TECHNISCHE UNIVERSITÄT DRESDEN

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Implementation and validation of a Python package for the calculation of time-resolved solar yields

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Task

The goal of the thesis is to develop a Python package capable of:

- Calculating solar irradiation on an inclined surface
- Calculating solar thermal yields
- Calculating photovoltaic yields

The package is to be validated with the selected reference software and be applied in a use-case scenario

Implementing a Python package – STLIB

STLIB features:

- Three solar thermal collector models
- Losses calculation due to piping and shading
- Deutsche Wetterdienst as weather data source
- PVWatts model for calculating photovoltaic power output
- Implementation of two anisotropic sky models
- Solar position and angle of incidence calculation

Validation

Validation of the STLIB was performed with the help of several reference tools

- FreeSolCalc Excel Tool
- Solites Excel Tool
- Polysun

Table 7: Solar thermal yields statistical values

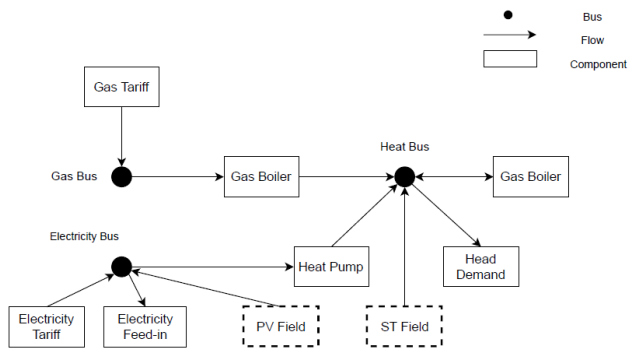
Reference to	MAPE (%)	MBE (MWh)	RMSE (MWh)	NRMSE
FSC	2,24	−0,26	0,48	0,004
Solites	0,82	−0,064	0,2	0,002
Polysun	18,62	−1,238	4,83	0,05

Table 8: PV yields statistical values

Reference to	MAPE (%)	MBE (kWh)	RMSE (kWh)	NRMSE
Polysun	6,22	−10,09	11,92	0,053

Application

Application was demonstrated by integrating STLIB into FlixOpt optimization tool



Conclusions

- STLIB performs accurate solar thermal calculations
- Higher deviations in solar thermal validation due to misconfiguration of Polysun software
- Higher deviations in photovoltaic validation due to simplifications of PVWatts model
- Succesful application performed within FlixOpt framework

Future work

STLIB can be improved in following ways:

- Implementation of anti-freeze losses, additional liquids, and sky models
- Bug fixing
- Code optimization
- More accepted weather data formats