

➤ **OBJECTIVE:** ECONOMIC ANALYSIS OF A PROJECT, consisting of the operation of a new incineration plant by the municipality.

In particular we are interested in the computation of a Solid Waste Tariff, consistent with our economic analysis.

➤ **METHOD FOR PROJECT APPRAISAL:** NET PRESENT VALUE OR NPV

The sum of discounted cash flows.

➤ **WHAT WE NEED:**

1. To compute the NPV, we need the cash flows associated to the project for the next 20 years
2. To compute the cash flows, we need to know the structure of the profit & loss accounts for the next 20 years

➤ **THE STEPS ARE:**

1. BUILD PROFIT & LOSS ACCOUNTS;
2. COMPUTE OPERATING CASH FLOWS;
3. COMPUTE NPV;
4. COMPUTE THE SOLID WASTE TARIFF.

Step 1: PROFIT & LOSS ACCOUNT *(spreadsheet profit_loss)*

➤ **REVENUES: UNIT PRICE * QUANTITIES**

- A) We compute unit price taking into account inflation
- B) We compute the quantities on the basis of the information on their trend over time

➤ **COSTS:**

- i. **VARIABLE COSTS: UNIT COST * QUANTITIES (waste).** They corresponds to 10% of the cost of employees. We take into account their trend over time.
- ii. **FIXED COSTS:** They do not depend on the quantities (of waste). They are 90% of the cost of employees and 100% of the other operating costs
- iii. **OTHER COSTS: MAINTENANCE COSTS**

➤ DEPRECIATION

Investments in physical capital are planned over the first 10 years. These costs need to be split over the 20 years.

In the spreadsheet depreciation, the depreciation rates are computed.

➤ TAXATION

Taxes are computed over the Operating profit:
Revenues – Operating costs – Depreciation

The tax rate is 37%.

Step 2: OPERATING CASH FLOWS (spreadsheet *cashflow*)

The operating cash flow for a generic year is given by:

GROSS PROFIT
- TAXATION
- INVESTMENTS: <ul style="list-style-type: none">• IN WORKING CAPITAL (OR LIQUIDITY)• IN PHYSICAL CAPITAL (E.G. PLANT & MACHINERY, ETC.)
+ DISINVESTMENTS: <ul style="list-style-type: none">• RECOVERY OF WORKING CAPITAL• RECOVERY OF PHYSICAL CAPITAL (E.G. SALE OF PLANTS AT THE END OF LIFE CYCLE)
= CASH FLOW FOR CAPITAL BUDGETING

➤ **WORKING CAPITAL = commercial credits + cash & bank accounts – commercial debts**

The working capital is a measure of the liquidity of the firm. By hypothesis, our firm needs to invest in working capital when revenues increase (for example because commercial credits increase).

By hypothesis at the end of the period all the working capital is recovered (e.g. all commercial credits are collected).

➤ **RESIDUAL VALUE OF PHYSICAL CAPITAL**

By hypothesis the residual value of the physical capital at the end of the period is nil.

Step 3: INDUSTRIAL OPERATION AND FINANCIAL OPERATION

- The investment project can be split into two parts:
 - **Industrial Operation:** the management of the incineration plant by the municipal firm.
 - **Financial Operation:** the possibility to enjoy a soft loan (with a reduced tax rate).

- To correctly evaluate the whole investment project, we need to compute two different NPVs: one for the industrial operation and one for the financial operation. We can finally sum up the two NPV, obtaining the NPV for the whole investment.

Step 4: FINANCIAL OPERATION (*spreadsheet financ_operat*)

The computation of the cash flow is given by:

Soft loan and/or free grants or loans (with '+' sign)
Reimbursement of annuities (with '-' sign)

By hypothesis the firm enjoys a soft loan amounting to 50% of the yearly investments. The loan has to be reimbursed over 10 years, the interest rate is 4% and the annuities are ordinary (constant, at the end of the year)

Example:

The financial cash flow associated to the loan on the investment of the first year is :

Soft loan: 50% of 50 mil.= + 25 mil. Euro
Ordinary annuity: The effective interest rate need to account for the tax rate: $0.04(1 - 0.37)$. The formula to compute the ordinary annuity is: 25 mil. divided by $[1 - (1 + i)^{-t}] / i =$ $25\text{mil.}/[(1 - (1+0.025)^{-10})/0.025] = 2.86 \text{ mil.}$ where i is the interest rate, t is the number of annuities or years (10).

Step 5: NPV INDUSTRIAL OPERATION

We now focus on the industrial operation.

The NPV is the sum of the discounted cash flows.

The discount rate we use is the **WEIGHTED AVERAGE COST OF CAPITAL (WACC)**

Please note that when discounting we need to take into account the **inflation rate**.

For a generic cash flow C_t , at time t , the discounting factor is: **$((1+WACC)^{-t}) * ((1+INFLATION RATE)^{-t})$**

The NPV of the industrial operation is negative (- 5.9 mil. Euro)

Step 6: THE SOLID WASTE TARIFF

We follow 3 steps:

- 1) Compute total operating costs and total investments for each year;
- 2) Obtain total revenues from waste disposal for each year as the difference between total operating and investment costs and total revenues from sale of energy;
- 3) Compute discounted revenues from waste disposal for each year and divide them by the total amount (tonnes) of processed waste

The average discounted solid waste tariff is 88.2 Euro per tonne of waste.