	2.50
4	Colliery B	Singles	28.3	1.40	2.50
5	Colliery C	Singles	29.2	1.40	4.50
6	Colliery C	Doubles	31.0	1.55	4.50

The manager informs you that there is a further cost for blending the two coals together, and that this cost amounts to 50p per tonne of coal blended.

**Task:** Please advise the manager about which source is the best option and why this is the case.

The manager then informs you that, alternatively, they could adopt a post-processing technique to increase the calorific value of their coal. More precisely, they can convert 23Gj/t-coal into 24.5Gj/t-coal at the cost of £6.00 per tonne of input, and incurring a loss of 7% in tonnage, meaning that processing 100 tonnes of 23Gj/t-coal returns only 93 tonnes of 24.5Gj/t-coal. The manager points out that they do not have to treat all their coal this way.

**Task:** Please help the manager understand whether this option is competitive compared to the blending approach.