



Questions:

Final Webinar 20/05/2021





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Agenda

Morning session (10 – 12.15): Demonstration and case studies

 $\odot 10'00$: Introduction and Plan4res modelling framework [Sandrine Charousset, EDF]

 $\odot 10'10$: Modelling projects within CINEA [Eleni Kontonasiou, EC]

O10'15: Policy Brief [Andreas Zucker, EC]

O10'35: Demonstration case studies:

CS1 : multi-energy system include gas modelling [Dieter Most, SIEMENS, Lothar Wyrwoll, RWTH Aachen, Inci Yueksel Erguen, ZIB Berlin]

CS2 : Strategic Development of Pan- European Network without Perfect Foresight and Considering Long-Term uncertainties [Spyros Giannelos, imperial College London]

•CS3 : Assessing cost of renewable integration and impact of climate change [Sandrine Charousset, EDF]

O Discussions Q&A

 \odot Result of the survey for the use cases [Danny Pudjianto, imperial College London] \odot Wrap up session 1





Agenda

1'15-3'00: Afternoon session 2 (1.15- 3pm): Modelling, solving algorithms and IT platform

- The plan4res IT Platform [Utz-Uwe haus, HPE]
- The SMS++ modelling framework [Antonio Frangioni, university of Pisa]
- PaPILO: A parallel presolving library for MIP and LP with multiprecision support [Ambros Gleixner, ZIB Berlin]
- Result of the survey for the modelling, solving algorithms and IT platform
 [Danny Pudjianto, Imperial College London]
- ODiscussions Q&A
- OWrap up and final remarks





plan4res Consortium

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The plan4res team







Context and objectives

Facing European targets for reduction of greenhouse gas emissions while maintaining high quality of supply and low cost

⇒Electricity : Increase Share of renewable

⇒Other Energies : move uses to low emission energy sources



- ⇒ Maximise the grid capacity to host renewable by optimising the best balance between infrastructure investments and optimum use of all assets
- ⇒ Maximise the use of all available flexibilities including traditional (generation plants....) and emerging (distributed assets, multi energy synergies...)

plan4res assumption : an integrated representation of the system is

necessary in order to achieve the objectives with the lowest cost



Results

An *end-to-end planning and operation tool,* composed of a set of optimization models based on an *integrated modelling* of the pan-European Energy System; An *IT platform* for providing seamless access to data and high performance computing resources, catering for flexible models (easily replacing submodels and the corresponding *efficient solution algorithms*) and workflows;

A database of public data

3 *case studies* highlighting the tool's adequacy and relevance.





An integrated Modelling

An end-to-end planning and operation tool, composed of a set of optimization models based on an integrated modelling of the pan-European Energy System

- Investment layer: Determine investment decisions
- Scenario valuation: Evaluate investment decisions/operational planning
- Analysis/additional tools: Impact of scenario on electricity & gas grid





Data – Main Results

Scenario generation

Demand time series for all EU countries (present climate) have been generated

Public datasets (released on Zenodo)

Scenarios for meteo dependent data (Elec demand, Inflows, Wind and PV Power), based on C3S Energy data and methods

Case Studies datasets:

- > Spatial electric and heat load profiles and renewable feed-in for CS1 simulations
- > Spatial distributions of electric energy mix and heating / cooling mix today
- > Gas Supply and Demand: Forecasts and Historical Data
- > Electricity System dataset based on eHighway and C3S Energy for CS3
- > Electricity System dataset based on openENTRANCE (TechnoFriendly 2030) and C3S Energy for CS3

Data transformation tools

For geographic and temporal aggregation / disaggregation

Data Formatting tools

- From openENTRANCE to plan4res
- Generation of NetCDF files for SMS++





Implementation - Results

- Extensible, self-documenting data format for model blocks
- First public release of SMS++ (innovative C++ modelling system) with many new features
- UDJ data movement library (manages data redistribution between applications)

Platform

- Containerized execution environment (all necessary components available, can run anywhere) with automatic data platform interfacing
- Workflow coordination using, e.g., swift-T

Demonstrators for each case study

- **C**S1:
 - > Multi Modal Model for optimized transition pathways of the pan-European energy system
 - > Detailed pan European market, electrical and gas grid models
- **CS2**:
- Strategic development of European Electricity Transmission System under long-term uncertainty
 C\$3:
 - > Parallel Seasonal Storage Valuation and European Unit Commitment models, based on SMS++





Solving Algorithms : results

The latest SCIP release for large-scale MIP problems

- StOpt, an open-source stochastic optimization library for large seasonal storage problems
- State-of-the-art Bundle-type methods for (parallel) decomposition approaches







3 Case Studies to highlight the tool's adequacy and relevance

- Sector coupling: which energy mix for achieving COP 21?
 - Based on a Multi-modal European energy concept for achieving COP 21
 - with perfect foresight, considering sector coupling of electricity, heat & cold, traffic, fuel/gas; and coupling to gas grids
- Strategic development of the pan-European transmission network
 - without perfect foresight and considering long-term uncertainties
- Assessing Feasibility of Scenarios, cost of RES integration and value of flexibilities for the European electricity system
 Without perfect foresight :



Strategic Development of the pan-European transmission network

 Consider long-term uncertainties in generation, demand, and technology costs
 Multi-asset capability including new networks, energy storage and demand-side measures
 Optimal investment strategies from 2020 to 2050
 Robust first-stage commitments

Cost of RES integration and impact of climate change for the European power system

Making the best use of all flexibilities will be necessary to enable least-cost integration of a high share of renewable energy sources



Main results are available:

https://zenodo.org/communities/plan4res

https://gitlab.com/smspp/smspp-project

Questions:



zenodo







in plan4res





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26th – 28th October 2021 EMP-E 2021 is an online conference

https://www.energymodellingplatform.eu/conferences/emp-e-2021/



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