COAL IN SUSTAINABLE DEVELOPMENT

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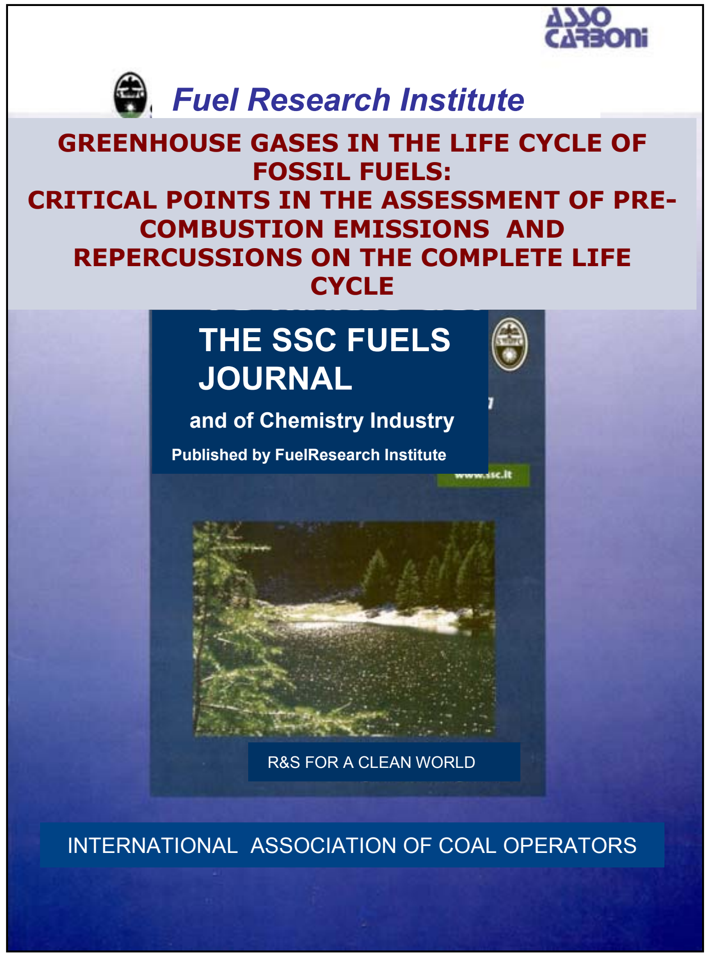
Gas vs Coal
LIFE CYCLE ASSESSMENT
S.S.C. - Fuels Research Institute



Greenhouse gases in the life cycle of fossil fuels:

Critical points in the assessment of pre-combustion emissions and repercussions on the complete life cycles

A previous study on the life cycle of fossil fuels in the production of thermoelectric energy detected the main weaknesses of coal, oil and gas during combustion.

Attention is now paid to the **pre-combustion of natural gas and coal**.

Results show the amount of pre-combustion greenhouse gas emissions, their repercussion on the complete life cycle and the high uncertainty of assessment mainly due to the site-specificity of sources of emissions during pre-combustion and the methodology followed.

In the light of environmental and economic implications of Kyoto agreements (and those of the global market of permits of greenhouse gas emissions), a careful calculation of emissions requires the adoption of standardised procedures and guidelines.

Assessment of emissions in the two phases of the life cycle

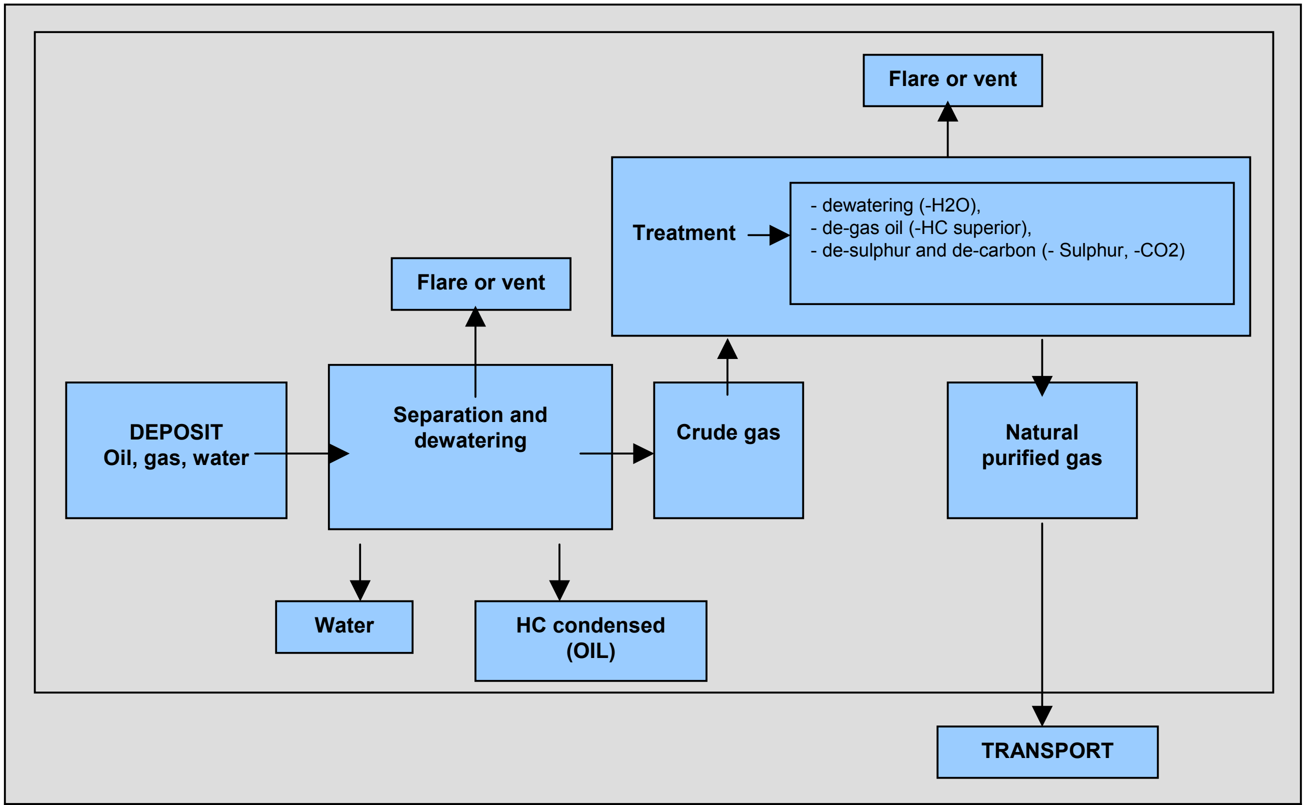


Figure 1: Production and processing of natural gas

Distribution of European greenhouse emissions in energy sub-sectors

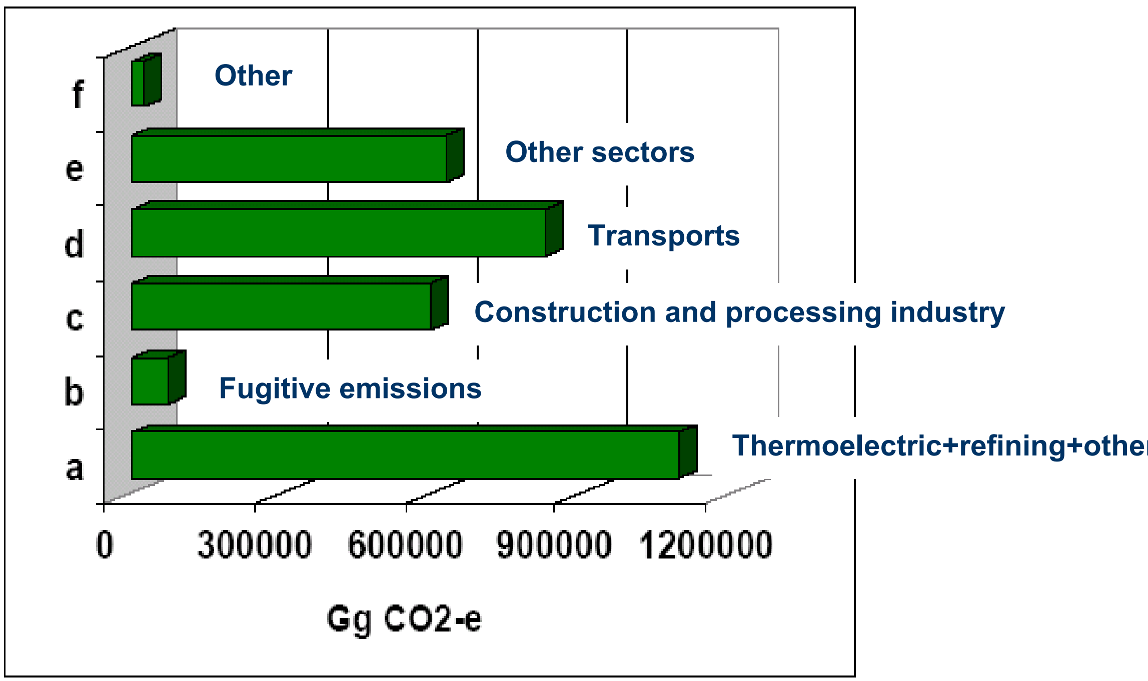


Figure 3

Comparison between results obtained by applying different protocols in the assessment of CO_2 and CH_4 emissions from onshore oil and gas wells

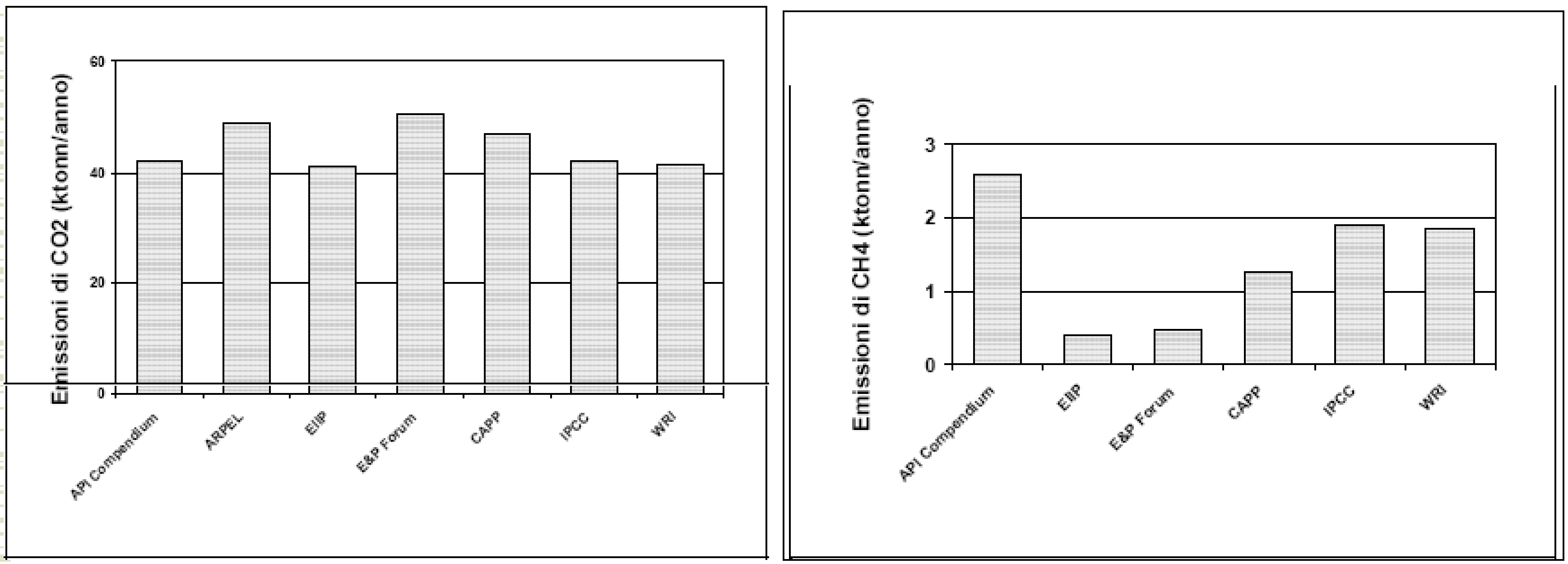
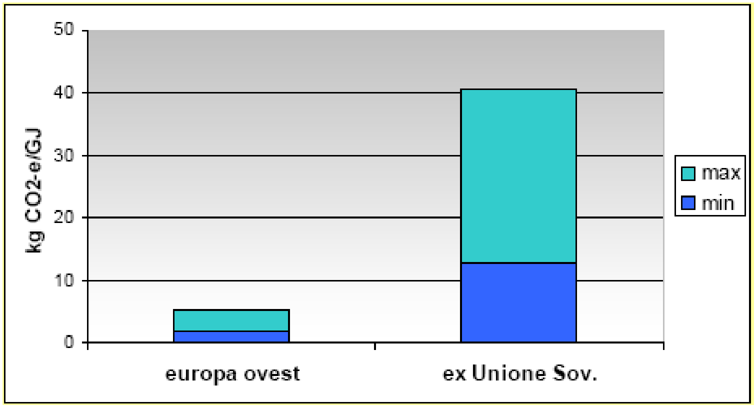


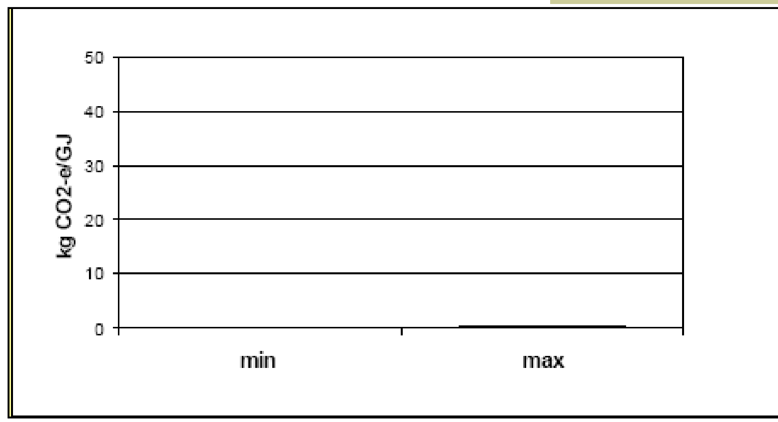
Figure 4

Protocols used for assessment

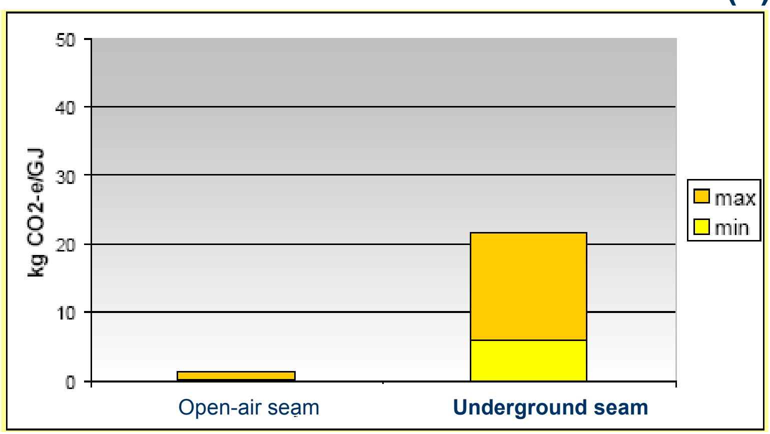
Range of methane emissions in pre-combustion



(a) natural gas



(b) oil

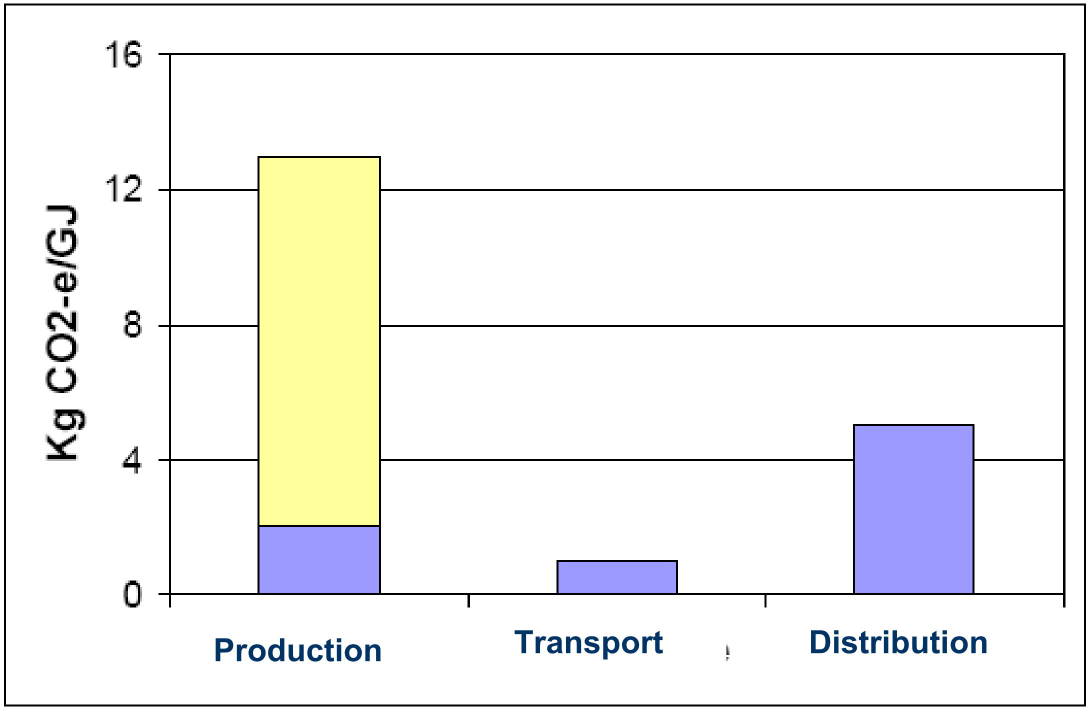


(c) coal

Figure 6

Data are calculated according IPCC factors (reference approach)

Greenhouse emissions in pre-combustion of Australian natural gas



The range of production segment mirrors the minimum and maximum CO2 content of the gas in the deposit (from Ref.29)

Figure 7

Greenhouse emissions in pre-combustion of natural gas produced in different countries and characterised by different percentages of CO_2 in the gas in deposit

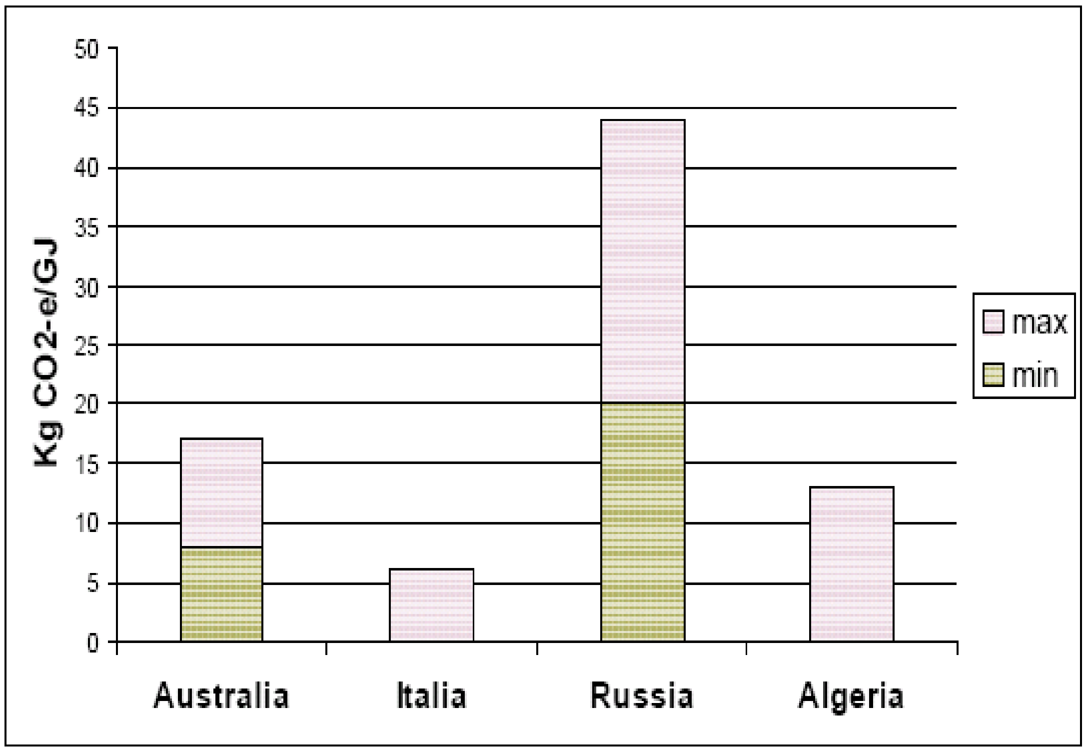


Figure 8

Pre-combustion greenhouse emissions per energy unit of mined coal

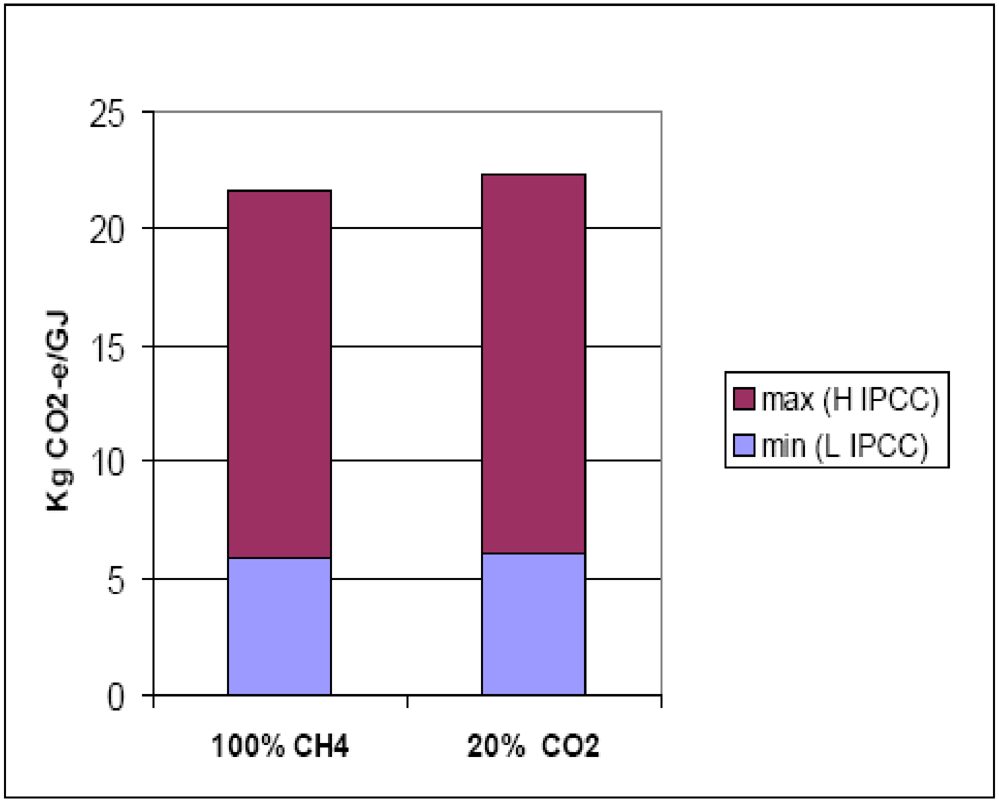
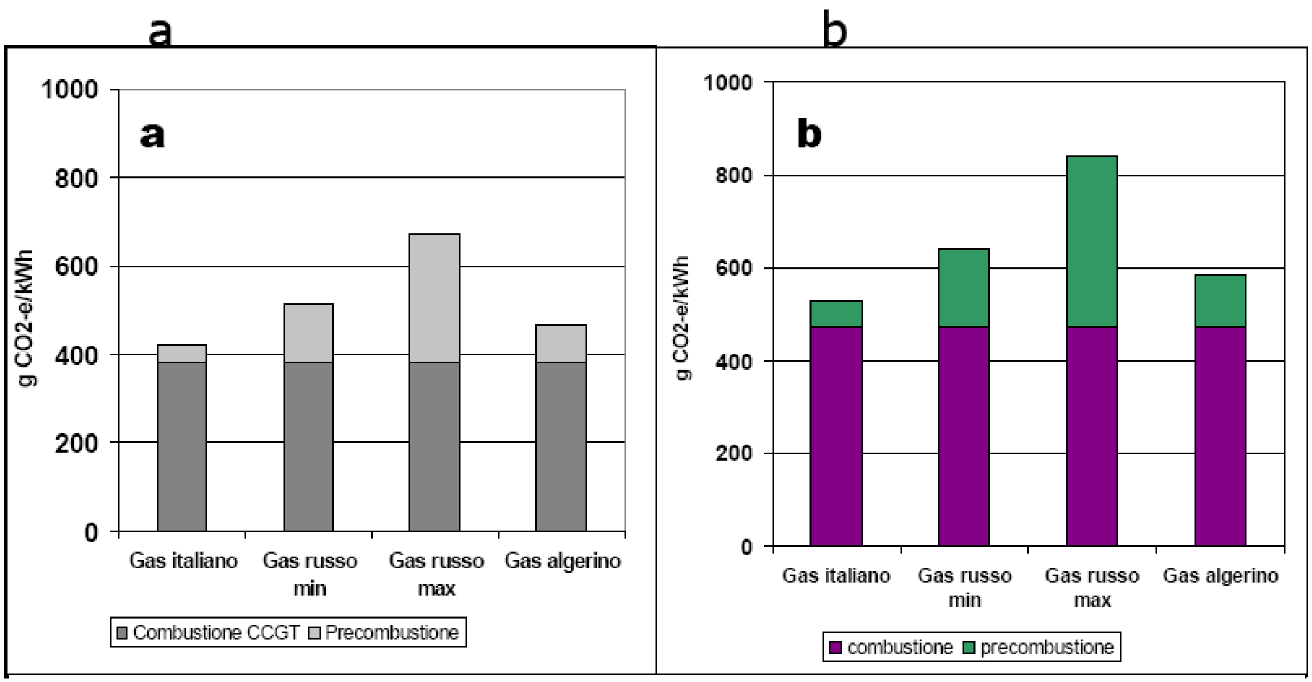


Figure 9

Range of greenhouse emissions in pre-combustion of coal mined from underground seam according to different percentages of CO_2 of the gas in deposit

Life cycle of national and imported natural gas and greenhouse emissions in thermoelectric production

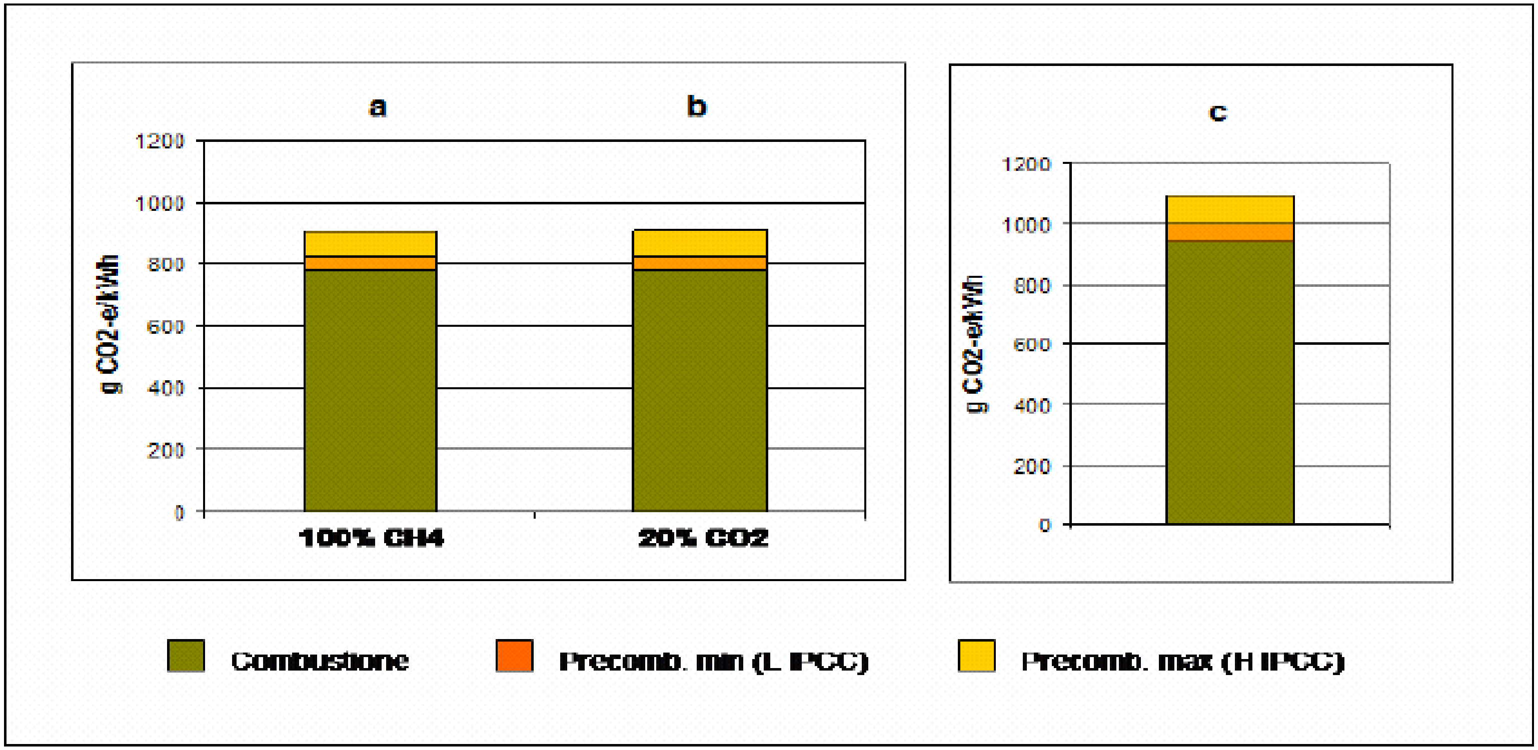
Figure 10



(a) NGCC plant, yield 54%

(b) average of gas-fuelled plants in Italy 1999, yield 43%

Greenhouse emissions in the life cycle of coal mined from underground seam and used to produce thermoelectric energy



(a) and (b): USC plant (yield 44%) for the two cases in the previous slide

(c) average for coal plants in Italy in 1999 (yield 36%)

Figure 11

Potential variability range of greenhouse emissions in the life cycles of natural gas and coal

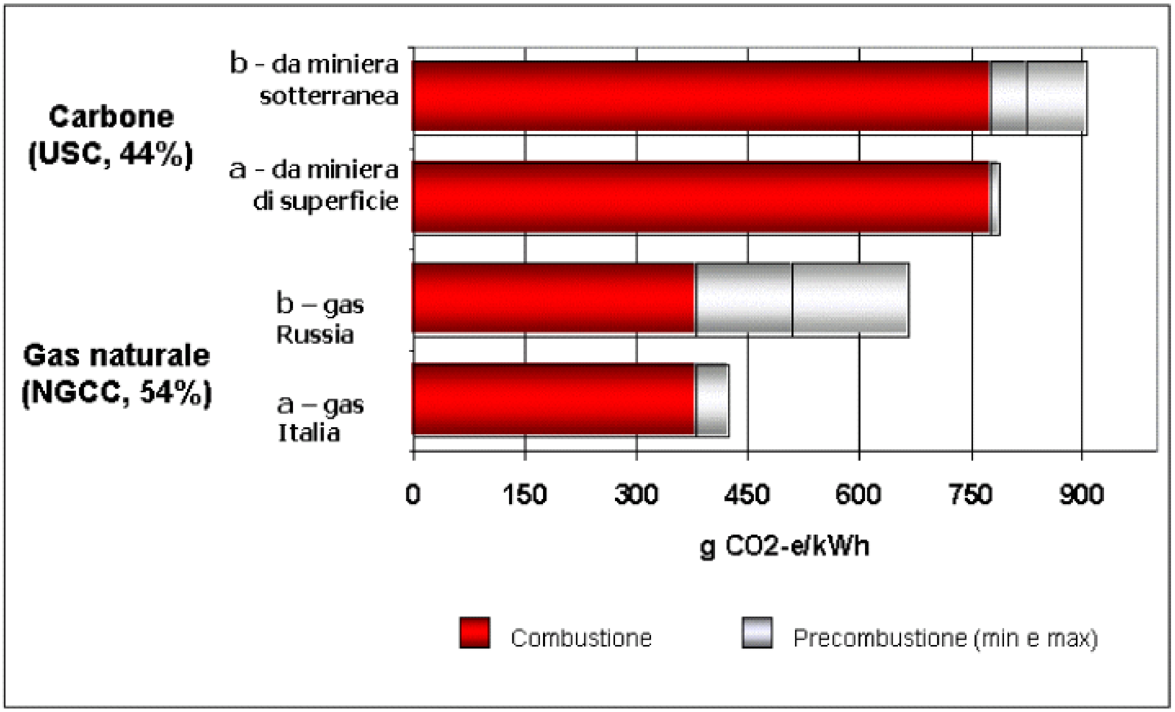


Figure 12

a) gas produced and used in Italy
b) borderline case of imported Russian gas

Conclusions

- Pre-combustion greenhouse emissions (mainly made by CH_4 and CO_2) can be a significative amount of emissions in a complete life cycle. Sources and size of these emissions, especially in extraction/production phases, are greatly site-specific: in fact, they depend on the specific processing and treatment chosen for that wells/deposit and on the different practices used (flaring and venting), the efficiency of reduction/control systems, the infrastructures, the specific composition of sour gas (CO_2/CH_4) present in the seam, as well as the procedures used to calculate them.

- The assessment of these emissions, obtained from average emissions factors, can therefore be subject to a more or less relevant degree of uncertainty.

Conclusions

•In the life cycle, the assessment of emissions due to the production of thermoelectric energy must consider the efficiency of combustion technology used, a factor that has a key role in emission reduction. In other words, also data on specific pre-combustion emissions must be related to the net energy produced and the technology used.

•The need for reliable data for both emissions stages (pre & post) becomes even more important in the light of emission transaction mechanisms envisaged by Kyoto objectives to reduce emissions.

•This clearly requires the adoption of harmonised national measure/control procedures which allow to obtain certified emissions data. In other words, only if data are reliable can the system of exchange mechanisms work, and only then we might have a reasonably certainty of a proper application of the Kyoto Protocol, whose costs would be de facto borne by the various countries.