

# Transformers

## Total Cost of Ownership Tool

The Schneider Electric Guide



**Total Cost of Ownership calculation is a key to consider operating costs when purchasing a new Transformer.**

### **Why use the TCO and TCO tool?**

Schneider Electric's Total Cost of Ownership - TCO Tool gives transformers cost along with their lifespan including purchasing and operating costs. It allows the user (manufacturer, designer, final user) to compare transformer designs in order to choose the best configuration for his need.

# Definitions & Calculation Method

**Total cost of ownership is the sum** of the initial purchase cost and the net present value of the cost of losses during the lifetime. In this calculation, differences in other lifecycle cost components such as installation, maintenance, possible out-time and decommission costs are not included.

**Total lifetime savings** is the gap in Total Cost of Ownership between 2 different equipment configurations.

**Payback time** in years corresponds to the time necessary to recover for a higher investment cost on a more efficient transformer. In other words, it is the time necessary for energy cost savings to reach the investment gap between 2 equipment configurations.

Calculation formulas are based on IEC 60076-20 (current draft) on applicable parts (the results fully applicable with "IEEE" transformers as well).

The simplified calculation formula of the Total cost of ownership becomes the following:

**Total Cost of Ownership = Purchasing Price + No Load Losses Cost + Load Losses Cost**

With:

**No Load Losses Cost: NLLC =  $(1+i)^n - 1 / i(1+i)^n \cdot C \cdot \text{Time}$**

**Load Losses Cost: LLC =  $(1+i)^n - 1 / i(1+i)^n \cdot C \cdot \text{Time} \cdot \text{Load factor}^2$**

Where:

*i*: Interest rate [%/year]

*n*: lifetime [years]

*C*: kWh price [USD/kWh]

*Time*: number of hours in a year [h/year] = 8760

*Load factor*: average load of the transformer during its life time

# How to fill out the form?

To help you use this tool, we have prefilled some fields with standard ones.  
Remember that they can always be changed.

Total Cost of Ownership

$$TCO = PP + ( A * P0 ) + ( B * Pk )$$

**PP : Purchasing Price** : Initial cost of the transformer  
**A : No load losses Cost** : The cost of losses at no load operation  
**P0 : No load losses** : The losses of the transformer at no load operation  
**B : Load losses Cost** : The cost of losses at rated current  
**Pk : Load losses** : The losses of the transformer at rated current

Calculate TCO Compare TCO

Calculate TCO of Transformer [Help](#) | [Feedback](#)

**Cost of Energy**

Do you know the values for A and B?  Yes  No

Currency used to calculate: EUR

Number of hours in the year (h/Yrs): 8760

Average Loading of the Transformer (%): 60

Transformer lifespan (Yrs): 20

Energy cost (EUR/kWh): Enter energy cost

Interest Rate (%): Enter interest rate

A (No load losses Capitalization) (EUR/W): Enter No load loss capitalization

B (Load losses Capitalization) (EUR/W): Enter Load loss capitalization

**Transformer Settings**

Do you know the values for P0 and Pk?  Yes  No

Product Family (Dry Type, Oil Immersed or MPT/LPT):

Rated power (kVA):

Maximum HV Insulation level (kV):

Maximum LV Insulation level (kV):

No load losses Level:

Load losses level:

No load losses (P0) (W): Enter P0

Load losses (Pk) (W): Enter Pk

Purchase Price (EUR): Enter purchase price

Run TCO

**Result**

Transformer Total Cost of Ownership:

Add to Compare

# How to fill out the form?

Note: if you know the values for A, B, P0 and Pk, no need to fill the other fields

A : Cost of losses at no load operation

B : Cost of losses at rated current

## 1. Number of hours in the year

Operating time of the transformer in hours/year  
Prefilled 8760 hours =Year round

## 2. Average Loading of the Transformer in %

Expected average loading of the transformer during its lifetime  
Prefilled 60% average load during lifespan

## 3. Transformer lifespan

Expected life considered in TCO calculation  
Prefilled 20 years

## 4. Energy cost: in currency/kWh

Initial cost of energy

**5. Interest Rate:** Interest rate of the investment (Cost of money), to consider energy cost evolution

Cost of Energy	Transformer Settings
Do you know the values for A and B? <input type="radio"/> Yes <input checked="" type="radio"/> No	Do you know the values for P0 and PK? <input type="radio"/> Yes <input checked="" type="radio"/> No
Currency used to calculate: EUR	Product Family (Dry Type, Oil immersed or MPT/LPT):
Number of hours in the year (h/Yrs): 8760	Rated power (kVA):
Average Loading of the Transformer (%): 60	Maximum HV insulation level (kV):
Transformer lifespan (Yrs): 20	Maximum LV insulation level (kV):
Energy cost (EUR/kWh):	No load losses Level:
Interest Rate (%):	Load losses level:
A (No load losses Capitalization) (EUR/W):	No load losses (P0) (W):
B (Load losses Capitalization) (EUR/W):	Load losses (PK) (W):
	Purchase Price (EUR):

P0: Transformer's losses at no load operation

Pk: Transformer's losses at rated current

1. **Product Family:** Type of transformer (to help on preselecting losses levels)

2. **Rated Power in kVA**

3. **Maximum High insulation Voltage in kV**

4. **Maximum Low insulation Voltage in kV**

5. **No load losses Level:** Level of losses at no load operation based on EN50 588 standard

6. **Load losses Level:** Level of losses at rated current based on EN50 588 standard

7. **Purchasing Price:** In Currency selected

# How to fill out the form?

Note: Make sure to fill out the same cost of energy for all transformers you want to compare.

Once all the fields are filled you can click on

**Run TCO**

TCO including Purchasing price + cost of operating will then be indicated beside Result

Then you can click on

**Add to Compare**

Your transformer will be added to comparison sheet  
You can compare up to 3 configurations

Once your transformers are added to comparison sheet

**Compare TCO**

To access comparison sheet

The screenshot shows a web form titled "Calculate TCO of Transformer" with two tabs: "Calculate TCO" and "Compare TCO". The "Compare TCO" tab is active, indicated by a green bar and an arrow from the top right. The form is divided into two columns: "Cost of Energy" and "Transformer Settings".

**Cost of Energy:**

- Do you know the values for A and B?  Yes  No
- Currency used to calculate: EUR
- Number of hours in the year (h/Yrs): 8760
- Average Loading of the Transformer (%): 60
- Transformer lifespan (Yrs): 20
- Energy cost (EUR/kWh): Enter energy cost
- Interest Rate (%): Enter interest rate
- A (No load losses Capitalization) (EUR/W): Enter No load loss capitalization
- B (Load losses Capitalization) (EUR/W): Enter Load loss capitalization

**Transformer Settings:**

- Do you know the values for P0 and PK?  Yes  No
- Product Family (Dry Type, Oil Immersed or MPT/LPT):
- Rated power (kVA):
- Maximum HV insulation level (kV):
- Maximum LV insulation level (kV):
- No load losses Level:
- Load losses level:
- No load losses (P0) (W): Enter P0
- Load losses (PK) (W): Enter PK
- Purchase Price (EUR): Enter purchase price

At the bottom of the form, there is a large green arrow pointing right with the text "Result" and "Transformer Total Cost of Ownership:". Below this arrow are two buttons: "Run TCO" and "Add to Compare".

Annotations: A grey box on the left contains instructions. Arrows point from the "Run TCO" button in the grey box to the "Run TCO" button on the form, and from the "Add to Compare" button in the grey box to the "Add to Compare" button on the form.

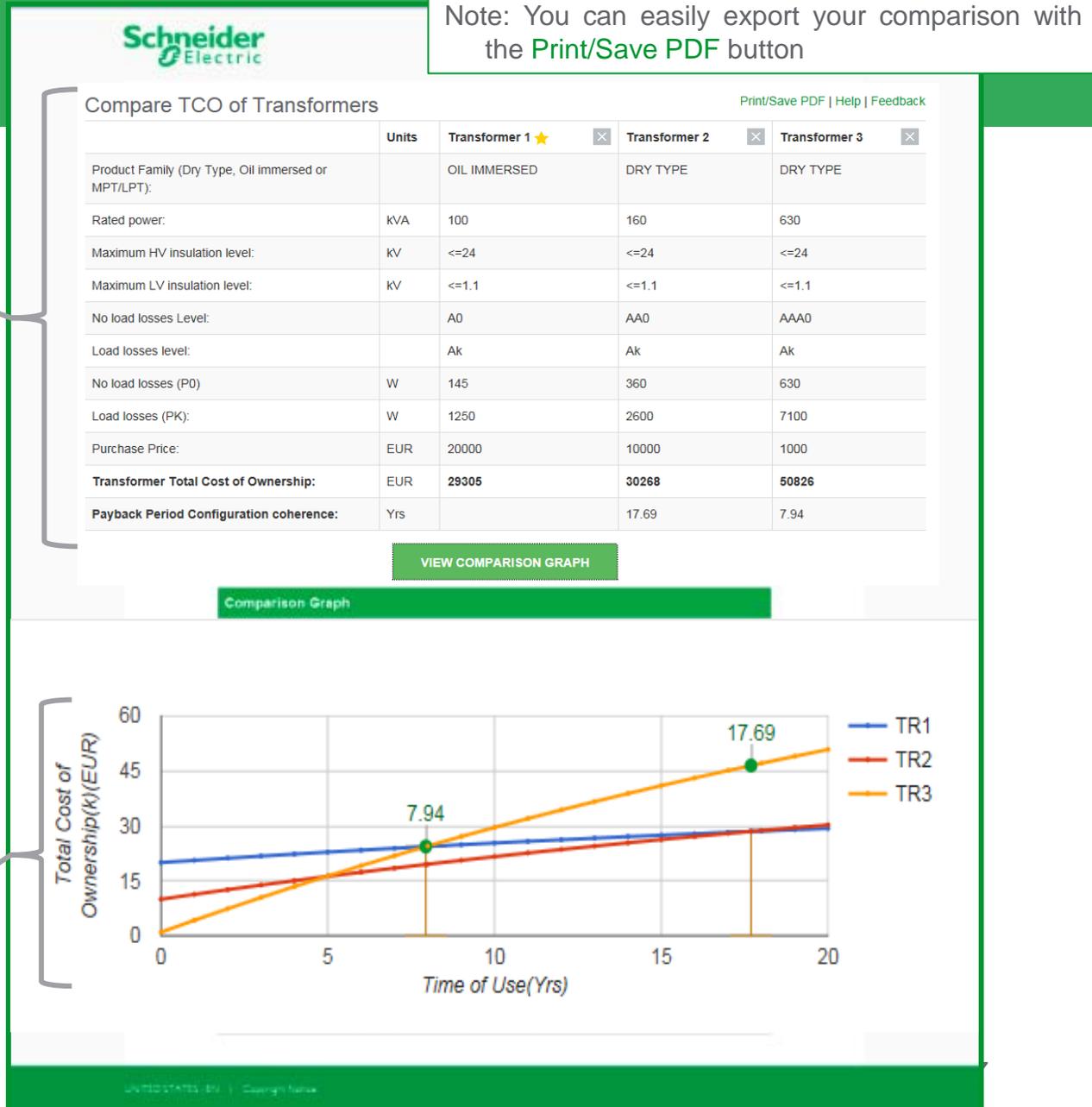
# Comparison table & graph

Summary of the data and TCO result for the equipments placed in the comparison table. Payback Time gives the time to recover the higher investment cost needed for cost efficient transformer.

 **Show the cost efficient transformer**

Example:  
In this case, 3 transformers are compared.  
The most efficient one appears to be transformer 1 because the payback time is the lowest compared to the 2 others.

Comparison graphic gives you visual result of the comparison.  
Each curve represents for a dedicated transformer the cumulative Total Cost of Ownership during the lifespan considered.  
Starting point of the curve corresponds to Purchasing price of the equipment.



**Make the most of your energy<sup>SM</sup>**

