

```

elif _operation == "MIRROR_Y":
    mirror_mod.use_x = False
    mirror_mod.use_y = True
    mirror_mod.use_z = False
elif _operation == "MIRROR_Z":
    mirror_mod.use_x = False
    mirror_mod.use_y = False

```

CUSTOMER CASE STUDY

Making data center billing more flexible and transparent with AVEVA™ PI System™

Aligned Energy - www.aligneddc.com
 Industry - Data Storage

Challenge

- Leverage more value from available real-time data to create greater flexibility and visibility regarding customer energy usage and billing.

Solution

- Use Asset Framework to model complex relationships between data center assets to create customer portals.

Result

- Customers are able to monitor their own energy usage and unused capacity.

As a data center co-location provider, Aligned Energy offers data resources to a broad range of clients. Customers using their data centers vary in size from single retail enterprises, who only need one rack or server, to hyper-scale customers who may need several racks and up to 8-megawatts of capacity. This wide range of capacity demands makes for a complicated power usage monitoring and billing situation. Aligned Energy has long used the PI System for traditional applications such as monitoring the power distribution and cooling in their data centers. But when they began looking for a way to make their power usage monitoring and billing systems more transparent and tailored to their customers' varied needs, they turned to Energy Metrics, a former subsidiary of Aligned Energy, for help. Energy Metrics devised a strategy to help Aligned Energy reach their transparency and flexibility goals by using Aligned Energy's existing PI System data in new ways.

Having a wide range of customers means that Aligned Energy has to be flexible enough to deal with constantly changing load demands. Not only do daily load demands vary significantly from client to client, load densities for a particular rack or pod can evolve over time. “Customers will start with one generation of equipment [and use] 7kw per rack. But over a period of three to five years, they replace the servers, and the servers are suddenly 22kw,” explained Rajendran Avadaippan, former CIO of Aligned Energy and current CEO of Energy Metrics, during his presentation at PI World 2018 in San Francisco. “As densities change and loads change, the cooling and power requirements change. We need to be able to flexibly change those parameters.”

Beyond the basics

Making sure cooling and power systems are adaptive and responsive to evolving load demands is pretty basic stuff for most data centers. But Aligned Energy was not content to simply provide the basics. “You monitor the back of the house, the chiller plants, generators. Here with Aligned Energy we very quickly learned that the focus was how do we take this data and turn it into continued customer engagement,” said Gregor Vilknor, the VP of Products at Energy Metrics.

Aligned Energy wanted to be able to support variable load demands, but do so while being completely transparent with their customers about power usage and related billing.

Energy Metrics helped Aligned Energy monitor power usage for different customers by creating what they call “charge points” at different levels in the power distribution system. For example, for smaller customers with smaller load demands who share power distribution units (PDUs) with other customers, Aligned Energy can monitor usage and create charge points at the Busway level. Monitoring the power usage for customers who require dedicated PDUs, on the other hand, can be done at the PDU output level. OSIsoft’s Asset Framework (AF) helps Energy Metrics model the complex contextual relationships between data center assets needed for this kind of monitoring. “You have a customer renting a room at a site ...The pods fit in a

room, the racks are inside a pod. But then the site has a bunch of PDUs, which aren’t necessarily associated with the rooms at all... This is a pretty complex data structure,” Vilknor explained. “Personally what I love about AF is how it enables us to model [these] complex data structures,” he said.

Billing transparency

On top of power usage monitoring, Aligned Energy wanted to be transparent with their customers about usage and billing. To help Aligned Energy accomplish this, Energy Metrics used web applications built on top of the PI System with Asset Framework to create customer portals, which provide dashboards that include capacity planning and utilization information. The portals act as a single source of truth and help customers easily see how much of their PDU capacity they are using, how much power they are consuming, or what their billing structure is. “We can create web applications that are completely riding on top of AF. You structure AF the right way, these web pages will come out just fine,” Vilknor said.

“Personally what I love about AF is how it enables us to model [these] complex data structures”

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Gregor Vilknor

VP of Products, Energy Metrics

Customers Billing Load (based on kWh data)
REFRESHED: 2:15:54 PM

Customers Breakdown
REFRESHED: 2:15:54 PM

Site Billing Loads (based on kWh data)
REFRESHED: 2:15:54 PM

Customers Listing
1 HOUR • REFRESHED: 2:15:54 PM

metaCustomer	Count of BillingPoint	KwhFromGwh	KwhFromKwh
metaCustomer	188	123.69	113.80
metaCustomer	32	41.61	41.59
metaCustomer	2	169.94	172.00
metaCustomer	40	26.82	26.92
metaCustomer	36	30.34	30.04
metaCustomer	20	0.02	0.04

DFW Uncertainty Table

metaCustomer	metaCustomer	metaCustomer	metaCustomer	metaCustomer	metaCustomer
metaCustomer	metaCustomer	metaCustomer	metaCustomer	metaCustomer	metaCustomer

DFW State Points

metaCustomer	metaCustomer	metaCustomer	metaCustomer	metaCustomer	metaCustomer
metaCustomer	metaCustomer	metaCustomer	metaCustomer	metaCustomer	metaCustomer

Push URL
https://api.powerbi.com/beta/ /dataset

Raw cURL PowerShell

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{
  "TimeStamp": "2018-03-13T22:31:33.229Z",
  "metaCustomer": "AAAAA555555",
  "metaSite": "AAAAA555555",
  "BillingPoint": "AAAAA555555",
  "KwhFromGwh": 98.6,
  "KwhFromKwh": 98.6,
  "DeltaAbsolute": 98.6,
  "DeltaRelative": 98.6,
  "IsStale": 98.6
}
```

- Dashboards can bubble up data quality issues.
- Highly granular data is no longer an extra, it's baked into the SLA.

In the future, Energy Metrics hopes to use Asset Framework Transformer to help partners like Aligned Energy create dedicated customer data feeds. “There is a need for customers to be able to tap into our data,” Vilknor said. “We wanted to give programmatic access

to it, not just dump or send reports.” To accomplish this, Energy Metrics plans to create mini Asset Framework models based on “mothership” models and provide dedicated PI Web API access for customers just to their mini Asset Framework models.

For more information Aligned Energy and the PI System, [watch the full presentation here.](#)