Synergistic Approach of Multi-Energy Models for an European Optimal Energy System Management Tool

Deliverable D5.1

New Version of the SCIP Solver Adapted and Integrated in plan4res Platform

Summary

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History of Changes

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List of acronyms used in this document

CIP	Constraint Integer Problems
GCG	Generic Column Generation
LP	Linear Programming
MILP	Mixed-Integer Linear Programming
MINLP	Mixed-Integer Nonlinear Programming
MIP	Mixed-Integer Programming

SCIP	Solving Constraint Integer Problems
Soplex	Sequential object-oriented simPlex
Zimpl	Zuse Institut Mathematical Programming Language
UG	Ubiquity Generator

Glossary of terms used in this document

Executive Summary

The general objective of plan4res is to fill the gaps between the increasing complexity of the future energy system planning and operational problems and the currently available system analysis tools. Enhanced end-to-end planning and operational tools dealing with technological and market uncertainty, emerging technologies and increased sector coupling of multi-energy vectors such as heat, cold and transport will be assembled in a synergistic approach to support European system planners, operators, decision makers, regulators.

The holistic approach of plan4res required to accomplish its ambitious objective, results in highly integrated models having high level of detail at European scale with high spatial and temporal resolutions and considering uncertainty. Solving this highly challenging models requires using decomposition and aggregation methods together with improved solvers.

SCIP is a framework for CIP that can also be used as a pure MIP and MINLP solver or as a framework for branch-cut-and-price. SCIP Optimization Suite provides a collection of software packages for mathematical optimization centered around the constraint integer programming framework SCIP.

SCIP Optimization Suite will be used by plan4res planning and operational tools to solve LPs and MIPs arising from optimization models of energy systems. These LPs and MIPs are either directly developed as a part of modelling framework of plan4res that can be formulated and solved by an integrated solver, or subproblems that are required by the stochastic solvers and decomposition methods, which is accomplished by integration of SCIP to SMS++ Framework and StOpt Library within the plan4res platform. New release of SCIP provides more efficient solutions to LPs and MIPs as a black-box solver with the improvements accomplished by SCIP and Soplex solvers as well as decomposition frameworks that facilitate using hard-to-implement decomposition algorithms and UG framework that facilitate shared memory parallelization.

In this document we will give a brief description of what is accomplished by the SCIP Optimization Suite v6.0 including advances in the software packages included in SCIP Optimization Suite v6.0, namely, in SCIP and Soplex solvers, Zimpl, the GCG solver and the UG framework, as well as references to the release documentation and downloadable code.

Key Words: Methods and Algorithms, MIP, MILP, MINLP, Optimization Software

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