OpenMod Africa

plan4res

Running plan4res

Sandrine Charousset,
EDF

June, 4, 2025

This project receives funding from the European Union's Horizon 2023 Framework Programme for Research and Innovation under Grant Agreement no. 101118123

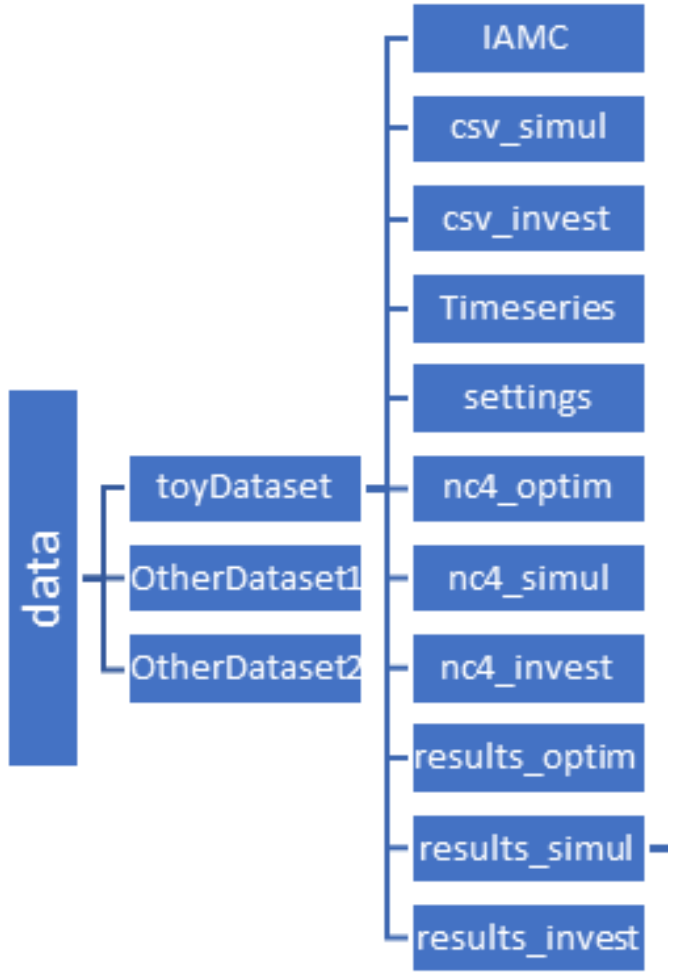
Plan4res study structure

Your datasets must be located in a subdir data/ in your main MYP4R user directory

Each study corresponds to a subdir in data/ , see toyDataset as an example

Each study directory has the same structure:

- IAMC : data in the IAMC format, usually created by GENeSYS-MOD (can be used to create the data in csv_X)
- csv_XXX: input data in native plan4res format
- nc4_XXX: SMS++ netCDF input data
- results_XXX: plan4res outputs
- Timeseries: all timeseries files
- settings: configuration files

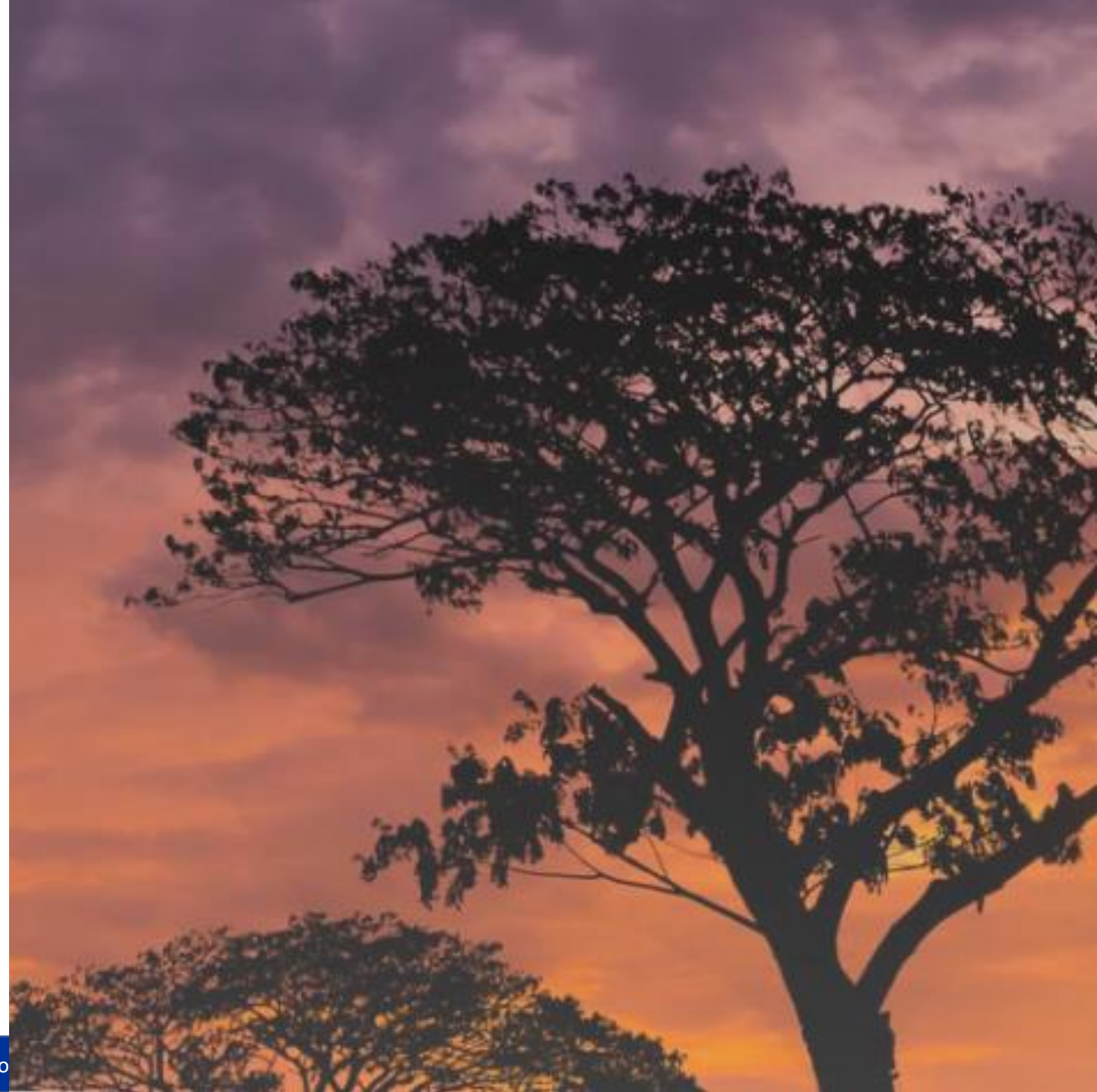


This project receives funding from the European Union's Horizon 2023 Framework Programme for Research and Innovation under Grant Agreement no. 101118123

OpenMod Africa

plan4res

Plan4res input data



This project receives funding from the European Union's Ho

Input data

Plan4res input data are composed of:

- Yearly data:
  - Electricity demand
  - Interconnections
  - Installed Capacities (for generation and storages)
  - Costs of technologies (operation and investment)
  - (optional) Constraints
- Hourly Timeseries: loadfactors for:
  - Hydraulic inflows
  - Electricity demand
  - RES potentials (PV, windPower, run of river)

This project receives funding from the European Union's Horizon 2023 Framework Programme for Research and Innovation under Grant Agreement no. 101118123

Plan4res csv datasets

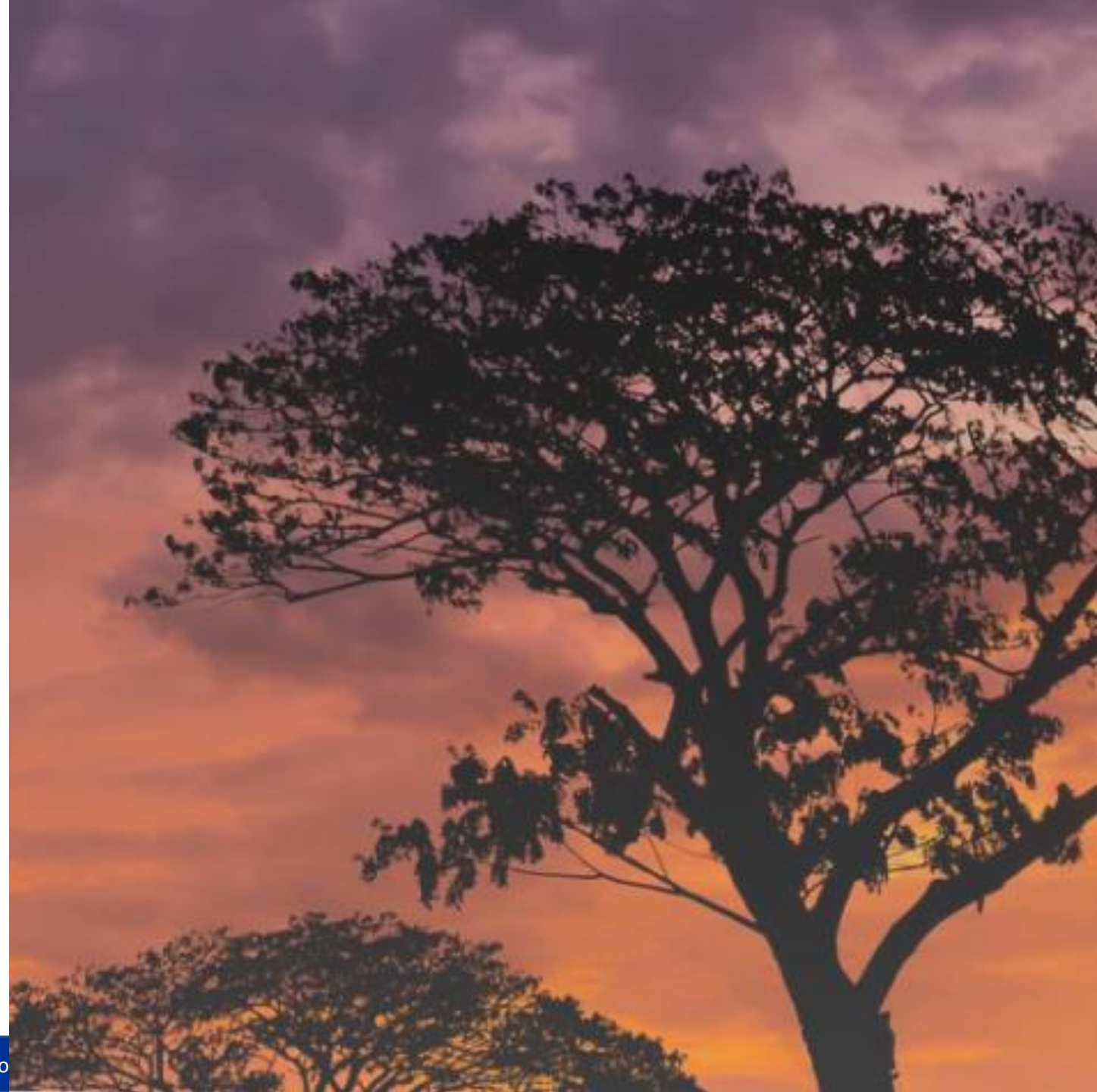
- Yearly data:
  - Regions: ZP_ZonePartition.csv
  - Demand: ZV_ZoneValues.csv
  - Interconnections: IN_Interconnections .csv
  - Thermal Power: TU_ThermalUnits.csv
  - Hydro Réservoirs: SS_SeasonalStorage.csv
  - Renewable Power: RES_RenewableUnits.csv
  - Storage: STS_ShortTermStorage.csv
- TimeSeries:
  - One csv file per variable and region

This project receives funding from the European Union's Horizon 2023 Framework Programme for Research and Innovation under Grant Agreement no. 101118123

OpenMod Africa

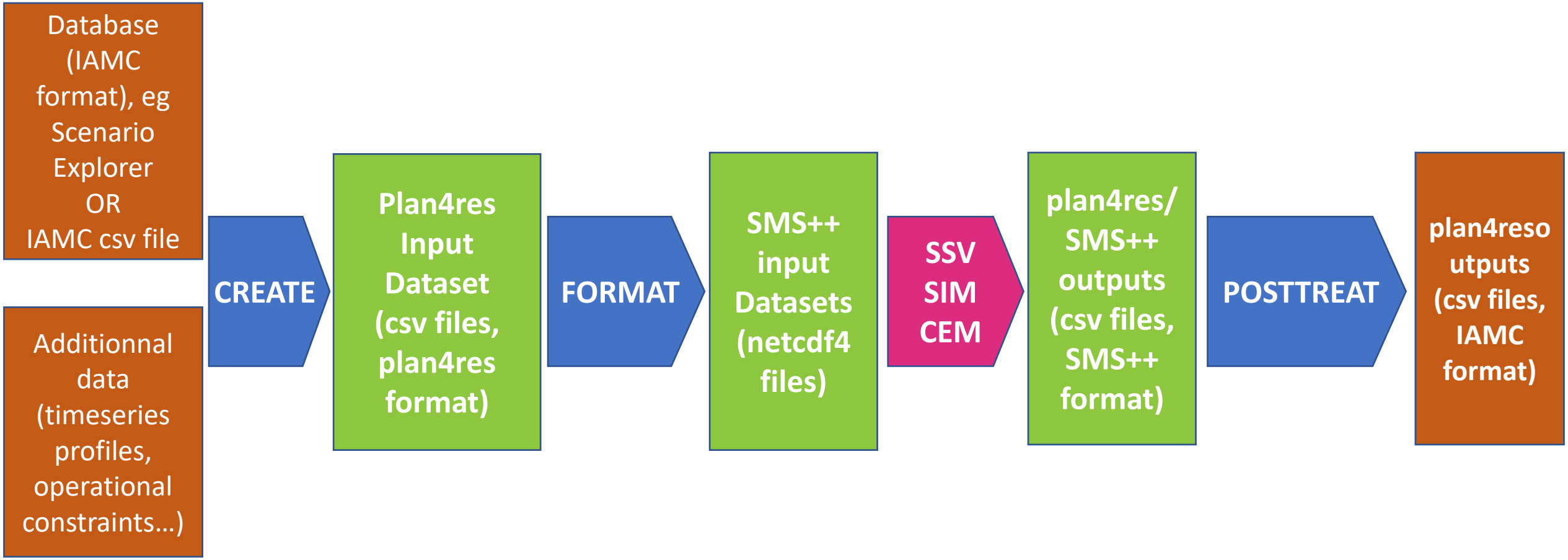
plan4res

Running plan4res modules



This project receives funding from the European Union's Ho

plan4res modules



This project receives funding from the European Union's Horizon 2023 Framework Programme for Research and Innovation under Grant Agreement no. 101118123

Plan4res modules

- CREATE: creates plan4res input data (csv files with plan4res native format) from IAMC files (usually outputs of GENeSYS-MOD in IAMC format)
- FORMAT: creates SMS++ input data (netcdf files with SMS++ format) from plan4res inputs (csv files with plan4res native format)
- SSV/CEM/SIM: Calculation modules corresponding to the 3 functions of plan4res, implemented with SMS++:
  - SSV: computes strategies for Hydro reservoirs
  - SIM: simulates the operation of the power system
  - CEM: adapts the power system (optimisation of investments)
- POSTTREAT: post-treatment of outputs of SIM/CEM

This project receives funding from the European Union's Horizon 2023 Framework Programme for Research and Innovation under Grant Agreement no. 101118123

Running the modules

All modules can be ran using the p4r function:

p4r MODULE dataset [options]

If you want to use SLURM to run with parallelisation:

sp4r MODULE dataset [options] –n NBNODES

NBNODES=number of nodes you are requesting

This project receives funding from the European Union's Horizon 2023 Framework Programme for Research and Innovation under Grant Agreement no. 101118123

A plan4res study step by step – step 1 - initialisation

Assumption: GENeSYS-MOD has been ran with success, and its outputs have been converted to the IAMC format => My_Study_IAMC.csv

Step 1: initialisation

- Create a sub-dir in MYP4R/data:

  mkdir MYP4R/data/MyStudy

- Create the IAMC sub-sub dir and feed it with your IAMC input:

  mkdir MYP4R/data/MyStudy/IAMC

  cp My_Study_IAMC.csv MYP4R/data/MyStudy/IAMC/MyStudy.csv

This project receives funding from the European Union's Horizon 2023 Framework Programme for Research and Innovation under Grant Agreement no. 101118123

A plan4res study step by step - step 2 create data

Assumption: GENeSYS-MOD has been ran with success, and its outputs have been converted to the IAMC format => My_Study_IAMC.csv

Step 2: creation of a plan4res dataset

- Create settings file settingsCreateInputPlan4res_simul.yml (for SSV/SIM)
  settingsCreateInputPlan4res_invest.yml (for CEM)

See next slide

- Run the CREATE module => This will create the csv files in csv_simul or csv_invest

  p4r CREATE MyStudy => add –M invest to create a dataset for optimisation of investments

- Adapt manually the csv files if necessary (in particular the data for investments)
- Create a subdir TimeSeries in MyStudy where you should place the timeseries csv files

This project receives funding from the European Union's Horizon 2023 Framework Programme for Research and Innovation under Grant Agreement no. 101118123

A plan4res study step by step - step 2 create data settingsCreatePlan4res_XX.yml

It is recommended to use the template on https://github.com/plan4res/toyDataset

Main parameters to update:

- Scenarios / years : choose one of the scenarios and years from the IAMC file
- listregionsGET: list of regions from the IAMC to be used for creating the dataset
- Aggregateregions: list of aggregated regions and how to build them
- partition/Countries = list of regions in the dataset; can include aggregated regions but the subregions of the aggregates must not be included
- technos: list of technos from the IAMC separated per plan4res categories
- StochasticScenarios: list of scenarios (from the TimeSeries) to be included
- CouplingConstraints: define the parameters for non served electricity and what are the different components of the power demand
- ParametersCreate: InitialFillingrate: remaining share of water in réservoirs at start of the study
- ParametersCreate: CapacityExpansion: define which technologies can be invested and investment bounds

Other fields may remain unchanged, see user manual for more details

This project receives funding from the European Union's Horizon 2023 Framework Programme for Research and Innovation under Grant Agreement no. 101118123

A plan4res study step by step - step3 create netcdf

Step 3: creation of SMS++ input files from a plan4res dataset

- Create settings file settings_format_optim.yml (for SSV)
  settings_format_simul.yml (for SIM)
  settings_format_invest.yml (for CEM)
  settings_format_postinvest.yml (for CEM with SIM)

See next slide

- Run the FORMAT module => This will create the netcdf files in nc4_optim, nc4_simul and nc4_invest

  p4r FORMAT MyStudy [options]

  options: -M optim/simul/invest (for SSV/SIM/CEM)

This project receives funding from the European Union's Horizon 2023 Framework Programme for Research and Innovation under Grant Agreement no. 101118123

A plan4res study step by step - step 3 create netcdf settings_format_XXX.yml

It is recommended to use the template on https://github.com/plan4res/toyDataset

Main parameters to update:

- **Calendar** : define the temporal scope and granularity
  - **dayFirst**: yes if dates are defined as DD/MM/YYYY
  - **BeginTimeSeries/ EndTimeSeries** : first/last timestep of the available timeseries
  - **BeginDataset/EndDataset**: first/last timestep of the case study
  - **SSVTimeStep**: duration of the timestep in the SSV (usually 1 week or 1 month)
  - **TimeStep**: duration of the timestep of the simulations

- **ParametersFormat** :
  - **Scenarios:** list of the scenarios you wish to include in the run. This list can be a subset of the scenarios used for creating the plan4res csv files

Other fields may remain unchanged, see user manual for more details

This project receives funding from the European Union's Horizon 2023 Framework Programme for Research and Innovation under Grant Agreement no. 101118123

A plan4res study step by step - step4 run SMS++

Step 4: run SMS++

- Create settings file plan4res_settings.yml

  You may keep all parameters unchanged

It is recommended to use the template on https://github.com/plan4res/toyDataset

- Run the sms++ modules

  p4r SSV MyStudy => you need to have ran p4r FORMAT –M optim before

  => produces results in results_optim

  p4r SIM MyStudy => you need to have ran p4r SSV and p4r FORMAT -M simul before

  => produces results in results_simul

  p4r CEM MyStudy => you need to have ran p4r SSV and p4r FORMAT -M invest before

  => produces results in results_invest

This project receives funding from the European Union's Horizon 2023 Framework Programme for Research and Innovation under Grant Agreement no. 101118123

A plan4res study step by step - step4 run SMS++

- The modules SSVandSIM and SSVandCEM are running a full workflow
  - p4r SSVandSIM MyStudy => runs FORMAT/SSV/FORMAT/SIM in sequence
  - p4r SSVandCEM MyStudy => runs FORMAT/SSV/FORMAT/CEM in sequence
- Some options allow to run workflows:
  - -C will force running p4r CREATE first
  - -F will force running p4r FORMAT
  - p4r SSV MyStudy –C –F is equivalent to:
    - p4r CREATE MyStudy
    - P4r FORMAT MyStudy
    - P4r SSV MyStudy
  - -H allows to hotstart a run of SSV or CEM from a previous result
- p4r –help will help you

This project receives funding from the European Union's Horizon 2023 Framework Programme for Research and Innovation under Grant Agreement no. 101118123

A plan4res study step by step - step5 post-treat results

Step 5: post-treatment of results

- Create settings file settingsPostTreatPlan4res_simul.yml (for SIM)
  settingsPostTreatPlan4res_invest.yml (for CEM)

See next slide

- Run the POSTTREAT module => This will create post-treated csv files and graphs in results_simul or results_invest

  p4r POSTTREAT MyStudy => add –M invest to posttreat results after CEM

This project receives funding from the European Union's Horizon 2023 Framework Programme for Research and Innovation under Grant Agreement no. 101118123

A plan4res study step by step - step 5 post-treat results settingsPostTreatPlan4res_XXX.yml

Main parameters to update:

- **Graphs** : define the size of the graphs per categories: Volume (1 per seasonal storage), Power (1 per technology), MarginalCost and Demand (1 per region), MarginalCostFlows and Flows (1 per interconnection); you must ensure that there are enough rows and columns so that all graphs fit in a page
  - **nbcols/nblines**: number of columns/rows
  - **SizeCol/SizeRow** : size of the columns/rows
  - **TitleSize/LabelSize:** size of the text in title/labels
- **scenario** : write here the name of the scenario you are choosing (will be used in IAMC outputs)
- **marginalcostlimits**: defines bounds for the marginal costs graphs
- **Technos** : All the technos defined in settingsCreate* must be present, each one must be linked to a colorcode
- **TechnosAggr** : defines aggregates of technologies, for producing aggregated outputs and graphs
- **pumping/nopumping**: all technologies from the categories SS and STS must be listed here, in one of the 2 lists (with or without pumping)

Other fields may remain unchanged, see user manual for more details

This project receives funding from the European Union's Horizon 2023 Framework Programme for Research and Innovation under Grant Agreement no. 101118123

OpenMod Africa

plan4res is now ready for running!

Thanks for your attention!

This project receives funding from the European Union's Horizon 2023 Framework Programme for Research and Innovation under Grant Agreement no. 101118123