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The Holistic Urban Energy Simulation (HUES) Platform

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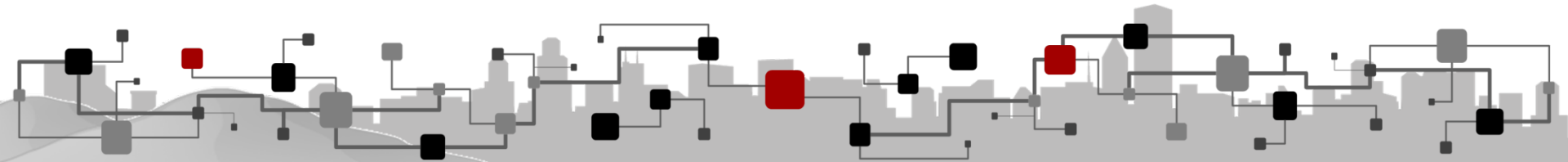

Focus of the HUES platform

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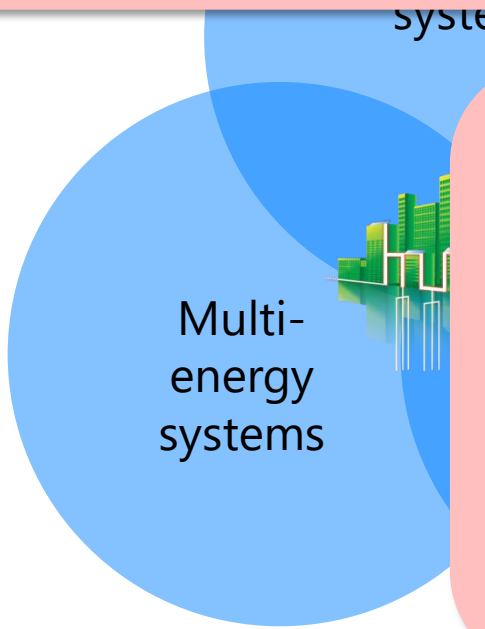
Distributed, renewable, multi-energy systems

Questions:

1. How can DRMES be optimally designed?
2. How can DRMES be optimally operated?



Given:

- Time-varying resource availability
- Multi-energy demand patterns
- Technical & economic constraints
- Regulatory/policy environment
- Uncertainties regarding fuel prices, energy demand, policy

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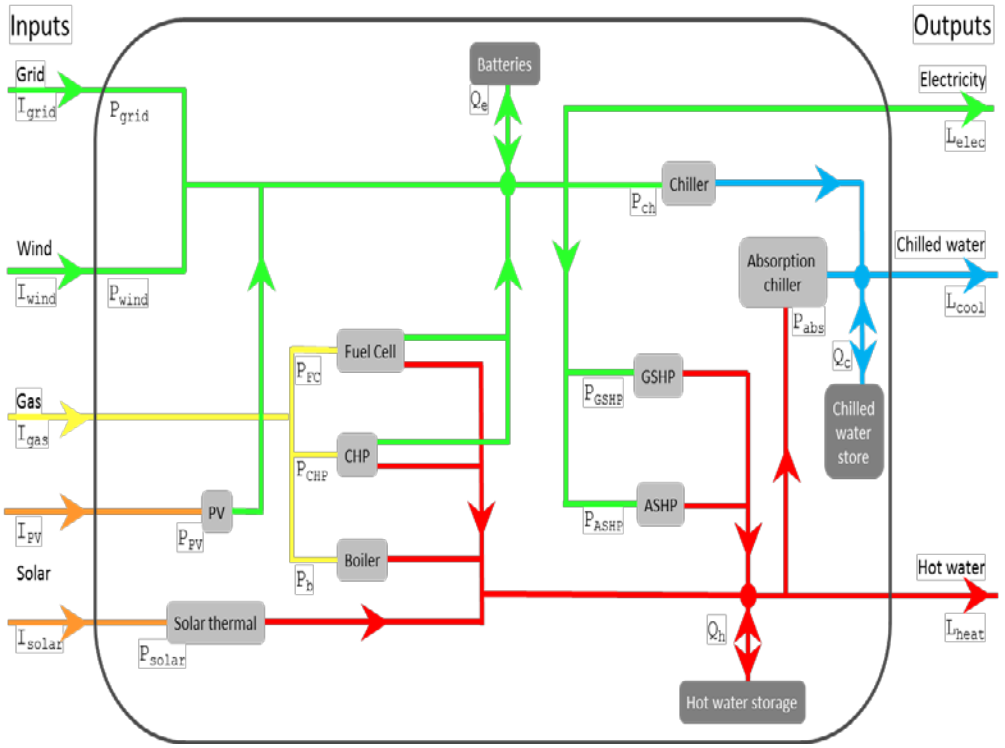
Energy hub: A conceptual model of multi-carrier energy systems used to represent the interactions of multiple energy conversion and storage technologies.

Energy hub model:

- Optimization of selection, dimensioning and scheduling of technologies in a distributed energy system
- Normally formulated as mixed-integer linear programs (MILP)



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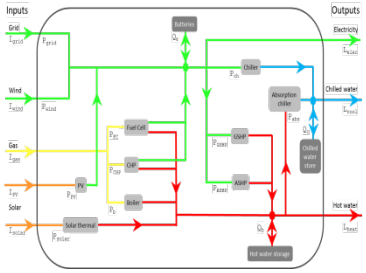
Cluster-based optimization of DES

Hyperheuristics for DES optimization

Thermal network modeling

Multi-agent optimization

Energy hub concept



Heat storage modeling

Building energy performance modeling

Electrical network modeling

Energy demand analysis

Purpose of the platform

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sccer | future energy efficient buildings & districts

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SECURE

Purpose:

1. **Enhance scientific transparency** by making models and data publicly accessible.
2. **Provide a more advanced starting point for future research on distributed energy systems** by making existing data and models more accessible and understandable to other researchers.
3. **Facilitate the design and operation of distributed energy systems in practice** by realizing an integrated platform for energy systems optimization and analysis.

Function 1: Module repository

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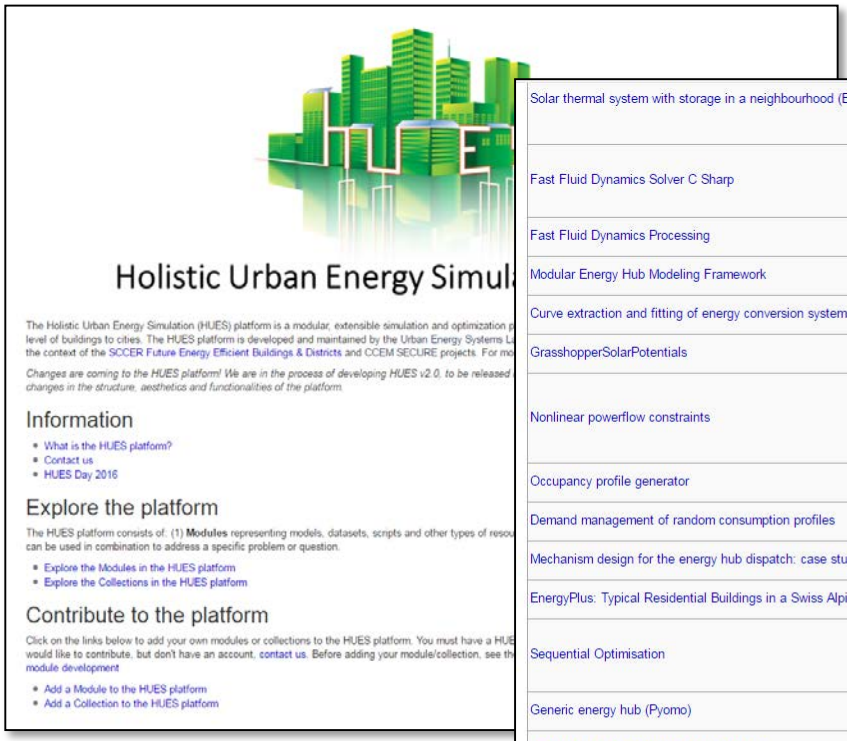


https://hues.e

Solar thermal system with storage in a neighbourhood (EnergyPlus)	Shanshan Hsieh	Heat storage Building simulation Solar Thermal
Fast Fluid Dynamics Solver C Sharp	Lukas Bystricky	FFD C Wind CFD
Fast Fluid Dynamics Processing	Christoph Waibel	FFD CFD
Modular Energy Hub Modeling Framework	Frederik Banis	Energy hub
Curve extraction and fitting of energy conversion systems	Marc Hohmann	
GrasshopperSolarPotentials	Christoph Waibel	Solar Potentials
Nonlinear powerflow constraints		Energy hub Grid constraints
Occupancy profile generator		
Demand management of random consumption profiles		
Mechanism design for the energy hub dispatch: case study		
EnergyPlus: Typical Residential Buildings in a Swiss Alpine V		
Sequential Optimisation		
Generic energy hub (Pyomo)		
Simple building energy model Rheinfelden		
Energy hub model for design, sizing and operation of an ene of buildings		
Unidirectional massflow LTN (IDA ICE)		
Simple office building EnergyPlus		
Rheinfelden energy hub thermal storage		
Multi-agent reinforcement learning based energy hub model		

Model:Solar thermal system with storage in a neighbourhood (EnergyPlus)

To edit the entries in this page, select "Edit with form" in the "Page tools" menu at the top of the page.

General information

Description	This model represents different configurations of solar thermal system with storage in a neighbourhood of 11 residential buildings. Relevant components in the model include buildings energy demand, solar thermal collectors, electrical heaters, storage tanks, and a district-heating network. An accurate representation of the system performance is strongly dependent on varying temperature states over a period of time, which can only be assessed through dynamic modelling.
Download URL	https://bitbucket.org/hues/solar-thermal-system-with-storage-in-a-neighbourhood/get/HEAD.zip
Authors	Shanshan Hsieh
Required software	EnergyPlus
Related publications	Hsieh,S., Orehounig, K., Weber, R., Dorer, V. 2015. Integration of Thermal Energy Storage at Building and Neighbourhood Scale. IBPSA Building Simulation Conference 2015. Hyderabad, India. Submitted.
Licence type	CC BY-NC-SA
Tags	Energyplus, District heating, Heat storage, Building simulation, Solar Thermal
Derivation of	
Accessible to	Public

Documentation

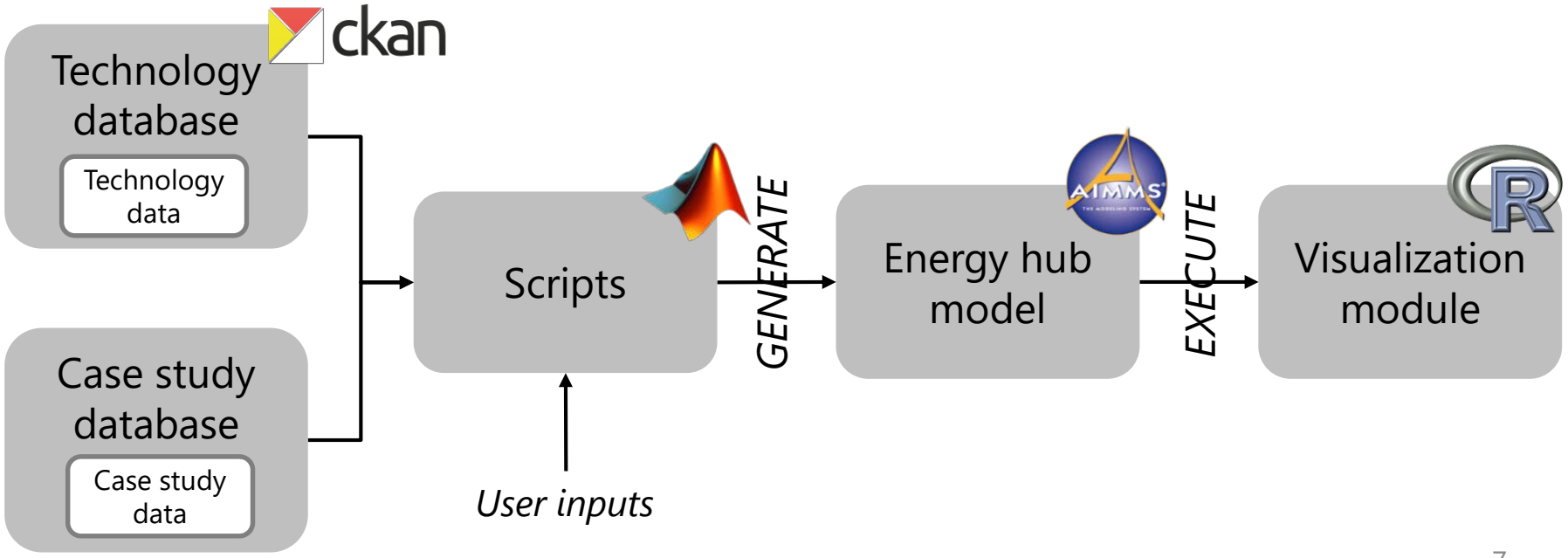
Documentation may be uploaded, linked or directly entered into the wiki.

Documentation URL(s):	https://bitbucket.org/hues/solar-thermal-system-with-storage-in-a-neighbourhood/overview
Documentation file:	
Documentation page:	

Function 2: Integrated optimization environment

Purpose is to enable:

1. Integration of modeling innovations into a common framework
2. Comprehensive analyses:
    - across case studies and technology configurations
    - across different assumptions & constraint formulations



Automated energy hub modeling workflow

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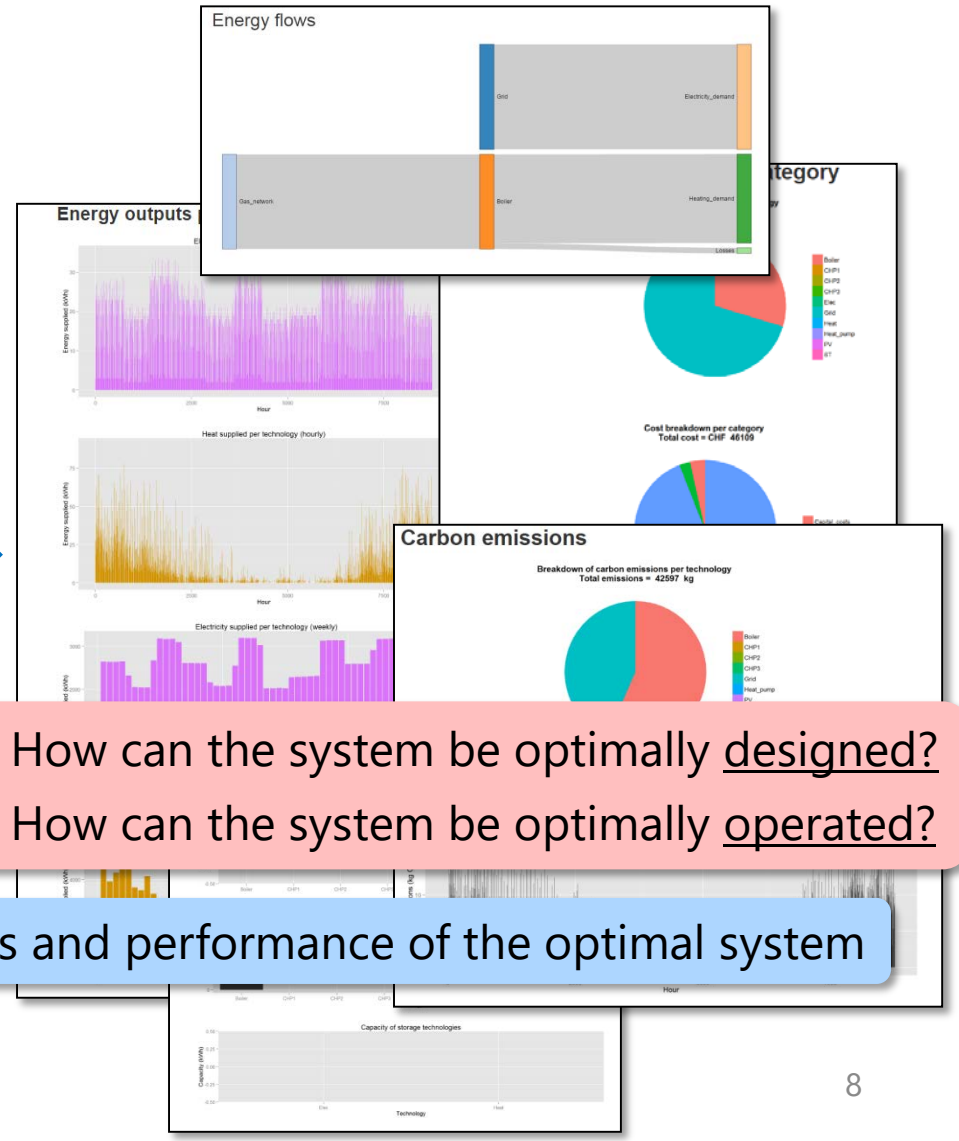
Interface (M-file)

```
%% DESCRIPTION OF THE SCENARIO
% This is a simple scenario based on the generic energy hub model.

%% SET THE SCENARIO NAME

%used for saving the results
scenario_name = 'generic_energy_hub_basic';

%% CASE TO BE ANALYZED

case_study = 'generic_energy_hub';

%% TECHNOLOGIES TO BE INCLUDED

technologies = ['CHP 1','CHP 2', 'CHP 3','Gas boiler 1','Solar PV 1','Solar therm

%% OBJECTIVE AND THE TYPE OF OPTIMIZATION

%objectives
% 1: cost minimization
% 2: carbon minimization
objective = 1;

%select technologies and do sizing?
select_techs_and_do_sizing = 1;

%% TIME VARIABLES

timestep = 'hours';
timesteps = 1:8760;
number_of_timesteps = length(timesteps);

%% ELECTRICITY GRID PARAMETERS

grid_connected_system = 1;

%% PRICE PARAMETERS

dynamic_electricity_price = 0;

grid_electricity_price = 0.24;
grid_electricity_feedin_price = 0.14;
gas_price = 0.09;
carbon_price = 0;
interest_rate = 0.08;

if dynamic_electricity_price == 1
    grid_electricity_price = csvread(strcat('scenarios\',scenario_name,'\electric
    grid_electricity_price = grid_electricity_price(:,3);
    xlswrite('aimms_model\energy_hub\electricity_costs.xlsx',grid_electricity_pri
end
```

Run

HTML reports



1. How can the system be optimally <u>designed?</u>
2. How can the system be optimally <u>operated?</u>

Dynamics and performance of the optimal system

Thank you for your attention.

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