

Modelling Renewable Energy Integration Technologies in the EnergyPLAN Tool

Exercise C: Adding District Heating (~60 minutes)

In this exercise 10 TWh of individual heating is converted to district heating, which can then be supplied with combined heat and power (CHP) plants, boilers, and thermal storage. Here are some assumptions you can make when modelling this scenario (please note that these are not always applicable, but we will assume them here for simplicity):

- 4 TWh of the 10 TWh should be provided by decentralised gas CHP (group 2) – assume there are 10% losses in the district heating pipes, as a percentage of total production.
- 6 TWh of the 10 TWh should be provided by centralised gas CHP (group 3) – assume there are 10% losses in the district heating pipes, as a percentage of total production.
- Boilers on the district heating system should cover the peak heat demand plus 20% (the peak heat demand can be found in the print out sheet). You can assume they are oil boilers.
- The capacity of CHP should be the average annual heat demand (the average heat demand can be found in the print out sheet)
- The thermal storage units for district heating should be equal to 8 hours of average annual heat demand.
- You should use the Optimisation Strategy: Technical Optimisation 2 – Balancing both heat and electricity demands
- The stabilisation share of CHP2 should be 100%
- You should use the CEEP Regulation: 23

Do not forget to change the costs.

To begin:

- Open the file “Energyland_step1_powerplants.txt” from Exercise B.
- Then go to File->Save As and save a new file called “Energyland_step2_districtheating.txt”

Here are the results.

Wind Power	Wind Power	Wind	CEEP	CEEP	Fuel	CO2	2020 Total Costs
%	TWh/year	MW	TWh/year	(% of Demand)	TWh/year	Mt/year	M€/year
0%	0.00	0	0.0	0%	185.2	46.94	16,406
10%	3.11	1,500	0.0	0%	181.5	45.54	16,328
21%	6.22	3,000	0.2	1%	178.4	44.31	16,263
31%	9.34	4,500	1.3	4%	177.4	43.49	16,269
41%	12.45	6,000	3.4	11%	178.5	43.10	16,360
52%	15.56	7,500	6.1	20%	180.9	42.97	16,504
62%	18.67	9,000	9.2	31%	184.2	43.03	16,683
73%	21.78	10,500	12.6	42%	188.1	43.20	16,885
83%	24.90	12,000	16.2	54%	192.4	43.45	17,105
93%	28.01	13,500	19.9	66%	197.0	43.76	17,335
104%	31.12	15,000	23.7	79%	201.8	44.12	17,574