Use of chemical equilibrium modelling in boiler design

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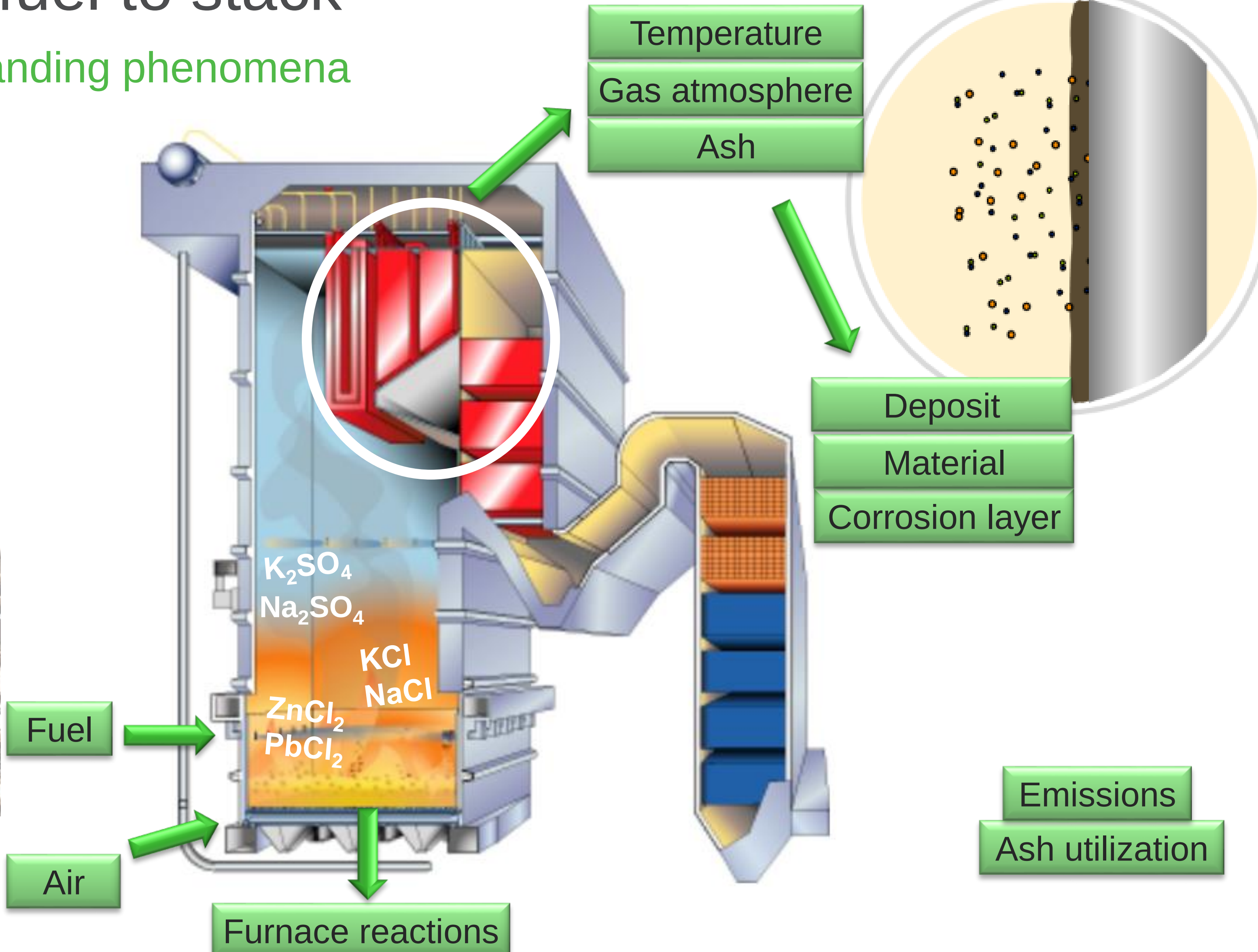
From fuel to stack

Understanding phenomena



SteaMax – Valmet in-house corrosion prediction method

Input

- Fuel composition
- Fuel mixture ratios
- Flue gas temperature profile
- Superheater location, temperature and materials

Output

- Fuel, boiler and material specific corrosion prediction
- Maximum steam temperatures for different material grades
- Corrosion prediction for different loads and fuel mixtures

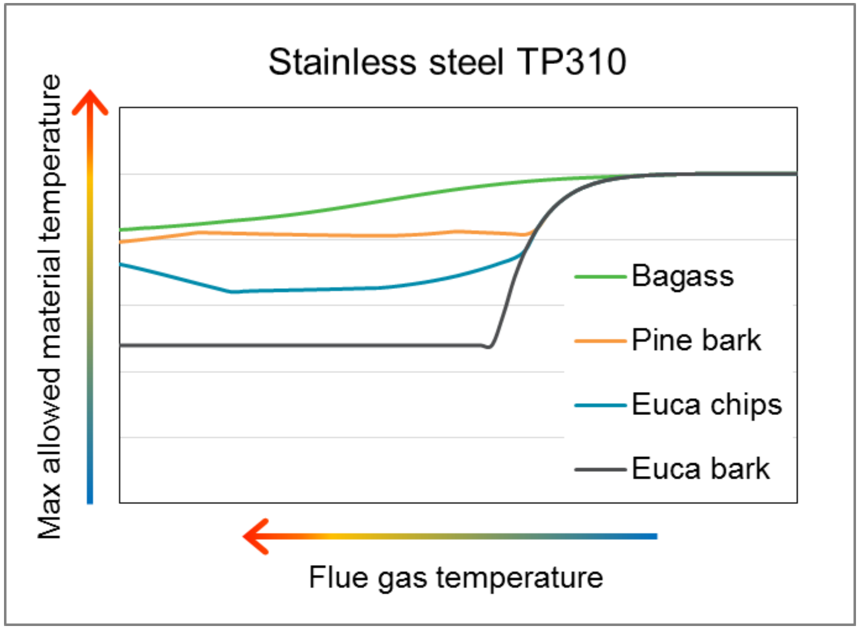
SteaMax is based on

- Thermodynamical modeling (ChemSheet) of the gas atmosphere
- Estimation of the corrosivity of the atmosphere
- Empirical data from more than 1300 laboratory corrosion tests and more than 45 full scale plants

Use of SteaMax

Plant, fuel and material specific corrosion prediction

- Selection of superheater materials
- Optimization of steam temperature
- Optimization of fuel mixtures and fuel limits
- Evaluation of the corrosivity of fuels and fuel mixtures
- Estimation of corrosion rate and superheater life time
- Trouble shooting



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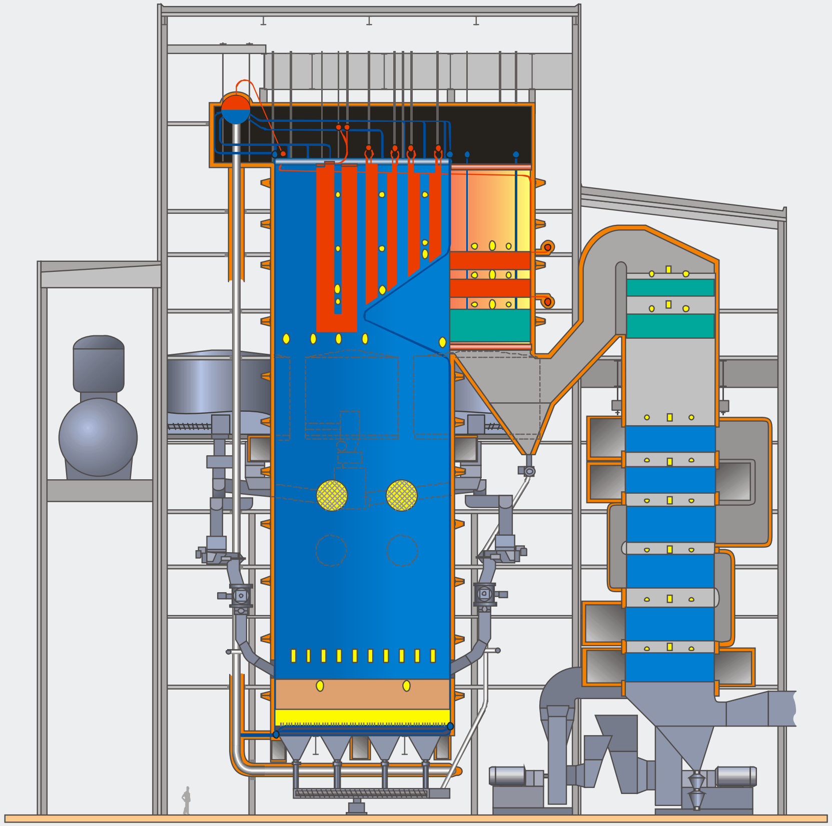
Case example: The effect of peat on corrosion

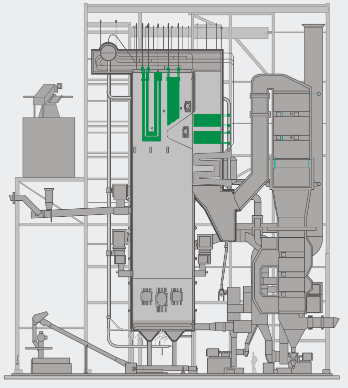
BFB in Finland

Steam	114 bar 541 °C
Fuels	Bark, forest residues, mill sludges, peat
Winter	100% load With peat
Spring	50% load Without peat

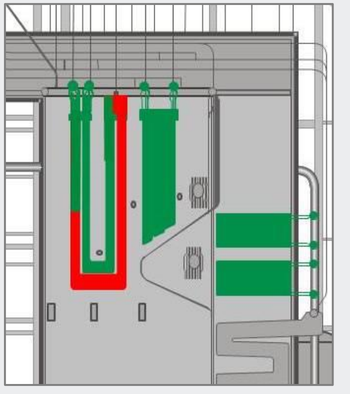


Conclusions of the SteaMax investigation

The effect of peat on corrosion



Winter:
- Full load
- Peat in the full mixture



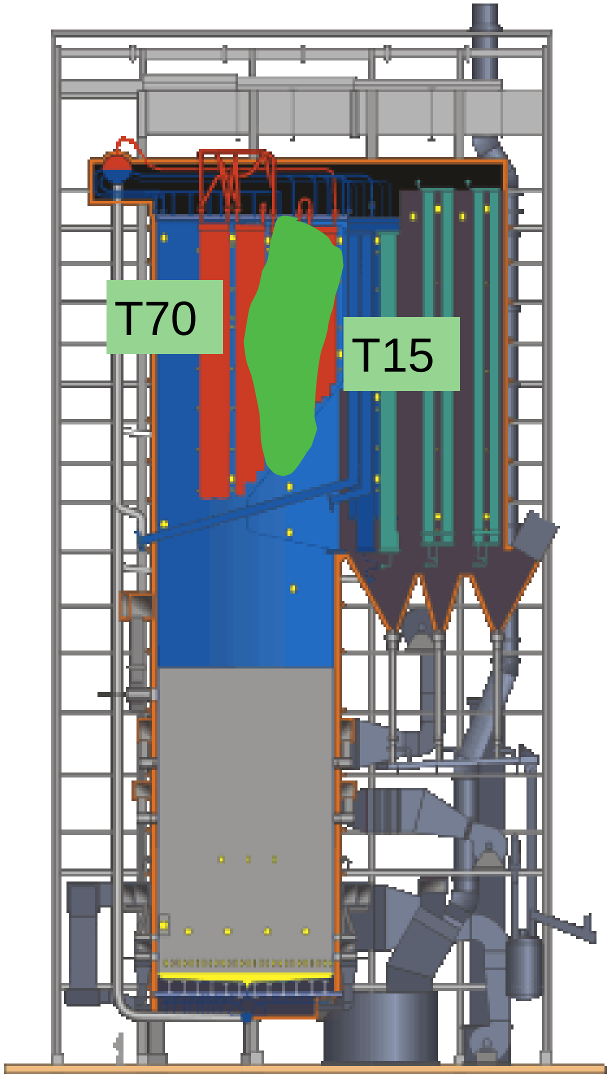
Spring:
- Partial load
- No peat in the full mixture

Alternative solutions:

- Changing part of the secondary superheater material
- Changing the fuel mixture composition
- Using an additive

Estimating the sticky area of recovery boiler ash

In our boiler designer tool with the help of ChemApp



- Calculating the melting temperatures based on ash composition
  - T15 to T70 (by melt weight percentage) is considered the sticky area
  - According to studies by Tran, Backman, Hupa, Reeve (1980s ->)
- Used for
  - Optimizing location of sticky area
  - Optimizing superheater arrangement
  - Making design changes to affect ash composition (e.g. ash treatment)
  - Predicting the effect of changes in boiler design or operation

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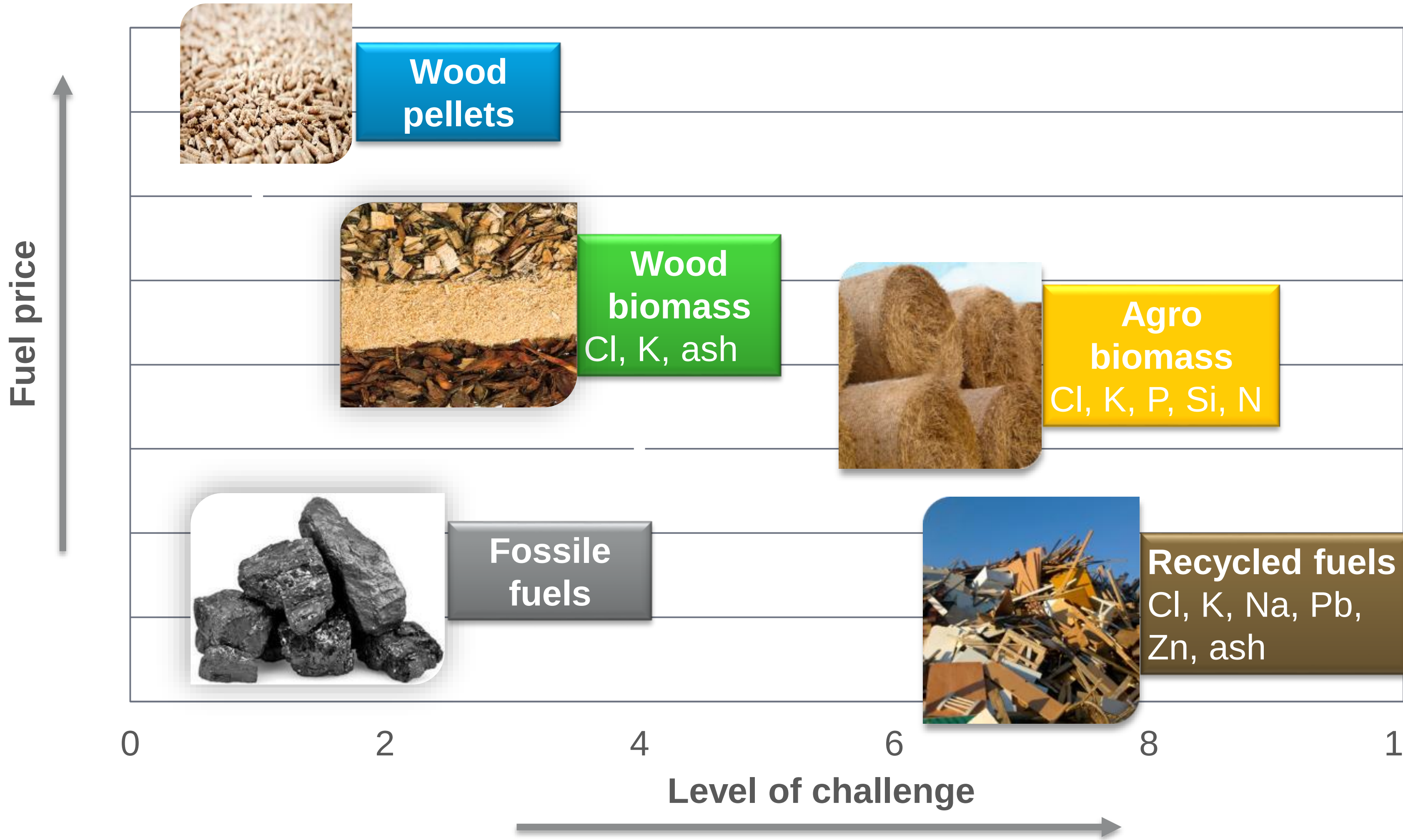
Why is chemical equilibrium modelling needed?

Increasing variety of fuel properties, increasing risk of corrosion



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