ece-docs

IIASA ECE Scenario Services Team

Jul 24, 2024

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THE IAMC DATA FORMAT

The *Integrated Assessment Modeling Consortium* (IAMC) developed a standardised tabular timeseries format to exchange scenario data related to energy systems modelling, land-use change, demand sectors, and economic indicators in the context of climate change mitigation pathways and the the Sustainable Development Goals (SDGs).

Read more about the *The IAMC timeseries data format*...

SCENARIO DATABASES HOSTED BY IIASA

The *Energy, Climate and Environment* program (ECE) at IIASA is hosting many databases for the community to facilitate scenario analysis, model comparison and dissemination.

Read more about the *Scenario databases hosted by IIASA*. . .

OPEN-SOURCE SOFTWARE PACKAGES

The *Scenario Services & Scientific Software team* in the Energy, Climate, and Environment program (ECE) at IIASA is developing several open-source Python packages for analysis, processing and management of scenario data in the IAMC format.

Read more about the *Open-source software packages*...

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4.1 The IAMC timeseries data format

4.1.1 Background

The *Integrated Assessment Modeling Consortium* (IAMC) developed a standardised tabular timeseries format to exchange scenario data related to energy systems modelling, land-use change, demand sectors, and economic indicators in the context of climate change mitigation pathways and the the Sustainable Development Goals (SDGs). Previous high-level use cases include reports by the *Intergovernmental Panel on Climate Change* (IPCC) and model comparison exercises within the *Energy Modeling Forum* (EMF) hosted by Stanford University.

Refer to https://data.ece.iiasa.ac.at/ for a selected list of projects using the IAMC data format.

4.1.2 An illustrative example

The table below shows a typical example of integrated-assessment scenario data following the IAMC format from the Horizon 2020 CD-LINKS project.

The scenario data is usually saved as *xlsx* or *csv* files in wide format (years as columns), but other types are also possible (e.g., via the pyam package).

	A	B	C	D	E	F	G	H	
1	**Model**	**Scenario**	**Region**	**Variable**	**Unit**	**2005**	**2010**	**2015**	
2	MESSAGE	CD-LINKS 400	World	Primary Energy	EJ/y	462.5	500.7	...	

Fig. 1: Illustrative example of IAMC-format timeseries data from the IAMC 1.5°C Scenario Explorer

4.1.3 Project "templates"

Each project using the IAMC timeseries data format defines a list of "variables" and regions for comparison and scenario analysis, commonly known as a "variable template".

The IAM community is developing a shared resource of variable and region definitions. The aim is to provide a central location to facilitate reuse of definitions and mappings across projects.

Visit https://github.com/IAMconsortium/common-definitions for more information.

4.1.4 Variable & region naming guidance

The *variable* column

The 'variable' column of the IAMC format describes the type of information represented in the specific timeseries. The variable name implements a "semi-hierarchical" structure using the | character (*pipe*, not l or i) to indicate the structure or "depth". Names (should) follow a structure like *Category|Subcategory|Specification*.

Semi-hierarchical means that a hierarchy can be imposed, e.g., one can enforce that the sum of *Emissions|CO2|Energy* and *Emissions|CO2|Other* must be equal to *Emissions|CO2* (if there are no other *Emissions|CO2|...* variables).

However, this is not mandatory, e.g., the sum of *Primary Energy|Coal*, *Primary Energy|Gas* and *Primary Energy|Fossil* should not be equal to *Primary Energy* because this would double-count fossil fuels.

Variable naming conventions

A variable name should adhere to the following conventions:

- A | (pipe) character indicates levels of hierarchy.

- Do not use spaces before and after the | character, but add a space between words

```
Primary Energy|Non-Biomass Renewables
```

- Do not use abbreviations (e.g, *PHEV*) unless strictly necessary.

- Do not use abbreviations of statistical operations (*min*, *max*, *avg*) but always spell out the term.

- All words must be capitalised (except for *and*, *w/*, *w/o*, etc.).

- If necessary to add a method or operation-identifier (e.g., Share, per capita) to a variable name, add it in square brackets, e.g.,

```
Population|Urban [Share]
```

Units

The **unit** attribute is **required** and its value should be compatible with the iam-units package. Alternatively, a variable can be *dimensionless*, i.e., not have a unit.

The *region* column

Common regions

In model-comparison projects, it is useful to define *common regions* that can be computed consistently from original model results. Widely used examples are the R5, R9 and R10 regions.

Naming conventions for native model regions

In contrast to common regions used for comparison or scenario analysis across models, each model has a "native region" resolution.

Models with a coarse spatial resolution should add a model-specific identifier to the native model regions (e.g., *MESSAGEix-GLOBIOM 1.1|North America*) to avoid confusion when comparing results to other models with similar-but-different regions.

If a model has a country-level resolution (where disambiguation is not a concern), we recommend to *not add* a model identifier.

For country-level regional resolution, the `nomenclature` package provides a standardized list of country names based on the `pycountry` package (link) and the ISO 3166-1 standard.

4.1.5 Related software packages

Read more about related *Open-source software packages*.

4.2 Scenario databases hosted by IIASA

The *Energy, Climate and Environment* program (ECE) at IIASA is hosting many databases for the community to facilitate scenario analysis, model comparison and dissemination.

4.2.1 Access and permission management

There are public and project-internal (private) databases. Access to project-internal instances is managed via the Scenario Services Manager. To participate in a project, please create an account and send the username to the project managers by email.

You can see all public and private database instances to which you have access, including your view/submit/edit permissions, in the *Services* tab of the manager.

4.2.2 Model registration

To participate in a model comparison project using the IIASA scenario database infrastructure, you have to "register" your model. A model registration requires three specifications:

- A model name including a *version number*, preferably using semantic versioning

- A list or mapping of region names as they will be submitted (uploaded) to an IIASA database instance by the modeling team, and how the region names should appear in the processed scenario data

- A model mapping to perform region aggregation from *native_regions* to *common_regions* and renaming of model native regions (optional)
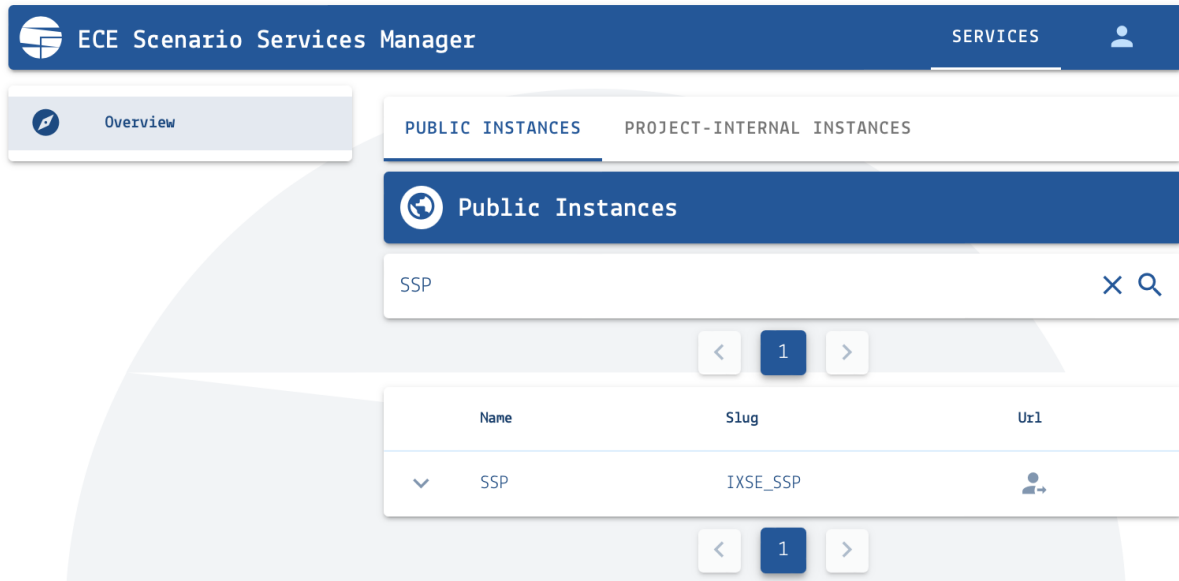
Fig. 2: Screenshot of the "Overview" page of the Scenario Services Manager

Option 1) Registration using an Excel template

If you do not feel comfortable using GitHub, please use the Excel template and send it to the project managers by email.

Option 2) Registration using a GitHub pull request

The preferred approach for model registration is starting a GitHub pull request. Please contact the administrators if permissions for the project repository are required.

Please follow the Model registration user guide.

4.2.3 Scenario version management

When submitting a scenario (a.k.a. "run") to an IIASA database instance with an already existing model-scenario combination, the database will save the new submission as a new version of that run. The **version number** is incremented automatically and the new version will be automatically set as **default version** for that model-scenario name.

To select other (non-default) versions, you can use the "Switch to Advanced View" button in the scenario-selection tab of an IIASA Scenario Explorer or you can use the `default_only=False` option of the function `pyam.read_iiasa()` or the **ixmp4** package (read the docs).
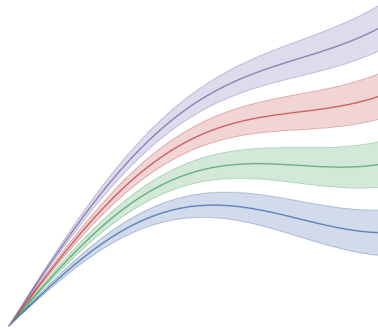
4.3 Open-source software packages

The *Scenario Services & Scientific Software team* in the Energy, Climate, and Environment program (ECE) at IIASA is developing several open-source Python packages to work with scenario data in *The IAMC timeseries data format*.

4.3.1 Scenario analysis: pyam

Analysis and visualization of integrated-assessment & macro-energy scenarios

https://pyam-iamc.readthedocs.io

4.3.2 Scenario processing: nomenclature

Management of IAMC-format project definitions

https://nomenclature-iamc.readthedocs.io

4.3.3 Data warehouse: ixmp4

Data warehouse for high-powered scenario analysis in the domain of integrated assessment of climate change and energy systems modeling

https://docs.ece.iiasa.ac.at/projects/ixmp4

LICENSE & SOURCE

The source code of this Sphinx project is available at https://github.com/iiasa/ece-docs under a Creative Commons CC0 1.0 License. The project is maintained by the *Scenario Services & Scientific Software* research theme at the IIASA Energy, Climate, and Environment program.

Visit https://software.ece.iiasa.ac.at for more information.