CALCULATIONS

CableApp uses load currents and correction factors as defined in HD 60364. This allows the user to adjust the calculation according to the desired installation. Correction factors include the following parameters: ambient temperature (air or soil, as appropriate), specific thermal resistance of the soil, multi-circuit effect.

INITIAL CONDITIONS FOR ASSESSING LOAD CURRENTS

Base cable installation conditions for cable estimates:

PARAMETER	VALUE
Air temperature	25°C
Soil temperature	15°C
Soil specific thermal resistance	1 K.m/W

CROSS-SECTION CALCULATION BY VOLTAGE DROP

To calculate the cable cross-section based on the voltage drop, it is appropriate to take into account the effect of reactance. This effect is significant, especially for copper conductors larger than 35 mm^2 or aluminium conductors larger than 70 mm^2.

Taking into account the effect of the reactance, the following formulas for calculating the voltage drop may be considered:

SINGLE PHASE	THREE PHASE
$S = \dfrac{2 \cdot L \cdot I \cdot \cos\phi}{\gamma \cdot (\Delta U - 2 \cdot 10^{-3} \cdot x/n \cdot L \cdot I \cdot \sin\phi)}$	$S = \dfrac{\sqrt{3} \cdot L \cdot I \cdot \cos\phi}{\gamma \cdot (\Delta U - \sqrt{3} \cdot 10^{-3} \cdot x/n \cdot L \cdot I \cdot \sin\phi)}$
Where - n = wires per phase - Φ = angle between current and voltage - γ = conductivity - L = length of a circuit	

ENERGY-INTELLIGENT SOLUTION

In addition to technical requirements, the choice of conductor cross-section is increasingly influenced by economic and/or ecological considerations. After all, in the case of a conductor cross-section that is larger than the minimum technical requirement, the losses due to cable resistance are reduced. This saves energy throughout the life span of the cable. These savings can be seen as savings from annual losses or reductions in CO2 emissions.

Potential savings should only be considered as a guide. According to the Joule-Lenz law, the amount of heat released by a conductor due to the operation of electric current is proportional to the square of the current, the resistance of the conductor and the time.

It can be stated that the thermal energy of a cable corresponds to the following general formula:

SINGLE PHASE	THREE PHASE
$E_P = 2 / n \cdot R \cdot (I \cdot I_{rms})^2 \cdot L \cdot t / 1000$	$E_p = 2 / n \cdot R \cdot (I \cdot I_{rms})^2 \cdot L \cdot t / 1000$

Where
- E_P = energy generated in the circuit (losses)
- n = wires per phase
- R = conductor resistance
- I = current
- I_{rms} = current mean value
- L = length of a circuit
- T = circuit operating time

CableApp calculates the annual savings in euros and CO2 savings for a cable that is one or two cross-sections larger than the minimum technical requirement. The energy price per kWh can be set on the "Settings" or "Advanced calculation" pages.

When calculating the annual savings, CableApp assumes that the work is continuous, i.e. 8,670 hours per year.

As a rule, the cables are not constantly loaded with the same current. For example, engines are not used continuously at full load and many business premises are not used for over 10-12 hours a day. To adjust this, you can set the average usage factor as a percentage of working time on either the "Settings" or "Advanced Calculation" pages.

100%

40% I (dwelling)

60% I (public places / offices)

75% I (industry)

Other %

As the cross-section area of the cable increases, the resistance (R) decreases. When transmitting the same current (I), the lost energy (EP) decreases. These energy savings can be seen both as cost savings on electricity bills and as a reduction in CO2 emissions.

The cable itself is more expensive because it has a larger cross-section area, but the installer receives the following:

- lower running costs, lower energy bills,
- reduced CO2 emissions, greener offer,
- longer cable service life due to lower operating temperature.

  The standard service life of a structure is based on the maximum cable load (maximum operating temperature) for each hour during its specified service life in years.

- better short-circuit withstand - a larger cross-section withstands higher current in the event of a fault,
- possibility to use the cable to transmit bigger loads in the future.