Successful Energy Management
Through Electrical Submetering

H. James Harrington had it right; measurement is the key to improvement. And nowhere does that ring truer than managing a building's energy. But in the energy management arena it's not just what you measure that is important. How you measure it, how accurate it needs to be, how much it will cost, how you deploy your meters, and what you do with the energy data once you have it are equally important questions to consider.
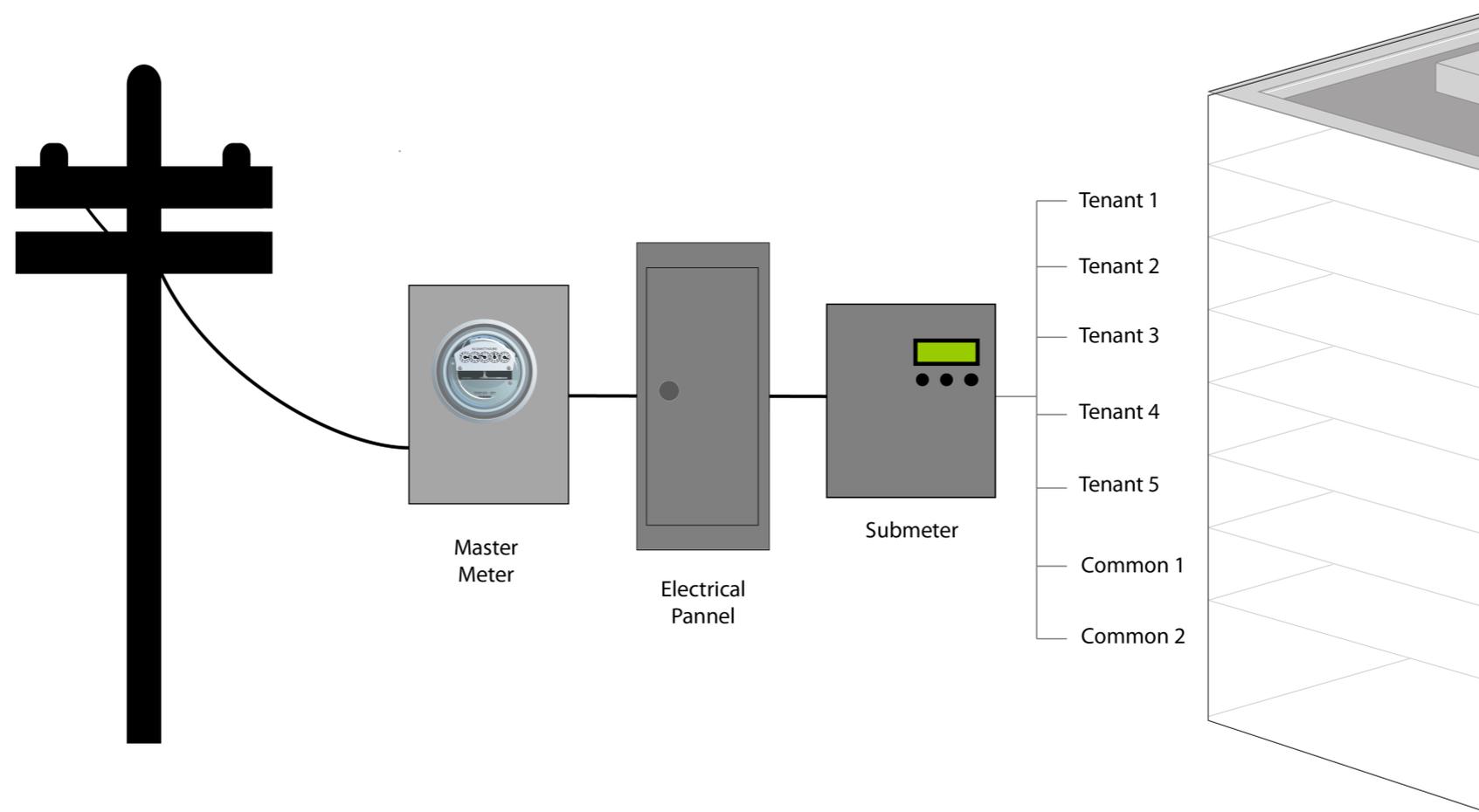
WHAT IS ELECTRICAL SUBMETERING?

Many multi-unit buildings use a single "master meter." Electricity comes into a building at bulk rate prices from the Utility and is distributed to tenants and building equipment after the meter.

Submetering is the measurement of electricity consumption beyond the master meter. Submeters (also referred to as power meters, electrical meters, and energy monitors) are installed after the master meter to measure individual electrical load.

Electrical submetering allows for the granular measurement of energy use, right down to the individual circuit. Building owners and property managers can pinpoint energy use, identify failing equipment, and allocate cost fairly by installing submeters.

Master Meter

Electrical Pannel

Submeter

Tenant 1

Tenant 2

Tenant 3

Tenant 4

Tenant 5

Common 1

Common 2

Submeters can measure energy use for tenants, departments, building equipment, or any other electrical load.

WHAT ARE THE BENEFITS OF ELECTRICAL SUBMETERING?

Submeters allow for the granular measurement of energy use — right down to the individual circuit. Building owners and property managers can pinpoint consumption, identify failing equipment, and allocate costs fairly by installing submeters. Tenants pay only for the electricity they use, can account for their consumption, conserve energy, and lower their electricity bills.

REDUCE ENERGY USE, SAVE MONEY

There are several strategies for reducing energy costs, but few are as compelling and fundamental as submetering. Many studies have shown that using submeters to allocate charges based on actual energy use is one of the most effective ways to reduce electricity consumption.

Perhaps the most exhaustive study of applying electrical submetering to multi-unit buildings was undertaken by the U.S. Department of Energy as part of the Federal Energy Management Program (FEMP) in 2007.

How Much Could You Save ?

Action	Observed Savings	Reasons for Savings
Installation of Meters	0 — 2 %	Hawthorne Effect
Bill Allocation Only	2.5 — 5 %	Improved Awareness
Building Tune-up	5 — 15%	Improved Awareness and Identification of Simple Operations and Maintenance Improvements
Continuous Commissioning	15 — 45%	Improved Awareness, Identification of Simple Operation and Maintenance Improvements, Project Accomplishment and Continued Management Attention

This study showed that merely installing meters resulted in a 2% reduction in energy use through the Hawthorne Effect. [1]

But that was just the start. FEMP found that submetering as part of a coherent, continuous commissioning program of benchmarking, analysis, and remediation can result in 15% to 45% savings. [2]

1. _The Hawthorne Effect refers to how people modify their behaviour when being observed or measured._

2. _Making the Case for Energy Metering, ASHRAE_

IT'S NOT ENOUGH TO MEASURE

Mr. Harrington did indeed have it right. Measurement truly is the key to improvement. [3] But there is an important corollary to Harrington's assertion; it's not enough to measure.

Accountability and incentive are required to inspire improvement. No matter how you slice it, stakeholders must have visibility to the electricity they consume (and be responsible for it) if sustainable energy management is to occur.

Whether the goal is reducing energy use or just sharing cost equitably — without accountability, action will not happen in a viable manner.

ACCOUNTABILITY MEANS PAYING

Electricity is a valuable and constrained resource. The best incentive for conservation is paying for its use. Tenants are more likely to practice positive energy efficiency habits when they are able to track, review, and pay for their actual electricity consumption.

But it's not as straightforward as simply measuring electricity for energy management accountability. How you measure it, how accurate it needs to be, how you deploy your meters, and what you do with the energy data once you have it are equally important considerations.

3. *Business Process Improvement, H. James Harrington*

IT STARTS WITH THE METER

When choosing electrical meters for a submetering project, it's important to consider these four criteria:

- Multi-point vs single-point meters
- Approved electrical meters vs monitors
- Open systems for future-proof integration
- Meter maintenance and data management

Multi-point Versus Single-point Meters

Single-point meters are handy for measuring specific points of interest in a building. However, complete building coverage is required to gain sufficient knowledge to make successful energy management decisions. Compared to single-point meters, multi-point meters offer several advantages related to cost, deployment, and integration.

Advantage One — Low Cost Per Meter Point

Most buildings offer convenient electrical panel organization, making metering points of interest readily accessible. Multi-point meters excel in these situations because they can be efficiently deployed — significantly reducing the cost per meter point compared to single-point meters.

Advantage Two — Significantly Reduced Footprint

In addition to a lower cost per meter point, multi-point meters significantly reduce the footprint required for meter installation — a crucial consideration in retrofit applications where space is at a premium.

Advantage Three — Easily Accessible Energy Data

Along with space and cost savings, multi-point meters offer easy data access. A well-executed metering plan creates an energy information center that can be integrated with existing systems — including building automation and financial systems.

Approved, Standards-Based Meters

There is a growing wave of regulation throughout North America focused on the metering of electricity consumption. Many cities and states are establishing directives to reduce energy use and align electricity payment with consumption. If money changes hands (as with government incentive programs or tenant billing, for example), certified meters become a legislated requirement in these jurisdictions.

Regulatory bodies are using the tried and tested ANSI C12.20 0.5 accuracy class as the standard that meters must meet, and requiring third-party laboratory certification to prove that they do. California's Title 24 and New York City's Local Laws 97 and 88 are recent examples of governments legislating approved submetering solutions for energy management and tenant billing applications.

Open-Systems for Future-Proof Integration

In addition to ANSI C12.20 0.5 approved meters, savvy property owners install open systems meters to integrate with existing energy management, tenant billing, and building automation systems.

Standards-based, open protocol meters help property managers and building owners avoid vendor "lock-in" and keep them in control of their data. They also ensure that the meters can keep pace with technology evolution and last for years to come.
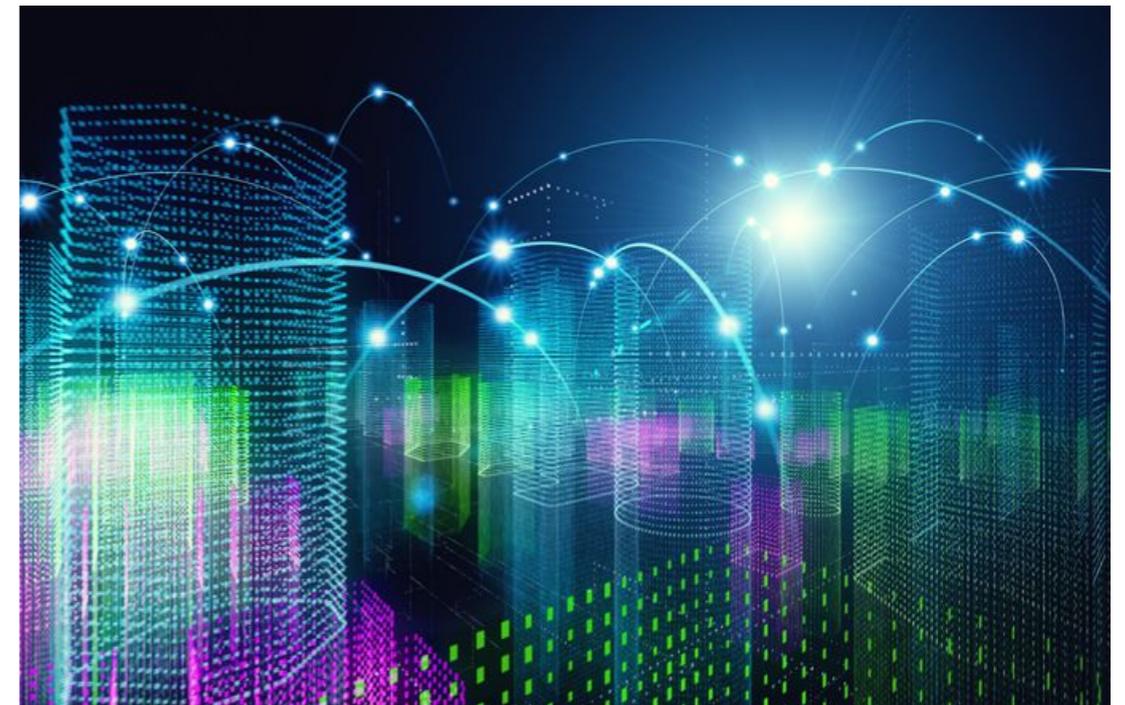

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METER MAINTENANCE AND DATA MANAGEMENT

Many submetering networks are managed through on-site meter management systems, proprietary gateways, or dedicated server-based applications. Installing these systems can present obstacles to meter management and maintenance, as well as data accessibility.

Cloud-based energy management systems avoid these pitfalls and bridge the energy information gap by making data visible to all stakeholders as needed. They accomplish this by communicating concurrently with building automation systems over building automation protocols and information technology systems over internet protocols.

Data that was once only available to Facilities Management is now readily obtainable by anyone who needs to know. Operations personnel can monitor and maintain a metering network while property managers and building owners can access the data they need to make energy decisions.
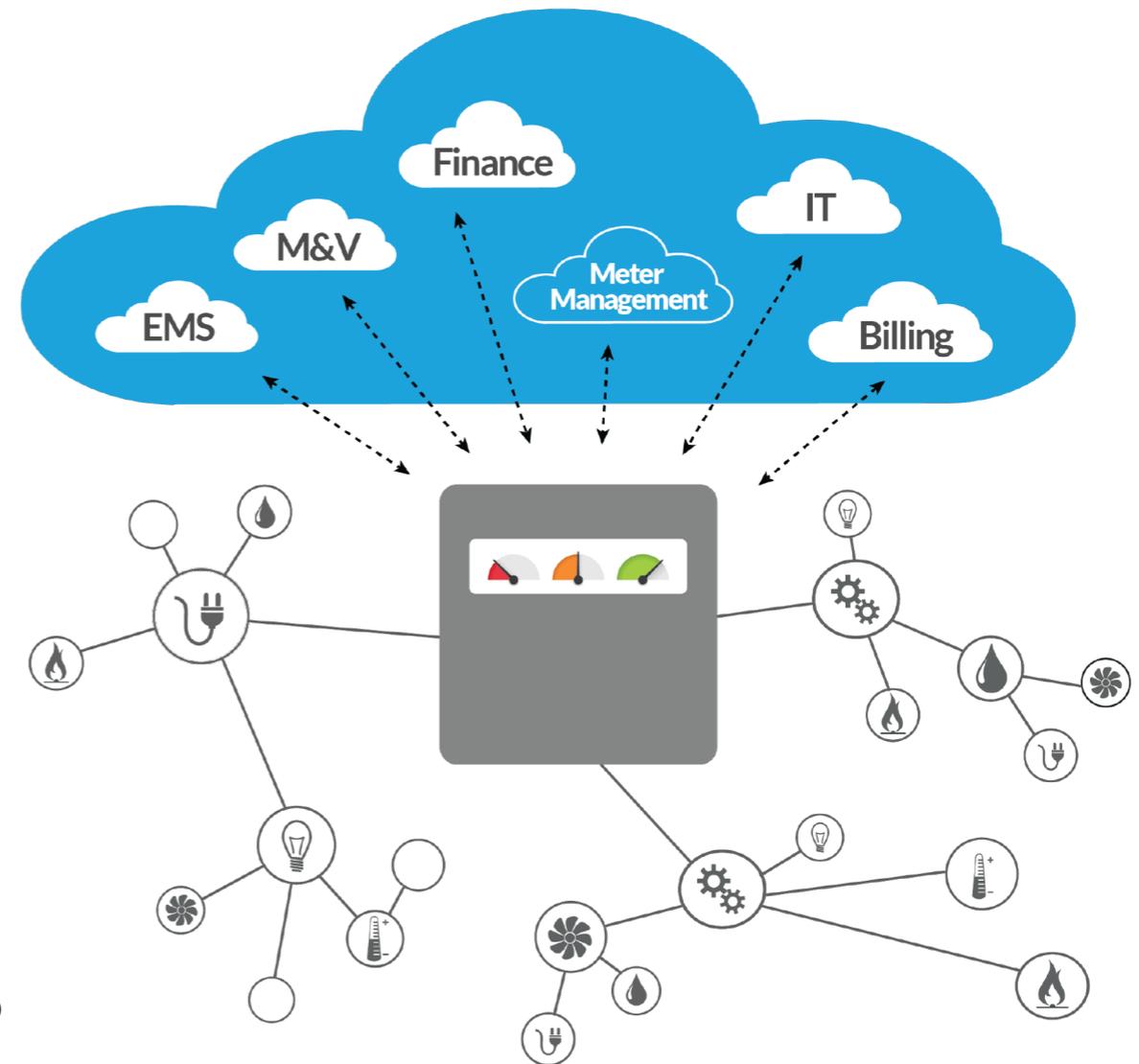
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FIVE STEPS TO A SUCCESSFUL SUBMETERING PROJECT

Choosing the right submeters for your energy management program is essential, but that's just the beginning. A successful submetering project must be carefully planned and artfully executed to maximize the value of your meter investment.

Complete the following five steps and your submeters will provide building owners and property managers with the information they need (when needed) to manage energy programs, save energy and bill tenants.

1. Clarify project goals

2. Understand the electrical architecture

3. Design meter deployment

4. Install and configure the meters

5. Meter commissioning

Clarify Project Goals

Understand the Electrical Architecture

Design Meter Deployment

Install and Configure the Meters

Meter Commissioning
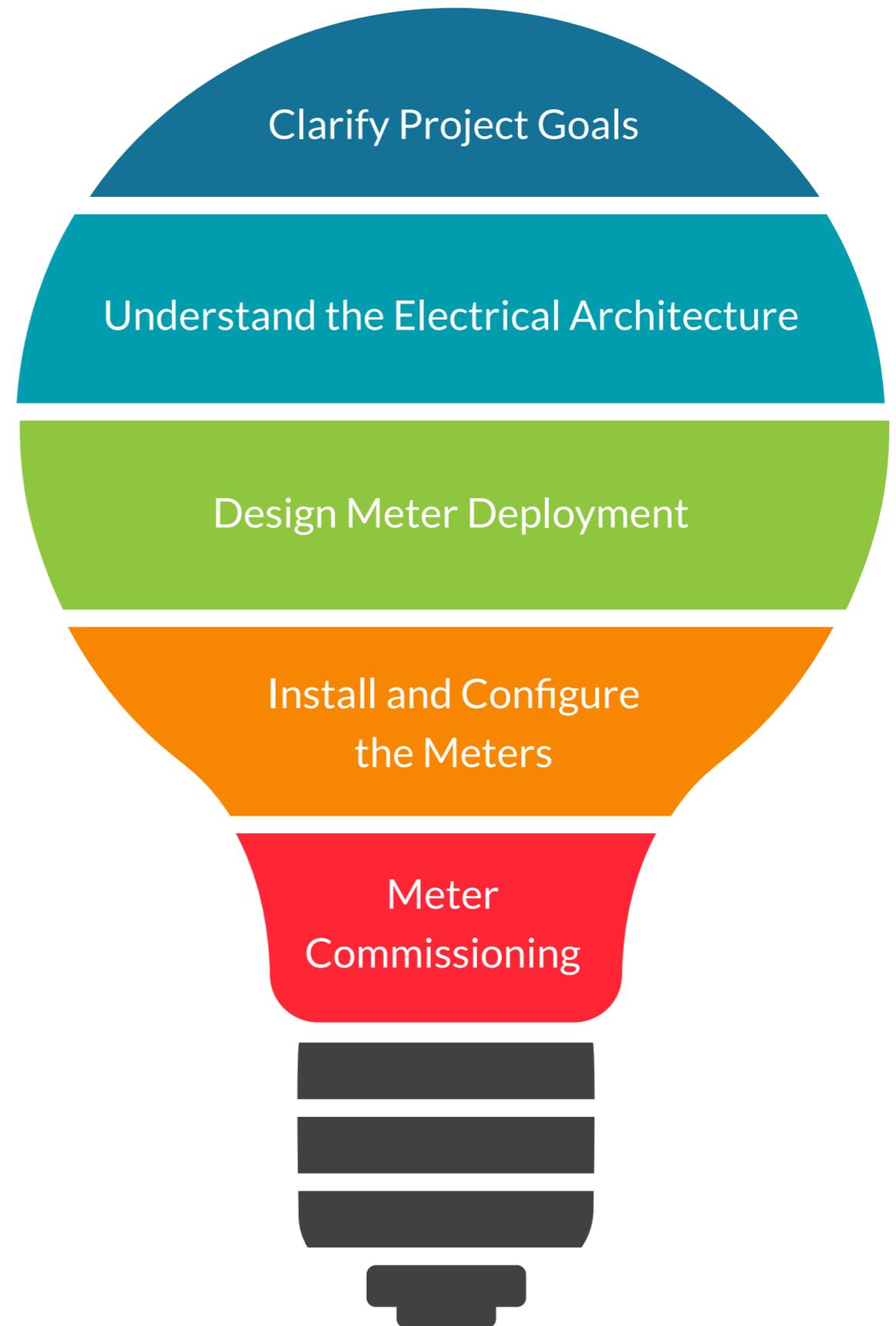
1. Clarify Project Goals

The first step is to be very clear about why electrical energy information is required in the first place. Is it needed to bill tenants for their electricity consumption? Do property managers want to understand energy use patterns to modify building management practices? Is the goal to identify failing equipment? Is the desire to qualify for utility-based or government incentives?

Being clear on your project's goals makes it easy to pinpoint the type and amount of metering equipment needed.

Utility billing and other revenue or performance-based applications, for example, will likely require meters that are listed with jurisdictional authorities. In contrast, energy management applications such as measurement and verification (M&V) or equipment consumption benchmarking can typically deploy non-listed meters.
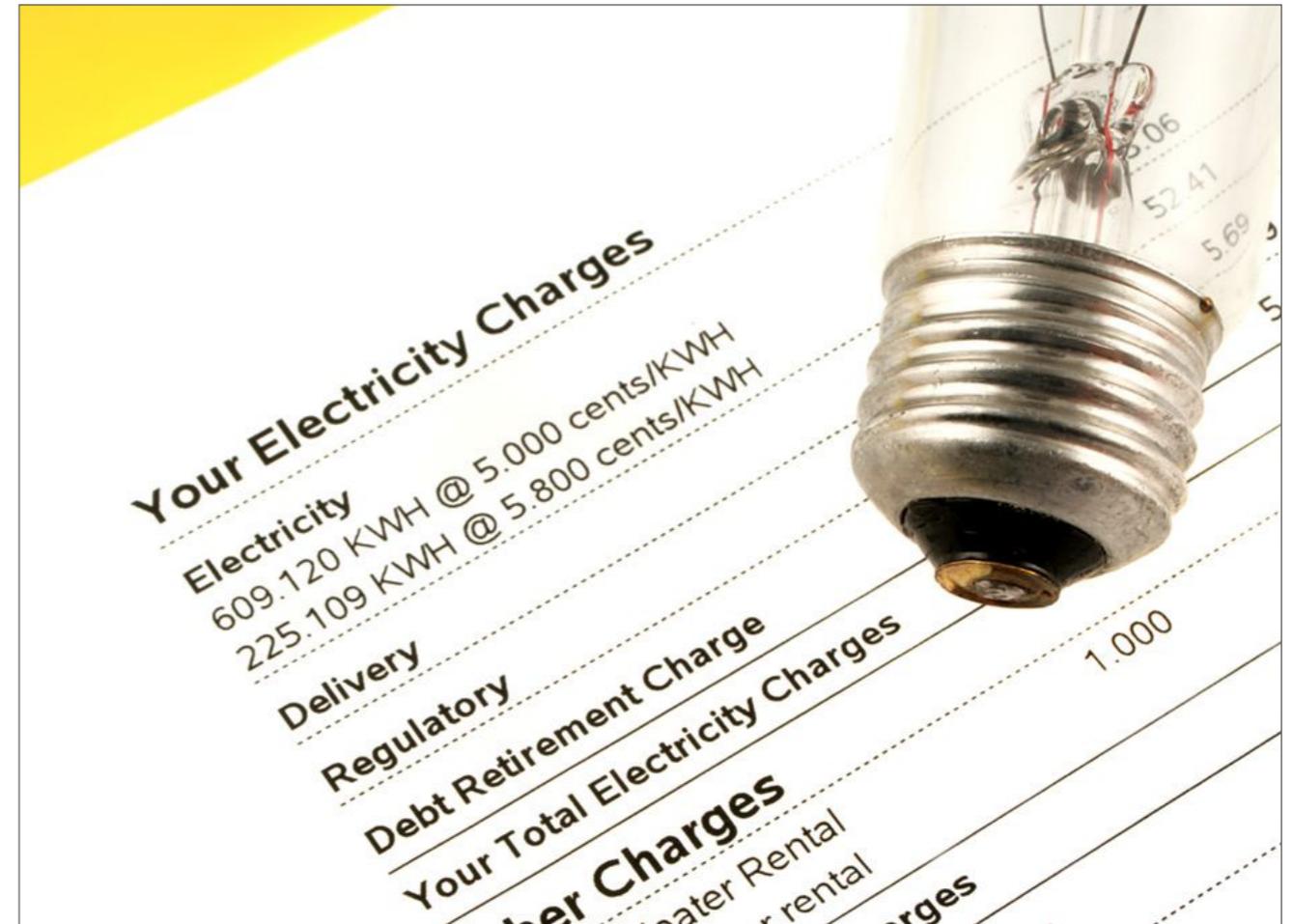
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Make a list of your project goals and all the stakeholders that need access to your energy information. This will inform the types of meters you require and what meter maintenance, energy management, and/or billing software you will need to deploy.

2. Understand Electrical Architecture

The importance of good onsite information at the start of a metering project can't be overstated. Accurate data upfront will ensure that your submetering design is optimal and that meter installation, configuration, and commissioning proceed smoothly.

The best records of the electrical system of a building are the single-line electrical schematic and panel schedules. These are readily available for new installations or facilities under construction. For older buildings, single-line drawings are often less accurate (if they exist at all), making a site visit mandatory.

Site visit information, coupled with knowledge derived from any electrical schematics or schedules that do exist, should be recorded in a standard, easy-to-read format. This allows the information to be shared between the project manager, electrician, system managers and support staff.
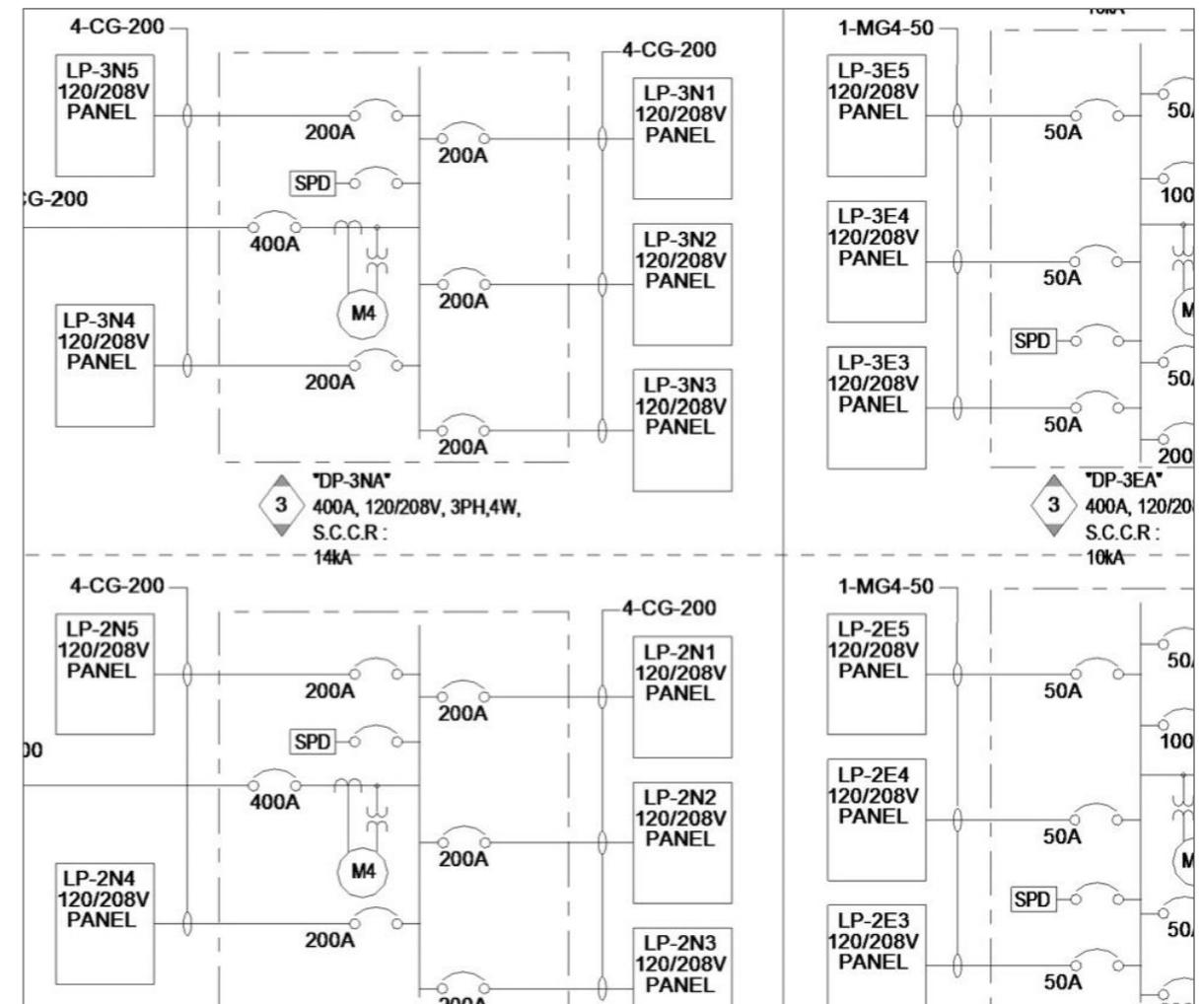
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At Triacta, we use a spreadsheet system that supports both paper-based and electronic data collection. The spreadsheet information is compiled by those conducting the site survey and shared with the rest of the team so everyone works from the same base assumptions.

3. Design Meter Deployment

This step determines the number of meters deployed, your meter programming requirements, any additional system components needed, and how the metering system will communicate with other systems. Careful communication between team members in the design phase saves money, time, and effort down the road. It also ensures data can be easily shared with energy management, billing, and building management systems.

At this stage it's essential to have a deployment platform that supports all aspects of the metering project — from meter installation, configuration, and diagnostics, to billing, measurement, verification, and system integration.

For more on secure, cloud-based platforms for meter deployment, configuration, and management, see: The Importance of Cloud-based Meter Management.

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4. Install and Configure the Meters

Under most building codes, installing multi-point meters requires a licensed electrician as current transformers will have to be installed directly on the electrical service conductors inside the panel. If solid-core, revenue-grade current transformers (CT) are to be used (necessary for accurate revenue applications), conductors will have to be disconnected.

The importance of a thorough site survey or single-line drawing analysis is emphasized during this part of the process. This analysis will determine wiring and voltage configurations along with ampere ratings. Amperage determines the CT's necessary for use with the meters.

Once installed, meters must be configured for the required application. Meter configuration includes the type of electrical service (i.e. 3 phase 3 wire, 3 phase 4 wire) and voltage and amperage requirements. Also, information about the communication network must be entered to ensure the meters report to the metering platform and any energy management, billing, or building management network as required.

Meter configuration is often performed onsite using a web page connection or specialized computer

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application. However, onsite configuration is not ideal as mistakes can be made during data entry that may not be discovered until later in the process. An alternative method is to pre-program meters before shipping them to the site. Unfortunately, this can cause issues if programming errors are discovered or suspected once technicians have left the site.

Triacta uses cloud-based software to configure meters. Once installed and reporting to Triacta Meter Manager, meters can be configured remotely — saving time and reducing costly site visits.

5. Meter Commissioning and Ongoing Monitoring

Commissioning is simply the process of generating a service load in the panel (turning on power to a load such as lights) and ensuring that the meter sees the load correctly. If required, meter verification would occur at this point to ensure the meter conforms to any applicable regulatory requirements.

Beyond viewing energy consumption information, the metering network should be monitored to ensure ongoing success once in place. A cloud-based management system allows for easy remote diagnostics, maintenance and support.

SUCCESSFUL ENERGY MANAGEMENT THROUGH SUBMETERING

Multi-point submeters are the most cost-effective solution for the granular monitoring of a building's energy consumption — which is essential for any sustainable energy management program. Still, care must be taken to ensure that your metering platform is deployed correctly to realize all the benefits of submetering. Following the 5 steps outlined here will ensure a successful, cost-optimized deployment.

The bottom line is this. The key to jump-starting your successful energy management project is to deploy approved, standards-based multi-point meters. These systems are cost-effective, integrate easily with existing financial and energy management platforms, allow for staged and affordable implementation, and protect building owners and managers against ever-evolving industry standards and business requirements.

ADDITIONAL RESOURCES

For more on multi-point electrical submetering:

From Space Saver to Information Cornerstone: The
Evolution of the Multi-Point Electrical Meter

Making the Case for Electrical Submeters

How to Choose the Right Electrical Submeter

ABOUT TRIACTA

Triacta Power Solutions designs and manufactures
revenue-grade electrical submeters for tenant
billing and energy management applications.
Triacta is a subsidiary of Metergy Solutions Inc.,
one of North America's most experienced
submetering providers.

Long known for its high-reliability, precise, multi-
protocol submetering products, Triacta's meters
have been easily and successfully deployed by
submetering companies, property owners, building
system integrators, and local distribution
companies since 2003.

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