PROPOS

Proposal for District-Wide Energy Management Information System to Benchmark Usage and Track Savings for Prop39 Projects

March 18, 2014

Chico Unified School District

lucid ™

Makers of

buildingOS_

buildingdashboard

Julie Kistle
Director of Facilities and Construction
Chico Unified School District

Dear Julie,

Lucid is pleased to submit this proposal to monitor energy consumption at all Chico Unified schools, providing an initial benchmark for usage, measuring and verifying savings from Prop39 projects on an ongoing basis, and providing a platform for occupant engagement and behavioral energy efficiency. Lucid has a market-proven energy management dashboard solution currently used by over 350 customers who track resource use data in over 5,000 buildings.

We believe that Lucid, with its decade of experience and pioneering work in real time resource monitoring and occupant engagement in educational buildings, will be the best solution for the goals you have set forth in your Prop39 planning activities. Highlights of Lucid's offering include:

⊙ **Proven data integration** — Proven integration with different metering and utility systems.
⊙ **User interface** — Visually compelling and award-winning design.
⊙ **Deep experience** — Extensive experience successfully implementing BuildingOS and Building Dashboard for thousands of buildings across hundreds of customers.
⊙ **Market leadership** — Lucid pioneered the concept of dashboards with realtime feedback for occupants in educational buildings, and has been pushing the envelop ever since.
⊙ **Product Engagement Team** — Our product engagement team is dedicated to providing resources and advice to you as you implement engagement programs using Lucid's systems.
⊙ **Scalable solution** — We can easily scale BuildingOS to incorporate additional sub-metering and resources, as the districts resource conservation goals mature.

Please do not hesitate to contact us with any questions. We appreciate this opportunity and look forward to your response.

Sincerely,

Vladi Shunturov
CEO

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1. Company Profile

Founded 10 years ago, Lucid is an energy management software company that specializes in eliminating the main barriers that make implementing energy efficiency measures in educational buildings so difficult: the high cost of information and the lack of accessible software tools.

BuildingOS, the first operating system for buildings, delivers connectivity to all metering vendors' technologies quickly and at lower cost. Once your metering and building systems data are centralized in a single repository, your entire team can begin to manage and reduce energy costs using powerful, intuitive online tools that are fun to use.

While the majority of software technology in buildings today has been designed only for engineers, performance depends on the decisions and behaviors of many. Lucid pioneered behavior-based energy reduction competitions, which enable occupants to affect the nearly 50% of electricity consumption that is not controlled by an automated system.

Lucid's software is used by the world's leading companies and institutions to manage thousands of buildings with $500 million in annual energy bills. The team today consists of 30+ engineers, artists, business development, and project management professionals.

The company began at Oberlin College in the Lewis Center for Environmental Studies, the first modern green building on a college campus. Lucid has been recognized by U.S. EPA, Cleantech Open, and the State Assembly of California for being a game changer in the energy industry.

The company has been growing at 50% each year for the past three years and has over 350 customers, including Google, Sony Pictures Entertainment, Fidelity Investments, Yahoo!, DuPont, and other Fortune 500 companies; city and state governments like Washington, D.C; eight out of the eight Ivy League universities; and 150+ college campuses in the U.S. and Canada. BuildingOS monitors over 5,000 buildings, 3,000 of which are monitored in real time with high-resolution interval meter data. Our software reaches hundreds of thousand of occupants, covering over 500M+ square feet of floor space, and processes 25,000 real-time interval meters that report data to our infrastructure every 5 minutes.

Based in Oakland, California, Lucid is a privately held company.

2. BuildingOS

2.1. Overview

BuildingOS is the first truly interoperable, vendor-agnostic, cloud-based energy information management platform on the market, designed to be accessible and valuable for engineers and non-engineers alike. BuildingOS is made specifically for critical stakeholders in energy efficiency and behavior change program management: energy managers, sustainability directors and program managers, outreach coordinators, facility managers and engineers, and other decision-makers and contributors.

2.2. Building Dashboard and Occupant Engagement

Lucid's Building Dashboard is the leading software for occupant engagement and building performance visualization. Building Dashboard is designed specifically to engage, educate, motivate, and empower building occupants -- including employees, staff, faculty, visitors, and members of the community -- to conserve resources. Deployed in over 5,000 institutional and commercial buildings, the product has a proven track record of success and delivery.

The award-winning Building Dashboard user interface has been shown to be a highly effective tool because it closes the gap between technical and non-technical audiences and enables a channel of communication which other systems have failed to provide. We firmly believe that for a technology to be effective it has to be accessible. This mantra drives all product development and design decisions and has helped shape Lucid as the pioneer and leader in the field.

2.3. Dashboards and Public Reporting

Building Dashboard Kiosk is designed specifically to engage, educate, motivate and empower building occupants to conserve resources: employees, students, customers, residents, and visitors. The Dashboard's highly intuitive applications reach out to easily inform the non-technical end user interacting with a energy data. This platform also excels at communicating other public information such as transportation schedules, events, announcements, navigation, sustainability initiatives, building green/LEED features, videos, slides, and many other tools designed to tell a client's story.
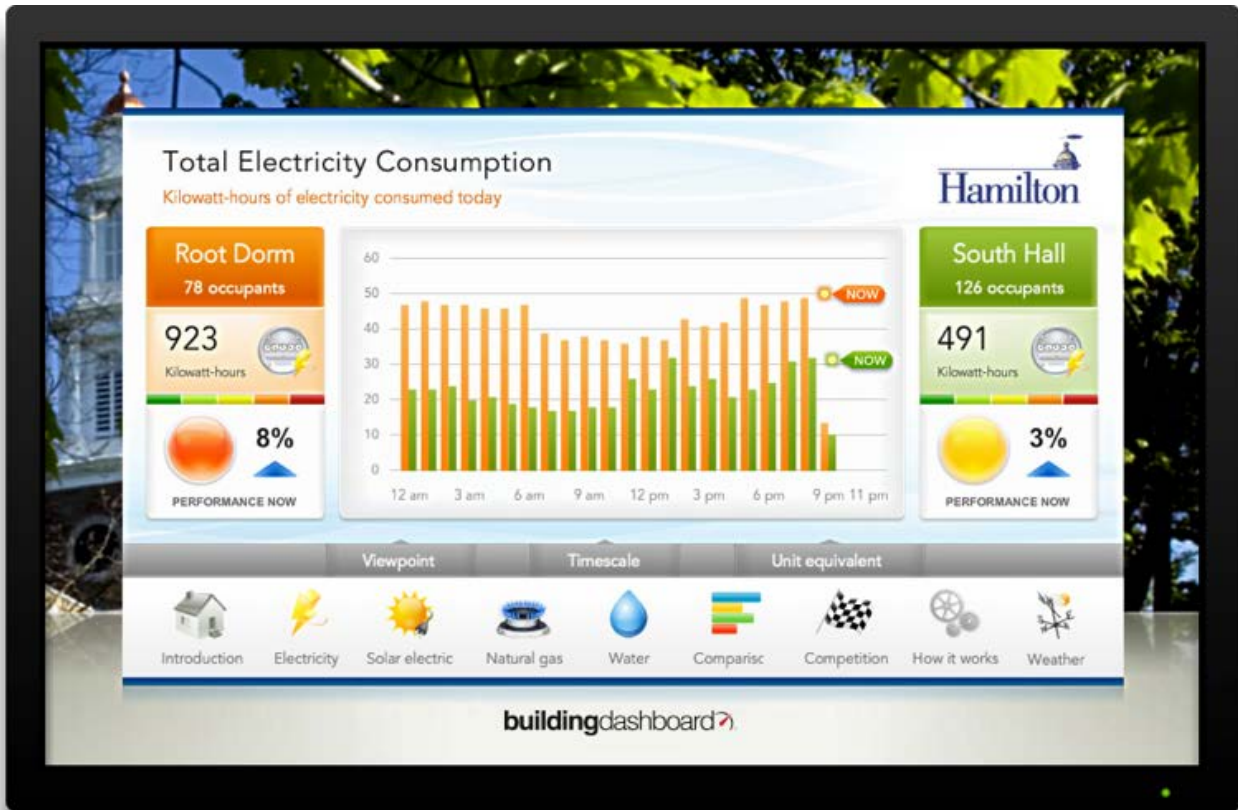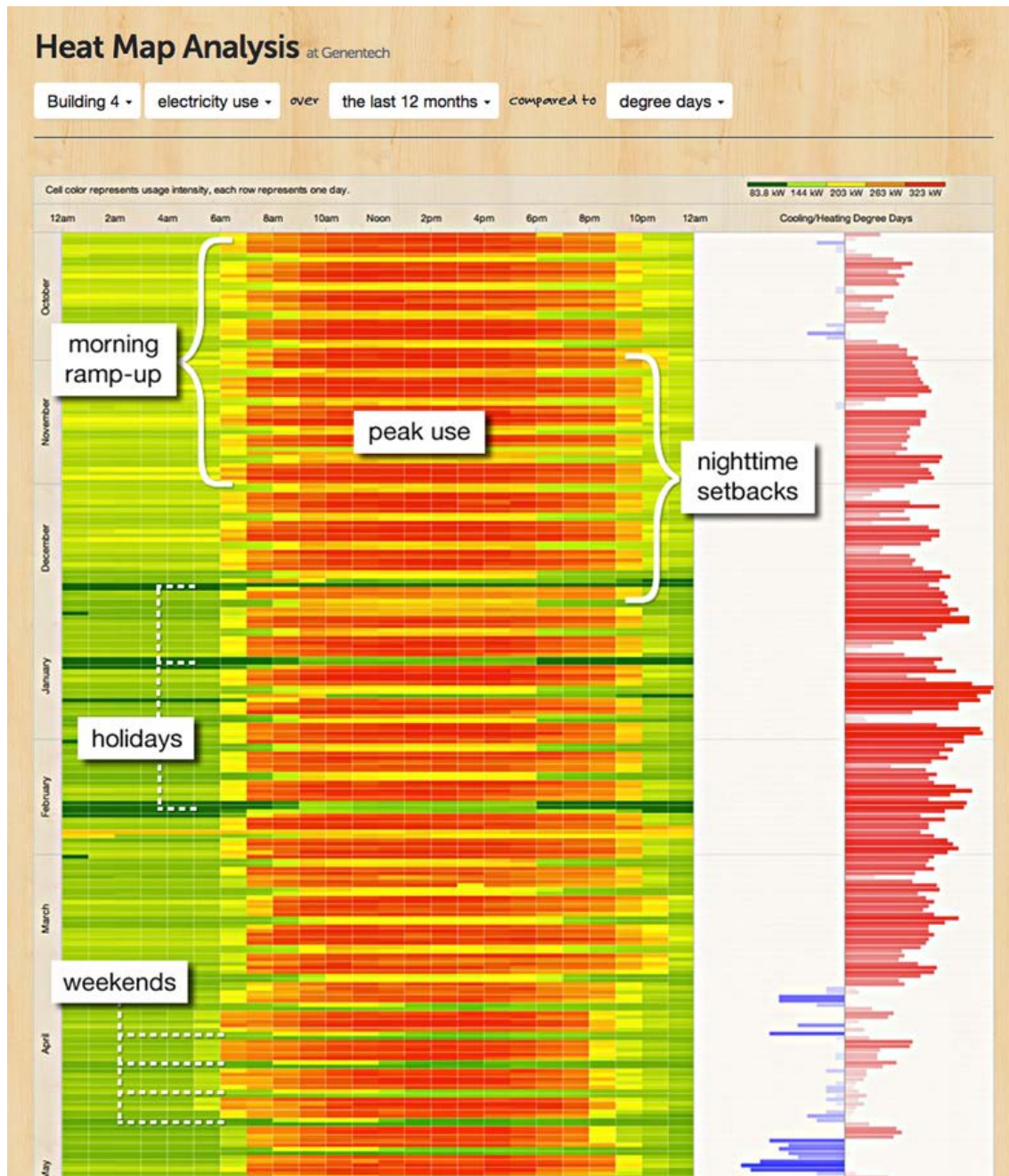
2.4. Analytics: Heat map Analysis

Using Lucid's Heat map Analysis, building managers can view energy consumption at a high level, revealing usage patterns, weather sensitivity, and opportunities for scheduling and controls refinements. With the 24 hours of the day on the horizontal axis and the days of the year on the vertical axis, the Heat map plots an entire year of hourly data — 8,760 data points — in one snapshot.

The ideal scheduling and controls settings are dependent on the occupancy and usage patterns of the building, of course, and buildings that are properly controlled for occupancy schedules and seasonal variability can achieve significant cost savings.

In a building with refined scheduling, the Heat map will reveal dependable and predictable patterns of consumption. Resource use will typically be highest at midday when the building is fully occupied and the impact of weather conditions is most pronounced, while off-hours should see reductions in consumption. Strong vertical lines show night setbacks where building systems slow during the evening and nighttime hours when the building isn't occupied. Weekly horizontal bars reveal weekend setbacks with building systems maintaining nighttime set points through the unoccupied weekend. Vacations surface as larger horizontal bars.

Lucid's Heat map Analysis provides a fantastic picture of overall building scheduling and weather sensitivity. Shape and color differences illuminate the underlying control settings at a high level, making an entire year's high-resolution data visible and understandable at a glance. A facility properly controlled for occupancy patterns and weather can achieve significant savings at a minimal cost. The Heat map helps find opportunities for low-touch, low-cost measures that should be taken before more aggressive action is explored. Before targeting facilities in your portfolio for audits and upgrades make sure you've explored opportunities for simple scheduling and controls changes that could save a lot with little financial investment.

2.5. Analytics: Drift Analysis

Portfolio Drift Analysis helps you look at all of your facilities at a glance and detect the drift (% change) of key building performance indicators such as average demand, peak load, base load, EUI. It also helps to identify problems and best-value opportunities for improvement in your portfolio. Managers of large, diverse building portfolios have to overcome a lot of challenges. How do you locate facilities that are drifting from baseline performance and should be investigated further for possible problems, changes in usage patterns, or opportunities for improvement, especially when the age, size, and equipment of the buildings vary widely? Where can you see the greatest return on investment while making progress toward your energy reduction goals?

Lucid's Portfolio Drift Analysis helps answer these questions by highlighting facilities that have deviated from their historic consumption patterns and emphasizing those with the largest impact on your portfolio. Facilities that are most important to focus on in greater detail will be immediately clear: size represents the contribution to portfolio performance and color represents the change in performance.
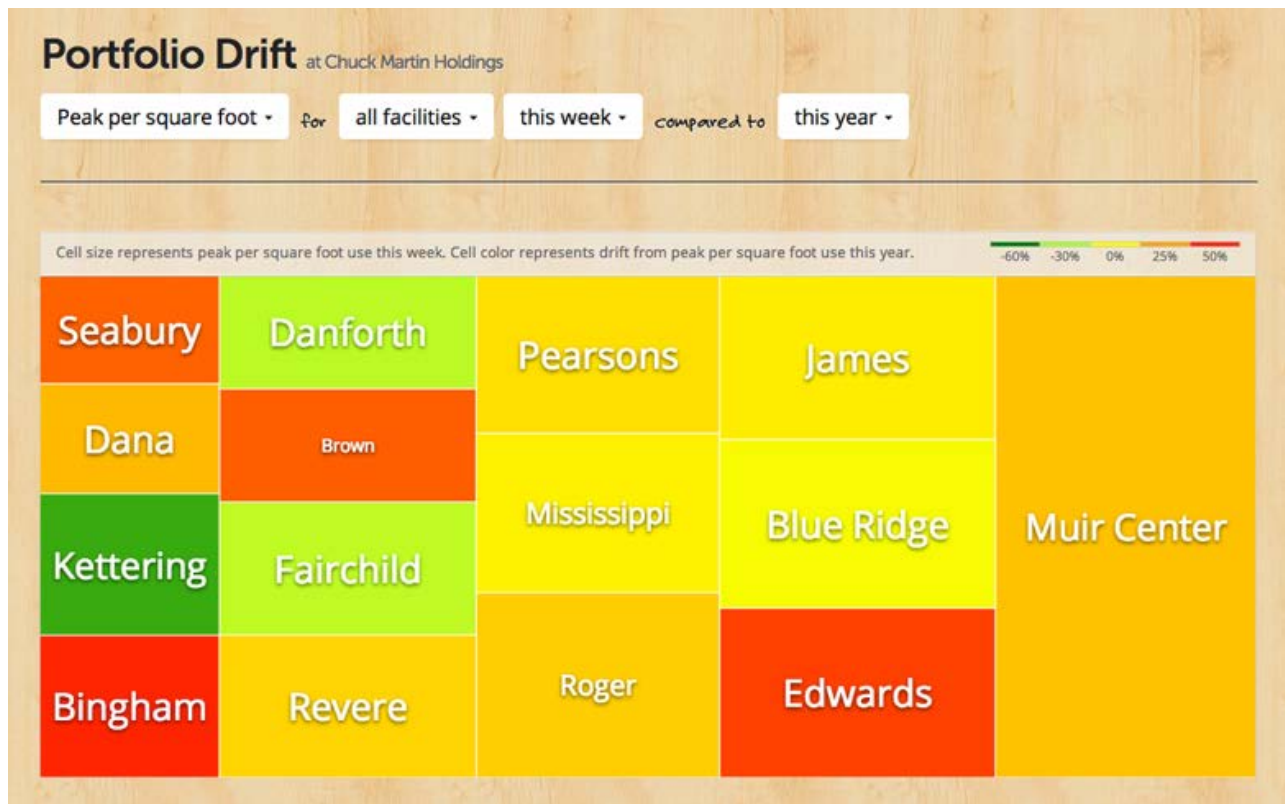

Changes in consumption patterns can happen for predictable and expected reasons. For example, if your portfolio of buildings included educational facilities, you might expect an increase in consumption as the school year begins after the summer break and your portfolio's rate of use would likely drift upward in comparison to recent history. The change in all of the facilities in tandem suggests that something on a broader scale has changed for

the portfolio like seasonality of weather or occupancy. Individual facilities that show a noticeable deviation from historic use may warrant further investigation.

If the portfolio as a whole shows a consistently positive or neutral change in consumption, but a single building stands out in the pack. This should raise a red flag and lead to a more detailed examination of consumption patterns, changes in occupancy schedules, or possible equipment or building automation failure.
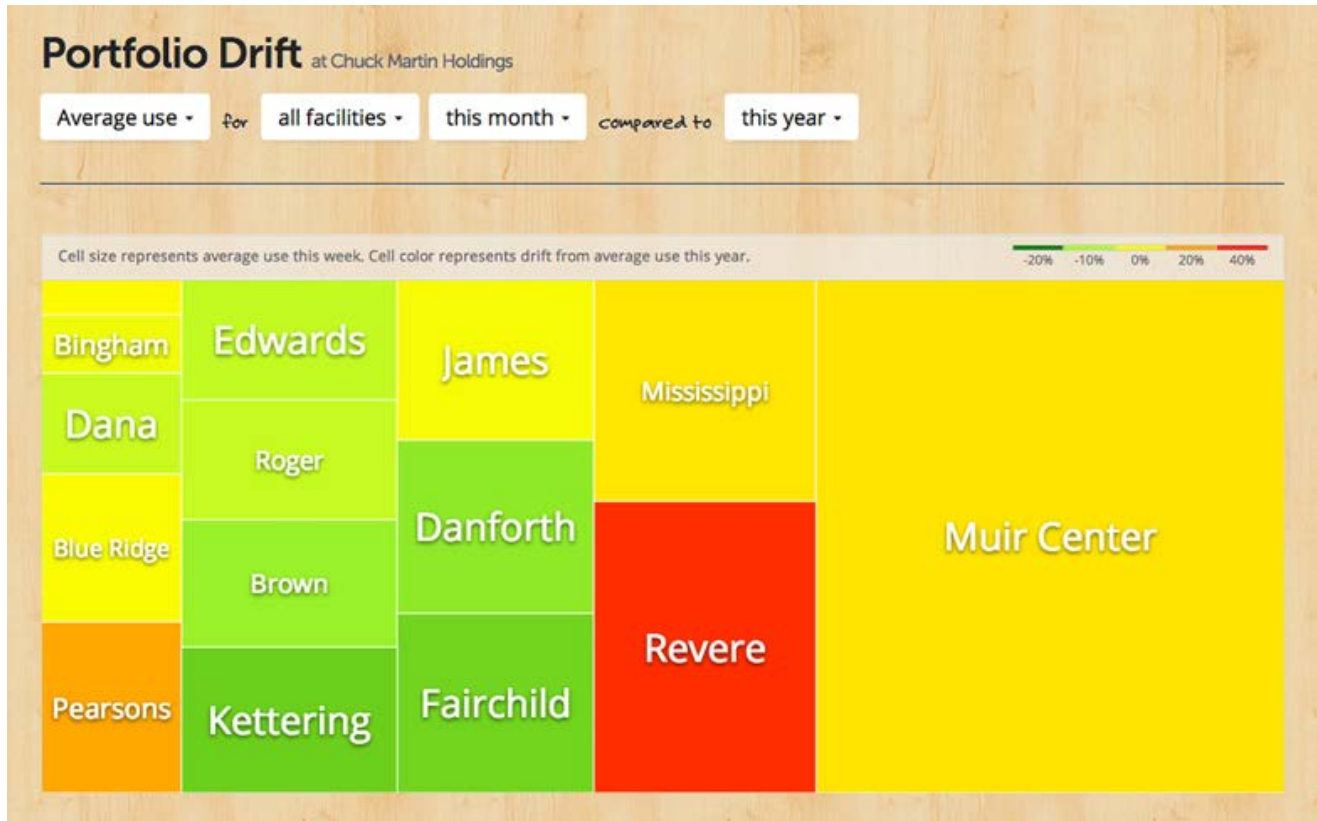

While potential problems are called out clearly in the Portfolio Drift Analysis, so are indicators of positive change. What is being done differently in this facilities that reduced their consumption. Is the change due to weather or occupancy patterns, or has there been a change in equipment or controls configuration that might be replicable in other facilities?

Lucid's Portfolio Drift Analysis provides an intuitive and valuable high-level view of changes in the performance of your portfolio. Facilities that require attention will surface in a visually compelling way while the importance of each facility in the overall performance of your portfolio is clearly displayed. By placing the performance of each facility in the context of the portfolio as a whole, the Portfolio Drift Analysis will provide guidance on those facilities to focus attention on first, assuring that time and resources are allocated as efficiently as possible.

2.6. Analytics: Comparisons

Comparisons allows energy managers to look at all of their facilities on a single graph. Buildings or building groups are visualized in easy-to-read bar charts. Bar charts support visualization for total consumption (kWh), demand (kW), sorting per person or square foot, cost, and emissions. Using the drop-down menus, users can specify the building type for the comparison (e.g., elementary, middle, high school, etc.), utility type (electricity, water, gas), and a time period for the comparison.
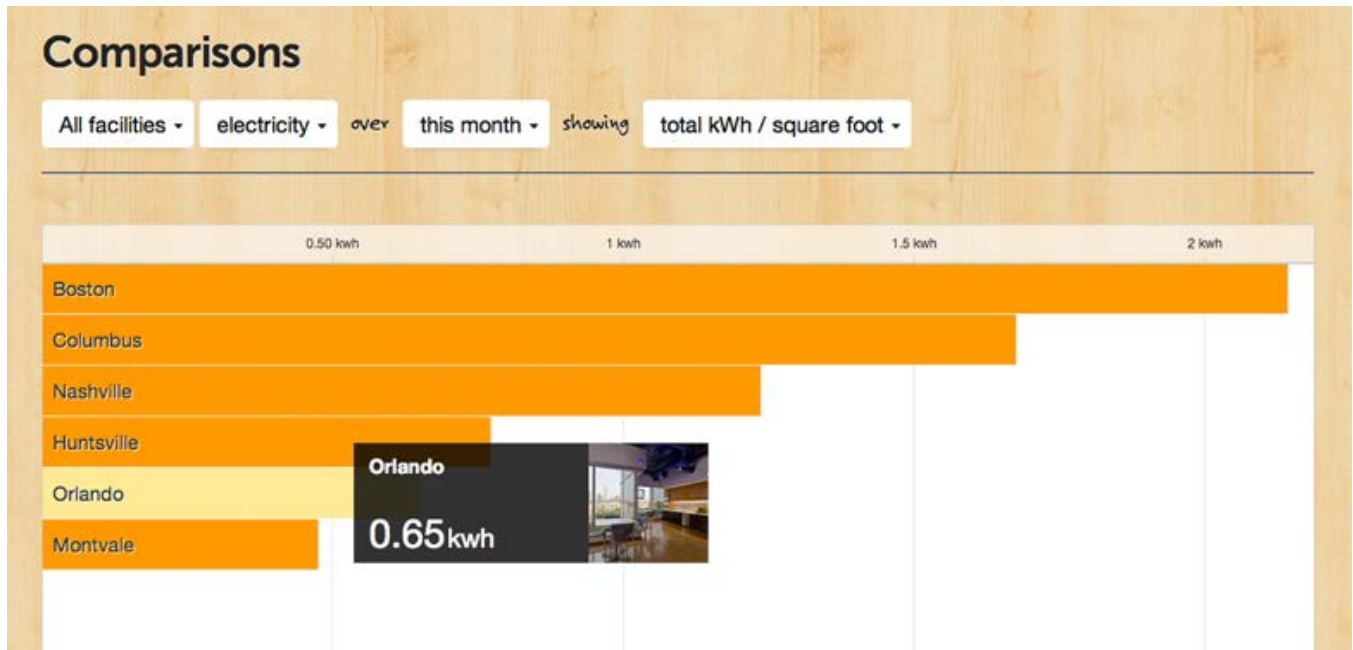

2.7. Analytics: Bill Analysis

The Bill Analysis feature in BuildingOS offers an option for bill reconciliation, which allows the user to compare billed versus measured consumption on both a calendarized basis and on a billing period. Calendarization of bill data happens on the fly automatically. Two data sets are stored and maintained: the bill records as well as the calendarized consumption data. Use BuildingOS for bill verification to compare usage numbers between meter readings and utility data to detect errors or overcharges. Manual bill entry is supported. Bill entry allows the user to enter consumption, peak demand, and total cost.

Bill Analysis

Atlanta Office ▾ · **electricity ▾** · **consumption ▾** · *showing* · **billed vs. measured ▾**
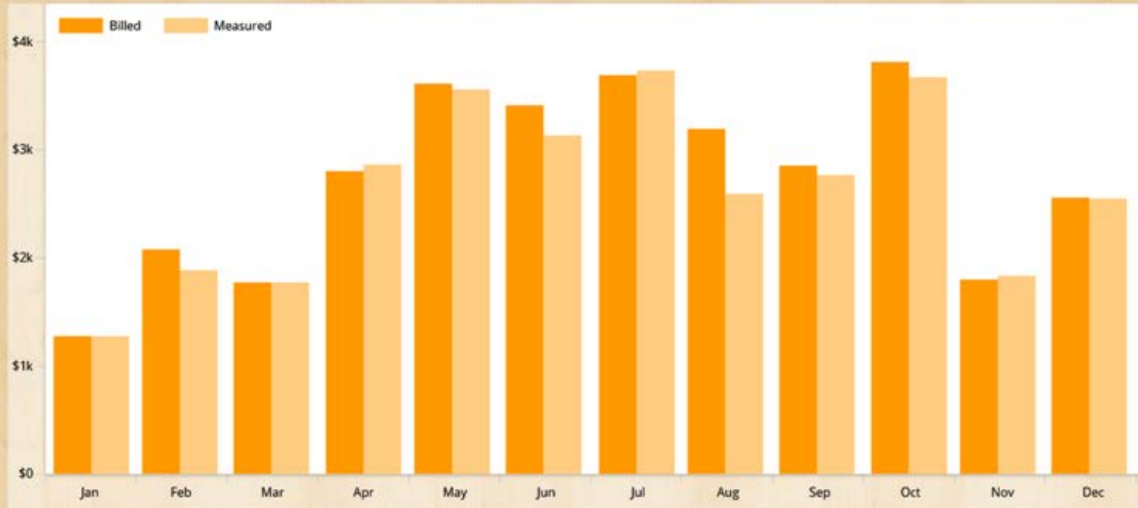
Month	Billed	Measured	% difference
📅 January	⚡ 34,450 kWh	⚡ 33,150 kWh	2.1%
📅 February	⚡ 46,019 kWh	⚡ 46,120 kWh	0.3%
📅 March	⚡ 57,925 kWh	⚡ 57,325 kWh	0.5%
📅 April	⚡ 77,990 kWh	⚡ 78,560 kWh	1.1%

2.8. Advanced Analytics: Measurement and Verification

Overview

Measurement and Verification, also known as M&V, is a meter data analysis methodology which is used to quantify the energy or water use savings associated with efficiency retrofits.

1 Collect baseline interval consumption to construct a baseline model

2 Evaluate efficiency opportunities

3 Implement equipment efficiency retrofits

4 Collect ongoing interval consumption data

5 Use weather-normalized regression models to quantify cumulative kWh savings post-retrofit and demonstrate measured ROI from the implemented measures
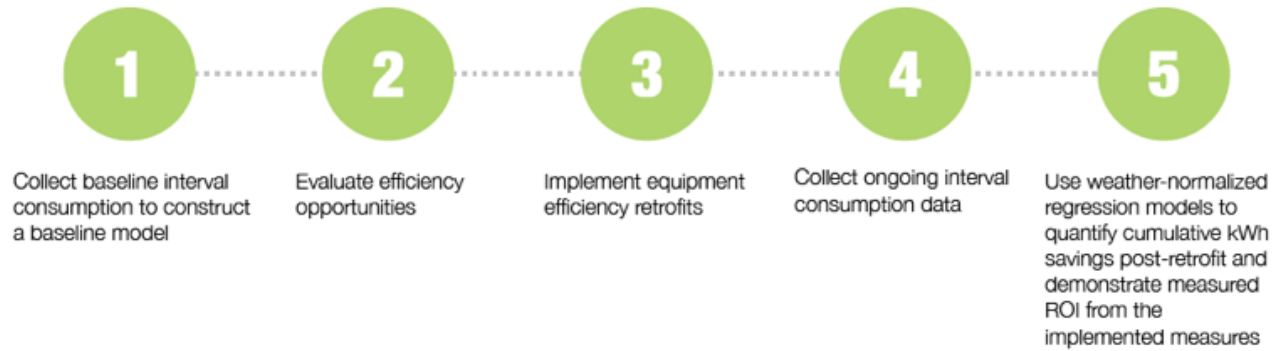
Interval Consumption Data

The real-time meter trending capabilities of BuildingOS enable collection of interval consumption data from over 150 different sub-metering, BMS, and utility data streams into a central repository. All of the data is normalized and neatly organized into 1-min, 5-min, 15-min, hourly, daily, and monthly roll-ups for easy and instant reporting. Having historical data going back at least 6 months before the retrofit is very important for generating an accurate baseline model of your facility. Lucid can work with you to import interval data archives from other systems into BuildingOS so you can gather a comprehensive history of usage trends for your facilities. We support CSV flat files as well as the Green Button XML format for utility interval data.
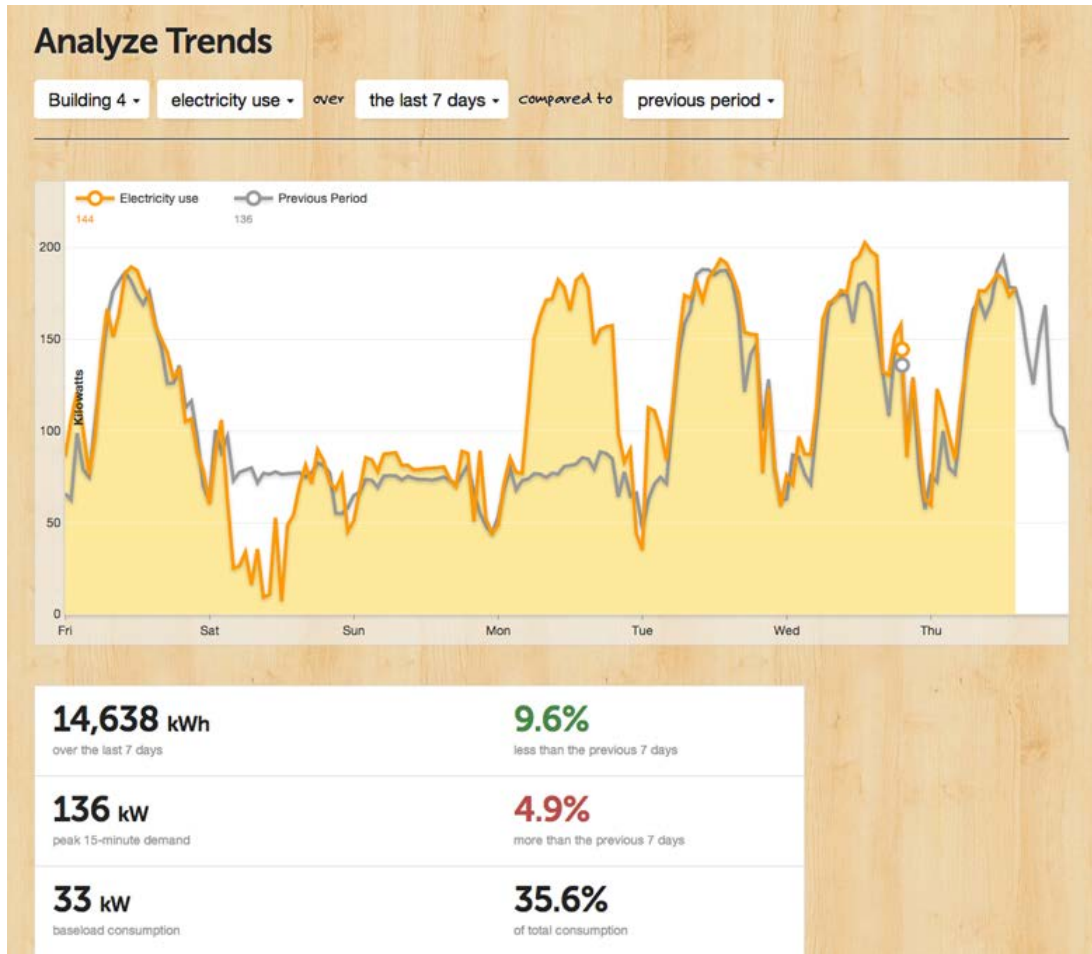
Weather Data

Changes in weather (outdoor temperature and humidity) can have a big impact on a building's electricity and total energy use. Normalizing for changes in weather is important because your baseline evaluation period may include summertime data while your evaluation period may take into account winter performance. BuildingOS automatically gathers 5 years of historical weather data for any facility you create and will automatically collect and store hourly trended data thereafter. BuildingOS uses Weather Underground as the source of weather data and collects data from the weather stations closest to your facility.

Time-of-Day and Day-of-Week

The regression model analysis also normalizes for time of day and day of week variations.

International Performance Monitoring and Verification Protocol, Schedule C
Building OS uses IPMVP Schedule C regression model analysis for measurement and verification of savings.

Efficiency Project Savings Tracking

An easy-to-use M&V app allows you to:
- Define an energy efficiency project

- Select the facilities which are involved
- Select the utility meters which should be used for the M&V calculations
- Select the baseline (seed) and evaluation periods
- Outline the specific measures and efficiency improvements which were part of the project

The application will then track and report on energy and dollar savings (based on a blended rate). Data exports of the savings calculations are also supported.

2.9. Advanced Analytics: Peak Demand Management and Forecasting

Overview
Peak demand charges can make up a rather significant part of your total energy spend and is one of the most effective levers which you have towards managing costs. The predictive forecasting capabilities of BuildingOS along with automated email alerts give you the forecastability necessary to avoid high peak demand charges.

Automated Bill Delivery
Automated bill delivery extracts the peak demand charges from your bill and allows you to see just how much you are being charged, giving you the ability to verify the billed peak demand against your interval data measurements.

Predictive Forecasting
Using regression model analysis and the daily weather forecast information which we have access through our integration with Weather Underground, BuildingOS can predict what your peak demand for the day is expected to be, given the weather forecast and historical performance of your facility under similar conditions.

Automated Peak Demand Alerts
Peak demand alerts can be configured for each facility and they will notify you whenever you are at risk of hitting or exceeding threshold peak demand values.

44.2 kW
peak 15-minute demand

1.7%
less than the previous week

Peak Demand Analysis
Intuitive tools in BuildingOS allow you to track how your peak demand changes over time and which days of the month and year contribute towards your peak demand charges.
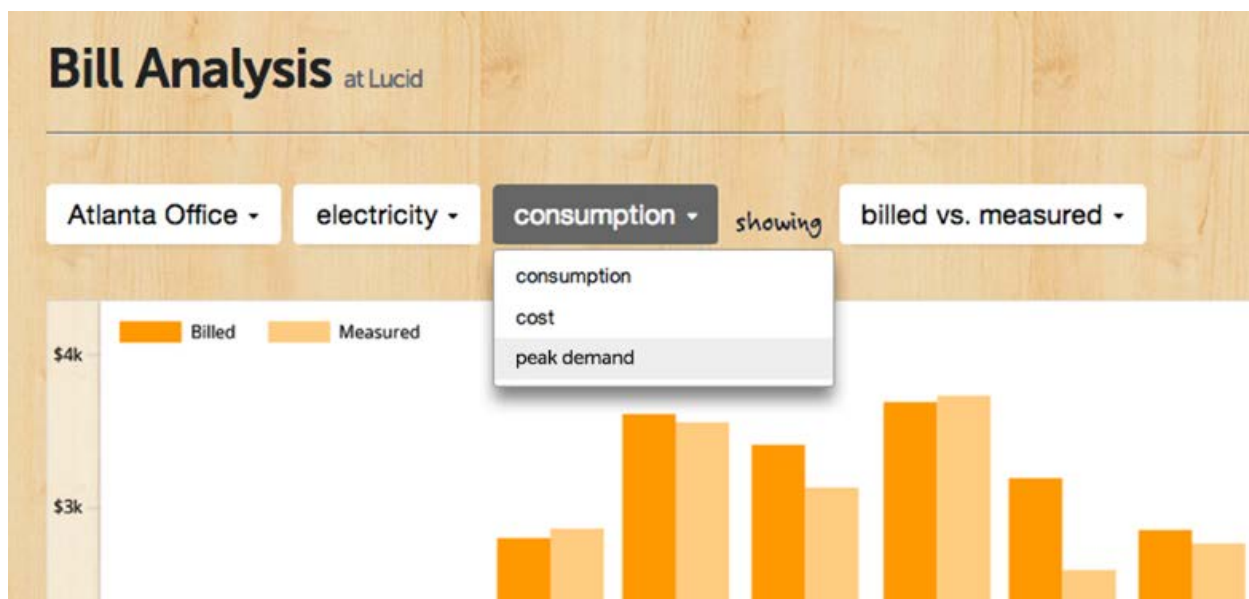
2.10. Meter Alerts

Email alerts and notifications give you instant feedback when real-time metered points go outside of established parameters. Budgeting in BuildingOS is supported through meter alerts, allowing the user to define a $ threshold for any month of the year which would notify the user when this usage has been reached. BuildingOS can report on:

- Demand exceeding a fixed value
- Demand exceeding predicted baseline by a %
- Daily use exceeding a fixed value
- Time of day, day of week, and month of year filters

2.11. Interoperability

BuildingOS and Building Dashboard are the most interconnected platforms in the energy data management software industry: we support 150+ integrations for tight data integrations with best-in-class building automation systems and energy data repositories (Siemens, Johnson Controls, Honeywell, Automated Logic), sub-meters, on-site generation systems (inverters for solar photovoltaic), lighting controls systems, utility smart meters, utility bill data, and demand response provider data. Customers can leverage our team of integration engineers to integrate these systems with BuildingOS and Building Dashboard as desired in order to inexpensively find energy and water savings opportunities.

2.12. Meter Data Management

Facility & Meter Management

BuildingOS users can edit building profile information and view connected meters. BuildingOS enables users to self-manage the creation of most meters, including calculated meters, from scratch. Users can view the details and statuses of all meters. Users can also create an unlimited number of "manual entry" meters to easily track data for non-realtime resources such as trash, recycling, compost, and California State Energy Code allowable consumption levels. Notifications and alerts are built into the system to pinpoint and monitor usage anomalies and offline data sources.

Data Management
The tools found here give users complete control over their own data. All interval data collected is stored for 15-min, hourly, daily, weekly, monthly, and yearly intervals. Data Downloader provides program managers, building operators, researchers, and students with an easy way to download CSV data sets of all resource use information collected and displayed by Building Dashboard. Uploading data for manual meters (such as trash, recycling, compost, etc.) is also simple.

Calculated meters
Your admin users can create calculated meters to easily display values such as total consumption or average consumption for groups of buildings, or to group sub-meters for a facility. These calculated meters can then be displayed and manipulated in BuildingOS and Building Dashboard in all the same ways as standard meters.

CSV Data Exports
The built-in Data Downloader app allows you to quickly and easily select a set of metering points, a date range and a desired data resolution and request a CSV export. BuildingOS will email you as soon as your export is ready for you to download.

2.13. Meter Uptime Notifications

Notification emails keep you abreast of the uptime status of your meters. Minimizing instances of missing and erroneous meter data is a goal of all energy management and sustainability professionals. And rightly so; high quality data is critical to enabling organizations to accurately identify the drivers of your portfolio's resource consumption, identify opportunities for savings, and run occupant engagement programs that depend on real-time data, such as competitions.

To make sure that you're able to maintain the highest quality meter data and ensure you're the first to know when there's a metering problems, BuildingOS provides Uptime Notifications within the product and via email. Uptime Notifications let you know what the problem is and when it happens.

The uptime status — either Online, Offline, or Flatlined — of automated meters is visible in BuildingOS everywhere that metering points are listed. You can easily see the status of all of a facility's meters, all of a Data Service's meters, or all of your organization's meters.

Notifications

Facility	Meter	Event	Occurred	Recovered
🏠 Austin Office	💧 Water Use	⊘ Meter offline	Sep 23, 1:17am	Sep 23, 2:49am
🏠 Austin Office	🔥 Natural Gas Use	🔔 Tier 2 pricing	Sep 21, 11:10am	Not yet
🏠 Austin Office	⚡ Electricity Use	⊘ Meter offline	Sep 24, 2:23pm	Sep 24, 4:20pm
🏠 Boulder Office	⚡ Electricity Use	— Meter flatlined	Sep 24, 12:21pm	Sep 24, 7:35pm
🏠 Boulder Office	⚡ Electricity Use	— Meter flatlined	Sep 24, 12:26pm	Sep 24, 5:21pm
🏠 Boulder Office	⚡ Electricity Use	⊘ Meter offline	Sep 23, 1:15am	Not yet
🏠 Boulder Office	💧 Water Use	⊘ Meter offline	Sep 23, 8:38pm	Sep 25, 8:50pm
🏠 Boulder Office	🔥 Natural Gas Use	🔔 Tier 2 pricing	Sep 21, 3:16pm	Sep 23, 3:24pm
🏠 Madison Office	⚡ Electricity Use	⊘ Meter offline	Sep 23, 10:15am	Sep 23, 1:17pm

All notifications ▾ for all facilities ▾ all meters ▾ over last week ▾

10 ⇕ records per page   Search: [ ]

When a meter flatlines, goes offline, or recovers to an Online state after being flatlined or online, BuildingOS will generate a Notification to let you know. New Notifications appear at the top of your homepage when you log in to BuildingOS, and the total number of new Notifications you have is visible in the navigation bar. You can click through to a full list of Notifications from either of these places.

BuildingOS users will receive an email within 5 minutes of a Notification being issued for any of the meters at your organization. This email will alert you to the change in status of the meter(s) in question, and will give you a summary of the current state of all of your meters. In one glance you'll know how many, what, and where any problems are so you know where you to take action. You'll also receive a weekly email that summarizes the uptime status of all of your meters to give you peace of mind, or nudge you to take action if needed.

2.14. Bill and Manual Meter Entry

Overview

BuildingOS serves as the central repository for all utility, bill, meter and sustainability data and while we have extensive support for automated interval data sources, manual and low-resolution data streams, such as bill data, manual meter entry data and waste and recycling data, are just as important for tracking improvement of key energy and sustainability metrics.

Manual Meter Entry

Some utilities may be difficult or expensive to sub-meter and you can easily capture these through manual meter entry data. BuildingOS supports three types of meter types: ones which have a totalizer (odometer), such as analog water meters, meters which can provide total consumption readings and meters which display current demand. All three are supported.

Manual Bill Entry

Users can manually key in bills for utilities where automatic bill delivery is not yet supported. BuildingOS accepts entry of both consumption and the bill amount. For Electricity meters you can also enter your peak demand charge and peak demand (kW) for each bill cycle. An integrated Bill Analysis app allows you to easily do year-over-year comparisons, perform bill reconciliation and track demand charges and costs over time.

Occupancy

Occupancy tracking is important for certain facility types. BuildingOS supports manual Occupancy reporting, either as a % occupied or headcount. This information can be used for normalization of energy data and savings.

Waste, Recycling and Compost

Sustainability teams working to improve waste diversion rates need easy tools to track the key metrics which demonstrate their progress. Manual tracking of waste, recycling and compost at the level of each facility or your entire campus is supported, along with reporting using the Analyze Trends app.

2.15. User Management

Lucid's goal is to unify disparate building systems' information into a consistent, modern, and easy-to-use online interface. This allows for transparency, visibility, and easy communication across your entire organization.

The User Management section of BuildingOS allows users to create BuildingOS accounts for an unlimited number of other individuals at Chico Unified School District. Because different users will have different needs, BuildingOS allows you to create different levels of authentication to differentiate between an administrative user, facilities, sustainability, and engineers. Some users will have permission to view information, while others will be able to edit, maintain, and have direct access to it. Organizations with a complex infrastructure can even grant users access only to specific buildings or specific geographic locations.

While Building Dashboard may be readily available to anyone, BuildingOS resides behind a level of authentication. Everyone with a designated email address from your organization will be able to sign on to BuildingOS. Once signed on, users are granted varying levels of permissions based on their role by an administrator.

2.16. System and Data Security

Lucid's BuildingOS servers store a limited amount of information related to its customers. The data stored falls into three distinct categories: meta-data, meter topology, and meter data. Meta data is data regarding the facilities which are monitored: addresses, locations, size, and number of occupants. Meter topology describes the meters, which the customer has integrated with the dashboard server, as well as the data services (data integrations) which deliver the meter data to Lucid's infrastructure. Finally, Lucid also stores the meter data itself.

User accounts, dashboard configurations, and meter/data service topology and configuration data are always treated as private. Facility meta-data as well as meter data can be configured to be either public or private, depending on the preference of each customer. The meter configuration is potentially the only touch point with our customers' systems.

2.17. Energy Star Portfolio Manager

Lucid has been an Energy Star Product and Service Provider (SPP) since 2011. We are also an Energy Service Provider (ESP), meaning BuildingOS and Building Dashboard integrate natively with Energy Star Portfolio Manager. Lucid offers advanced reporting capabilities such as trends of Energy Star scores and benchmarking scores across a portfolio of buildings. Chico Unified School District can share facilities and meters in question with Lucid, at which point we can begin to automatically track key metrics, like Energy Star score, as well as monthly meter data. BuildingOS can also report data to Portfolio Manager. Real-time or bill meters can also be connected to report to Energy Star.

3. Data Integration

3.1. Real-time Smart Meter Data via Rainforest EAGLE HAN Gateways

BuildingOS can leverage realtime smart meter data from your existing PG&E smart meters. As long as your smart meters support HAN (Home Area Network) wireless connectivity, Lucid can use the gateways to get 1min resolution realtime data directly into BuildingOS, taking full advantage of metering infrastructure which already exists. Each gateway needs to be installed within 75 feet wireless range of a smart meter and provided with an Ethernet connection, which pushes the data directly to BuildingOS every minute. The gateways are pre-configured to report data to BuildingOS and no integration fees are required as the technology requires no integration work on Lucid's side.

3.2. PG&E Smart Meter Interval Data

BuildingOS can integrate with PG&E InterAct interval smart meter data. Data is delivered by PG&E to BuildingOS on a daily schedule, as a single batch. One batch typically delivers 24 hours of interval data.

3.3. PG&E Automated Bill Delivery

As an add-on package, utility bill data can also be automated for automatic delivery to BuildingOS via the PG&E InterAct portal. Lucid can parse out the bill data and organize the bill consumption, bill amount, peak demand and peak demand change for reporting, analysis and notifications. A dedicated Bill Analysis app allows easy analysis of year-over-year usage trends, billed vs measured usage comparisons and validation as well as peak demand charge analysis.

4. Next-Gen Dashboard Technology: Building Blocks

Lucid is currently developing a new display technology for the next generation of Building Dashboard, called Building Blocks. Building Blocks are a library of HTML5-based embeddable blocks which may be embedded on any webpage to add specific dashboard functionality to specific pages.

Each Building Block will utilize fully responsive design, meaning that blocks will render differently on different screen sizes and will take full advantage of the available width of each section of the page in which they are positioned. The first Blocks that are being developed, and which we've already begun work on, are a Competition Standings block and a Resource Trends block (an interactive chart of resource use with timescale selection features). Additional Blocks that will be designed include a Resource Orb block, a Challenge block, a Comparisons block, and others. In addition to being individually embeddable on webpages, Blocks will be able to be assembled into a Dashboard framework that will look similar to the current Building Dashboard Kiosk product, which can in turn be embedded in webpages.

6. Budget and Fees

Based on our understanding of the project scope, we have prepared a proposal for a Five Year License Agreement, including all costs for the duration of the agreement in one up front payment, so that the District may make use of Prop39 planning funds to implement the system.

Lucid's fee structure is extremely simple, and is comprised of a one-time Setup & Configuration fee, and a recurring Software License fee that is priced on an annual basis, with discounts for multi-year licenses. The Software License start date is the date of contract execution. In this case, Lucid has proposed a five year agreement and waived all set-up and integration charges, as well as provided a hardware credit for each school. All implementation, support, product engagement and technical resources are included in the proposal.