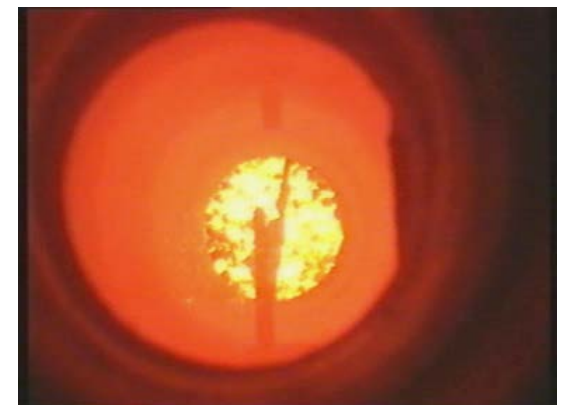
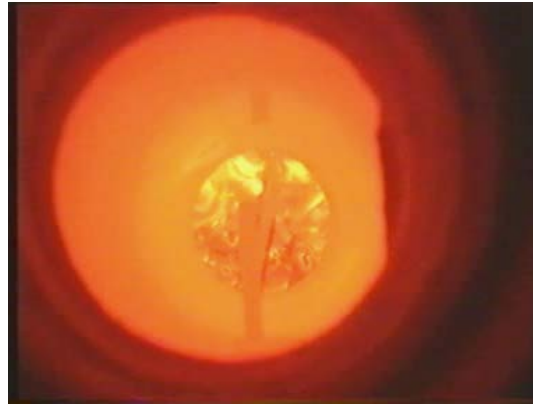


Grate firing NO_x – reduction by the means of oscillatory combustion

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Background

- Facilities for (solid) biomass combustion in Germany
 - ✓ < 1 MW – 13 000
 - ✓ 1-5 MW – 2000
- Heat output – 167 000 TJ → 15,7 Mio. t. saving of CO₂/equiv.
- Biomass incineration → emissions of **NO_x**, CO, fine dust – harmful
- NO_x – emissions ~ 40 000 t/y = 400 000 t/y CO₂/equiv.
- NO_x – why harmful ?
 - ✓ NO₂ – strong oxidizer → irritation of human respiratory system and eyes
 - ✓ precursors for ground level ozone and secondary fine dust
 - ✓ act over-fertilizing → direct harm to soil and vegetation

Sources:

[1] <https://mediathek.fnr.de/grafiken/daten-und-fakten/bioenergie/fest-biobrennstoffe/waermebereitstellung-aus-erneuerbaren-energien.html>

[2] Johannes Kröner: Holzaschezertifizierungskonzept für kleine und mittlere Heizwerke, Masterthesis Universität Hohenheim, Institut für Kulturpflanzenwissenschaften, 2015, Hohenheim

[3] Fachverband Holzenergie in BBE: Gemeinsame Stellungnahme zum vorliegenden Entwurf des BMUB vom 29. Mai 2015 zur Novellierung der Ersten Allgemeinen Verwaltungsvorschrift zum Bundes-Immissionsschutzgesetz

[4] Lammel G, et al. Environ Sci Pollut Res Int. 1995. Max-Planck-Institut für Meteorologie, Bundesstraße 55, D-20146, Hamburg, Germany, Environ Sci Pollut Res Int. 1995 Jul;2(1):40-5. doi: 10.1007/BF02987512

[5] http://www.muellerbbm.de/fileadmin/user_upload/gmbh/Veroeffentlichungen/2010/01-13-02.pdf

[6] <https://www.umweltbundesamt.de/service/uba-fragen/warum-sind-stickstoffoxide-schaedlich>

Measures for NO_x - reduction

Primary measures

→ Intervention in the combustion process

Air / fuel staging

- fuel partly oxidized (i. e. gasification) in numerous steps
- secondary zone full combustion
- time staging, can be combined with local staging

Flue gas recirculation

- O₂-concentration drop → lower T°C (by thermal NO)

Residence time reduction at higher temperatures

Quenching

- H₂O-injection for T°C-reduction (motor engineering)

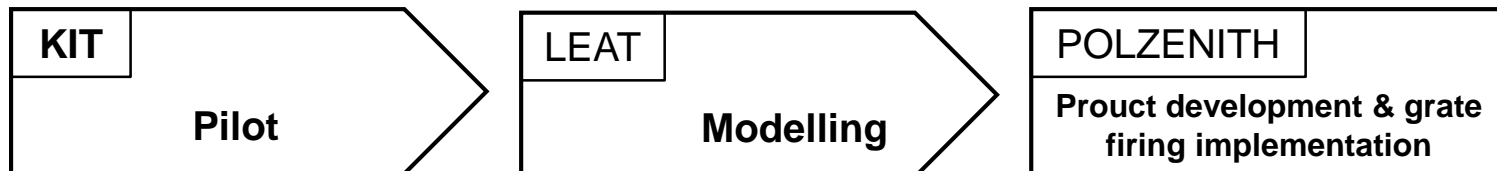
Secondary measures

→ Reduction of formed NO

Non-catalytic (SNCR)

Catalytic (SCR)

- Project partners ITC /KIT, LEAT / Ruhr-University Bochum, company POLZENITH
- Application of furniture residues (fixing plates, biomass) as a fuel in firing systems up to 20 MW
- Implementation of air / fuel staging (primary measure) into grate firing → lower investment costs due to the avoidance of secondary measures (50% drop of NO_x costs)
- NO_x reduction in accordance with the new TA Luft limits
- Increased competitiveness on the European market of the industrial partner (POLZENITH) and long-term business opportunities



Offer: Experimental work at pilot fixed bed reactor @ KIT

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*https://www.itc.kit.edu/downloads/BioOszi_Steckbrief_en_01022019.pdf