REMix: an open energy systems optimisation framework for large model instances
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ENERGY SYSTEMS MODELLING FRAMEWORK

SECTORAL INTEGRATION

SECURITY OF SUPPLY

Fig. 1 - Schematic modelling concept of REMix.²

Fig. 2 - Reduction of the REMix solution space by addition of stability constraints.⁴

Fig. 3 - Schematic representation of the evaluation of adaptivity in the optimisation of transformation paths.⁴

Fig. 4 - Exemplary impact of a heat wave on electricity demand in different regions.⁴

Fig. 5 - Technological scope: around 100 technologies; grey ones yet to be integrated.⁴

Fig. 6 - HPC workflow managed with JUBE.⁶

Fig. 7 - Mean capacity difference depending on method choice.⁴

Fig. 8 - Relative deviation of key indicators depending on scenario sample size compared to mean value for 3,000 scenarios.⁶

Fig. 9 - Scaling behaviour of different solvers on energy system optimisation model (ESOM) instances.⁵

Fig. 10 - Manually annotated and permuted coefficient matrix of an ESOM instance.⁵

REFERENCES

4 Schnugge, J. et al. (2022): To be published.

Large-scale energy systems and multi-sectoral integration

“100 different technologies in total
45 in heat sector, with 17 heat groups to represent different temperature regimes
25的不同技术，总共
45个在热领域，包含17个热群，用来代表不同温度条件

100种不同的技术
45种在热领域，包含17种热群，用来代表不同的温度条件

Large-scale scenarios
Commercial (CPLEX)
Manually annotated and permuted
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open source since September 2023
multi-sector.

Project UNSEEN
consideration of parameter uncertainties in around 11,000 scenarios with Monte Carlo analysis coupling of REMix with agent-based model AMIRIS® via HPC workflow

Fig. 11 - Model instances

LP Solver
• PIPS-IPM++
• Commercial (CPLEX)
Scenario evaluation
• AMIRIS
• Python scripts
• Life-cycle indicators
Scenario generator
Parameter sampling
Parameters
Postsolve
Optimized scenarios

Project STAWESOM
integration of stability constraints
linking to AC grid solution

Project ARTESIS
optimisation of robust and adaptive pathways
linking to consistent socio-economic scenarios

Project ReMoDigital
identification of resilient system designs
comprehensive stress-testing modelling

Fig. 12 - Scaling behaviour of different solvers on energy system optimisation model (ESOM) instances.⁵

Parallel solving of large-scale ESOMs
- cross-sectoral investment and dispatch planning for generation, storage and transmission
- > 100 million variables / constraints

Project PEREGRINE
objective: broad applicability of open-source LP solver PIPS-IPM++

Invocation: personal interviews
- Which solutions are desired? Interfaces (e.g., Pyomo)? Solver containers?

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Fig. 13 - Model instances

LP Solvers
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Fig. 14 - Reduction of the REMix solution space by addition of stability constraints.⁴

Fig. 15 - Schematic representation of the evaluation of adaptivity in the optimisation of transformation paths.⁴

Fig. 16 - Exemplary impact of a heat wave on electricity demand in different regions.⁴

Fig. 17 - Relative deviation of key indicators depending on scenario sample size compared to mean value for 3,000 scenarios.⁶

Fig. 18 - Scaling behaviour of different solvers on energy system optimisation model (ESOM) instances.⁵

Fig. 19 - Manually annotated and permuted coefficient matrix of an ESOM instance.⁵

Fig. 20 - Invitations: personal interviews
- Which solutions are desired? Interfaces (e.g., Pyomo)? Solver containers?

Cloud computing?
- reach out to karl.kien@coa.dlr.de

Research
- automated block-structure detection and solver parameterisation