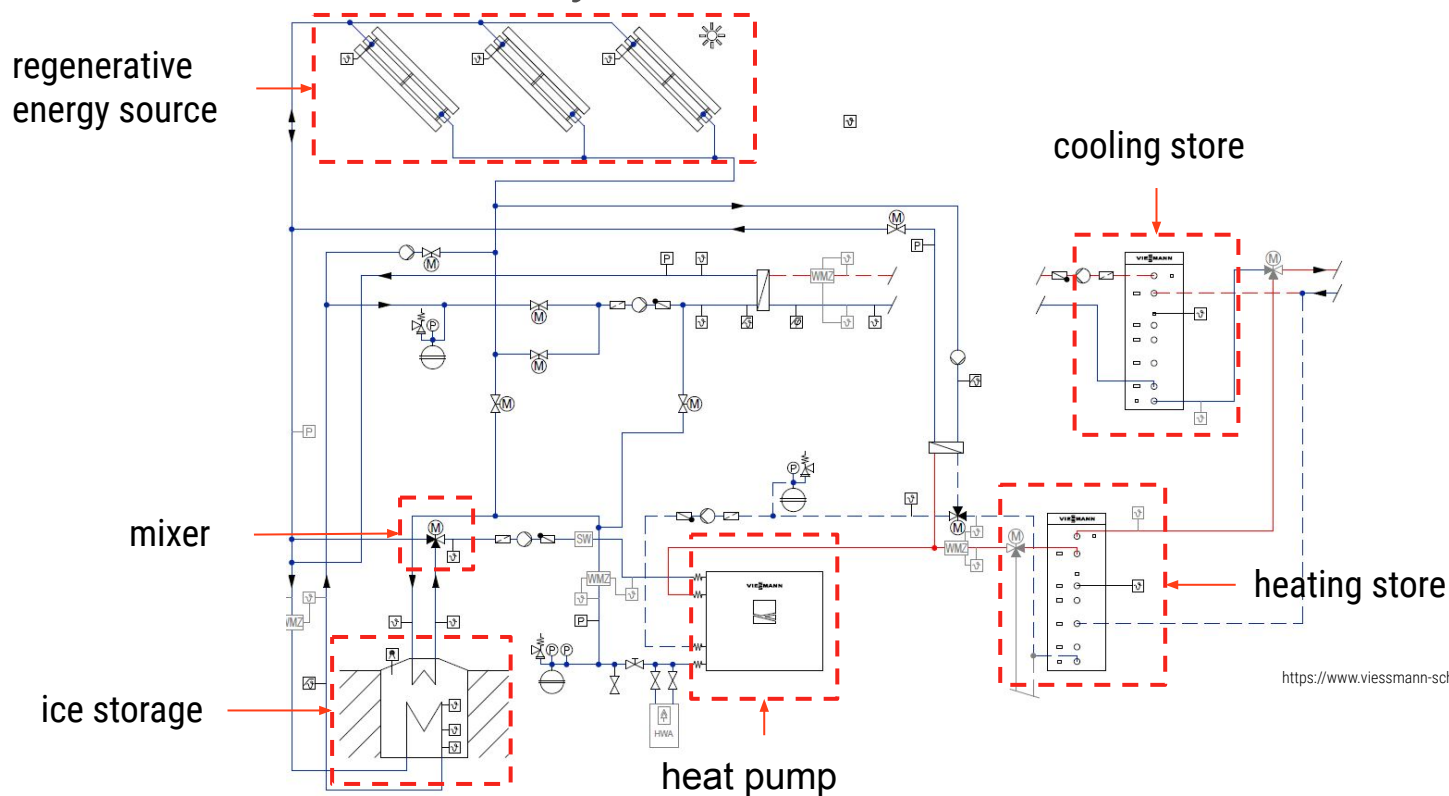


Development of a system controller for heat pump systems

Application of the Simulink PLC Coder

Hydraulic scheme of the system controller



<https://www.viessmann-schemes.com/>

The combined **solar, heat pump & ice storage system** is controlled with a PLC.

Development of a system controller

Motivation & Goals

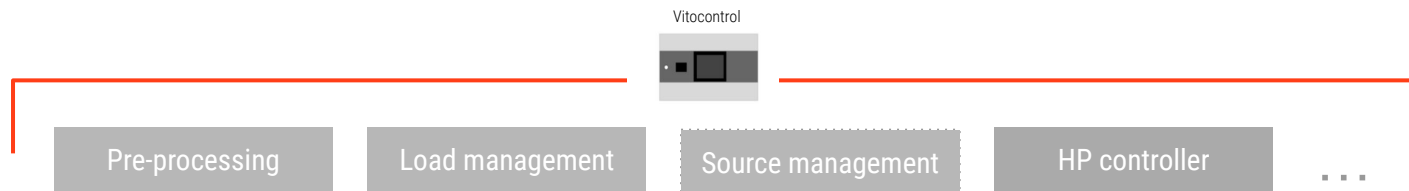
Motivation for MBD

- Development and graphical presentation in one programme
- Development can be made available to any target IDE via PLC Coder
- Higher test possibility than with a pure PLC development

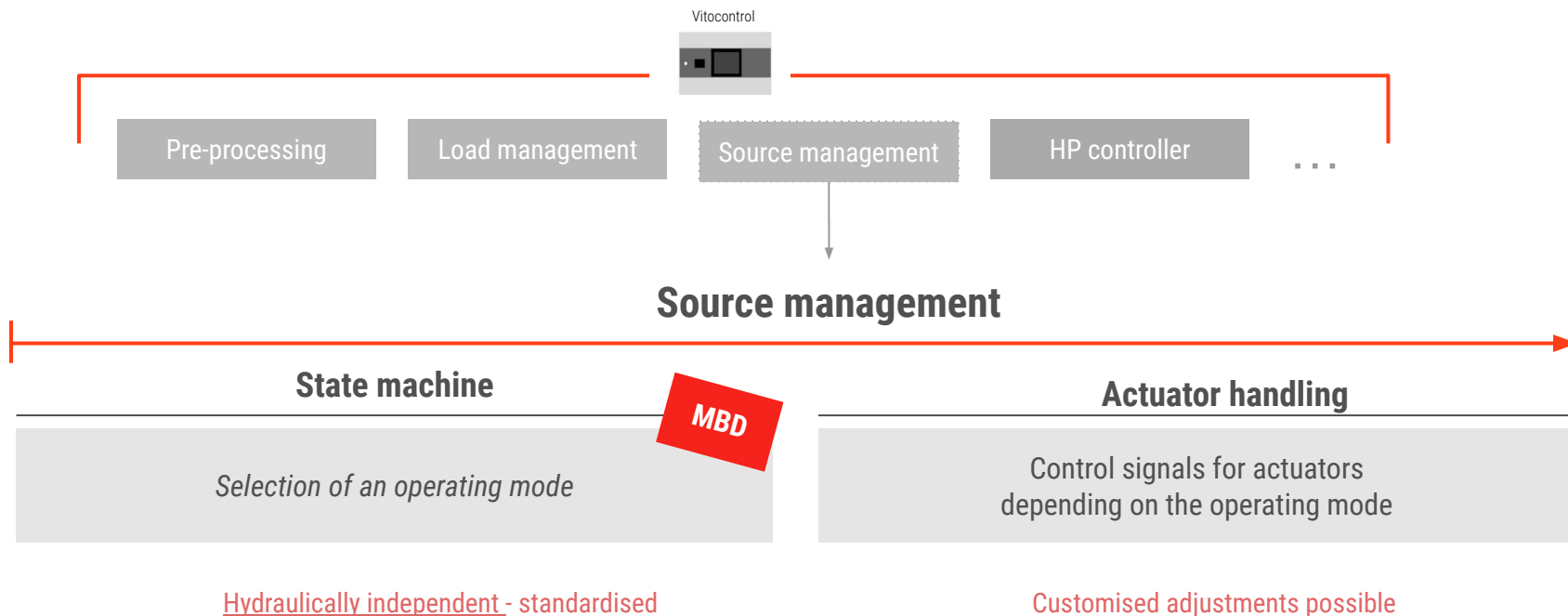
Goals

- Development of a control strategy for ice storage management
- Mapping of necessary operating states of the hydraulic system
- Easily expandable interface

Development of a system controller Architecture

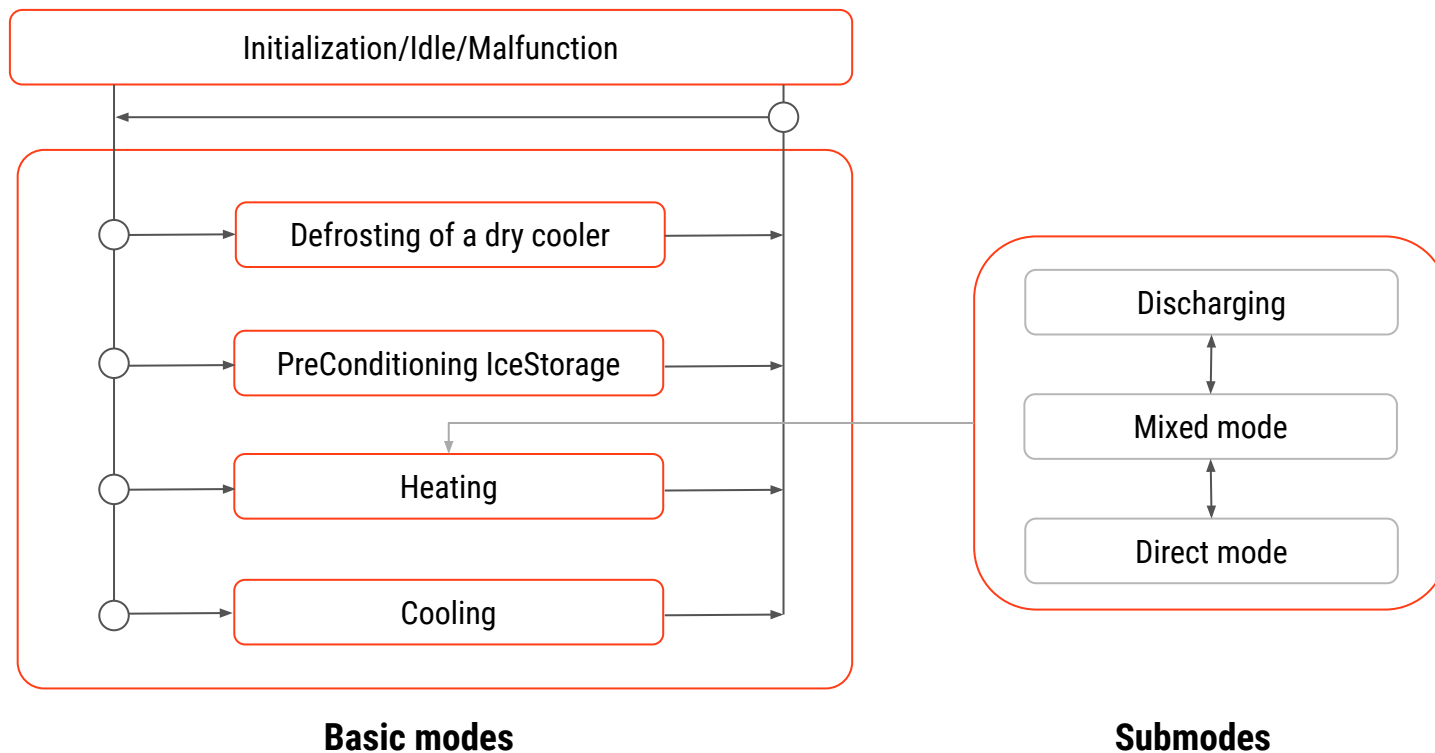


Development of a system controller Architecture



Development of a system controller

Programme schedule

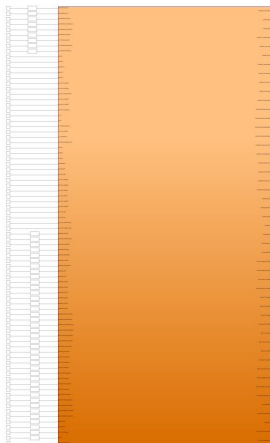


Application of the Simulink PLC Coder

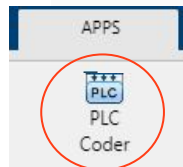
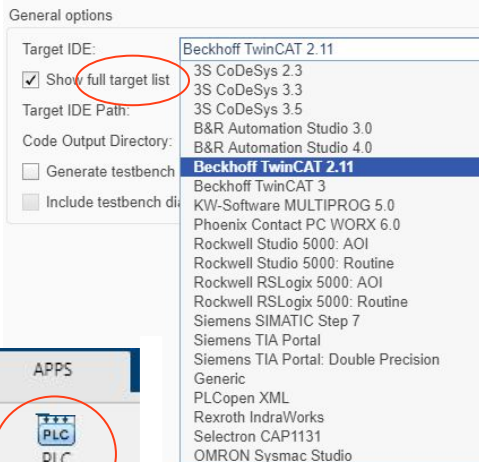
Generation of structured text

1. Prepare model

- Atomic Subsystem
- Define data types
- Add block description



2. Application of the PLC Coder



3. Import PLC Export

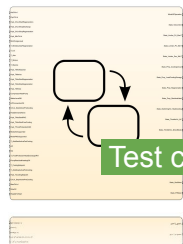


```
37648 c_Quellenmanagement_IN_Stan: USINT := 2;  
37649 END_VAR  
37650 RESOURCE  
37651 TASK Standard (PRIORITY := 1, INTERVAL := T#50ms);  
37652 PLC_PRG();  
37653 END_TASK  
37654 END_RESOURCE
```

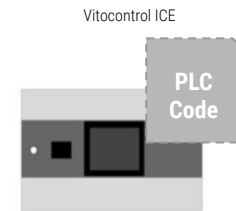
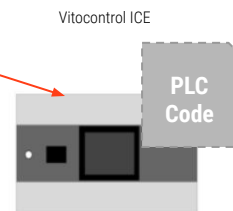
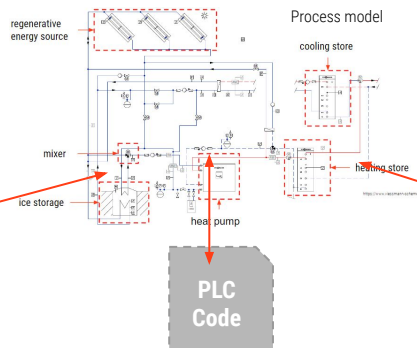
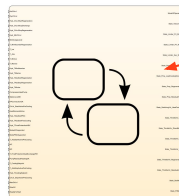
~38 000 lines of code

Testing of the system controller

Simulink & PLC



Test cases



Unit test



MiL test



SiL test



HiL test



Field test

Generation of test cases per function & operation mode with predefined exceptions

Development of an automated testbench

Testing the controller logic with a replication of the energy system in Simulink

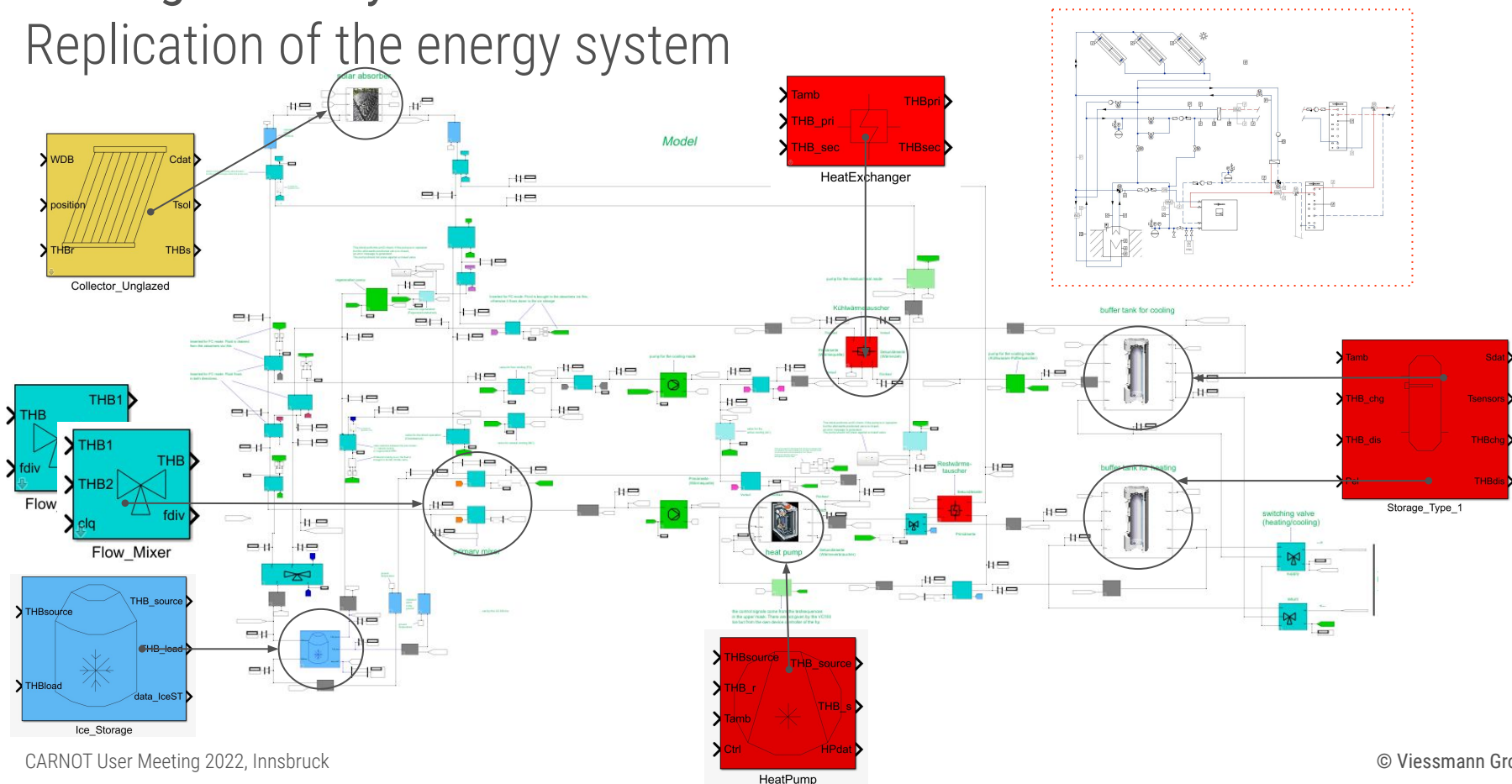
Testing the PLC Code integrated in the PLC PowerShell

Testing the PLC Code integrated in the final hardware

Currently monitoring the behavior of the control strategy under real conditions

Testing of the system controller

Replication of the energy system



Conclusion

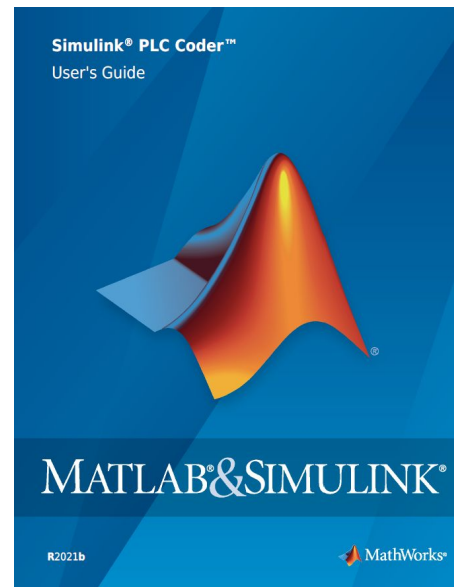
Development of a system controller

1. MBD & testing with Simulink

- + Fast development due to parallel testing
- + Function module validated by multiple test options
- + State machine expandable according to customer specifications

2. Application of the PLC Coder

- + Fast generation of PLC code
- + PLC code easily importable on the PLC
- No changes possible by PLC programmers
- Limitations of the PLC Coder



<https://de.mathworks.com/help/plccoder/>

Development of **guidelines** for MBD using Stateflow and for the application of the PLC Coder necessary

Thank you for your attention!