



Tenant Space Submetering

June 16, 2011

- Benefits of Tenant Submetering
- Business Case for Tenant Submetering
- General overview of meter types
- Tenant Submetering Strategies - Design considerations
- Tenant Submetering Strategies - Implementation considerations
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Tenant sub-metering is a broad term applied to the use of hardware and software to bill tenants in commercial facilities for their actual usage of energy. The goals of tenant sub-metering are: 1) to ensure that the owner recovers the cost of energy from tenants, and 2) to make sure that tenants with high energy usage are not subsidized by those with lower usage.

- Impact of measurement - “if you can’t measure it, you can’t manage it”
 - Current utility practice to measure costs and use on a monthly basis is inadequate for managing tenant energy needs
 - Energy & Financial managers require an adequate understanding of where energy is being used, rates and costs, to reduce building operation and maintenance (O&M) costs
 - Measuring tenant energy use via submetering can generate efficiency savings (via installing technologies) and conservation savings (improved O&M practices and/or behavioral changes)
 - Tenant outlook: if all else is equal why lease in an inefficient building?

- Trending as a means to identify anomalies
 - Baseline energy use by system over time is key to being able to spot anomalies
 - The refined timescale of submetering provides actionable insights into daily, weekly or seasonal O&M issues, equipment performance or behavior of occupants – identify opportunities for efficiency retrofits via audits
 - Analysis with decision-support tools can help change your buildings consumption profile and achieve financial payback for submetering

- Possible energy savings impact
- Increasing Tenant awareness of energy use – passing on cost to tenant:
(A separately metered building, where tenants pay for what they consume, will have lower energy costs by 21% on average even if the Energy Star score is the same. When you pay for what you consume, you become more frugal.)
 - Maintain building comfort at lower cost
 - Reduced energy emissions (carbon reduction)
 - Aligning behavioral change with incentives, due to data
 - Peak demand reduction
 - Identify system scheduling or operator errors
 - Submetering data provides a basis for ranking cost effectiveness of retrofit projects
- Cost of implementation
 - Vornado Realty Trust, 2009, New York, sub metered tenant with 400,000 ft.², tenant identified savings opportunity via hourly consumption profiles, 18% reduction from baseline, 8% reduction in demand, saving \$160,000 (Energy Information Portal for tenants) - *Tenant sub metering example*
 - Adobe Systems, 2006, three high-rise buildings, 1,000,000 ft.², meter cost: \$20,000, spent \$1.1 million on energy projects, \$350,000 in rebates, saved \$1 million per year in costs - *Building submetering example*
 - Bank of America, San Francisco, 2008, 120 sub meters installed, \$1 million of savings in first year of use, payback for submetering in days - *Building submetering example*

– Lease Implications

- Owners responsible for submetering, savings primarily benefit tenants
- Net versus Gross Leases (Net encourages conservation, Gross does not)
- Potential to buy at wholesale and resell energy/bill tenants with reasonable rate of return
- Resale allowed NY, NJ, CA, UK, Australia
- Complex rules for distributing energy use cost to tenants
- Local regulation may or may not prevent submetering - billing
- Building owners may be able to negotiate better utility rates – benefits to tenants, this can include reduced demand charges (New York ConEd)
- Submetering that leads to conservation has the potential to reduce expensive infrastructure capacity extensions, such as electrical risers
- Not all tenants will benefit equally, tenants with higher use will face higher utility bills
- Utilities often prefer fewer master meters and will provide incentives via lower rates to accomplish this, in commercial building

– Meter Types

- Feed-through meter (utility), Current-transformer meter, Electronic Non-socket meter (clamp-on CT)



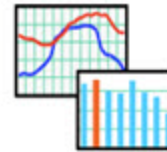
– Communication enabled meters

- Utility or sub metering device that uses hardwired, wireless or optical port to transfer detailed energy use data



- Most utilities are equipping commercial buildings with this type of meter, along with web-based data presentment software

- Web based data logging (panel or circuit aggregated to tenant)
 - Internet accessible meter data, both real-time and historic, including data presentment tools for analysis graphics or representation of energy use



Graphical Visualization

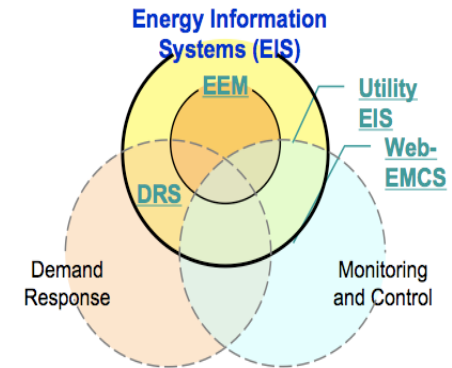
- Cloud - online Building Energy Management System data (New Buildings with sophisticated controls)
 - Energy and system data from building energy management systems accessible via distributed cloud systems such as Amazon, rather than from service providers own servers
 - Dashboards emphasizes graphical presentation of data to support quick decision making

- Other meters: (sub circuit – miscellaneous electric loads - MELs)
 - manual acquisition, freestanding data logger with USB or other cable connection, download direct to PC



- Analysis and Data Storage
 - Energy Information Systems (EIS) , a broad class of analysis tools that range from spreadsheets, report generation, graphical presentation and trend identification
 - EIS information can be for presentation to building energy managers, facility managers, electric utilities or financial managers
 - EIS requires equipment and technical staff to communicate results of submetering, another alternative is to purchase EIS services for a fee from third-party vendors that provide expertise in diagnosing energy issues
 - Data storage considerations: structured query language (SQL) compliant system, trend data archived daily or less, database file format should allow EIS use, all data is time stamped and password protection
 - The ability to identifying abnormal energy consumption which would not be recognizable in normal utility usage data enhances building performance by avoiding unplanned maintenance outages

- EIS provide
 - Web-accessible hourly whole-building electric data
 - Graphical/visualization capabilities
 - Automated building energy analyses
- EIS are NOT
 - Most Energy Management and Control Systems (EMCS)
 - Equipment fault detection and diagnostic (FDD)
 - Energy information dashboards
 - Greenhouse gas (GHG) footprint calculators
- Vendors
 - Pulse Energy, Northwrite, McKinstry EEM Suite, Serious Energy, Energent, EFT Energy Manager, Automated Energy, Energy ICT, Noveda, Schneider ION EEM, Interval Data Systems Energy Witness, DGLogik, FactoryIQ, Johnson Sustainability



Slide content from: Jessica Granderson, LBNL

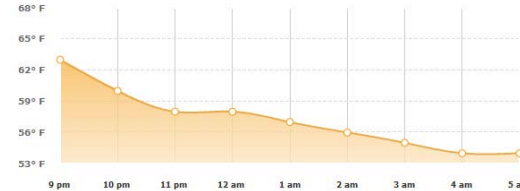
- Implementation Planning outline:
 - Feasibility Study
 - Design submetering plan
 - Install submeters
 - Gather and Track Data
 - Normalize Data
 - Establish Baselines
 - Benchmark
 - Analyze Data
 - Conduct Technical Assessments and Audits

- Tenant space (without net lease tenants lack motivation to reduce energy use)
 - Single tenant circuits
 - In commercial or residential situations simplifies submetering
 - Requires circuits be identified at the panel for each tenant (often not the case), identifying circuits adds cost to submetering implementation
 - Multi-tenant circuits
 - Without dedicated circuits per tenant submetering must depend on allocating load percentages
- By common space circuits
 - Common area lighting, Elevators, HVAC, parking lot lighting, telecommunications equipment

Tenant Submetering Strategies - Design Considerations

– Normalization Factors

- Degree days – heating and cooling



- Occupancy hours – schedule



– Optimal Resolution Recommendations - How far down do you need to go? HVAC, Lighting , Plug Load

- Options are: major systems – HVAC, Lighting, etc
- Panel or circuit level to aggregate to a particular tenant
- Sub circuit for miscellaneous loads (gets messy)

– Safety

- Installation of submetering of equipment electrical circuits should be done by qualified electricians
- If a panel or circuit is not grounded, it is not dead, but you could be

– Security & Communications Issues

- Communications standards: what pathways in place already and can they be used?
- Encryption of data from meter to database: How important is data security to you as tenant?
- You must answer – How important is data access/security? Access level, energy manager, all staff

- Organizations
 - Building Owner Managers Association - BOMA
 - U.S. Green Building Council certifies: Leadership in Energy and Environmental Design – LEED
 - Continental Automated Building Association – CABA
- Best Practice guidelines, tools, templates
 - See links slides, **Bold most important, look at these first**

Ask Questions!

– Business Case

- Cost
 - **Vornado** <http://www.baruch.cuny.edu/realestate/pdf/Unprecedented-Visibility-Vornado-White-Paper.pdf>
 - Cisco http://www.energystar.gov/ia/business/networking/presentations/Aug06_Submetering.pdf
- Residential Savings
 - NYC - Jefferson Towers <http://submeteronline.com/pdf/JeffersonTowersCaseStudy.pdf>
 - NYC - <http://www.submeteronline.com/pdf/CadmanPlazaCaseStudy.pdf>
 - Toronto - [http://amcobi.com/images/stories/Options to Reduce Energy Consumption by Encouraging Sub-Metering and Individual Billing in Multi-Residential Rental Dwellings Govt Ontario.pdf](http://amcobi.com/images/stories/Options_to_Reduce_Energy_Consumption_by_Encouraging_Sub-Metering_and_Individual_Billing_in_Multi-Residential_Rental_Dwellings_Govt_Ontario.pdf)
 - Toronto EnerCare - <http://www.enercare.ca/case-studies>
 - Water sub metering study - http://www.awwa.org/waterwiser/references/pdfs/RES_METER_Mayer_P_Submetering_Billing_Programs_in_Multi.pdf
 - NYSERDA Residential Sub Meter Program Link: <http://www.getenergysmart.org/MultiFamilyHomes/ExistingBuilding/BuildingOwner/ERMM.aspx>
- Lease Implications
 - <http://www.dteenergy.com/pdfs/rider4.pdf> Detroit Edison
 - <http://www.consumersenergy.com/WebApps/stancustforms.nsf/%28FormsByID%29/Form%200408~?OpenDocument> Consumers Energy
 - http://www.ofgem.gov.uk/Media/PressRel/Archive/1359-r0503_13jan.pdf UK regulator Ofgem
 - http://www.state.nj.us/emp/home/docs/pdf/080708_NWPServices_WillieB.pdf New Jersey
 - <http://documents.dps.state.ny.us/public/Common/ViewDoc.aspx?DocRefId={52CAD715-2A99-4FC5-8864-4B93D0D6DE40}> New York
 - http://docs.cpuc.ca.gov/published/Final_decision/72471-05.htm California

– How to

- **Federal Energy Management Program, “Guidance for Electric Metering in Federal Buildings,”** February 3, 2006, http://www1.eere.energy.gov/femp/pdfs/adv_metering.pdf
- **Metering best practices, A Guide to Achieving Utility Resource Efficiency,** http://eere.pnnl.gov/building-technologies/pdf/mbpg_guide_08.pdf
- **GUIDE TO THE IMPLEMENTATION OF TENANT SUBMETERING AND BILLING FOR COMMERCIAL BUILDINGS IN NORTHERN CALIFORNIA, BOMA** http://www.bomacal.org/documents/BOMA%20Submetering%20Guide%20-%20Northern%20California04_07_08.pdf
- **Do Green Buildings Make Dollars and Sense?** <http://www.imt.org/files/FileUpload/files/Benchmark/DoGreenBuildingsMakeDollarsSense2.pdf>
- **Energy Efficiency and Property Value** <http://www.imt.org/rating-value.html>
- **M&V Guidelines: Measurement and Verification for Federal Energy Projects Version 3.0,** http://www1.eere.energy.gov/femp/pdfs/mv_guidelines.pdf
- **Leasing & Energy** http://www.betterbricks.com/graphics/assets/documents/BB_WinTactics_LeaseTypes_final.pdf
- **EPA M&V Checklist** http://www.betterbricks.com/graphics/assets/documents/BB_WinTactics_LeaseTypes_final.pdf
- **Monitoring-Based Commissioning** http://www.peci.org/ncbc/2008/docs/Proceedings08/Brown_ppt.pdf
- **Submetering – A Practical Approach”,** GE ESL Magazine, Summer 2005, http://www.geindustrial.com/Newsletter/fall05_submetering.pdf
- **Lawrence Berkeley National Laboratory, “Building Energy Information Systems and Performance Monitoring (EISPM),** <http://eis.lbl.gov/>
- **Building Benchmarking** <http://energyiq.lbl.gov/>
- **New York Legal Journal, residential issues -** <http://www.harrisbeach.com/files/2010/NYLJFlynnMcManusSubmetering3.15.10.pdf>
- **Residential Submetering Saves Energy,** <http://www.prnewswire.com/news-releases/cammebys-internationals-five-residential-developments-in-the-boroughs-of-new-york-city-prove-that-submetering-saves-energy-96987669.html>

Meters Types (Electric, Water, Gas links)

– Electric

- Communications Enabled
 - **Shark wireless tenant metering** <http://www.electroind.com/shark100s.html>
 - Veris <http://www.veris.com/>
 - Obvius <http://www.obvius.com/>
- Web based data logging
 - Smart Works <http://www.smart-watt.com/>
 - Schneider <http://static.schneider-electric.us/docs/Electrical%20Distribution/Integrated%20Equipment/Integrated%20Power%20Center-IPC/2220BR0901.pdf>
 - **E-Mon, D-Mon** <http://www.emon.com/commercial.html>
 - Obvius <http://www.obvius.com/>
- Cloud – online
 - Echelon and Serious Materials http://www.echelon.com/company/press/2011/serious_materials.htm
 - Scientific Conservation <http://scientificconservation.com/>
 - Cimetrics <http://www.cimetrics.com/>
- Manual
 - Watts-Up <https://www.wattsupmeters.com/secure/products.php?pn=0&wai=72&more=2>
 - Hobo <http://www.onsetcomp.com/>
 - Dent <http://www.dentinstruments.com/>

– Water

- AquaCue <http://www.aquacue.com/Aquacue/Home.html>
- Various http://www.guardianwp.com/pages/services/water_submetering.aspx

– Gas

- Various <http://esubmeter.com/>

– Integration of All

- EKA systems http://www.ekasystems.com/pdf_documents/The_Benefits_of_Smart_Network_AMI_Solutions.pdf