Development of Control Functions for Ice Storage – Heat Pump Systems with Carnot

Application of the Simulink PLC Coder

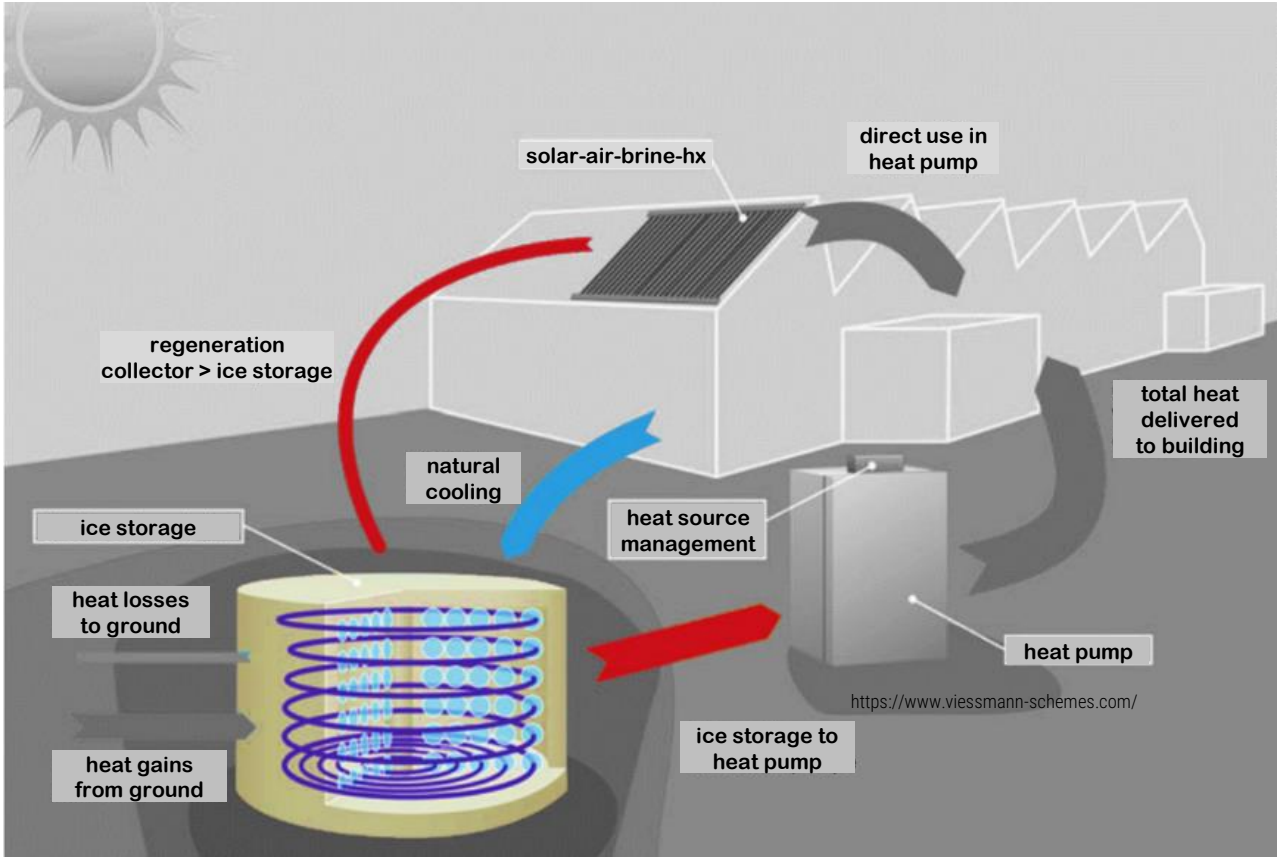
CARNOT User Meeting 2023, Bologna Ralf Dott

Development of control functions
Goals

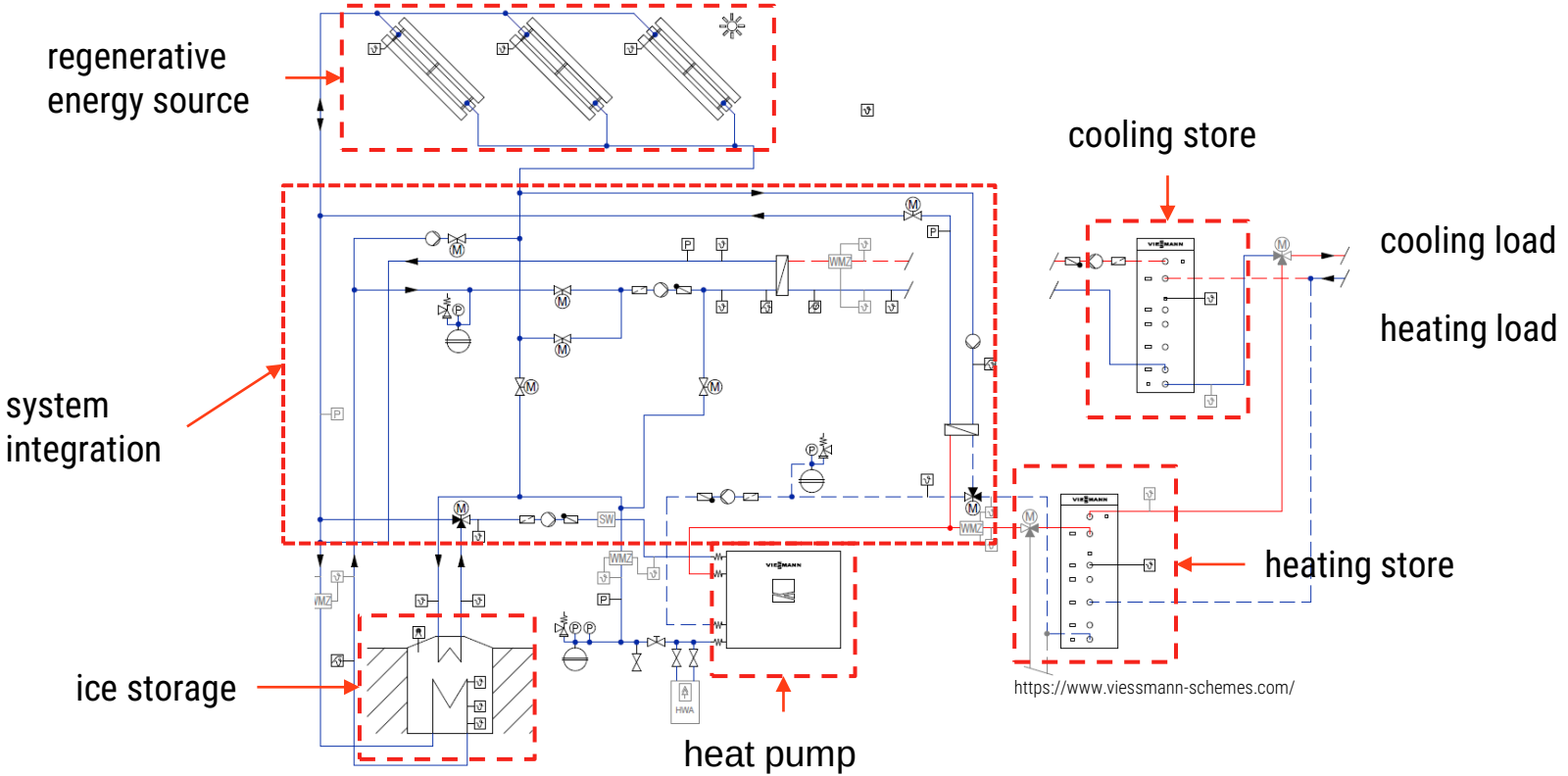
Goals

- Speed up system development
- Development of control functions independent of the application platform
- Handle functionally complex systems
- Integration in requirement, development and (automatic) test environment

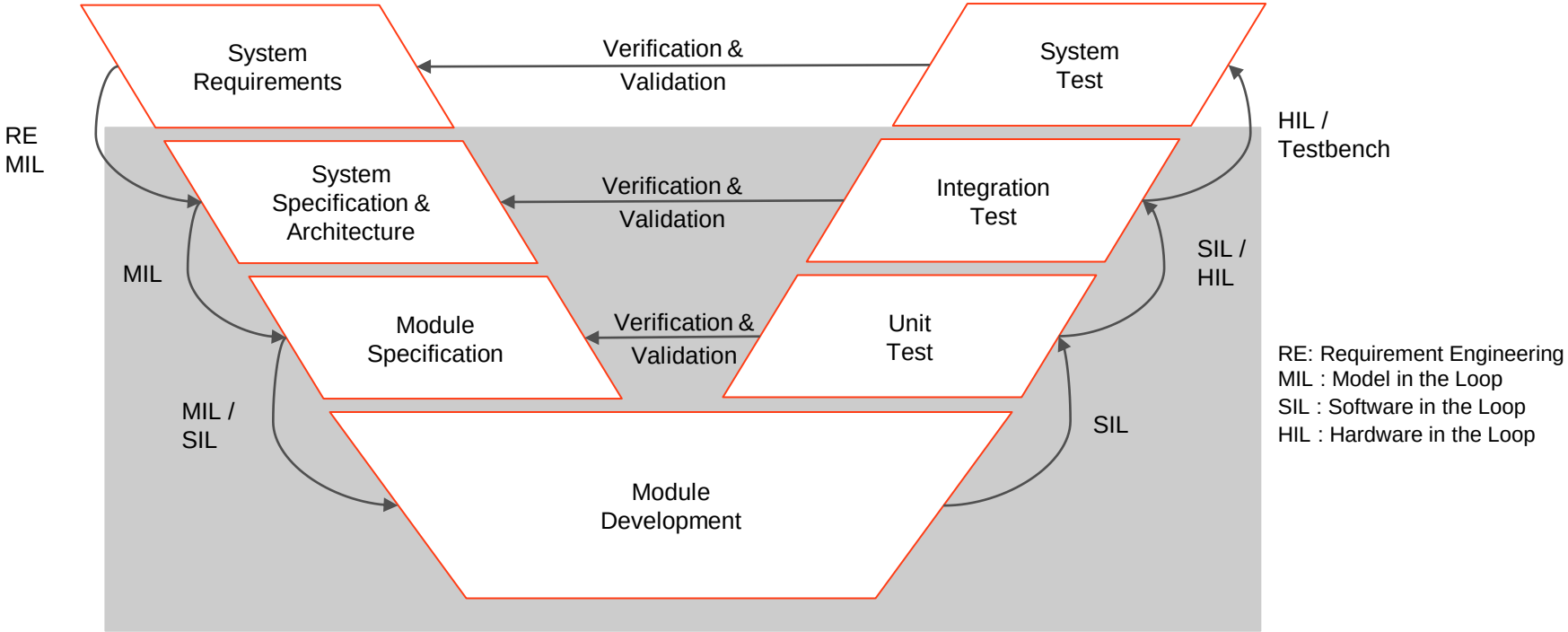
Ice-Storage system + Solar-Air-brine-Collectors



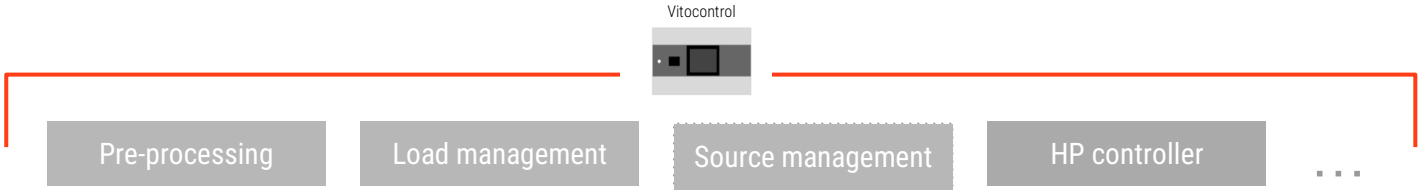
Hydraulic scheme of the system controller



Controller development (V-model)



Development of a system controller
Architecture



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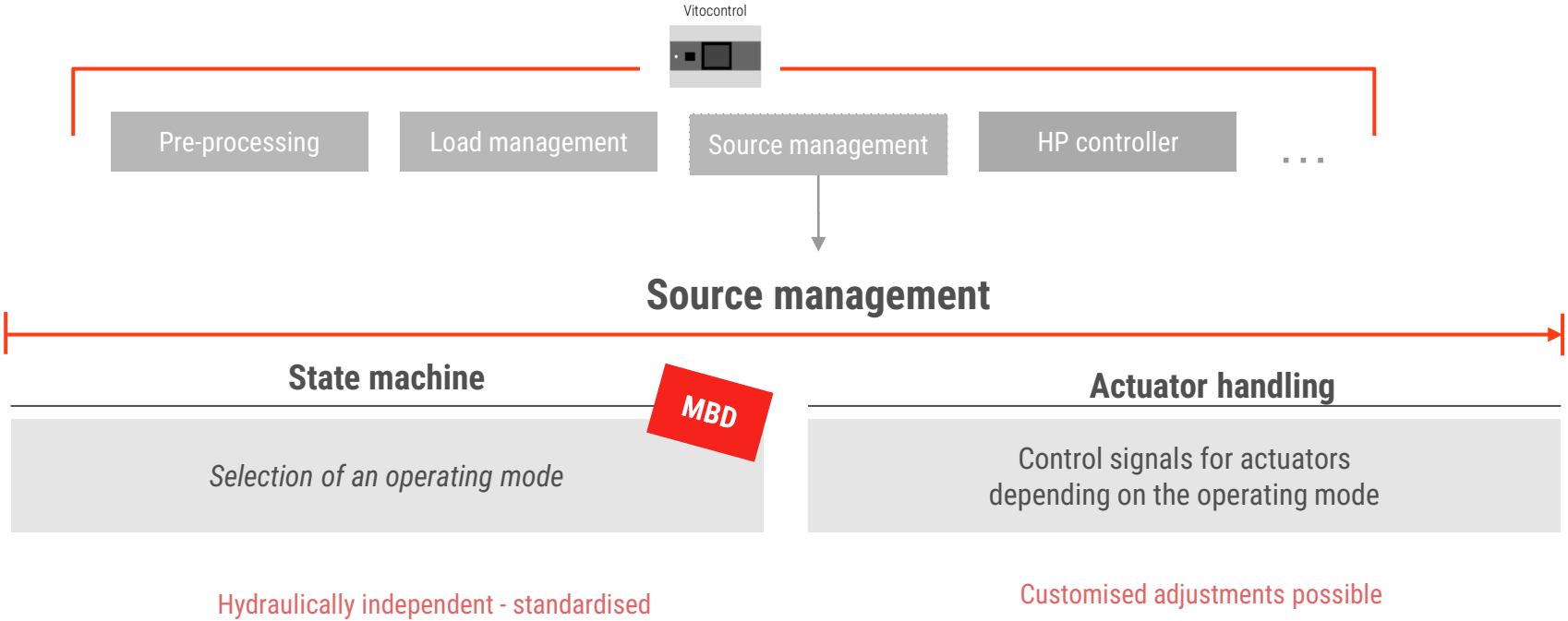
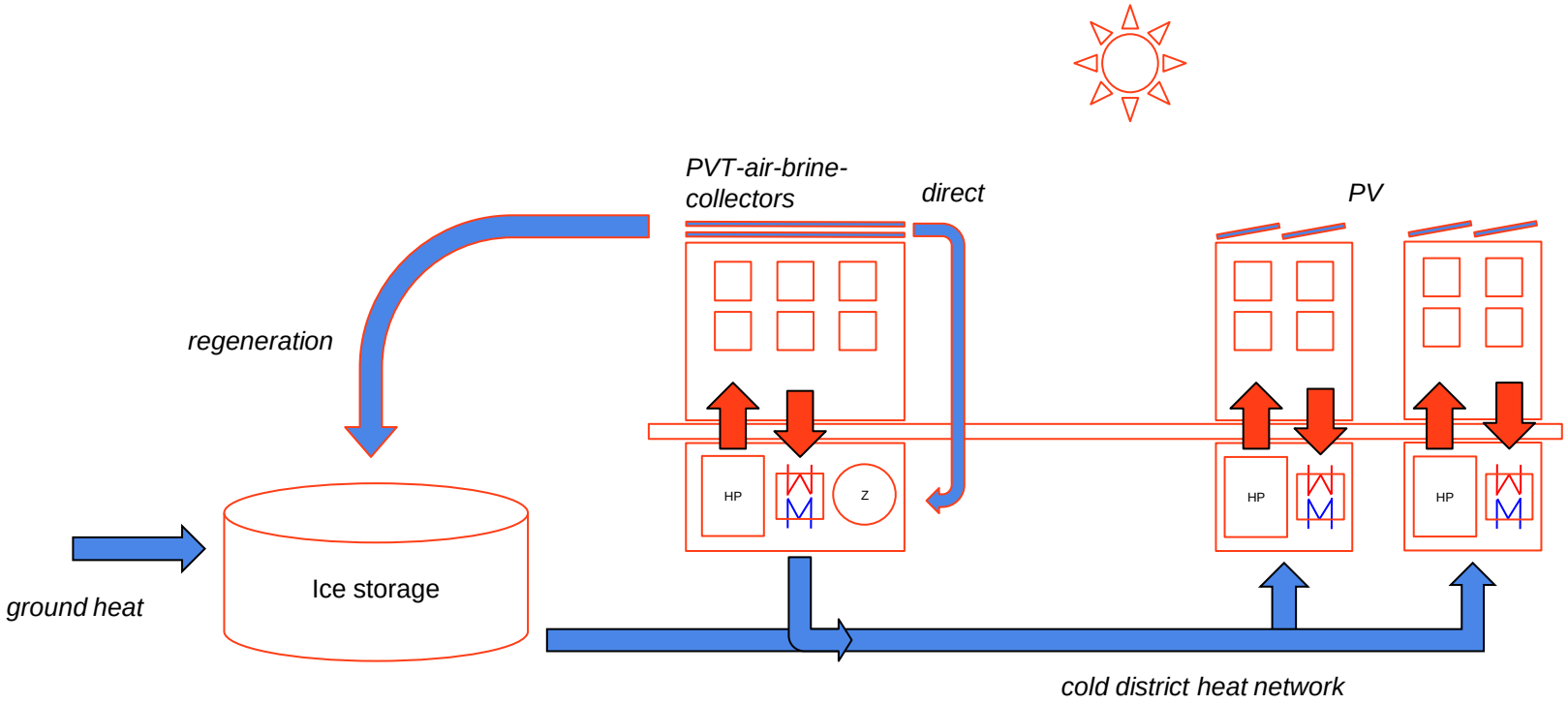


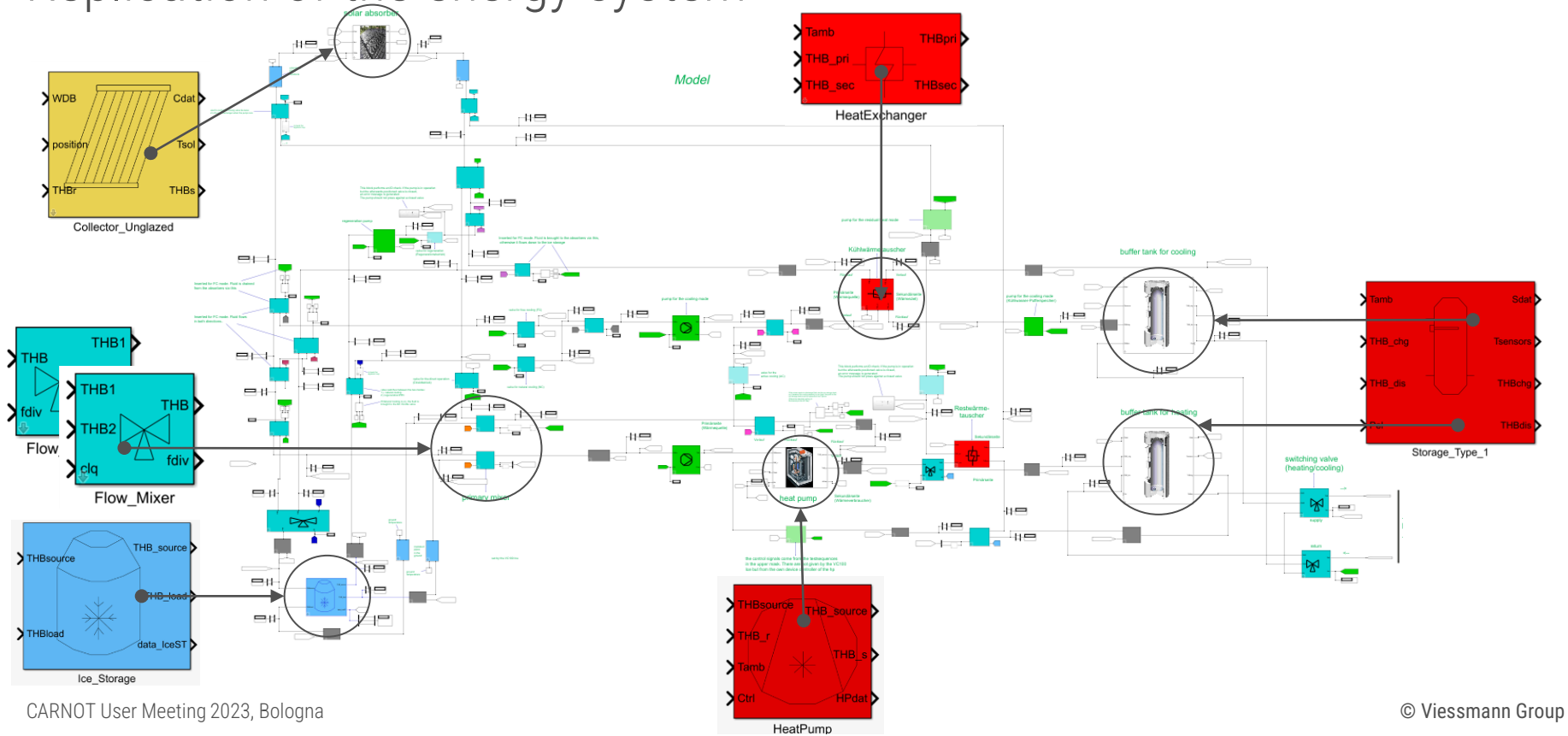
Cold district heat network



“longtime weather forecast” in Ice-Storage systems

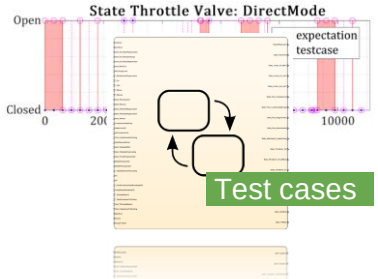
Testing of the system controller

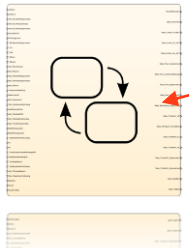
Replication of the energy system

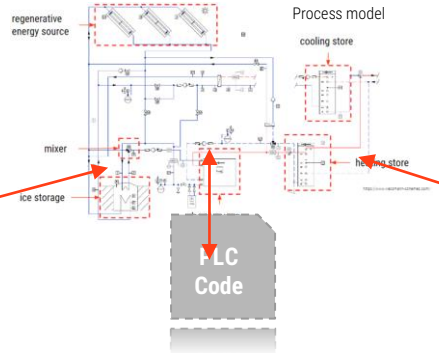


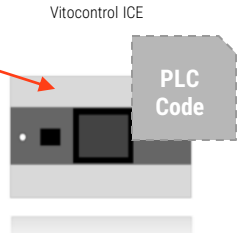
Testing of the system controller

Simulink & PLC









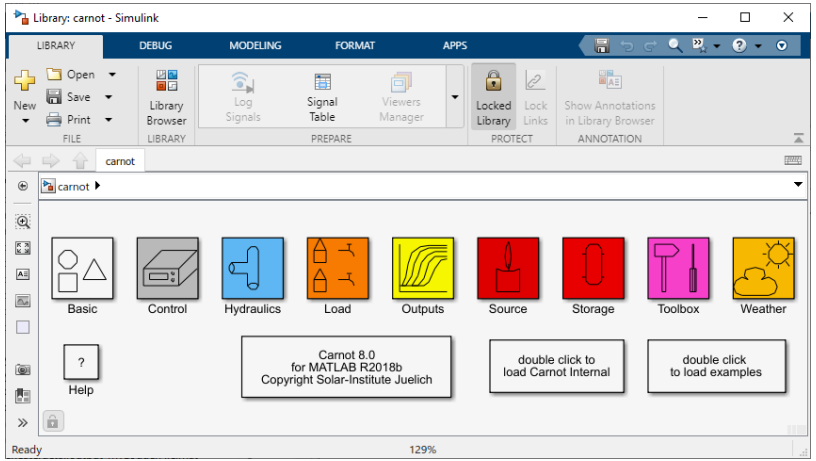
Unit test	MiL test	SiL test	HiL test	Field test
Generation of test cases per function & operation mode with predefined exceptions Development of an automated testbench	Testing the controller logic with a replication of the energy system in Simulink	Testing the PLC Code integrated in the PLC PowerShell	Testing the PLC Code integrated in the final hardware	**Currently monitoring the behavior of the control strategy under real conditions**

Conclusion

Development of a system controller

MBD & testing with Matlab/Simulink & Carnot

- \+ Fast development due to parallel testing
- \+ Function module validated by multiple test options
- \+ State machine expandable according to customer specifications
- \+ Code generation for different platforms



Thank you for your attention!