Engineering Economics

ECO

Final Project

Investing in a heat pump

The Danish Energy Agency (DEA) is a major contributor to Denmark's role as a pioneer in the cost-effective transformation of the energy sector-for the benefit of the Danish climate and economy.

The DEA is undertaking missions related to the production, supply and consumption of energy and makes efforts to reduce CO2 emissions.

The DEA also participates in International energy collaboration in China, Mexico, Ukraine, Indonesia and South Africa, among others.

The DEA focuses on a high level of professionalism and knowledge sharing among the many disciplines and prides itself that it is a good employer with flexibility to meet individual needs.

There are currently funds that have been earmarked for a team trip that will advise urban heating plants and other stakeholders on concrete options for the adoption of large heat pumps.

With these heat pumps, it is expected that the company will reduce the cost of electricity and water cooling by 2 million Danish kroner (DKK) per year.

The heat pump system that is proposed is powered by electricity and produces 5½ MW of thermal power. The establishment's COP (coefficient of performance), which is a measure of the relationship between the energy output of the pump and its input, is 4, which means that if the input of the pump is 1 kWh of electricity, the output will be 4 KWh of heat. A COP of 4 is a relatively high value for a pump, and realistic in our case

since 3 to 4 pumps are connected in parallel. The price of heat supplied to the urban heating system is of 337 DKK/MWh. The price of electricity supplying the pump is 1.10 DKK/kWh.

The company works in three teams, seven days a week, all year round, but the pump system should only work 360 days a year.

The investment in the pump itself is 12 million of Danish kroner (DKK). In addition, the investment in pipelines, a transformer, a building to house the transformer and the design work cost is of 3 million DKK. The lifetime of the investment is estimated at 15 years and the interest rate is 8% per year.

The most important operating costs come from the electricity that powers the pump. In addition, maintenance costs, etc., will cost 2 million DKK per year.

Questions

In your handwritten answers, clearly show your steps and approach by identifying the cash flows in your calculations and what they represent. For example, investment = $300 000 or revenue = $34.

1. Calculate annual operating expenses.
2. Identify all cash flows and convert these values into a (constant) annuity on the life of the project.
3. Calculate the net present value of this project from your response in 2.
4. Calculate the discounted payback period of this project.