



Advanced analysis and reports

Introduction

The Yggio Power Bi Custom Connector enables the user in a fast and easy way to get data directly from an Yggio account into Power BI desktop for advanced analysis. Creating reports likes the following ones will just take minutes after some training.

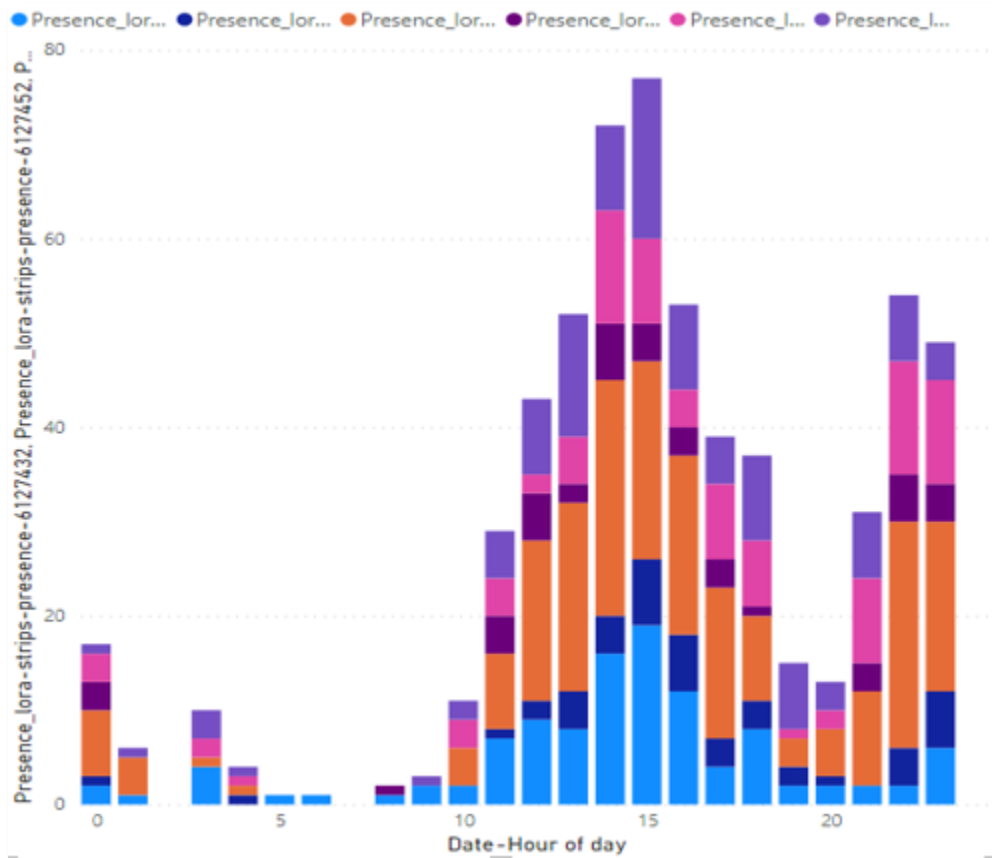


Figure 1 Utilization of assets over hour of day

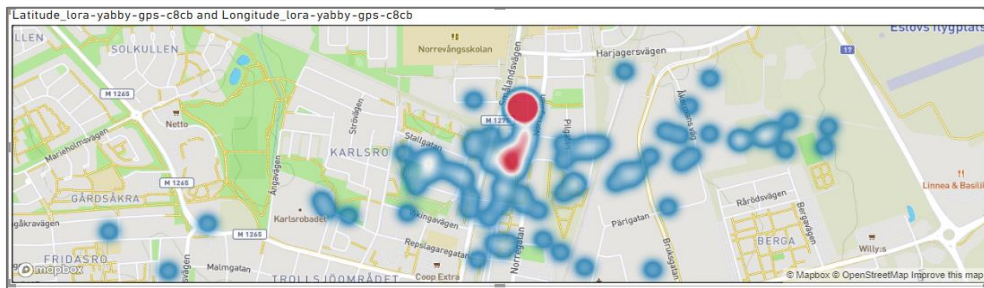


Figure 2 Asset tracking

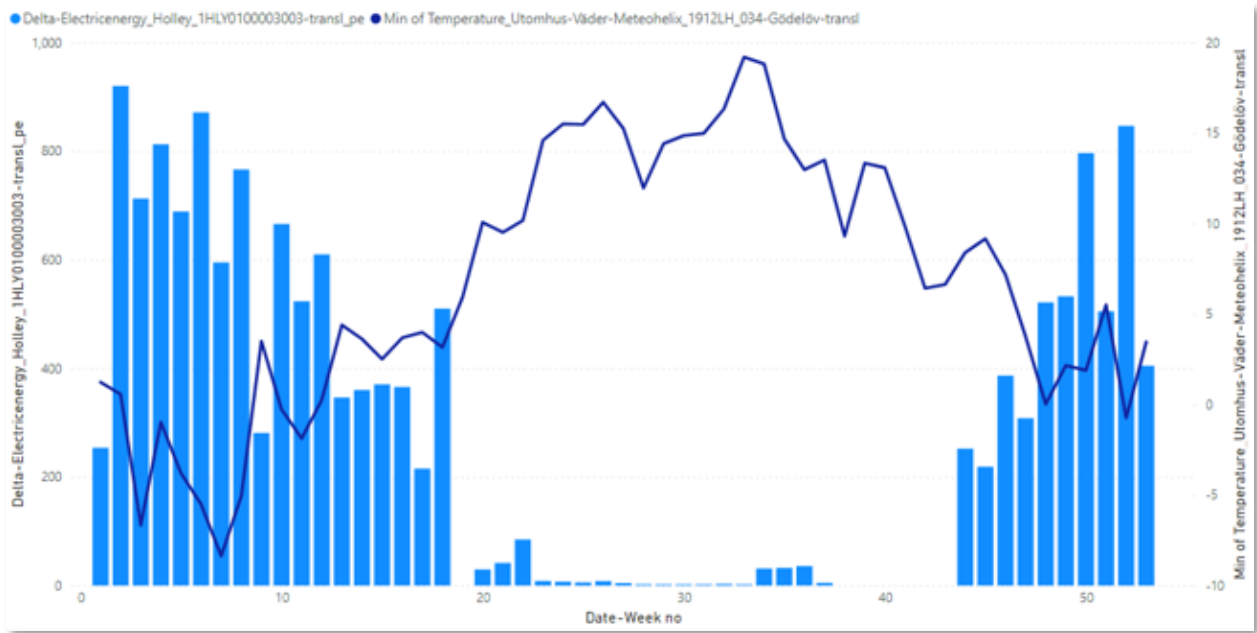


Figure 3 Energy consumption vs outdoor temperature

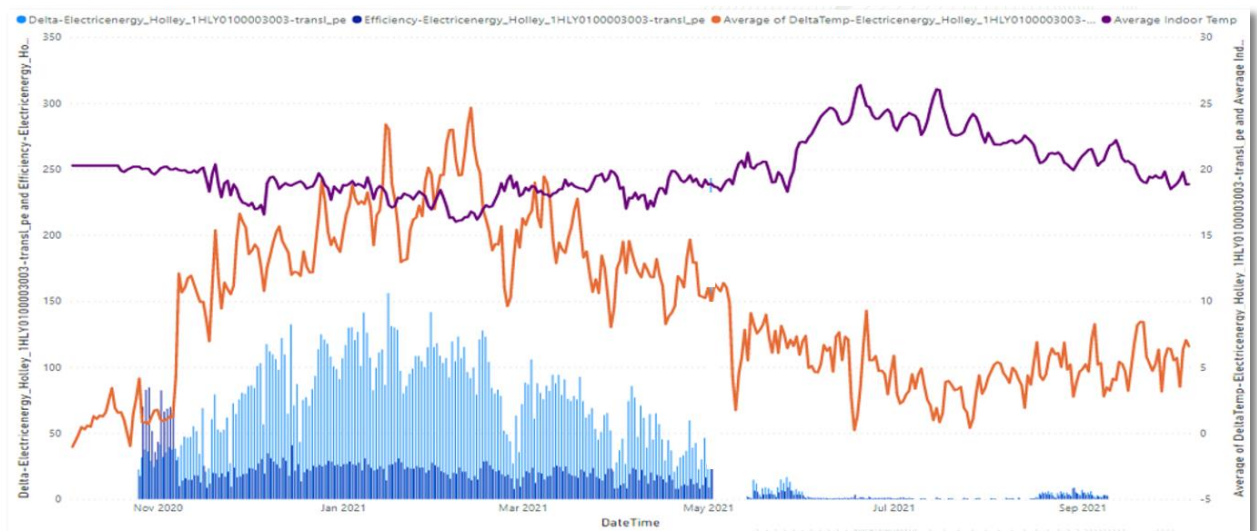


Figure 4 Energy efficiency KPI measurements

Then after exporting the reports to Power BI cloud and installing a Power BI Enterprise gateway with access to the Yggio connector they can also be automatically refreshed and shared. However, it is no requirement to use Power BI cloud, only using Power BI desktop works well.

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1. Get started


1.1. Installation

To be able to proceed with the installation one must use a Windows (Power BI not supported on Mac or Linux) computer and be local administrator on the computer or if IT has set a policy to allow the needed components to get installed by users.

1. Download and install Power BI Desktop directly from: <https://docs.microsoft.com/en-us/power-bi/fundamentals/desktop-get-the-desktop>
2. Download the Yggio Power BI Custom Connector ZIP file directly from Yggio Docs/Power BI (or other place if instructed by IT) and extract the two files YggioConnector.pqx and Yggio_regkey.reg.
 - a. Place YggioConnector.pqx in the folder (if the folder does not exist create it, it's important to use exactly the correct spelling):

[Documents] > Power BI Desktop > Custom Connectors

In a computer with English language setting the folder will be:

 > This PC > Documents > Power BI Desktop > Custom Connectors

- b. Double click on the Yggio_regkey.reg and accept that it modifies the computer. This will install the Sensative Certificate thumbprint in the computers registry and allow Power BI to use the Yggio custom connector without changing Power BI's security settings.

In case the thumbprint is not installed in the registry Power BI will complain that it cannot validate the Yggio connector and if user still wants to use it the security settings must be lowered to allow 3rd party custom connectors. This can be done from the Power BI menu "File > Options and Settings > Global > Security > Data Extensions > (Not recommended) Allow any extension load without validation or warning".

1.2. Limitations

This documentation is focused on the functionality provided by the Yggio Power BI Custom Connector. It does not, except for a few hints, contains any description of general Power BI documentation which is available on: <https://docs.microsoft.com/en-us/power-bi/>

2. Overview of functionality

1.3. Fundamentals

The connector enables three different ways to connect to Yggio and get the data. These three different ways provide different levels of freedoms about what amount of IoT nodes and what data fields that can be used to select what data to extract:

- 1) Navigator: The Power BI Navigator by selecting “Get Data” and search for “Yggio” and then connect to an Yggio server. This gives most constraints in what data to retrieve from time series but is also the most ease-of-use UX to get started.
 - a. For time series charts it is limited to 8 nodes * 4 time series fields that are selected from a list of pre-defined fields or manually entered.
 - b. The Navigator works well for most use cases when one needs to retrieve data.

- 2) Formula bar: Use “Get Data” > “Blank query”, write “=Yggio” and then from the drop-down box select what Yggio function to use to extract data. This will open a 2 or 3-step guide to retrieve data which removes some of the limitations in the Navigator interface.
 - a. For charts it is limited to 8 nodes * 4 time series fields where the 3 first time series fields are retrieved from the selected nodes and the 4th one is a list of pre-defined fields to increase flexibility.
 - b. If working with devices where the pre-defined list of time series fields in the navigator UI is not providing the expected result using the formula bar probably will.

- 3) Free query in formula bar: Use “Get Data” > “Blank query”, write “=Yggio” and then directly write the full queries in the formula bar. This enables us to extract data from more than 8 nodes* 4 time series fields in one query by using lists, i.e., all constrains are removed and queries can be made that retrieves a lot of data. The drawback is one must know the syntax of the queries, the names of the IoT nodes, available options, and eventual fields one wants to retrieve. The syntax is well documented when using the Yggio queries inside Power BI. There are two reason to use this mode:
 1. If one wants to retrieve time series data from more than 8 nodes.
 2. If one wants to use PowerQuery M-language to retrieve complex data sets from Yggio.

An easier way to get used to directly write the full queries in the formula bar or in PowerQuery is to start with creating a query with the navigator or use the step-by-step approach in the formula bar and then modify the resulting query to match the desired result.

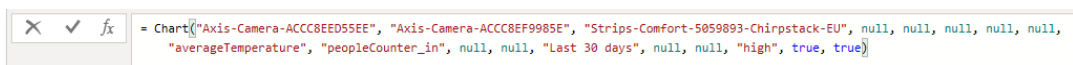


Figure 5 Query modified directly in Formula bar

For very advanced users it is feasible to use the Yggio queries directly from inside Power BI advanced editor that use PowerQuery language and create complex queries that aggregate data from different data sources.

1.4. Features

The following queries are implemented in the connector:

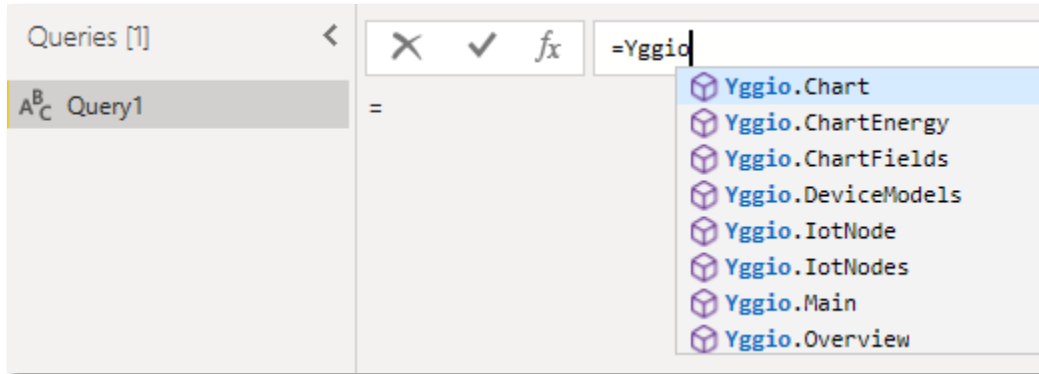
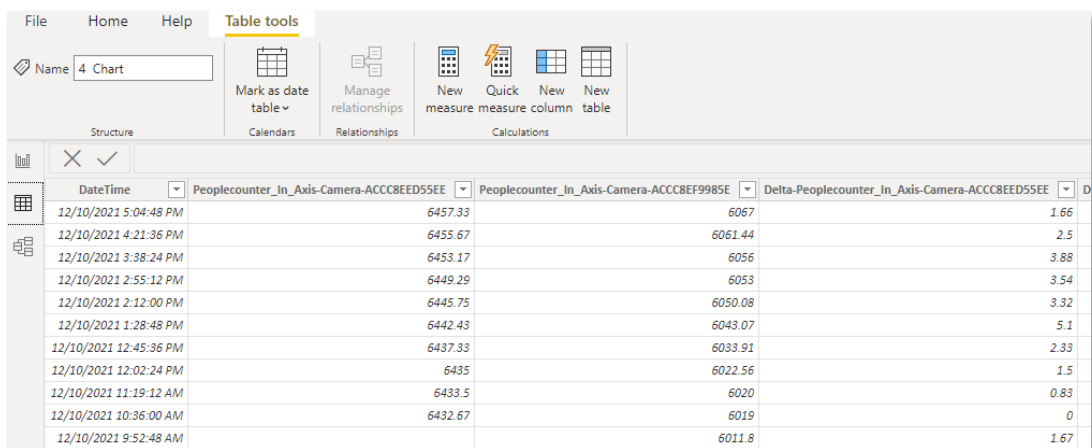


Figure 6 Available features

- Chart: Retrieve a cube of general time series data for X nodes * Y fields * Z time. Option to add extra statistical columns and use value functions (mean, max, min, first, last, count, sum and difference) on the time series data to enable fast and easy creation of advanced charts or reports, for example billing reports.



The screenshot shows the Power BI interface with a data table loaded by a Yggio Chart query. The table has the following columns: DateTime, Peoplecounter_In_Axis-Camera-ACCC8EED55EE, Peoplecounter_In_Axis-Camera-ACCC8EF9985E, and Delta-Peoplecounter_In_Axis-Camera-ACCC8EED55EE. The data is as follows:

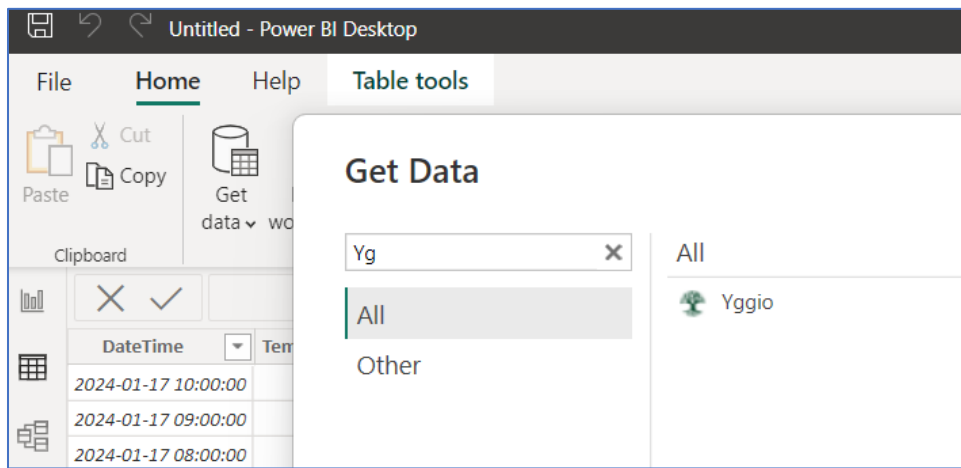
DateTime	Peoplecounter_In_Axis-Camera-ACCC8EED55EE	Peoplecounter_In_Axis-Camera-ACCC8EF9985E	Delta-Peoplecounter_In_Axis-Camera-ACCC8EED55EE
12/10/2021 5:04:48 PM	6457.33	6067	1.66
12/10/2021 4:21:36 PM	6455.67	6061.44	2.5
12/10/2021 3:38:24 PM	6453.17	6056	3.88
12/10/2021 2:55:12 PM	6449.29	6053	3.54
12/10/2021 2:12:00 PM	6445.75	6050.08	3.32
12/10/2021 1:28:48 PM	6442.43	6043.07	5.1
12/10/2021 12:45:36 PM	6437.33	6033.91	2.33
12/10/2021 12:02:24 PM	6435	6022.56	1.5
12/10/2021 11:19:12 AM	6433.5	6020	0.83
12/10/2021 10:36:00 AM	6432.67	6019	0
12/10/2021 9:52:48 AM		6011.8	1.67

Figure 7 Data set loaded by Yggio Chart query

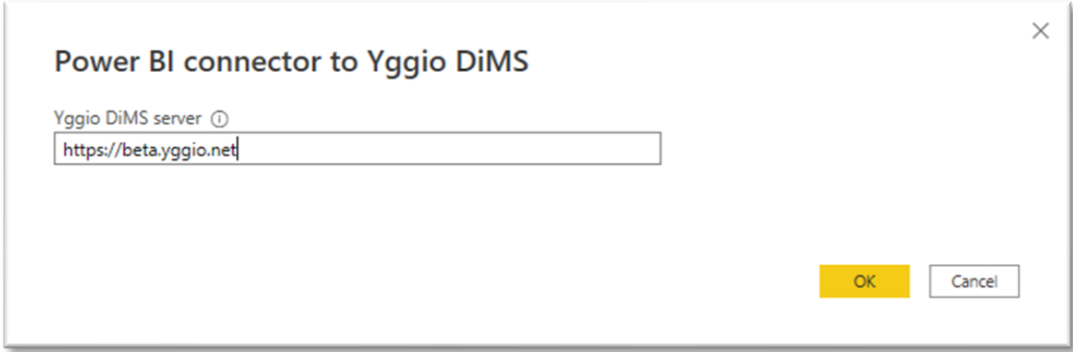
- ChartEnergy: Retrieve time series data focused on energy efficiency KPI calculation for a building based on energy consumption, outdoor temperature, average indoor temperature and building area.
- ChartFields: Retrieve available time series fields for selected nodes.
- Device Models: Retrieve available device decoders or “translators” in Yggio terminology. The reason it is called translators in Yggio is that it usually includes normalization of data format to FIWARE standard instead of just decoding.
- lotNode: Retrieve current data of several IoT nodes formatted in columns to make it easy to compare them.
- lotNodes: Retrieve current data of several IoT nodes formatted in rows to increase visibility of available data.
- Main: Open the navigator main menu in a table format. Normally not used from formula bar.
- Overview: Retrieve an overview of available devices in an account and when they reported.

1.5. Connecting to Yggio

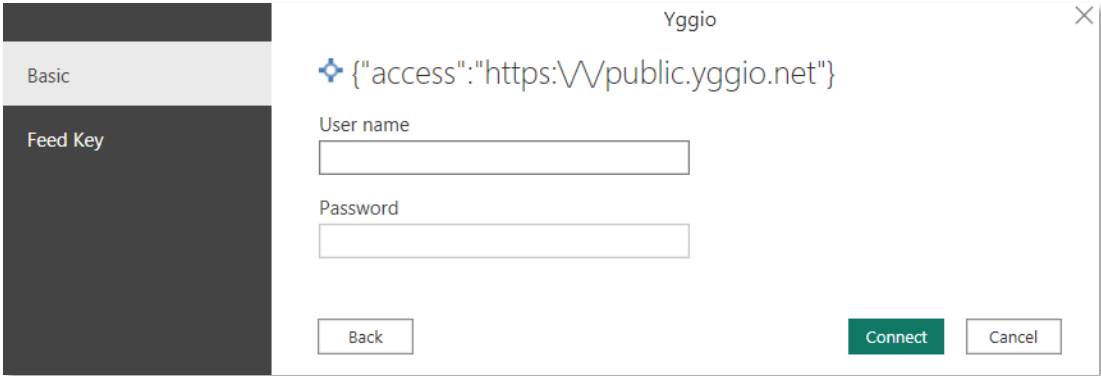
After selecting “Get Data” or directly starting an Yggio query from the formula bar the following dialogue will show up. Choose the Yggio connector.



In the next dialogue box enter the URL to the required Yggio server.



Next step is to enter credentials to log in to the server. Enter either your username and password or add an API key token. Once this is entered it will get stored in Power BI credential list and will automatically be re-used next time you want to connect to the same Yggio server. Yggio API keys will expire after a while so if using them one will need to update them from time to time. To be able to log in to another account the servers stored credentials must be cleared from Power BI > File > Options & Settings > Data Sources.



To make it easy to connect to different Yggio servers and use different Yggio accounts the connector uses a pre-defined list of Yggio servers with short names and allows a user defined “tag” to identify what credentials to use.

For example, server “BY” equals <https://beta.yggio.net> and by using server URL “BY+demo” Power BI will store the credentials under the data source path “BY+demo”. This enables, for example, “BY+test” to be used as a different data source path to log into another account on the same server. Short names for some Yggio servers for reference are:

- PY = <https://public.yggio.net>
- EU = <https://yggio.eu>
- BY = <https://beta.yggio.net>
- Y3B = <https://yggio3-beta.sensitive.net>
- YG = <https://ygg.io>

The server’s short name plus the user defined tags to identify data source paths enables a user that has knowledge of several different Yggio accounts on an Yggio server, like an appointed data scientist and report professional, to quickly switch between accounts and retrieve relevant data to make reports and analysis.

If you get an error message when Power BI tries to get data from Yggio, the URL to the server that was entered cannot be found. In that case, please enter a valid server URL or short name.

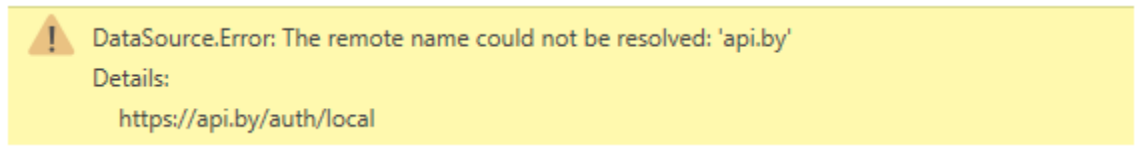


Figure 8 Yggio server not found

1.6. Ease of use

The Yggio Power BI connector is forgiving in its syntax evaluation that it will try to interpret what the user wants and retrieve the corresponding data. It is not needed to use exact matching names, for example using “Temp” will retrieve first available time series field that converted to lower case starts with the 4 characters “temp”. Similar forgiveness is available in other places like using the time period “2 m” to retrieve the last 2 months of data.

Inside Power BI the full syntax and what options are available and documented in detail so even writing Yggio queries inside the advanced editor will become relatively easy.

```
function (access as text, optional names as any, optional field as any, optional timePeriod as nullable text, optional resolution as nullable text, optional enableExtraDateColumns as nullable logical, optional enableDelta as nullable logical, optional nameIsDevEui as nullable logical) as table

Example: Retrieve IoT node data in 3 dimensions

Usage:
Yggio.Chart("Y3B+User", {"Strips-Comfort","Strips-Drip"},{"rssi","snr"},"Last 10 days", "Full")

Output:
#table({datetime, "rssi-Strips-Comfort","snr-Strips-Comfort", "rssi-Strips-Drip-1", "snr-Strips-Drip-1"},{
  {"8/14/2021 10:23 AM", "-87","-1","-113","-5"},
  {"8/15/2021 10:13 AM", "-81","1","-118","-7"},
  {"8/16/2021 10:28 AM", "-82","3","-110","-3"},
  {"8/17/2021 10:35 AM", "-92","-5","-105","-4"},
  {"8/18/2021 10:43 AM", "-85","-1","-107","-5"},
  .....
})
```

Figure 9 Yggio Chart query documentation inside Power BI. If type states “any” it is either a “list” or “text” that get accepted.

1.7. Multi language support

The connector is multi-lingual and will try to follow the language used in the Power BI installation on the computer. Currently it supports English and Swedish language.

3. Use the connector to extract data

3.1. Navigator interface and parameters

In the Power BI click “Get Data”, in the pop-up windows search for Yggio.

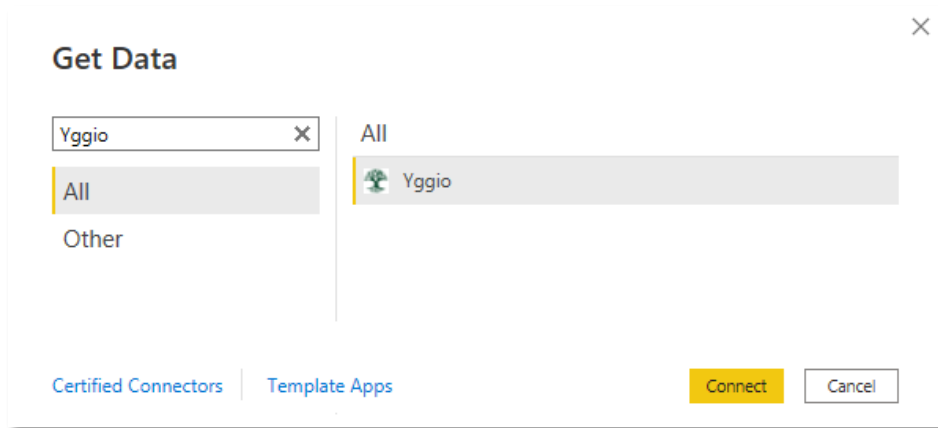


Figure 10 Get Data from Yggio

After selecting “Connect”, enter the credentials in the Yggio Connector Navigator UI that gets displayed. Select the desired query and follow the available options in the UI.

Charts

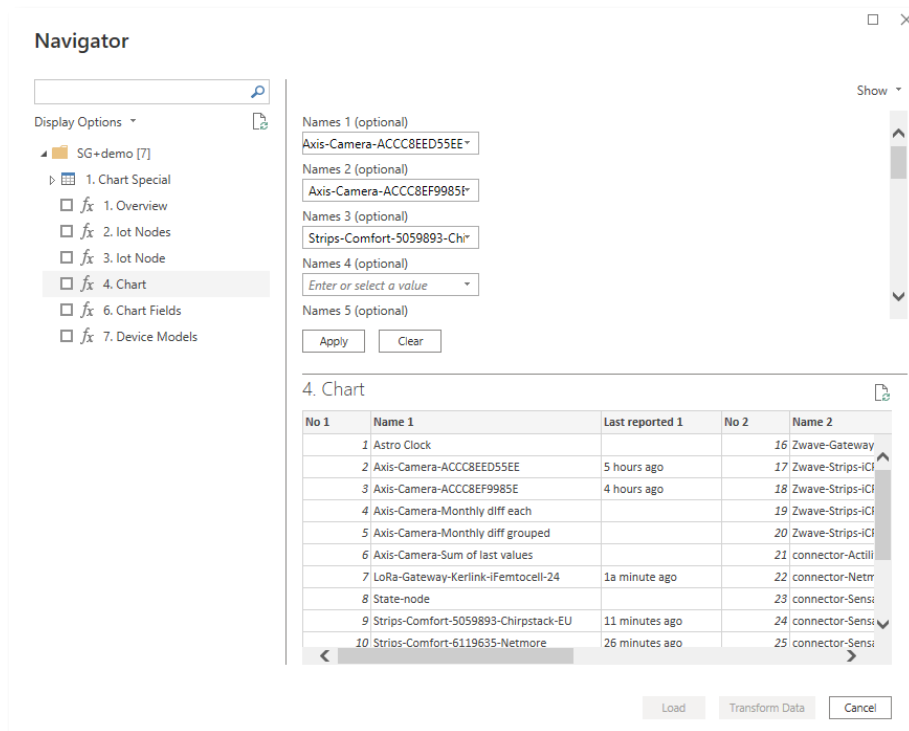
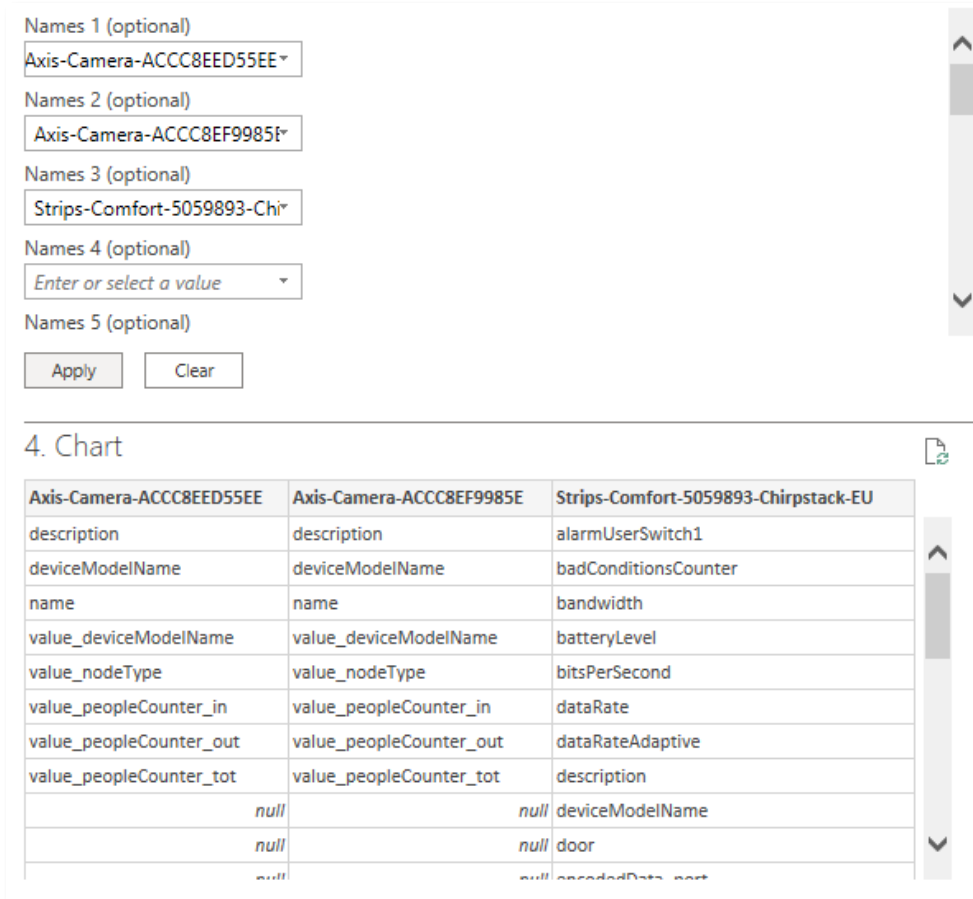


Figure 11 The Yggio connector's Navigator UI

Per default to support the user in selecting the right data the preview window in the bottom right will populate with available IoT nodes and available time series fields after clicking “Apply”. It is very helpful to check that one gets the required data before loading it into Power BI.



The screenshot shows the configuration interface for the Yggio Power BI Custom Connector. It features five optional input fields for selecting IoT nodes, each with a dropdown arrow. The selected nodes are:

- Names 1 (optional): Axis-Camera-ACCC8EED55EE
- Names 2 (optional): Axis-Camera-ACCC8EF9985E
- Names 3 (optional): Strips-Comfort-5059893-Chirpstack-EU
- Names 4 (optional): Enter or select a value
- Names 5 (optional): (empty)

Below the input fields are "Apply" and "Clear" buttons. A preview window titled "4. Chart" displays a table of available time series fields for the selected nodes:

Axis-Camera-ACCC8EED55EE	Axis-Camera-ACCC8EF9985E	Strips-Comfort-5059893-Chirpstack-EU
description	description	alarmUserSwitch1
deviceModelName	deviceModelName	badConditionsCounter
name	name	bandwidth
value_deviceModelName	value_deviceModelName	batteryLevel
value_nodeType	value_nodeType	bitsPerSecond
value_peopleCounter_in	value_peopleCounter_in	dataRate
value_peopleCounter_out	value_peopleCounter_out	dataRateAdaptive
value_peopleCounter_tot	value_peopleCounter_tot	description
null	null	deviceModelName
null	null	door
null	null	encodedData

Figure 12 Some IoT nodes selected and then "Apply" was clicked to get available time series field in the preview window.

In the query Chart there are some optional parameters that can be set that are very important to correctly set to retrieve the expected data. These are:

- Time period: Defines the time period of data to extract.
- Resolution: Defines resolution of the data to achieve. The amount of data that can be retrieved is currently limited by Yggio to 1000 data points per time series field.
 - Resolutions of every hour, every day, every week, every month and every quarter do exactly what they say and get one data point per time series corresponding to the selected resolution.
 - Full resolution: Will take every data point. If high frequency reporting node or long time period the 1000 data point limit will limit the time period over which one gets data.

- High resolution: Will after a certain minimum distance between the data points are exceeded, if available, try to retrieve the maximum 1000 data points for the given time period.
- Low resolution: Compared with high resolution has longer minimum distance between data points and once that is exceeded, if available, try to retrieve the maximum 1000 data points for the given time period.
- Enable calculation of utilization by via extra date columns: This feature adds extra columns that group the retrieved data in hour of day, day of week, week no, etc. This simplifies the complexity of making reports based on grouped data significantly.
- Value Function: Determines what calculation to apply between data points given by the resolution. Available calculations over data points in the given resolution:
 - Mean: Calculate the average value.
 - Min: Returns the minimum value.
 - Max: Returns the maximum value.
 - First: Returns the first value.
 - Last: Returns the last value.
 - Count: Count the number of data points.
 - Sum: Summarize the value of all the data points.
 - Difference: Calculate the difference between the value in the last data point and the first data point.

Time period (priority over from/to dates) (optional)

From date and time of day (optional)

To date and time of day (optional)

Resolution (optional)

Enable calculation of utilization via extra date c... (optional)

Enable calculation of Delta for IMB-Individual mea... (optional)

Figure 13 Available optional parameters in Chart query

To create a billing metering report, or in Swedish an “IMD – Individuell mätning och debitering” report it is recommended to use the following settings:

- Time period: Last 3 months.
- Resolution: Every day
- Extra date columns: True
- Value function: Difference

Then one just summarize the delta values per month through Power BI’s standard transform and report functions.

Chart Energy Efficiency

Most advanced feature is the Chart Energy Efficiency that will calculate an energy efficiency KPI based on the following formula:

- $\text{Energy used per time unit} / (\text{Area} \times (1 + \text{Abs}(\text{avg. indoor} - \text{outdoor temp})))$

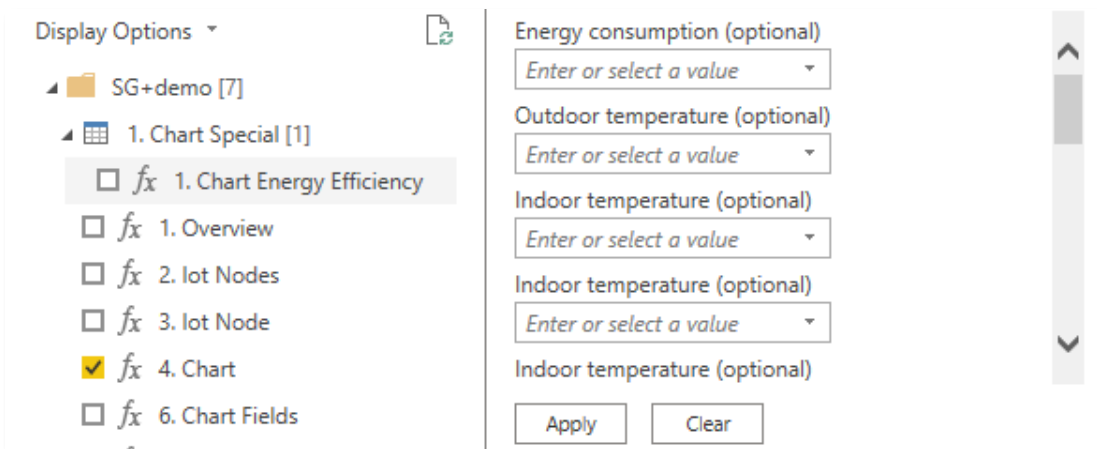


Figure 14 Calculate a buildings energy efficiency just by measuring a few parameters

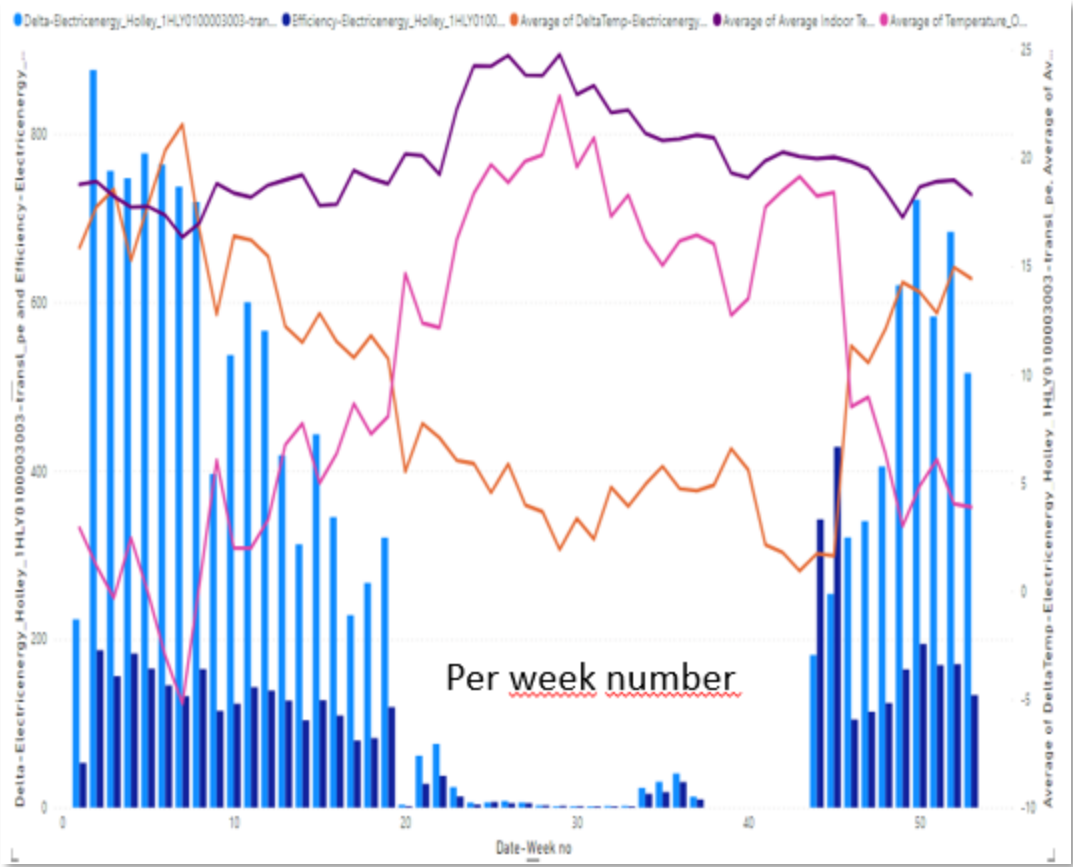


Figure 15 Energy efficiency (dark blue) for a building grouped per week during a year

An example of a resulting chart after using an energy efficiency query is available in the above image grouped per week. Then if one had changed windows or exchanged to a more efficient heating system or take some other action to improve the building the dark blue bars for the energy efficiency KPI should become lower.

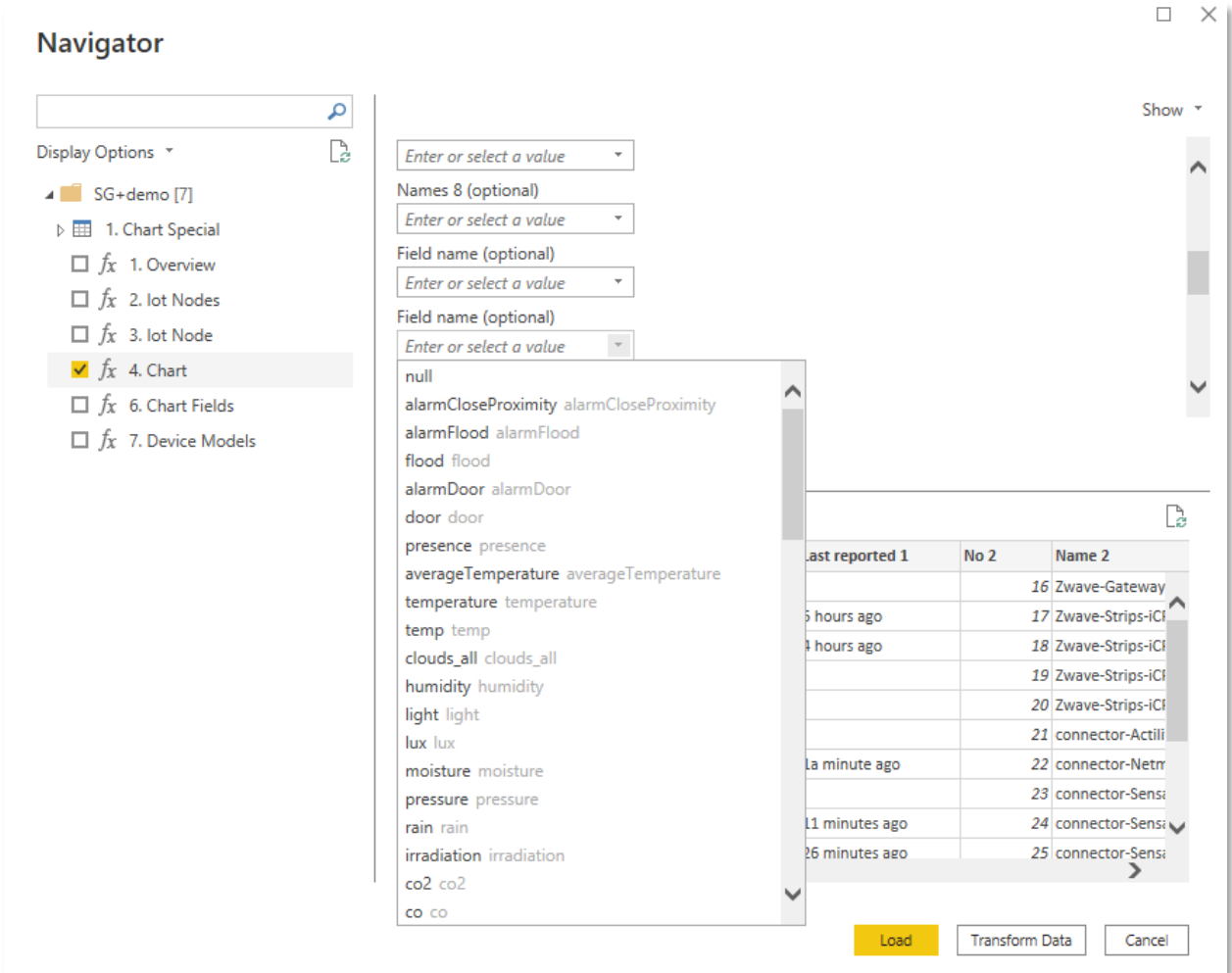


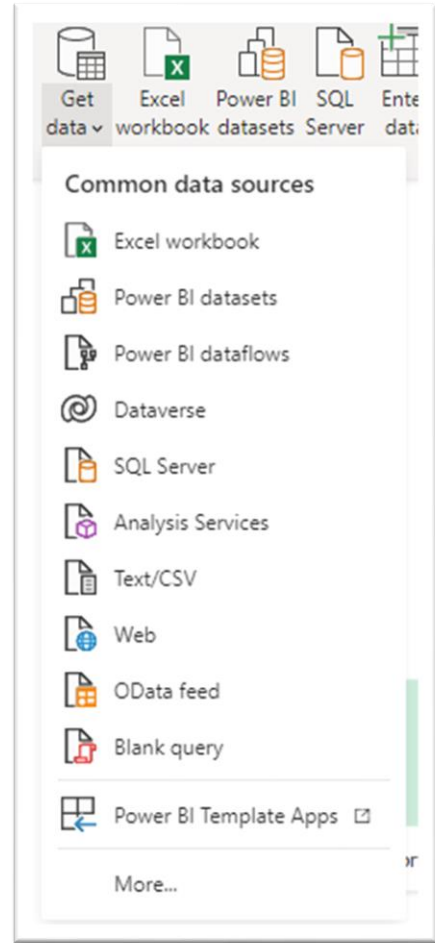
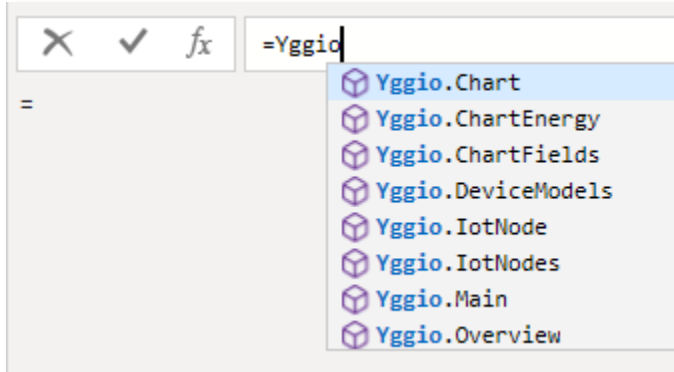
Figure 16 Available pre-defined time series fields. Grouped per area of use case. Chart query is marked and ready to load.

The data will get loaded into Power BI for analysis and creating reports after one marked the checkbox next to a query and clicked "Load".

3.2. The formula bar

The formula bar is reached from the Power BI UI by clicking the small arrow down just below “Get Data” and then select “Blank query”. After doing that a new Power Query editor window will open and the cursor will be placed in the formula bar.

Start by typing “=Yggio” and the following drop down will get visible.



Now one can just select one the queries and then push return and the formula bar UI, documentation and the full syntax for the selected query will get visible. The different queries have different syntax and different required parameters but are structured in the same style so one will get used to them pretty fast.

The query called Yggio.Main is the Navigator UI specification and there is no purpose to use it directly from the formula bar.

The first parameters in all queries are the Yggio DiMS server. In some queries one can enter more parameters into the first step in the UI but is always ok to just enter the desired server plus credential tag and then click invoke.

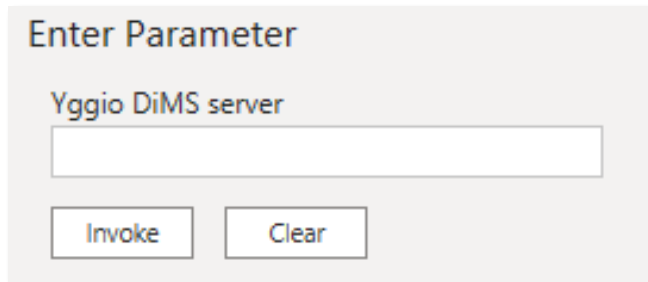


Figure 17 Enter Yggio DiMS with or without a credential tag. Like "BY+mydemo". After clicking "Invoke" if the tag is new the username and password dialogue will pop-up.

✕ ✓ fx = Yggio.DeviceModels

Device Model decoders

List the core device models with decoder support

Enter Parameter

Yggio DiMS server

function (access as text) as table

Example: List available core device model decoders

Usage:

```
Yggio.DeviceModels ("Y3B+User")
```

Output:

```
#table({"Device Models"},{
    {"Strips M +Drip"},
    {"Strips M +Guard"},
    {"Strips M +Comfort"},
    {"Strips M +Presence"}
    .....
})
```

Figure 18 The command to list available device model decoders (translators) available in an Yggio server. The documentation is extensive and show exact syntax of each query.

After clicking invoke and enter the credentials Power BI will log in to the Yggio account and new UI to fill remaining parameters will get visible with all available nodes pre-populated into the dropdown boxes to select node names.

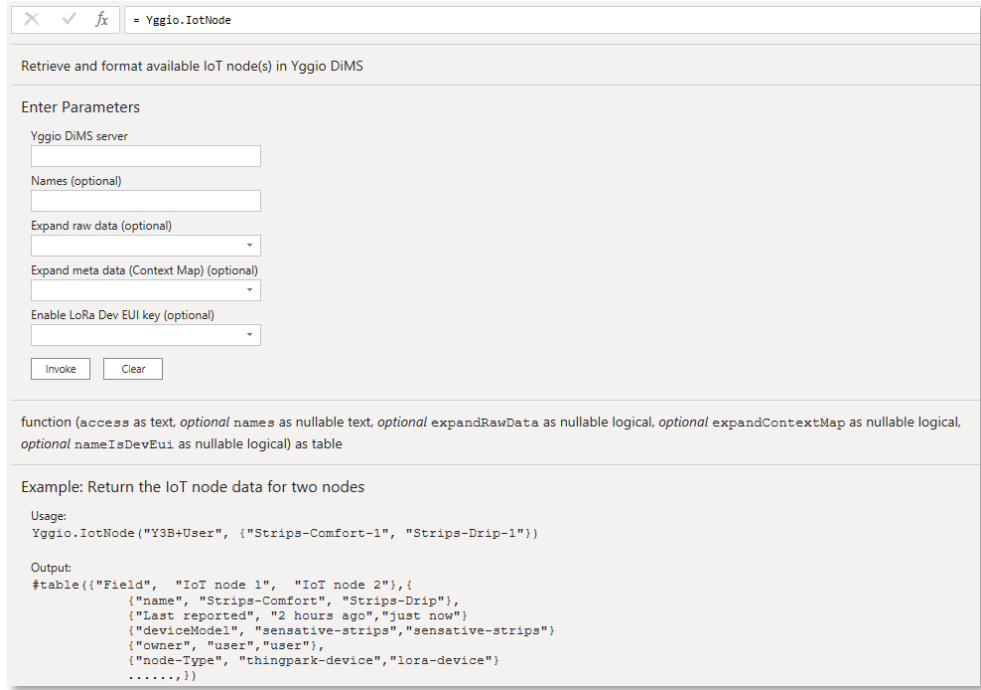


Figure 19 UI to retrieve one or several IoT nodes for comparison.

By entering a list of devices in "Names" a lot of devices can get retrieved.

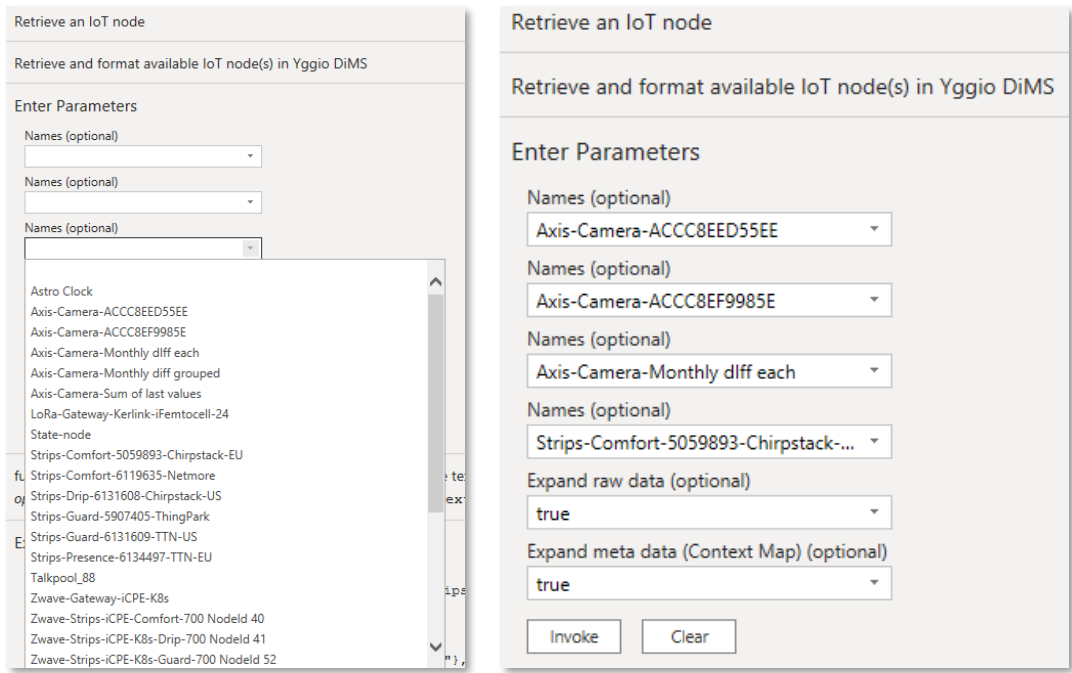


Figure 20 Step 2 in the UI to select what IoT-nodes to compare.

In 2nd step depending on query selected one might choose to expand nested JSON structures in Yggio data like the raw data and the Context Map (MetaData). After clicking “invoke” one more time the data will get loaded into the Power Query editor and one might do further transformations of the data set before selecting “Close and apply” and start creating a report.

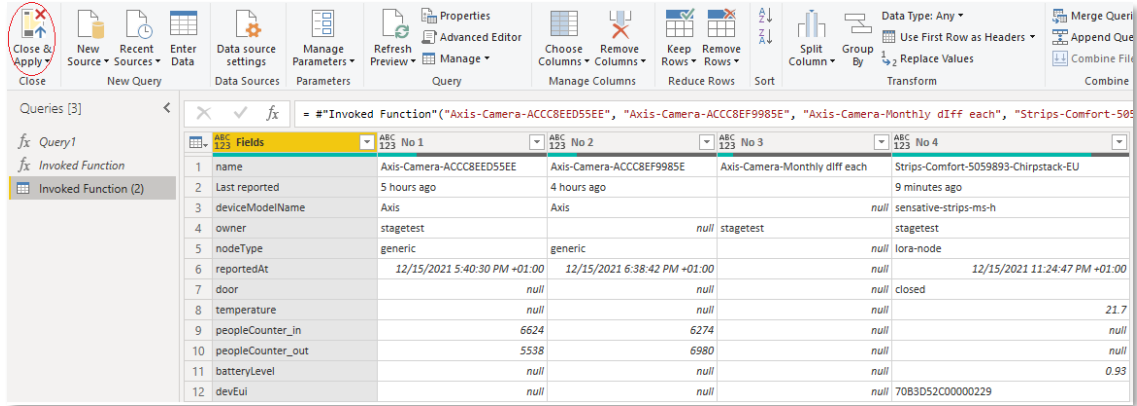


Figure 21 The resulting data set of the query loaded into the Power Query editor.

The same principle applies for all the other available queries. The big benefit with using the formula bar and its UI to extract data vs the Navigator is that when using the query Yggio.Chart or Yggio.ChartEnergy the available time series fields per node name get pre-populated for the first 3 out of 8 nodes. The 4th field is still the pre-defined time series fields to increase flexibility of what data to retrieve for the last 5 nodes.

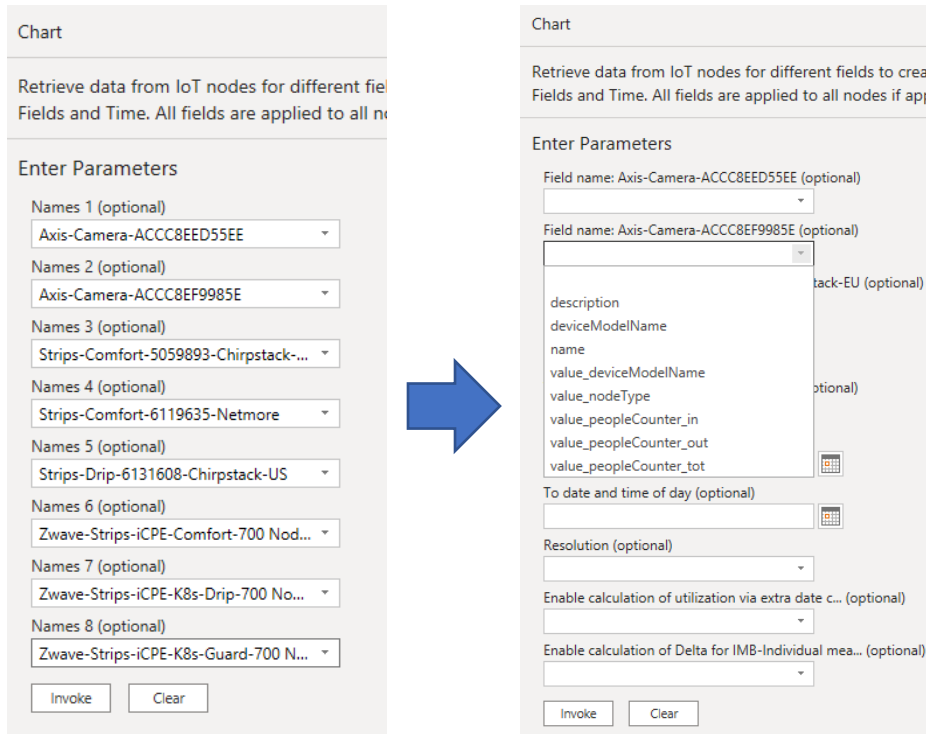


Figure 22 After selecting nodes in chart available times series field per nodes will get pre-populated after clicking “Invoke”

3.3. Directly enter full query in formula bar

Except automating the Yggio Power Connector from PowerQuery the main reason to enter the full query directly in the formula bar is to avoid limitations in number of node names and time series fields that can be retrieved.

The parameters to enter node names and fields names supports list of parameters {"par1", "par2", "par3", ...} that enables one to go beyond the limitations imposed by the UI. Power BI is providing some syntax support when writing the parameters which helps out a lot to get it right.

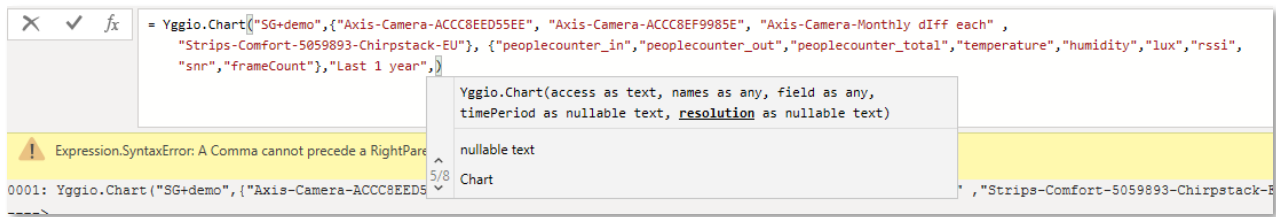
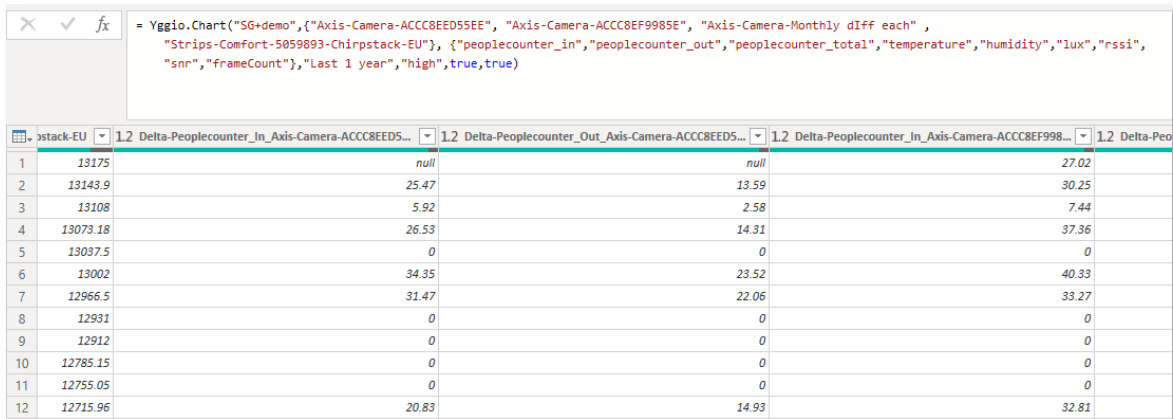


Figure 23 Writing full query directly in formula bar that cannot be done through the UI since retrieves 9 different time series fields. Requires one know what node names and time series fields to retrieve.



	1.2 Delta-Peoplecounter_In_Axis-Camera-ACCC8EED55EE	1.2 Delta-Peoplecounter_Out_Axis-Camera-ACCC8EED55EE	1.2 Delta-Peoplecounter_In_Axis-Camera-ACCC8EF9985E	1.2 Delta-Peoplecounter_Out_Axis-Camera-ACCC8EF9985E
1	13175	null		27.02
2	13143.9	25.47	13.59	30.25
3	13108	5.92	2.58	7.44
4	13073.18	26.53	14.31	37.36
5	13037.5	0	0	0
6	13002	34.35	23.52	40.33
7	12966.5	31.47	22.06	33.27
8	12931	0	0	0
9	12912	0	0	0
10	12785.15	0	0	0
11	12755.05	0	0	0
12	12715.96	20.83	14.93	32.81

Figure 24 Result of full query above. Since the connector is "forgiving" even if one do some typo one will get some result.

4. Some Power BI hints and sample graphical reports

Once a data set has been retrieved it is time to create the report. If still in the Power Query editor click top left corner "Close and Apply" and the full queries will get loaded into the Power BI data set, then click on to the report editor to the top left.

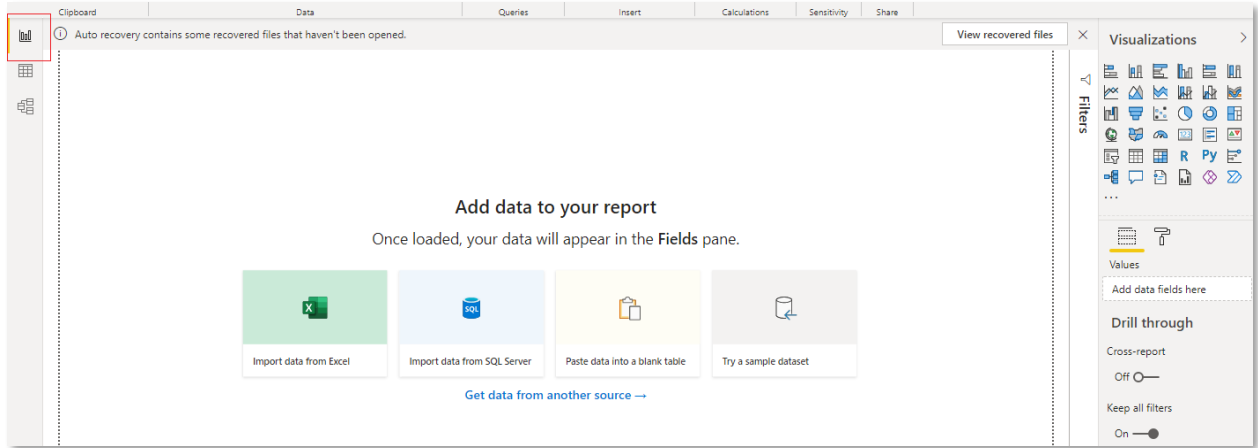


Figure 25 Start the report editor by clicking on the graph icon on the top left.

The most important thing to do at first is to change the data type of the datetime column from “datetime” to “time”. If not doing this Power BI will try to group all the data and most graph widgets will not work as they should.

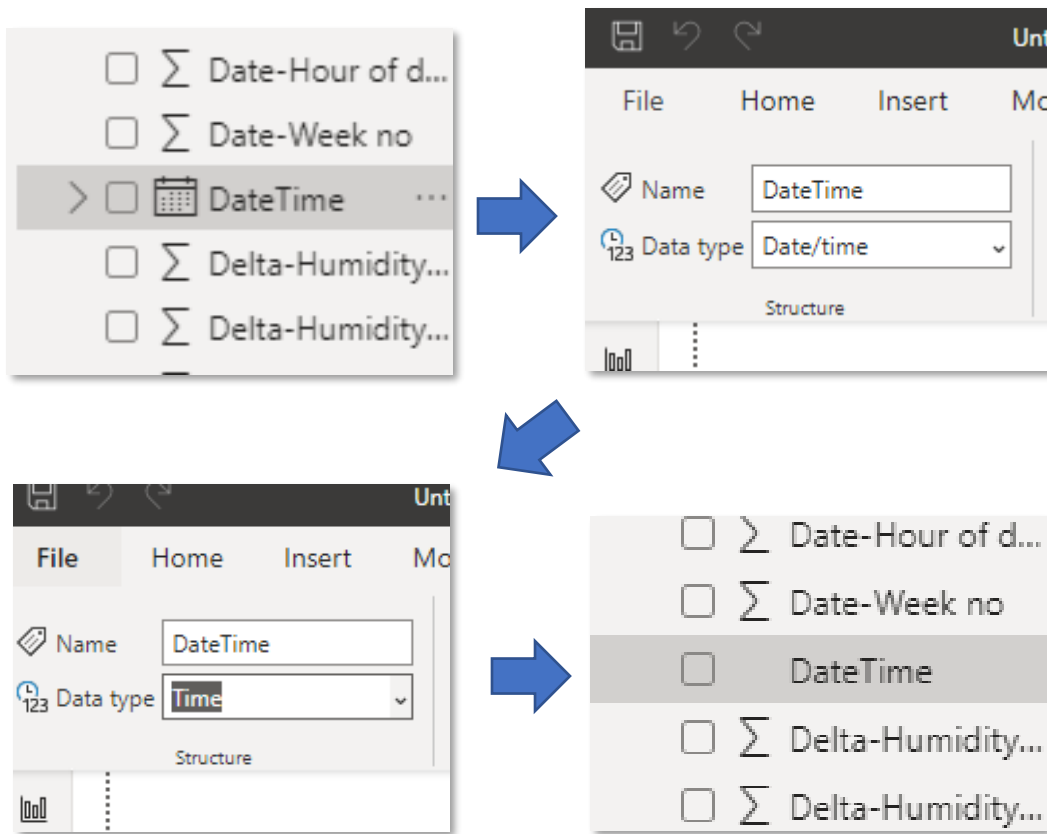


Figure 26 Change the data type of the datetime column

The recommendation then is to start with basic chart widgets like Line chart, Column chart and Pie chart and start experimenting by drag and drop time and data fields to their respective corresponding fields. On each widget one can usually select if one should summarize the values that ends up same group, do average or some other calculation on them. What to choose totally depends on what one is interested into visualize.

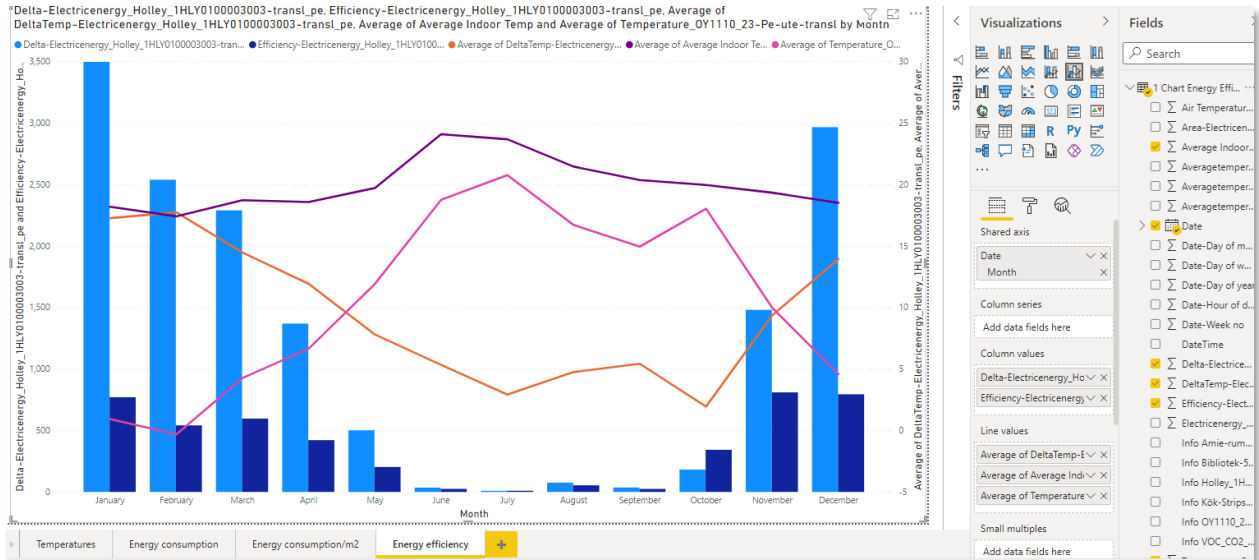


Figure 27 How to make an energy efficiency KPI graph

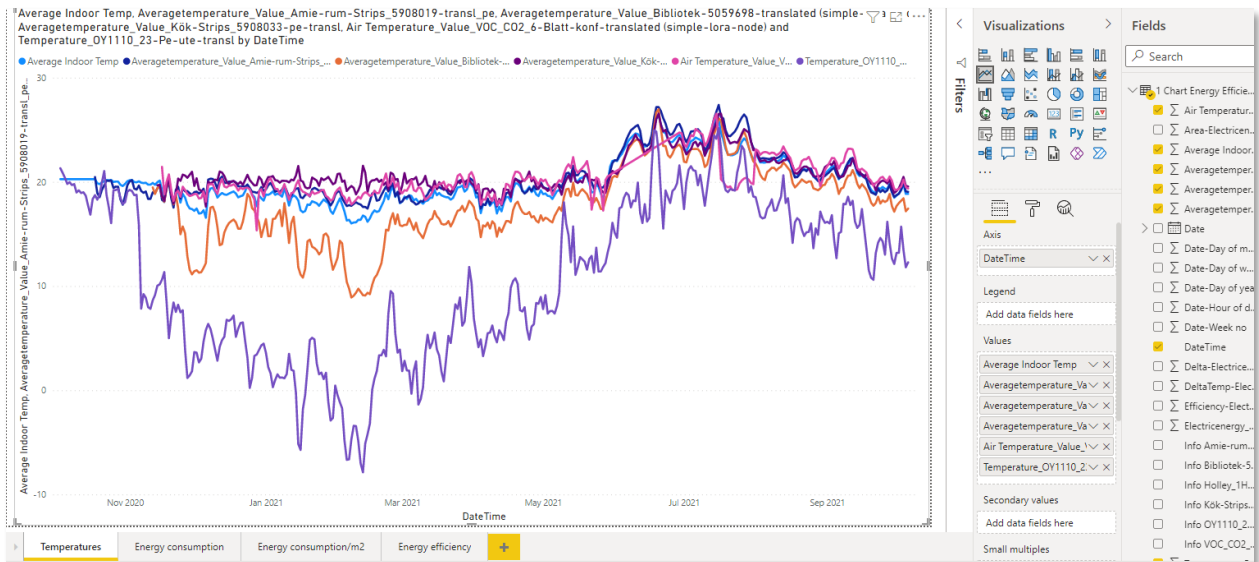


Figure 28 How to make a chart that compare indoor temps, average indoor temps vs outdoor temp by using Yggio.ChartEnergy

name	Last reported	value_humidity_value	value_main_temp	value_main_humidity	connector_name
AXIS-Camera-People-Counter-1	8 days ago				
AXIS-Camera-People-Counter-2	8 days ago				
BOX2_Electric_meter_1	just now				
BOX2_Electric_meter_2	just now				
BOX2_Engine_Flow1	just now				
BOX2_Pressure_Tank	just now				
BOX2_Temp_Meter	just now				
ICPE-Zwave-Gateway	1.2 months ago				
NEW-YORK-Weather	8 days ago	19.46	82		
NKE-Watteco-SmartPlug-81AF	1.5 months ago				Yggio Beta LoRa-connector (chirpstack)
OY1110_23-ute-Pe	13 minutes ago				Yggio Beta LoRa-connector (chirpstack)
State - Water guard					
Strippa-Watervalve-No2045006531	2 minutes ago				Yggio Beta LoRa-connector (chirpstack)
Strips-LoRa-Comfort-1	1a minute ago				Yggio Beta LoRa-connector (chirpstack)
Strips-LoRa-Comfort-2	7 minutes ago				Yggio Beta LoRa-connector (chirpstack)
Strips-LoRa-Drip-1	9 minutes ago				Yggio Beta LoRa-connector (chirpstack)
Strips-LoRa-Drip-1-translated (simple-lora-node)	9 minutes ago				
Strips-LoRa-MSH-1-translated (simple-lora-node)	1a minute ago	72.5			
Strips-Zwave-Drip-9	9 hours ago				ICPE-Zwave-Gateway
Strips-Zwave-Guard-11	9 hours ago				ICPE-Zwave-Gateway
T2					
T-Smart Color Button - Zwave 14	2 months ago				Yggio Beta LoRa-connector (chirpstack)
T-Strippa-Watervalve-No2045006531-translated (simple-lora-node)	2 minutes ago				ICPE-Zwave-Gateway
T-Strips-LoRa-Drip-1-translated (Real-estate-core-compatible-device)	9 minutes ago				
T-Strips-LoRa-MSH-1-translated (fiware-device)	1a minute ago				
T-Strips-Zwave-Drip-9-translated (SimpleDevice)	9 hours ago				
TTN LoRa Strips Water Leak	6 minutes ago				
Universal-access-Elsys-ERS-Sound	just now				Yggio Beta LoRa-connector (chirpstack)
Universal-access-Elsys-ERS-Sound-translated (simple-lora-node)	just now				
Utb_universal_access-1					
Utb_universal_access-2					Yggio Beta LoRa-connector (chirpstack)
UTB1					
UTB2					
Utb2-1	7 minutes ago	40			

Figure 29 How to make an IoT node status over view report with Yggio.IoTnodes query

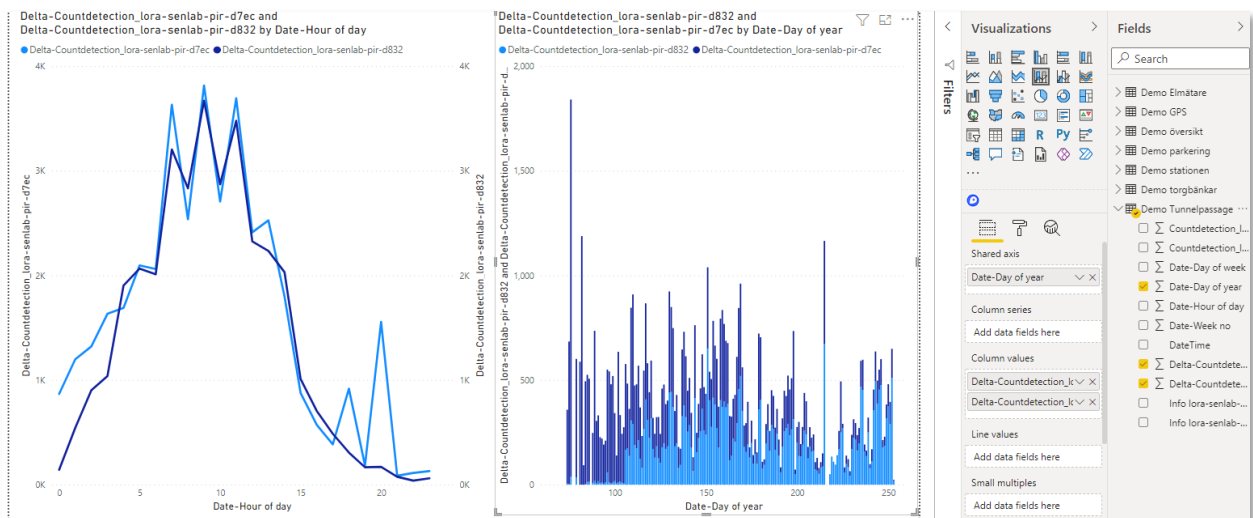


Figure 30 How to make distribution of assets od day of year and hour of day (to get left graph just replace "Day of year" with "Hour of day" value)

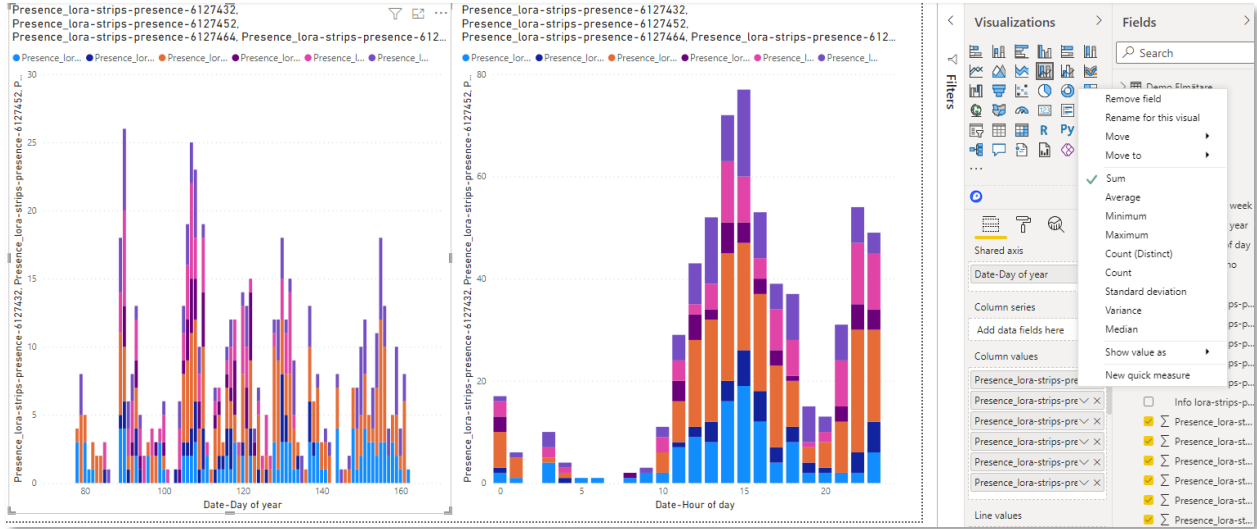


Figure 31 Another example of distribution of assets. These are Strips Presence that is not just counting up and instead turn "occupancy" on and off so no need to use delta calculation and instead just "Summary" calculation directly on the values.

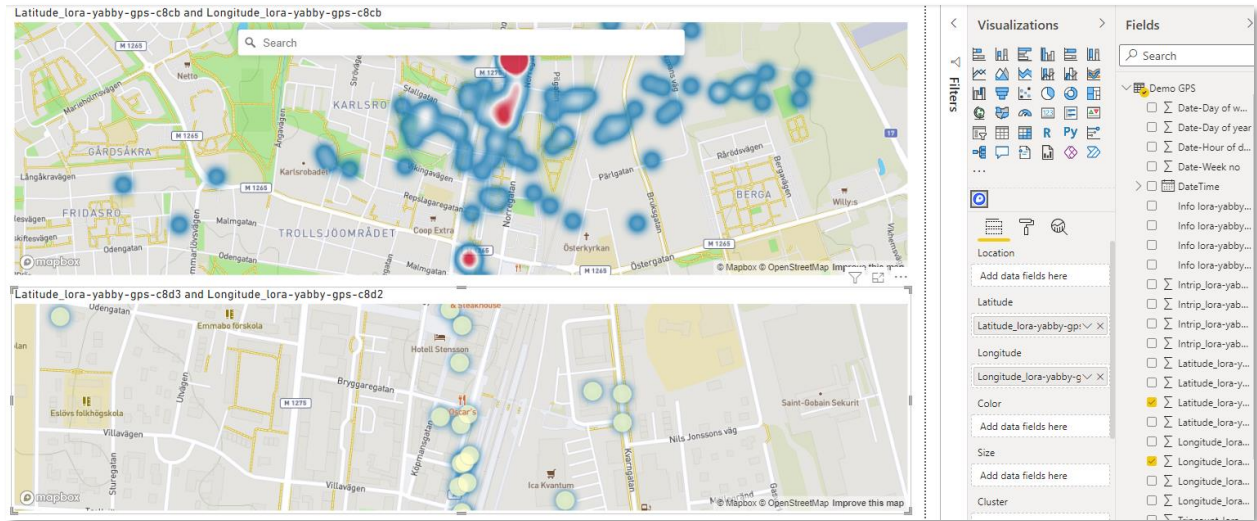


Figure 32 By using a 3rd party downloadable widget called MapBox and populate it with GPS data heat maps can be created. Other widgets support movement tracking of assets.