Practical Exercise 1- 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 1 clip we prepared for using the software
3. Complete the tasks step-by-step as outlined below

----Model Answers----

Task 1 - Map creation – Bradford on Avon (UK)

Create an account, a project and a map.

a. The created map should be for the example area you can see on the picture below in Bradford (UK) on the Avon River;
b. Use 2000 heating degree days for the heat demand estimate.
c. Find “St Thomas More Catholic Church” on your map, one street north of the northernmost bend in the river, slightly west of the bridge.

Question 1:

What is the modelled annual heat demand for this building?

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Correct answer:

60.52 MWh/yr

1. Public spaces – annual demand & peak demands

In the area shown, there are five churches/ religious places of worship

a) Select them all and identify their total annual demand and their total peak demand
b) In the area shown, there are 4 pubs, write down their names and identify the annual & peak demands per pub.

Question 2:

What is the total annual demand of the five churches?

Correct answer:

Trick question! Depending on the actual area that was selected, there could be up to 7 'Places of Worship' identified. These are listed below with annual heat demands, making a total of 291.57 MWh/yr. If five were chosen, the sum of these would be correct.

- **St Thomas More Catholic Church: 60.52 MWh/yr**
- **Bradford on Avon Baptist Church: 23.67 MWh/yr**
- **Saxon Church of St Lawrence: 12.17 MWh/yr**
- **United Church: 37.54 MWh/yr**
- **Ton Boon Trust: 13.48 MWh/yr**
- **Holy Trinity Church: 134.28 MWh/yr**
- **Zion Baptist Church: 9.9 MWh/yr**

What is the total peak demand of the churches (combined)?

My answer:

- **St Thomas More Catholic Church: 51.88 kWp**
- **Bradford on Avon Baptist Church: 33.59 kWp**

- **Saxon Church of St Lawrence: 27.88 kWp**
- **United Church 40.47: kWp**
- **Ton Boon Trust: 28.53 kWp**
- **Holy Trinity Church: 88.48 kWp**
- **Zion Baptist Church: 26.76 kWp**

Total peak heat demand of all 7 Places of Worship is 297.58 kWp. If five were chosen, the sum of these would be correct.

List the four pubs with their individual annual demand and their peak demand?

My answer:

- **The Bear Inn: 10.88 MWh/yr; 27.24 kWp**
- **The Bunch of Grapes: 11.82 MWh/yr; 27.71 kWp**
- **The Dandy Lion: 13.84 MWh/yr; 28.71 kWp**
- **Timbrell's Yard: 53.84 MWh/yr; 48.56 kWp**

There is also a 5th pub that may have been selected at the southern limit of the map:

- **Three Horseshoes: 50.77 MWh/yr; 47.04 kWp**

2. Network construction

Construct a network problem containing the four pubs as required demands (red), and St Thomas More Catholic Church.

a) Mark St Thomas More as a supply location with the following parameters:
   - Maximum capacity: 10MW
   - Supply cost:3c/kWh (assume units are €cents)
   - Capacity cost: 300¤/kW (assume units are €)
   - CO2 factor: 300 g/kWh

b) Allow the model to use any of the roads on the map for pipes.

c) Ask the model to solve your network, and look at the solution summary.

Question 3:

What total length of pipe is required?

Correct answer:

527.96 m

How much revenue does the church receive from pubs?

Correct answer:

€311.79k

What are the annual associated emissions?

Correct answer:

67.67 tCO_2/yr

3. Cooling network

Go back to the project page and click on 'COLD NET +' and create a cooling network.

Question 4:

What different user-input data would be needed if optimising a cooling network?

Correct answer:

There is actually very little difference in the optimisation models used for heating and cooling, so the input fields required are virtually the same. The actual input values would of course need revising, mainly in defining a new set of supply parameters to suit a cooling plant specification (max. capacity, supply cost, emission factors, etc). Also, as for a heat network, the default parameters provided under financial objectives, capital costs, emission costs/limits, tariffs, connection costs, pipe costs/losses, pumping costs and insulation/individual system measures (when considering whole-system optimisation) should all be reviewed for suitability to the local context.

Improved estimates for individual building cooling demands could also be entered if such data is available.