



A CUSTOMER'S TECHNICAL GUIDE TO ENERGY EFFICIENCY



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Know more about energy efficiency. This manual offers up-to-date and cost-effective strategies for managing your electricity consumption. We hope that the following pages would inspire you to begin your journey towards energy efficiency.



POWER SITUATION IN THE PHILIPPINES

We use electrical energy every day – lots of it – to light up, cool our homes and office buildings; to make products and provide services indispensable to our daily lives--essentially, to power up an entire nation. But this energy is not infinite. Sometimes there could be a shortage or there may be no supply at all.

As industries, businesses and the population grow, so does energy consumption. Demand for electrical energy is expected to increase as the Philippine economy grows.

According to the Department of Energy's Philippine Energy Plan (Supply and Demand Outlook*), demand in Luzon, where Meralco's franchise area is located, is projected to increase at an annual average growth rate of 4.79%. This means that the demand for power will more or less double in the next 10 to 15 years.

There are two ways to bridge this supply-demand gap. First is through specific energy policies, both addressing the supply and demand-side; and private sector-initiated power generation projects to bring in additional power-generating capacities. Second is through the implementation of energy efficiency initiatives at both the supply and demand-sides.

* Source : http://www.doe.gov.ph/doe_files/pdf/01_Energy_Situationer/2012-2030-PEP.pdf



Energy efficiency is a win-win formula for the customer, the utility and the nation.

WHY ENERGY EFFICIENCY

While increasing power-generating capacity is necessary, utilizing energy efficiently and responsibly is equally important. Energy efficiency benefits not only distribution utilities and their customers, but also the economy and the environment.

As a customer-centric organization, Meralco is a strong advocate of the efficient use of energy among all types of electricity consumers – from households and offices to commercial and industrial establishments. The Philippines' largest distribution utility designs products, programs, services and educational campaigns that empower end-users to use energy wisely.

Meralco Products, Programs, Services & Education Campaigns

Products	Programs	Services	Educational Campaigns
Prepaid Retail Electricity Service	Bright Ideas	Energy Services	Meralco Advisory
Peak/Off-peak Rates Program	Power Ideas	Business & Technical Consultancy	Power Up Forums
	Orange Tag	Net Metering	Power Lab
		Power Profile	Power Club
		MoVE App (Meralco Virtual Engine App)	

For more information on Meralco services, kindly contact your Relationship Manager today.

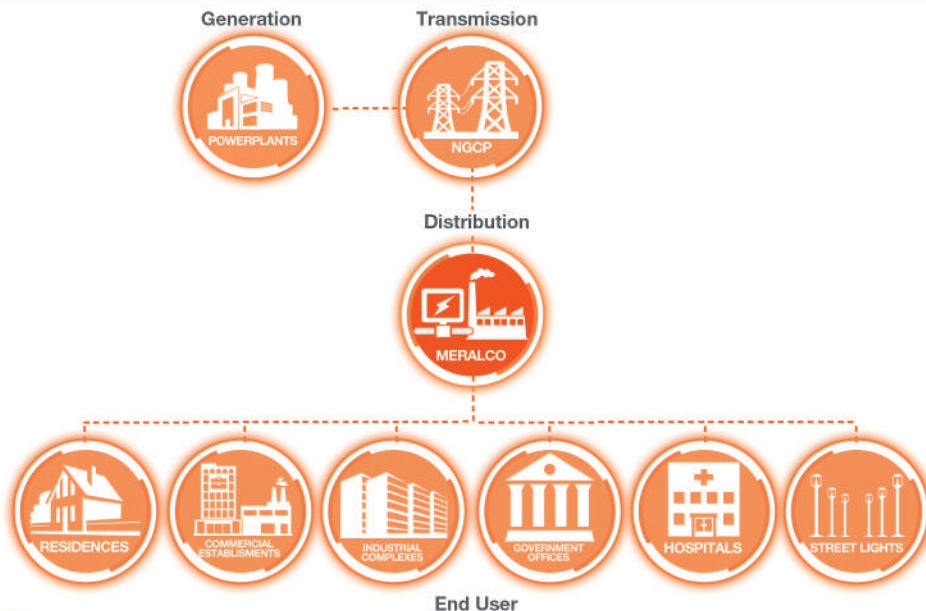
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DELIVERING ELECTRIC POWER

The Philippines' electric grid is set up to balance energy efficiency, safety, and value-for-money. Major power plants produce the bulk of energy from many sources such as coal, oil, natural gas, hydro, wind and solar. To transmit the energy from the power plants, the National Grid Corporation of the Philippines (NGCP) uses high voltages to minimize energy loss experienced when electricity passes through hundreds of kilometres of wires. Distribution utilities, like Meralco, convert the high voltages to levels that will be utilized by the customers (230V, 400V, 460V, 20KV and 32KV).



End users can check the cost of electric power in each stage of delivery, as these are itemized in the electric bill, for transparency. The distribution charge of the distribution utility is less than 20 percent of the total bill. The rest, where the bulk of the bill is, are “pass-through” charges comprised of generation charges, transmission charges, system loss, taxes and subsidies.

UNDERSTANDING THE ELECTRIC BILL



All end users are primarily charged based on their energy consumption or the kilowatt-hours (kWh) consumed over a given period of time, usually a month, which constitutes 1 billing period.

Below are factors that affect the electric bill by end user type:

END-USER TYPE	ENERGY (kWh)	DEMAND (kW)	POWER FACTOR	LOAD FACTOR
Residential	✓	-	-	-
Commercial	✓	✓ ● ● ●	✓ ● ●	✓ ●
Industrial	✓	✓ ● ●	✓ ● ●	✓ ●
● – for customers with contracted capacity of 5kW to 40kW ● – for customers with contracted capacity of 40kW and above ● – for contestable customers with contracted capacity of 750kW and above				

Let's take a closer look at these factors.

- Energy consumption (kilowatt-hours, kWh)** is the total energy used over a period of time, usually a month (1 billing period) as measured by the electric kilowatt-hour meter.
- Demand consumption (kilowatt, kW)** is the peak power consumption within a standard 15-minute interval over a period of time, usually a month (1 billing period), as measured by the electric kilowatt-hour (kWh) meter.



Commercial and Industrial customers with contracted capacity of 40kW and above and some commercial customers with contracted capacity between 5kW to 40kW are charged with a fixed cost based on their Guaranteed Minimum Billing Demand (GMBD). The

GMBD ensures that the right amount of power the customer has contracted with the utility is allocated to them, regardless if the customer fully consumes or utilizes it or not.

The GMBD is equivalent to 70% of contracted capacity. The contracted capacity, on the other hand, depending on industry classification, can be around 60% - 80% of applied load.

3. **Power Factor (PF, %)** is the ratio of real power in kilowatts (kW) flowing into a load or system to the apparent power (in kilovolt-amperes, kVA), expressed between 0 to 100%.

Because of the nature of electricity, a system with high power factor will lose less energy compared to a system with low power factor when delivering the same amount of power to their load. To encourage customers to operate with high power factor, utilities provide incentives to those with power factor above 85% while applying additional charges to those with power factor below 85%.

4. **Load Factor (LF, %)** is the average load in kilowatts (kW) over the maximum load in kW over a given period of time. It can also be the actual kilowatt-hours (kWh) over the total possible kWh that could be used at a particular kW level. It is expressed between 0 to 100%.



As a customer-centric organization, Meralco advises customers to carefully evaluate their applied load to optimize power utilization and improve energy efficiency.



The load factor can be derived from a customer's load profile. Customers with high load factors, same as those with high power factors, use energy efficiently. This means that their power utilization is relatively constant in relation to their contracted capacities. Conversely, customers with low load factors simply indicate that power utilization is irregular and the capacity available to the customer is not fully utilized.

Load factors for all types of end users can be measured. Commercial and Industrial customers benefit from high load factors. In addition, contestable customers with demand of more than 750kW can receive incentives from the retail electricity supplier (RES) for having a high load factor.

Let's illustrate with two examples below:

In both examples, a customer applies for an electric service with a total electrical load of 500kW, as applied load. Contracted capacity is 400kW (80% of applied load). GMBD is 280kW (70% of contracted capacity).

Example 1:
Customer's maximum peak demand is only at 250 kW (below GMBD)
Load Factor = 0.65
Power Factor = 0.75

FACTORS		DEMAND CHARGES	POWER FACTOR ADJUSTMENT	AVE. COST PER kWh (P/kWh)
GMBD (kW)	280	P66,402.00	P11,548.56 surcharge	P7.19 ↑
REGISTERED DEMAND (kW)	250 ↓			
LOAD FACTOR	0.65 ↓			
POWER FACTOR	0.75 ↓			

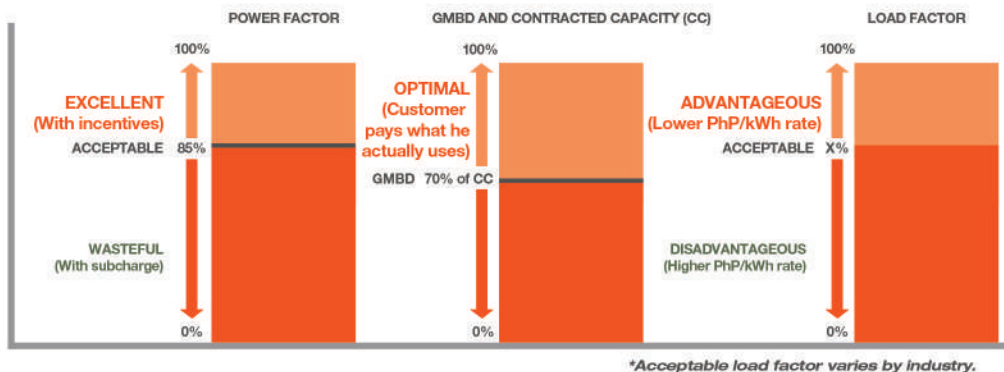
It pays to know important information about your electric bill.



Example 2:
Customer's maximum peak demand is only at 250 kW (below GMBD)
Load Factor = 0.82
Power Factor = 0.95

FACTORS		DEMAND CHARGES	POWER FACTOR ADJUSTMENT	AVE. COST PER kWh (P/kWh)
GMBD (kW)	280	P66,402.00	P6,224.73 discount	P6.71 ↓
REGISTERED DEMAND (kW)	280			
LOAD FACTOR	0.82 ↑			
POWER FACTOR	0.95 ↑			

Three variables significantly affect the cost of energy per kWh--demand, load factor and power factor. Because of the interplay of these variables, there is a P0.48/kWh (7.19-6.71=0.48) or a 7% difference between the cost per kWh of Example 1 and that of Example 2. The customer in Example 2 has a maximum peak demand within the GMBD, and a higher load factor and power factor, while the customer in Example 1 pays for the contracted capacity of 280kW, even when its demand is only at 250kW.



MANAGING Energy Efficiently



Energy Efficiency

Energy efficiency is a way of optimizing energy use without sacrificing comfort, convenience or productivity, by employing best practices and deploying efficient technologies that optimize energy utilization.



LUMENS OUTPUT = SAME

✓ LOWER POWER USE BUT SAME OR BETTER PERFORMANCE

Benefits of Energy Efficiency

The benefits of energy efficiency are diverse and many. Corporations and industries that practice energy efficiency not only improve their operations and productivity, but also demonstrate a sense of social responsibility by contributing to a healthier environment. Energy efficiency is a smart practice.

END USER BENEFITS

- Improve energy savings
- Reduce cost
- Ensure continuous operations
- Positive effect on productivity and competitiveness

SOCIAL BENEFITS

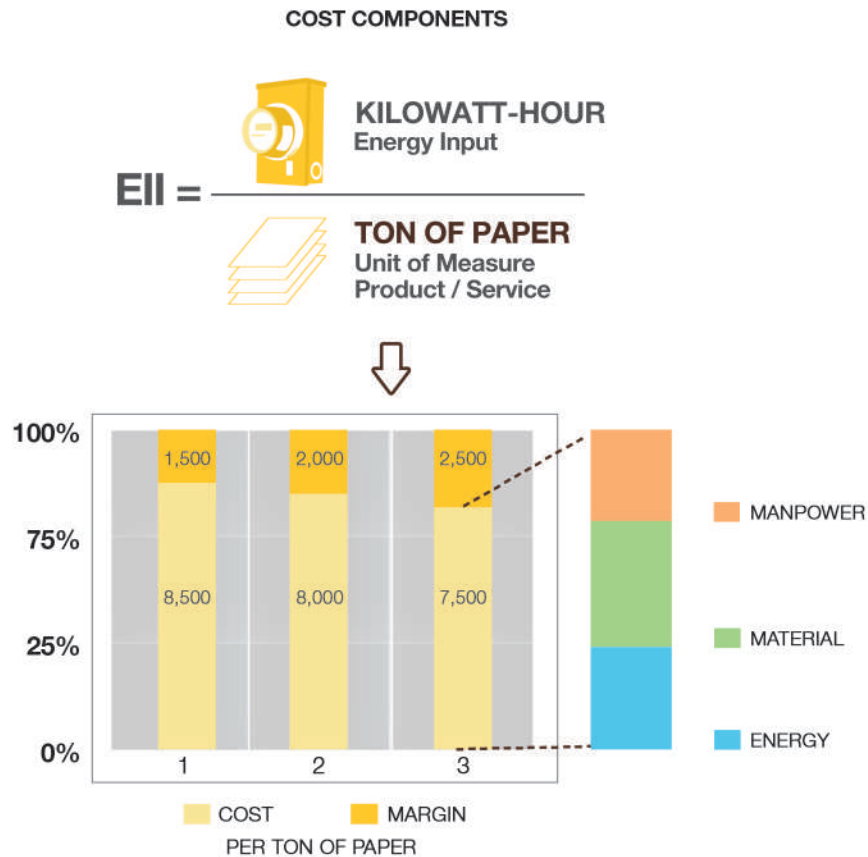
- Conserve resources
- Reduce environment degradation
- Reduce dependency on fossil fuels for power generation

INDUSTRY BENEFITS

- Address demand-supply deficiencies and improve security of supply
- Improve operating and system efficiency
- Reduce / defer capital investments by delaying construction of power plants
- Improve value of service to customers

Energy Intensity Index

Energy Intensity Index (EII), also known as Specific Energy Consumption (SEC) or Energy Utilization Index (EUI), measures the amount of energy in kilowatt-hours (kWh) used to produce a unit of product or service.



The lower the EII, the better.

Globalization, which breaks down trade barriers, encourages business and industries to improve their EII's in order to remain competitive and profitable.

YEAR	COST TO MANUFACTURE (PhP/ton of paper)				Selling Price (PhP/ton)	EII	SAVINGS
	ENERGY	MATERIAL	MANPOWER	TOTAL			
1	3,500			8,500		500	1,500
2	3,000	3,000	2,000	8,000	10,000	427.57	2,000
3	2,500			7,500		357.14	2,500

Note: For illustration purposes, electricity rate at P7.00/kWh

In this example, while the price per ton of paper and other costs to manufacture are kept constant, the reduction in energy costs to produce a ton of paper every year allows improved margins.

EII BY INDUSTRIES	UNIT OF MEASURE	INDUSTRY BENCHMARK EII
Automotive	$\frac{\text{kWh}}{\text{vehicle}}$	Facility or organizational performance may be benchmarked to: (1) Past Performance (2) Industry Average (3) Best in Class
Real Estate	$\frac{\text{kWh}}{\text{m}^2}$	
Retail	$\frac{\text{kWh}}{\text{merchandise}}$	
eCommerce	$\frac{\text{kWh}}{\text{transaction}}$	



The EII provides an indication of an organization's competitiveness to produce goods and services. Continuous improvement of the EII improves efficiency in operations and profitability.

QUICK GUIDE TO ENERGY EFFICIENCY

Realizing energy efficiency is easy, cost-effective and widely available. These four simple steps will guide you in maximizing and sustaining the numerous benefits of energy efficiency.

PLAN

Know more about your organization's energy consumption. This stage of information gathering can reveal so many things – get to know the why, where, when and how much energy is being used in your organization. This phase sets the baseline, objectives and targets for creating comprehensive, integrated and sustainable action plans.

DO

Implement the action plans in a timely and cost-effective manner. Proper communication, documentation and management during the execution phase are required to ensure effectiveness of all efforts.

CHECK

Periodically monitor and measure each implemented action plan against indicators and report the results.

ACT

Continually make efforts to improve each stage or specific action plans and its corresponding energy performance measure/s. This will help institutionalize energy efficiency as a way of life whether it be employing efficient operating procedures/processes and best practices, or deploying energy efficient technologies.



Before any plans are made and carried out, it is important to get management support and commitment to this endeavour. After which, form an energy team and appoint an energy champion.

PLAN

Know your organization's current energy state. Set baselines, objectives and targets and energy performance measures/indicators. Create action plans.



Why is energy used?

Energy should be used to produce goods and services.

Check:

- Energy usage outside of operating hours
- Energy used to keep machines idling when they could be turned off

Where is energy used?

Knowing where energy is used will help identify and target areas for improvement.

Check:

- Equipment and processes per area
- Air conditioning / space cooling / heating
- Office equipment
- Lighting

When is energy used?

Knowing the time of day energy is used will help analyze consumption patterns and/or behaviors.

Check:

- Energy consumption at its peak and at its lowest
- Unusual variations in energy usage, especially when there is no production

How much energy is used?

Knowing how much energy is being used will help determine if your contracted capacity matches your actual consumption.

Check:

- Equipment (if properly sized)

Information is key in starting your energy efficiency roadmap.



PLAN continuation

Make integrated and sustainable action plans that will address the following:

1. Your objectives and targets

What are the energy performance goals that the organization needs to achieve?

2. Your energy baseline

What coverage period will be used as basis of comparison for energy performance?

3. Your energy performance indicators

What quantitative measures of energy performance needs to be identified to measure effectiveness?

4. Your specific action plans on:

- Your energy consumption – Are there energy usages that are unnecessary or not optimal?
- Your equipment and facilities – What equipment/machines and/or appliances can be upgraded or replaced to improve performance and increase efficiency? What facility improvement can be done?
- Your processes - What processes, operating procedures, practices and/or systems can be put in place or improved?
- Your contracted capacity – What is the forecast for load growth and/or expansion to avoid mismatch between your contracted capacity and your facility's power requirements?

DO

Ensure that the action plans are implemented and the following are properly done:

1. Communicate

Ensure that every individual in the organization is made aware of the energy efficiency plans and encouraged to do their share.

2. Document

Maintain a documented information to ensure that all information are available and accurate.

CHECK

Periodically monitor and evaluate the following:

1. Action plans as against the energy performance indicators

Measure and analyze if the action plans are generating expected results.

2. Non compliance, corrective and preventive actions

Check for issues and concerns. Identify measures to correct actual and potential problems.

ACT

Review the energy performance results and take action to ensure continuity, sustainability and effectiveness.

1. Review plans

Check whether the measures implemented could be done better, faster and more cost-effective.

2. Continue cycle

Plan succeeding phases. Adopt or develop better energy efficiency best practices and energy efficient technologies.

3. Recognize achievements

Recognition is key to motivate every group or individual in the organization to do an even better job and affirm commitment.



OPPORTUNITIES FOR ENERGY EFFICIENCY

Improve your organization's energy efficiency with these proven solutions. Implementing some of these solutions may need the assistance of energy service companies (ESCOs) or other trade allies.

CATEGORY	MEASURES	INVESTMENTS		
		ZERO	MINIMAL	INTENSIVE
PROCESS / BUILDING DESIGN CHANGES	EFFICIENT OPERATING PROCEDURE			
	GOOD HOUSEKEEPING			
	PREVENTIVE MAINTENANCE			
	PROCESS CHANGES			
	BETTER BUILDING DESIGN AND ENVELOPE			
EFFICIENT TECHNOLOGIES (NEW, REPLACEMENTS, RETROFIT)	VARIABLE SPEED DRIVES / INVERTERS			
	EFFICIENT LIGHTING			
	ELECTRIC VEHICLES			
	LED TECHNOLOGY			
	HIGH EFFICIENCY MOTORS			
	DISTRICT COOLING / HIGH EFFICIENCY CHILLERS / ICE STORAGE SYSTEMS			
	WASTE HEAT RECOVERY			
SOLUTIONS	ENERGY MANAGEMENT SYSTEMS			
	POWER FACTOR CORRECTION			



Good news! Proven energy efficiency measures are widely available and some require no investment at all.

SUCCESS STORIES



Case Study 1: Shopping mall

For the retail industry, a relevant EII measure is the amount of energy needed (kWh) for each floor area (m²) per year. A Meralco-client mall implemented cost-effective energy efficiency measures that enabled it to reduce over 10 kWh/m², resulting in savings of almost ₱800,000 every month, while recovering its investment in just 2 months. With the energy efficiency measures, the mall has remained profitable and competitive, while continuing to offer customers a convenient shopping experience.

ENERGY EFFICIENCY MEASURES

	Solution	Description	Investment
Lighting	Efficient operating procedures	<ul style="list-style-type: none"> Construction of electric circuits, allowing change of required lighting configuration based on scenarios Proper scheduling of lighting 	–
Escalator	Efficient operating procedures	<ul style="list-style-type: none"> Activation of escalator 30 minutes after opening hours 	–
Cooling	Efficient chillers	<ul style="list-style-type: none"> Upgrade of existing sensors (i.e. differential pressure sensors of chillers) 	₱50,000 ++
Pump	Preventive maintenance	<ul style="list-style-type: none"> Rehabilitation of pumps/motors 	₱200,000 ++
Insulation	Better building design and envelope	<ul style="list-style-type: none"> Improvement of thermal insulation 	₱800,000 ++
Total			Php1.0M++

After energy efficiency measures

EII	Reduction of over
	10 kWh/m²
	Before = 194.03 kWh/m ² After = 182.02 kWh/m ²

SAVINGS	Almost
	₱800,000
	per month

ROI	Just
	2 months

SUCCESS STORIES



Case Study 2: Manufacturing Plant

For the manufacturing industry, a relevant EII measure is the amount of energy needed (kWh) for a certain amount of product (kg) per year. A Meralco-client manufacturer employed cost-effective energy efficiency measures that enabled it to reduce over 0.1 kWh/kg, resulting in savings of almost ₱70 million every year, while recovering its investment in just over one year. The energy efficiency measures that the manufacturer undertook improved its manufacturing process, reduced its power consumption and increased its profit.

ENERGY EFFICIENCY MEASURES

	Solution	Description	Investment
Manufacturing	High efficiency motors	<ul style="list-style-type: none"> Replacement of mechanical equipment Shift to servo motors 	₱70M++
Manufacturing	Variable Speed Drives	<ul style="list-style-type: none"> Replacement of air compressor Shift to variable-speed drive (VSD) 	₱2M++
Cooling	Efficient chillers	<ul style="list-style-type: none"> Shift to centralized water chiller from individual water chiller per machine 	₱4M++
Total			₱76.0M++

After energy efficiency measures



GLOSSARY

Applied Load

Total power in watts (W) or kilowatts (kW) indicated in the service application, when an end user applies for an electric service with a distribution utility (DU). This is computed based on the end user's submitted electrical plan.

Contracted Capacity

Equivalent to demand factor multiplied by the applied load (DF x Applied Load). Demand factor is dependent on the applicant's industry classification. Demand factor for commercial and industrial end-users can range between 60% to 80%.

Contestable Customers

End users who have choice on the supplier of electricity.

Demand

Peak power consumption in kilowatt (kW) within a standard 15-minute interval over a period of time, usually a month (1 billing period), as measured by the electric kilowatt-hour (kWh) meter.

Distribution Utility (DU)

Any electric cooperative, private corporation, government-owned utility or existing local government unit that has an exclusive franchise to operate a distribution system, including in economic zones.

Energy Consumption

Electrical energy actually used. It is measured in watt-hours (Wh, watts x hours) or kilowatt-hours (kWh, watts/1000 x hours).

Energy Efficiency

A way of optimizing energy use without sacrificing comfort, convenience and/or productivity, through the employment of best practices and/or the deployment of efficient technologies that optimize energy utilization. It can be measured based on the amount of energy used versus the level of product or service produced.

Energy Intensity Index (EII)

Also known as Specific Energy Consumption (SEC) or Energy Utilization Index (EUI). It measures the amount of energy used (energy input) to produce a unit of product or service (output). Having lower EII means using energy more efficiently, since the energy requirement and costs associated in producing an output are less.

GLOSSARY

Energy Utilization Index (EUI)

Another term for Energy Intensity Index (EII) or Specific Energy Consumption (SEC). See EII.

End User

Any person or entity requiring the supply and delivery of electricity for its own use. End users can be household, office, commercial, industrial, hospital, military institutions, government, and streetlight service users.

Guaranteed Minimum Billing Demand (GMBD)

Equivalent to 70% of contracted capacity. This ensures that the end user's contracted capacity is matched by facilities installed by the distribution utility to provide a reliable and safe power supply. This is a fixed cost in the bill, whether the end user consumes power or not.

Load Factor (LF, %)

Average load in kilowatts (kW) over maximum load in kW over a given period of time, or actual kilowatt-hours (kWh) over total possible kWh that could be used at a particular kW level. It is expressed between 0 to 1 or in percent. It will always be less than 1, since maximum demand is always more than average demand as not all loads will be connected at the same time.

Load Profile

Graphical representation of the variation of power use over time. Distribution utilities and end users can use their load profile to study and analyze energy consumption patterns and/or behaviors.

Power Consumption

Measure of how much energy is used over a period of time. For electrical power, it is expressed in joules per second, watts (W) or kilowatts (kW).

Power Factor (PF, %)

Ratio of real power in kilowatts (kW) flowing into a load or system to the apparent power in kilovolt-amperes (kVA), expressed between 0 and 1 or in percent.

Retail Electricity Supplier (RES)

Person or entity authorized by the Energy Regulatory Commission (ERC) to sell, broker, market or aggregate electricity to end users.

Specific Energy Consumption (SEC)

Another term for Energy Intensity Index (EII) or Energy Utilization Index (EUI). See EII.

To learn more on how to manage your energy more efficiently, consult your Relationship Manager today!