Practical Exercise 3 – Model Answers

Please read the instructions, descriptions and questions below carefully and follow these steps:

1. Access the tool (https://tool.thermos-project.eu)
2. Watch Exercise 3 clip we prepared for using the software
3. Complete the tasks step-by-step as outlined below

----Model Answers----

Practical Exercise 3 – Model Answers

Modifying demands and paths

This exercise involves editing candidates as described in the accompanying video. Please return to your original scenario from Exercise 1 (the network connecting pubs and churches) and answer the following questions:

Part 1: Modifying demands

Question 1:

Change the annual demand for each pub to be double its original value. What does this do to the network economics when you solve the problem? Why?

Correct answer:

- **Capital cost – unchanged (the plant size/cost has not changed)**
- **Operating cost – increased (more heat being generated at a supply cost of 3c/kWh set in Exercise 1)**
- **Operating revenue – increased (more heat being sold)**
- **NPV – increased (more revenue - capital cost unchanged)**
- **Emissions – increased (more heat being generated to meet increased demand, so more fuel used creating more emissions).**

Question 2:

Now change the peak demand for each pub to be double its original value. What does this do to the network economics when you solve the problem? Why?

Correct answer:

- **Capital cost – increased (larger plant size needed to meet higher peak demand)**
- **Operating cost – increased (larger plant increases cost due to capacity cost of 300€/kW set in Exercise 1)**
- **Operating revenue – unchanged from Q1 (same amount of heat being sold at same tariff)**
- **NPV – decreased (capital and operating costs have increased due to higher peak demand)**

- **Emissions – unchanged from Q1 (same amount of heat generated and fuel used).**

Question 3:

Now experiment with adding an annual capacity charge tariff for the pubs. What does this do to the network economics when you solve the problem? Why?

Correct answer:

- **Capital cost – unchanged (capital cost unaffected by tariff)**
- **Operating cost – unchanged (operating cost unaffected by tariff)**
- **Operating revenue – increased (revenue now includes extra income from capacity charge tariff)**
- **NPV – increased (revenue is higher)**
- **Emissions – unchanged (same amount of heat generated and fuel used).**

Part 2: Modifying paths

Question 4:

Select the paths that the optimiser chose to use for the network in Exercise 1. They are likely to have been assigned the default 'hard dig' civil costs. Change these to 'soft' and resolve. What does this do to the resulting network?

Correct answer:

Decreases capital cost by a significant amount and therefore network NPV is considerably higher.

Part 3: Supply optimisation

Question 5:

Without changing anything, optimise the supply of the network and check the supply solution, solution summary page. Note down the plant technologies used, the total cost and the heat production.

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Select all of the buildings within your network and set the heat profiles to flat. Optimise the supply and check the supply solution, solution summary page.

What has changed? Has the solution resulted in more plant or less? Has the solution resulted in more heat generation or less? Suggest reasons for the changes.

Correct answer:

Applying flat heat demand profiles results in less plant i.e. only heat pumps are specified instead of heat pumps + storage. This results in a higher capacity heat pump and significantly more heat generation as a constant and continual amount of heat is required i.e. there is no benefit from using storage.