

Coscine Documentation

Ignacio Martínez López,^{a,c} Lazher Mejdí,^b Kourosh Malek^b

^aDepartamento de Física Teórica, Mod. 15, Universidad Autónoma de Madrid, E-28049 Madrid, Spain.

^bTheory and Computation of Energy Materials (IET-3), Forschungszentrum Jülich GmbH, 52425 Jülich, Germany

^cCentro de Investigaciones Energéticas, Medioambientales y Tecnológicas (CIEMAT), Dept. de Tecnología, Av. Complutense 40, Madrid, Spain

E-mail: ignacio.martinez@ciemat.es

Abstract. This document provides a practical guide to using the Coscine platform within the RISEnergy project. It explains how to create and manage resources, link metadata to existing schemas, and develop customized metadata profiles using AIMS. The guide follows a step-by-step approach, covering account setup, project participation, resource creation, and metadata integration. It also outlines key considerations, common challenges, and recommended practices to ensure efficient and error-free use of both platforms. In addition, the document demonstrates the application of these processes through concrete use cases, including PEM fuel cell systems and building-integrated photovoltaic (BIPV) monitoring, illustrating how metadata schemas can be effectively designed and implemented in real research scenarios.

Keywords: AIMS, Coscine, FAIR data, Metadata, Metadata schema

Contents

1	Introduction	1
2	Getting started with Coscine	2
2.1	Create a Coscine account	2
2.2	Join the RISEnergy project in Coscine	3
2.3	Add a resource and use metadata profile (template)	3
3	Developing metadata profiles with AIMS	7
3.1	Getting starting with AIMS	8
3.2	<i>Available Metadata Profiles</i> panel	9
3.3	<i>Vocabulary Terms</i> panel	9
3.4	<i>Detail View (Fields)</i> panel	10
3.5	<i>Field Properties</i> panel	10
3.6	Saving and submitting a metadata profile	14
4	Use case examples	14
4.1	PEM fuel cell use case and metadata schema	14
4.2	BIPV monitoring use case and metadata schema	18
5	Conclusions and Outlook	20

1 Introduction

This documentation is intended to support RISEnergy partners in using the [Coscine platform](#) and its associated services, as well as to foster cooperation towards the definition of common Meta-Data (MD) schema for each Renewable Energy (RE) technology. Establishing such shared schemas is essential to enhance collaboration among our institutes and to effectively fulfil the goals of the RISEnergy project. The initial presentation of this material is specifically aimed at the Work Package (WP) 3 workshop of RISEnergy.

To this end, the document is structured as follows. Section 2 describes the procedure and provides the main guidelines for using the Coscine platform to link datasets to the MD profiles already developed within the project. Section 3 presents several practical considerations, based on our experience with the AIMS platform from Coscine, that are relevant for the proper development of MD schemes. An illustrative use case from CIEMAT, focusing on a metadata schema example, is presented in Section 4. Finally, the conclusions of this work are discussed in Section 5.

For platform users, it is also recommended to consult the official documentation provided by the platform itself [Coscine documentation](#), which served as an additional source of information for the preparation of this document. If any issue is encountered while using coscine, it is highly encouraged that to contact the developers directly via this email: servicedesk@itc.rwth-aachen.de.

2 Getting started with Coscine

This section provides a step-by-step guide to start using the Coscine platform and to link externally hosted data to a MD schema within Coscine.

2.1 Create a Coscine account

Go to the Coscine login page: <https://coscine.rwth-aachen.de/login>. Click on “Login (all institutions)”, as shown in Figure 1. **Logging in directly via ORCID from the main page may prevent access to projects in which the user is a member.**¹

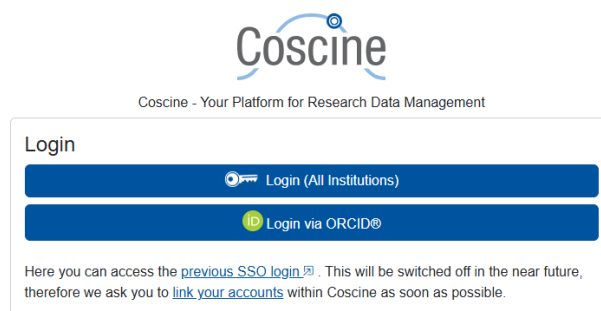


Figure 1: Coscine login options.

Afterwards, the user will be redirected to the page shown in Figure 2. In most cases, the user’s institution may not appear in the list. Therefore, please select either:

- **Helmholtz ID** (if available), or
- **ORCID**.

In our case, logging in via ORCID worked correctly (see Figure 2).


¹This appears to be a platform-related issue.

Welcome

You have been forwarded here by a service to authenticate yourself:

Coscine

Select home organization

 Remember Home organisation
 

Login with other identity providers:



Figure 2: Login options after selecting “Login (all institutions)”.

2.2 Join the RISEnergy project in Coscine

After creating an account, the user has to send the email address used for registration to Lazher Mejdi (m.lazher@fz-juelich.de). The user will be added to the already created RISEnergy project in Coscine.

Once added, the project will appear in the project list, as illustrated in Figure 3.

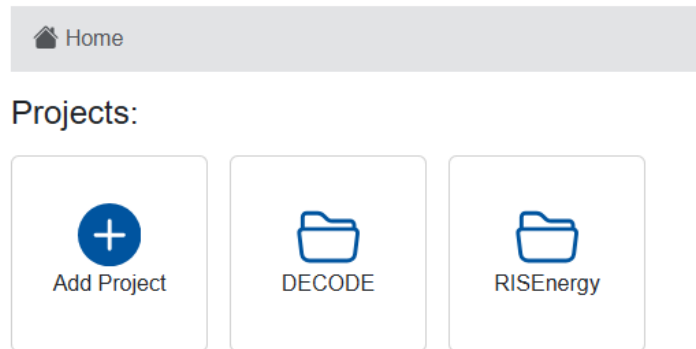


Figure 3: List of projects available in the home page of Coscine.

2.3 Add a resource and use metadata profile (template)

In Coscine, a *resource* represents a digital object (e.g., time series, images, videos, code, etc).

By default, Coscine does not provide cloud storage for direct data uploads (unlike platforms such as Zenodo, GitLab, or GitHub). However, it is possible to apply for cloud storage of up to 125 TB (<https://docs.coscine.de/en/projects/storage/>).

We are currently in the process of applying for cloud storage and expect to receive dedicated RISEnergy project storage. Alternatively, Coscine can be used exclusively for MD management while the data remain hosted in external repositories. This approach is often suitable, as many users already rely on institutional or domain-specific storage solutions.

To create a resource within the RISEnergy project, click on “Add Resource” (see Figure 4).

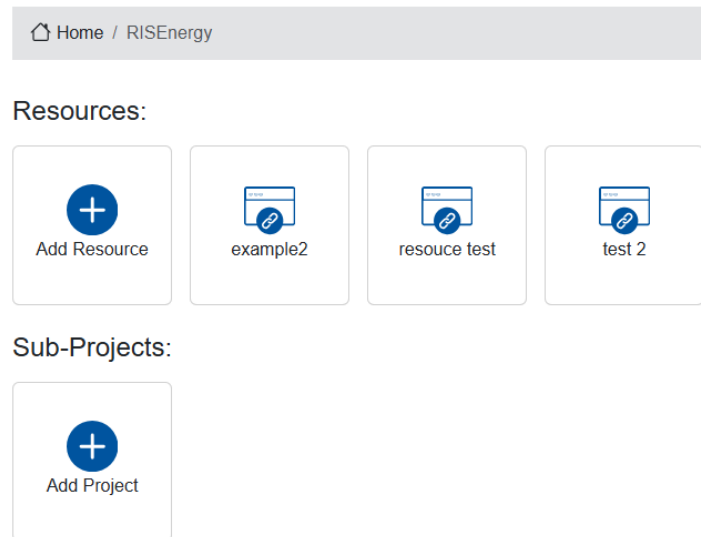


Figure 4: Project interface showing the “Add Resource” option.

The user will then be prompted to a form with four steps to complete:

- **Step 1: Resource Configuration**

This step involves selecting the appropriate *resource type* from five available options in the dropdown menu (see Figure 5).

The first three types—S3, Web, and WORM—store data in the cloud and require a storage application process. A more detailed explanation of these types is provided below:

- Web resources can be accessed via the Coscine web interface or the REST API. Employees of DH.NRW universities automatically receive 100 GB of storage space per project for this resource type. If more than 100 GB is required, a storage application must be submitted for the respective Coscine project. MD entry through Coscine is mandatory, whether using the web interface or the REST API.
- S3 resources can be accessed via the web interface, the REST API, or directly using S3 credentials through S3 clients (e.g., Cyberduck). Since MD entry is not enforced when uploading files via S3, submitting a storage application is always required.

- WORM (Write Once, Read Many) resources ensure that once data is stored, it cannot be modified or deleted. Applying for this resource type requires submitting a storage application and conducting a prior consultation with the RDM staff of the user’s home organization.

In addition to these, there is the GitLab resource type, which is intended for users who store code in a GitLab repository and wish to enrich it with MD in Coscine.

The final option, Linked Data, is used when users already have an external data repository for storing their data and want to use Coscine solely for MD management.

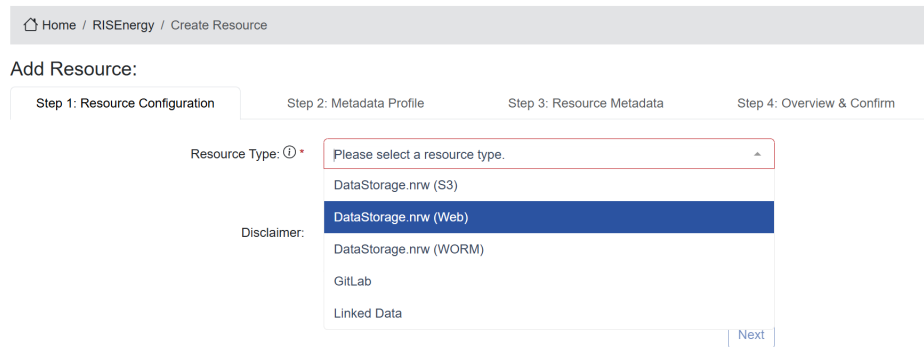


Figure 5: Resource configuration step when adding a resource to Coscine

- **Step 2: MD Profile**

In Coscine, MD templates are referred to as *MD Profiles*. The user can select an existing profile from the available list and click “Next” to continue. If none of the existing templates meet the user’s requirements, Section 3 explains how to create a custom MD schema. There will be a dedicated *MD Profiles* section for the RISEnergy project, where templates created by project partners are grouped (see Figure 6).

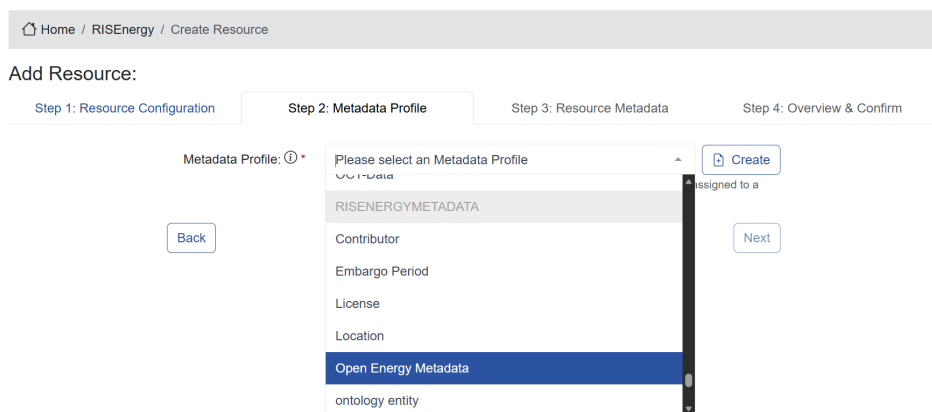


Figure 6: *MD profile* selection options of a resource in Coscine

- **Step 3: Resource MD**

Fill in the administrative MD fields. Mandatory fields must be completed clearly and concisely to avoid ambiguities. These fields describe the resource itself (see Figure 7).

The screenshot shows the 'Add Resource' form in the Coscine system, specifically Step 3: Resource Metadata. The form is titled 'Add Resource:' and has four steps: Step 1: Resource Configuration, Step 2: Metadata Profile, Step 3: Resource Metadata (current), and Step 4: Overview & Confirm. The form contains the following fields:

- Resource Name:** A text input field with the value 'Resource Name' and a character count of '0 / 200'.
- Display Name:** A text input field with the value 'Display Name' and a character count of '0 / 25'.
- Resource Description:** A text area with the value 'Resource Description' and a character count of '0 / 10000'.
- Discipline:** A dropdown menu with the selected option 'Electrical Engineering and Information Technology 4.42'. Other visible options include 'Fluid Mechanics, Technical Thermodynamics and Thermal Energy Engineering 4.22', 'Computer Science 4.43', and 'Systems Engineering 4.41'.
- Resource Keywords:** A text input field with the placeholder 'Type, then press "Enter" to insert a Keyword'.
- Metadata Visibility:** Radio buttons for 'Project Members' (selected) and 'Public'.
- License:** A dropdown menu with the value 'Please select a License'.
- Internal Rules for Reuse:** A text input field with the value 'Internal Rules for Reuse' and a character count of '0 / 200'.
- Resource created:** A text input field with the value '-'.

At the bottom of the form, there are two buttons: 'Back' and 'Next'.

Figure 7: Definition of the administrative MD of a resource in Coscine.

- **Step 4: Overview and Confirmation**

Review the information entered to ensure correctness before final confirmation.

After creating the resource, it will appear on the project page (*resource test* in Figure 4). By selecting it, the user can link externally hosted data through the *Data URL* field and complete the MD fields defined in the selected schema as seen in Figure 8.

Once the entry is completed, it can be saved. Additional entries that has the same *MD profile* can be added to the same resource if needed.

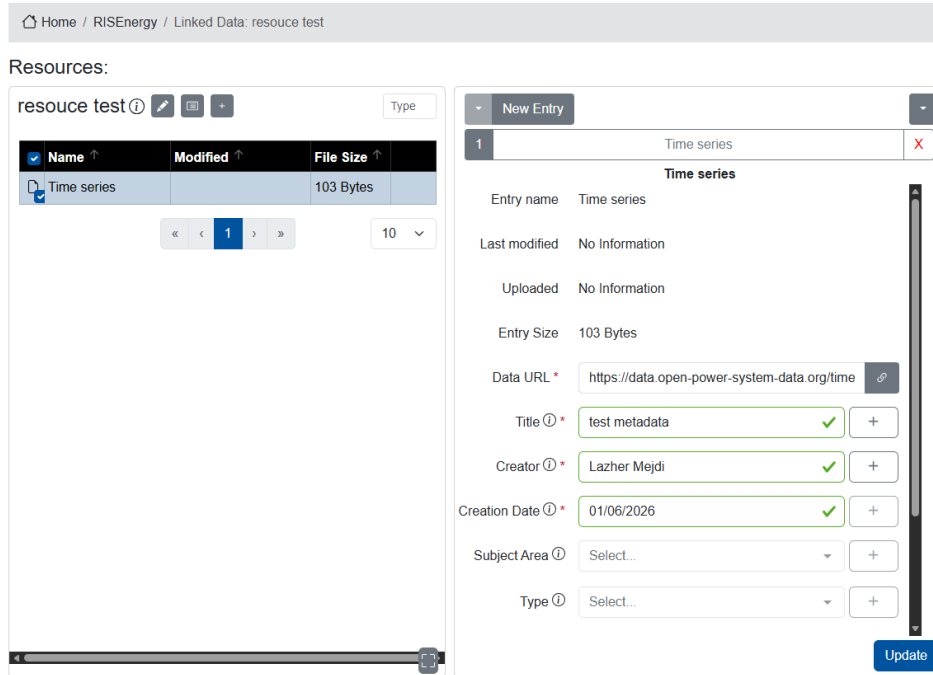


Figure 8: Interface for adding a new entry to an existing resource.

3 Developing metadata profiles with AIMS

Coscine provides another web-based platform for MD profile service called “[Applying Interoperable Metadata Standards \(AIMS\)](#)”. It is an instance tailored for Coscine, originally developed within the [AIMS project](#) for MD creation, sharing, and reuse. The platform is maintained by RWTH Aachen University. If at any point the user have doubts or questions regarding any of the quantities, terms, or concepts used in AIMS, he can contact them directly for clarification. In particular, the ontologists involved in the development of this resource can provide guidance and help resolve ambiguities related to definitions, units, or semantic interpretations ².

To become familiar with the tool, Coscine provides tutorials through its [video tutorials](#). The [first video](#) introduces how AIMS works together with Coscine and gives an overview of the AIMS interface. It explains different ways to create MD profiles—such as creating a new one, importing existing profiles, or modifying profiles by copying, extending, or versioning them. It also clarifies the differences between these options and highlights which types of MD are most important when building a profile. The [second video](#) demonstrates how to create a sample MD profile in AIMS. It highlights key properties of MD fields, provides practical tips, and explains how to stay in touch with the Coscine team after submitting the profile as a draft. The [third video](#) focuses on advanced MD field properties, including string-based, value-based, administrative, and paired properties.

²Contact: servicedesk@itc.rwth-aachen.de

3.1 Getting starting with AIMS

The AIMS interface (Figure 9), from left to right, shows four panels:

- **Available Metadata Profiles panel:** a list of available MD templates,
- **Vocabulary Terms panel:** search bar for matching a MD field to an existing ontology term,
- **Detail View (Fields) panel:** the list of fields included in the MD profile the user is currently working on, and,
- **Field Properties panel:** the panel used to edit the properties (name, description, datatype, etc.) of a selected MD field.

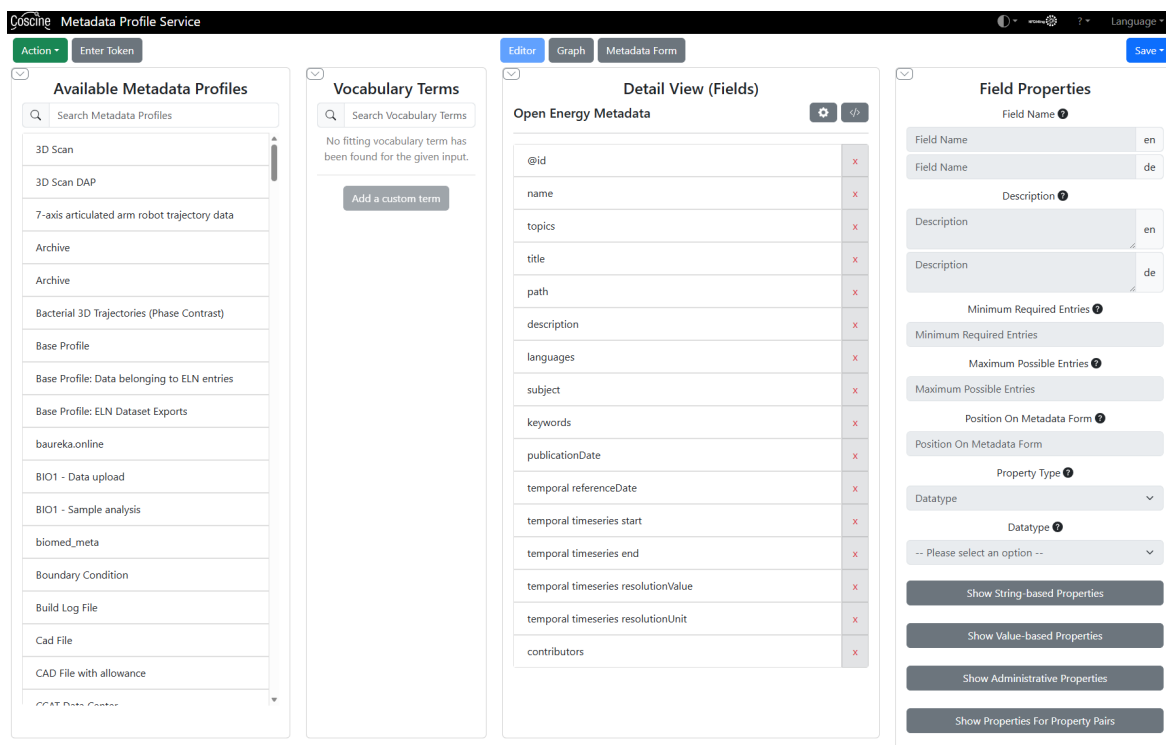


Figure 9: AIMS available MD profiles

To begin working in AIMS, click the *Action* button located in the upper-left corner of the landing page User Interface (UI) (see Figure 9). This opens a menu with two categories of options available:

- **New:** for adding MD profiles to the already existing list of Coscine AIMS, through two options:
 - **Create:** Creates a new MD profile from scratch.

- **Import**: Imports an existing MD profile from formats such as Turtle, JSON-LD, or other supported files. This option is useful when the profile has already been defined externally, saving significant time compared to manual creation.
- **Edit**: this category of options allow the user to start working from an existing MD profile from the available list of MD profiles in the **Available Metadata Profiles** panel .

The following subsections describe how to work with MD fields, using each of the aforementioned panels in the AIMS UI.

3.2 Available Metadata Profiles panel

The leftmost panel in the AIMS UI (Figure 9) displays a list of all available MD profiles within the AIMS instance of Coscine. From this panel, users may select an existing MD profile to begin working, either by directly browsing the list or by using the search bar to perform a keyword-based search.

If an MD profile closely matches the user’s requirements, it should be selected, followed by choosing the *Action* button and then one of the options: *Copy*, *Extend*, or *New Version*. The differences between these options are as follows:

- **Copy**: Allows the addition of new fields or the removal of existing ones.
- **Extend**: Prevents modification of inherited fields; only new fields may be added.
- **New Version**: Allows both the addition and removal of fields, with all modifications being fully traceable.

3.3 Vocabulary Terms panel

The second panel from left to right in the AIMS UI (Figure 9) is the *Vocabulary Terms* panel. It is used to construct MD profiles field by field and to link each field to controlled vocabularies or ontologies.

When defining an MD field, it is recommended to associate it with an existing ontology term to improve semantic clarity, interoperability, and reusability of the MD. To select an appropriate term, the user has to search for a matching term for his MD field in the *Vocabulary Terms* search bar.

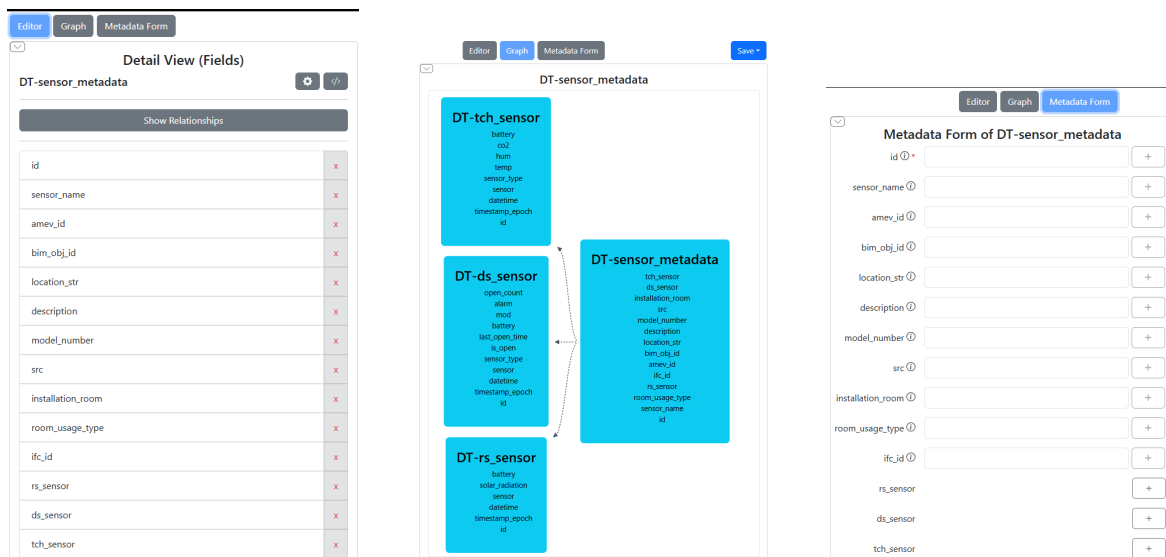
If no suitable term is available, external terminology services may be consulted, such as <https://terminology.tib.eu/ts/>. Once a relevant term is identified, the user has to copy its Internationalized Resource Identifier (IRI) and proceed as follows:

1. Select *Add a custom term* in the *Vocabulary Terms* panel.
2. Enter the required information in the *Field Properties* panel (fourth panel in Figure 9), including field name, description, and whether the field is mandatory.
3. Click *Show Administrative Properties*.
4. Paste the IRI into the *Term IRI* field.

3.4 Detail View (Fields) panel

The *Detail View (Fields)* panel, shown as the third panel from left to right in the AIMS UI (Figure 9), provides three selectable views accessible above the panel title:

- **Editor:** Enables editing of individual MD fields (Figure 10a). It also provides access to:
 - The Meta-MD, containing descriptive information about the MD profile (e.g., title, description, creator), accessible via the gear icon in the top-right corner.
 - The generated turtle code of the current MD profile, accessible via the `</>` icon next to the gear icon.
- **Graph:** Displays the hierarchical structure of the MD profile as a graph, particularly useful view when composed of multiple MD profiles (Figure 10b).
- **Metadata Form:** Shows how the MD profile is presented to end users (Figure 10c).



(a) *Editor* view of the Available Metadata Profiles panel

(b) *Graph* view of the Available Metadata Profiles panel

(c) *Metadata Form* view of the Available Metadata Profiles panel

Figure 10: Views of the *Detail View (Fields)* panel: (a) *Editor*, (b) *Graph*, and (c) *Metadata Form*.

3.5 Field Properties panel

The *Field Properties* panel, which is the fourth panel from left to right in the AIMS UI (Figure 9), is used to define the properties of each field in the MD profile.

It is recommended to fill in at least the following five properties:

- *Field Name*: Provide a clear and meaningful name for the MD field, including units in parentheses when applicable (e.g., *area (cm²)*).
- *Description*: Write a brief but precise explanation that clearly conveys the intended meaning of the field while avoiding ambiguity.
- *Minimum Required Entries*: Indicates whether the field is mandatory and how many entries are required. For example, if the minimum required entries is set to 2, at least two values must be provided. In the overall MD profile, there should be at least one required field.
- *Property Type*: As shown in Figure 11a, this defines the type of the MD field. It can be a basic data type (e.g., *integer*, *float*, *string*, *date*; see Figure 11b). It is recommended to choose this accurately to facilitate validation later. It can also be a *class*, *satisfies a Profile (always) (node)* (used when the field itself corresponds to a previously defined MD profile in AIMS), or a *List* of selectable values.
- *Term IRI*: By clicking on *Show Administrative Properties*, the *Term IRI* field becomes visible. It represents the IRI of the ontology term that best matches the MD field.

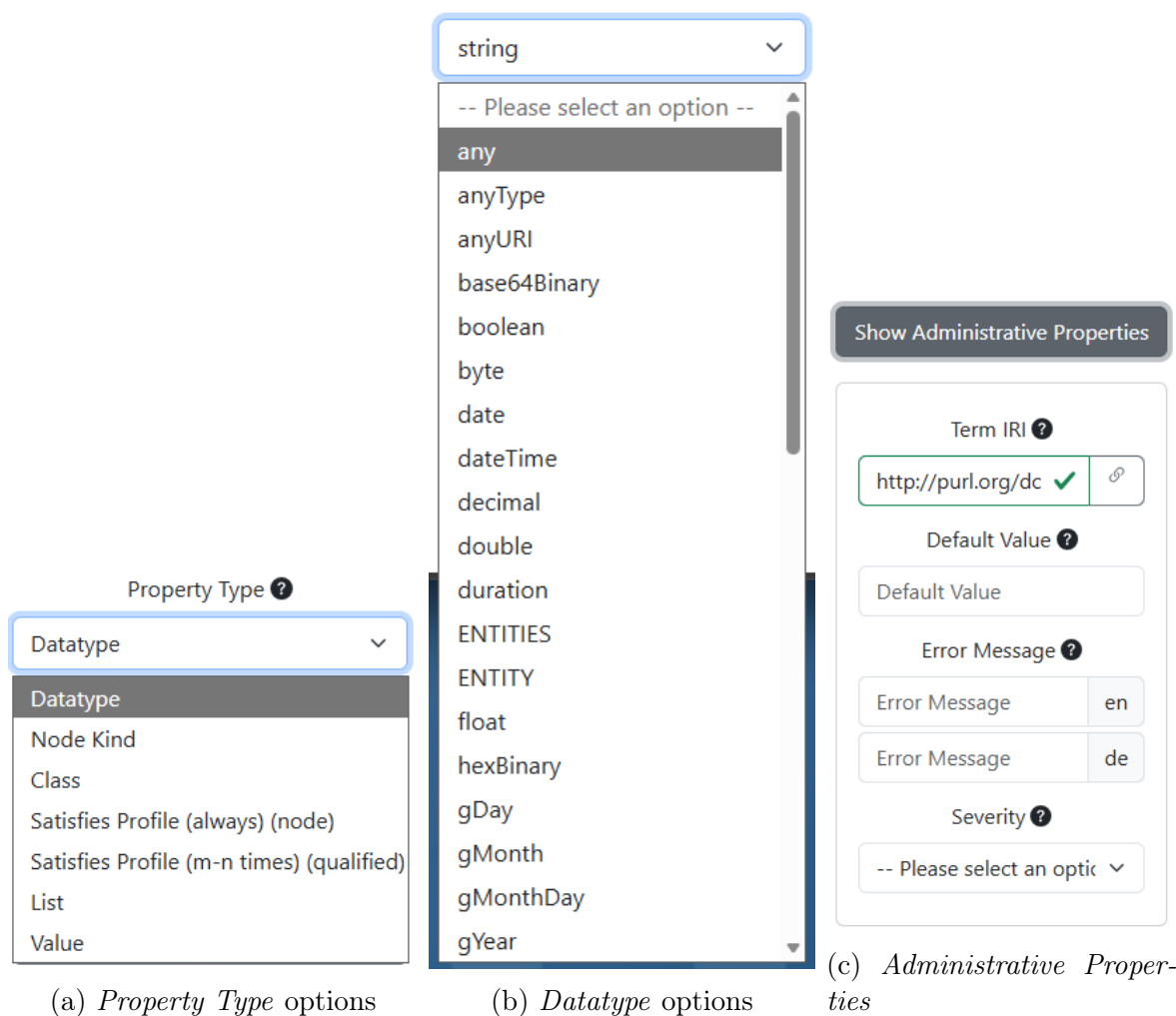


Figure 11: Recommended to fill properties of a metadata field in the *Field Properties* panel: (a) *Property Type* options, (b) *Datatype* options, and (c) *Administrative Properties*.

For string-based data (see Figure 12), AIMS provides additional restrictions such as single-line input, length constraints, or a specific format through the “Regex Pattern” option. Regex patterns can be used to enforce that an entry matches a certain form, e.g. requiring a “.../...” structure for an input like “gas components: H2/N2”³. For more information on regex patterns, see the [XML Schema Tutorial](#).

³This example illustrates the purpose of regex patterns; however, complex composite entries should be avoided whenever possible, and simpler representations are preferred.

Figure 12: AIMS “Show String-based Properties” options

In addition, AIMS provides another type of restriction through property pairs, which allow the user to define constraints relating his entry to an already existing standard or reference. For example, he may specify that a given entry should match a particular value from a dataset (see Figure ??).

Figure 13: AIMS “Show Properties For Property Pairs” options

For more details about the other properties that can be set for an MD field please check [video 3](#) in the Cosince documentation website.

3.6 Saving and submitting a metadata profile

After submitting an MD profile, the platform service team will typically contact the user by email to request clarifications and suggest improvements. After one or more iterations, the profile is accepted and becomes accessible to all users.

4 Use case examples

This section shows a full example of a MD schema development in AIMS linked to actual MD in Coscine.

4.1 PEM fuel cell use case and metadata schema

We aim to use Coscine as a collaborative platform to support the development of common MD schemas for the different technologies addressed within the RISEnergy project. Establishing shared and well-structured schemas is essential to promote interoperability, ensure consistency in data documentation, and ultimately strengthen collaboration among participating institutes. A harmonized MD framework will enable more efficient data exchange, comparability of results, and alignment with the broader objectives of the project.

As no specific RISEnergy MD samples were initially available, we began by defining MD schemas in the AIMS facility of Coscine using fuel cell experiments from CIEMAT as a pilot case. Although PEM fuel cells are not formally included in the current RISEnergy scope, they are technologically related to several project activities and could potentially become relevant in the future. For this reason, they provided a suitable and scientifically meaningful starting point to test the workflow, structure the MD fields, and evaluate the platform’s capabilities. The resulting schema has been uploaded to Coscine and is currently pending approval.

This use case concerns the electrochemical characterization of proton exchange membrane fuel cells (PEMFCs). A PEMFC is an electrochemical energy conversion device that transforms the chemical energy of hydrogen and oxygen directly into electricity through redox reactions, producing water and heat as by-products. The core component of the system is the membrane electrode assembly (MEA), which consists of a proton-conducting polymer membrane sandwiched between two porous catalyst layers. At the anode, hydrogen is oxidized into protons and electrons; the protons migrate through the membrane while the electrons travel through an external circuit, generating electrical power. At the cathode, oxygen is reduced and combines with protons to form water. The efficiency and durability of this process depend strongly on both material composition and operating conditions.

A central scientific parameter in this context is the ionomer-to-carbon (I/C) ratio, which significantly influences the microstructure of the catalyst layer, proton conductivity, gas transport pathways, and overall electrode performance. Together with platinum loading at the anode and cathode, the I/C ratio determines the density of active catalytic sites and the electrochemically active surface area. Operational parameters—including reactant gases, gas flow rates, relative humidity, pressure, and

cell temperature—directly affect reaction kinetics and transport processes. Assembly-related parameters such as tightening torque and the use of hot pressing influence mechanical compression and interfacial resistance.

The table below describes the MD fields defined for this use case.

Table 1: MD fields for the PEMFC use case.

Original Term	Example	Description
MEA	H14CX483_A 7018_H14CX4 83	Assembly entity linking membrane and electrodes.
Date	18-09-2025	Date of the experiment or measurement.
BoT (Beginning of Test)	09:14:05	Indicates the time of beginning of a test.
EoT (End of Test)	09:24:11	Indicates the end of a test.
Testbench	CIEMAT_PE M3	Identifier or name of the fuel cell test bench or station used.
CCM (Catalyst-Coated Membrane)	CEA_A7018	Indicates the ID of the catalyst coated membrane used.
Pt Loading Anode (mg Pt/cm ²)	0.12	Platinum catalyst loading in the anode catalyst layer, expressed as mass per area.
Pt Loading Cathode (mg Pt/cm ²)	0.21	Platinum catalyst loading in the cathode catalyst layer, expressed as mass per area.
I/C Anode	1.1	Ionomer-to-carbon ratio in the anode catalyst layer.
I/C Cathode	0.7	Ionomer-to-carbon ratio in the cathode catalyst layer.
GDL Anode	H14CX483 (Freudenberg)	Reference to the gas diffusion layer used on the anode side.
GDL Cathode	H14CX483 (Freudenberg)	Reference to the gas diffusion layer used on the cathode side.
Membrane	Gore 788.12	Reference to the membrane type used in the membrane electrode assembly (MEA.)
Active Area (cm ²)	15.2	Active electrochemical area of the cell.
Hot pressing	No	Indicates whether a hot-pressing step was used during MEA fabrication.
Gas reactants	H2	Reactant gases supplied to the anode and cathode.
Flow Rate (cm ³ /min)	500	Gas flow rates at the anode and cathode.

Continued on next page

Original Term	Example	Description
Relative Humidity (%)	80	Relative humidity of the inlet gases at anode and cathode.
Back pressure (bar)	1	Back pressure applied at the anode and cathode outlets.
Absolute pressure (bar)	2	Absolute pressure of the anode and cathode gas streams.
Cell temp (°C)	80	Operating temperature of the cell during the test.
Cell type	CIEMAT-AC- 1	Type or configuration of the electrochemical cell.
Tightening torque (Nm)	2	Torque applied during cell assembly to clamp the cell components.

Now we describe the steps followed to include this MD profile in AIMS.

- **Step 1: Name and description.** Once we accessed the main screen of the MD Profile Service, we searched for relevant vocabulary terms using the browser shown in the second panel of Figure 9. We checked whether any existing terms matched those required for our profile. If no suitable term was found, we selected the option “*Add a custom term*” to define a new one.
- **Step 2: Completing the fields.** From the “Detail View Fields” panel (see third panel of Figure 9), we selected each field individually, including both those identified in the vocabulary browser and the newly created ones. For each field, we specified the name (including units in parentheses when applicable) and provided a concise and unambiguous description (see fourth panel of Figure 9), following the examples shown in Table 1.

For mandatory fields, we set the value of “Minimum Required Entries” to 1. Optionally, we defined the “Position on MD Form” to control the layout of the final schema. Since we did not intend to overly restrict valid entries, we selected the “Property Type” *Datatype* in most cases. Within this category, we used:

- *string* for textual entries,
- *decimal* for measurable quantities⁴,
- *boolean* for the “Hot pressing” field (to indicate whether this method was applied during cell assembly),
- *time* for “Date”, “Beginning of Test”, and “End of Test”, as these refer to the time at which measurements were performed.

For the fields “I/C Anode” and “I/C Cathode”, we selected the “Property Type” *List* and explicitly defined the set of allowed values (see Figure 14).

⁴We initially used float, but the AIMS service recommended better use decimal since floating-point numbers can lack precision in certain ranges. Therefore, they are generally not recommended for persistently storing data, as they may lead to information loss.

Property Type ?

List
▼

List ?

0.7	string	▼	✕
1.1	string	▼	✕
1.5	string	▼	✕

Add Entry

Figure 14: AIMS Property Type list example.

- Step 3: String and value-based properties.** In our case, string-based constraints (see Figure 12) were used to define a “Regex Pattern” for fields such as “BoT” and “EoT” (hours format), as well as for “Gas (reactants)” and “Flow rate”, which follow a “.../...” structure where each side of the slash corresponds to cathode and anode values, respectively.

Regarding value-based constraints (see Figure 13), we applied them only to define the “Minimum Inclusive” restriction for the “Active Area” field, ensuring that its value must be greater than 0.

- Step 4: Administrative properties.** Administrative properties were used to link our fields to a specific “Term IRI” when no suitable term was available in the AIMS vocabulary but an appropriate one was found in external digital resources (see Figure 11c).

Once all fields were defined, we selected the “Save” option (see fourth panel of Figure 9). We also downloaded the generated code as a backup in case of token-related issues (as mentioned at the beginning of Section 3) and then submitted the profile.

After a few days (typically less than a week), the platform sends feedback via email, including suggested corrections or improvements. In our case, when reviewing the `text/turtle` version of the profile, the following issue was identified:

```
sh:property [
  sh:datatype xsd:string ;
  sh:description "Assembly entity linking membrane and electrodes."@en ;
  sh:hasValue "" ;
  sh:minCount 1 ;
  sh:name "MEA"@en ;
  sh:order 1 ;
  sh:path <https://purl.org/coscine/terms/684505e6-08df-42ac-9bdf-aa9e4b4c9e2d/> ;
]
```

A bug caused the field `sh:hasValue` to appear empty, which prevented the code from compiling. Additionally, we were advised to standardize the “Date” field by adopting the ISO 8601 format together with the datatype `xsd:date`.

The reviewers also suggested using the following IRIs:

- Date → <http://purl.org/dc/terms/date>
- Testbench → <http://schema.org/instrument>
- Operating temperature → <http://purl.org/dc/terms/temperature>

Finally, the platform provides two options: either revise the profile independently and resubmit it, or reply to the email accepting the proposed corrections, after which the service team directly merges the updated MD profile.

4.2 BIPV monitoring use case and metadata schema

In addition, we obtained preliminary photovoltaic (PV) MD schemas from our CIEMAT partners. Although these schemas are not yet formally implemented in their routine workflows, they are currently used as reference structures for future standardization efforts. The next step will be to implement and adapt these schemas within the Coscine AIMS framework.

This use case concerns the monitoring and performance characterization of a Building-Integrated Photovoltaic (BIPV) façade system. A BIPV installation integrates photovoltaic modules directly into the building envelope, where they function both as construction elements and as electricity generators. The photovoltaic module converts solar irradiance into electrical energy through the photovoltaic effect, while its thermal behavior is influenced by mounting configuration and ventilation.

The system under study consists of a vertically installed monocrystalline silicon module. Electrical characteristics under Standard Test Conditions (STC)—including maximum power and voltage/current at maximum power point—serve as reference values for field performance assessment. Irradiance measurements are obtained via calibrated pyranometers, and module temperature is monitored to quantify temperature-related efficiency losses. Electrical operation is controlled through an electronic load with MPPT, enabling accurate power determination.

Installation parameters such as azimuth, tilt, and mounting type determine irradiance incidence and thermal exchange. Detailed documentation of location and sensor configuration ensures reproducibility and comparability across installations.

The table below summarizes the MD structure defined for this use case.

Table 2: Metadata fields for the BIPV monitoring use case and mapping to AIMWORKS canonical keys.

Original Term	Example	Description
project_id	BIPV_FACA DE_001	Unique identifier of the experiment/use case.

Continued on next page

Original Term	Example	Description
description	Monitorización de rendimiento térmico y eléctrico en fachada BIPV ventilada	Short description of the experimental objective and context.
location.site_name	CIEMAT Building 42	Name/label of the measurement site.
location.coordinates.lat	40.4167	Geographic latitude of the site.
location.coordinates.lon	-3.7037	Geographic longitude of the site.
location.coordinates.alt	650	Site altitude above sea level.
location.timezone	Europe/Madrid	Time zone used for timestamps and local time interpretation.
installation_parameters.azimuth	180	Orientation of the BIPV plane (degrees, typically 0=N, 90=E, 180=S).
installation_parameters.tilt	90	Tilt angle of the BIPV plane (degrees from horizontal).
installation_parameters.mounting_type	BIPV - Rainshield	Mounting configuration / integration type of the PV façade.
installation_parameters.bifaciality	False	Indicates whether the module is bifacial.
hardware_specifications.module.manufacturer	SunPower	PV module manufacturer.
hardware_specifications.module.model	E-18-305	PV module model identifier.
hardware_specifications.module.technology	m-Si	PV cell technology (e.g., mono-Si, poly-Si, thin-film).
hardware_specifications.module.p_max_stc	250	Maximum power at STC (typically in W).
hardware_specifications.module.v_mp_stc	31.2	Voltage at maximum power point at STC (typically in V).
hardware_specifications.module.i_mp_stc	8.02	Current at maximum power point at STC (typically in A).
hardware_specifications.inverter_or_load	Electronic Load - MPPT Tracker	Device used to operate the module (inverter, MPPT, electronic load).

Continued on next page

Original Term	Example	Description
sensors[].id	PYR_01	Unique identifier of the sensor in the setup.
sensors[].type	Pyranometer	Sensor category / measurement principle.
sensors[].model	Kipp & Zonen CMP11	Sensor model name/number.
sensors[].unit	W/m ²	Physical unit of the sensor output.
sensors[].location	back-surface- center	Placement of the sensor relative to the module/system.
data_format.sampling_interval_seconds	60	Sampling interval of recorded data in seconds.
data_format.aggregation	average	Aggregation applied to raw data (average, median, etc.).
columns_mapping.timestamp	ISO8601	Timestamp encoding/format used in files.
columns_mapping.poa_irradiance	PYR_01	Column name/source channel for plane-of-array irradiance.
columns_mapping.module_temp	T_MOD_01	Column name/source channel for module temperature.
columns_mapping.dc_voltage	V_DC_MEAS	Column name/source channel for DC voltage measurement.
columns_mapping.dc_current	I_DC_MEAS	Column name/source channel for DC current measurement.

5 Conclusions and Outlook

In this work, we have developed a detailed explanation and tutorial of the use of Coscine platform in the context of RISEnergy.

Acknowledgements

RWTH Aachen University, Coscine project, AIMS project.