



SkySpark®

SkySpark® for Energy Analysis, Commissioning and M&V

SkySpark's Suite of Energy Analysis Tools

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SkyFoundry

The SkySpark Suite of Energy Analysis Tools

While SkySpark is primarily known for its leading-edge analytics – automatically processing rules and algorithms to detect issues in equipment and sensor data – SkySpark includes a comprehensive suite of energy analysis tools that address all phases of the analysis process from data collection and normalization, through analysis, visualization and reporting.

Continuously refined and enhanced over the last 10 years, these tools enable energy engineers to efficiently collect and analyze energy consumption and cost data, and quickly and easily produce informative reports and interactive views.

SkySpark® Analytics automatically analyzes building, energy and equipment data to identify issues, faults, deviations and correlations, all of which are opportunities for improved performance and operational savings.

SkySpark helps facility owners and operators find what matters™ in the vast amount of data produced by today's smart systems.

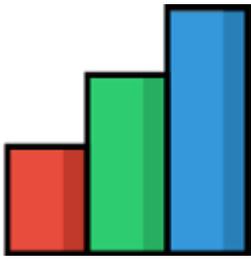
Acquiring Energy Data - Where it all Starts

The energy analysis process starts with the ability to acquire energy-related data. That data may come from an on-premise smart meter, a web-service data feed provided by the utility company, submeters that communicate using an IP protocol or are connected to an automation system, data previously stored in a database, or provided in text or csv file format. SkySpark works with it all and takes the critical step to normalize the data from these diverse sources providing users with a seamless presentation of energy data - no matter the format or source.

SkySpark supports a variety of data acquisition connectors as a standard feature: BACnet[®] IP, Modbus TCP, oBIX, Haystack, SNMP, Sedona, OPC UA, MQTT, SQL, CSV import (manual batch or automated), and a REST API.

SkySpark also includes a connector development toolkit and integration with Energy Star Portfolio Manager[®].





KPI APP

The KPI APP: Calculating, Presenting and Tracking KPIs and Trends

Once all energy data is acquired, the next step is to calculate Key Performance Indicators (KPIs). With SkySpark, virtually any metric that can be expressed with a math formula can be created as a KPI. Once defined, SkySpark's automated engine continuously calculates and stores KPI values. The KPI App then provides the user with access to view KPI values and their history over time.

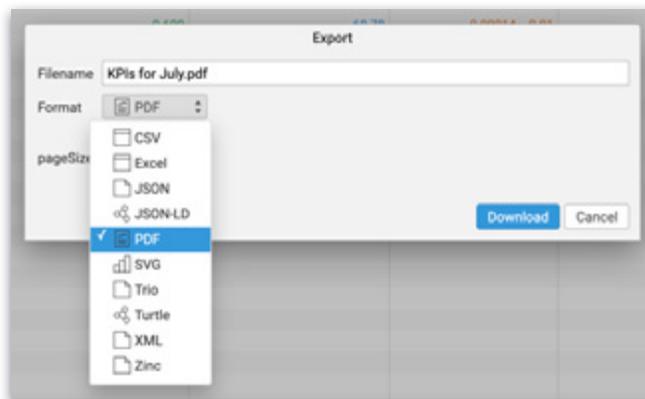


View KPIs as Trends Over Time.



Display KPI values and trends in a range of formats (bubble charts, bar charts, line charts and text). Save views as favorites for easy access by other users.

Any view can be exported in a variety of standard formats.



The ENERGY APP: Meter Data Visualization, Analysis and Reporting



ENERGY APP

The SkySpark Energy App provides a suite of tools to view and analyze meter data – electricity, oil, gas, water – or virtually any metered resource.

Whether it's data from physical meters or virtual meters based on calculations, the Energy App allows operators to quickly view meter data across any desired period of time. The App supports meter hierarchies, and association of meters with specific equipment. Let's review some of the "views" provided by the Energy App.

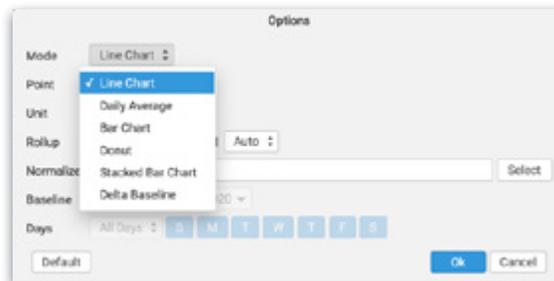
The Usage View

The Usage View provides operators with the ability to chart meter data across any time period, normalize energy use for standard factors including weather and building size as well as virtually any custom, user-defined **normalization factor** imaginable.

Baseline tools allow selection of standard or custom baselines which can be based on past history, calculations, or projected energy use data generated by external energy modeling tools.



View comparing electrical demand (or any metered resource) across multiple sites. Options allow selection of metered resource (i.e., consumption, demand, oil, gas, water, etc.) and multiple chart types.



Customized Charting Tools

All of the SkySpark energy-focused apps support quick and easy chart customization. Users can drag and drop data items to create multi-axis charts, change the weight of chart lines, apply fills to create area and confidence charts, select colors, adjust heat map gradients, control chart height, and opacity of chart widgets.

Area Chart Example.



View comparing electrical demand (or any metered resource) across multiple sites. Options allow selection of metered resource (i.e., consumption, demand, oil, gas, water, etc.) and multiple chart types.



SkySpark Tariff Engine Calculates True Energy Costs



For most facilities, the cost of energy is not a simple calculation of kwh times a fixed number like \$0.12/per kwh. Electric energy costs are calculated based on complex tariff rates. SkySpark includes a Tariff Engine that calculates real energy costs based on true tariff rates.

By combining energy use data with tariff-based costs, SkySpark provides true insight into the financial impacts of actual energy use patterns.

Supports Real-World, Complex Energy Rate Structures

The rate modeler feature of the SkySpark Tariff Engine allows rates to be defined based on a wide range of billing “charges” including:

- Consumption
- Demand
- Service and equipment charges (both fixed rate and percentage-based)
- Minimum contract charges
- Distribution and Generation charges
- Ratchets
- Time of Use including both time of day and monthly use factors
- Ranges (or blocks)
- Currency
- Custom charges which can be expressed as math functions
- Definition of billing periods (including support for variable billing periods)
- Variable fees based on data retrieved from external systems

Once the “charges” that make up a tariff rate are defined, the tariff is then assigned to a meter(s). The SkySpark Tariff Engine then calculates energy costs based on the tariff charges. The result is a precise calculation of cost associated with electricity and other energy resources.

The Tariff Engine can also be used in conjunction with the SkySpark Scheduling features to create schedule-aware tariffs that take into account time of day, and monthly and seasonal tariff elements. In addition, SkySpark’s open API allows for direct integration with Tariff Rate services and databases offered by third party providers.

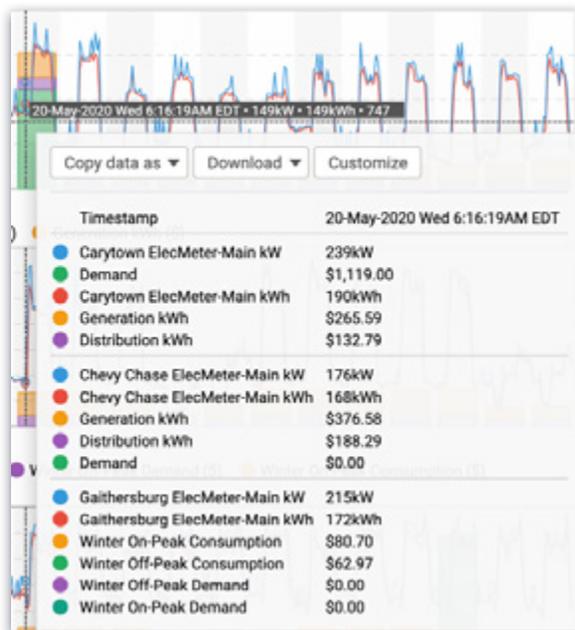
The following view shows an example of cost based on a rate with multiple charges: a basic charge, distribution charge for kWh, generation charges for kWh, and a demand charge.

The line graphs represent the consumption and demand values from the meters. The vertical bar graphs represent the costs calculated based on the charges associated with the Tariff rate. SkySpark automatically correlates energy use and cost data and overlays them to provide operators with a clear view of how energy consumption and demand impact actual energy costs.

By clicking anywhere on the chart, the user is provided with a popup showing all details of the energy and cost data.

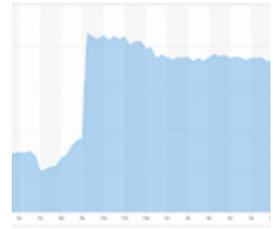


With another click, users can export all of the data in a range of formats (CSV, JSON, JSON-LD, Trio, Turtle, XML and Zinc), and download the view as an image (svg and png are supported).



The Rate Modeler has been tested with rates from around the world and is extremely flexible to address unique charges and rate structures. And, it supports rates where charges change over time by tracking charges as a history record.

Identifying Opportunities Related to Demand Management and Utility Pricing Programs



In many cases, the largest portion of energy cost is associated with very few hours of operation. Energy demand charges can often account for 40% of the total energy bill. This means that appropriate demand management strategies can have a significant impact on reducing total annual energy spend.

Unexpected demand charges can quickly upset planned energy budgets. Peak demand avoidance is not necessarily an energy efficiency measure, but rather can best be viewed as a risk mitigation strategy. As an example, in a recent project the top 100 hours account for 340 kW of peak demand – or: 1% of consumption is but resulted in 18% of annual demand charges.

SkySpark's Load Profiling, Load Duration, Heat Maps, and Analytic Rules provide clear insight into energy demand levels, times of occurrence, duration and the equipment impacting those peaks. When combined with the Tariff engine features the cost impact of energy demand is shown in direct correlation with energy demand and consumption data.

Load Profiling: Daily Average Demand Profile

Assessing the impact of energy demand typically starts with analyzing your Daily Average Demand Profile. The legend shows that our average is being calculated based on the data for all days of the month. Days are selectable to enable easy analysis of weekend or weekday demand patterns.

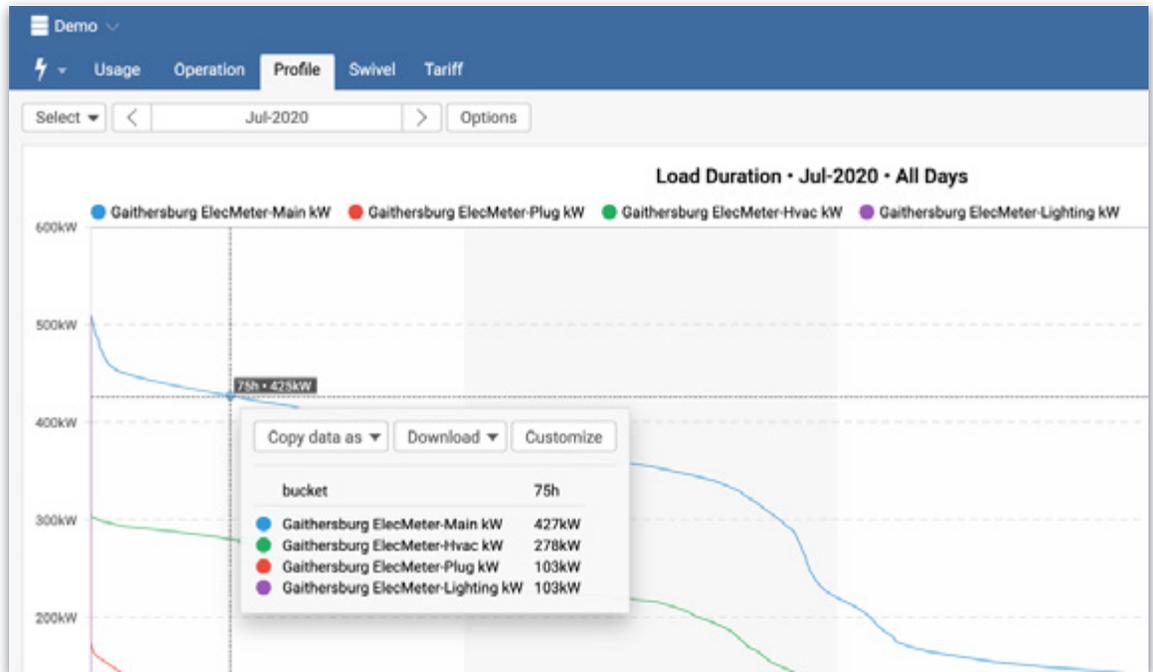


In this example the daily average demand profile for the month of July is selected.

The Load Duration View

The Load Duration View shows the number of hours that a facility operates at any level of demand, providing operators with insight into the viability of ECMs to reduce energy costs. The Load Duration View provides a quick and easy way to assess the amount of time demand (or consumption or cost) exceeds any desired value.

In this Load Duration View, the Gaithersburg site Main kW meter exceeded 425 kW for 75 hours in the month of July.

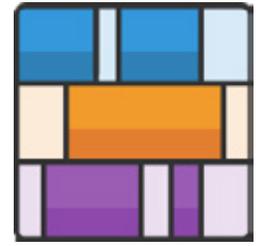


The Heat Map View

The Heat Map View shows demand or consumption intensity. Easy customization allows modification of colors and the number of gradient levels. Each cell represents a meter reading that can be inspected with a single click.



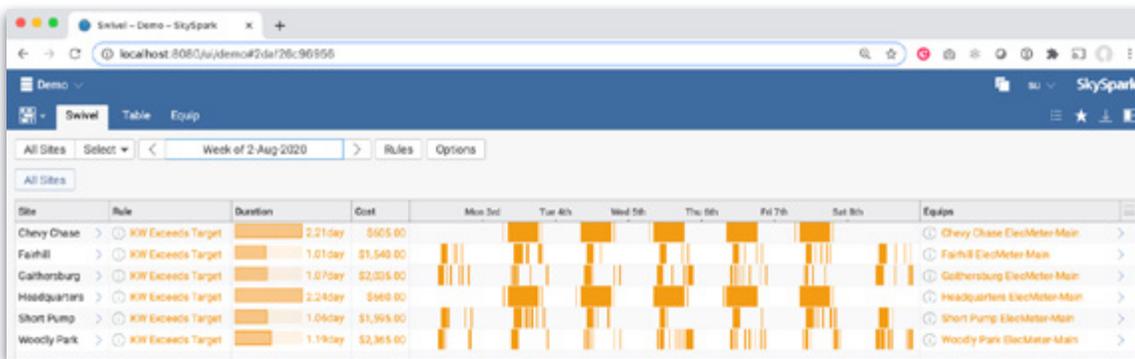
Analytic Rules: Automated Detection of Energy Use Patterns



SPARK APP

Analytic Rules automatically analyze meter and equipment data to detect demand peaks (or other anomalies) and display them as “Sparks” in the Spark App. Sparks include time and duration of occurrence (shown as a timeline), and cost (if cost factors have been defined) and the meter or equipment where the peak was detected. Users can select any time frame to see demand related sparks during that period. And remember, costs can be calculated based on detailed tariff rate charges.

The Spark App shows issues, patterns, deviations, faults, correlations and opportunities for operational improvements and cost reduction (collectively referred to as “Sparks”) detected by Analytic Rules.



“Sparks” are displayed in a variety of formats: timelines, bubble charts, bar charts and tables.



SkySpark includes a workflow system to take issues from identification to resolution.

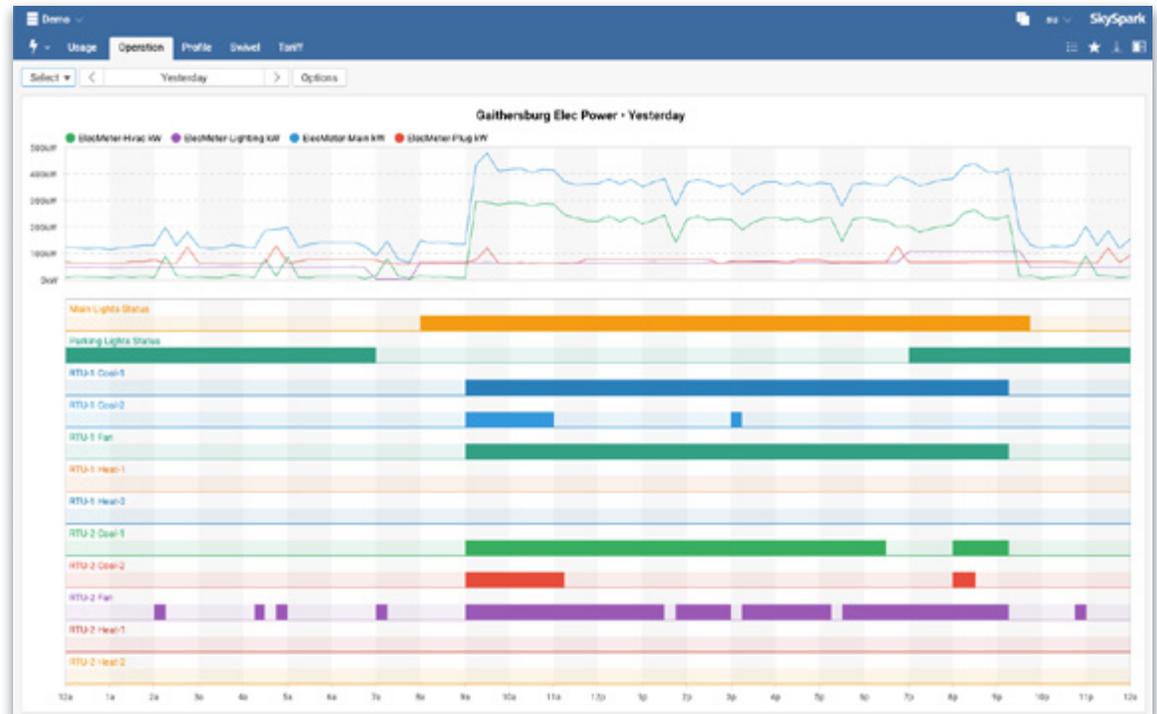


The Operations View: Correlating Meter Data and Equipment Operation

One of the most powerful and informative views provided by SkySpark is the Operations View. The Operations View directly correlates equipment operation status with energy demand and consumption values.

The ability of SkySpark to automatically correlate meter data and equipment operational status enables operators to clearly see the how equipment operation affects energy use patterns.

The Operations View shows energy use (demand as shown) correlated with equipment operational status. This provides clear insight into the impact of equipment operation on energy use.



Integrated with Energy Star® Portfolio Manager®



Developed by the EPA, ENERGY STAR Portfolio Manager®, is an online tool to measure and track energy and water consumption, as well as greenhouse gas emissions. It can be used to benchmark the performance of one building or a whole portfolio of buildings. Use of Portfolio Manager is growing – well over 40 percent of U.S. commercial building space is benchmarked in Portfolio Manager.

Portfolio Manager offers an extensive API, known as the Portfolio Manager web service, which enables external software applications to interact with Portfolio Manager services. SkySpark's Energy Star integration supports a wide range of PM services. Here are a few examples.

Generate “Property” Accounts in Energy Star Directly from SkySpark

SkySpark's Energy Star App allows you to set up a connection to Energy Star and define an Energy Star “property” (referred to as a Site in SkySpark) and add tags to define required items like area, year built, address, occupancy percentage, & primary use function.

Push Energy Consumption Data to Portfolio Manager

Once an Energy Star “property” is setup, SkySpark can automatically push energy consumption data into PM on a continuous basis, or as a onetime batch. Uploading consumption data to PM is the first step in utilizing PM features for benchmarking your building performance against the PM “peer group” database of buildings. Portfolio Manager provides over 100 different metrics that provide insight into how facilities are performing.

Pull Energy Consumption Data into SkySpark

Many owners have been entering energy consumption data into PM for some period of time. Typically, this was done in a manual, batch-type process. All of that data can now be pulled into SkySpark to populate historic energy data for use in the SkySpark Energy App, Historian and KPI App. *Note:* Energy Star deals with monthly energy consumption data.

Energy Star Portfolio Manager is often used as the reporting mechanism to support new initiatives by major cities that have enacted energy reporting and disclosure requirements in their jurisdictions.

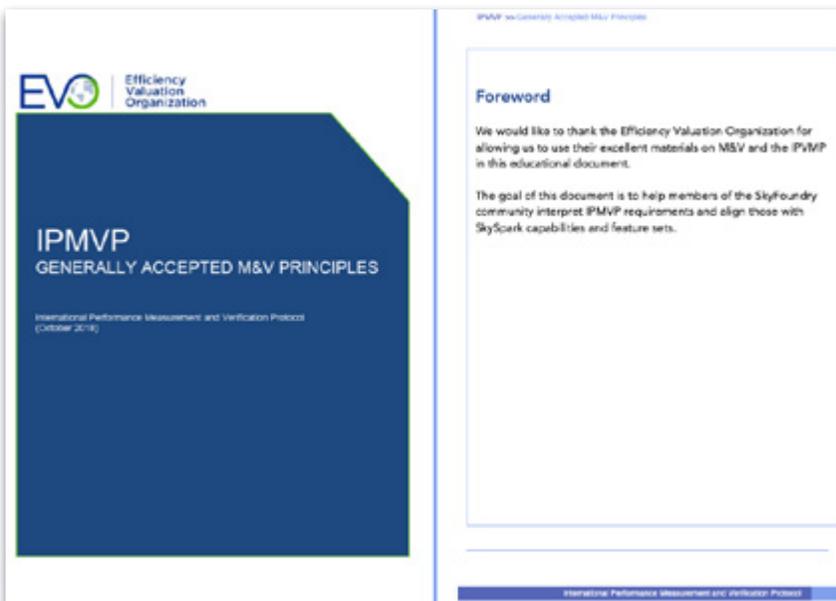
Aligning SkySpark Capabilities with IPMVP Requirements

SkySpark provides a business-transforming solution for consultants involved in energy analysis, commissioning, Monitoring & Verification and similar services. SkySpark enables these companies to automate significant portions of the work they have historically done with extensive manual effort.

No more manually managing data and building and updating spreadsheets. Any KPI, analysis, data transformation, normalization calculation or rollup can become automatic in SkySpark. Energy analysis reports due tomorrow? No problem – once the data is loaded and analysis functions defined, the results are continuously calculated and ready in SkySpark. Reports can be generated in Excel®, PDF, PNG, Google Sheets® and other formats. And, SkySpark can automatically email reports as attachments or hyperlinks directly into views in SkySpark.

We offer an application note entitled [Applying SkySpark to Meet IPMVP Generally Accepted M&V Principles](#) to help M&V professionals interpret IPMVP requirements and align them with SkySpark capabilities and feature sets.

We would like to thank the Efficiency Valuation Organization for allowing us to use their excellent materials on M&V and the IPMVP in this White Paper.



SkySpark for Energy Analysis and Reporting

Whether you are looking to start your energy data journey with interval data from a single meter, combine it with Tariff rate data and equipment operational data, SkySpark provides a cost-effective solution that can be quickly tailored to your needs without adding unnecessary complexity.

Attend a SkySpark demonstration webcast for a more indepth understanding of the capabilities of SkySpark. For the schedule of these 90-minute sessions visit: skyfoundry.com/calendar.

SkySpark® Specifications

Operating Systems Supported:

Microsoft Windows, Mac OSX, Linux.

SkySpark requires a Java Virtual Machine on the server. Java Version 1.8 is recommended.

System Requirements:

SkySpark will run on almost any computer from small Edge IoT device (in the class of a Beagleboard Black or Raspberry Pi), a laptop to a cloud service provider. Compute resources vary based on system capacity and the number of connectors used to acquire data. Capacity is measured by the number of points. A point is anything you are recording data for.

User Interface:

All SkySpark views are delivered in a standard web browser using HTML5 technology. SkySpark supports current versions of all major web browsers including Google Chrome, Microsoft Internet Explorer, Safari and Firefox.

Connectors for Data Access:

SkySpark includes the following data connectors: BACnet IP, oBIX, Modbus TCP, OPC UA, MQTT, Haystack, Sedona, SQL Database via JDBC, CSV data import, SkyFoundry REST API, Energy Star Portfolio Manager, and Lightweight Directory Access Protocol for centralized user credential management. SkySpark also provides a Connector Development Toolkit enabling the creation of custom connectors.

Export Formats Supported:

PDF, PNG, SVG, Excel, CSV, HTML, Text, JSON, Zinc and Trio.

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