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NATIONAL OPEN ACCESS SCIENTIFIC CENTRE FOR FUTURE ENERGY TECHNOLOGIES

OPEN R & D LITHUANIA

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Effect of Ozone on Combustion Performance of BioMethane (SNG) and Low Calorific Gas

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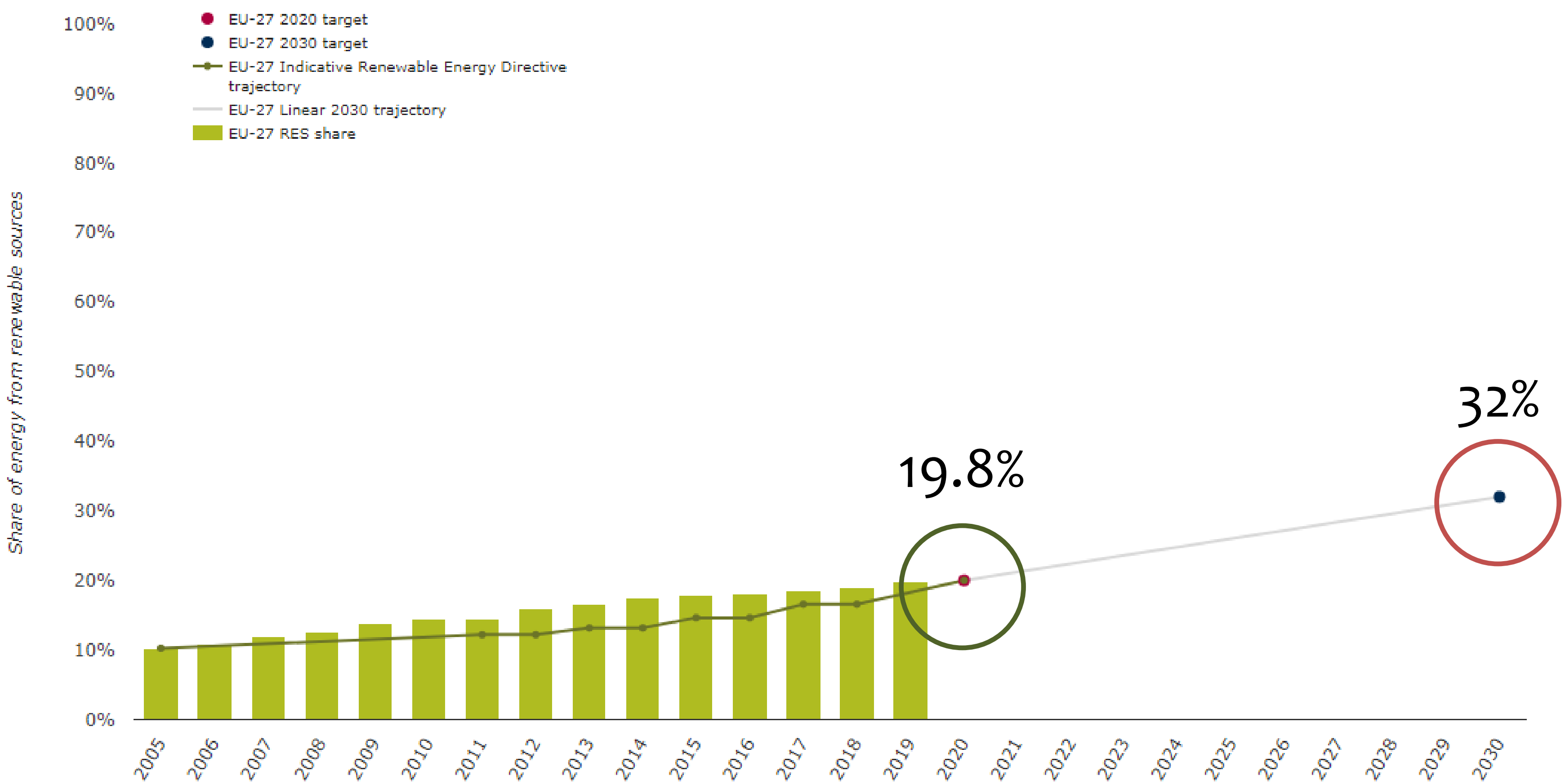
RES targets since 2005



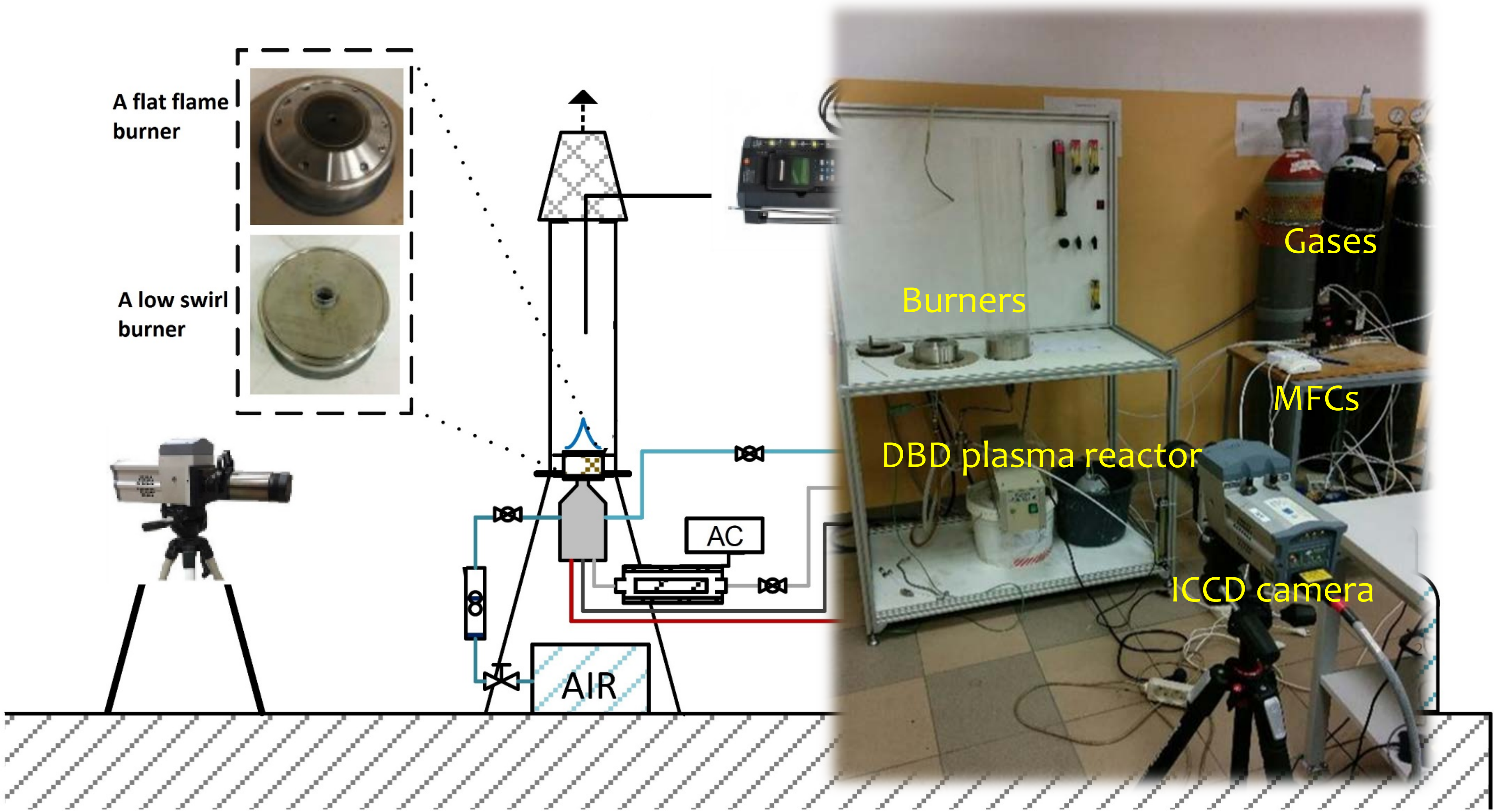
Share of renewable energy in gross final energy consumption [t2020_31] provided by **Statistical Office of the European Union (Eurostat)**

Biomethane (SNG) production via thermochemical processes

- Thermal conversion of waste or low quality biomass to syngas.

- Syngas conversion to SNG via methanation process.

The combustion setup



Flame analysis system

- The **ICCD camera Andor iStar 734** has a sensor with 1024x1024 pixels sensitive to 200-800 nm wavelength;
- The resolution achieved was 6.6 pixel: 1 mm;
- The exposure time **0.4 s, 300 frames** were accumulated into **a single frame.**

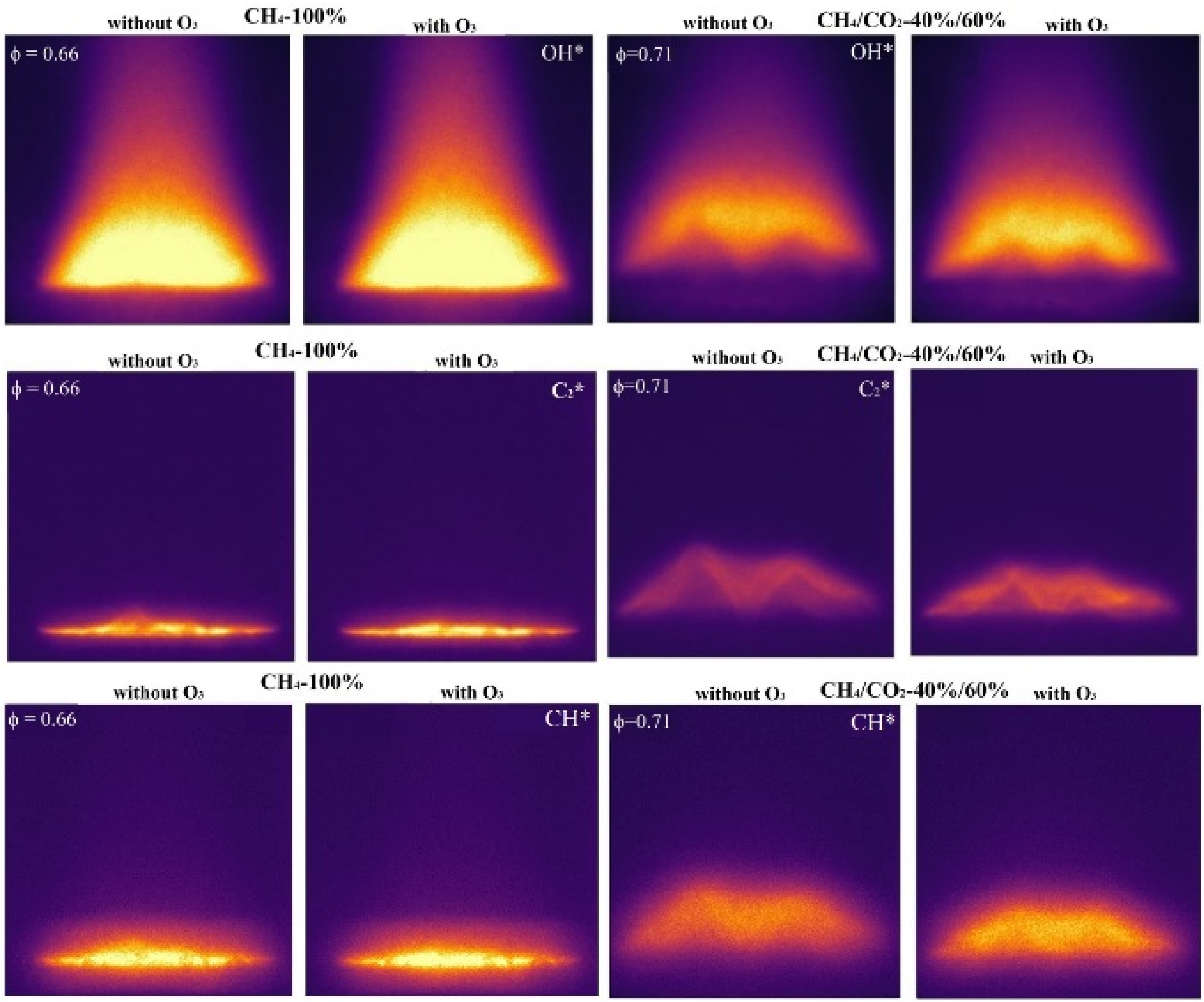
- Optical filters:
- **CH*** (431.1 nm, >95%);
- **C_2*** (514 nm,>65%);
- **OH*** (282.9 nm, >65%);

Flame images of CH_4 100-40 vol%

OH*

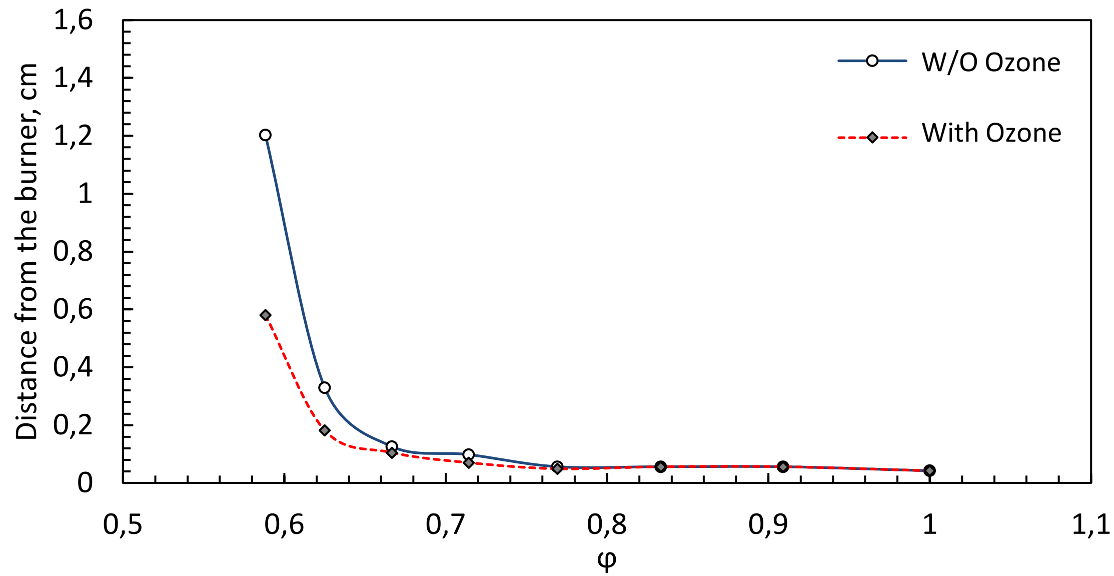
C$_2$*

CH*

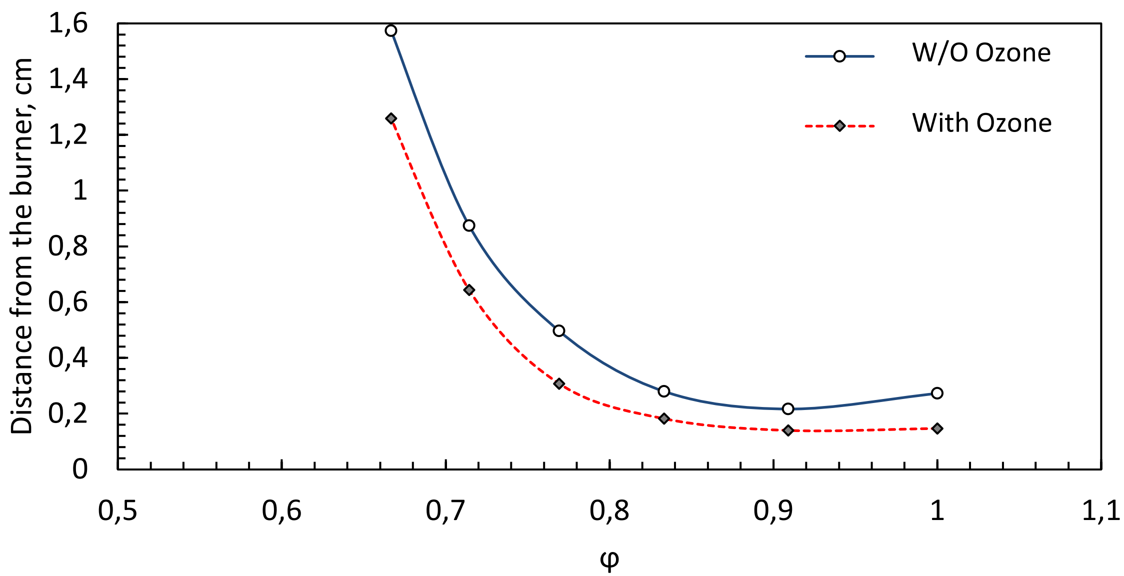


OH* intensity distribution per height

Methane (SNG)
CH_4 – 100%



LCV gas
40% CH_4 in CO_2



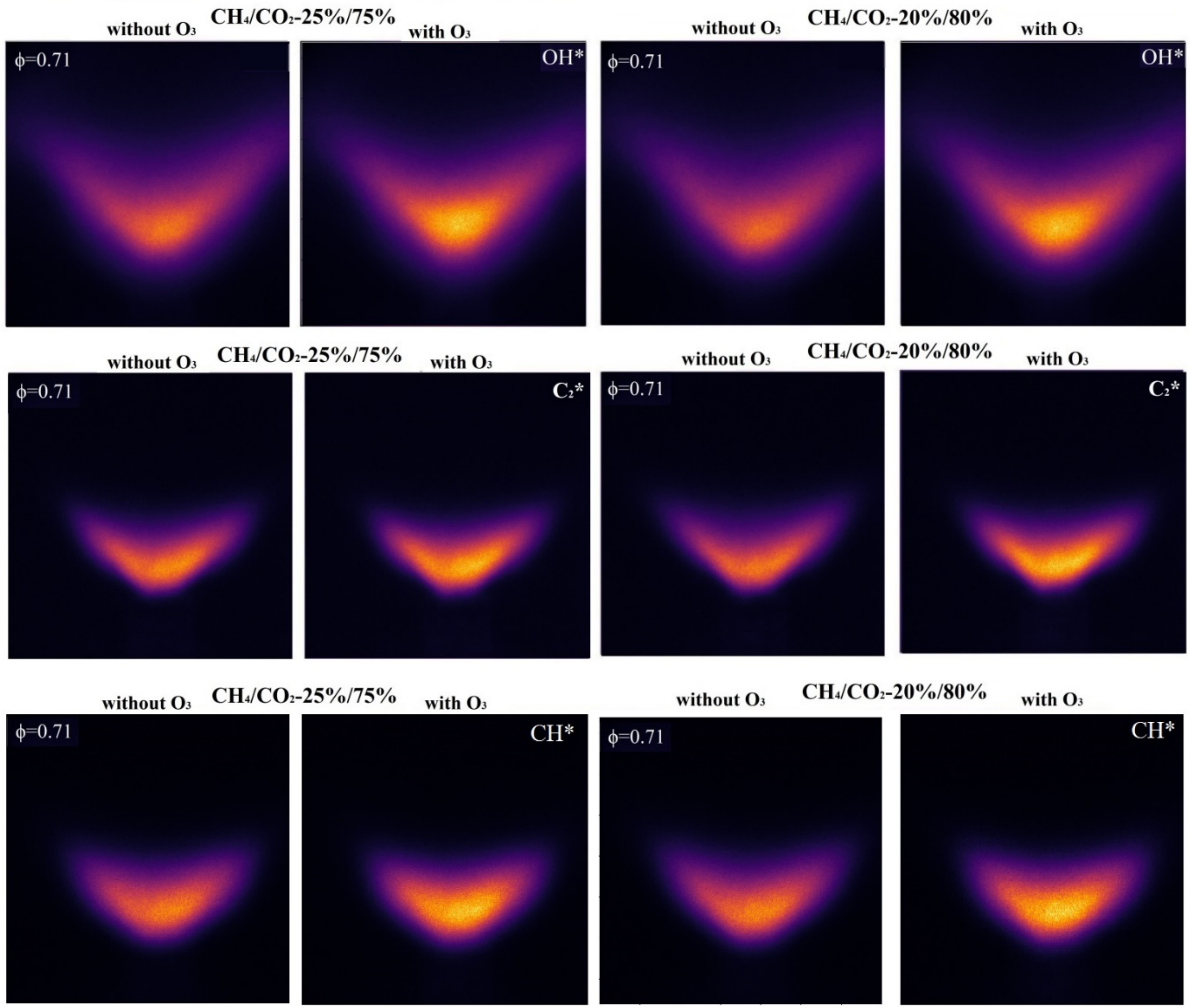
ϕ ϕ

Flame images of CH_4 25-20 vol%

OH*

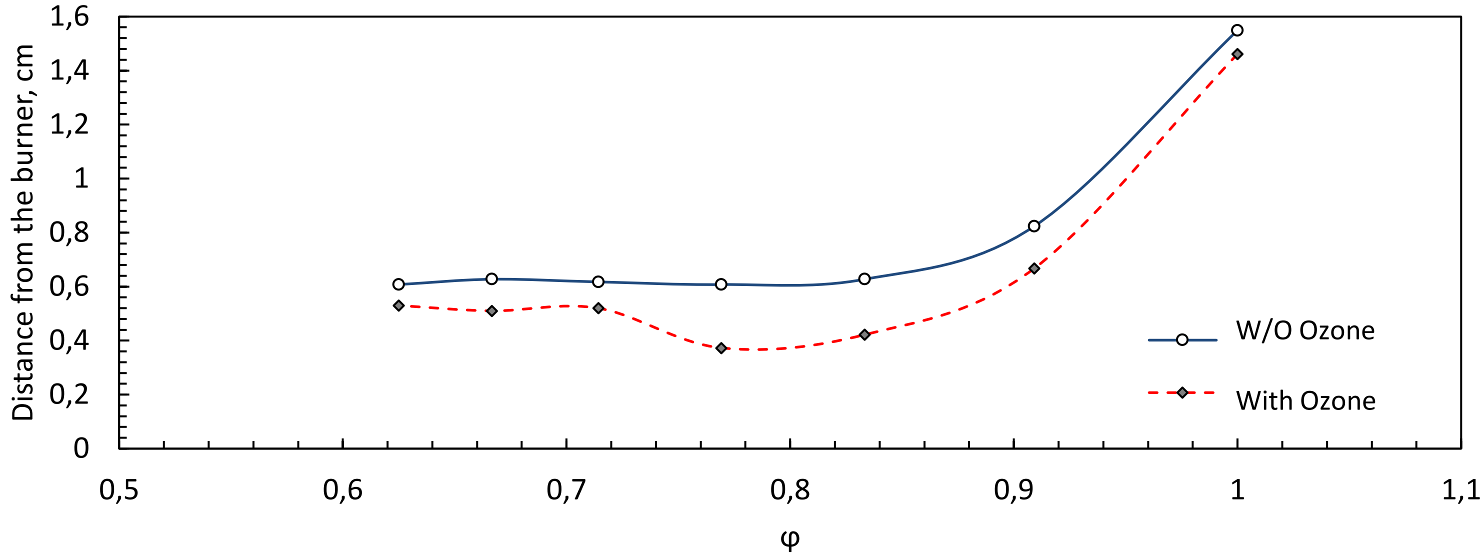
C_2*

CH*

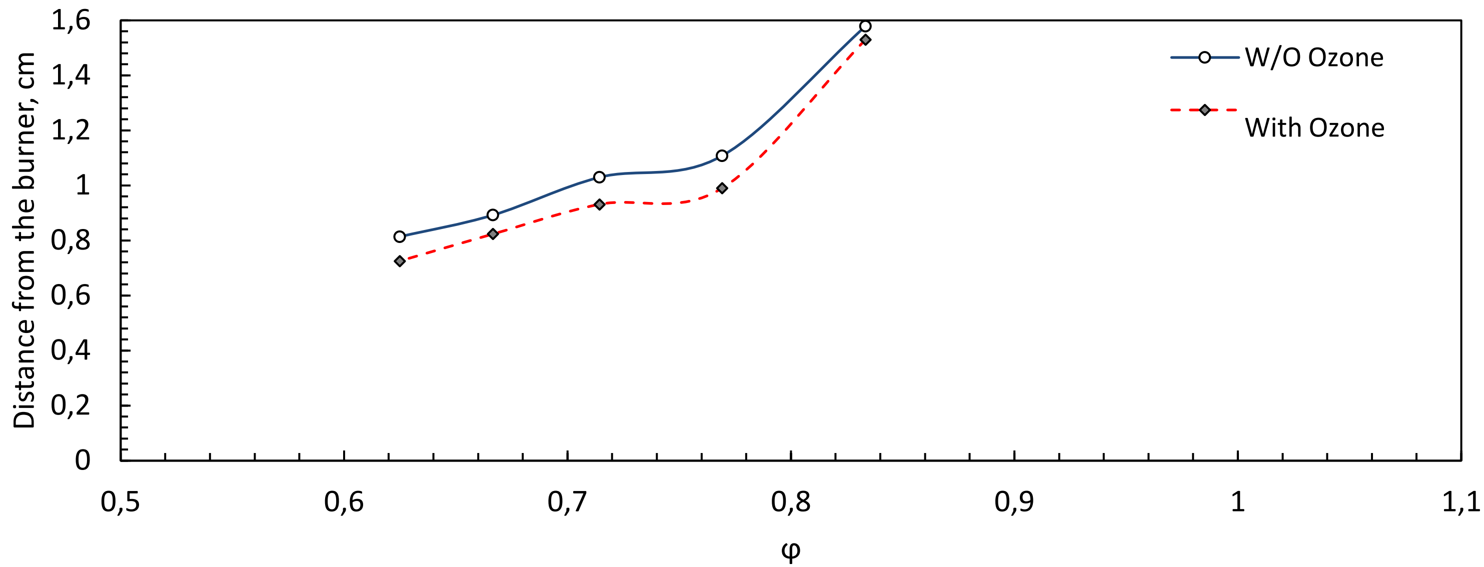


OH* intensity distribution per height

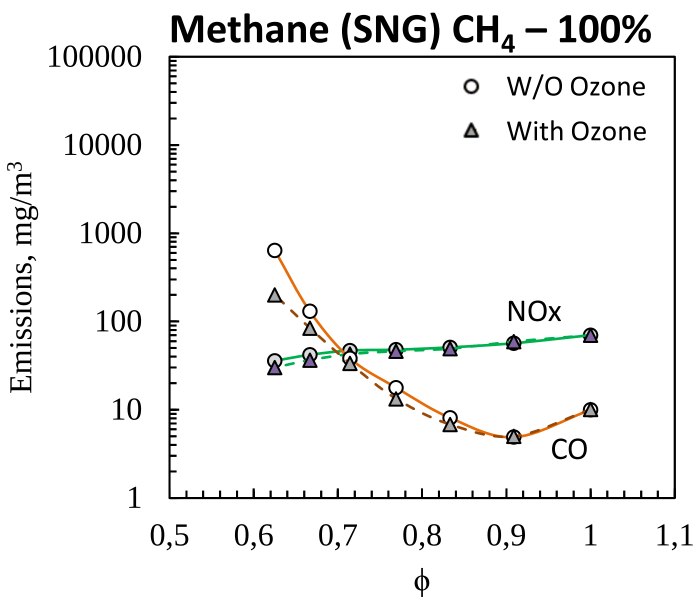
LCV gas
25% CH_4 in CO_2

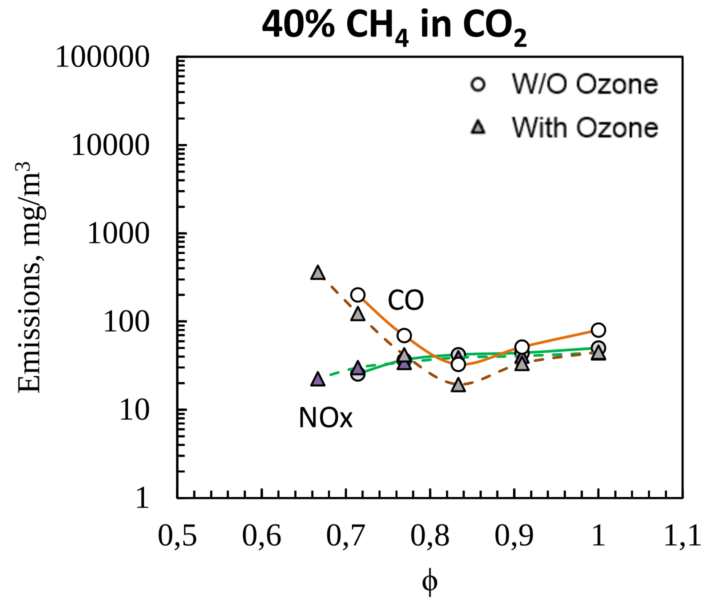


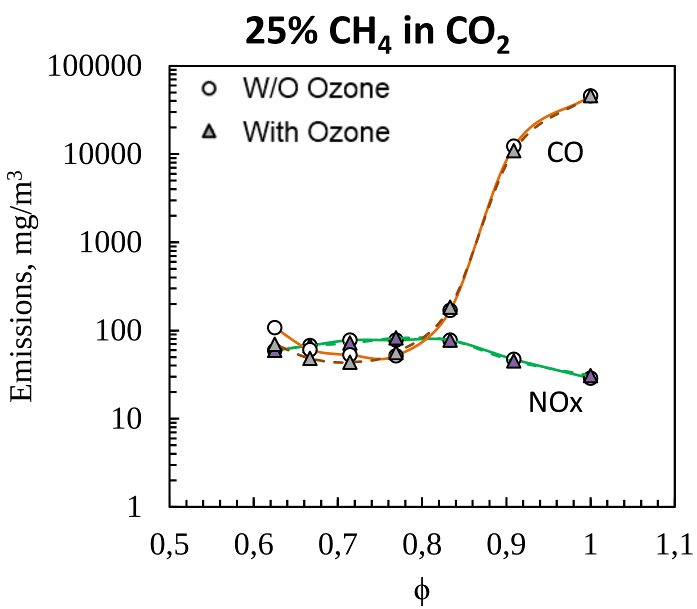
LCV gas
20% CH_4 in CO_2

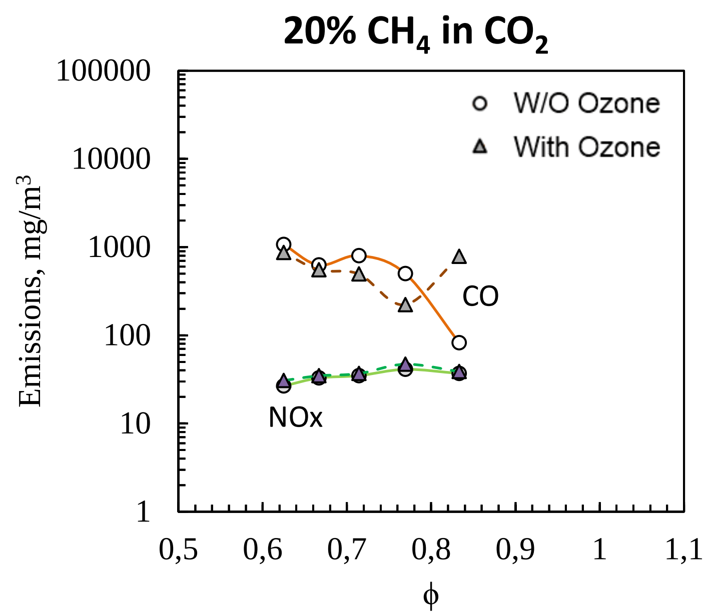


CO and NOx emissions









Conclusions

- An addition of O_3 reduced the flame lift-off by 20-40% and by 40-70% in the case of SNG and in the case of LCV gases, respectively.
- The ozone effect was weaker on LCV gases with CH_4 concentration of 20-25 vol% supplying oxygen-enriched air and the flame lift-off was reduced only from 33% to 9%.
- The ozone enrichment of SNG combustion reduced NOx and CO emissions by 2-7 mg/m^3 and by 200-4 mg/m^3 increasing Φ from 0.625 to 0.833, respectively, but NOx concentrations increased by 2 mg/m^3 at higher φ values.
- The highest effect on CO decrease was observed during ozone assisted combustion of CH_4-20%/CO_2-80% mixture. CO emissions decreased by 70-300 mg/m^3.

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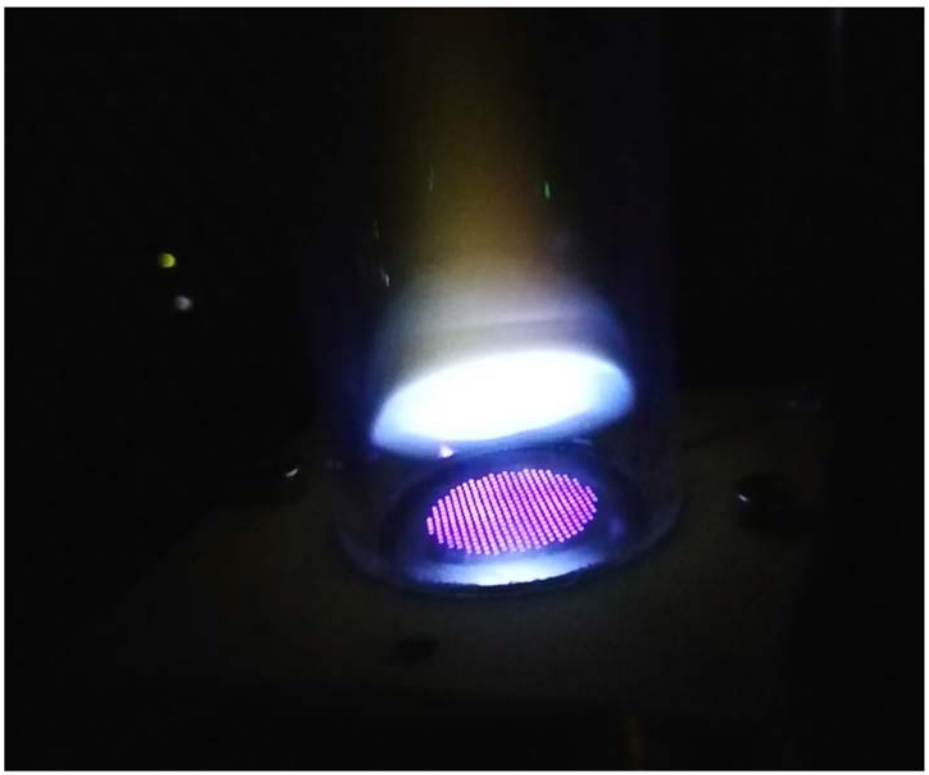
Thank you for the attention



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