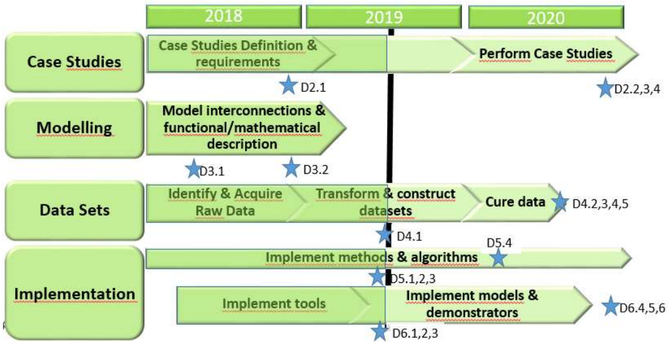
plan4res Newsletter #2, June 2019

The 2030 and 2050 EU's carbon reduction targets are calling for significant changes in our energy system: more flexibility, more active involvement of all stakeholders and more collaboration to enable least-cost integration of higher deployment of variable renewable energy sources. The **plan4res** Consortium aims at filling the gaps between the increasing complexity of the future energy system planning and operational problems, and the currently available Energy Systems Modelling tools, by implementing:

- 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 algorithm**) and workflows;
- **A database of public data** and 3 **case studies** highlighting the tool's adequacy and relevance.

Where we are



plan4res May meeting in Basel

plan4res first deliverables released

The plan4res team has delivered during the first 18 months of the project 9 technical deliverables, among which 6 are public. They are available on our website www.plan4res.eu

[D3.1 : Description of Model Interconnections]()

[D2.1 : Definition and requirements of three case studies]()

[D5.1 : New version of the SCIP Solver Adapted and Integrated in plan4res Platform]()

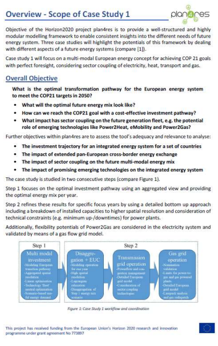
[D5.2 : New version of the StOpt library adapted to plan4res]()

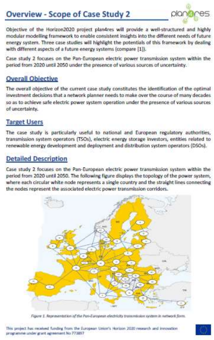
[D5.3 : New version of the NDOSolver/FIOracle software]()

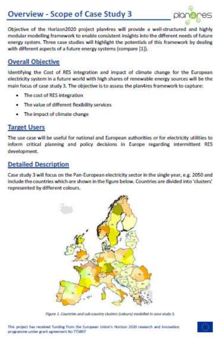
[D6.1 : Specification for the plan4res Platform Implementation]()

plan4res case studies summaries

They are available for download from plan4res website www.plan4res.eu, section The Project / Main deliverables







This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 773897. It is funded under the H2020 LCE-05–2017 Program – "Tools and technologies for coordination and integration of the European energy system" for 3 years (01-11-2017 to 31-10-2020

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A common platform for Plan4Res

The plan4res planning tool is composed of a data repository, a staging area, a transformation environment, a computation environment and a result storage area. Setting it up only requires a project download from a gitlab repository -- the directory structure as well as all necessary software will be downloaded and ready-to-run.

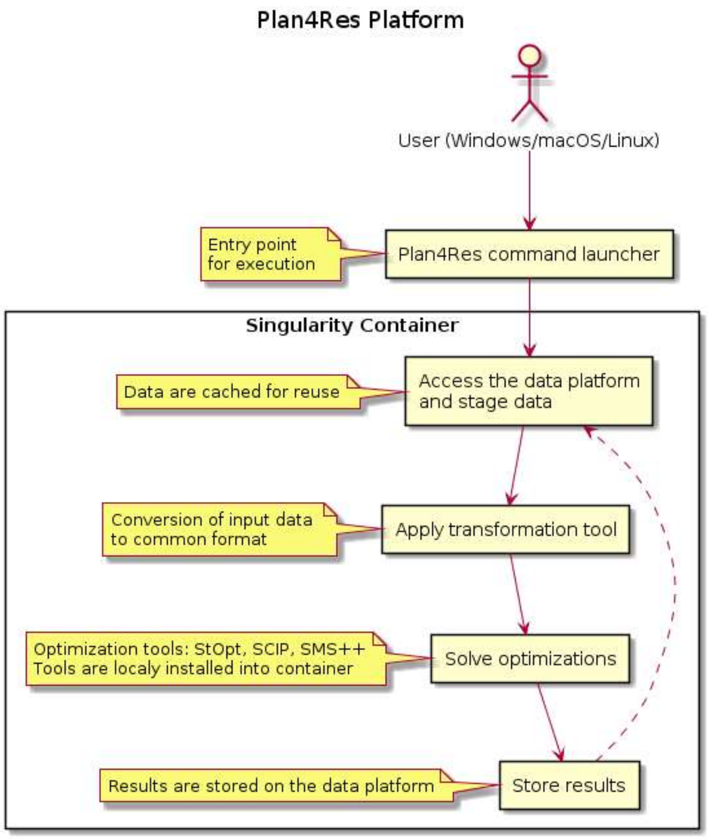
Curated data, case study formulations, and results are stored in a central repository, and – subject to dataset dependent access control – accessible to multiple users or the public. We operate a cloud-based data server for this purpose. This makes data consistency across partners and provides versioning and checkpointing options. For all data on this platform, a common naming scheme and file format agreement have been made.

To access this we have defined a Linux-based software environment and a directory structure, as well as a set of utility programs that every partner can deploy to obtain a local staging area (cache of central repository data as well as data in the progress of being curated for publication), as well as a transformation and a computation environment. This ensures portability of code, scripts, and simplifies data handling across sites since we can rely on the same compilers, libraries, and data formats being in use throughout the project. An add-on mechanism allows installation of separately-licensed software locally, still in a controlled and reproducible way.

To ensure consistent behaviour across all installations, the software environment is built as a Singularity 3 container. Containers are a growing technology to solve the problem of making software to run reliably when moved from one computing environment to another: Using containers allows to deploy applications across operating systems without having to build and configure separately. For partners running on Windows or macOS the container is to be run inside a virtual machine; for those running a variant of Linux (including high-performance computing environments like Cray's CLE), the container can take full advantage of the underlying hardware.

While it is possible to simply use the container environment interactively, we believe that eventually, case study runs will be performed as a non-interactive (parametrized) workflow. We have chosen the Swift/T workflow language and built a library of supporting functions for it that make access to the central data repository (including caching of data) a built-in function. Transformation tools will be wrapped similarly. We have successfully tested a distributed workflow developed on a laptop on a Cray XC40 supercomputer with hundreds of compute nodes. Depending on the computational needs of the particular user's modelling and optimization programs, the platform environment can be scaled to the required size.

We are convinced that with this common foundation, much of the effort typically spent in adaptation and maintenance of software and data interoperability for successful collaboration across partner sites can instead be spent on modelling and implementation.



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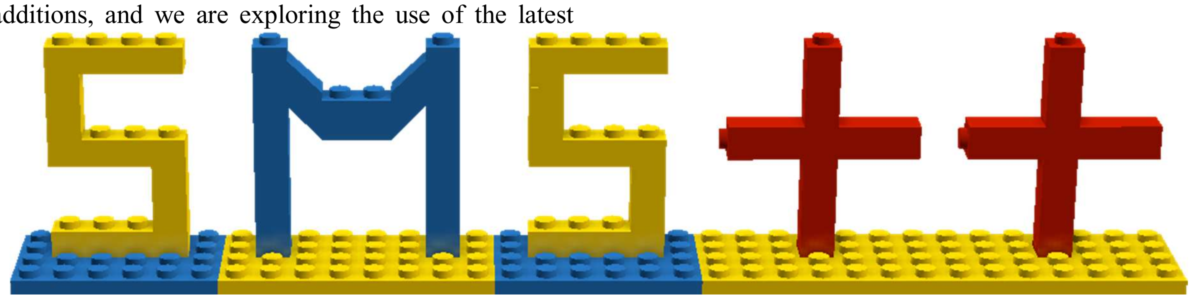
First release of the open-source library SMS++

After the SMS++Lab has been completed with the recruitment of Ali Ghezelsoflu, Niccolò Iardella and Rafael Lobato, the development of the SMS++ components of the project is now in full swing. The development team has subdivided the work in order to advance the several components that will be needed for the project. In particular, we are advancing both the components that are very specific to the project (the "Block" representing the model as required by the different Case Studies, such as the European Unit Commitment problem, and the corresponding "Solver"), and components which, while crucial for the project, will also have widespread use in different applications (interfaces with general-purpose solvers, Block for Lagrangian and Benders' decomposition). Having obtained the collaboration of highly skilled software developers, in particular, Enrico Gorgone, will help us achieve our ambitious objectives.

The team is growing together into the best practices of software development required for such a complex project: use of multiple nested git repositories and branches, unit testing, pairwise programming. The C++ standard required by the project has been recently bumped up to C++-17 due to the usefulness of some of the latest additions, and we are exploring the use of the latest language features in order to develop new, exciting features in the SMS++ system, in particular related to the more efficient handling of uncertain data in optimization models. It would appear that for this we could benefit for the even more advanced features scheduled for the next standard upgrade, in particular reflection, and we are evaluating our option and eagerly anticipating the possibilities that this would unlock

The next major step in the development of SMS++ will be the introduction of multi-threading capabilities, which is now in the initial stages of analysis. With the help of the Cray experts, we will update SMS++ by allowing asynchronous communication between the several different components (Solver, Function, ...) that have computational capabilities. This will hopefully be made easier by the careful design choices, in particular, those related to communication from Block and Solver via the Modification mechanism. We are really looking forward to incorporating the state-of-the-art of C++ multi-threading capabilities in our project since this will greatly enhance its capabilities w.r.t. current modelling systems, as required by the challenging objectives required by the plan4res project.



EMP-E 2019

plan4res, together with 9 other H2020 funded projects is organising the 3rd EMP-E conference, in Brussels Oct.8-9, “Modelling the implementation of A Clean Planet For All Strategy”. Plenary sessions (Oct.8) will deal with :

- Achieving ambitious RES deployment in a multi-coupled European Energy System – Techno-Economic, Financial and Societal Challenges
- The effects of externalisation on decarbonisation
- Pathways and scenarios towards the Paris agreement
- Decarbonisation of cities – Modelling energy transition, sector coupling and cross-sectoral challenges

http://www.energymodellingplatform.eu/home-emp-e-2019.html

To know more

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