



## Intro To GOES Energy Management System (GEMS)



Electrical machines must be supplied with energy in order to work. In the case of electric motors, more energy must be supplied than what is actually required to turn the motor's shaft, since a certain amount of energy is required just to maintain the necessary magnetic field of the motor. This energy is known as reactive (or magnetizing) power. Utility companies will provide a limited amount of reactive power at no cost, however, customers with high reactive power loads are charged for the additional power. They call this additional charge a power factor penalty (demand charge or power factor surcharge).

### What Is Power Factor?

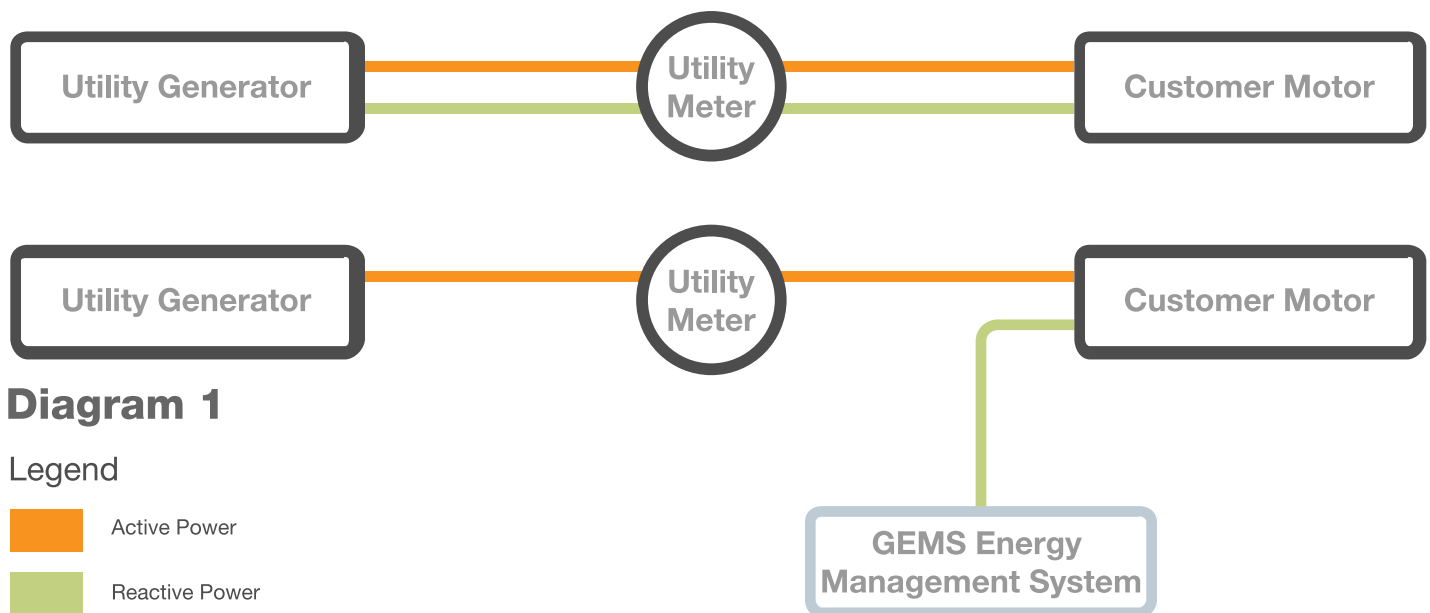
Power factor (pf) is the ratio of the active (or useable) power measured in kilowatts (kW), to the total (active and reactive) power measured in kilovolt amperes (kVA), and is calculated as  $kW / kVA = pf$ . Power factor is commonly referred to in percent, with 100% being a perfect power factor, also called unity. At unity power factor, the  $kVA = kW$ , therefore the utility company does not supply any reactive power.

## What is Power Factor Correction Equipment?

GEMS equipment provides the means of reducing the reactive power being supplied by the utility. Reducing the reactive power supplied by the utility results in a cost reduction to electrical bills, since the kVA demand is also reduced. GEMS capacitors are the main component in GEMS equipment, with their size most often referred to in kVAR. Diagram 1 illustrates how a GEMS capacitor works when installed on the line side of a motor.

### How does it work?

GEMS capacitors act as a “reactive power generator,” providing the magnetizing power a motor requires to operate - rather than the motor having to draw it from the utility. Improving your power factor will reduce the amperage draw from the utility generator. The reduced amperage is a measurable value.



The example in diagram 1 makes the application of GEMS equipment look simple - and sometimes it is. However, in situations where an entire electrical distribution (or multiple electrical distributions) requires correction, finding the best solution (technically and economically) is more challenging.

## What is the target power factor and how is it determined?

The “target power factor” is the power factor a consumer must obtain to avoid paying a power factor penalty. Utility companies set the target power factor(s) for their consumers. They vary anywhere from 90% to 100%, depending on the utility company, and specific rate structure within a given utility company.

Even if your target power factor is 100%, it is not always in your best interest to obtain a unity power factor; because increasing the power factor is not a linear relationship with the corresponding savings. It is the responsibility of your GEMS equipment designer to ensure you receive the optimal combination.

## How much money can be saved through Power Factor Correction?

The amount of annual savings which can be achieved is based on a number of factors:

- ▶ the existing power factor,
- ▶ the target power factor,
- ▶ the existing kVA demand, and
- ▶ the utility and rate structure.

Since there is a vast difference between the costs of consumer’s electrical bills, talking about dollars saved through GEMS can be misleading; so instead, we talk about payback periods. On average, the supply of GEMS equipment has a payback period of 18 to 24 months. Below are two examples to show you how GEMS equipment saves money for two customers in different situations:

### Customer “A” Building Complex

No. of Distributions: 4

Recommendation for Correction: **48 GEMS**

Cost of GEMS Equipment: **\$144,000.00**

Payback Period: **17 Months**

Annual Savings: **\$102,000.00**

### Customer “B” Building Complex

No. of Distributions: 1

Recommendation for Correction: **11 GEMS**

Cost of GEMS Equipment: **\$30,000.00**

Payback Period: **8 Months**

Annual Savings: **\$42,000.00**

Although the differences in kVA demand for Customers “A” and “B” are enormous, each benefited from the installation of GEMS equipment with payback periods under 18 months. The savings which can be achieved through GEMS equipment is relative to the cost of a customer’s electricity bills.

## Things To Consider

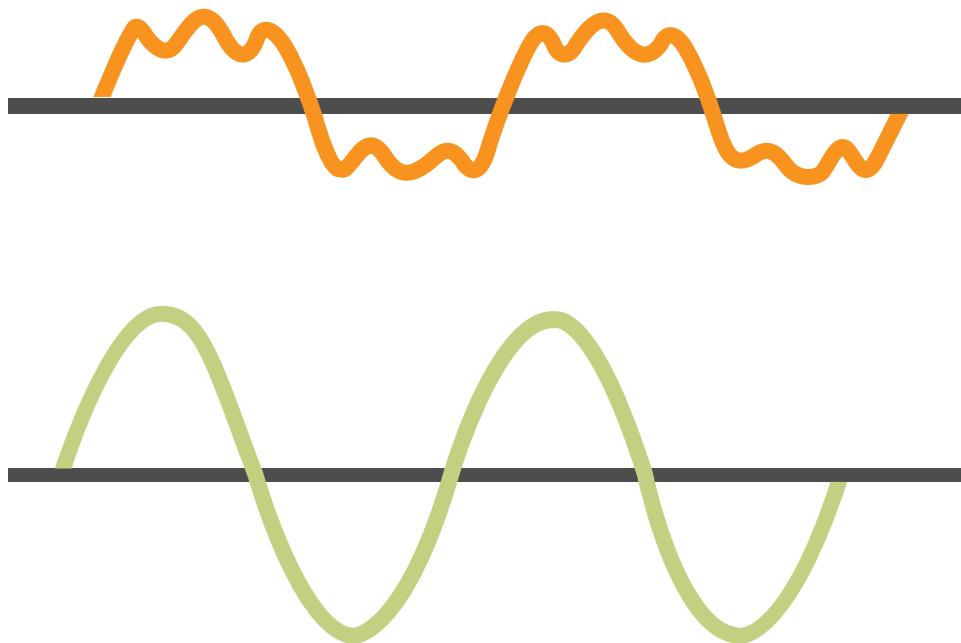
### Harmonics

“Harmonics” has been made out to be a mystical problem...leaving most people convinced they will never understand what they are, what they can do to electrical distributions, why they occur, and how to conquer them. We want to change that.

### What Are Harmonics?

Harmonics is a steady state distortion of the electrical sine wave. Most often called the THD (total harmonic distortion), it is referred to in percent. THD is also broken down into an ITHD (for current) and VTHD (for voltage). Diagram 2 illustrates the difference between a harmonic contaminated sine wave (upper) and a normal sine wave (lower).

### Diagram 2



## **What Generates Harmonics?**

Harmonics are generated by non-linear load on your electrical distribution. Variable frequency / speed drives are common culprits. Arc welders, DC rectifiers and soft start motors (on start up only) are also contributors. To make matters more complicated, harmonics can also be imported into your electrical distribution from your utility...the welding shop down the road from you could be the cause of your motor's early retirement!

## **Summary**

Would you like to know how much your facility could stand to save through GEMS equipment? If so, GOES can conduct a Preliminary Evaluation for you. This evaluation will provide you with an estimated annual savings, guaranteed 24 month ROI, certificate for a \$.60 per square foot of air conditioned space federal tax deduction, along with an estimated equipment cost. In order for us to execute the evaluation, we require your last 12 months power bills and a digital blueprint of your facility. Calculations can be done with fewer bills, if the last 12 are not available. For the evaluation, there will be a fee of \$249.95 to secure the federal tax deduction.

GOES can provide you with all your GEMS, preliminary evaluations, power factor studies and harmonics analyses, guaranteed savings, engineered products (designed to meet the requirements of your electrical distribution), and after sale support.

## **A GOES Solution. Your Solution**

Lease-to-Own Program

- ▶ Your GEMS Equipment is generating to pay for your GEMS equipment!
- ▶ Obtain your GEMS Equipment without affecting your cash flow!
- ▶ Program can be set up for all applications!