

# Flexibility of multi-fuel plants - Needs, possibilities and solutions



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Solution Architect for Global  
Bioeconomy & Cleantech Opportunities



# Drivers: Future multi-fuel CHP



More flexibility!

Generation capacity mix is changing



- Future Thermal power plants
- Wider operating range
- Quick responses to load changes

Increased Investment risk



- Uncertainties
  - Economics
  - Policies
- Volatility
  - Electricity prices
  - Fuel prices

Financial performance to be improved



- New revenue streams
- New business models





# Future multi-fuel CHP: Next level



## Revenue:

- Electricity
- Heat
- Steam
- **New streams**
- **New Business models**

Maximize revenue

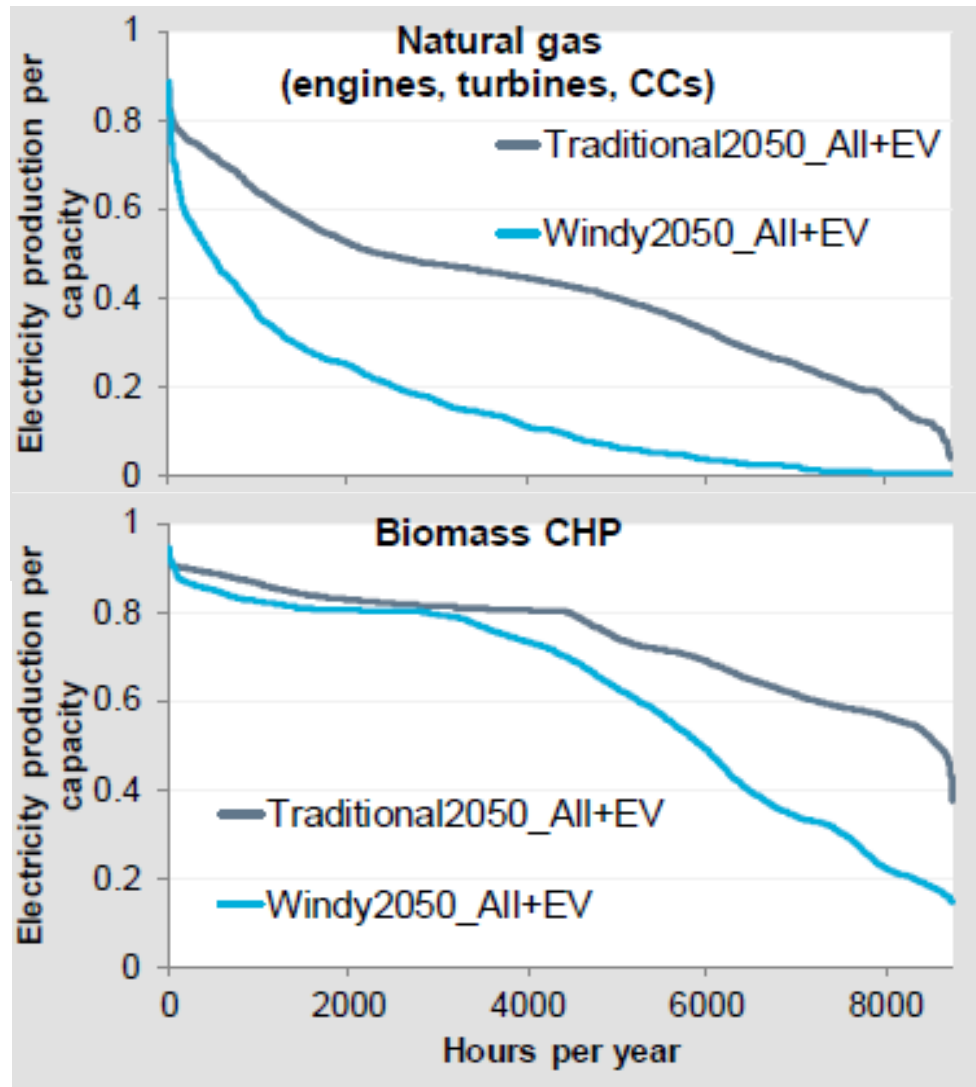
## Costs:

- Fuels
- Emissions
- Ash, water etc
- O&M
- **New Business models**

Minimize costs

Profit

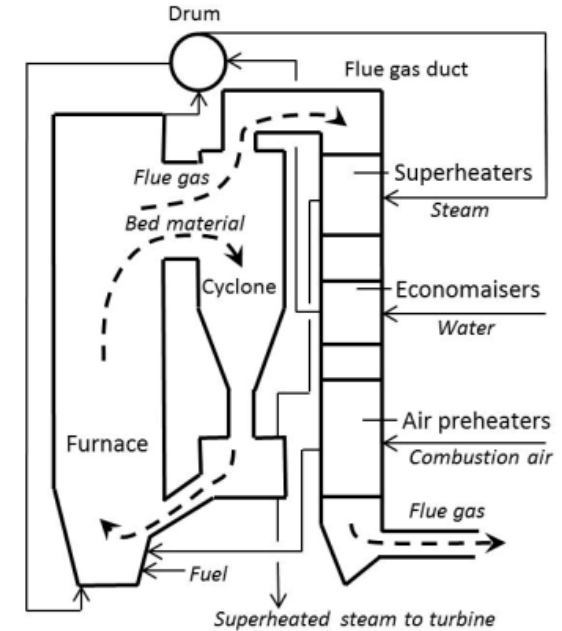
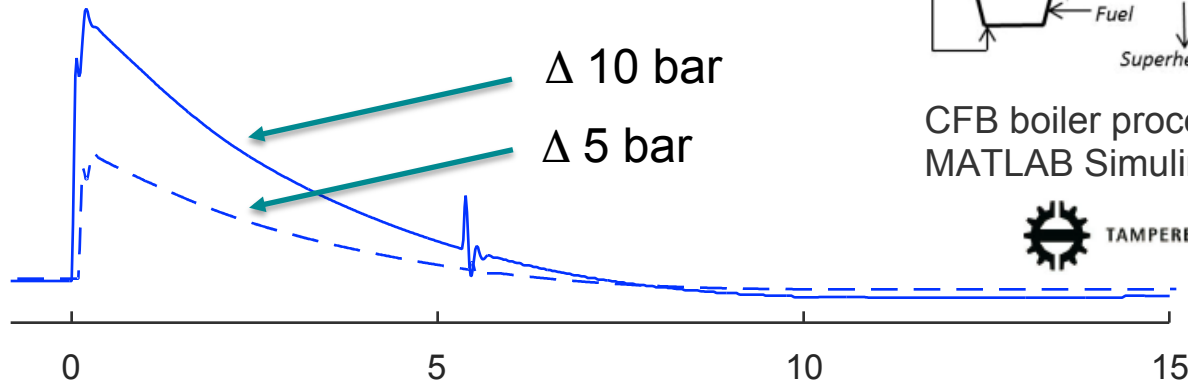




# Dynamic model for design and testing

- A dynamic simulator is applied in testing flexibility
  - Process parameter studies
  - Output constraints
  - Process design improvement

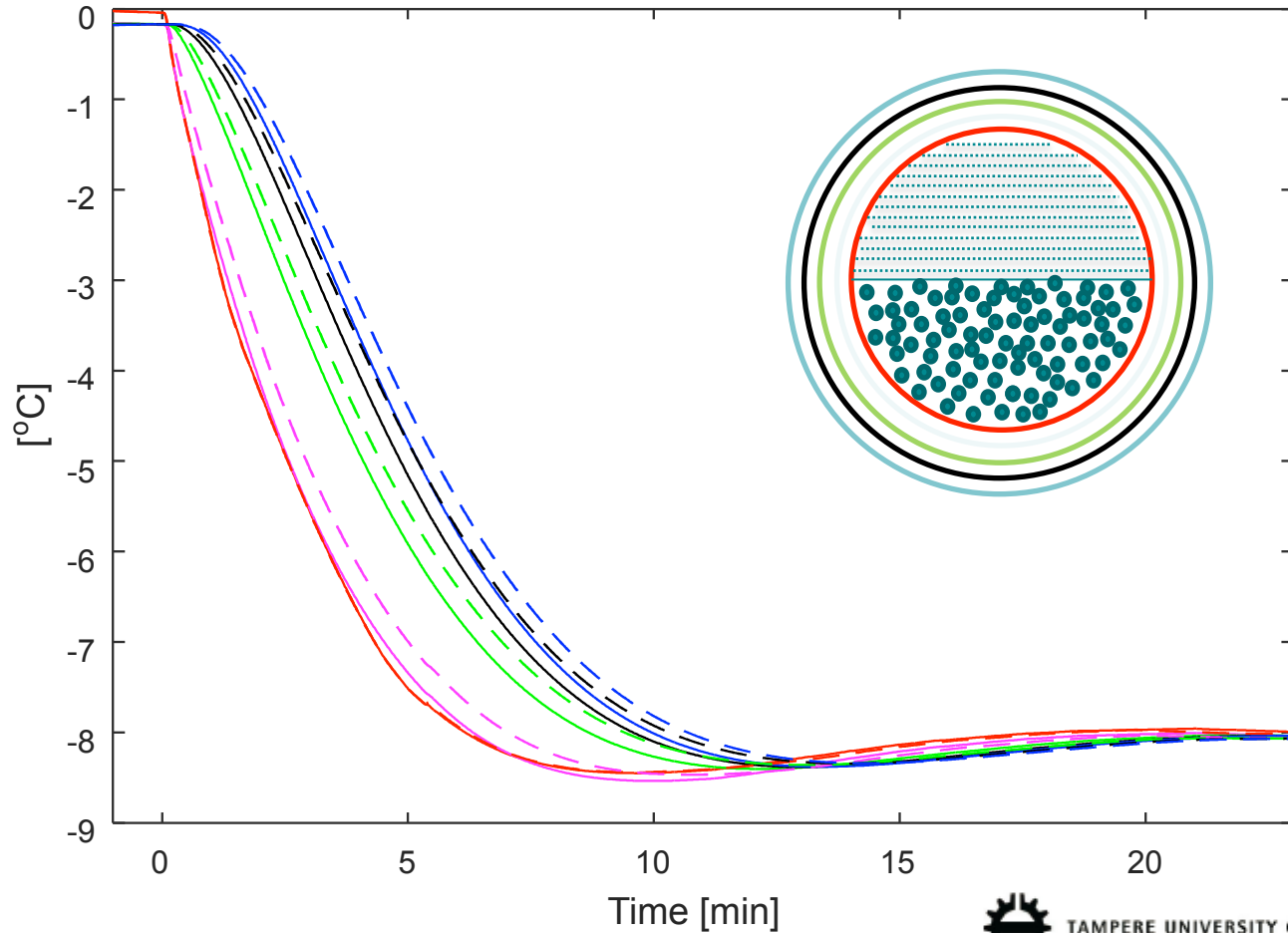
**Main steam mass flow**



CFB boiler process model in MATLAB Simulink

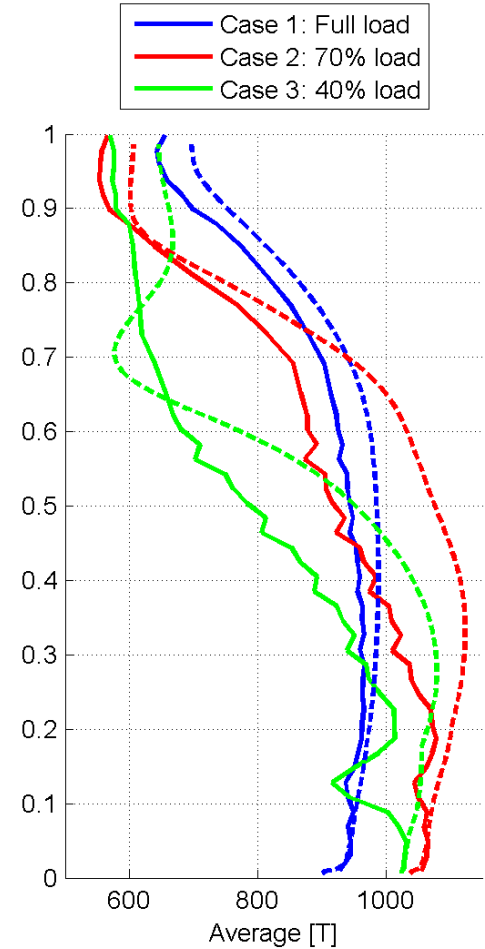
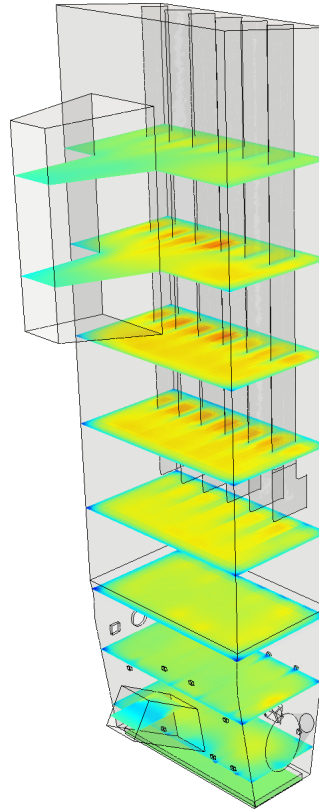
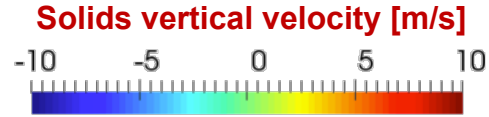


# Temperature change in the drum



# Dynamic CFD modelling

- Coupled CFD-Apros process simulator
- Dynamic models that can calculate ramps
- Emissions, controls, local conditions inside the boiler





## SUMMARY

- Biomass CHP needs fuel, operational and solution flexibility
- Biomass CHP is needed also 2050 in windy scenario
- Boiler design needs renewal
- Tools for testing new designs are now available
- Further development is needed

