

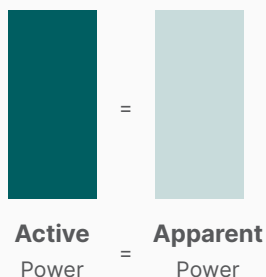
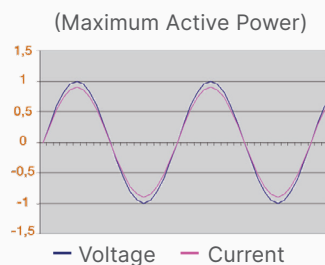
POWER COMPENSATION

Why do we need power compensation?

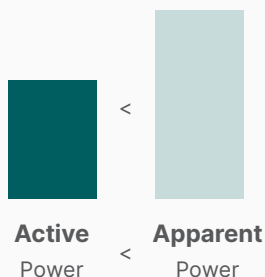
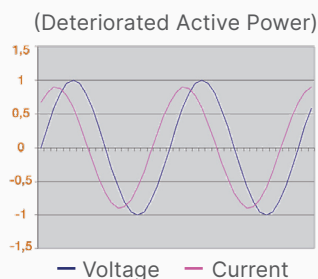
Power Factor Correction

Connected equipment (transformers, motors, air-conditioning, refrigerators, etc.) cause a phase angle between current and voltage. When the current is phase-shifted, it takes more current to deliver the same amount of active power.

Voltage and current should be like this:



But are like this:



Power factor
= Active power / Apparent power

Dephasing between current and voltage decreases the active power (only the active power is converted into useful mechanical power).

Key Benefits

- Cost savings
- More power
- Less CO₂
- A range of products based on field-proven experience

Impact of Reactive Power

- Transmission equipment has to be sized for the apparent power, yet only active power is useful
- Increased losses in the network
- You pay for apparent power but use active power (higher electricity bill)
- Penalty fees for customers with a low power factor (example < 0.95)

Who?

- Power consumers, network operators, power suppliers, power industry, hospitals, offices, public buildings, and factories

Solution

- The power factor of a facility can be improved by installing capacitor banks



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Harmonic Filtering

Variable speed drives (process industries, lifts, air conditioning pumps, etc.) uninterruptible power supplies for computers, electronic equipment, etc. and distorts the current (introduce harmonics).

Impact of Harmonics on Transmission/Distribution Equipment:

- Additional losses (paid for by the end user)
- Heating in power cables
- Audible noise (transformers)

Impact of Harmonics on Connected Equipment:

- Decreased machine efficiency and lifetime
- Costly process shutdowns
- Disturbed electronic equipment (computers, telephones)

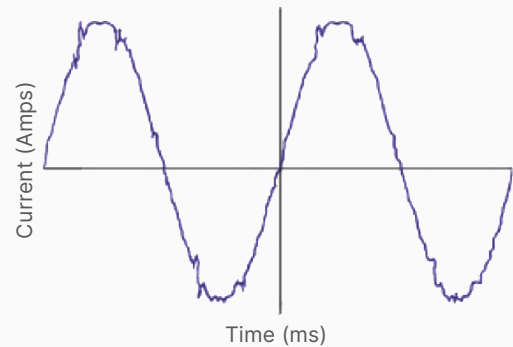
Who?

- Power consumers, network operators, power suppliers, power industry

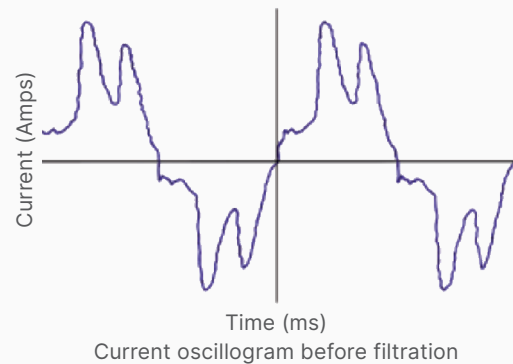
Solution:

- Harmonics can be filtered through a combination of reactors and capacitors (passive filtering) or by injecting the exact opposite of the harmonics detected (active filter) into the network.

Current should be like this:



But is like this:



Series Compensation

Long overhead lines cause the voltage to drop along the line. More current is needed to deliver the same power.

Impact:

- Decreased amount of useful power
- Additional losses (network power losses are proportional to the square of the current)
- Reduced transmission capacity of the overhead line

Who?

- Transmission utilities

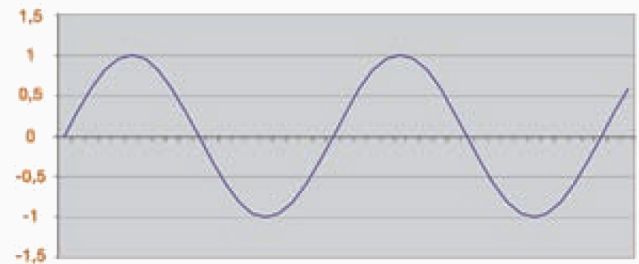
Solution:

- Voltage could be increased with the help of capacitor banks connected in series

Main Advantages:

- Today, Grid Solutions at GE Vernova is the only international company to provide both air core reactors and capacitors, the key elements for medium and high voltage reactive power compensation solutions.
- We analyze the electrical installation of our customers (industries or utilities) to propose and supply the most suitable compensation solution.

Voltage should be like this:



— Voltage

But is like this:



— Voltage



Benefits of power factor correction

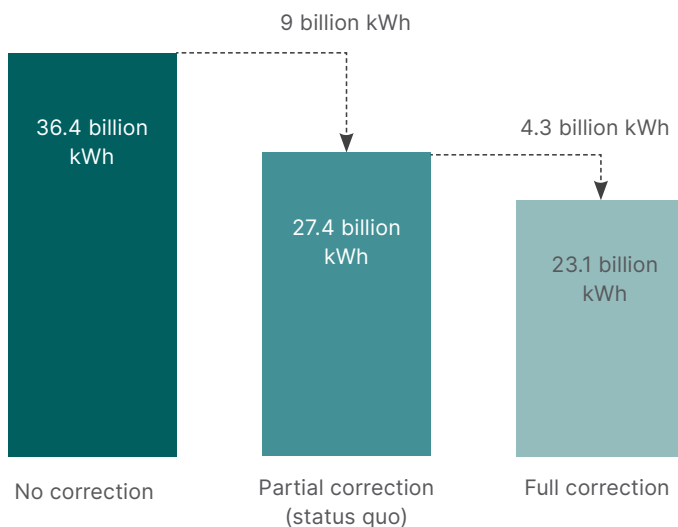
Example: Germany

By decreasing the electrical losses in the transmission and distribution networks, and hence reducing the emissions of CO₂, this technology is making an active contribution to reducing global warming.

Benefits of Power Factor Correction

- Power factor correction reduced network losses in Germany in 1999 by 9 billion kWh (5.1 million ton of CO₂)
- With the maximum possible use of power factor correction, there is the potential for a further reduction in network losses of 4.3 billion kWh
- An additional improvement can be obtained by harmonic filtering, avoiding harmonic currents flowing in the network

Source: German electrical and electronic manufacturers' association – September 2003



Current-dependent network losses (1999 values)

Power Compensation Brings:

Economic Benefits

- Saving the costs of reactive power
- Additional savings through reduced active power losses
- Reduction in investment cost

Return on investment is generally below 18 months.

Environmental Benefits

- Reduced CO₂ emissions
Customers see environmental benefits through energy savings and more efficient power systems

By saving millions of tons of CO₂, power compensation makes an active contribution to protecting the environment.

For more information, visit
[gevernova.com/grid-solutions](https://www.gevernova.com/grid-solutions)

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