TECHNISCHE UNIVERSITÄT WIEN

ESEA Institut für Energiesysteme und Elektrische Antriebe

# Symbiose-4-IuG

Optimal allocation of storage and conversion technologies in an urban energy system

Highlights of Energy Research 2018 - System Integration and Sector Coupling

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# SYMBIOSE-4-IUG

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TU WIEN ESEA Institut für Energiesysteme und Elektrische Antriebe

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illwerke vkw

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# Motivation

- **Renewable energy system**
  - Volatile power generation
  - Low controllability
- **Pump storage capacities not sufficient**
  - „S4MG“: 100% renewable Austria
  - 5 times the electrical power necessary
  - > 100 times the capacity necessary
- **Possible solution: decentralized storage technologies**
  - Decentralized load generation balance
  - Hybrid energy systems – coupling of existing energy systems

# Project Goals

The **aims** of the project "Symbise-4-Industrie und Gewerbe" were:

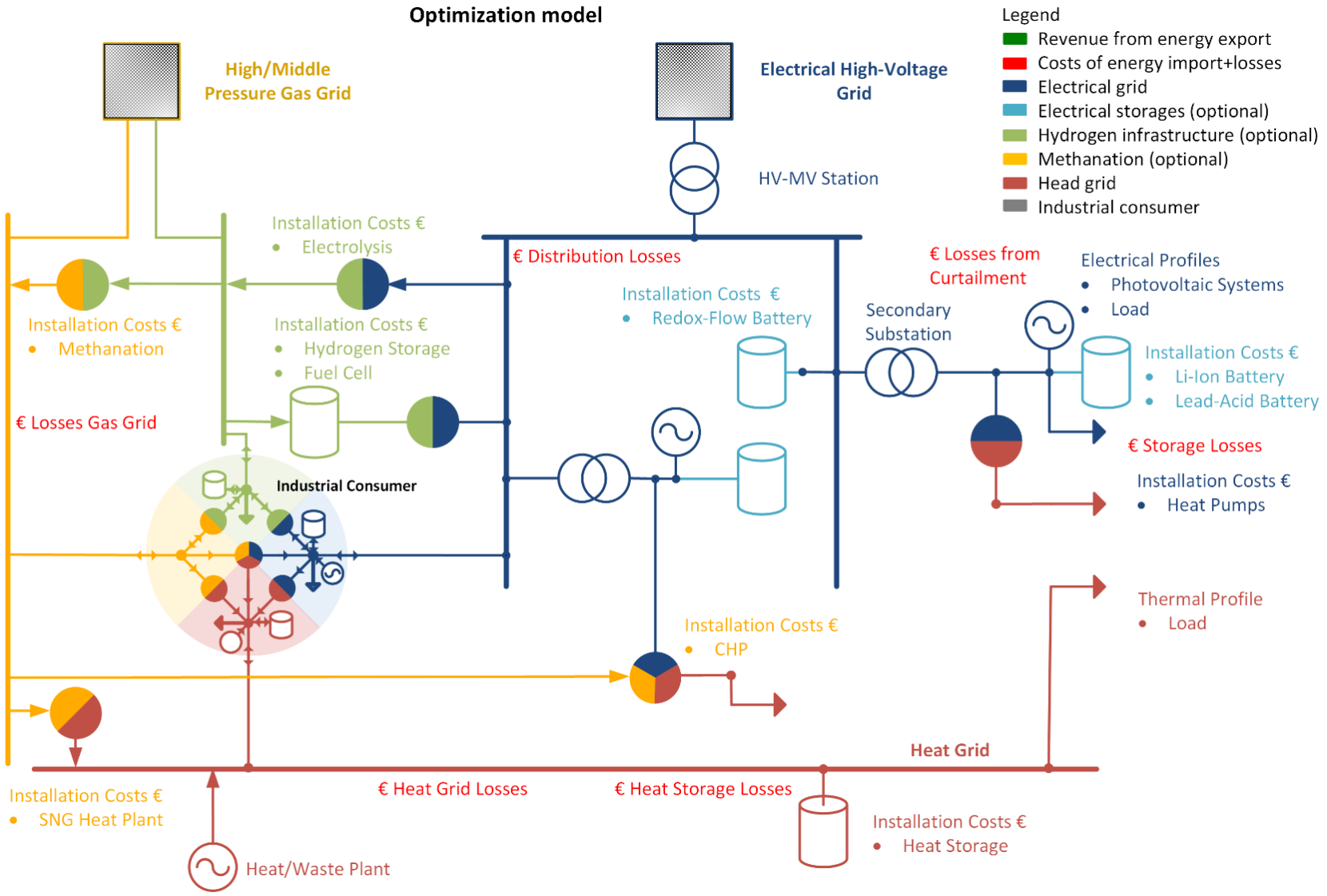
- to determine the **decentralized storage demand** and potential for **conversion technologies** for the coupling of existing energy systems (electricity-, gas- and heat grid) in a city with a high share of renewable energy generation

- to highlight the **potential** of coupled infrastructure **for the industrial and commercial sector** and their **shifting potentials**

- to show the effects of the coupling of energy grids on **network operations**

- to determine **potentials for reducing the import dependency and $CO_2$ emissions** for the city of the future when implementing the ideas of “Symbiose-4-IuG”

# Optimization Topology



# Optimization Model

## Linear optimization

- Size of storage and conversion technologies
- Positioning and operations
- Demand side management, curtailment of PV generation, losses

## Constraints

- Load generation balance (electrical and heat grid)
- Power and energy limits for
  - Storage and conversion technologies
  - Lines and transformers (DC Load flow)

## Scenarios for Stakeholders

- Technical scenario
- Economical scenarios
  - End consumer
  - (Urban) Community
  - Community with minimal import

## Goal

- Minimal system costs

# Results

## Positioning and dimensions of storage and conversation technologies for the considered urban energy system

- From a technical perspective no decentralized storages were necessary for 100% of possible PV installation in this urban electrical grid
- From an economical stakeholder's point of view storage and conversion technologies were introduced and improved own consumption
- $CO_2$ emissions and import dependencies could be reduced significantly

## Stakeholder industrial costumer

- Load shift potential for specific industrial costumer processes were determined
- Power-to-$H_2$ for company fleet and for heating processes were investigated

## Transfer of results to cities in Austria

- Investigations showed results of the considered urban energy system can be best transferred to cities under 50.000 residents (68 out of 77)
- Upscaling of results for import dependency of fossil fuels and $CO_2$ emissions were calculated

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STADT der Zukunft


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