Interface Specification Document

NET2GRID EnergyAI™ Output File Specification

Document Version: 2026-1

NET2GRID

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REVISION HISTORY

2023-1	Initial revision containing all NILM reports that can be generated in a NET2GRID EnergyAI™ along with their requirements and specifications.	2023-06-16
2023-2	Added description on the processDates of Disaggregation Categories report that was missing. Refined the chargingType returned values in the DER Detection Report	2023-08-08
2024-1	Removed notification messages from DER Detection, PV Candidate Sizing and BESS Candidate Sizing reports. Added new supported error code in disaggregation categories report. Minor refinements in the description of Solar Production Metrics and Insights Reports	2024-01-12
2024-2	Introduction of the EV confidence score instead of the binary EV detection status in DER EV detection.	2024-02-12
2024-3	Updated the NILM Status Report specifications for LR installations. Updated the Disaggregation Categories Report specifications with new date fields and by defining the "year" and "month" fields as optional. Added HVAC as a new detection service in the DER report.	2024-04-18
2024-4	DER's *SolarPanelDetectionObject* object was updated to include the *solarProductionGranularity* field. Moreover, *hourlyProductionPerDay* field was renamed to *solarProductionPerDay*	2024-10-31
2025-1	Added the specifications of the weekly reports	2025-01-09
2025-2	Changed Recommendations Reports sections	2025-02-11
2025-3	Added Suggested Profile Correction Report	2025-03-26

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2025-4	Added Manual Meter Reading Disaggregation Categories Report Updated SuggestedProfileCorrection report	2025-05-05
2025-5	Support Appliance Events Report in LR measurements	2025-06-03
2025-6	Update the example of the DER Report to correctly match the schema Air-condition is a Non Time Based appliance in the NILM Status Report Updated the description of the contents of the NILM Status Report Update Gas Disaggregation comment to note that the output unit of measure is the with the input unit of measure	2025-10-10
2026-1	Updated report paths at the DER Detection Report Updated peakTime specs in solar production metrics report	2025-12-29

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Introduction

The scope of this document is to specify the interface according to which NET2GRID EnergyAI™ will provide the Customer Intelligence export files to the customer.
Each report type has their own specification and requirements in order to be generated that is described in detail in the specifications section. The export process though is the same for every type of report that is generated by NET2GRID EnergyAI™.

The export process

The export process consists of the following steps:

1. Based on the report's specifications and if requirements are met, a report is generated from NET2GRID EnergyAI™ and gets stored in the AWS S3 export bucket that has been created for the customer
2. A message is published to the relevant AWS SQS queue that can be used as a trigger for the customer to consume the produced report containing the location and the metadata that are relevant for the produced report

The AWS SQS queues will contain the messages that will be published for each exported report, containing the information that is necessary for retrieval of the file and the identification of the end-user and installation that it is mapped to. Thus, customers will be able to consume those messages, in a synchronous or asynchronous manner, based on their needs.

Resource access management

NET2GRID is responsible for setting up the infrastructure and managing the access to the report files that are generated by NET2GRID EnergyAI™. The following information will be provided to the customer to get access to the reports:

1. The S3 export bucket name
2. AWS IAM credentials with permission to access the resources inside the relevant directory in S3 export bucket and the SQS queues
3. The SQS queues names

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All reports inside the S3 export bucket are organized in directories per labelpartner. The credentials that are provided to the customer by NET2GRID are specific to the directory of one specific labelpartner to ensure the Least Privilege security policy is applied. In the NET2GRID EnergyAI™ platform implementations where a single labelpartner is applicable then all the resources will exist under this single labelpartner identifier.

Directory structure

As mentioned earlier the S3 export bucket for Customer Intelligence reports is organized per labelpartner and follows the following file structure:
s3://<exportBucket>/<labelpartner>/<reportPathAndFilename>

where

- exportBucket = The name of the AWS S3 bucket that contains all the reports
- labelpartner = The identifier of the labelpartner
- reportPathAndFilename = the path and filename of the generated report differs per report type. In the Interface Specifications section below with details per report type this field is described in detail.

Interface specifications

The following table contains the list of reports that are supported in NET2GRID EnergyAI™ along with their reported frequency and a short description. Each of the supported interfaces is described in detail in its relevant section of Interface specifications.

Report Type	Reported Frequency	Description	Data resolution
Monthly Disaggregation Categories	Daily	Per-activity breakdown of total electricity consumption for the installation on a specific month.	Low and High Resolution

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Weekly Disaggregation Categories	Weekly	Per-activity breakdown of total electricity consumption for the installation on a specific week.	Low and High Resolution
Solar Production Metrics	Daily	Solar production breakdown for the installation on a specific day.	Low and High Resolution
Monthly Insights	Monthly	A comparative overview of the installation's overall and activity consumption on a specific month.	Low and High Resolution
Weekly Insights	Weekly	A comparative overview of the installation's overall and activity consumption on a specific week.	Low and High Resolution
Monthly Recommendations	Monthly	A set of energy savings recommendations relative to the installation on a specific month.	Low and High Resolution
Weekly Recommendations	Weekly	A set of energy savings recommendations relative to the installation on a specific week.	Low and High Resolution
Appliance Events	Daily	Appliance level breakdown of total electricity consumption for the installation on a specific day.	High Resolution
Appliance Efficiencies	Monthly	It contains information on the efficiency of specific appliances within an installation.	High Resolution
NILM Status Report	Daily	It contains information about the results of training phases and planned retrainings for an installation.	Low and High Resolution
Suggested Profile Correction	15th day of a month	It contains the detection of assets such as Photovoltaics, Electric Vehicles and HVAC in installations that have undeclared the corresponding information in the user profiles.	Low and High Resolution

Manual Meter Reading	Every time a manual meter measure ment is retrieved.	Per-activity breakdown of total electricity consumption for the installation between two points of electricity data availability.	Low Resolution
DER Detection	Ad-hoc	It contains detection of assets such as PVs, BESS units, EVs and HVAC in the installation.	Low and High Resolution
PV Candidate Sizing	Ad-hoc	It contains recommendation on the sizing for solar panels for the installation	Low and High Resolution
BESS Candidate Sizing	Ad-hoc	It contains recommendation on the sizing for BESS for the installation	Low and High Resolution

Monthly Disaggregation Categories Report

These reports correspond to a per-activity breakdown of total electricity consumption for each end-user and for each month. For example, 'customer X's electricity usage in November 2020 consisted of 70% space heating, 20% cooking, and 10% lighting'. The activity breakdowns in this report are provided as a daily updated batch for each month under examination. This means that the report's progress is updated daily with the detected appliance events of the examined day.

Electricity consumption will be broken down into the 12 activities presented in the following figure along with the appliances comprising each one. It should be noted that all the appliances that cannot be part of specific activities are placed under the Other category.

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Categories	Appliances		
Always-ON/Standby			
Refrigeration	Refrigerator	Freezer	Combo
Laundry	Washing Machine	Dishwasher	Tumble Dryer
Cooking	Oven	Hob	
Electric Vehicle	EV Charging		
Pool & Sauna			
Lighting			
Entertainment			
Space Heating	Airco	Heat Pump	
Other			
Water Heating	Electric Shower	Immersion Heater	Water Boiler
PV Production			

NET2GRID's algorithms determine the activity breakdown by utilizing standard consumption proportions and then refining that for individual customers based on identified activity usage events, as well as customer, building, and appliance ownership metadata.

The table below lists the identifiers of each disaggregation category along with some metadata:

Table: Activities (Disaggregation Categories) Supported

Activity Identifier	Description	Electricity
alwaysOn	Always On	Electricity Consumption
refrigeration	Refrigeration	Electricity Consumption
spaceHeating	Space Heating	Electricity & Gas Consumption

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waterHeating	Water Heating	Electricity & Gas Consumption
cooking	Cooking	Electricity & Gas Consumption
laundry	Laundry	Electricity Consumption
lighting	Lighting	Electricity Consumption
entertainment	Entertainment	Electricity Consumption
electricVehicle	Electric Vehicle	Electricity Consumption
poolOrSauna	Pool & Sauna	Electricity Consumption
other	Other	Electricity & Gas Consumption
solar	PV Production	Electricity Production

Requirements

Conditions for report to be generated

Disaggregation Categories reports are generated daily if new measurement data becomes available for the installation and month under examination.

Data resolution Requirements

Can be generated when either high resolution energy and power data or low resolution energy data are available for the installation.

Installation Profile Impact

Our disaggregation results are highly dependent on the profile information provided by the end-user. This information allows us to achieve more accurate disaggregation results and also offer more personalized services such as insights and recommendations. However, there are cases that the end-user does not fill in all the necessary information for his profile, or he may postpone it for a later time, or the customer is not able to provide this information for the end-user at all. In cases when no profile information is or can be provided, NET2GRID is able to

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proceed with generating Disaggregation Categories reports using the Default Installation Profile scheme that is described below.

Default installation profile

There is a mechanism that allows for a Default Installation Profile scheme to kick in and fill in all the missing installation demographics and appliance attributes that are not provided from the end-user. This default profile is specific per label partner, meaning that the same values will be filled for all end-users that belong to this labelpartner and have not provided their installation profile. For example, if "photovoltaic=False", then for all end-users that have not filled this option, it will be assumed that there are no solar panels installed. This of course leads to less personalization.

Specifications

Location

The disaggregation categories reports are generated under the S3 export bucket for Customer Intelligence reports following the following format:

s3://<exportBucket>/<labelpartner>/reports/<installationIdentifier>/<serviceType>/disaggregation-categories/<filename>

where

- exportBucket = The name of the AWS S3 bucket that contains all the reports
- labelpartner = The identifier of the labelpartner
- installationIdentifier = The external installation identifier that was provided by the customer during end-user provisioning. It is a unique identifier of a specific household of an end-user.
- serviceType = The measurement resolution that has been used to generate the report. Can be:
    - "SM" when low resolution data energy data were available or
    - "RT" when high resolution energy and power data were available

- filename = the filename of the generated report in the following format

  <internalInstallationIdentifier>_<reportDate>_disaggregation_categories.json

  where
  - internalInstallationIdentifier = the installation identifier used internally in NET2GRID EnergyAI™
  - reportDate = the day in YYYYMMDD format until which the report was generated for (the last full day for which data were available)

Report Format

The Disaggregation Categories Report is defined in JSON format.

The JSON report contains the following fields

Field	Type	Description
year	integer	(optional) The year under examination of the report. It is provided in monthly disaggregation categories report when the serviceType=SM/RT and the billing period functionality is not enabled.
month	integer	(optional) The month under examination of the report. It is provided in monthly disaggregation categories report when the serviceType is SM or RT and the billing period functionality is not enabled.
periodStartDate	string	The start date of the period against which the report is generated, in YYYYMMDD format in the local timezone of the installation.
periodEndDate	string	The end date for the period against which the report is generated, in YYYYMMDD format in the local timezone of the installation.
reportingDate	string	The last date within the reporting period, when measurement data was available, in YYYYMMDD format in the local timezone of the installation.

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error	string	The reported error for the report, in a string format. The applicable values are described in the table below
timestamp	long	The timestamp that the message was produced and published, in UNIX Timestamp in milliseconds
serviceType	string	The measurement feed that was used in order to produce the report. The allowed values are: • "SM" or "AMR" in case of low resolution energy measurement data • "RT" in case of high resolution power and energy measurement data
version	string	The version of the service that the report corresponds to, i.e. "2.3"
electricityConsumption	object	The electricity consumption disaggregation object as described in the table below
gasConsumption	object	The gas consumption disaggregation object as described in the table below
electricityProduction	object	The electricity production disaggregation object as described in the table below
alwaysOnConsumption	object	The always-on consumption disaggregation object as described in the table below
processDates	object	(optional) The object containing the "lastProcessCommodityDate" object as described in the lastProcessCommodityDate table below. This object is returned only in case the serviceType=SM.

The error codes applicable to the Disaggregation Report are described in the table below:

Error Code	Message	Report	Description

		Provided	
null	-	true	No error during the reporting process
30001	Incomplete Profile for Disaggregation Categories Report	true	There are essential fields of the profile that are not filled correctly or at all.
30002	Erroneous Profile Info	false	There are filled values in the profile that are excessive or inconsistent.
30003	No Current Period Disaggregation Document Available	false	There are no measurements from the installation under examination from the current month
30004	Excessive Value on Disaggregation Document	false	The total energy consumption value for the month/billing period is (erroneously) excessively high.
30005	Negative Value on Disaggregation Document	false	The total energy consumption value for the month/billing period is negative.
30006	No Measurements Available	false	The reporting day measurements are not available.
30007	Insufficient Data Measurements	false	The reporting day measurements are not sufficient for a consumption disaggregation analysis.
30008	No billing period detected	true	The reporting date does not belong to a billing period even if the billing period functionality is enabled in the platform.
30009	Non-increasing measurement values.	false	The measurement values are non-increasing, resulting in negative electricity consumption.
30010	Missing Secondary Meter Measurements	true	The installation does not have secondary meter measurements even if this functionality is enabled and measurements are expected.

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The electricityConsumption object contains the electricity consumption for the reporting period in kWh in the form of the fields described in the table below:

Field	Type	Description
alwaysOn	float	The electricity consumption of the always-on category
refrigeration	float	The electricity consumption of the refrigeration category
spaceHeating	float	The electricity consumption of the space heating category
waterHeating	float	The electricity consumption of the water heating category
cooking	float	The electricity consumption of the cooking category
laundry	float	The electricity consumption of the laundry category
lighting	float	The electricity consumption of the lighting category
entertainment	float	The electricity consumption of the entertainment category
electricVehicle	float	The electricity consumption of the electric vehicle category
poolOrSauna	float	The electricity consumption of the pool/sauna category in kWh
other	float	The electricity consumption of the other category
total	float	The total electricity consumption in kWh

The gasConsumption object contains the gas consumption for the reporting period in the input unit of the gas measurements in the form of the fields described in the table below:

Field	Type	Description
spaceHeating	float	The gas consumption of the space heating category
waterHeating	float	The gas consumption of the water heating category
cooking	float	The gas consumption of the cooking category

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total	float	The total gas consumption in the unit in which the gas data are measured from the energy meter.

The electricityProduction object contains the electricity production for the reporting period in kWh of the fields described in the table below:

Field	Type	Description
solar	float	The electricity production of solar category
total	float	The total electricity production in kWh

The alwaysOnConsumption object contains the always-on electricity consumption for the reporting period in kWh of the following fields:

Field	Type	Description
whitegoods	float	The always-on electricity consumption of the whitegoods category
cooking	float	The always-on electricity consumption of the cooking category
spaceHeatingAndCooling	float	The always-on electricity consumption of the space heating and cooling category
computersAndPeripherals	float	The always-on electricity consumption of the computers and peripherals category
homeEntertainment	float	The always-on electricity consumption of the home entertainment category
other	float	The always-on electricity consumption of the other category
total	float	The total always-on monthly electricity consumption in kWh

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The lastProcessCommodityDate object contains per metric the last day of data that was taken into account for the report to be generated. The following metrics can be found as fields in the object:

Field	Type	Description
csd	string	(optional) The last date that electricity summation was available when the report was generated in a String YYYYMMDD format
csr	string	(optional) The last date that electricity production was available when the report was generated in a String YYYYMMDD format
gas	string	(optional) The last date that gas production was available when the report was generated in a String YYYYMMDD format

Example file

A Disaggregation Categories report would be generated in a location like:
s3://s3-export-ABC/labelpartnerB/reports/installationX/SM/disaggregation-categories/abc123456_20230105_disaggregation_categories.json

The contents would be similar to the below example:


```
{
   "year": 2023,
   "month": 1,
   "error": "null",
   "timestamp": 1673109098233,
   "periodStartDate": "20230101",
   "periodEndDate": "20230131",
   "reportingDate": "20230105",
   "serviceType": "AMR",
   "version": "2.3",
   "electricityConsumption":
   {
      "alwaysOn": 1.75783,
```

```
    "refrigeration": 1.40626,
    "spaceHeating": 0.0,
    "waterHeating": 0.0,
    "cooking": 0.52733,
    "laundry": 1.14259,
    "lighting": 0.70313,
    "entertainment": 0.96679,
    "electricVehicle": 0.0,
    "poolOrSauna": 0.0,
    "other": 0.79101,
    "total": 7.295
  },
  "gasConsumption":
  {
    "spaceHeating": 2.90705,
    "waterHeating": 0.24593,
    "cooking": 0.0,
    "total": 3.153
  },
  "electricityProduction":
  {
    "solar": 0.87199,
    "total": 0.87199
  },
  "alwaysOnConsumption":
  {
    "whitegoods": 0.10018,
    "cooking": 0.11249,
    "spaceHeatingAndCooling": 0.04921,
    "computersAndPeripherals": 0.69257,
    "homeEntertainment": 0.71016,
    "other": 0.09316,
    "total": 1.75783
```

```
    },
    "processDates":
    {
      "lastProcessCommodityDate":
      {
        "csd": "20230105",
        "csr": "20230105",
        "gas": "20230105"
      }
    }
}
```


Notification message & queue

The queue that will be used to publish messages when a Disaggregation Categories report is generated by NET2GRID EnergyAI™ Platform will be communicated to the customer by NET2GRID.

This queue is available only for EnergyAI™ Platforms that don't have CE-API enabled.

Usually the name of the queue will be like:

disaggregation_categories_<labelpartner>

The message that will be published will be in JSON format contain the following fields:

Field	Type	Description
bucket	string	The name of the bucket that contains the report
filename	string	The filename (full path) of the file that was generated

An example of such a message is shown below:


```
{
        "bucket": "s3-export-customerA",
        "filename":
```

"/labelpartnerB/reports/installationX/SM/disaggregation-categories/abc123456_20230105_disaggregation_categories.json"
}

Each message will contain an attribute named “routingKey” of type String that will contain the <installation identifier>.disaggregation_categories as value.

Weekly Disaggregation Categories Report

This report has the same specifications as the Monthly Disaggregation Categories Report, but its scope is to show the disaggregation on a weekly level.

Requirements

Conditions for report to be generated

Weekly Disaggregation Categories reports are generated weekly on the 1st day of the week, meaning Monday and concern the previous week (Monday to Sunday). The exact day of the week for the generation of the weekly reports can be configured though based on data availability.

Note that the weekly reports will start to be generated after 7 days, when the Training Phase One is successfully completed.

Specifications

Location

The weekly disaggregation categories reports are generated under the S3 export bucket for Customer Intelligence reports following the following format:

s3://<exportBucket>/<labelpartner>/reports/<installationIdentifier>/<serviceType>/weekly-disaggregation-categories/<filename>

where

- exportBucket = The name of the AWS S3 bucket that contains all the reports
- labelpartner = The identifier of the labelpartner

- installationIdentifier = The external installation identifier that was provided by the customer during end-user provisioning. It is a unique identifier of a specific household of an end-user.
- serviceType = The measurement resolution that has been used to generate the report. Can be:
    - "SM" when low resolution data energy data were available or
    - "RT" when high resolution energy and power data were available
- filename = the filename of the generated report in the following format

    <internalInstallationIdentifier>_<reportWeek>_weekly_disaggregation_categories.json

    where
    - internalInstallationIdentifier = the installation identifier used internally in NET2GRID EnergyAI™
    - reportWeek = the report week, in xxxxWww format, for which the report was generated

Report Format

The Weekly Disaggregation Categories Report is defined in JSON format.
The JSON report contains the following fields

Field	Type	Description
week	string	The week under examination of the report in xxxxWww ISO-8601 format.
periodStartDate	string	The start date of the period against which the report is generated, in YYYYMMDD format in the local timezone of the installation.
periodEndDate	string	The end date for the period against which the report is generated, in YYYYMMDD format in the local timezone of the installation.
reportingDate	string	The last date within the reporting period, when measurement data was available, in YYYYMMDD format in the local timezone of the installation.

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error	string	The reported error for the report, in a string format. The applicable values are described in the table below
timestamp	long	The timestamp that the message was produced and published, in UNIX Timestamp in milliseconds
serviceType	string	(optional) The measurement feed that was used in order to produce the report. The allowed values are: • "SM" in case of low resolution energy measurement data • "RT" in case of high resolution power and energy measurement data This field is returned only in case of an EnergyAI™ Active platform.
version	string	The version of the service that the report corresponds to, i.e. "2.3"
electricityConsumption	object	(optional) The electricity consumption disaggregation object as described in the table above
gasConsumption	object	(optional) The gas consumption disaggregation object as described in the table above
electricityProduction	object	(optional) The electricity production disaggregation object as described in the table above
alwaysOnConsumption	object	(optional) The always-on consumption disaggregation object as described in the table above
processDates	object	(optional) The object containing the "lastProcessCommodityDate" object as described in the lastProcessCommodityDate table below. This object is returned only in case the serviceType=SM.

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The error codes applicable to the Weekly Disaggregation Report are described in the table below:

Error Code	Message	Report Provided	Description
null	-	true	No error during the reporting process
30001	Incomplete Profile for Disaggregation Categories Report	true	There are essential fields of the profile that are not filled correctly or at all.
30002	Erroneous Profile Info	false	There are filled values in the profile that are excessive or inconsistent.
30003	No Current Period Disaggregation Document Available	false	There are no measurements from the installation under examination from the current week
30004	Excessive Value on Disaggregation Document	false	The total energy consumption value for the week period is (erroneously) excessively high.
30005	Negative Value on Disaggregation Document	false	The total energy consumption value for the week period is negative.

Example file

A Weekly Disaggregation Categories report would be generated in a location like:
s3://s3-export-ABC/labelpartnerB/reports/installationX/SM/weekly-disaggregation-categories/abc123456_2023W32_weekly_disaggregation_categories.json

The contents would be similar to the below example:


```
{
  "week": "2023W32",
  "month": 1,
  "error": "null",
  "timestamp": 1673109098233,
  "periodStartDate": "20230807",
  "periodEndDate": "20230813",
```


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```
"reportingDate": "20230813",
"serviceType": "SM",
"version": "2.3",
"electricityConsumption":
{
   "alwaysOn": 1.75783,
   "refrigeration": 1.40626,
   "spaceHeating": 0.0,
   "waterHeating": 0.0,
   "cooking": 0.52733,
   "laundry": 1.14259,
   "lighting": 0.70313,
   "entertainment": 0.96679,
   "electricVehicle": 0.0,
   "poolOrSauna": 0.0,
   "other": 0.79101,
   "total": 7.295
},
"gasConsumption":
{
   "spaceHeating": 2.90705,
   "waterHeating": 0.24593,
   "cooking": 0.0,
   "total": 3.153
},
"electricityProduction":
{
   "solar": 0.87199,
   "total": 0.87199
},
"alwaysOnConsumption":
{
   "whitegoods": 0.10018,
   "cooking": 0.11249,
```

```
      "spaceHeatingAndCooling": 0.04921,
      "computersAndPeripherals": 0.69257,
      "homeEntertainment": 0.71016,
      "other": 0.09316,
      "total": 1.75783
    },
    "processDates":
    {
      "lastProcessCommodityDate":
      {
        "csd": "20230105",
        "csr": "20230105",
        "gas": "20230105"
      }
    }
}
```


Notification message & queue

The queue that will be used to publish messages when a Weekly Disaggregation Categories report is generated by NET2GRID EnergyAI™ Platform will be communicated to the customer by NET2GRID.

This queue is available only for EnergyAI™ Platforms that don't have CE-API enabled.

Usually the name of the queue will be like:

weekly_disaggregation_categories_<labelpartner>

The message that will be published will be in JSON format contain the following fields:

Field	Type	Description
bucket	string	The name of the bucket that contains the report
filename	string	The filename (full path) of the file that was generated

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An example of such a message is shown below:


```
{
        "bucket": "s3-export-customerA",
        "filename":
"/labelpartnerB/reports/installationX/SM/weekly-disaggregation-categories/abc123456_202
30105_weekly_disaggregation_categories.json"
}
```


Each message will contain an attribute named "routingKey" of type String that will contain the <installation identifier>.weekly_disaggregation_categories as value.

Manual Meter Reading Disaggregation Categories Report

The Manual Meter Reading Disaggregation Categories report contains the electricity consumption disaggregation for a specific period of time which is defined as the period between the last two points of available energy data. This functionality can be enabled at a label partner level only for NET2GRID EnergyAI™ Core Platforms.

Requirements

Conditions for report to be generated

Manual Meter Reading Disaggregation Categories reports are generated every time a new measurements file is provided.

Data resolution Requirements

This type of report can be generated when manual meter reading energy data is available for the installation. Such data typically has a very low temporal resolution - often limited to just one reading per month or even per quarter - making it insufficient for detailed energy consumption analysis.

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Specifications

Location

The disaggregation categories reports are generated under the S3 export bucket for Customer Intelligence reports following the following format:

s3://<exportBucket>/<labelpartner>/reports/<installationIdentifier>/<serviceType>/disaggregation-categories/<filename>

where

- exportBucket = The name of the AWS S3 bucket that contains all the reports
- labelpartner = The identifier of the labelpartner which has a service type the manual meter reading functionality
- installationIdentifier = The external installation identifier that was provided by the customer during end-user provisioning. It is a unique identifier of a specific household of an end-user.
- serviceType = The measurement resolution that has been used to generate the report. It has the following value:
    - "MR" when manual meter reading functionality is declared in the label partner
- filename = the filename of the generated report in the following format

    <internalInstallationIdentifier>_<reportDate>_disaggregation_categories.json

    where
    - internalInstallationIdentifier = the installation identifier used internally in NET2GRID EnergyAI™
    - reportDate = the day in YYYYMMDD format until which the report was generated for (the last day for which data were available)

Report Format

The Manual Meter Reading Disaggregation Categories Report is defined in JSON format.
The JSON report contains the following fields.

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Field	Type	Description
periodStartDate	string	The start date of the period against which the report is generated, in YYYYMMDD format in the local timezone of the installation.
periodEndDate	string	The end date for the period against which the report is generated, in YYYYMMDD format in the local timezone of the installation.
reportingDate	string	The last date within the reporting period, when measurement data was available, in YYYYMMDD format in the local timezone of the installation.
error	string	The reported error for the report, in a string format. The applicable values are described in the table below
timestamp	long	The timestamp that the message was produced and published, in UNIX Timestamp in milliseconds
serviceType	string	The measurement feed that was used in order to produce the report. The allowed value is "MR" which indicates the manual meter reading functionality.
version	string	The version of the service that the report corresponds to, i.e. "2.3"
electricityConsumption	object	(optional) The electricity consumption disaggregation object as described in the table above
gasConsumption	object	(optional) The gas consumption disaggregation object as an empty document. (for consistency with the rest of the disaggregation categories report)
electricityProduction	object	(optional) The electricity production disaggregation object as an empty document. (for consistency with the rest of the disaggregation categories report)

alwaysOnConsumption	object	(optional) The always-on consumption disaggregation object as described in the table above

The error codes applicable to the Manual Meter Reading Disaggregation Report are described in the table below:

Error Code	Message	Disaggregation elements provided	Description
null	-	true	No error during the reporting process
30006	No Measurements Available	false	The reporting day measurements are not available.
30007	Insufficient Data Measurements	false	The reporting day measurements are not sufficient for a consumption disaggregation analysis or the values provided are not summation values and do not increase over time.

Example file

A Manual Meter Reading Disaggregation Categories report would be generated in a location like: s3://s3-export-ABC/labelpartnerB/reports/installationX/MR/disaggregation-categories/abc123456_20211215_disaggregation_categories.json

The contents would be similar to the below example:


```
{
  "periodStartDate": "20211113",
  "periodEndDate": "20211215",
  "reportingDate": "20211215",
  "error": "null",
```

```
  "timestamp": 1673109098233,
  "serviceType": "MR",
  "version": "5.3",
  "electricityConsumption":
  {
    "alwaysOn": 1.75783,
    "refrigeration": 1.40626,
    "spaceHeating": 0.0,
    "waterHeating": 0.0,
    "cooking": 0.52733,
    "laundry": 1.14259,
    "lighting": 0.70313,
    "entertainment": 0.96679,
    "electricVehicle": 0.0,
    "poolOrSauna": 0.0,
    "other": 0.79101,
    "total": 7.295
  },
  "gasConsumption": {},
  "electricityProduction": {},
  "alwaysOnConsumption":
  {
    "whitegoods": 0.10018,
    "cooking": 0.11249,
    "spaceHeatingAndCooling": 0.04921,
    "computersAndPeripherals": 0.69257,
    "homeEntertainment": 0.71016,
    "other": 0.09316,
    "total": 1.75783
  }
}
```

Notification message & queue

The queue that will be used to publish messages when a Manual Meter Reading Disaggregation Categories report is generated by NET2GRID EnergyAI™ Platform will be communicated to the customer by NET2GRID.
This queue is available only for EnergyAI™ Platforms that don't have CE-API enabled.

Usually the name of the queue will be like:

disaggregation_categories_<labelpartner>

The message that will be published will be in JSON format contain the following fields:

Field	Type	Description
bucket	string	The name of the bucket that contains the report
filename	string	The filename (full path) of the file that was generated

An example of such a message is shown below:


```
{
    "bucket": "s3-export-customerA",
    "filename":
"/labelpartnerB/reports/installationX/MR/disaggregation-categories/abc123456_20230105_
disaggregation_categories.json"
}
```


Each message will contain an attribute named "routingKey" of type String that will contain the <installation identifier>.disaggregation_categories as value.

Solar Production Metrics Report

NET2GRID solution implements an intelligent, non-intrusive, inverter-agnostic service that provides an overview of an installation's daily solar production in a very cost-efficient way. The solar production metrics calculated and reported for an end-user are the following:

- Generated solar production: The overall estimated daily solar production.
- Overproduction percentage: The percentage of the day that the solar panels produced more than the installation's energy consumption.
- Peak production value: The peak of the produced active power value during the day.
- Peak production timestamp: The specific date and time when the peak occurred.
- Sun hours monthly efficiency percentage: The efficiency of the solar panel for the examined day compared with the actual maximum capacity of the solar panel for that specific month.
- Sun hours annual efficiency percentage: The efficiency of the solar panel for the examined day compared with the actual maximum capacity of the solar panel.

More information about NET2GRID Solar Production Service can be found in this article.

Requirements

Conditions for report to be generated

Solar Production Metrics reports are generated daily if

1. new measurement data becomes available for the installation under examination and
2. electricity that is returned to the grid is being reported for this installation and
3. "photovoltaic" attribute in property information of installation profile is not set to false.

Data resolution Requirements

Can be generated when either high resolution energy and power data or low resolution energy data are available for the installation.

Specifications

Location

The solar production metrics reports are generated under the S3 export bucket for Customer Intelligence reports following the following format:

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s3://<exportBucket>/<labelpartner>/reports/<installationIdentifier>/<serviceType>/solar-production-metrics/<filename>

where

- exportBucket = The name of the AWS S3 bucket that contains all the reports
- labelpartner = The identifier of the labelpartner
- installationIdentifier = The external installation identifier that was provided by the customer during end-user provisioning. It is a unique identifier of a specific household of an end-user.
- serviceType = The measurement resolution that has been used to generate the report. Can be:
    - "SM" when low resolution data energy data were available or
    - "RT" when high resolution energy and power data were available
- filename = the filename of the generated report in the following format

  <internalInstallationIdentifier>_<reportDate>_solar_production_metrics.json

  where
    - internalInstallationIdentifier = the installation identifier used internally in N2G EnergyAI
    - reportDate = the day in YYYYMMDD format until which the report was generated for (the last full day for which data were available)

Report Format

The Solar Production Metrics Report is defined in JSON format.

The JSON report contains the following fields

Field	Type	Description
date	string	The date under examination
error	string	The reported error for the report, in a string format. The applicable values are described in the table below
timestamp	long	The timestamp that the message was produced and published, in UNIX Timestamp in milliseconds

version	string	The version of the service that the report corresponds to, i.e. "2.3"
solarProductionMetrics	object	The SolarProductionMetrics object as described in the table below

The SolarProductionMetrics object contains the following fields:

Field	Type	Description
dailyProduction	double	The estimated daily production of the installation for the date of interest, in kWh
peakTime	long	The Unix Timestamp in seconds of the peak solar production for the date of interest
peakValue	integer	The active power value that was measured at the peak in solar production in W
overproductionPercentage	double	The percentage of the day time that the solar production was higher than the consumption
efficiencyAnnual	double	(optional) The efficiency of the solar panel for that specific day compared to the best yearly production.
efficiencyMonth	double	(optional) The efficiency of the solar panel for that specific day compared to the best monthly production
perHour	double array	An 24-index array containing the hourly solar production, in kWh. The array is in local time 24-hour span.

Example File

A Solar Production Metrics report would be generated in a location like:

s3://s3-export-ABC/labelpartnerB/reports/installationX/SM/solar-production-metrics/abc123456_20230519_solar_production_metrics.json

The contents would be similar to the below example:


```
{
  "date": "20230519",
  "error": "null",
  "timestamp": 1684777690568,
  "version": "2.3",
  "solarProductionMetrics":
  {
    "dailyProduction": 16.543,
    "peakTime": 1684496700,
    "peakValue": 2902,
    "overproductionPercentage": 57.323,
    "efficiencyAnnual": 0.689,
    "efficiencyMonth": 0.755,
    "perHour":
    [
      0.0,
      0.0,
      0.0,
      0.0,
      0.0,
      0.0,
      0.073,
      0.022,
      0.025,
      0.604,
      2.54,
      2.8,
      2.545,
      1.91,
      2.447,
      2.023,
```

```
        1.167,
        0.314,
        0.06,
        0.002,
        0.0,
        0.0,
        0.0,
        0.0
      ]
    }
  }
```


Monthly Insights Report

This report provides a comparative overview of the installation's overall and activity/appliance consumption. This comparison is made with

1. the historical consumption of the same installation for the previous months and
2. the consumption of other installations with similar profile characteristics.

Furthermore, the comparison is applied to the total energy delivered from the grid, total energy returned to the grid and also on a per-appliance basis. Finally, the comparison categories are differentiated into peak and non-peak periods of the day if time of use metrics are available for the installation. Such personalized insights provided to the end-user may incentivize meaningful actions targeting energy consumption reduction.

Requirements

Conditions for report to be generated

Insight reports are generated monthly if new measurement data becomes available for the installation under examination during the previous month.

Data resolution Requirements

Can be generated when either high resolution energy and power data or low resolution energy data are available for the installation.

Installation Profile Impact

When no profile information is provided, Insights reports will be generated containing only self-comparison information. For peer-comparison to be available the following profile information need to be specified as a minimum:

- Country
- Postal Code
- Number of Occupants
- Property Type
- Property Age

Specifications

Location

The Insights reports are generated under the S3 export bucket for Customer Intelligence reports following the following format:

s3://<exportBucket>/<labelpartner>/reports/<installationIdentifier>/<serviceType>/insights/<filename>

where

- exportBucket = The name of the AWS S3 bucket that contains all the reports
- labelpartner = The identifier of the labelpartner
- installationIdentifier = The external installation identifier that was provided by the customer during end-user provisioning. It is a unique identifier of a specific household of an end-user.
- serviceType = The measurement resolution that has been used to generate the report. Can be:
    - "SM" when low resolution data energy data were available or
    - "RT" when high resolution energy and power data were available

- filename = the filename of the generated report in the following format

  <internalInstallationIdentifier>_<reportMonth>_insights.json

  where
  - internalInstallationIdentifier = the installation identifier used internally in NET2GRID EnergyAI™
  - reportMonth = the month in YYYYMM format which the report was generated forReport Format

Report Format

The Insights Report is defined in JSON format.

The JSON report contains the following fields

Field	Type	Description
year	integer	The year under examination of the report
month	integer	The month under examination of the report
error	string	The reported error for the Insights report, in a string format. The applicable values are described in the table below
timestamp	long	The timestamp that the message was produced and published, in UNIX Timestamp in milliseconds
serviceType	string	The measurement feed that was used in order to produce the report. The allowed values are: • "SM" or "AMR" in case of low resolution energy measurement data • "RT" in case of high resolution power and energy measurement data
version	string	The version of the service that the report corresponds to, i.e. "2.3"
clusterId	string	The unique identifier of the cluster in which the installation is classified for NILM analysis. This cluster id will be used to calculate the peer comparison insights.

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insights	list	The list of insights that were estimated for that specific installation and date. It is an array of objects of type "InsightReportObjects" as described in the table below
efficiencies	map <string, ApplianceEnergyEfficiency>	This object is generated only in the case of high resolution data and contains the Appliance Efficiencies Report. Its contents are described in that section. It is a map of applianceType (string) and ApplianceEnergyEfficiency objects. The supported appliance types at the moment are: • refrigeration • washingMachine • dishWasher

The error codes applicable to the Insights Report are described in the table below:

Error Code	Message	Report Provided	Description
null	-	true	No error during the reporting process
30002	Erroneous Profile Info	false	There are filled values in the profile that are excessive or inconsistent.
30003	No Current Period Disaggregation Document Available	false	There are no measurements from the installation under examination from the current month
30004	Excessive Value on Disaggregation Document	false	The total energy consumption value for the month/billing period is (erroneously) excessively high.
30005	Negative Value on Disaggregation Document	false	The total energy consumption value for the month/billing period is negative.
40001	Incomplete Profile for Insights Reports	false	There are essential fields of the profile that are not filled correctly or at all.
40002	No Peer Installations Available for Comparison	true	There are no peer installations in the same group as the installation under

			examination
40003	No Previous Period Consumption Available for Comparison	true	There is no information for the previous month's consumption for the installation under examination
40004	No Peer Installations and Previous Period's Measurements Available for Comparison	false	There are no peer installations or information for the previous month's consumption for the installation under examination

The InsightReportObjects object contains the following fields:

Field	Type	Description
id	string	The ID of insight. The format of the ID String is specified as aa-t-pp, where: • aa: activity type • t: time of use (Total or Peak tariff) • pp: type (self or peer comparison) The expected values in each case are described below.
appliance	string	The appliance type or activity of the insight or the "total". • In case of High Resolution data the allowed appliance identifiers in Table: Appliance Events Supported. • In case of Low Resolution data the allowed values are the activities identifiers listed in Table: Activities (Disaggregation Categories) Supported
type	string	The type of insight. Can be • "self" when insight relevant to self comparison or • "peer" when insight relevant to peer comparison
timeOfUse	string	The metric used for this insight. The allowed values are: • "total": when the total consumption/feedin of the installation was used

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		• "peak": when tier information was available and taken into account for this insight. This is available only in high-resolution data solutions.
data	list	The list of InsightData objects (described below)
status	string	The status of the insight, meaning how important it is for the installation. The status of the insight is calculated based on the percentage of the used energy compared to the benchmark energy. Can be: • "0": Very low • "1": Low • "2": A bit low • "3": Same • "4": A bit high • "5": High • "6": Very High
relevance	float	The relevance of the insight to a specific installation. It can contain values from 0.0 to 1.0 and higher number means that the insight is more relevant to that installation.
isPositive	boolean	A flag signifying if the insight relevance is positive (bad practice) or negative (good practice).

The insight ID abbreviations that are applicable are listed in the table below

Abr	Description	Found in HR	Found in LR
Activity types (aa part in ID)			
TE	Total Electricity Delivered	✓	✓
AON	Always On	✓	✓
RFR	Refrigeration	✓	✓

LIG	Lighting	✓	✓
ENT	Entertainment	✓	✓
LAU	Laundry	✗	✓
DW	Dishwasher	✓	✗
WM	Washing Machine	✓	✗
DR	Tumble Dryer	✓	✗
COO	Cooking	✗	✓
OV	Oven	✓	✗
WH	Water Heating	✗	✓
FH	Electric Shower	✓	✗
IH	Immersion Heater	✓	✗
WBL	Water Boiler	✓	✗
SH	Space Heating	✗	✓
AIR	Air Condition	✓	✗
HP	Heat Pumps	✓	✗
EV	Electric Vehicle	✓	✗
PS	Pool & Sauna	✓	✗
OTH	Other	✓	✓
SP	Solar Production	✓	✗
TG	Total Gas Delivered	✓	✓
COOG	Cooking using Gas	✓	✓

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SHG	Space Heating using Gas	✓	✓
WHG	Water Heating using Gas	✓	✓
Time of Use (t part of ID)			
T	Total	✓	✓
P	Peak	✓	✓
Peer or Self comparison (pp part in ID)			
PP	Self comparison	✓	✓
Ot	Peer Comparison	✓	✓

The InsightData objects contain the following fields:

Field	Type	Description
name	string	The name of the insight data metric. The applicable values that are contained in each object are: • "benchmark": This is the value that is going to be used as a benchmark for the comparison. In the self insights, this is equal to the previous month's consumption. In peer insights, this value equals the median of the peer group's consumption values. • "usage": This is the actual energy consumption value for the activity and the current month under examination. It is used to be compared with the benchmark value • "deltaKwh": This is the difference, in absolute value, between the usage and the benchmark value (usageValue - benchmarkValue). • "deltaPerc": This is the difference, as a percentage value, between the usage and the benchmark value (deltaKwh / benchmarkValue).
value	float	The value of the insight data metric.

The "ApplianceEnergyEfficiency" object is described in the table below:

Field	Type	Description
overallEfficiencyScore	integer	The overall energy efficiency score for the appliance under examination taking into account both the appliance and the usage efficiency. Acceptable values are [20, 180] with the following mapping: • [20, 80]: efficient • (80, 120]: neutral • (120, 180]: inefficient.
applianceEfficiencyScore	integer	The appliance energy efficiency score for the appliance under examination. Acceptable values are [20, 180] with the following mapping: • [20, 80]: efficient • (80, 120]: neutral • (120, 180]: inefficient.
usageEfficiencyScore	integer	The usage energy efficiency score for the appliance under examination. Acceptable values are [20, 180] with the following mapping: • [20, 80]: efficient • (80, 120]: neutral • (120, 180]: inefficient.
overallEEI	float	The overall energy efficiency index for the appliance under examination. Acceptable values are [0, Infinity]
frequency	integer	The number of end uses for the appliance under examination.
meanEnergy	float	The mean end uses' energy consumption for the appliance under examination in kWh.
modeTemperature	integer	The mode end uses' temperature for the appliance under examination. The mode is used here, since this

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		attribute has specific values, thus the most used is selected. The acceptable values are going to be: • 0: Cold Program [0 - 30 degrees) • 1: Normal Program [30 - 60 degrees) • 2: Hot Program [60 - 90 degrees],
meanDuration	integer	The mean end uses' duration for the appliance under examination (in seconds)

Example File

An Insight report would be generated in a location like:
s3://s3-export-ABC/labelpartnerB/reports/installationX/SM/insights/abc123456_202304_insights.json

The contents would be similar to the below example for low resolution data:


```
{
   "year": 2023,
   "month": 4,
   "error": "null",
   "timestamp": 1683068106236,
   "serviceType": "SM",
   "version": "3.12",
                                                                    "clusterId":
"country_BE_postalCodeRange_0_3990_5Occupant(s)_post-2000_end-terrace",
   "insights":
   [
     {
        "id": "EV-T-Ot",
        "appliance": "electricVehicle",
        "type": "peer",
        "timeOfUse": "total",
        "data":
```

```
    [
      {
        "name": "usage",
        "value": 0.0
      },
      {
        "name": "benchmark",
        "value": 62.981
      },
      {
        "name": "deltaKwh",
        "value": -62.981
      },
      {
        "name": "deltaPerc",
        "value": -100.0
      }
    ],
    "status": "0",
    "relevance": 1.0,
    "isPositive": false
  },
  {
    "id": "WHG-T-PP",
    "appliance": "waterHeating",
    "type": "self",
    "timeOfUse": "total",
    "data":
    [
      {
        "name": "usage",
        "value": 43.218
      },
```

```
        {
          "name": "benchmark",
          "value": 21.533
        },
        {
          "name": "deltaKwh",
          "value": 21.684
        },
        {
          "name": "deltaPerc",
          "value": 100.703
        }
      ],
      "status": "6",
      "relevance": 1.0,
      "isPositive": true
    },
    {
      "id": "SHG-T-PP",
      "appliance": "spaceHeating",
      "type": "self",
      "timeOfUse": "total",
      "data":
      [
        {
          "name": "usage",
          "value": 65.525
        },
        {
          "name": "benchmark",
          "value": 154.652
        },
        {
```

```
            "name": "deltaKwh",
            "value": -89.127
          },
          {
            "name": "deltaPerc",
            "value": -57.63
          }
        ],
        "status": "0",
        "relevance": 1.0,
        "isPositive": false
      }
    ]
}
```


Below there is another example in the case of high resolution data where the Appliance Efficiencies report is part of the Insights report.


```
{
  "year": 2023,
  "month": 4,
  "error": "null",
  "timestamp": 1682918119367,
  "serviceType": "RT",
  "version": "3.12",
  "clusterId": "country_BE_postalCodeRange_0_3990_2Occupant(s)_1976-1999_detached",
  "insights":
  [
    {
      "id": "TG-T-Ot",
      "appliance": "total",
      "type": "peer",
      "timeOfUse": "total",
```

```
    "data":
    [
      {
        "name": "usage",
        "value": 11.88
      },
      {
        "name": "benchmark",
        "value": 114.385
      },
      {
        "name": "deltaKwh",
        "value": -102.504
      },
      {
        "name": "deltaPerc",
        "value": -89.613
      }
    ],
    "status": "0",
    "relevance": 1.0,
    "isPositive": false
  },
  {
    "id": "PER-P-PP",
    "appliance": "peakElectricityReturn",
    "type": "self",
    "timeOfUse": "peak",
    "data":
    [
      {
        "name": "usage",
        "value": 96.028
```

```
        },
        {
          "name": "benchmark",
          "value": 3.871
        },
        {
          "name": "deltaKwh",
          "value": 92.156
        },
        {
          "name": "deltaPerc",
          "value": 2380.087
        }
      ],
      "status": "6",
      "relevance": 1.0,
      "isPositive": false
    }
  ],
  "efficiencies":
  {
    "refrigeration":
    {
      "overallEEI": 7.097,
      "overallEfficiencyScore": 50,
      "applianceEfficiencyScore": 100,
      "usageEfficiencyScore": 50,
      "meanEnergy": 0.834,
      "meanDuration": 86399,
      "frequency": 30,
      "modeTemperature": 0
    },
    "washingMachine":
```

```
      {
        "overallEEI": 51.221,
        "overallEfficiencyScore": 50,
        "applianceEfficiencyScore": 100,
        "usageEfficiencyScore": 50,
        "meanEnergy": 0.174,
        "meanDuration": 1230,
        "frequency": 9,
        "modeTemperature": 0
      }
    }
  }
```


Weekly Insights Report

This report has the same specifications as the Monthly Insights Report, but its scope is to show the insights on a weekly level.

Requirements

Conditions for report to be generated

Weekly Insight reports are generated weekly on the 1st day of the week, meaning Monday and concern the previous week (Monday to Sunday).

Location

The Weekly Insights reports are generated under the S3 export bucket for Customer Intelligence reports following the following format:

s3://<exportBucket>/<labelpartner>/reports/<installationIdentifier>/<serviceType>/weekly-insights/<filename>

where

- exportBucket = The name of the AWS S3 bucket that contains all the reports
- labelpartner = The identifier of the labelpartner
- installationIdentifier = The external installation identifier that was provided by the customer during end-user provisioning. It is a unique identifier of a specific household of an end-user.
- serviceType = The measurement resolution that has been used to generate the report. Can be:
    - "SM" when low resolution data energy data were available or
    - "RT" when high resolution energy and power data were available
- filename = the filename of the generated report in the following format

  <internalInstallationIdentifier>_<reportWeek>_weekly_insights.json

  where
    - internalInstallationIdentifier = the installation identifier used internally in NET2GRID EnergyAI™
    - reportWeek = the report week, in xxxxWww format, for which the report was generated

The Insights Report is defined in JSON format.

The JSON report contains the following fields

Field	Type	Description
week	string	The week under examination of the report in xxxxWww ISO-8601 format.
error	string	The reported error for the Weekly Insights report, in a string format. The applicable values are described in the table below
timestamp	long	The timestamp that the message was produced and published, in UNIX Timestamp in milliseconds
serviceType	string	(optional) The measurement feed that was used in order to produce the report. The allowed values are: • "SM" in case of low resolution energy measurement data

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		• "RT" in case of high resolution power and energy measurement data This field is returned only in case of an EnergyAI™ Active platform.
version	string	The version of the service that the report corresponds to, i.e. "2.3"
clusterId	string	The unique identifier of the cluster in which the installation is classified for NILM analysis. This cluster id will be used to calculate the peer comparison insights.
insights	list	(optional) The list of insights that were estimated for that specific installation and date. It is an array of objects of type "InsightReportObjects" as described in the table above

The error codes applicable to the Weekly Insights Report are described in the table below:

Error Code	Message	Report Provided	Description
null	-	true	No error during the reporting process
30002	Erroneous Profile Info	false	There are filled values in the profile that are excessive or inconsistent.
30003	No Current Period Disaggregation Document Available	false	There are no measurements from the installation under examination from the current week
30004	Excessive Value on Disaggregation Document	false	The total energy consumption value for the week period is (erroneously) excessively high.
30005	Negative Value on Disaggregation Document	false	The total energy consumption value for the week period is negative.
40001	Incomplete Profile for Insights Reports	false	There are essential fields of the profile that are not filled correctly or at all.

40002	No Peer Installations Available for Comparison	true	There are no peer installations in the same group as the installation under examination
40003	No Previous Period Consumption Available for Comparison	true	There is no information for the previous week's consumption for the installation under examination
40004	No Peer Installations and Previous Period's Measurements Available for Comparison	false	There are no peer installations or information for the previous week's consumption for the installation under examination

Example File

A Weekly Insight report would be generated in a location like:
s3://s3-export-ABC/labelpartnerB/reports/installationX/SM/weekly-insights/abc123456_2023W01_weekly_insights.json

The contents would be similar to the below example for low resolution data:


```
{
  "week": "2023W01",
  "error": "null",
  "timestamp": 1683068106236,
  "serviceType": "RT",
  "version": "3.12",
                                                    "clusterId":
"country_BE_postalCodeRange_0_3990_5Occupant(s)_post-2000_end-terrace",
  "insights":
  [
    {
      "id": "EV-T-Ot",
      "appliance": "electricVehicle",
      "type": "peer",
      "timeOfUse": "total",
```

```
    "data":
    [
      {
        "name": "usage",
        "value": 0.0
      },
      {
        "name": "benchmark",
        "value": 62.981
      },
      {
        "name": "deltaKwh",
        "value": -62.981
      },
      {
        "name": "deltaPerc",
        "value": -100.0
      }
    ],
    "status": "0",
    "relevance": 1.0,
    "isPositive": false
  },
  {
    "id": "WHG-T-PP",
    "appliance": "waterHeating",
    "type": "self",
    "timeOfUse": "total",
    "data":
    [
      {
        "name": "usage",
        "value": 43.218
```

```
      },
      {
        "name": "benchmark",
        "value": 21.533
      },
      {
        "name": "deltaKwh",
        "value": 21.684
      },
      {
        "name": "deltaPerc",
        "value": 100.703
      }
    ],
    "status": "6",
    "relevance": 1.0,
    "isPositive": true
  },
  {
    "id": "SHG-T-PP",
    "appliance": "spaceHeating",
    "type": "self",
    "timeOfUse": "total",
    "data":
    [
      {
        "name": "usage",
        "value": 65.525
      },
      {
        "name": "benchmark",
        "value": 154.652
      },
```

```
        {
          "name": "deltaKwh",
          "value": -89.127
        },
        {
          "name": "deltaPerc",
          "value": -57.63
        }
      ],
      "status": "0",
      "relevance": 1.0,
      "isPositive": false
    }
  ]
}
```


Notification message & queue

The queue that will be used to publish messages when a Weekly Insights report is generated by NET2GRID EnergyAI™ Platform will be communicated to the customer by NET2GRID.
This queue is available only for EnergyAI™ Platforms that don't have CE-API enabled.

The name of the queue will be like:

weekly_insights

The message that will be published will be in JSON format contain the following fields:

Field	Type	Description
bucket	string	The name of the bucket that contains the report
filename	string	The filename (full path) of the file that was generated

An example of such a message is shown below:

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```
{
        "bucket": "s3-export-customerA",
        "filename":
"/labelpartnerB/reports/installationX/SM/weekly-insights/abc123456_2024W32_weekly_insights.json"
}
```


Each message will contain an attribute named “routingKey” of type String that will contain the <installation_identifier>.weekly_insights as value.

Monthly Recommendations Report

The monthly Recommendations Report contains a set of recommendations focused on helping the end-users reduce their consumption by taking small actions that are not difficult to follow. Recommendations are based on end-users’ needs, can relate either to activities (e.g., laundry) or appliances (e.g., dishwasher) and correspond to three different actions:

- behavior (for example, ‘Turn off appliances completely after use.’),
- settings (for example, ‘Try to avoid overdrying your clothes. Choose the appropriate programme.’)
- small investment (for example, ‘Replace old light bulbs or halogen lights by energy efficient LED lamps.’),
- investment (for example, ‘Purchase a more efficient dryer.’)
- maintenance (for example, ‘defrost freezer regularly’)

Requirements

Conditions for report to be generated

Recommendations reports are generated monthly if new measurement data becomes available for the installation under examination during the previous month.

Data resolution Requirements

Can be generated when either high resolution energy and power data or low resolution energy data are available for the installation.

Installation Profile Impact

When no profile information is provided, Recommendations reports will be generated following a demographics approach. For more personalized disaggregation the following profile information need to be specified as a minimum:

- Ownership
- Property Type
- Property Age

Specifications

Location

The Recommendations reports are generated under the S3 export bucket for Customer Intelligence reports following the following format:

s3://<exportBucket>/<labelpartner>/reports/<installationIdentifier>/<serviceType>/recommendations/<filename>

where

- exportBucket = The name of the AWS S3 bucket that contains all the reports
- labelpartner = The identifier of the labelpartner
- installationIdentifier = The external installation identifier that was provided by the customer during end-user provisioning. It is a unique identifier of a specific household of an end-user.
- serviceType = The measurement resolution that has been used to generate the report. Can be:
    - "SM" when low resolution data energy data were available or
    - "RT" when high resolution energy and power data were available
- filename = the filename of the generated report in the following format

    <internalInstallationIdentifier>_<reportMonth>_recommendations.json

    where
    - internalInstallationIdentifier = the installation identifier used internally in NET2GRID EnergyAI™

- reportMonth = the month in YYYYMM format until which the report was generated for

Report Format

The Recommendations Report is defined in JSON format.

The JSON report contains the following fields

Field	Type	Description
error	string	The reported error for the Recommendations report, in a string format. The applicable values are described in the table below
timestamp	long	The timestamp that the message was produced and published, in UNIX Timestamp in milliseconds
version	string	The version of the service that the report corresponds to, i.e. "2.3"
serviceType	string	The measurement feed that was used in order to produce the report. The allowed values are: • "SM" or "AMR" in case of low resolution energy measurement data • "RT" in case of high resolution power and energy measurement data
recommendations	list	The list of "Recommendation" objects that are described in the table below

The "Recommendation" object contains the following fields:

Field	Type	Description
id	string	The unique ID of the recommendation.

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disaggregationCategory	string	The energy category related to the recommendation (e.g., "Refrigeration").
appliance	string	Specific appliance affected by the recommendation.
deltaPerc	float	Excess consumption percentage compared to peers.
actionType	string	Type of action required. Possible values: • BEHAVIOUR • SETTINGS • SMALL_INVESTMENT • INVESTMENT • MAINTENANCE
savingCostsKWh	float	Estimated savings in kWh per month if the recommendation is followed.

The error codes applicable to the Recommendations Report are described in the table below:

Error Code	Message	Report Provided	Description
null	-	true	No error during the reporting process
30002	Erroneous Profile Info	false	There are filled values in the profile that are excessive or inconsistent.
50001	Incomplete Profile for Recommendation Reports	false	There are essential fields of the profile that are not filled correctly or at all.
50002	No Installation Insight Report Available	true	There are no insights reports present for the installation under examination.

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Example File

A Recommendations report would be generated in a location like:
s3://s3-export-ABC/labelpartnerB/reports/installationX/SM/recommendations/abc123456_202304_recommendations.json

The contents would be similar to the below example:


```
{
  "error": "null",
  "timestamp": 1737072233081,
  "version": "3.5",
  "recommendations": [
    {
      "id": "T50",
      "relevance": 0.75,
      "disaggregationCategory": "laundry",
      "appliance": "dishWasher",
      "deltaPerc": 0.25,
      "actionType": "SMALL_INVESTMENT",
      "savingCostsKWh": 19.25
    },
    {
      "id": "T10",
      "relevance": 0.5,
      "disaggregationCategory": "alwaysOn",
      "appliance": "alwaysOn",
      "deltaPerc": 0.16,
      "actionType": "BEHAVIOUR",
      "savingCostsKWh": 10.05
    }
  ],
  "serviceType": "SM"
}
```

Recommendations Descriptions

The following table defines the mapping between the recommendations IDs and its description.

ID	Category	Short Description	Type
T10	Always On	Turn off appliances completely after use.	Behaviour change
T30	Always On	Use power strips to easily switch off multiple appliances after use.	Small investment
T20	Always On	Turn off as many appliances as possible when you go on holiday.	Behaviour change
T200	Laundry	Wait until you have a full load before turning on your washing machine.	Behaviour change
T210	Laundry	Use a low temperature or eco programme that is tuned to work effectively. Most energy is used for heating up water.	Settings
T290	Laundry	Purchase a more efficient washing machine.	Investment
T230	Laundry	Make use of nice weather, dry your clothes outside.	Behaviour change
T250	Laundry	Try to avoid overdrying your clothes. Choose the appropriate programme.	Settings
T270	Laundry	Clean the filter of your dryer regularly. A dirty filter blocks the airflow causing your dryer to use more energy.	Maintenance
T280	Laundry	Use eco balls in your dryer. They create gaps in your laundry and let the air move around easier.	Small investment
T300	Laundry	Purchase a more efficient dryer.	Investment

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T50	Laundry	Use a low temperature or eco programme that is tuned to work effectively. Most energy is used for heating up water.	Settings
T60	Laundry	Wait until you have a full load before turning on your dishwasher.	Behaviour change
T80	Laundry	Purchase a more efficient dishwasher.	Investment
T90	Cooking	Keep the oven door closed as much as possible while using the oven.	Behaviour change
T150	Cooking	Turn off the oven a little earlier. Many dishes will carry on cooking while the oven cools down slowly.	Behaviour change
T100	Cooking	Use a microwave for small cooking tasks instead of the oven.	Behaviour change
T110	Cooking	Use a lid on your pan. This helps to keep the heat inside your pan as much as possible.	Behaviour change
T130	Cooking	You only need one ring for cooking, if you use a steamer or segmented pan for cooking your vegetables.	Small investment
T140	Cooking	Choose the right size cooking ring and check that the flame does not exceed the pan you use for cooking.	Behaviour change
T160	Cooking	Most vegetables can be boiled in a 1-2 cm layer of water.	Behaviour change
T120	Cooking	Use an electric kettle to boil water for cooking instead of a pan on the hob.	Behaviour change
T340	Lighting	Replace old light bulbs or halogen lights by energy efficient LED lamps.	Small investment
T330	Lighting	Switch off your lighting when you leave the room.	Behaviour change
T310	Lighting	Add a timer to your outdoor lighting.	Small investment

T360	Refrigeration	Don't leave the doors of your refrigeration appliances open unnecessarily.	Behaviour change
T380	Refrigeration	Let hot food cool down first before putting it in the fridge.	Behaviour change
T390	Refrigeration	Regularly check the rubber edges of your refrigeration appliances. They may no longer seal properly, allowing cold air to escape.	Maintenance
T400	Refrigeration	Defrost your freezer regularly. It is already worth defrosting your freezer from 0.5 cm of ice.	Maintenance
T410	Refrigeration	Regularly dust the condenser coils at the back of your fridge and freezer.	Maintenance
T420	Refrigeration	Check the temperature of your fridge and adjust if necessary: 4 to 6°C is ideal for fridges.	Settings
T430	Refrigeration	Purchase more efficient refrigeration appliances.	Investment
T440	Refrigeration	Leave about 10 cm of space behind your refrigeration appliances.	Maintenance
T350	Refrigeration	Do you really need your second fridge? Especially old models are real energy guzzlers.	Behaviour change
T450	Refrigeration	Consider buying a larger fridge so you no longer need a second appliance. One large fridge is more economical than two smaller ones.	Investment
T460	Refrigeration	Do you insist on keeping your second fridge for parties and barbecues? Unplug it and turn it on only when you need it. Don't forget to unplug it again afterwards.	Behaviour change
T260	Pool pump	Upgrade to a more efficient pool pump for swimming pools.	Behaviour change
T470	Space heating	It is a waste to heat rooms when you are not around. Leave the heating off in the rooms you don't go	Behaviour change

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		much.	
T480	Space heating	Keep the doors closed so that heat does not escape from the living room.	Behaviour change
T500	Space heating	Do doors often stay open unnoticed? Then buy a door spring or door closer for a few euros. This will close the door automatically.	Small investment
T520	Space heating	In bedrooms, leave the heating off. Use an extra blanket or warm your bed with a warm hot water bottle or electric blanket.	Behaviour change
T540	Space heating	Don't set the thermostat higher than 19 degrees. Were you already doing that? Then see if you can go down another degree.	Behaviour change
T550	Space heating	If you are active in the house for longer, you can turn down the heating a degree lower.	Behaviour change
T560	Space heating	Set the thermostat to 15 degrees at night. Do this as early as an hour before you go to sleep: as your house cools down slowly.	Behaviour change
T370	Space heating	Set the thermostat to 6 degrees when you go away for a few days.	Behaviour change
T580	Space heating	Install a smart thermostat.	Small investment
T570	Space heating	Install thermostatic radiator valves.	Small investment
T510	Space heating	Let the heated air around your radiators circulate sufficiently. Don't block this with curtains or furniture.	Behaviour change
T490	Space heating	Draught excluders might help to keep the warmth inside your home.	Small investment
T530	Space heating	Close your curtains when it is cold at night. This will	Behaviour

		keep the warmth in the room.	change
T320	Space heating	Are your curtains blocking your radiator? Shorten them and let the warmth flow freely into your room—don't let your heat get trapped!	Small investment
T610	Space heating	Insulating your walls, either externally or internally, can help reduce heating costs and keep your home cool in summer.	Investment
T620	Space heating	Is your radiator on an uninsulated outside wall? Place radiator foil between the radiator and wall to reduce heat loss.	Behaviour change
T590	Space heating	Do you have a radiator with 2 or 3 plates? Then attach a radiator fan under the radiator. This will blow heat into the room, making it feel warmer faster.	Behaviour change
T650	Space heating	Replacing single glass windows with double or triple glass will help to save on heating costs and in the summer to keep your home cool.	Investment
T600	Space heating	Do you have single or double glazing and can't replace it right away? Then window film could be a solution. This will improve the insulating effect of the glass.	Behaviour change
T630	Space heating	The temperature of the hot water is usually set at 80 degrees, but can safely be set to a lower temperature. Do not go lower than 60 degrees, as you will increase the risk of legionella.	Behaviour change
T640	Space heating	Insulate the heating pipes in unheated areas like the crawl space or attic to prevent heat loss from the boiler to the radiators.	Behaviour change
T660	Space heating	Use an infrared panel to heat yourself, not the whole room. They heat up very quickly.	Behaviour change

T670	Space heating	Replace your gas boiler with a more efficient (hybrid) heat pump.	Investment
T680	Space heating	Schedule maintenance for your heating system for optimal performance.	Maintenance
T690	Space cooling	Use ceiling fans to supplement air conditioning.	Behaviour change
T710	Space cooling	Clean or replace HVAC filters regularly for optimal efficiency.	Behaviour change
T700	Water heating	Install a thermostatic mixer tap in the shower and kitchen. You lose less hot water while setting the right temperature.	Behaviour change
T730	Water heating	Replace your showerhead for a low-flow model.	Behaviour change
T720	Water heating	Put a water-saving nozzle or flow restrictor on your hot water taps.	Behaviour change
T770	Water heating	Is your boiler set to the comfort setting? Then change it to eco-setting for hot water. The comfort setting keeps the boiler standby all day.	Behaviour change
T780	Water heating	Take quicker, refreshing showers and reduce your energy usage for water heating	Behaviour change
T790	Water heating	Do you sometimes take a bath? Then you can save on that too. After all, bathing uses 3 times as much water as a 5-minute shower.	Behaviour change
T800	Water heating	New bathroom? Have a shower heat recovery system installed. This uses the heat from the run-off shower water to pre-heat the cold water.	Investment
T820	Pool pump	Upgrade to a more efficient pool pump for swimming pools.	Behaviour change

Notification message & queue

The queue that will be used to publish messages when a Monthly Recommendations report is generated by NET2GRID EnergyAI™ Platform will be communicated to the customer by NET2GRID.
This queue is available only for EnergyAI™ Platforms that don't have CE-API enabled.

Usually the name of the queue will be like: recommendations

The message that will be published will be in JSON format contain the following fields:

Field	Type	Description
bucket	string	The name of the bucket that contains the report
filename	string	The filename (full path) of the file that was generated

An example of such a message is shown below:


```
{
        "bucket": "s3-export-customerA",
        "filename":
"/labelpartnerB/reports/installationX/SM/recommendations/abc123456_202401_recommendations.json"
}
```


Each message will contain an attribute named "routingKey" of type String that will contain the <installation identifier>.recommendations as value.

Weekly Recommendations Report

This report has the same specifications as the Monthly Recommendations Report, but its scope is to show the recommendations based on the insights on a weekly level.

Requirements

Conditions for report to be generated

Weekly Recommendations reports are generated weekly on the 1st day of the week (Monday) and concern the previous week (Monday to Sunday).

Specifications

Location

The Weekly Recommendations reports are generated under the S3 export bucket for Customer Intelligence reports following the following format:

s3://<exportBucket>/<labelpartner>/reports/<installationIdentifier>/<serviceType>/weekly-recommendations/<filename>

where

- exportBucket = The name of the AWS S3 bucket that contains all the reports
- labelpartner = The identifier of the labelpartner
- installationIdentifier = The external installation identifier that was provided by the customer during end-user provisioning. It is a unique identifier of a specific household of an end-user.
- serviceType = The measurement resolution that has been used to generate the report. Can be:
    - "SM" when low resolution data energy data were available or
    - "RT" when high resolution energy and power data were available
- filename = the filename of the generated report in the following format

  <internalInstallationIdentifier>_<reportWeek>_weekly_recommendations.json

  where
    - internalInstallationIdentifier = the installation identifier used internally in NET2GRID EnergyAI™
    - reportWeek = the report week, in xxxxWww format, for which the report was generated

Report Format

The Weekly Recommendations Report is defined in JSON format.

The JSON report contains the following fields

Field	Type	Description
error	string	The reported error for the Recommendations report, in a string format. The applicable values are described in the table below
timestamp	long	The timestamp that the message was produced and published, in UNIX Timestamp in milliseconds
version	string	The version of the service that the report corresponds to, i.e. "2.3"
serviceType	string	The measurement feed that was used in order to produce the report. The allowed values are: • "SM" or "AMR" in case of low resolution energy measurement data • "RT" in case of high resolution power and energy measurement data
recommendations	list	The list of "Recommendation" objects that are described in the table below

The "Recommendation" object contains the following fields:

Field	Type	Description
id	string	The unique ID of the recommendation.
disaggregationCategory	string	The energy category related to the recommendation (e.g., "Refrigeration").
appliance	string	Specific appliance affected by the recommendation.

deltaPerc	float	Excess consumption percentage compared to peers.
actionType	string	Type of action required. Possible values: • BEHAVIOUR • SETTINGS • SMALL_INVESTMENT • INVESTMENT • MAINTENANCE
savingCostsKWh	float	Estimated savings in kWh per week if the recommendation is followed.

The error codes applicable to the Recommendations Report are described in the table below:

Error Code	Message	Report Provided	Description
null	-	true	No error during the reporting process
30002	Erroneous Profile Info	false	There are filled values in the profile that are excessive or inconsistent.
50001	Incomplete Profile for Recommendation Reports	false	There are essential fields of the profile that are not filled correctly or at all.
50002	No Installation Insight Report Available	true	There are no insights reports present for the installation under examination.

Example File

A Weekly Recommendations report would be generated in a location like:
s3://s3-export-ABC/labelpartnerB/reports/installationX/SM/weekly-recommendations/abc123456_2023W05_weekly_recommendations.json

The contents would be similar to the below example:


```
{
  "error": "null",
  "timestamp": 1737072233081,
  "version": "3.5",
  "recommendations": [
    {
      "id": "T50",
      "relevance": 0.75,
      "disaggregationCategory": "laundry",
      "appliance": "dishWasher",
      "deltaPerc": 0.25,
      "actionType": "SMALL_INVESTMENT",
      "savingCostsKWh": 19.25
    },
    {
      "id": "T10",
      "relevance": 0.5,
      "disaggregationCategory": "alwaysOn",
      "appliance": "alwaysOn",
      "deltaPerc": 0.16,
      "actionType": "BEHAVIOUR",
      "savingCostsKWh": 10.05
    }
  ],
  "serviceType": "SM"
}
```


Notification message & queue

The queue that will be used to publish messages when a Weekly Recommendations report is generated by NET2GRID EnergyAI™ Platform will be communicated to the customer by NET2GRID.

This queue is available only for EnergyAI™ Platforms that don't have CE-API enabled.

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Usually the name of the queue will be like: weekly_recommendations

The message that will be published will be in JSON format contain the following fields:

Field	Type	Description
bucket	string	The name of the bucket that contains the report
filename	string	The filename (full path) of the file that was generated

An example of such a message is shown below:

```
{
        "bucket": "s3-export-customerA",
        "filename":
"/labelpartnerB/reports/installationX/SM/weekly-recommendations/abc123456_2024W32_
weekly_recommendations.json"
}
```

Each message will contain an attribute named “routingKey” of type String that will contain the <installation identifier>.weekly_recommendations as value.

Appliance Events Report

This report provides the results of the daily disaggregation for the previous day. Thus, the end-user can have an overview of the electricity consumption that can be attributed to each appliance installed in the household, understanding its consumption behavior impact and how appliances operation affects the electricity bill.

It is important to note that two types of appliance events are included in the report: (a) non-time based and (b) time-based events.

- Non-time Based (NTB) events correspond to appliances operating throughout the day or having multiple switch-on events during the day, so identifying and reporting each individual one would not be convenient for reporting. Thus, the energy consumption is aggregated daily, in kWh, and the start and stop timestamps of the events are set to the beginning and the end of the day under examination.

- Time-based (TB) events are mapped to appliances whose operation can be pinpointed at specific periods of the day using analytical methods, such as washing machine or dishwasher appliance events. These events have specific start and stop timestamps and the energy usage corresponding to each specific event in kWh.

It is essential to mention that not all of the existing electrical appliances are supported since

1. there are low-consumption appliances, with minimal participation in the daily consumption, that are nearly impossible to detect in that sampling granularity and
2. there are a lot of specific appliances with very low penetration to the market.

Thus, NET2GRID NILM Service focuses on the energy-intensive appliances that are found in most installations and participate heavily in the overall energy consumption. The appliances that are currently supported are the following:

Table: Appliance Events Supported

Appliance Identifier	Description	Supported in RT disaggregation	Supported in LR disaggregation	Type of Events	Per Hour consumption breakdown available
alwaysOn	Always On	true	false	NTB	false
refrigeration	Refrigeration	true	false	NTB	false
lighting	Lighting	true	false	NTB	true
entertainment	Entertainment	true	false	NTB	true
washingMachine	Washing Machine	true	false	TB	false
dishWasher	Dishwasher	true	false	TB	false
dryer	Tumble Dryer	true	false	TB	false
oven	Oven / Grill / Stove	true	false	TB	false
heatPumps	Heat Pumps	true	false	NTB	false

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airConditioning	Air Condition	true	false	NTB	false
waterBoiler	Water Boiler	true	false	NTB	false
flowHeater	Electric Shower	true	false	TB	false
immersionHeater	Immersion Heater	true	false	TB	false
electricVehicle	Electric Vehicle	true	true	TB	false
solarProduction	Solar Production	true	false	NTB	true

It should be noted that the Always On, Refrigeration, Lighting, and Entertainment events contain the aggregated consumption of all the appliances that participate in each activity, daily. Specifically:

- Always On refers to the standby energy consumption of the appliances that are constantly plugged in. Even though the individual standby consumption of the installed devices may be trivial, their daily aggregated consumption can reach 25 - 30% of the daily consumption.
- Refrigeration consists of all fridges, freezers, or fridge/freezer combo that may appear in an installation. It is standard for households to have more than one refrigeration appliance in different house rooms. Additionally, these appliances must be operational all day and night, meaning that this category's consumption can also be substantial.
- The Lighting category contains all the illuminating appliances in an installation. This category's consumption is pretty low for residential consumers, and the primary consumption appears mostly at night. In commercial buildings, lighting consumption is concentrated during market hours and is significantly higher.
- The Entertainment category comprises a large variety of non-energy-intensive appliances used for entertainment or educational purposes. This category contains TVs, game consoles, and home cinema systems, in addition to desktop computers, laptops, tablets, and mobile phones.

Requirements

Conditions for report to be generated

Appliance Events reports are generated daily if new measurement data becomes available for the installation and day under examination.

Data resolution Requirements

The generation of the Appliance Events Report is supported both on HR and LR measurements.

Installation Profile Impact

When no profile information is provided, Appliance Events reports will be generated following some specific conventions. NET2GRID solution can handle missing profile information for the most commonly used appliances (e.g., refrigeration appliances, washing machine, etc.) gracefully, meaning that if the end-user has not filled the related profile information, the identification algorithm is trying to identify the existence of these appliances automatically. However, in the case of less common appliances (e.g. EV, air condition), it is required that the relevant profile information is filled in to initiate the training process for that specific appliance.

Specifications

Location

The Appliance Events reports are generated under the S3 export bucket for Customer Intelligence reports following the following format:

s3://<exportBucket>/<labelpartner>/reports/<installationIdentifier>/<serviceType>/appliance-events/<filename>

where

- exportBucket = The name of the AWS S3 bucket that contains all the reports
- labelpartner = The identifier of the labelpartner
- installationIdentifier = The external installation identifier that was provided by the customer during end-user provisioning. It is a unique identifier of a specific household of an end-user
- serviceType = The measurement resolution that has been used to generate the report. Can be:
    - "SM" when low resolution data energy data were available or
    - "RT" when high resolution energy and power data were available

- filename = the filename of the generated report in the following format

  <internalInstallationIdentifier>_<reportDate>_appliance_events.json

  where
  - internalInstallationIdentifier = the installation identifier used internally in NET2GRID EnergyAI™
  - reportDate = the day in YYYYMMDD format for which the report was generated

Report Format

The Appliance Events Report is defined in JSON format.

The JSON report contains the following fields

Field	Type	Description
date	string	The date of the appliance events report in a String YYYYMMDD format
error	string	The reported error for the report, in a string format. The applicable values are described in the table below
timestamp	long	The timestamp that the report was produced and published, in UNIX Timestamp in milliseconds
version	string	The version of the service that the report corresponds to, i.e. "2.3"
sunriseTimestamp	long	The second of the day that the sun rises for that specific date / geolocation, as a UNIX Timestamp
sunsetTimestamp	long	The second of the day that the sun sets for that specific date / geolocation, as a UNIX Timestamp
reportEvents	list	The list of ReportEvents objects that were detected in that installation on the report date. The format of the ReportEvents objects is described in the table below

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solarProduction	object	The SolarProductionMetrics object as described in the table below
lightingConsumption	double array	An 24-index array containing the hourly consumption for lighting, in kWh. The array is in local time 24-hour span.
entertainmentConsumption	double array	An 24-index array containing the hourly consumption for entertainment, in kWh. The array is in local time 24-hour span.

The ReportEvents object contains the following fields:

Field	Type	Description
id	integer	A unique identifier for the report event (per installation)
applianceType	string	The appliance type that is responsible for the report event. The allowed values that are applicable for this field are present in the Appliance Identifiers column of Table: Appliance Events Supported
startTime	long	The start timestamp of the reported appliance end use, as a UNIX Timestamp in milliseconds
stopTime	long	The stop timestamp of the reported appliance end use, as a UNIX Timestamp in milliseconds
usage	float	The energy usage of the reported appliance event, in kWh.

The SolarProductionMetrics object contains the following fields:

Field	Type	Description
dailyProduction	double	The estimated daily production of the installation for the date of interest, in kWh

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peakTime	long	The Unix Timestamp in milliseconds of the peak solar production for the date of interest
peakValue	integer	The active power value that was measured at the peak in solar production in W
overproductionPercentage	double	The percentage of the day time that the solar production was higher than the consumption
efficiencyAnnual	double	(optional) The efficiency of the solar panel for that specific day compared to the best yearly production.
efficiencyMonth	double	(optional) The efficiency of the solar panel for that specific day compared to the best monthly production
perHour	double array	An 24-index array containing the hourly solar production, in kWh. The array is in local time 24-hour span.

The error codes applicable to the Appliance Events Report are described in the table below:

Error Code	Message	Report Provided	Supported in RT	Supported in LR	Description
null	-	true	true	true	No error during the reporting process
20001	Insufficient Data	false	true	false	There are a lot of data missing from the daily measurements (currently the threshold is set to 10 hours)
20002	Poor Data Resolution	false	true	false	The resolution of the data measurements do not allow for time series analysis (currently set to 30 seconds)
30006	Null or Empty Measurements	false	false	true	The reporting day measurements are not available.

30007	Insufficient Data Measurements	false	false	true	The reporting day measurements are not sufficient for a consumption disaggregation analysis.
20003	No Events Available	false	false	true	No events were detected or the EV appliance was not declared in the user profile.
30010	Missing Secondary Meter Measurements	true	false	true	The installation does not have secondary meter measurements even if this functionality is enabled and measurements are expected.

Example File

An Appliance Events report would be generated in a location like:
s3://s3-export-ABC/labelpartnerB/reports/installationX/RT/appliance-events/abc123456_20230523_appliance_events.json

The contents would be similar to the below example:


```
{
  "date": "20230523",
  "error": "null",
  "timestamp": 1684895713243,
  "version": "4.6",
  "sunriseTimestamp": 1684813380,
  "sunsetTimestamp": 1684870560,
  "reportEvents":
  [
    {
      "applianceType": "alwaysOn",
      "startTime": 1684792800,
      "stopTime": 1684879199,
```


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```
    "usage": 2.733,
    "id": 5289
  },
  {
    "applianceType": "refrigeration",
    "startTime": 1684792800,
    "stopTime": 1684879199,
    "usage": 0.967,
    "id": 5290
  },
  {
    "applianceType": "lighting",
    "startTime": 1684792800,
    "stopTime": 1684879199,
    "usage": 0.094,
    "id": 5291
  },
  {
    "applianceType": "entertainment",
    "startTime": 1684792800,
    "stopTime": 1684879199,
    "usage": 0.284,
    "id": 5292
  },
  {
    "applianceType": "heatPumps",
    "startTime": 1684792800,
    "stopTime": 1684879199,
    "usage": 0.832,
    "id": 5295
  },
  {
    "applianceType": "solarProduction",
```


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```
      "startTime": 1684792800,
      "stopTime": 1684879199,
      "usage": 11.062,
      "id": 5296
    },
    {
      "applianceType": "airConditioning",
      "startTime": 1684840875,
      "stopTime": 1684844133,
      "usage": 0.885,
      "id": 5293
    }
  ],
  "solarProduction":
  {
    "dailyProduction": 11.062,
    "peakTime": 1684848575,
    "peakValue": 4061,
    "overproductionPercentage": 88.004,
    "efficiencyAnnual": 0.351,
    "efficiencyMonth": 0.351,
    "perHour":
    [
      0.0,
      0.0,
      0.0,
      0.0,
      0.0,
      0.0,
      0.0,
      0.049,
      0.221,
      0.332,
```

```
        0.553,
        1.394,
        1.048,
        1.656,
        1.917,
        1.445,
        0.906,
        0.548,
        0.425,
        0.407,
        0.136,
        0.015,
        0.0,
        0.0
      ]
  },
  "lightingConsumption":
  [
    0.002,
    0.002,
    0.0,
    0.0,
    0.004,
    0.0,
    0.0,
    0.002,
    0.012,
    0.009,
    0.0,
    0.001,
    0.0,
    0.0,
    0.0,
```

```
    0.007,
    0.0,
    0.009,
    0.005,
    0.005,
    0.004,
    0.008,
    0.011,
    0.005
  ],
  "entertainmentConsumption":
  [
    0.008,
    0.007,
    0.0,
    0.0,
    0.014,
    0.0,
    0.0,
    0.006,
    0.037,
    0.027,
    0.0,
    0.004,
    0.0,
    0.0,
    0.0,
    0.022,
    0.0,
    0.027,
    0.017,
    0.017,
    0.012,
```

```
      0.027,
      0.035,
      0.017
    ]
}
```


Appliance Efficiencies Report

Apart from the end-user's behavior, another reason for increased daily/monthly consumption is appliance inefficiency. If, for example, the washing machine installed within a household is old and energy inefficient, changing one's behavior will not solve the problem of overconsumption.
The monthly Appliance Efficiencies report contains valuable information about the efficiency of an appliance (currently dishwasher, washing machine, and refrigeration) based on energy consumption and specific appliance demographics criteria. For each month, the end-users are provided with a table - regarding each appliance - including information about the appliance usage frequency (number of end uses and average energy consumption during the past 30 days), the average temperature, and the average duration. Based on this, a set of efficiency scores is calculated for each appliance determining its efficiency.

Requirements

Conditions for report to be generated
Appliance Efficiencies reports are generated monthly if:

- new measurement data becomes available for the installation and month under examination
- installation profile information with metadata on appliances (type, age, volume, brand)
- appliance events reports have been generated during the month for this installation

Data resolution Requirements
Can be generated only when high resolution energy and power data are available for the installation.

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The Appliance Efficiencies reports at the moment are part of the Insights Report so its location, format and examples are covered in that section.

NILM Status Report

The NILM Status Report is used to communicate the status of the entire service, up to that particular point in time, to the end-users. The three categories of information that are communicated back to the end-user are

- General NILM Status: This contains information about the training process's progress (explained in the following subsection) and the quality of measured data.
- Report Services Status: This contains information on all the other daily/monthly reports provided by NET2GRID Solution. With this information at hand, it is easy for the end-user to observe which services are enabled, if there is profile information missing for certain reporting services, if more time is needed for the provision of a service, etc.
- Appliances/Activities Status: Contains information on all the appliances/activities that are supported by the NET2GRID Solution Services. Having this information readily available, the end-user can check which appliances are detected in the installation, if there is profile information missing for certain appliances, how many attempts have been done for training specific appliances, and many more.

Requirements

Conditions for report to be generated

NILM Status reports are generated daily if new measurement data becomes available for the installation.

Data resolution Requirements

Can be generated only when high resolution energy and power data are available for the installation.

Installation Profile Impact

Profile information doesn't impact the generation of the NILM Status Report.

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Specifications

Location

The NILM Status Reports reports are generated under the S3 export bucket for Customer Intelligence reports following the following format:

s3://<exportBucket>/<labelpartner>/reports/<installationIdentifier>/<serviceType>/nilm-status/<filename>

where

- exportBucket = The name of the AWS S3 bucket that contains all the reports
- labelpartner = The identifier of the labelpartner
- installationIdentifier = The external installation identifier that was provided by the customer during end-user provisioning. It is a unique identifier of a specific household of an end-user
- serviceType = The measurement resolution that has been used to generate the report. Can be:
    - "SM" when low resolution data energy data were available or
    - "RT" when high resolution energy and power data were available
- filename = the filename of the generated report in the following format

    <internalInstallationIdentifier>_<reportDate>_nilm_status.json

    where
    - internalInstallationIdentifier = the installation identifier used internally in NET2GRID EnergyAI™
    - reportDate = the day in YYYYMMDD format for which the report was generated

Report Format

The NILM Status Report is defined in JSON format.

The JSON report contains the following fields

Field	Type	Description
date	string	The date of the report

error	string	The reported error for the report, in a string format. The applicable values are described in the table below
timestamp	long	The timestamp that the message was produced and published, in UNIX Timestamp in milliseconds
version	string	The version of the service that the report corresponds to, i.e. "2.3"
nilmStatus	integer	The NILM Phase Status as estimated from available information. Available values: 0: No model has been created for the user. Reports are based on demographic data. 1: Training Phase 1 has run. Personalized models have been trained for refrigeration, always on and solar (if applicable). Also models for lighting and entertainment are given as existing in this phase. 2: Training Phase 2 has been executed. Some of the user's declared appliances/activities have been trained. There are still other training attempts to train the models of the undetected appliances/activities. 3: Post Training Phase 2. Training has been completed. Excluding adhoc requests and profile updates, no new models will be trained for the user.
goodDataDays	integer	The number of good data days for the installation under examination
poorDataDays	integer	The number of poor data days for the installation under examination

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services	Map <String, ServiceStatus>	The map contains the service status for all the NILM Service services. The allowed values of the key are the following service types: • dailyDisaggregation • solarProductionMetrics • monthlyDisaggregation • insights • recommendations • hardwareParameters • applianceEfficiencies The values of the map are ServiceStatus objects with the format described below.
timeBasedAppliances	Map <String, ApplianceStatus>	(applies ONLY to HR data) The map containing the time based Appliance models status of the installation. The allowed values of the key are the appliance type identifiers listed in Table: Appliance Events Supported of type TB. The values of the map are ApplianceStatus objects with the format described below.
nonTimeBasedAppliances	Map <String, ApplianceStatus>	(applies ONLY to HR data) The map containing the non time based Appliance models status of the installation. The allowed values of the key are the appliance type identifiers listed in Table: Appliance Events Supported of type NTB. The values of the map are ApplianceStatus objects with the format described below.
nonTimeBasedActivities	Map<String, ApplianceStatus>	(applies ONLY to LR data) The map contains the non time based Appliance model status of the installation. The allowed values of the key are the activity type identifiers listed in Table:

		Activities (Disaggregation Categories) Supported. The values of the map are ApplianceStatus objects with the format described below.
retrainSchedule	Map <string, string>	The map containing the retraining processes that are scheduled for the installation. The keys are the appliance types listed in Table: Appliance Events Supported and the values are the date in YYYYMMDD format.

The error codes applicable to the NILM Status Report are described in the table below:

Error Code	Message	Report Provided	Description
null	-	true	No error during the reporting process

The ServiceStatus object contains the following fields:

Field	Type	Description
available	boolean	The flag showing the availability of the service for the installation. When true this means that the service is provided to the installation.
profileComplete	boolean	The flag showing if the installation profile's attributes that is related to the service has been filled by the end-user
monthComplete	boolean	(Optional) The flag showing if 30 days of data have passed for the specific process. Applicable only when the service is the monthlyDisaggregation.
timestamp	string	The timestamp of the initialization of the process in ISO-8601 format

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The ApplianceStatus object contains the following fields:

Field	Type	Description
available	boolean	The flag showing if the appliance has been identified in the installation.
profileRequired	boolean	The flag indicates whether installation profile setup is required for the identification of a specific appliance.
profileComplete	boolean	The flag indicates if the installation profile attributes that are relevant to the identification of the appliance in the installation have been filled in by the end-user
profileAdded	boolean	The flag indicates if the installation profile attributes that are relevant to the identification of the appliance have been updated by the end-user since the last time the report was sent
attemptsLeft	integer	Represents the training attempts left for that specific appliance. Applicable only for TB appliances on High Resolution data.
models	integer	The number of models stored in the installation model for that specific appliance type. If no models are available, then this key is skipped (it appears only if its value is > 0).
version	string	The Analytics Platform version that was utilized for the creation of the appliance model
timestamp	DateTime	The timestamp in milliseconds of the latest update of the used appliance model in ISO-8601 format

Example File

A NILM Status report would be generated in a location like:

s3://s3-export-ABC/labelpartnerB/reports/installationX/RT/nilm-status/abc123456_20230519_nilm_status.json

The contents would be similar to the below example:


```
{
  "date": "20230523",
  "error": "null",
  "timestamp": 1684895713748,
  "version": "4.9",
  "nilmStatus": 3,
  "goodDataDays": 66,
  "poorDataDays": 0,
  "services":
  {
    "dailyDisaggregation":
    {
      "available": true,
      "profileComplete": true,
      "timestamp": "2023-03-28T06:02:48+00:00"
    },
    "solarProductionMetrics":
    {
      "available": true,
      "profileComplete": true,
      "timestamp": "2023-03-28T06:02:48+00:00"
    },
    "monthlyDisaggregation":
    {
      "available": true,
      "profileComplete": true,
      "monthComplete": true,
      "timestamp": "2023-03-28T06:02:48+00:00"
    },
    "insights":
    {
      "available": true,
```

```
      "profileComplete": true,
      "timestamp": "2023-03-28T06:02:48+00:00"
    },
    "recommendations":
    {
      "available": true,
      "profileComplete": true,
      "timestamp": "2023-03-28T06:02:48+00:00"
    },
    "hardwareParameters":
    {
      "available": false,
      "profileComplete": true
    },
    "applianceEfficiencies":
    {
      "available": true,
      "profileComplete": false,
      "timestamp": "2023-04-18T06:15:11+00:00"
    }
  },
  "timeBasedAppliances":
  {
    "washingMachine":
    {
      "available": true,
      "profileRequired": false,
      "profileComplete": true,
      "profileAdded": false,
      "models": 1,
      "version": "2023 Q2",
      "timestamp": "2023-04-18T06:15:11+00:00"
    },
```

```
"dishWasher":
{
   "available": true,
   "profileRequired": false,
   "profileComplete": false,
   "profileAdded": false,
   "models": 1,
   "version": "2023 Q2",
   "timestamp": "2023-04-18T06:15:25+00:00"
},
"oven":
{
   "available": true,
   "profileRequired": false,
   "profileComplete": true,
   "profileAdded": false,
   "models": 4,
   "version": "2023 Q2",
   "timestamp": "2023-04-18T06:19:32+00:00"
},
"dryer":
{
   "available": true,
   "profileRequired": false,
   "profileComplete": true,
   "profileAdded": false,
   "models": 1,
   "version": "2023 Q2",
   "timestamp": "2023-04-18T06:16:34+00:00"
},
"flowHeater":
{
   "available": false,
```

```
    "profileRequired": true,
    "profileComplete": false,
    "profileAdded": false,
    "attemptsLeft": 1
  },
  "immersionHeater":
  {
    "available": true,
    "profileRequired": true,
    "profileComplete": true,
    "profileAdded": false,
    "models": 1,
    "version": "2023 Q2",
    "timestamp": "2023-04-18T06:21:57+00:00"
  },
  "electricVehicle":
  {
    "available": false,
    "profileRequired": true,
    "profileComplete": false,
    "profileAdded": false,
    "attemptsLeft": 1
  },
  "airConditioning":
  {
    "available": true,
    "profileRequired": true,
    "profileComplete": true,
    "profileAdded": false,
    "models": 1,
    "version": "2023 Q2",
    "timestamp": "2023-04-18T06:18:42+00:00"
  }
```

```
  },
  "nonTimeBasedAppliances":
  {
    "alwaysOn":
    {
      "available": true,
      "profileRequired": false,
      "profileComplete": true,
      "profileAdded": false,
      "models": 1,
      "version": "2023 Q2",
      "timestamp": "2023-05-13T06:03:19+00:00"
    },
    "refrigeration":
    {
      "available": true,
      "profileRequired": false,
      "profileComplete": true,
      "profileAdded": false,
      "models": 1,
      "version": "2023 Q2",
      "timestamp": "2023-05-13T06:03:19+00:00"
    },
    "lighting":
    {
      "available": true,
      "profileRequired": false,
      "profileComplete": true,
      "profileAdded": false,
      "models": 1,
      "version": "2023 Q2",
      "timestamp": "2023-05-13T06:03:19+00:00"
    },
```


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```
"entertainment":
{
   "available": true,
   "profileRequired": false,
   "profileComplete": true,
   "profileAdded": false,
   "models": 1,
   "version": "2023 Q2",
   "timestamp": "2023-05-13T06:03:19+00:00"
},
"waterBoiler":
{
   "available": false,
   "profileRequired": true,
   "profileComplete": false,
   "profileAdded": false
},
"heatPumps":
{
   "available": true,
   "profileRequired": true,
   "profileComplete": true,
   "profileAdded": false,
   "models": 1,
   "version": "2023 Q2",
   "timestamp": "2023-04-18T06:19:21+00:00"
},
"solarProduction":
{
   "available": true,
   "profileRequired": false,
   "profileComplete": true,
   "profileAdded": false,
```

```
        "models": 1,
        "version": "2023 Q2",
        "timestamp": "2023-04-18T06:21:57+00:00"
      }
    },
    "retrainSchedule":
    {
      "airConditioning": "NA",
      "alwaysOn": "NA",
      "dishWasher": "NA",
      "dryer": "NA",
      "electricVehicle": "NA",
      "entertainment": "NA",
      "flowHeater": "NA",
      "heatPumps": "NA",
      "immersionHeater": "NA",
      "lighting": "NA",
      "oven": "NA",
      "refrigeration": "NA",
      "solarProduction": "NA",
      "washingMachine": "NA",
      "waterBoiler": "NA"
    }
  }
```


Suggested Profile Correction Report

The intention of this report is the detection of assets such as Photovoltaics, Electric Vehicles and HVAC in installations that have undeclared the corresponding information in the user profiles.

Requirements

Conditions for report to be generated

The suggested profile correction reports are generated in the 15th day of every month and for all the installations that:

- They have at least one **undeclared** profile attribute for the following assets:
    - Electric Vehicle,
    - Photovoltaics,
    - Non-electric or undeclared HVAC - the latter is considered declared if any of the following are present:
        - Electric radiators,
        - Electric storage,
        - Electric heat pump,
        - Hybrid heat pump
        - Air Condition.
- They do not have secondary meter measurements for the aforementioned categories.
- They meet specific requirements regarding the re-execution period in order to avoid generating the same reports since no change has been performed in the user profile:
    - If installation was flagged for profile correction (appliance is detected), the re-execution occurs:
        - Electric Vehicle: after 6 months
        - HVAC: after 1 year
        - Photovoltaics: flagged installations are excluded from future re-executions
    - If an installation was not flagged for correction, a re-execution occurs:
        - Electric Vehicle: after 1 month
        - HVAC: after 3 months
        - Photovoltaics: after 1 month

Requirements

The requirements for the Suggested Profile Correction reports to be generated are:

- high or low resolution energy measurement data to be available for the period for which the report will be generated
- high or low resolution energy measurement data to be available for an installation for more than 6 months and existence of at least 3 months of winter and summer months (in total) within the period under consideration.

- The required metrics for the execution are CSD and CSR measurements with 15-60 minute or 1-10 second granularity.
- Energy injection (CSR) can be omitted if no energy is produced in the household.

Specifications

Location

The suggested profile correction reports are generated under the S3 export bucket for Customer Intelligence reports following the following format:

s3://<exportBucket>/<labelpartner>/reports/<installationIdentifier>/<serviceType>/suggested-profile-correction/<filename>

where

- exportBucket = The name of the AWS S3 bucket that contains all the reports in the format s3-export-<platform>, as mentioned here.
- labelpartner = The identifier of the labelpartner.
- installationIdentifier = The external installation identifier that was provided by the customer during end-user provisioning. It is a unique identifier of a specific household of an end-user.
- serviceType = The measurement resolution that has been used to generate the report. Can be:
    - "SM" when low resolution energy data were available or
    - "RT" when high resolution energy and power data were available
- filename = the filename of the generated report in the following format
  <internalInstallationIdentifier>_<executionDate>_suggested_profile_correction.json
  where
    - internalInstallationIdentifier = the installation identifier used internally in N2G Insight
    - executionDate = the date of execution in YYYYMMDD format

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Report Format

The Suggested Profile Correction report is defined in JSON format.

The JSON report contains the following fields

Field	Type	Description
startDate	string	The start date in YYYYMMDD format of the period over which the detection process is executed
stopDate	string	The stop date in YYYYMMDD format of the period over which the detection process is executed
timestamp	long	The timestamp that the message was produced and published, in UNIX Timestamp in milliseconds
version	string	The version of the service that the report corresponds to, i.e. "2.3"
error	string	The reported error for the report, in a string format. The applicable values are described in the table below.
profileStatus	integer	The status of the profile, as an integer value. The applicable values are 0 or 1, indicating default or personalised profile correspondingly.
insights	Map <string, DetectionStatus>	The insights for all the services under examination, as a map with key the service name and value a DetectionStatus in the format described below. The allowed keys are the following: • "solarPanel" • "electricVehicle" • "HVAC"

The Detection Status object contains the following fields:

Field	Type	Description
detection	int	The status of the detection process, with possible values: 1: the appliance is detected 0: the appliance is not detected

The error codes applicable to the Suggested Profile Correction Report are described in the table below:

Error Code	Message	Report Provided	Description
null	-	true	No error during the detection process.
30007	Insufficient Data Measurements	false	Insufficient data measurements during the detection process found.

Example File

A Suggested Profile Correction Report would be generated in a location like:
s3://s3-export-ABC/labelpartnerB/reports/abc123456/SM/suggested-profile-correction/abc123456_20221231_suggested_profile_correction.json

The contents would be similar to the below example:


```
{
 "error": "null",
 "timestamp": 1733298007771,
 "version": "5.3",
 "startDate": "20220101",
 "stopDate": "20221231",
  "profileStatus": 1,
  "insights": {
   "electricVehicle": {
```

```
      "detection": 1
  },
  "solarPanel": {
      "detection": 1
  },
    "HVAC": {
       "detection": 1
  }
}
}
```


Notification message & queue

The queue that will be used to publish messages when a Suggested Profile Correction report is generated by NET2GRID EnergyAI™ Platform will be communicated to the customer by NET2GRID.

This queue is available only for EnergyAI™ Platforms that don't have CE-API enabled.

The name of the queue will be like:

profile_correction

The message that will be published will be in JSON format contain the following fields:

Field	Type	Description
bucket	string	The name of the bucket that contains the report
filename	string	The filename (full path) of the file that was generated

An example of such a message is shown below:


```
{
        "bucket": "s3-export-customerA",
        "filename":
"/labelpartnerB/reports/abc123456/SM/suggested-profile-correction/abc123456_20221231
_suggested_profile_correction.json"
}
```

Each message will contain an attribute named "routingKey" of type String that will contain the <installation_identifier>.profile_correction as value.

DER Detection Report

The intention of this tool is the detection of assets such as PVs, BESS units and EVs in installations.

Requirements

Distributed Energy Resources (DER) Detection reports are generated on a daily basis for each installation whose measurement data is uploaded on that day.

- If a full year of measurement data is available, the report covers the complete year.
- If less than one year of data is available, the report covers the entire available measurement period

Requirements for DER Detection Execution

DER Detection reports are generated only when the following requirements are met:

- high or low resolution energy measurement data to be available for the period for which the report will be generated
- high or low resolution energy measurement data to be available for an installation for more than 3 months and ideally for one year.
- The required metrics for DER execution are CSD and CSR with 15-60 minute or 1-10 second granularity. Energy injection (CSR) can be omitted if no energy is produced in the household.
- A DER Detection execution for an installation is triggered only when new measurement data is available and at least one (1) month has elapsed since the installation's last successful DER Detection execution.
    - If new measurement data is uploaded before one full month has passed since the last execution, no new execution is performed.
    - Once one full month has elapsed, the next upload of measurement data triggers a new DER Detection execution.

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- No executions are performed in the absence of new measurement data, even if the one-month period has elapsed.

Installation profile impact

There is no installation profile impact on the generation of the DER Detection reports.

Specifications

Location

The DER detection reports are generated under the S3 export bucket for Customer Intelligence reports following the following format:

s3://<exportBucket>/<labelpartner>/reports/<installationIdentifier>/<serviceType>/ci-smart-insights/<filename>

where

- exportBucket = The name of the AWS S3 bucket that contains all the reports
- labelpartner = The identifier of the labelpartner
- installationIdentifier = The external installation identifier that was provided by the customer during end-user provisioning. It is a unique identifier of a specific household of an end-user.
- serviceType = The measurement resolution that has been used to generate the report. Can be:
  - "SM" when low resolution energy data were available or
  - "RT" when high resolution energy and power data were available
- filename = the filename of the generated report in the following format *<internalInstallationIdentifier>_<reportStartDate>_<reportEndDate<>_ci_smart_insights.json* where
  - internalInstallationIdentifier = the installation identifier used internally in NET2GRID EnergyAI™
  - reportStartDate = the day in YYYYMMDD format from which the report was generated

- reportEndDate = the day in YYYYMMDD format until which the report was generated

Report Format

The DER detection report is defined in JSON format.

The JSON report contains the following fields

Field	Type	Description
startDate	string	The start date in YYYYMMDD format of the period over which the detection process is executed
stopDate	string	The stop date in YYYYMMDD format of the period over which the detection process is executed
timestamp	long	The timestamp that the message was produced and published, in UNIX Timestamp in milliseconds
version	string	The version of the service that the report corresponds to, i.e. "2.3"
servicesInsights	Map <string, CIServiceObject>	The insights for all the services under examination, as a map with key the service name and value a CIServiceObject in the format described below. The allowed keys are the following: • "solarPanel" • "BESS" • "electricVehicle" • "HVAC"

The The CIServiceObject object contains the following fields:

Field	Type	Description
detection	boolean	The status of the detection process. Valid for the PV, BESS and HVAC insights.

detectionScore	double	The EV confidence score, in the range [0,1]. Valid only for EV insights.
insights	object	The insights of the detected service, which can be • SolarPanelDetectionObject for the solar panels • ElectricVehicleDetectionObject for the electric vehicles • HVACDetectionObject for the HVAC process Currently no insights are provided for the BESS detection.

The SolarPanelDetectionObject object contains the following fields:

Field	Type	Description
capacity	integer	The capacity of the detected Solar Panel
solarProductionGranularity	integer	The solar production granularity in minutes.
solarProductionPerDay	Map<string, array>	The solar production of each day of each month, as a map with key the date in YYYYMMDD format and value an array of doubles with the solar production of each interval of the day. The interval is defined by the solar production granularity.
maxProductionOfMonth	Map<string, Map<string, array>>	The maximum solar production per month, as a map with key the month in YYYY-MM format and value the map with key the date that the maximum production is encountered in YYYYMMDD format and value the maximum solar production as a double.

The ElectricVehicleDetectionObject object contains the following fields:

Field	Type	Description

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chargingType	string	The charging type of the most common detected Electric Vehicle model found in the examined period. The valid values of types are: - L1 - L2 - L2-multi-phase.
eventsPerMonth	Map<string, array>	The events per month as map with the key being the month as a String value in YYYY-MM format and value an array of ChargingEventObject objects.

The ChargingEventObject object contains the following fields:

Field	Type	Description
usage	double	The energy consumption of this event in kWh.
startTime	long	The timestamp that the charging event started in UNIX Timestamp in seconds
stopTime	long	The timestamp that the charging event stopped in UNIX Timestamp in seconds

The HVACDetectionObject object contains the following fields:

Field	Type	Description
type	string	The type of hvac found in the examined period. The valid values of types are: - cooling - heating - heatingAndCooling

Example File

A DER detection report would be generated in a location like:

s3://s3-export-ABC/labelpartnerB/reports/abc123456/SM/ci-smart-insights/abc123456_20220401_20230331_ci_smart_insights.json

The contents would be similar to the below example:


```
{
  "startDate": "20220401",
  "stopDate": "20230331",
  "timestamp": 1682478369683,
  "version": "1.3",
  "servicesInsights":
  {
    "solarPanel":
    {
      "detection": true,
      "insights":
      {
        "capacity": 2972,
        "solarProductionGranularity": 60,
        "maxProductionOfMonth":
        {
                "2022-04":{"20220426":0.345},
                "2022-05":{"20220523":0.297},
                "2022-06":{"20220622":0.303},
                "2022-07":{"20220710":0.214},
                "2022-08":{"20220823":0.446},
                "2022-09":{"20220911":0.342},
                "2022-10":{"20221026":10.628},
                "2022-11":{"20221102":10.249},
                "2022-12":{"20221213":4.81},
                "2023-01":{"20230118":5.48},
                "2023-02":{"20230227":15.397},
                "2023-03":{"20230301":15.345}
        },
```

```
            "solarProductionPerDay":
            {

"20230301":[0.0,0.0,0.0,0.0,0.0,0.0,0.0,0.079,0.124,0.271,0.304,0.354,0.331,0.276,0.169,0.18
1,0.093,0.043,0.0,0.0,0.0,0.0,0.0,0.0],

"20230302":[0.0,0.0,0.0,0.0,0.0,0.0,0.0,0.079,0.124,0.271,0.304,0.354,0.331,0.276,0.169,0.18
1,0.093,0.043,0.0,0.0,0.0,0.0,0.0,0.0]
            }
          }
        },
        "BESS":
        {
          "detection": false
        },
        "electricVehicle":
        {
          "detectionScore": 0.674,
          "insights":
          {
            "chargingType": "L1",
            "eventsPerMonth":
            {
                    "2023-02":[
                            {"usage":5.64,"startTime":1676004421,"stopTime":1676013618},
                            {"usage":5.001,"startTime":1676445618,"stopTime":1676460018}
                    ],
                    "2023-03":[
                            {"usage":5.64,"startTime":1678879218,"stopTime":1678889118}
                    ]
            }
          }
        },
```

```
    "HVAC": {
          "detection": true,
          "insights" : {
               "type": "cooling"
          }
       }
    }
}
```


PV Candidate Sizing Report

The candidate sizing for solar panels contains three main strategies designed to detect the best solar panel capacity to:

1. maximize the self-sufficiency of the installation considering the whole year
2. maximize the self-sufficiency of the installation, during spring and autumn and
3. cover the household's energy demands during winter months up to a specific percentage, while limiting the energy surplus during summer months up to a specific percentage

Requirements

Conditions for report to be generated

PV candidate sizing reports are generated ad-hoc upon request from Customer for a specific period.

Requirements

The requirements for the PV candidate sizing reports to be generated are:

- high or low resolution energy measurement data to be available for the period for which the report will be generated
- high or low resolution energy measurement data to be available for an installation for more than 1 year
- Current Summation Received is required to be provided for the report to be generated.

Installation profile impact

There is no installation profile setup requirement for the report to be generated

Specifications

Location

The PV candidate sizing reports are generated under the S3 export bucket for Customer Intelligence reports following the following format:

s3://<exportBucket>/<labelpartner>/smart-insights-reports/solar-capacity-recommender/<reportDate>/<filename>

where

- exportBucket = The name of the AWS S3 bucket that contains all the reports
- labelpartner = The identifier of the labelpartner
- reportDate = The date in YYYYMMDD format in which the report was generated
- filename = the filename of the generated report in the following format *<internalInstallationIdentifier>_<reportStartDate>_<reportEndDate<>_solar_capacity_recommender.json*

  where
  - internalInstallationIdentifier = the installation identifier used internally in NET2GRID EnergyAI™
  - reportStartDate = the day in YYYYMMDD format from which the report was generated
  - reportEndDate = the day in YYYYMMDD format until which the report was generated

Report Format

The PV candidate sizing Report is defined in JSON format.
The JSON report contains the following fields

Field	Type	Description
startDate	string	The start date in YYYYMMDD format of the period over which the solar panel recommendation is estimated.

stopDate	string	The stop date in YYYYMMDD format of the period over which the solar panel recommendation is estimated
timestamp	long	The timestamp that the message was produced and published, in UNIX Timestamp in milliseconds
version	string	The version of the service that the report corresponds to, i.e. "2.3"
recommendations	Map<string, SelfSufficiencyObject>	The recommendations for all strategies, as a map with key the strategy name and value the SelfSufficiencyObject that is described in the table below. The valid keys of the map are: • wholeYearSelfSufficiency • summerWinterSelfSufficiency • springAutumnSelfSufficiency

The SelfSufficiencyObject object contains the following fields:

Field	Type	Description
capacity	integer	The capacity of the recommended solar panel in Watts

Example File

A PV candidate sizing report would be generated in a location like:

s3://s3-export-ABC/labelpartnerB/smart-insights-reports/solar-capacity-recommender/20230427/abc123456_20220401_20230331_solar_capacity_recommender.json

The contents would be similar to the below example:

```
{
   "startDate": "20220401",
   "stopDate": "20230331",
   "timestamp": 1682751423528,
   "version": "1.2",
   "recommendations":
   {
      "wholeYearSelfSufficiency":
      {
         "capacity": 2500
      },
      "summerWinterSelfSufficiency":
      {
         "capacity": 2500
      },
      "springAutumnSelfSufficiency":
      {
         "capacity": 2500
      }
   }
}
```


BESS Candidate Sizing Report

The BESS candidate sizing tool aims to estimate the most suitable BESS size in Wh based on the energy surplus that is returned to the grid and is executed only for installations with solar panels.

Requirements

Conditions for report to be generated

BESS candidate sizing reports are generated ad-hoc upon request from Customer for a specific period.

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Requirements

The requirements for the BESS candidate sizing reports to be generated are:

- high or low resolution energy measurement data to be available for the period for which the report will be generated
- high or low resolution energy measurement data to be available for an installation for more than 1 year
- Current Summation Received is required to be provided for the report to be generated, in case of low resolution data..

Installation profile impact

There are no installation profile requirements for the generation of the BESS candidate sizing reports.

Specifications

Location

The BESS candidate sizing reports are generated under the S3 export bucket for Customer Intelligence reports following the following format:

s3://<exportBucket>/<labelpartner>/smart-insights-reports/bess-size-recommender/<reportDate>/<filename>

where

- exportBucket = The name of the AWS S3 bucket that contains all the reports
- labelpartner = The identifier of the labelpartner
- reportDate = The date in YYYYMMDD format in which the report was generated
- filename = the filename of the generated report in the following format *<internalInstallationIdentifier>_<reportStartDate>_<reportEndDate<>_bess_size_recommender.json*

  where
  - internalInstallationIdentifier = the installation identifier used internally in NET2GRID EnergyAI™

- reportStartDate = the day in YYYYMMDD format from which the report was generated
- reportEndDate = the day in YYYYMMDD format until which the report was generated

Report Format

The BESS candidate sizing Report is defined in JSON format.

The JSON report contains the following fields

Field	Type	Description
startDate	string	The start date in YYYYMMDD format of the period over which the BESS recommendation is estimated.
stopDate	string	The stop date in YYYYMMDD format of the period over which the BESS recommendation is estimated
timestamp	long	The timestamp that the message was produced and published, in UNIX Timestamp in milliseconds
version	string	The version of the service that the report corresponds to, i.e. "2.3"
energySurplusRecommendation	object	The sizing result based on energy surplus in EnergySurplusRecommendationObject format that is described in the table below

The EnergySurplusRecommendationObject object contains the following fields:

Field	Type	Description
capacity	integer	The capacity of the BESS in Watts

Example File

A BESS candidate sizing report would be generated in a location like:
s3://s3-export-ABC/labelpartnerB/smart-insights-reports/bess-size-recommender/20230427/abc123456_20220401_20230331_bess_size_recommender.json

The contents would be similar to the below example:


```
{
   "startDate": "20220401",
   "stopDate": "20230331",
   "timestamp": 1683023385534,
   "version": "1.2",
   "energySurplusRecommendation":
   {
      "capacity": 5000
   }
}
```