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Metering Solutions For Cost Management and Cost Savings

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Introduction

The international focus on reducing building energy use and related greenhouse-gas emissions is only becoming more intense, as regulators in Europe and the United States continue to tighten building-performance requirements. Tenant metering – that is, tracking electrical loads at the tenant level and/or power metering that is tracking electrical loads at the circuit level – is becoming a bigger part of these new regulations.

However, there's good news for building owners in this new reliance on tenant metering. By understanding where their energy dollars are being spent, owners can more accurately target efficiency investments toward those opportunities offering the greatest possible returns. And more precise tenant fees can have a similarly positive impact on an owner's bottom line.

In this eGuide, Schneider Electric experts explore some of the more important efficiency regulations now shaping electrical-system designs around the globe, along with solutions available today for meeting these evolving tenant metering requirements. Read on to learn how energy-usage data is becoming a critical element in the daily lives of today's building owners and managers.

Energy-usage data is becoming a critical element in the daily lives of today's building owners and managers.

Energy Regulations for Commercial Buildings

Author: Poonam Walid

Commercial buildings dominate the modern landscape in more ways than one.

I mean they're more than just big to the eye. They're big in terms of energy, too. So in this article, I'm covering some energy-related regulations that impact buildings. In the next article, I'll go over solutions and additional benefits.

Right now, though, let's talk about the size of buildings, energy-wise. According to the United Nations, buildings produce up to 30% of greenhouse gases and consume up to 40% of all energy.

That's a big chunk of emissions and energy consumption. It means that buildings are big in terms of meeting greenhouse gas emission goals. Those vary by region.

According to the United Nations, buildings produce up to 30% of greenhouse gases and consume up to 40% of all energy.

Many governments have gone on record as wanting to cut greenhouse gas emissions by 80 percent below 1990 levels by 2050.

You can't get there without buildings playing a critical role. And if building owners, operators, tenants and occupants think this is all some future concern, I've got some news. Regulations are already rolling out, with these intended to hit intermediate goals and then, finally, the ultimate one in 2050.

For instance, there's the EU's energy efficiency directive. Its binding measures apply to all stages of the energy chain. The goal is to increase energy efficiency by 20% and get 20% of all energy from renewables by 2020. (I wonder if they went with all those 20s to make things easier to remember.)

For a North American version of the same, consider the California Energy Commission's Title 24. The Commission says its regulations have saved consumers billions in energy costs. So, it's not going to stop mandating greater energy efficiency, as can be seen in the fact that it's already into pre-rulemaking for its 2019 standards.

For buildings, a big point about Title 24 is that electrical power distribution systems must measure loads downstream of the service meter. We're not talking only about big loads, like heating, ventilation and air conditioning (HVAC) or lighting. The regulations also mandate metering of tenant areas and lobbies. For large buildings, those with a service rated at more than 1000 kVA, metering must give at the time and historical peak demand.

Energy Regulations for Commercial Buildings (cont.)

The idea in both Europe and America is that you know where energy is going, and then you can take steps to cut consumption.

The regulations in Title 24 mandate metering of tenant areas and lobbies.

The idea in both Europe and America is that you know where energy is going, and then you can take steps to cut consumption. And if you do try to cut consumption, you'll have data to confirm that what you did worked. If it didn't, you'll know that, too.

So, the larger picture of meeting greenhouse gas reductions means that more targeted metering is coming. In some locations, like the UK, solutions to reduce greenhouse gas emissions are being applied to new and old buildings. For a retrofit, the new solutions must be implemented if the building is expanded or if there's a change in use.

Given that buildings are in use for decades, it's likely regulators elsewhere really won't have any choice. Even if mandates today only apply to new buildings, eventually the drive to cut emissions will run into a reality: there's no way to get there without targeting existing buildings as well.

If you are looking for more details, you can check out the following documents:

Theme	Type	Link
IEC 61557-12	White paper	Guide to using IEC 61557-12 standard to simplify the setup of an energy measurement plan
Measurement applications	White paper	Guide to energy measurement applications and standards

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Energy and Power Metering: Solutions and Additional Benefits

Author: Poonam Walid

In my previous article, I talked about energy regulations and tenant metering. The EU's energy efficiency directive and the California Energy Commission's Title 24 point to a future in which electrical metering and load measurement will be much wider than is the case today. Metering will be more granular, possibly at the level of individual plugs, and extended to valuable measurements such as power factor, voltage and power demand.

What's more, it's not just new buildings that will have to adhere to these standards. Older ones are also likely to be required to meet these regulations, perhaps when electrical service retrofits or upgrades are done.

Ok, that's the situation. So, what is the answer?

Well, the regulations define what the solution should look like, partially fulfilling the old management command to bring not only problems but also solutions. For instance, Title 24 lists minimum requirements for electrical metering. At all service levels, meters have to provide electrical demand at every instant of time. Historical peak demand is required of services rated 250 kVA or above. Services rated more than 1000 kVA also have to produce information on kWh per rate period.

For commercial buildings, tenant metering also implies that:

1. Devices be easily embedded within an energy management system, and

2. That they monitor power at key distribution points in a system or be located on critical equipment.

Today there are high density metering (HDM) packages or power meters complying with IEC 61557-12 that can meet both of these requirements.

It's not just new buildings that will have to adhere to these standards. Older ones are also likely to be required to meet these regulations.

Furthermore, these metering systems have greater communication capabilities. So they can integrate information from multiple energy sources, like water, air, gas and steam. They may also have optional network features that allow alarming on critical conditions or the carrying out of power quality analysis.

Another set of benefits arise because the regulations require meters to be accurate, precise and reliable. This means

Energy and Power Metering: Solutions and Additional Benefits (cont.)

that the data produced will be of higher quality than was the case in the past. So, analysis of energy consumption at the whole building down to the tenant metering level will be better, proof yet again of the truth of that old computer science saying about garbage in, garbage out – or, in this case, better data in, better results out.

> Beyond meeting regulations, tenant metering and multiple meter points create benefits.

However, these advanced and more capable meters are not enough. Any solution also has to include software systems to manage the devices. One reason to do so is that adding meters that produce more data more often makes it cost-prohibitive to collect the information manually. The old approach of having someone walk around with a clipboard and write down numbers just becomes too expensive. On top of that, the manual approach is a recipe for data entry mistakes to be made, either on initial collection or subsequent transcription into the building management system (BMS).

So, there are regulation-driven changes coming to metering. More data will be collected, with tenant metering a reality. The benefits can include improved energy efficiency, as well as greater insight into the energy aspects of building management. But, any solution needs the network capabilities and services to fully support the new meters.

For an example of such solutions and meters, look here.

If you are looking for more details, you can check out the following documents:

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Tenant Metering: It Makes Dollars and Sense

Author: Pankaj Lal

Whether you are a building owner or tenant, adopting tenant metering makes more sense than ever when it comes to cost savings and sustainability.

Tenant metering allows you to see how much energy is consumed based on actual data at a granular level and the cost of that energy. Typically, technology such as meters and software, allow you to generate fees for each tenant.

What Are the Benefits for You?

- Tenant metering enables actionable insights into daily, weekly or seasonal operational and maintenance issues, equipment performance or behavior of occupants. Having this information allows you to easily identify opportunities for savings.

Key market segments where tenant metering is especially relevant are office buildings, retail, federal government facilities, multi-tenant buildings, airports and mixed use buildings.

- Tenant metering also enables building owners to manage their electricity budget more efficiently and reduce exposure to rate increases and uncontrolled consumption. Reducing operating expenses improves buildings' net operating income (NOI) and value.

- For tenants, tenant metering data can provide important feedback on energy consumption to promote behavioral change that leads to energy conservation.

These benefits apply to both new and existing buildings. Key market segments where tenant metering is especially relevant are office buildings, retail, federal government facilities, multi-tenant buildings, airports and mixed use buildings. Combining software with decision-support tools with tenant metering can further help change your building's consumption profile and achieve financial payback.

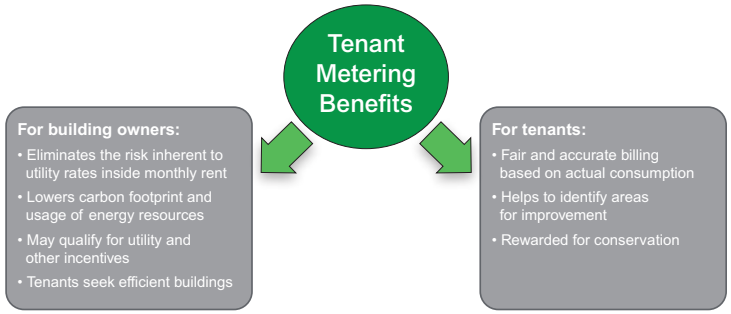

Figure 1: Win-Win using Tenant Metering.

Market Drivers Point to Growing Adoption

The demand for tenant metering is growing quickly. In fact, the market is projected to double in size by 2020 to $1.6 billion, according to a report from Pike Research. That growth is fueled by market drivers such as:

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Tenant Metering: It Makes Dollars and Sense (cont.)

- **High performance buildings** with lower energy usage and the means to track energy usage by tenant *are more desirable, easier to lease and have higher market value,* according to a report from the Continental Automated Building Association.

- **Green building certification** such as LEED for New Construction (NC) or existing buildings (EB) which is being increasingly adopted. Advanced energy metering provides up to two LEED points for metering all energy sources used in the tenant space, and any individual energy end uses that represent 10% or more of the total annual consumption of the tenant space.

Cities such as Seattle, Austin, New York, Boston, Atlanta, Washington, D.C. and states like Washington and California have passed tough energy efficiency regulations for non-residential and residential buildings.

- **Local mandates** have put tremendous pressure on commercial property owners to develop strategies to comply, while managing costs and maintaining profitability. For example, cities such as Seattle, Austin, New York, Boston, Atlanta, Washington, D.C. and states like Washington and California have passed tough energy efficiency regulations for non-residential and residential buildings.

Expected Payback for Building Owners

GSA's Office of High Performance Green Buildings study observed up to 45% bottom-line energy cost savings with use of tenant metering and associated building tune-up, load management and ongoing commissioning. That study looks at the cumulative benefits of tenant metering and associated actions, including building tune-up, load management and ongoing commissioning.

And when tenants pay for what they consume using tenant metering, they can lower energy costs by 21% according to a report from the U.S. Department of Energy. This report looks at just the benefits realized from the metering, bill allocation and client behavior change.

In both cases, tenant metering is the key to energy management and cost savings. It is the vital tool that makes owners and tenants aware of usage and cost. That data in turn provides actionable insights to make decisions that deliver significant energy cost savings and guide operations and energy investment decisions.

Learn more about Schneider Electric's tenant metering solutions.

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Metering a Bigger Requirement Under California's Updated Title 24

Author: Drew Reid

California's Title 24 energy standards have long been some of the most demanding efficiency guidelines in the country, and the 2013 updates (which went into effect July 1, 2014) continue that tradition. While lighting and plug-load-control requirements have gotten more attention among electrical professionals, new metering rules outlined in Section 130.5 could pose equal challenges for consulting specifying engineers and their clients. Section 130.5(a), which defines metering provisions for new electrical service, is one of two additions to Title 24 that new electrical service installations will need to address.

California's Title 24, Section 130.5(a) requires all mandated capabilities be incorporated into a single meter for the largest energy users.

Under the 2013 standards, newly installed electrical service in non-residential buildings – including service from the local electric utility and that from other sources, such as photovoltaic systems, but excluding emergency power sources – now, at a minimum, must have permanently installed, user-accessible metering of total electrical service. Additionally, that metering must provide both instantaneous kilowatt-hour (kWh) demand readings, as well as the ability to supply kWh demand information for a user-resettable period.

While it might seem like a utility meter would suffice for this purpose, most utility meters don't offer the ability to monitor usage for a user-resettable period, and this is a critical

Table 130.5(a) Minimum Requirements for Metering of Electric Load

Meter Type	Services rated 50 kVA or less	Services rated more than 50 kVA and less than or equal to 250 kVA	Services rated more than 250 kVA and less than or equal to 1000 kVA	Services rated more than 1000 kVA
Instantaneous (at the time) kWh demand	Required	Required	Required	Required
Historical peak demand (kWh)	Not required	Not required	Required	Required
Resettable kWh	Required	Required	Required	Required
kWh per rate period	Not required	Not required	Not required	Required
Amperage Translation	Less than or equal to 139A at 208V 60A at 480V	Less than or equal to 694A at 208V 301A at 480V	Less than or equal to 2776A at 208V 1203A at 480V	Greater than 2776A at 208V 1203A at 480V

Metering a Bigger Requirement Under California's Updated Title 24 (cont.)

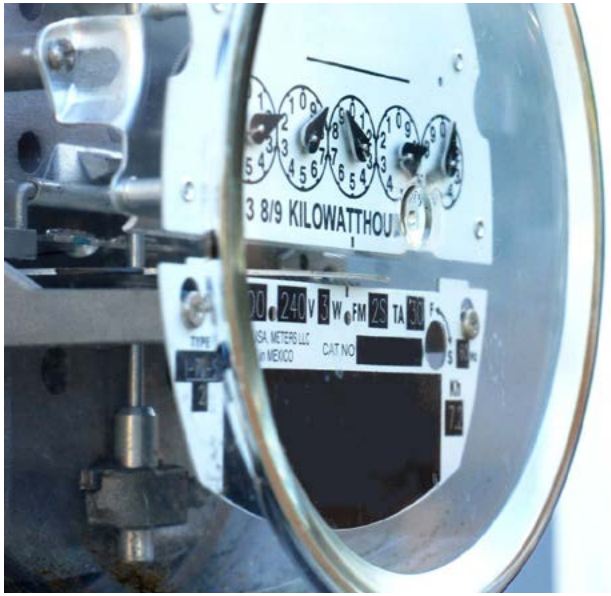
element in a code designed to engage building owners and managers in their facilities' energy use. As the saying goes, "what can't be measured can't be managed." User-resettable meters make it easier to run energy studies and enable before/after comparisons of any future efficiency upgrades.

As shown in the table outlining Section 130.5(a) requirements, larger facilities require even more detailed metering under the 2013 revisions. In addition to the base-level functions described above, metering for new electrical services rated more than 250 kilovolt-amperes (kVA) also must provide information on historical peak demand in kilowatts. For services rated over 1000 kVA, metering must include kWh-usage per rate period. Yes, this functionality is redundant to what any basic utility meter would provide, but the regulations require all mandated capabilities be incorporated into a single meter for these largest energy users.

So, how can system designers meet these upgraded requirements? The best approach is always relative to the situation at hand. One approach would be to install a stand-alone meter adjacent to the panelboard or switchboard at the service entrance. However, with space often limited in cramped electrical rooms, another approach would be to incorporate metering inside the electrical distribution equipment. Schneider Electric offers a range of energy and power meters that meet or exceed the requirements of Title 24 and many of these meters can be incorporated within the equipment itself as a more space-friendly solution.

Because we know the new metering requirements can be complicated to address, Schneider has experts available through its Consulting Engineer Portal you can call on for expert advice.

> User-resettable meters make it easier to run energy studies and enable before/after comparisons of any future efficiency upgrades.



Metering for new electrical services rated more than 250 kilovolt-amperes (kVA) also must provide information on historical peak demand in kilowatts.

Designing Metering Under Title 24: A Question of Space Versus Cost

Author: Drew Reid

The recently updated Section 130.5(b) of the California Energy Commission's Title 24 efficiency standard adds new requirements to designs for new electrical services rated over 50 kVA. Understanding that "what can't be measured can't be managed," these requirements intend to provide greater visibility to energy usage within a facility. "Disaggregation of electrical circuits" is intended to make it relatively easy to measure energy consumed by lighting,

Table 130.5(b) Minimum Requirements for Separation of Electric Load

Load Type	Services rated 50 kVA or less	Services rated more than 50 kVA and less than or equal to 250 kVA	Services rated more than 250 kVA and less than or equal to 1000 kVA	Services rated more than 1000 kVA
Lighting including exit and egress lighting and exterior lighting	Not required	All lighting in aggregate	All lighting disaggregated by floor, type or area	All lighting disaggregated by floor, type, or area
HVAC systems and components including chillers, fans, heaters, furnaces, package units, cooling towers, and circulation pumps associated with HVAC	Not required	All HVAC in aggregate	All HVAC in aggregate and each HVAC load rated at least 50 kVA	All HVAC in aggregate and each HVAC load rated at least 50 kVA
Domestic and service water system pumps and related systems and components	Not required	All loads in aggregate	All loads in aggregate	All loads in aggregate
Plug load including appliances rated less than 25 kVA	Not required	All plug load in aggregate Groups of plug loads exceeding 25 kVA connected load in an area less than 5000 sf	All plug load separated by floor, type or area Groups of plug loads exceeding 25 kVA connected load in an area less 5000 sf	All plug load separated by floor, type or area Groups of plug loads exceeding 25 kVA connected load in an area less than 5000 sf
Elevators, escalators, moving walks, and transit systems	Not required	All loads in aggregate	All loads in aggregate	All loads in aggregate
Other individual non-HVAC loads or appliances rated 25 kVA or greater	Not required	All	Each	Each
Industrial and commercial load centers 25 kVA or greater including theatrical lighting installations and commercial kitchens	Not required	All	Each	Each
Renewable power source (net or total)	Each group	Each group	Each group	Each group
Loads associated with renewable power source	Not required	All loads in aggregate	All loads in aggregate	All loads in aggregate
Charging stations for electric vehicles	All loads in aggregate	All loads in aggregate	All loads in aggregate	All loads in aggregate
Amperage Translation	Less than or equal to 139A at 208V 60A at 480V	Less than or equal to 694A at 208V 301A at 480V	Less than or equal to 2776A at 208V 1203A at 480V	Greater than 2776A at 208V 1203A at 480V

Designing Metering Under Title 24: A Question of Space Versus Cost (cont.)

"Disaggregation of electrical circuits" makes it relatively easy to measure energy consumed in multitenant setitngs.

HVAC-related motors and elevator systems – and, in multitenant settings, by building area, such as lobbies and tenant-controlled spaces.

At a minimum, the design of the electrical system must allow measurement of loads by specific types and these requirements increase as the size of the service increases. Specific load/building-area types that must be addressed are outlined in Table 130.5(b).

This is only a wiring requirement in the 2013 version of Title 24, and providing meters is optional. Best explained in the Title 24 Compliance Manual, "The intent is to have a single feeder or breaker with each type of load (such as lighting) on it, such that a meter could be placed on the feeder to report energy use by that load type." This arrangement of circuits provides for future tenant metering, even if that's not part of the owners current plans.

To help illustrate the allowed wiring, the Compliance Manual says this: "This section of the Standard requires buildings to be wired in a manner that separates loads by types into independent feeders and risers through the building." It is clear that the intent of the allowed wiring is to separate the circuit types after the service meter to allow simple measurement. The code describes distribution methods allowed to accomplish this that can be scalable to buildings of larger size:

- Provide "separate switchboards, motor control centers, or panelboards to which are connected only the required load or group of loads." The physical layout should ensure adequate space inside or adjacent to each panelboard for the future addition of individual meters.

- For additional loads of a particular type, it further allows "SUBPANELS OF THE ABOVE to which are connected ONLY the required load or group of loads AND for which the subpanel load can be INDEPENDENTLY measured in aggregate."

At a minimum, the design of the electrical system must allow measurement of loads by specific types and these requirements increase as the size of the service increases.

Designing Metering Under Title 24: A Question of Space Versus Cost (cont.)

Exception to the distribution system design requirement of Section 130.5(b)

There is one exception to strictly segregating circuits to allow measurement at a single point. This is if "a complete metering and measurement system IS PROVIDED that at a minimum measures and reports the loads called for in Table 130.5(b)." This type of system can calculate the total energy use of a particular load type from multiple measurement points, using additive or subtractive methods. Under this plan, the panelboards must incorporate permanent branch-circuit current transformers that communicate to permanent metering and measuring systems provided at time of construction.

Although metering equipment has a cost, an advantage of this approach is that it allows load types to be consolidated and mixed within a smaller number of panelboards. Such systems can save additional space if contained within the panelboard. Jobsite conditions can favor this approach. Essentially, the decision boils down to an evaluation of available space versus a project's budget. Disaggregated, multi-panel designs mean more electrical equipment, which also means more space dedicated to non-revenue infrastructure. The consolidated design requires fewer panels, but those panels become more expensive due to the required addition of current transformers at each circuit and the associated metering devices. However, it makes it much more likely that the building owner will actually get the information they need to help cut energy use and lower the monthly utility bill.

Many consulting engineers can have an "a-ha moment" when they tally up the cost of a mixed-load design. If the end user attaches a premium to space savings – or has a true interest in using the metering data – projects can justify the upfront cost of mixed-load panels with permanent metering included. This becomes especially true in larger jobs requiring 10 or more mixed-load panels, where economies of scale and other savings can help the approach make economic sense.

For more help, check out Schneider Electric's Professional Engineer Portal for additional information and for access to experts you can call on for advice on how these new requirements might affect plans for your next project in California or other jurisdictions that might be following Title 24 guidelines.

Many consulting engineers can have an "a-ha moment" when they tally up the cost of a mixed-load design.

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