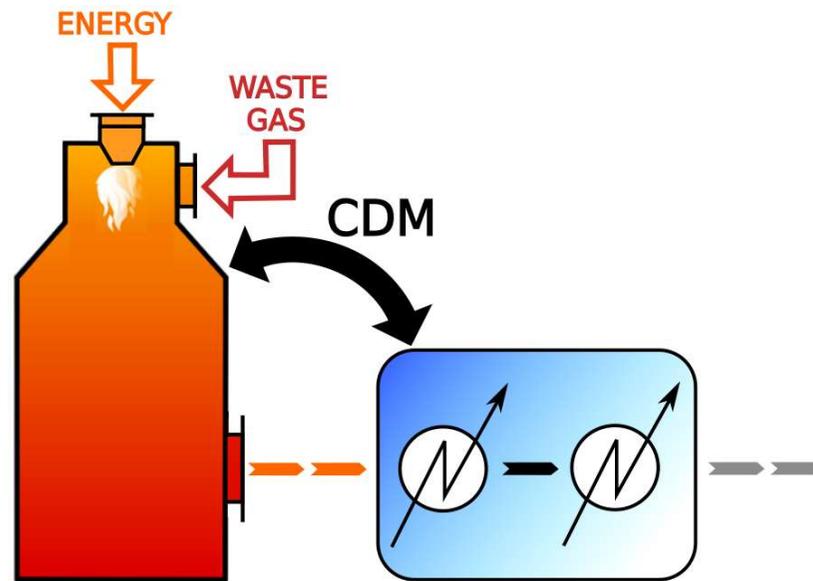**Dr. Zdeněk Jegla**
Associate professor
Institute of Process Engineering
BUT, Czech Republic

Vít Freisleben
Process engineer and Researcher
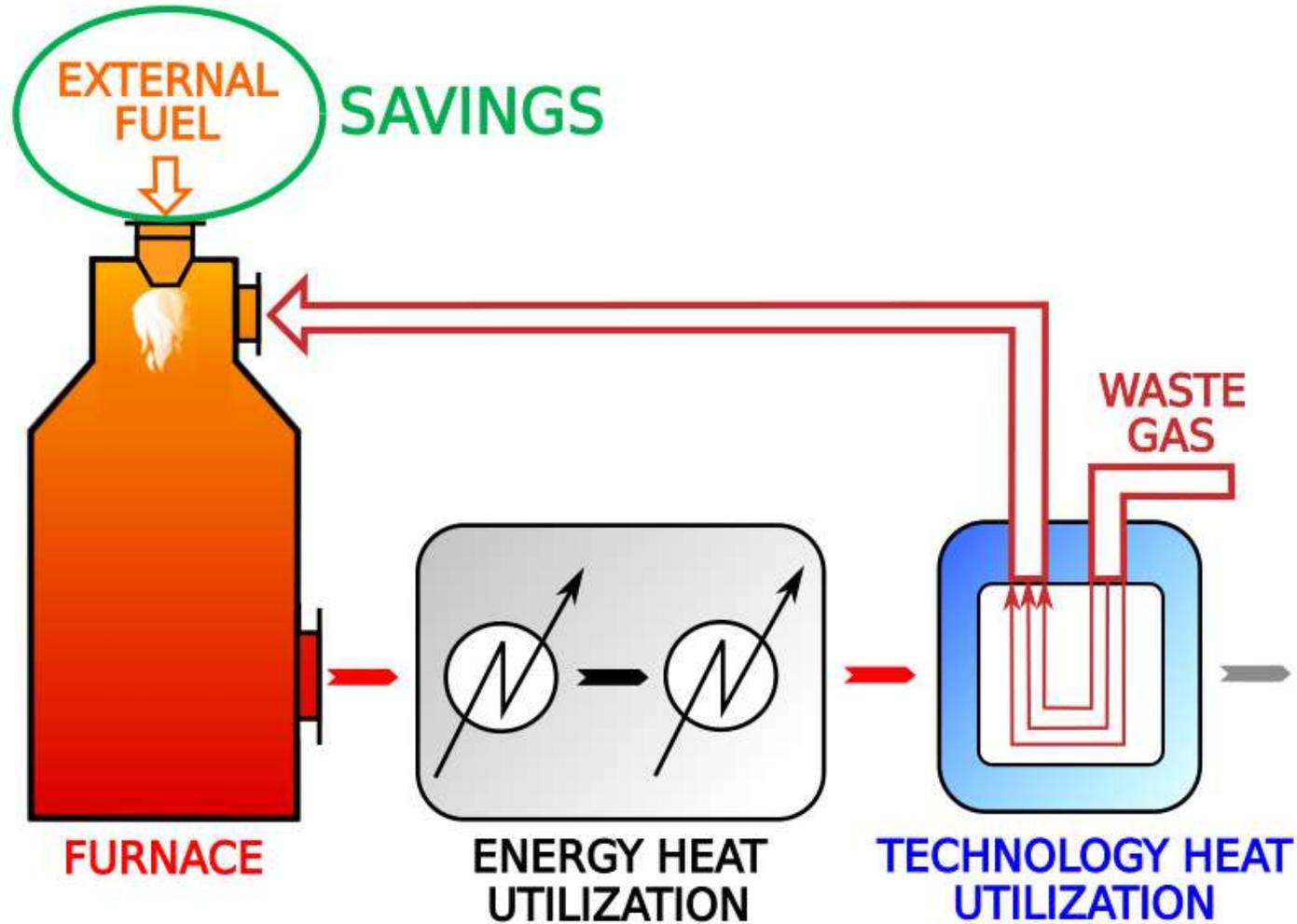EVECO Brno, Czech Republic

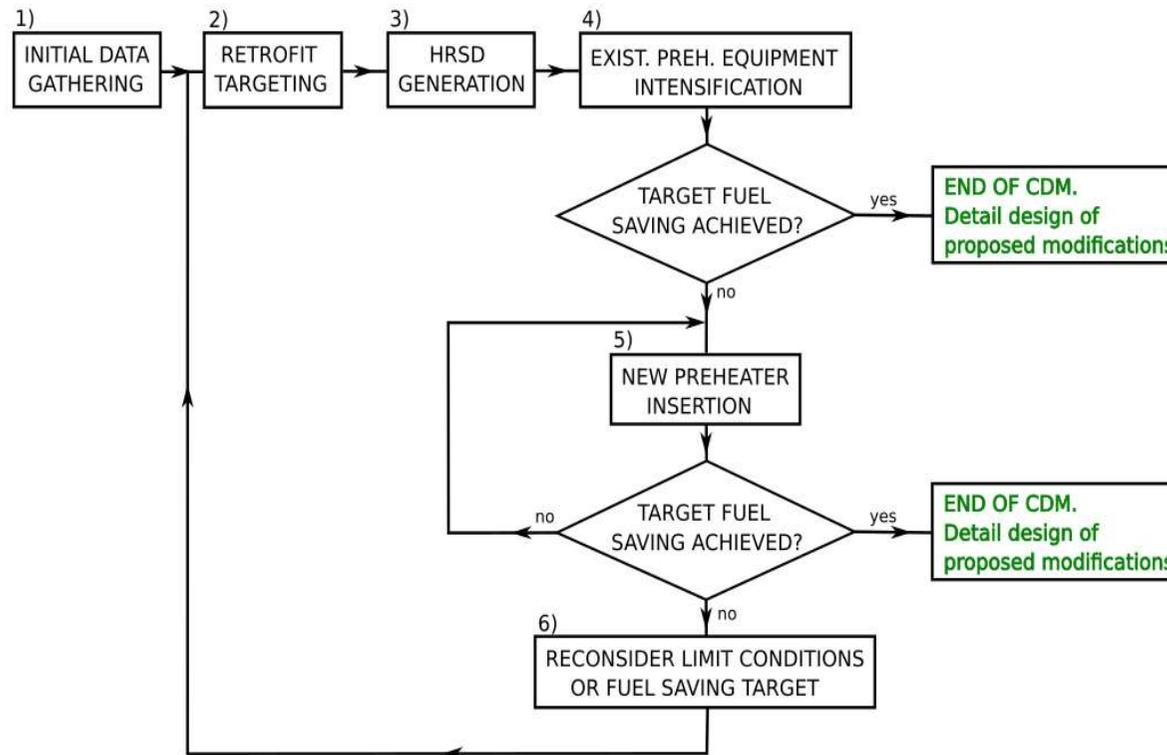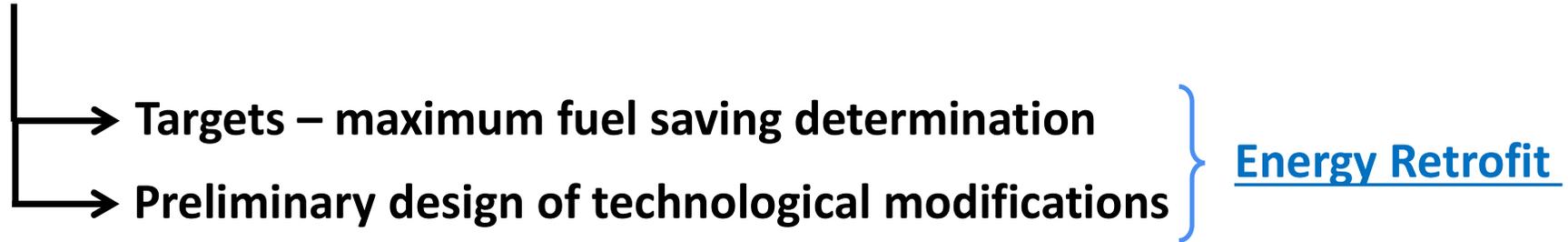# Retrofit of Integrated Waste Gas-to-Energy Units by Conceptual Design Method

WASTE GAS
(VOCs, O$_2$, INNERTS)

Integrated Waste Gas-to-Energy unit

EXTERNAL FUEL

SAVINGS

WASTE GAS

FURNACE

ENERGY HEAT UTILIZATION

TECHNOLOGY HEAT UTILIZATION

CDM – Method for Energy Retrofit of WGtE units

Targets – maximum fuel saving determination

Preliminary design of technological modifications

Energy Retrofit

CDM → 1) Initial data gathering
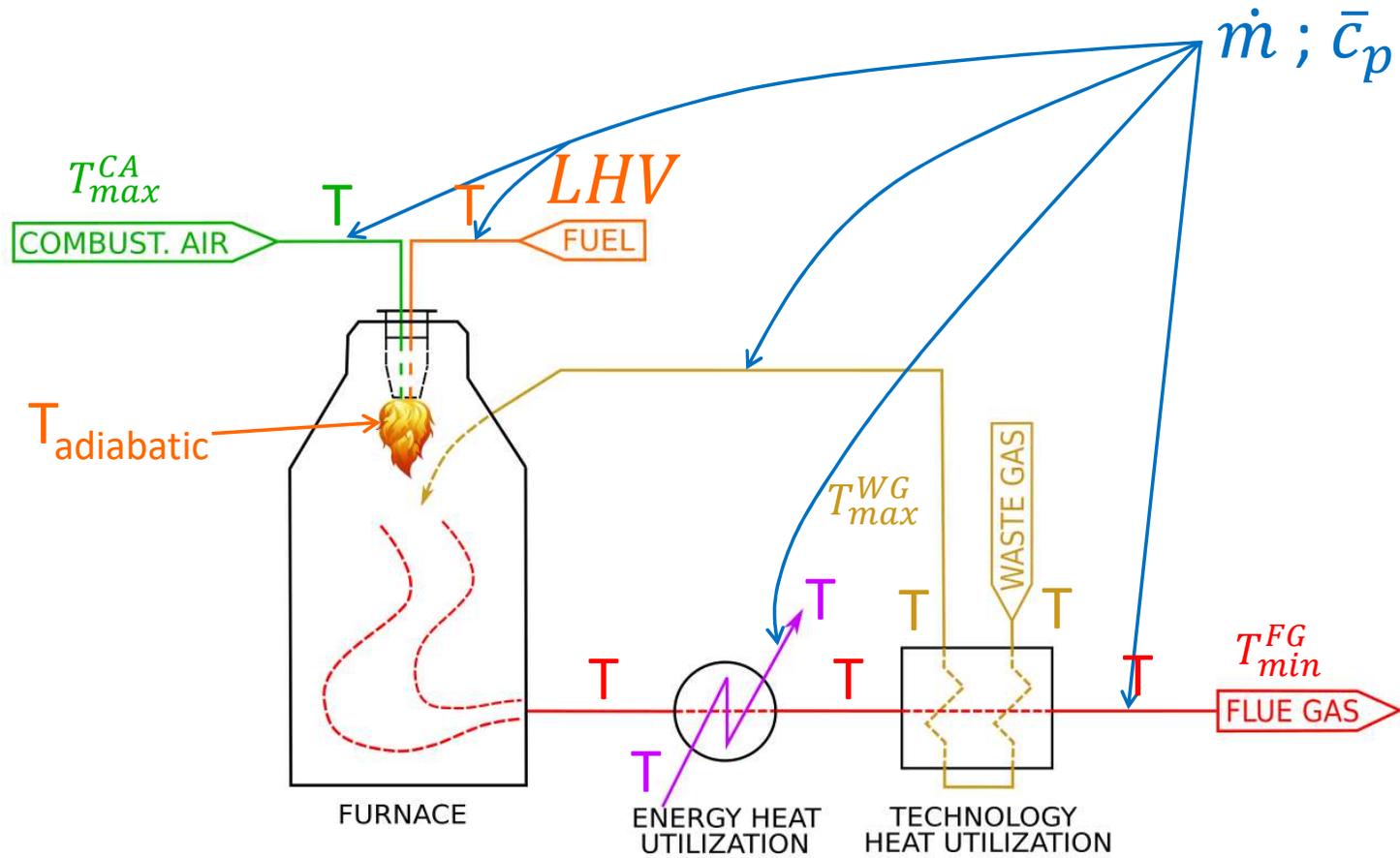
CDM → 2) Retrofit targeting

Maximum flue gas heat utilization

(FG outlet temperature = T_{min}^{FG})

$$\Delta \dot{f}_s^{\dot{Q}_{loss}} = \frac{\dot{Q}_{loss}^{FG}}{FHV_{CC} + (T_{CC}^{FG} - T_{min}^{FG}) \cdot \bar{c}_p^{FG} \cdot (K+1)}$$

Maximum technology heat utilization
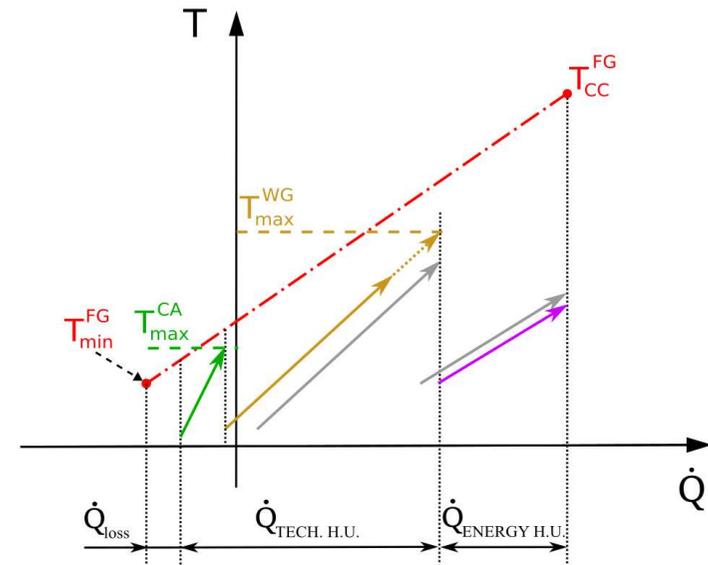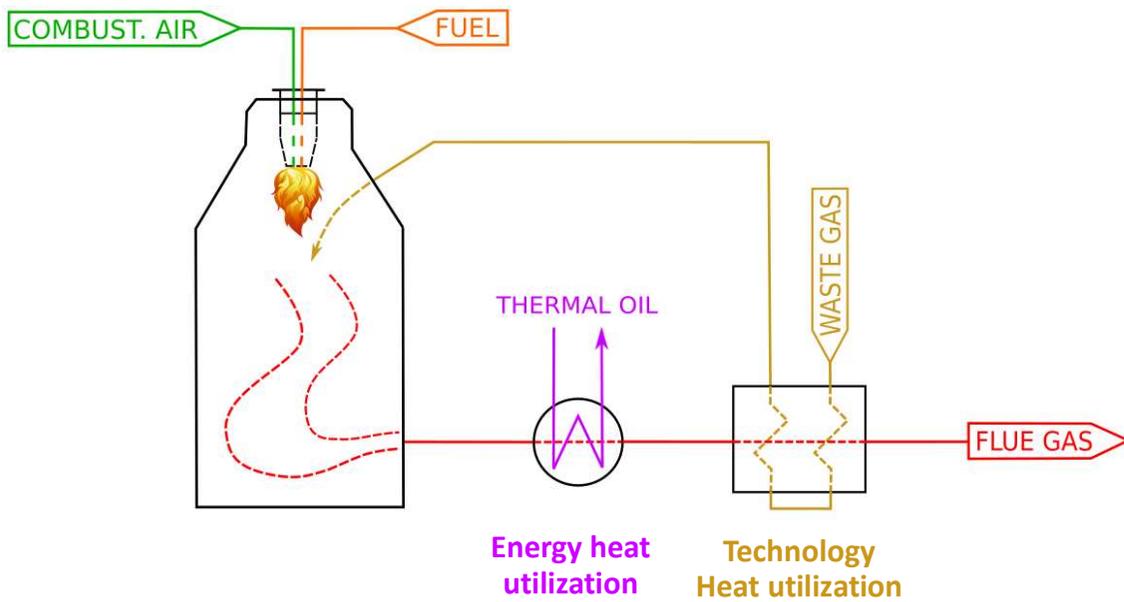
(WG and CA temperatures = T_{max}^{CA} ; T_{max}^{WG})

$$\Delta \dot{f}_s^{Tmax} = \frac{\Delta \dot{Q}_{prh}^{WG} + \dot{m}_{ExUn}^{FG} \cdot \theta}{FHV_{CC} + \theta}$$

$$\Delta \dot{Q}_{prh}^{WG} = \sum_i \left(\dot{m}^{WG,i} \cdot \bar{c}_{p,i}^{WG,i} \cdot \left(T_{max}^{WG,i} - T_{out}^{WG,i} \right) \right)$$

$$\theta = K \cdot \bar{c}_p^{CA} \cdot (T_{max}^{CA} - T_{out}^{CA})$$

$$\Delta \dot{f}_s^{target} = min \left\{ \Delta \dot{f}_s^{\dot{Q}_{loss}} ; \Delta \dot{f}_s^{Tmax} \right\}$$
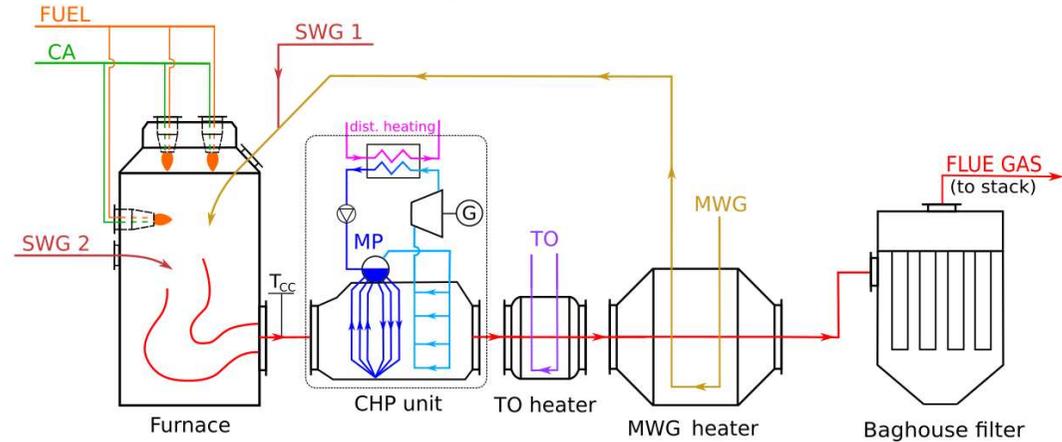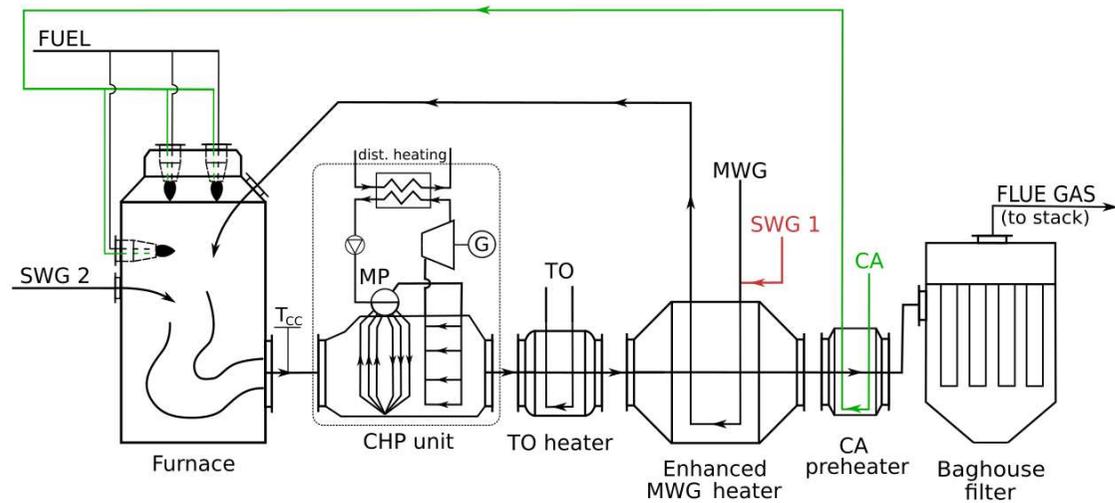
CDM → Is the target achieved?

Case study 1

Existing WGtE unit

Deviation with results of non-linear simulation:

2,5%

Energy Retrofit by CDM

Case study 2

CHEMCAD 7

HTRI Xchanger Suite 7

Deviation with results of non-linear simulation:

5,1%

Existing WGtE unit

FUEL — COMBUSTION AIR

Waste Gas — FLUE GAS

WG heater
Combustion chamber
FG turnover chamber
WG turnover chamber

Energy Retrofit by CDM

FUEL — New CA preheater

WG — FLUE GAS

COMBUSTION AIR

New WG heater
Modified WG turnover chamber
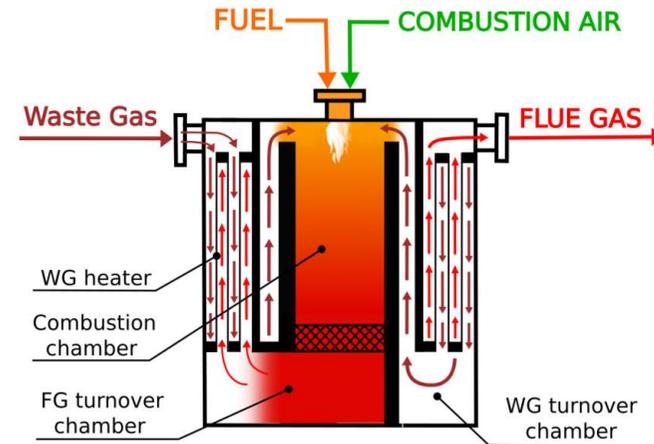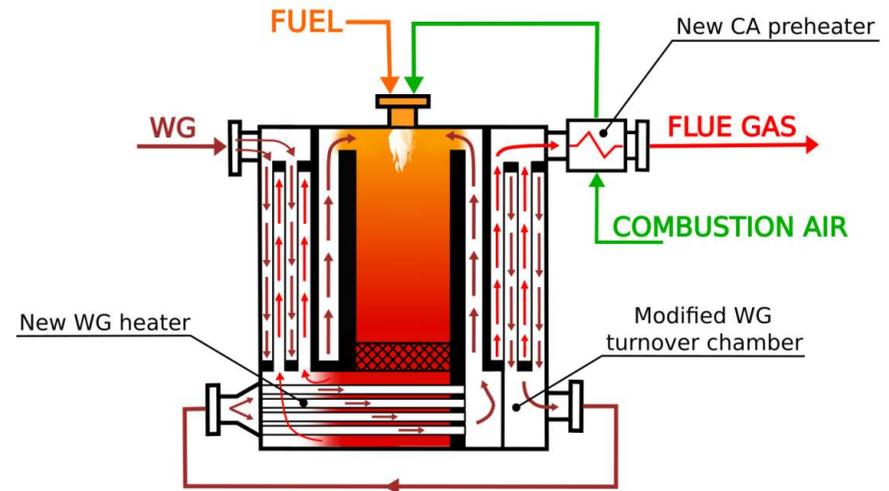
Grateful acknowledgments

Thank You!