SkyFoundry

Energy Twin
SkySpark-based Machine Learning for Monitoring Based Commissioning

Case Study
May 2021

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Energy Twin – Machine Learning MBCx in SkySpark

Energy Twin (ET), a machine learning SkySpark extension for energy consumption analysis, is designed for efficient multiple building monitoring using artificial intelligence. ET aims to identify problems and reveal the potential for future energy consumption savings and optimization.

"This case study is a good example of how AI can improve our work. In this case, AI does not replace an expert; it makes their work more efficient. AI performs the repetitive and dull part of the job - such as comparing all measured data and detecting anomalies. The expert then spends precious time only with the events that matter and are worth investigating."

Jan Široký, PhD. - leader of the Energy Twin team

Our Goals in Developing the Energy Twin Machine Learning Extension

Provide a systematic approach

- clearly define metrics for anomaly detection and their evaluation
- prioritize remedial actions by estimating the amount of wasted energy provide consistent results regardless of the portfolio size

Save the time of the experts

- increase experts' efficiency significantly
- allow experts to focus on in-depth analysis of suspicious events

Project Details

Client Requirements

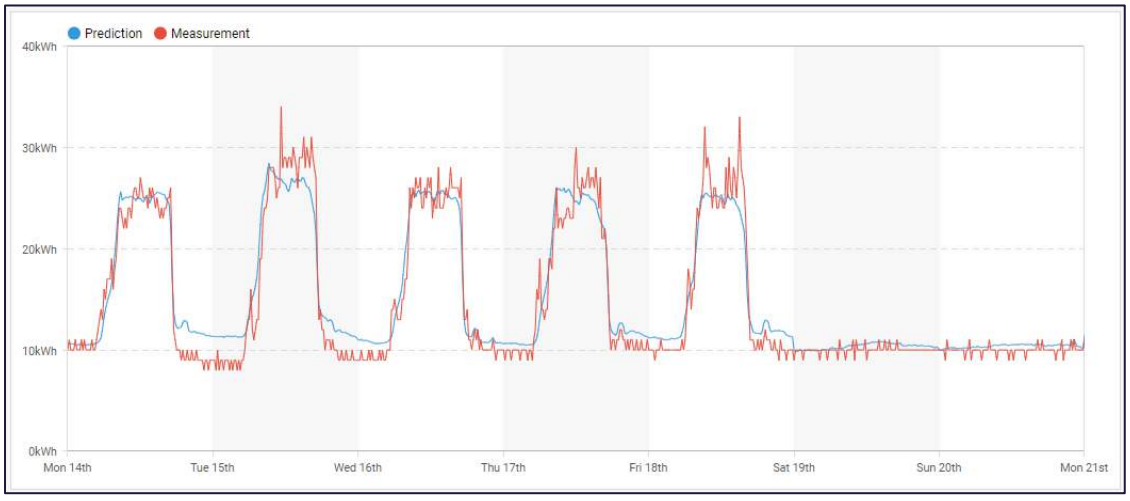
The client needed online monitoring of their portfolio, which consisted of 80 electric site meters representing office buildings of various sizes with known schedules. The goal was to detect any significant deviation from the building's normal behavior and provide a summary for local technician investigation when needed.

Contractor's Goal

The contractor's goal was to maximize the time efficiency of his experts to achieve the client requirements while also minimizing any opportunity for as well as minimize the human-error effect.

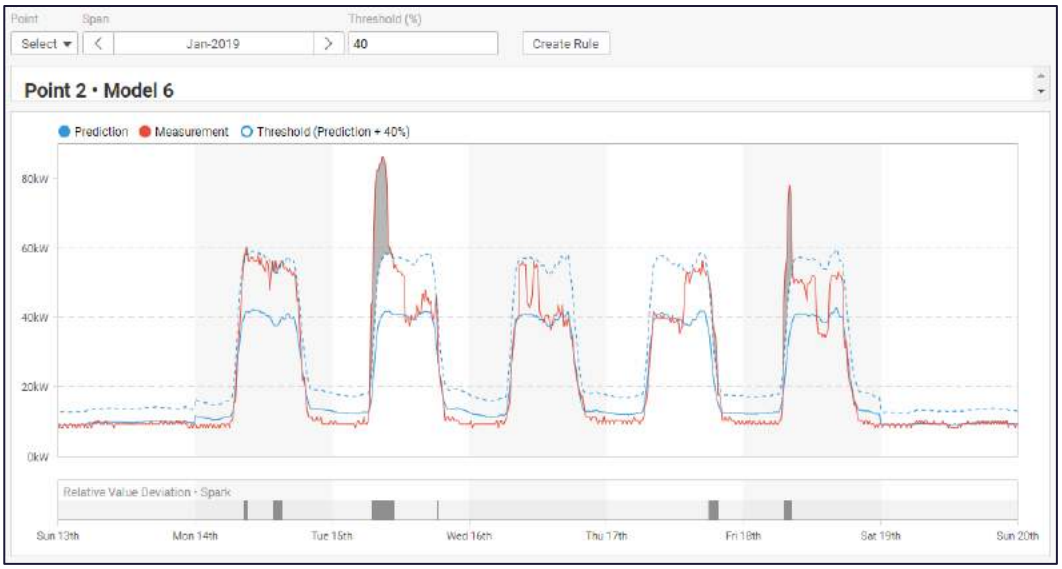
Model Training

For each site meter in the client's portfolio, a model was identified using ET. The models were based on a minimum of one year of energy consumption data with a 15 min sampling period. The resulting good fit of the data to the machine learning model can be seen in the image below where successful fit is demonstrated by the closeness of the prediction and measurement curves.



Spark Rule Definitions

Energy Twin has many available spark rules. In this case, the Relative Value Deviation spark rule is ideal. The threshold is defined using the relative difference from the predicted value. This spark is recommended for a portfolio with different absolute values, in other words, a portfolio including buildings of various sizes. As shown in the image below, the spark is activated when the measurement is greater than the predicted value by +40%.

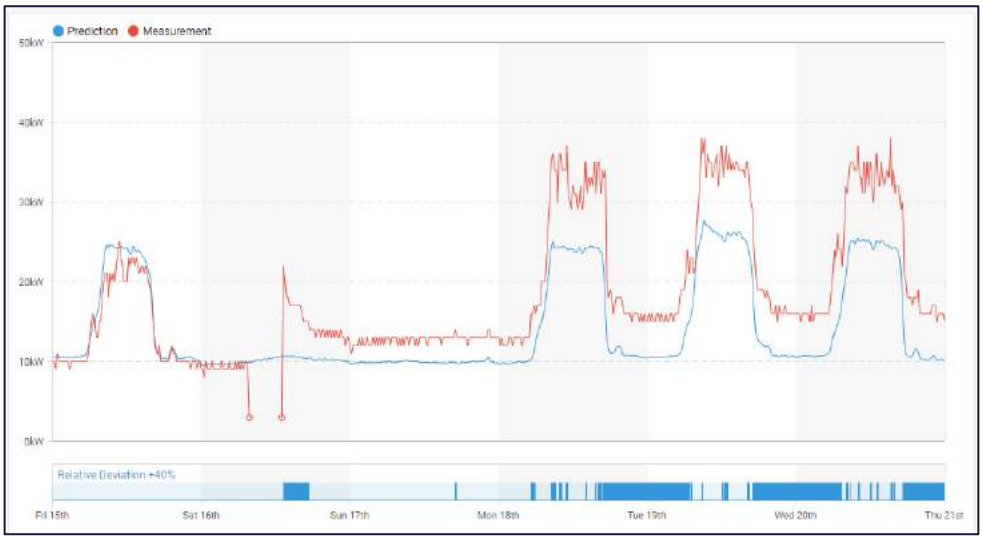


Evaluation of Sparks Produced

Every week only 30 minutes of expert's time are needed for supervising the whole 80 buildings portfolio on average. ET can prioritize buildings by estimated wasted energy. As you can see from the results below, Site 2 is identified as a problematic building worth investigating.

Local Investigation Based on Sparks

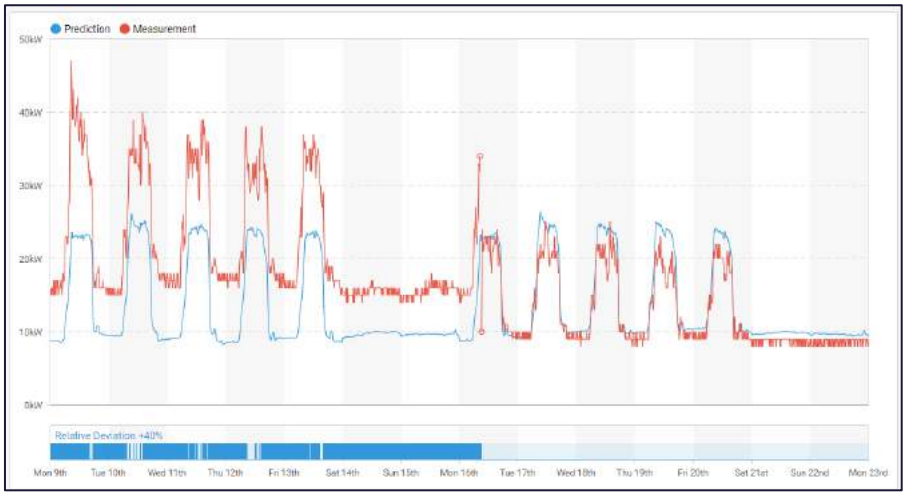
Based on Energy Twin analysis, Site2 was identified as a problematic building worth investigating. The local investigation identified that a technician was changing electric meter current transformers and mistakenly replaced them with a transformer with a different conversion factor.



Fixing the Problems

After finding the source of the abnormal energy consumption and fixing it, one can see that the model fits the measurement, and there is no active spark in the image on the next page. As a result, daily energy consumption was lowered by 160 kWh, which is 58 MWh per year, ensuing in financial savings.

The critical question is, how long could this problem stay undetected in such an extensive building portfolio? It would probably be until the next yearly billing period or, in the worst case, until the meter was due to routine replacement.



In the view above, we can see the correction of the energy consumption issue after resolution of the issue identified by the Spark Rule

Conclusion

With such a large portfolio, operational issues occur every week. Other anomalies within this project were revealed, such as non-stop operation of air doors due to manual overrides and non-stop operating of local electrical heaters.

The primary purpose of this case study was not the identification of incorrect transformers or other anomalies; it is to show the advantages of the systematic and scalable approach to continuous energy consumption analysis. Using ET on your portfolio will allow you to identify all significant anomalies in your data with minimal effort.

Benefits

The Energy Twin Machine Learning extension enables SkyFoundry partners and clients to:

- provide better project results with less effort
- maintain high standards of services regardless of portfolio size
- focus on the most severe anomalies

Additional Capabilities

- Energy Twin provides various types of anomaly detection algorithms (absolute value change, relative value change, standard deviation-based change, daily prediction and measurement difference integral change)
- Energy Twin provides an open API allowing you to implement your own detection using predictions

Energy Twin Machine Learning Extension for SkySpark

The Energy Twin team is a SkyFoundry partner based in the Czech Republic. They have deep expertise in Machine Learning and other advanced AI techniques for energy analysis and fault detection.

For more information, contact the Energy Twin team at:

https://et.mervis.info/

Energy Twin®

SkySpark® – Analytics for a World of Smart Device Data

The past decade has seen dramatic advances in automation systems and smart devices. From IP connected systems using a variety of standard protocols, to support for web services and xml data schemas, it is now possible to get the data produced by the wide range of devices found in today's buildings and equipment systems.

Access to this data opens up new opportunities for the creation of value-added services to help businesses reduce energy consumption and cost and to identify opportunities to enhance operations through improved control, and replacement or repair of capital equipment. Access to the data is just the first step in that journey, however. The new challenge is how to manage and derive value from the exploding amount of data available from these smart and connected devices. SkyFoundry SkySpark directly addresses this challenge.

*The new frontier is to efficiently manage and analyze data to **find what matters™**.*

About SkyFoundry

SkyFoundry's mission is to provide software solutions for the "Internet of Things". Areas of focus include:

- Building automation and facility management
- Energy management, utility data analytics
- Remote device and equipment monitoring
- Asset management

SkyFoundry's software helps customers derive value from their investments in smart systems. Learn more and request a demonstration at www.skyfoundry.com.

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