9th International Conference on Engineering
for Waste and Biomass Valorisation

WasteEng 22

June 27-30, 2022
Copenhagen, Denmar

WasteEng Conference Series

www.wasteeng.org

Dynamic simulation and optimization of a waste incineration plant

Moritz Westermeier, Christoph Wieland, Hartmut Spliethoff

OptiMaDyn

MARTIN

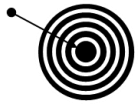
TECHNISCHE UNIVERSITÄT DARMSTADT

CMV systems

Chair of Energy Systems
TUM School of Engineering and Design
Technical University of Munich

Agenda

1. Motivation



2. Goals of the Project

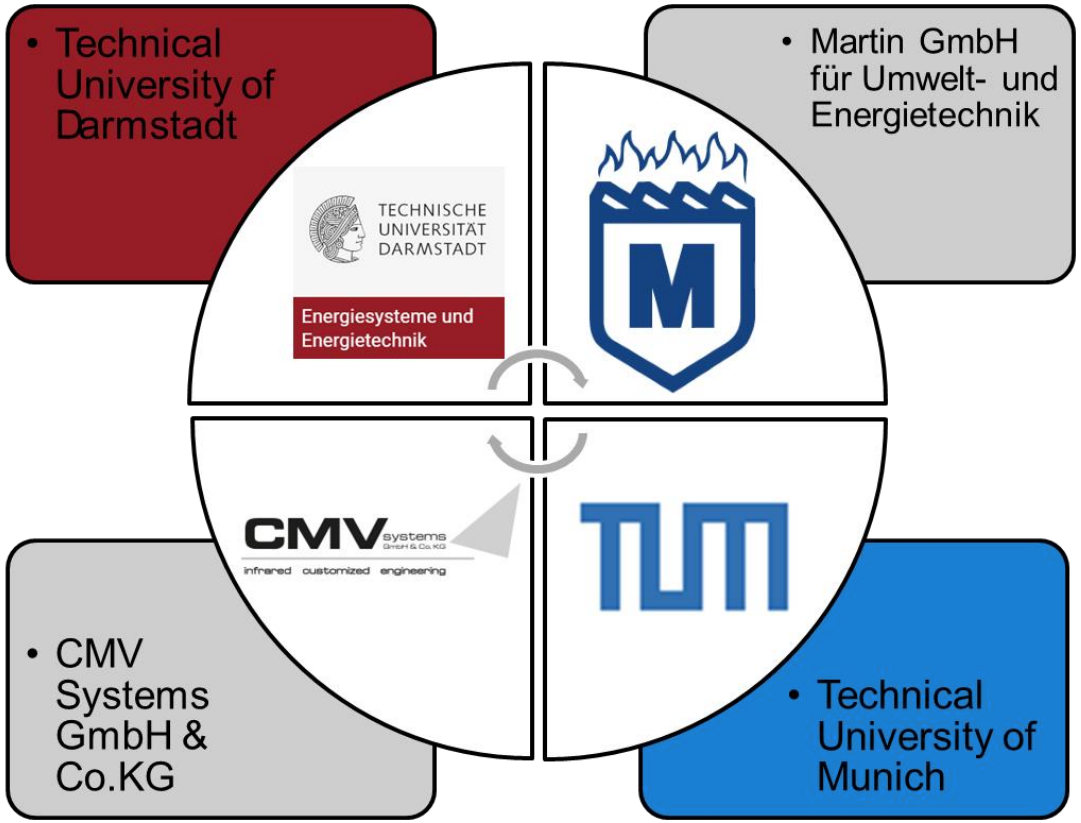
3. Methods

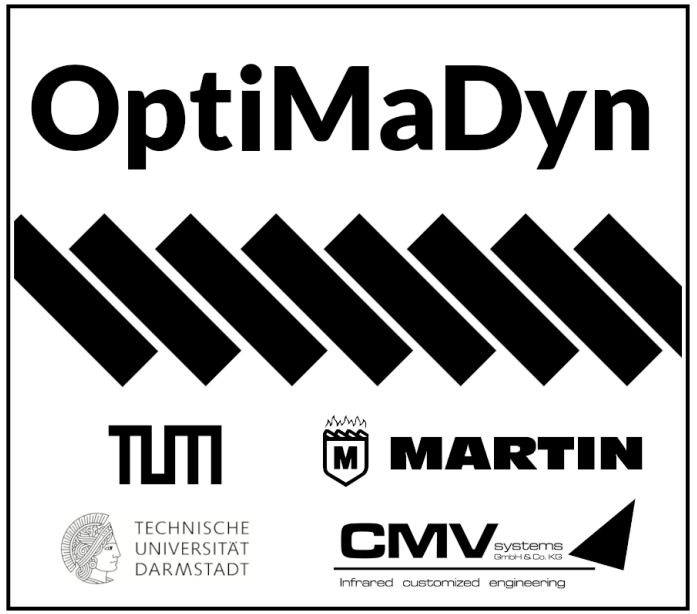
4. Conclusion and Outlook

Chair of Energy Systems
TUM School of Engineering and Design
Technical University of Munich

Optimization of the Control Structures of Waste Incinerators through Dynamic Process Modelling and the Use of Innovative Monitoring Methods

01.07.2021 – 30.06.2025





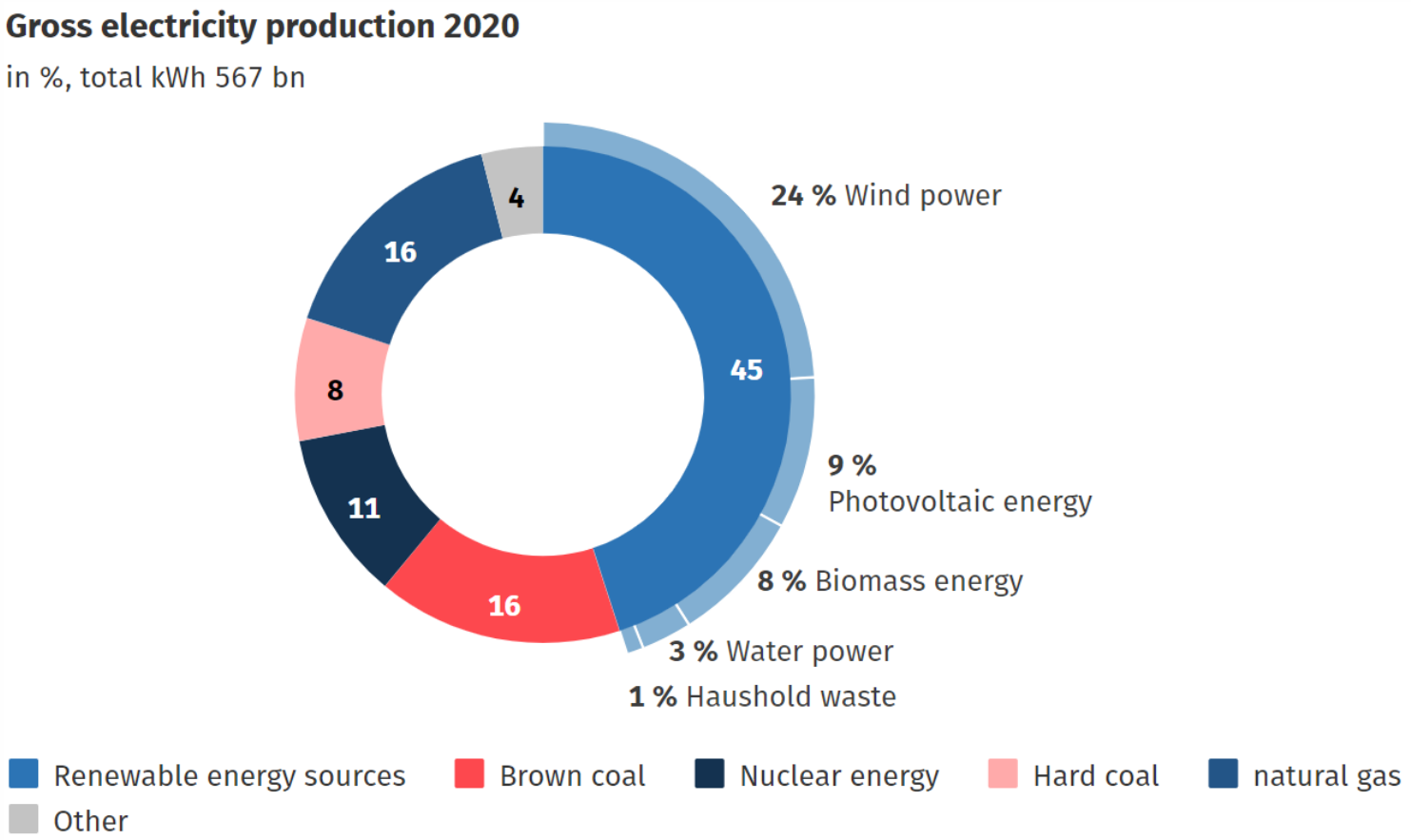
Motivation

Energy System

- Growing amount of renewable energy sources
- Operating reserve (control power) is ma supplied by conventional power plants

State of the art WIP

- Waste incineration plants (WIP) run at fu load (electricity is byproduct)
- Dynamic of Waste Incineration plants is very important in this use case
- Large dead times waste→energy



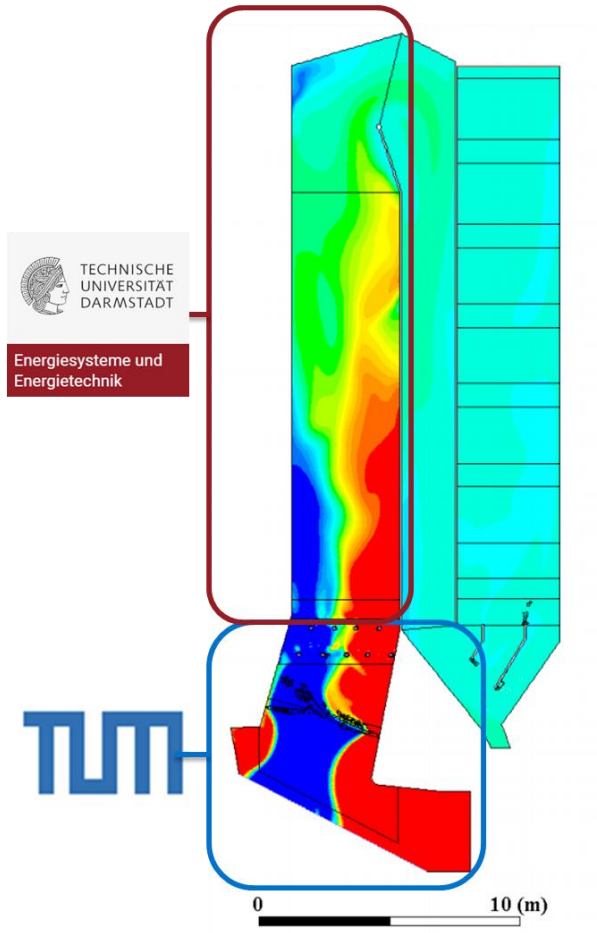
Goals of the Project

- Goal
  - Investigating the basics for the supply of operating reserve

- Partial goals:
  - Increase of **load stability** and **flexibility**
  - Fulfill the **emission limits**
  - Improving the system understanding of the **dynamics in waste incineration plants**

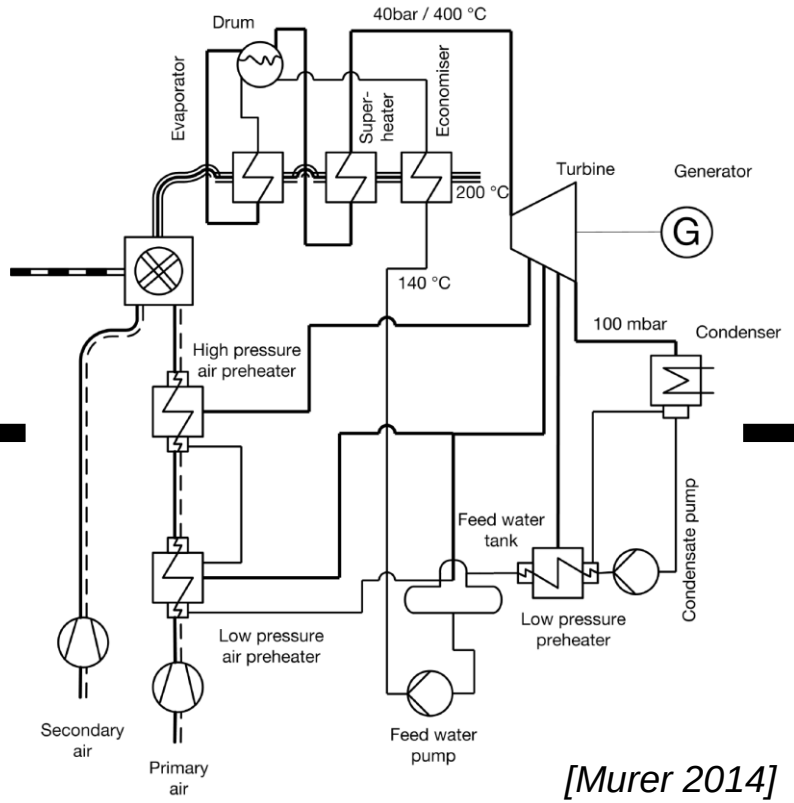
Methods

CFD+DEM Simulation



+

Dynamic Process Simulation



[Murer 2014]

+

Measurement Campaign

[ZEVO Plzeň]

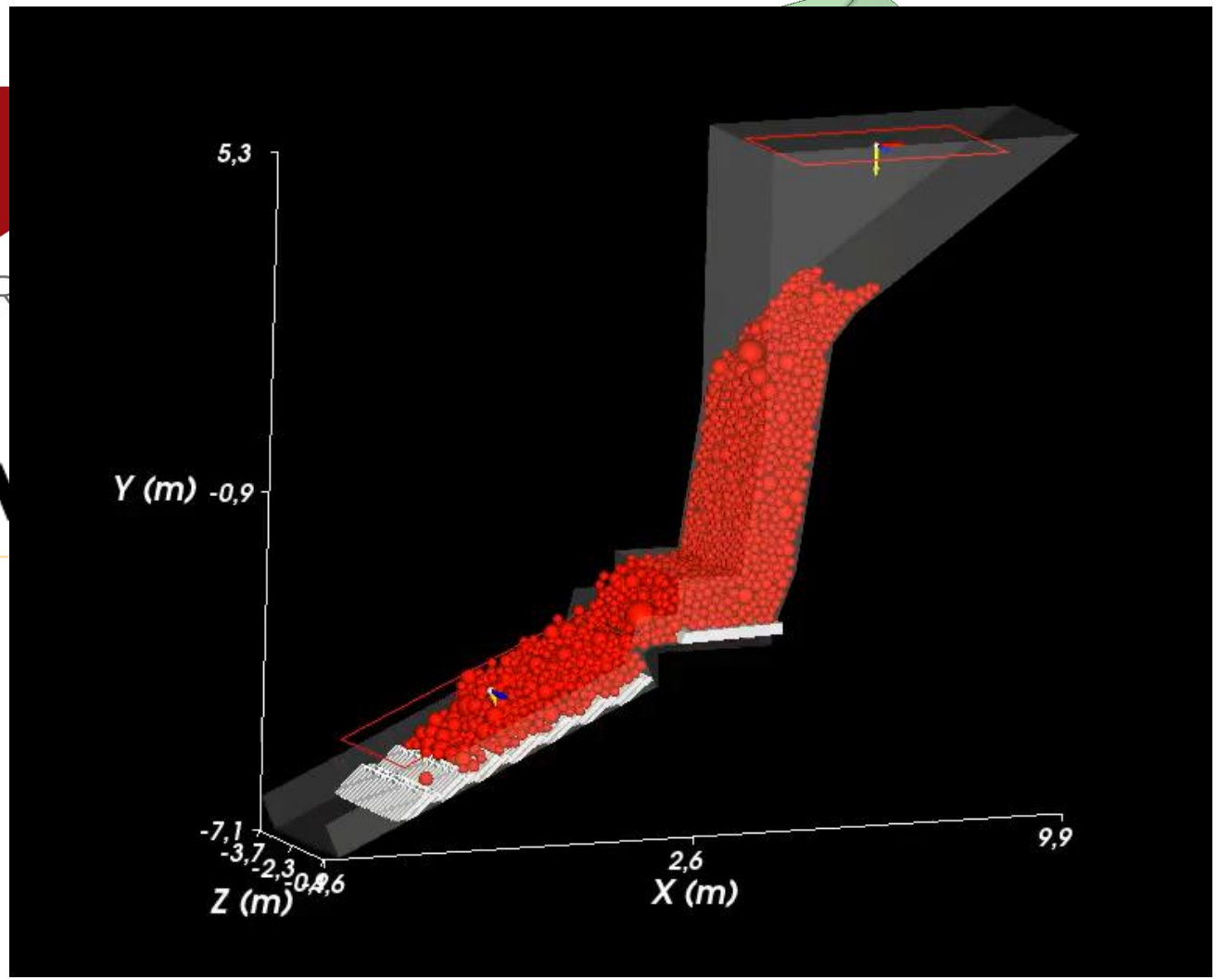
CFD+DEM

Discrete Element Method (DEM)

- Simulation Software: Ansys Rocky
- Investigation of waste feeding

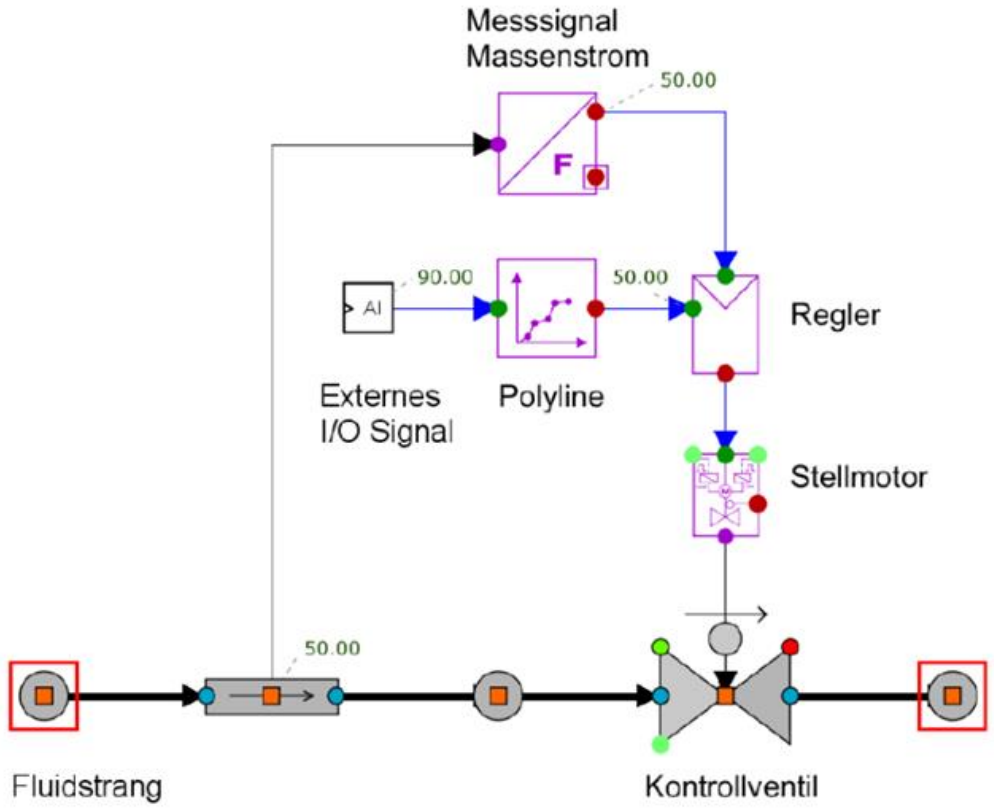
Computational Fluid Dynamics (CFD)

- Simulation Software: Ansys Fluent
- Simulation of combustion reactions
- Calculation of heat transfer
- Investigation of corrosion



Dynamic Process Simulation

- Software: Apros
- Modelling of the process and the control system
- Validation of the model using data from measurement campaigns
- current status:
  - » Model of the reference plant is running
  - » first validiation with measurement data

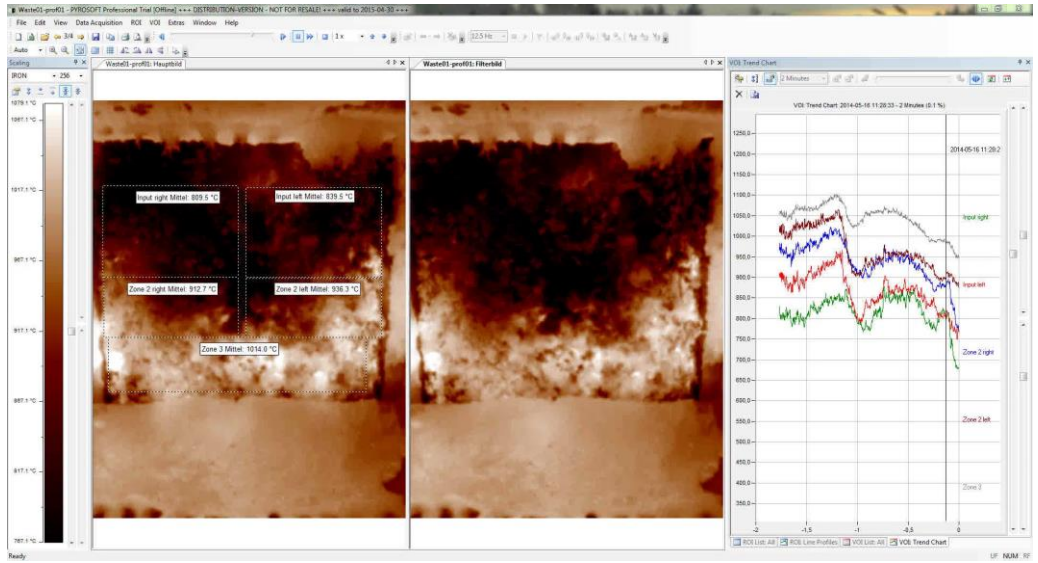


Measurement Campaigns

- Two measurement campaigns during the project
  1. Before Optimizations: Collecting data for model validation
  2. After Optimization: Investigate benefits

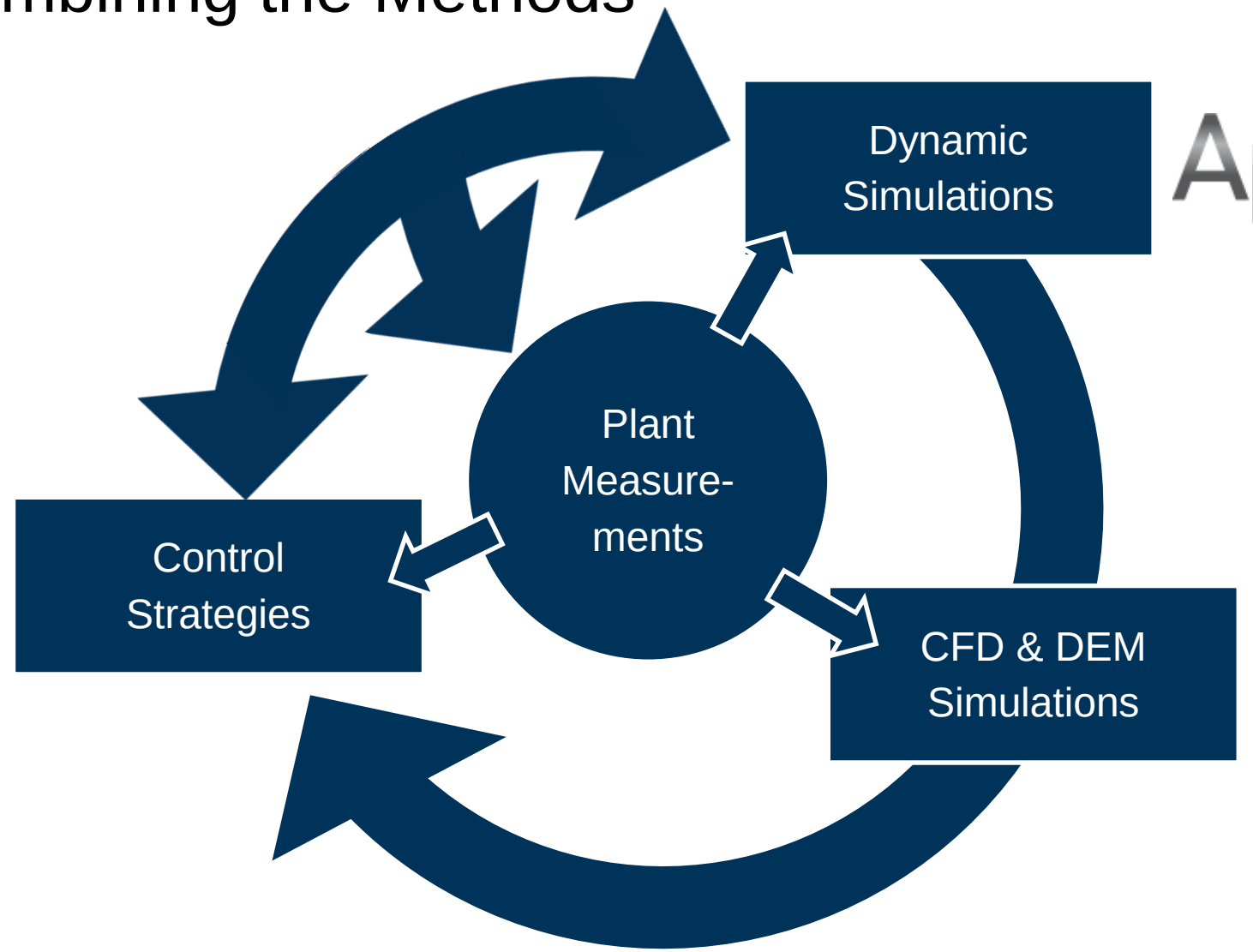
- Installation of additional measurement equipment
  - » Infrared camera to measure the temperature distribution on the grate
  - » Temperature Sensors / Pyrometers to measure the flue gas temperature
  - » Online Corrosion measurement to analyze corrosion in different operation points

- Measurement of the dynamic system behavior based on defined load changes



Online monitoring of fire grate [CMV Systems GmbH]

Combining the Methods



Apros

Ansys FLUENT

ROCKY

Conclusion and Outlook

- Dynamic operation of waste incineration plants will be important for the future energy system
- This project investigates the dynmaics of waste incinertors

- Development of modern control strategies
  - » Reduction of dead times during control
  - » Increasing the dynamics of MVAs
  - » Improvement of the control quality of MVAs

Outlook:

- Measurement campaigns will start soon
- Full validation of different models
- Optimazations will be implemented in reference plant

OptiMaDyn

TECHNISCHE UNIVERSITÄT DARMSTADT

MARTIN

CMV systems GmbH & Co. KG
Infrared customized engineering

Supported by:

Federal Ministry for Economic Affairs and Climate Action

on the basis of a decision by the German Bundestag

Thank you for your attention!

Contact:

Moritz Westermeier, M.Sc.
TUM School of Engineering and Design
Technical University of Munich
Chair of Energy Systems