*ISPRA*
*Istituto Superiore per la Protezione e la Ricerca Ambientale*

# Le emissioni delle emissioni di gas serra dell'Italia 2020

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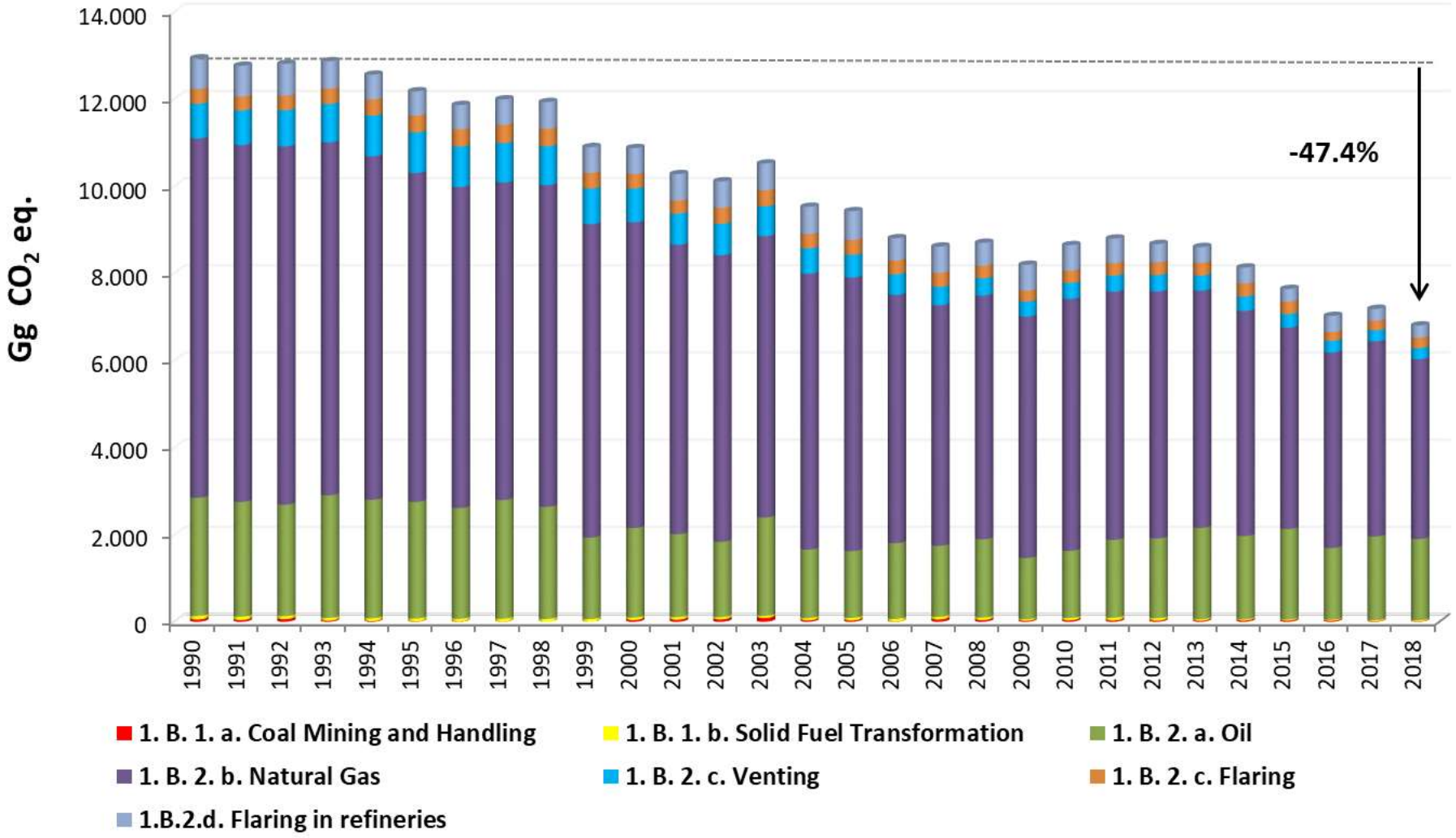
*LE EMISSIONI DI METANO DELLA FILIERA DEL GAS NATURALE IN ITALIA*

*Presentazione dei risultati preliminari dello studio Amici della Terra per EDF-Europe su proposte di strumenti di mercato per la riduzione delle emissioni di metano nella filiera del gas naturale*

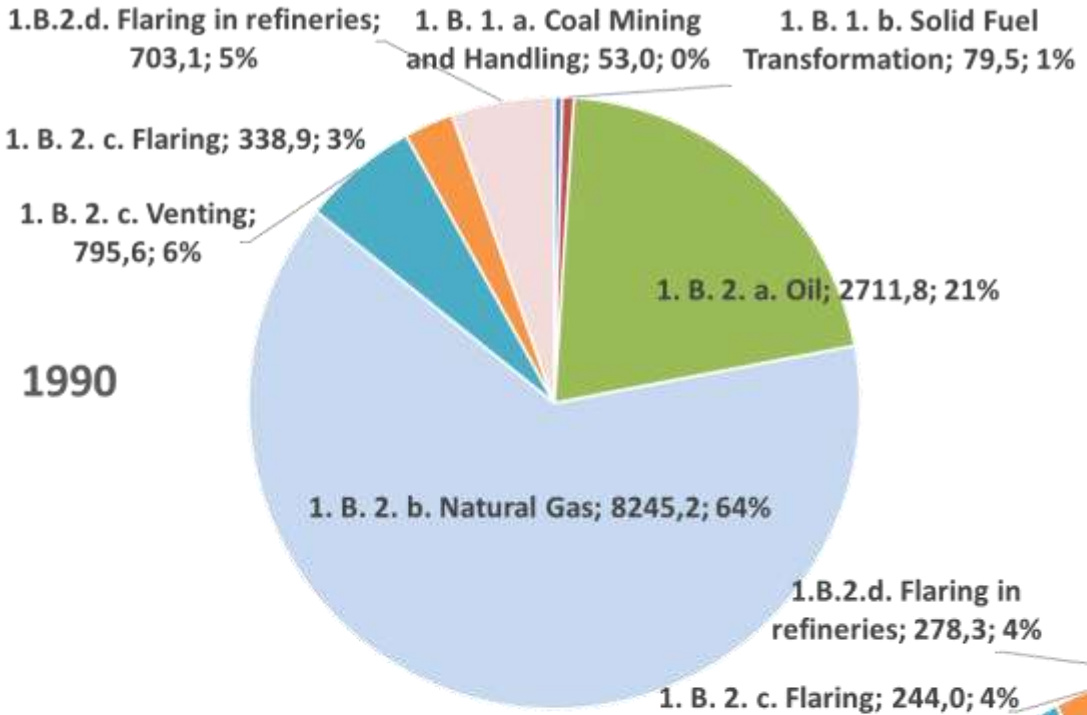
*Roma, 01/07/2020*

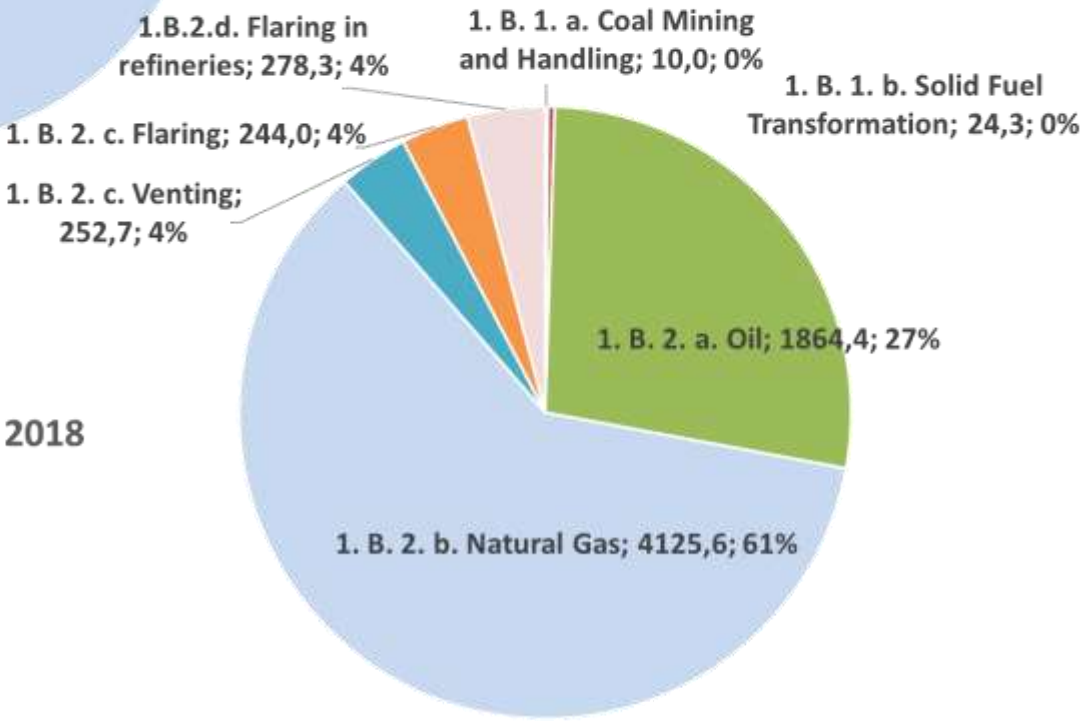
# Overview (1)

In 2018 fugitive GHG emissions account for 2.0% out of the emissions in the energy sector and 1.6% of total emissions. The most relevant gases are $CH_4$ from gas operations and $CO_2$ from oil operations.



# Overview (2)

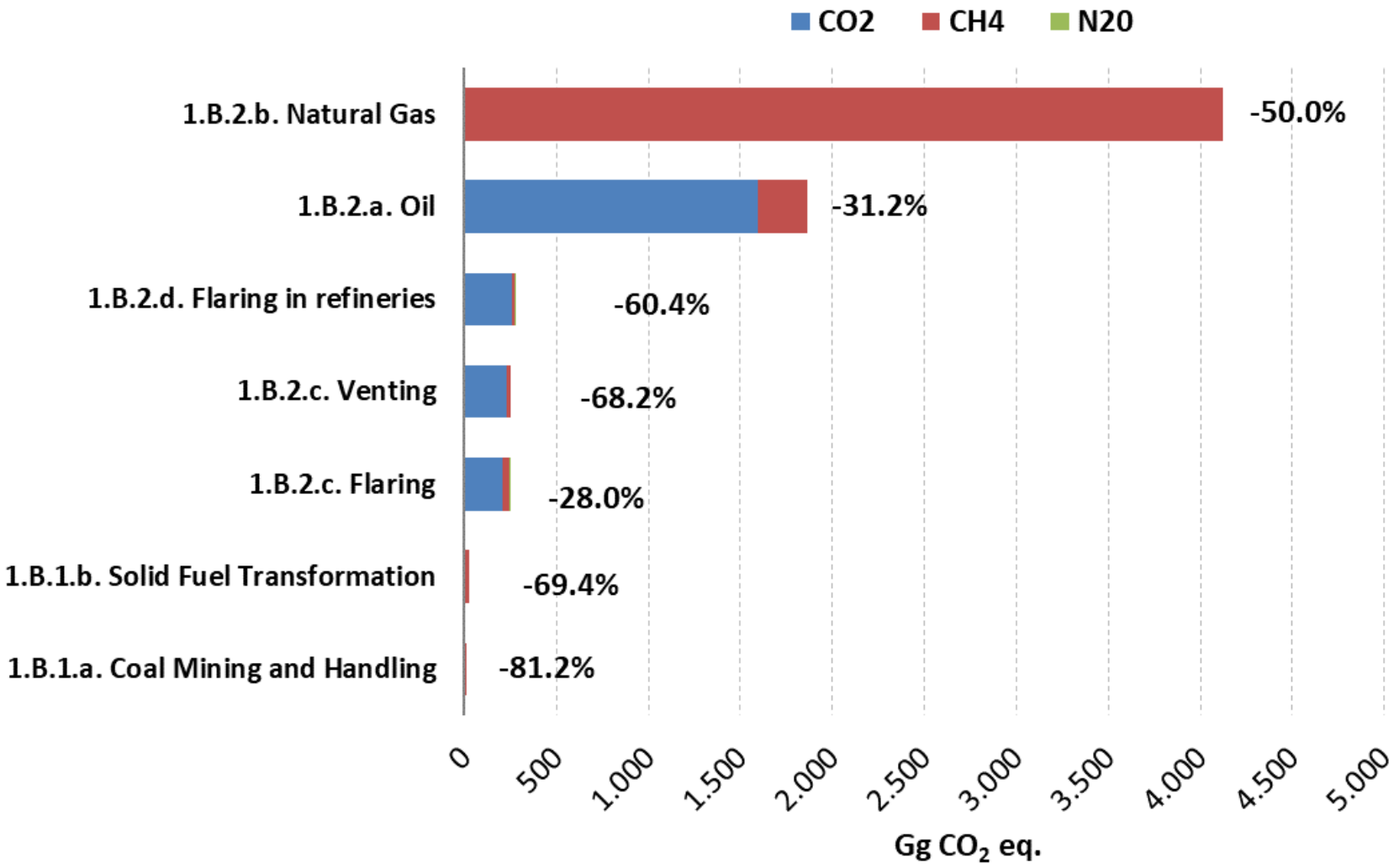


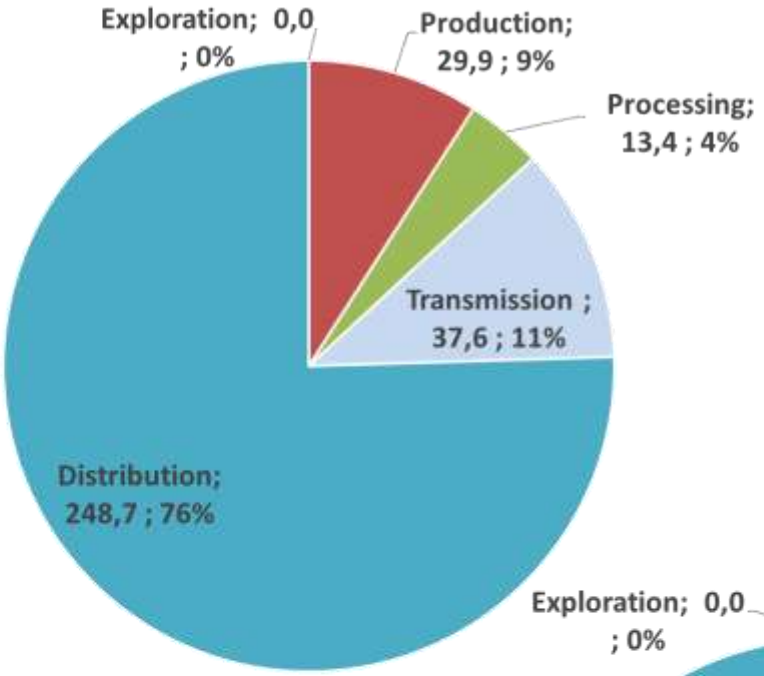

Fugitive GHG emissions from NG source account for 61% of total GHG fugitive emissions in 2018 with a slight decrease of share wrt 1990.

# Overview (3)

In 2018 $CH_4$ is the main gas of fugitive emissions from natural gas transmission, distribution, and production, while $CO_2$ is the main gas for oil operations (refining and storage), flaring in refineries, and flaring for fuels production, mainly for oil. $N_2O$ is emitted in flaring.

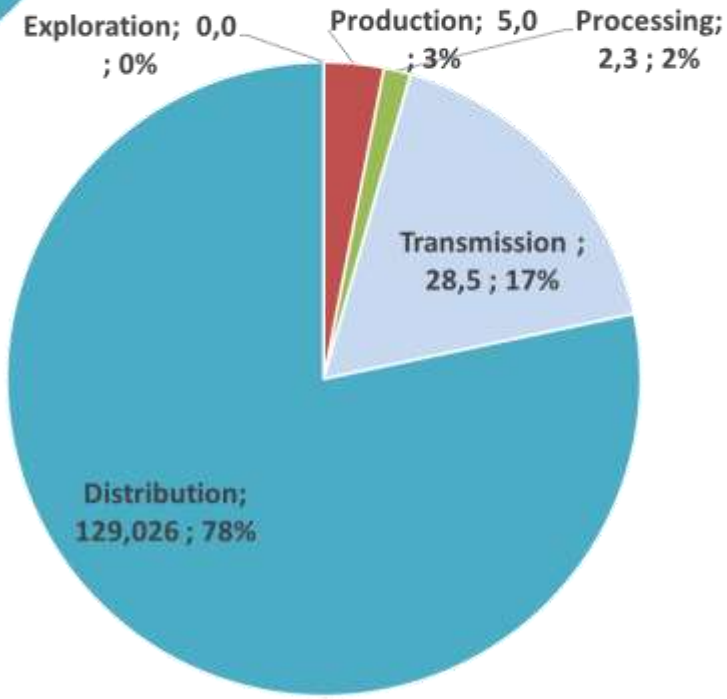


# Natural gas




1990

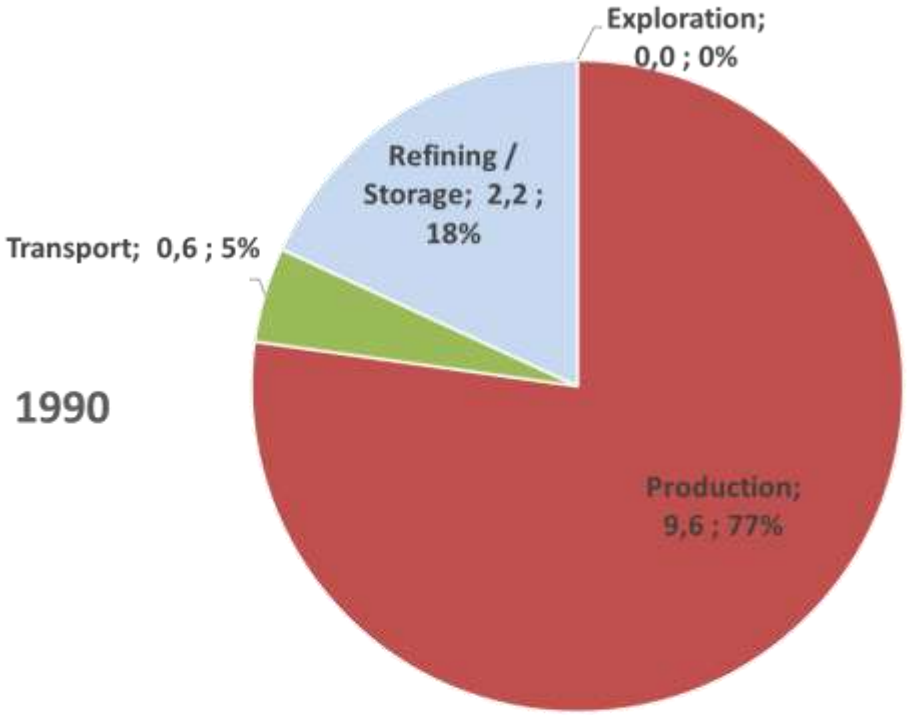
The great majority of CH4 fugitive emissions occurs for the NG distribution, followed by NG transmission. These activities account for about 95% of CH4 fugitive emissions in 2018 from 1.B.2.b source.

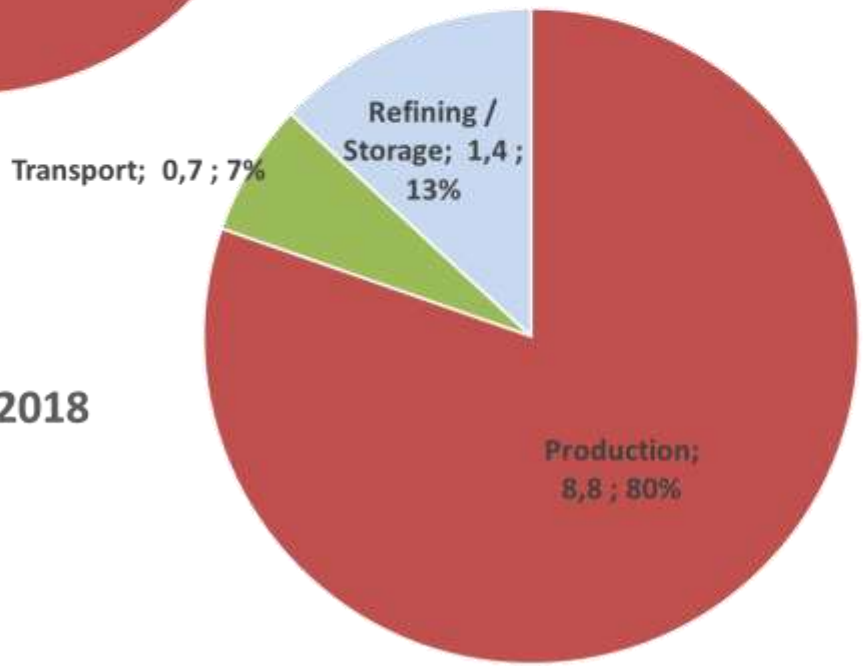



2018

In 2018 about 20% of distribution leakage are estimated occurring inside the houses.

# Oil




As for Oil sources (1.B.2.a) the great majority of CH4 fugitive emissions occurs for production activity, followed by refining/storage.

# Methodological issues: Solid fuels

Activity data used to estimate fugitive emissions by solid fuels operations are supplied by Ministry for Economic Development (MSE) and National Institute of Statistics (ISTAT).
Emission factors are from IPCC guidelines (2006) and EMEP/CORINAIR Guidebook (2007).

| Activity | Description | Data source | Emissions | Emission factor |
|---|---|---|---|---|
| **Coal mining and handling** | **Coal and lignite produced** | **MSE** | **$CO_2$, $CH_4$** | **IPCC, EMEP/CORINAIR** |
| **Solid fuel transformation** | **Coke produced** | **ISTAT** | **$CO_2$, $CH_4$** | **EMEP/CORINAIR** |

# Methodological issues: Oil operations

Activity data used to estimate fugitive emissions by oil operations are supplied by Ministry for Economic Development (MSE), Ministry of Infrastructure and Transport (MIT), Emission Trading Scheme database (ETS), and associations of oil operators (UP), oil&gas operator (ENI).
Emission factors are from IPCC (GPG 2000; 2006) and country specific (CS).

| Activity | Description | Data source | Emissions | Emission factor |
|---|---|---|---|---|
| **Exploration** | **N° Wells** | **MSE** | **$CO_2$, $CH_4$, $N_2O$** | **IPCC** |
| **Production** | **Oil produced** | **MSE, UP** | **$CO_2$, $CH_4$** | **IPCC, CS (ENI)** |
| **Transport** | **Oil transported** | **MIT** | **$CO_2$, $CH_4$** | **IPCC** |
| **Refining Storage / Flaring in refineries** | **Oil processed, crude oil losses, gas flared** | **MSE, UP, ETS** | **$CO_2$, $CH_4$, $N_2O$** | **IPCC, CS (UP / ETS)** |
| **Venting / Flaring** | **Oil produced** | **MSE, UP** | **$CO_2$, $CH_4$, $N_2O$** | **IPCC, CS (ENI)** |

# Methodological issues: Gas operations

Activity data used to estimate fugitive emissions by gas operations are supplied by Ministry for Economic Development (MSE), Emission Trading Scheme database (ETS), Autority for Electricity and Gas (ARERA), oil&gas operators (ENI, SNAM, EDISON, ITALGAS, ENEL).
Emission factors are from IPCC (GPG 2000; 2006) and country specific (CS).

| Activity | Description | Data source | Emissions | Emission factor |
|---|---|---|---|---|
| **Exploration** | **N° Wells** | **MSE** | **$CO_2$, $CH_4$** | **IPCC** |
| **Production / Processing** | **Gas produced** | **MSE** | **$CO_2$, $CH_4$** | **IPCC, CS (ENI)** |
| **Transmission (pipelines)** | **Gas transported** | **SNAM, EDISON, ARERA** | **$CO_2$, $CH_4$** | **CS (SNAM / EDISON / ITALGAS / ENEL / AEEG)** |
| **Distribution (networks)** | **Gas distributed** | **SNAM, ITALGAS, ENEL, ARERA** | **$CO_2$, $CH_4$** | **CS (SNAM / EDISON / ITALGAS / ENEL / AEEG)** |
| **Venting / Flaring** | **Gas produced** | **MSE** | **$CO_2$, $CH_4$, $N_2O$** | **IPCC, CS (ENI)** |

# QA/QC and verification (1)

SNAM is the main operator for national gas transmission and import-export. ITALGAS and ENEL (now 2iReteGas) are the main operators for gas distribution.

SNAM accounts for about 93% of national pipelines length and about 99% of transported gas. ITALGAS and ENEL account for about 48% of distribution network length and about 44% of distributed gas. There are about 220 operators distributing natural gas.

ARERA is the National Authority for Electricity and Gas. Starting from 2000 every year issues a report with information on pipelines and network length, operating pressure, and network type concerning pipelines material.

# QA/QC and verification (2)

A study was carried out by ISPRA in 1999 in order to assess emissions from the whole natural gas distribution grid. The study addressed natural gas leakages, pipelines material, and operating pressure with data of 1995. All main gas operators were involved.

An estimation model was set up in order to approximate the known gas emissions from the main operators and total emissions for year 1995. Emission factors distinct by pressure (low, medium and high) and material (cast iron, grey cast iron, steel or polyethylene) was applied to achieve the goal.

Emission factors from Battelle study for former West Germany was applied and cross checked with operators data.

The estimation model so calibrated on main operators was used to estimate fugitive emissions from minor operators.

# QA/QC and verification (3)

SNAM, ITALGAS, and ENEL publish annually environmental reports with amount of natural gas conveyed and leaks. Moreover SNAM provides to ISPRA chemical composition and energy content of national gas imported and produced.

The estimation model used to estimate fugitive emissions is updated every year considering data published by ARERA on pipelines and it is calibrated with annual leakage data published by main operators in their environmental reports.

Natural gas leaks by main operators and average composition of natural gas are used to estimate fugitive emissions for different phases. For minor operators lower quality standard and higher specific emission factors for network material, venting, and other accidental losses were considered.

# Emission factors

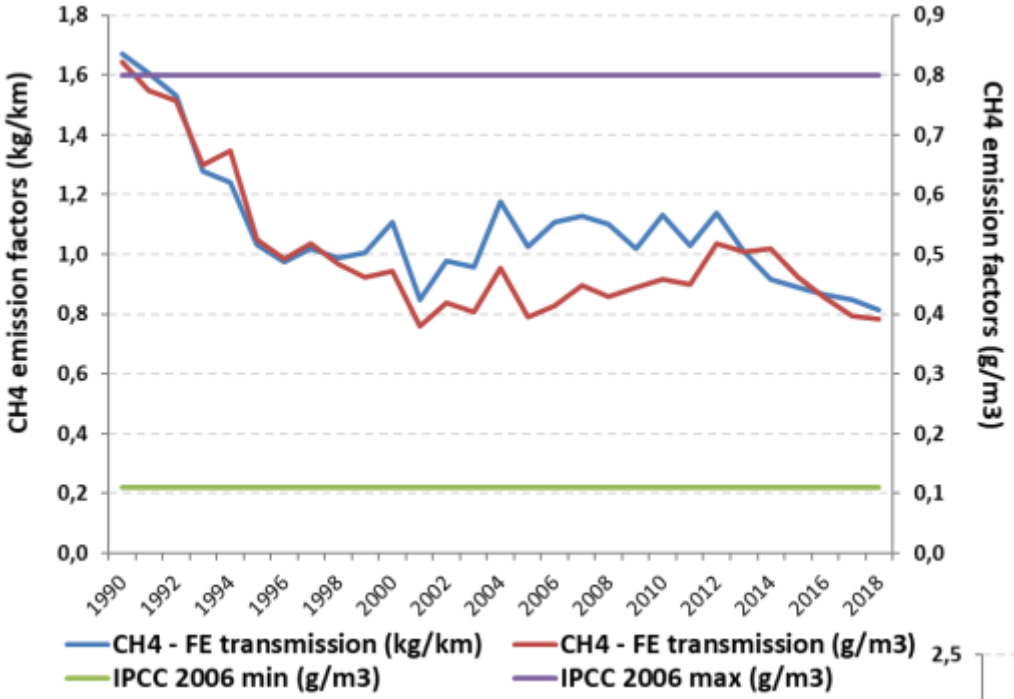
## NG emission factors for transmission and distribution in 2018

| Material | Pressure | | |
|---|---|---|---|
| | High | Medium | Low |
| | $m^3/km$ | | |
| Steel | 600 (SNAM)<br>700 (Other) | 441 (Italgas)<br>533 (ENEL)<br>533 (Other) | 441 (Italgas)<br>533 (ENEL)<br>536 (Other) |
| Cast iron | - | 441 (Italgas)<br>533 (ENEL)<br>533 (Other) | 441 (Italgas)<br>533 (ENEL)<br>536 (Other) |
| Grey cast iron | - | - | 5110 (Italgas)<br>6205 (ENEL)<br>7136 (Other) |
| Polyethylene | - | - | 517 (Italgas)<br>720 (ENEL)<br>711 (Other) |

| | |
|---|---|
| **LNG regassification** | 0.35 Mm3 NG / Gm3 NG imported |
| **Pipeline compression station** | 0.16 $Mm^3$ NG / $Gm^3$ NG transported |
| **Pipeline transmission** | 600 - 700 $m^3/km$ (as reported in the previous table for high pressure pipelines) |
| **Venting and other accidental losses** | 0.014 $Mm^3$ NG / $Gm^3$ NG transported (SNAM)<br>0.120 $Mm^3$ NG / $Gm^3$ NG transported (other) |

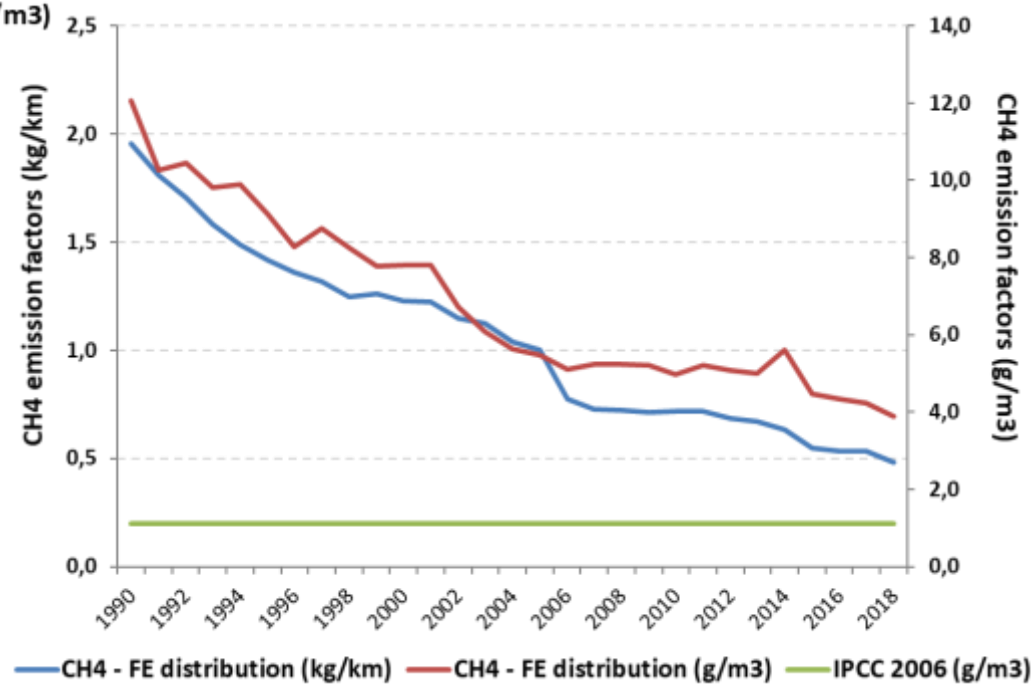
| | |
|---|---|
| **Pipeline distribution** | As in the previous table for medium and low pressure pipelines |
| **Venting and other accidental losses** | 0.028 $Mm^3$ NG / $Gm^3$ NG distributed (Italgas)<br>0.212 $Mm^3$ NG / $Gm^3$ NG distributed (Enel)<br>0.237 $Mm^3$ NG / $Gm^3$ NG distributed (Other) |

# Emission factors (1)



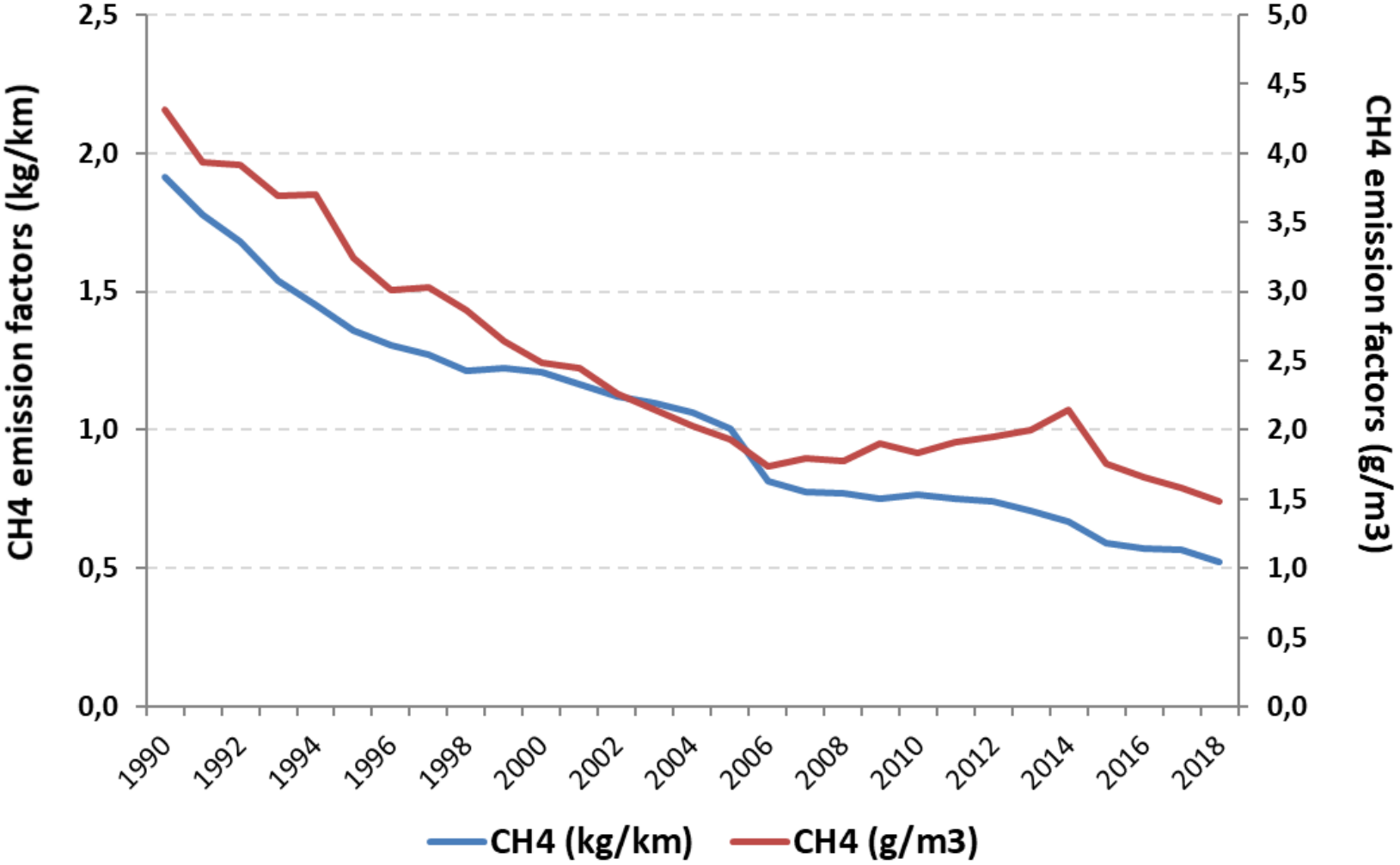

$CH_4$ emission factors time series since 1990 (fugitive emissions per km and per $m^3$) for natural gas transmission and distribution.

IPCC emission factors for transmission are referred to fugitive and venting.



# Emission factors (2)

$CH_4$ emission factors time series since 1990 (fugitive emissions per km and per $m^3$) considering natural gas transmission and distribution together.



*Grazie*