Enabling Tenant Participation in Renewable Energy Initiatives

A practical solution for enabling tenants to participate in solar or wind energy initiatives

A White Paper by Power Meter Technics

Meteringonline provides an innovative and cost-effective solution to enabling tenants to participate in renewable energy projects implemented by owners of multi-tenanted buildings.

The solution operates entirely in the cloud without the requirement for additional infrastructure or control systems and integrates seamlessly with Meteringonline's standard metering data acquisition and billing system.

Background

The installation of solar photovoltaic (PV) systems on commercial or industrial properties has become a commonplace practice.

Property investors generally look at the long-term value of their assets. Since solar provides consistent, affordable and clean energy over a 25-year lifetime, it is not surprising that commercial and industrial property funds are investing in solar.

For the most part, the size of the PV plants cannot sustain the whole centre but rather supplements the supply during periods of peak consumption. Shopping centres are particularly suited to the installation of solar panels as they have large homogenous roofs, the centres operate throughout the week and are the busiest during daylight hours, ensuring optimal use of PV energy.

Participation by tenants

In a typical shopping mall, the direct electricity consumption by tenants accounts for between 60% and 70% of the total consumption of the centre. This means that a significant proportion of energy generated by a PV system is consumed directly by the tenants of that building during normal opening hours.

Many property owners would like to assist their tenants to reduce their utility consumption so as to help them reduce their total cost of occupation and in so doing, the making the shopping centres become a more attractive option for renting commercial space.

The metering problem

There are ways that this saving could be estimated. For example, by simply reducing electricity tariffs to tenants by an amount based on what the assumed saving in bulk energy to the centre is, but these methods arbitrary and often subjective.

A far better solution would be for the property management company to charge tenants on a basis that distinguishes between the energy purchased from the power grid and that supplied from the PV system.

Until now, it has been almost impossible to enable tenants to directly benefit from solar

energy initiatives due to limitations in electrical reticulation and metering.

Using conventional metering systems, it would be impossible to accurately account for energy supplied by the grid and energy supplied by the PV systems to tenants without installing a separately metered PV supply to each tenant as shown in Figure 1.

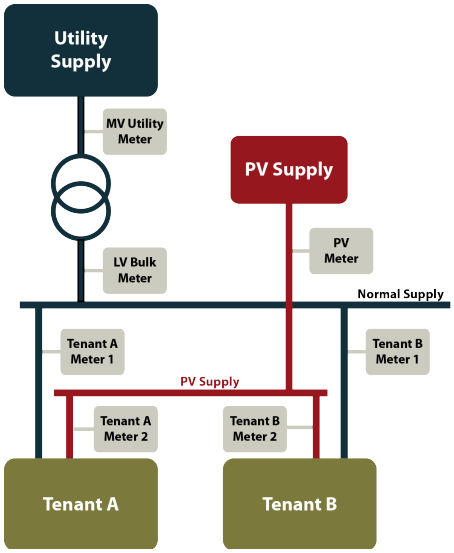

Figure 1: Separation of PV and Utility Supplies

The obvious disadvantage to this approach is that the reticulation would effectively have to be duplicated, with a normal, PV and possibly a generator standby supply interdependently provided to each tenant. Each supply would have to be individually metered.

Local signaling and control

Another possible solution would be to use meters that have the ability to switch tariffs in response to an external signal on a digital control input. A control signal would be sent to each tenant meter from the PV control system when the PV is generating energy and the meters would respond by accumulating energy in a second rate-register during this period. The consumption for both rates would then be read either manually or by means of an automated system and different tariffs applied to each rate as shown in Figure 2.

The main disadvantage with this approach is that it assumes that the PV panel will always operate at a fixed and known rate with constant generation irrespective of the time of day or solar radiation. There is no real way to determine how much energy was used proportionally from the utility supply and the PV supply.

A further disadvantage is that the metering system itself would be inherently more complex and therefore more difficult and more costly to maintain. There is also the problem of a single point of failure since the entire control system would rely on the controller at the PV plant.

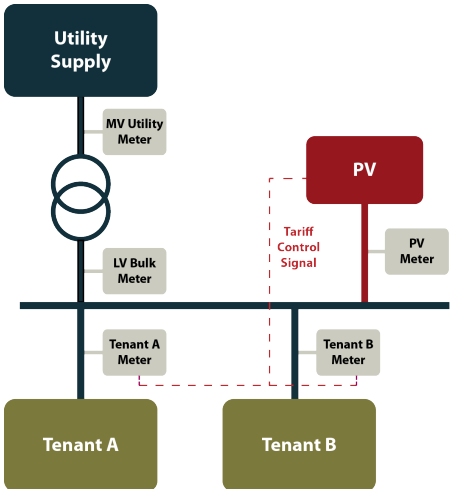

Figure 2: Local signalling solution

Virtual meters

A Virtual Meter is a mathematical construct used to calculate consumption for a logical load point where it is not possible or feasible to have an actual physical meter. Virtual meters are often used in modern Meter Data Management (MDM) systems like Meteringonline to provide aggregated data from two or more real meters.

A typical example of how virtual meters are used in commercial buildings is to provide aggregated total metering data for the consumption of common-area loads within a building so that these costs may be allocated to tenants on a pro-rata basis.

Virtual meters used for load-aggregation

The most common application for virtual meters to calculate an aggregated total consumption based on the readings of a number of physical meters.

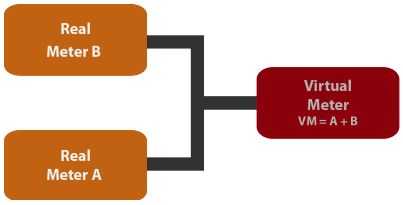

Figure 3: Virtual meter to aggregate two supply points

In the example shown in Figure 3, a virtual meter is used to aggregate the active and reactive energy recorded from two real meters. Because the aggregation is performed by means of a vector sum, the correctly diversified maximum demand of the aggregated load is obtained directly from the total active and reactive of the virtual meter.

Smart virtual meters

Meteringonline takes the concept of aggregate virtual meters further by the implementation of "smart virtual meters".

In this case a virtual meter is configured to register the consumption from a meter if a certain condition or set of conditions are met.

For example, a smart virtual meter can be constructed to only record energy if the active energy demand recorded by another meter has non-zero interval data – indicating that the PV was producing energy at the time – and the energy recorded is in exact proportion to the ratio of the PV to the utility supply.

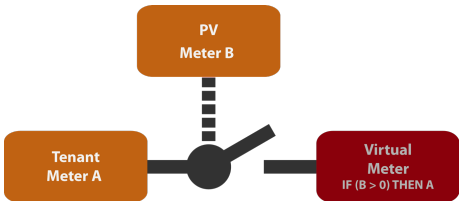

Figure 4:Virtual meter configured to register when PV is generating energy

A second smart virtual meter is then configured to register consumption from the tenant meter when the interval data from the PV is zero, in other words when the PV is not operating. The readings from these two virtual meters are then assigned the appropriate tariff - one for the cost of power supplied by the utility and one for the cost of electricity supplied by the PV.

The Meteringonline solution

Meteringonline provides an elegant solution to the problem of recovering the cost of locally generated energy using advanced software systems in conjunction with Smart Metering technology.

PMT pioneered the use of smart meters in commercial applications where power line communication technology (PLC) is used to communicate with smart meters. The smart meters are managed by data concentrators, which in turn are connected to the cloud-based Meteringonline servers using a standard wide-area network connection or GPRS or 3G cellular data communication. All load points within the building are equipped with smart meters, including supplies to tenants, common area loads, air handling units, generators and transformers.

This makes it possible to process all data offline using the Meteringonline Meter Data Management (MDM) system and conditional virtual meters as described earlier. This solution does not require the installation of complex and expensive control equipment and can be used with any modern meters that accurately record interval data.

The reticulation and metering system are configured exactly as shown in Figure 2, with the exception that no local control is needed.

This makes it possible to process all data offline using the Meteringonline Meter Data Management (MDM) system and conditional virtual meters as described earlier.

All meters within the Centre are configured to record active and reactive energy interval data (*depending on local tariffs, this may be either 30 or 15-minute interval data*) and this interval data is read by the cloud-based Meteringonline data acquisition server several times per day and stored on the Meteringonline meter data store.

Additional applications

The system is not limited to PV generation, but can be equally be applied to include any energy source such as standby energy from generators or heat recovery systems to harvest waste energy from chillers or other AHU plants as shown in Figure 6.

The only requirement is that the energy source should be metered.

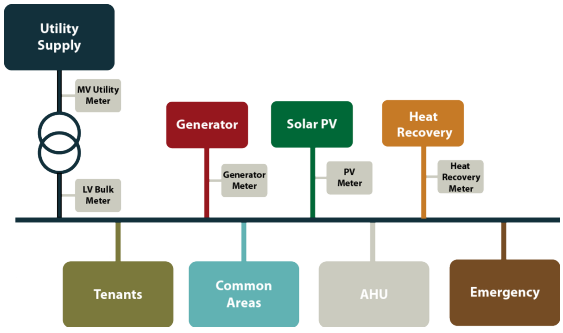

Figure 5: Solution for multiple energy supplies

Practical example

A practical example of how the system works using data from a small shopping mall in Johannesburg is shown in Figure 6.

The top profile shows the energy supplied by the centre's PV system over a seven-day period. The second graph shows the energy consumed by one of the centre's tenants that was supplied from this PV system over the same period.

The third graph shows the energy consumed by the tenant that was supplied by the electricity utility company and the last graph shows the total energy consumed by the tenant.

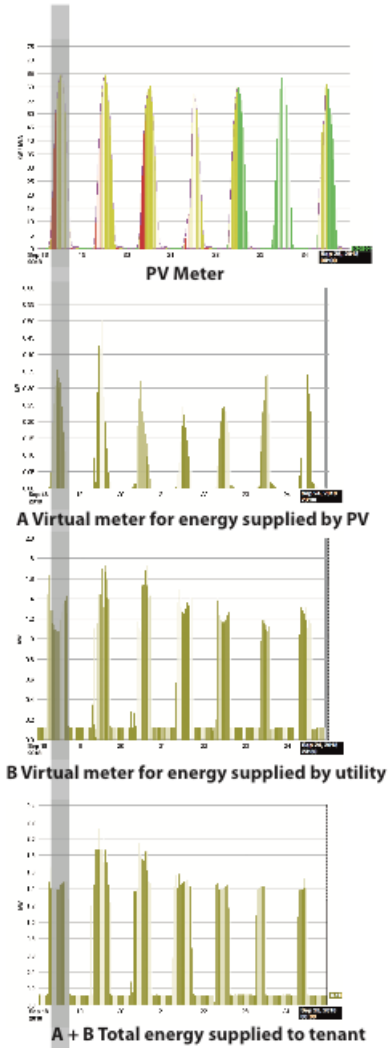

Figure 6: Energy profile showing conditional virtual metering

Finally, an electricity bill for the tenant is shown in Figure 7 where the rebate for PV generation has not been applied and Figure 8, where the total cost of electricity supplied by the PV is shown separately from the cost of electricity supplied by the utility and in each case the rate is clearly indicated.

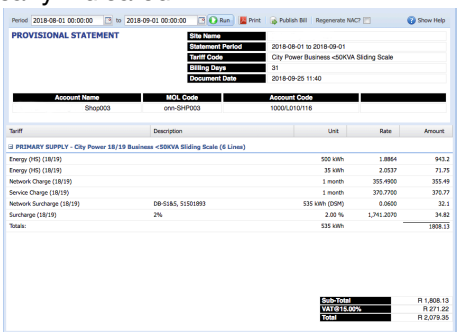

Figure 7: Utility bill with no PV rebate

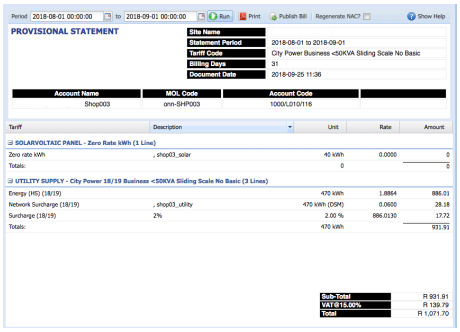

Figure 8: Utility bill with PV energy zero rated

As can be seen in the above example, the potential saving to a small tenant can be significant. These smaller tenants are usually the ones that would benefit the most from a reduction in utility costs, making them more profitable and ultimately better tenants.

Conclusion

The Meteringonline smart virtual meter system makes it possible for commercial properties to accurately allocate the savings of a PV generation system to tenants without the requirement of duplicating reticulation infrastructure or having complex control systems on site.

Power Meter Technics (Pty) Ltd
5 Silverstone Crescent
Kyalami Business Park
Kyalami, Midrand
1685

Tel: +27 (11) 466 1632
Fax: +27 (11) 466 1742
Email: info@pmt.co.za
Web: www.pmt.co.za