Lecture 9: Limiting CO2 emissions

DTU Course 46770: Integrated Energy Grids

March 2025

Problem 9.1. Use the model described in Problem 8.2 and assume that methane gas emits 0.198 tCO2 per MWh of thermal energy contained in the gas.

Consider the annualized capital costs and marginal generation costs for the different technologies in the following table.

Technology	Annualized capital costs (EUR/MW/a)	Marginal generation costs (EUR/MWh)
Onshower Wind	101,644	0
Solar PV	51,346	0
OCGT	47,718	64.7
CCGT	104,788	46.8
Battery inverter	12,894	0
Battery energy capacity	24,678	0

Table 1: Costs assumptions.

Limit the maximum CO2 emissions to 5 MtCO2/year.

a) Calculate the optimal installed capacities and plot the hourly generation and demand during January.

b) What is the CO2 tax required to attain such CO2 emissions limit?