IGRC Seoul 2011
International Gas Union Research Conference

marcogaz
TECHNICAL ASSOCIATION
OF THE EUROPEAN NATURAL GAS INDUSTRY

GDF SUEZ

LCA of the European natural gas chain: challenges and results
IGRC 2011

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- Methodology
- Results
- Conclusions and perspectives

Context and objectives

A need of a reference LCA for the European natural gas chain :

- To improve the knowledge on the environmental impact of the natural gas chain
- To identify solutions for potential improvements
- To promote the environmental performances of natural gas
- To contribute to European reference LCA databases (ELCD and ecoinvent)

The first LCA of natural gas chain realized directly by the industry

Creation of a LCA Working Group, within the existing **Joint Group on Health, Safety & Environment of Marcogaz and Eurogas** in order to realize the LCA

Critical review realized to ensure the credibility of the study and the compliance with ISO requirements

A few words about Marcogaz

→**Members of Marcogaz**

Mission :

➔ **to serve its members as the European window for any technical issue regarding natural gas.**

"As the representative organisation of the European Natural Gas Industry, it aims at monitoring and taking influence when needed on European technical regulation, standardisation and certification with respect to safety and integrity of gas systems and equipment, and rational use of energy".

The study has been realized in collaboration with Eurogas

Scope of the study

Focused on 3 main utilizations

- Electricity generation with natural gas combined cycle power plants (CCGT)
- Heating with condensing boilers (for domestic, commercial or industrial use)
- Cogeneration of heat and power (for domestic or commercial buildings)

3 environmental impact indicators studied

- Climate change
- Terrestrial acidification
- Non renewable energy use

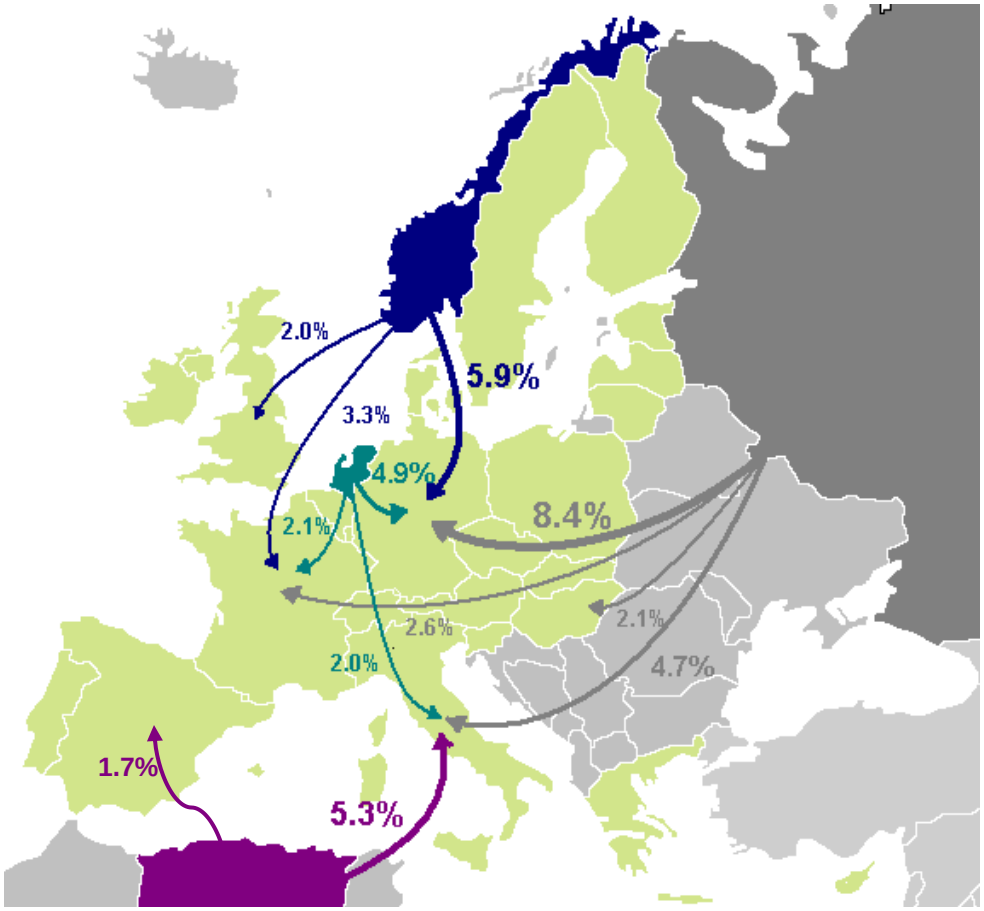
Impacts associated to the emissions on which the industry has a direct impact

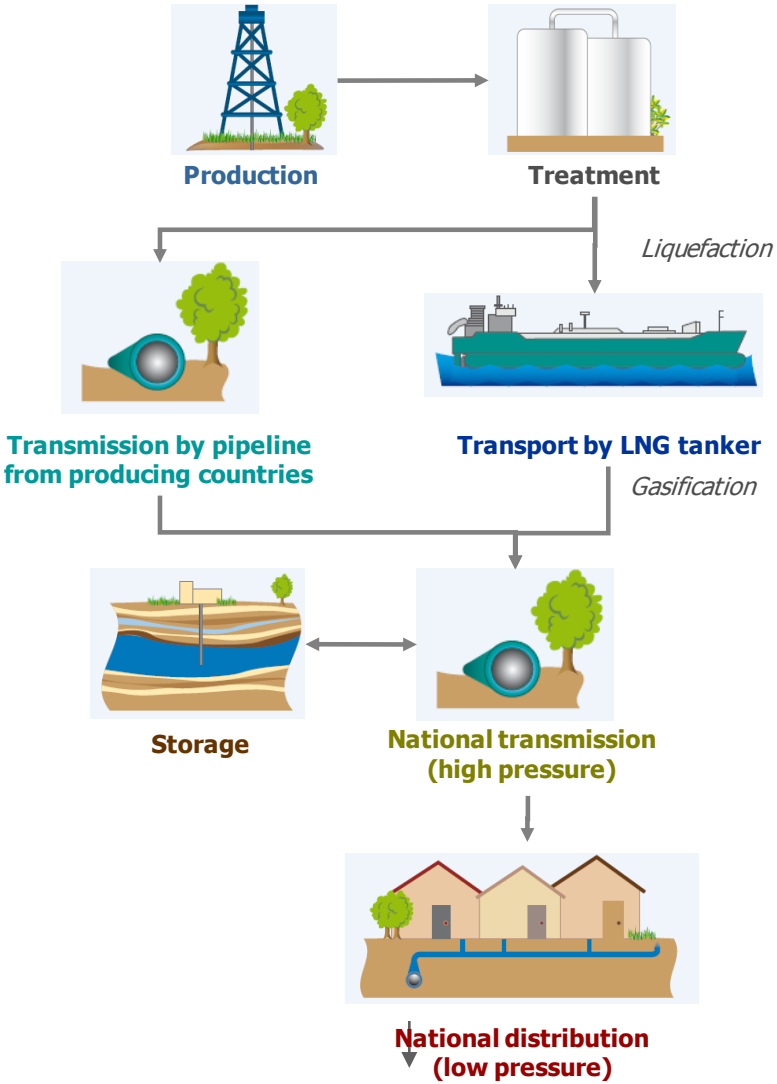
2 steps of analysis

- The upstream chain : up to the meter
- The complete chain including the final use

Steps of the natural gas chain modeled

with the main trade movements in Europe





Modelling of the natural gas chain
Comparison with the actual gas chain

Challenge

- Description of the whole natural gas chain with a LCA model,
  - including Countries specificities,
  - and various technologies used at each step.

Modelisation

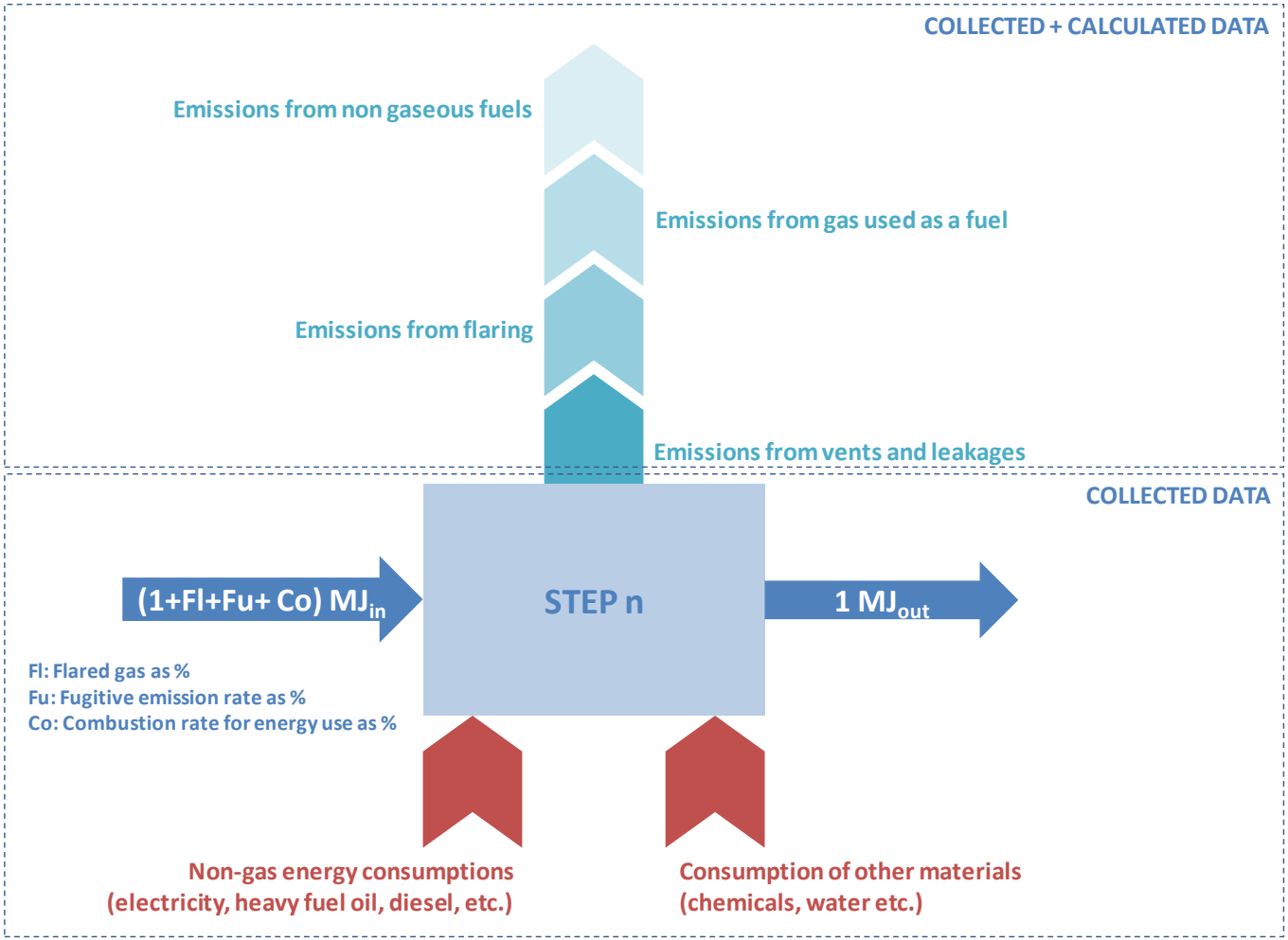
- For each step
  - generic model,
  - parameters,
  - adaptation to the available data.

Simplifications

- Infrastructure construction and dismantling excluded
- Evaluation on a steady state basis: no consideration of transition emissions and/or leakages (completion of a well, starting a liquefaction plant ...)
- Analogies for some countries due to a lack of specific data

Modelling of the gas chain

➔ design of each step



Main data sources for the inventory

Data from gas companies

- Collected with the LCA WG members
- Published in the sustainable developments reports of Companies

Data from literature on oil&gas industry

- BP Statistical review
- Wuppertal Institute
- IGU

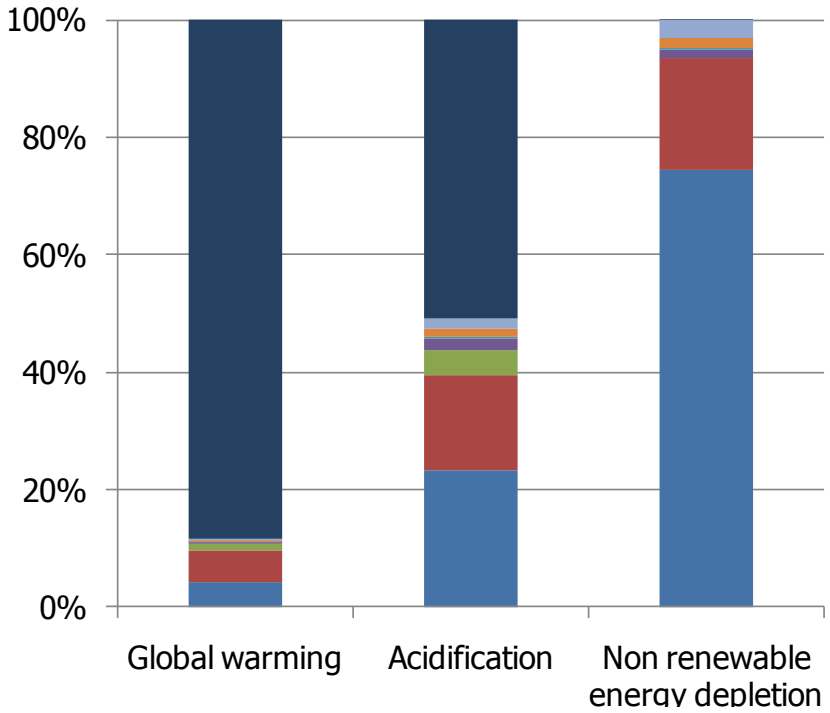
Other LCAs made by non-gas companies

- LCA Database : ecoinvent
- Paul Scherrer Institut
- LBST

Results on the whole life cycle, including the final use

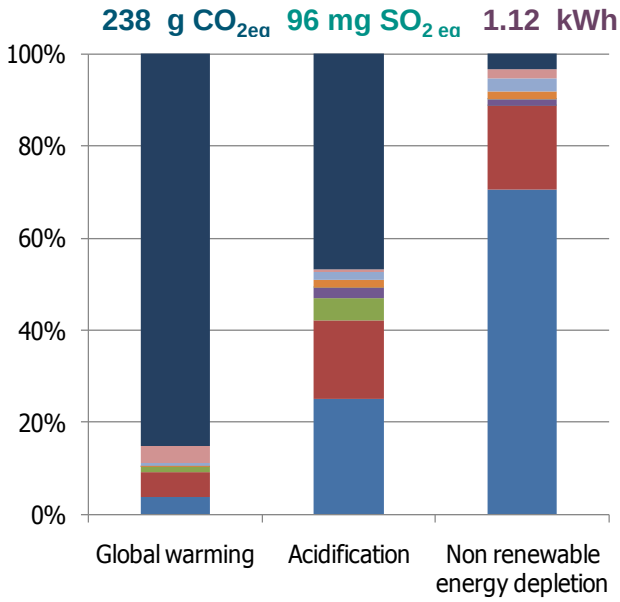
First example :

Electricity production: CCGT

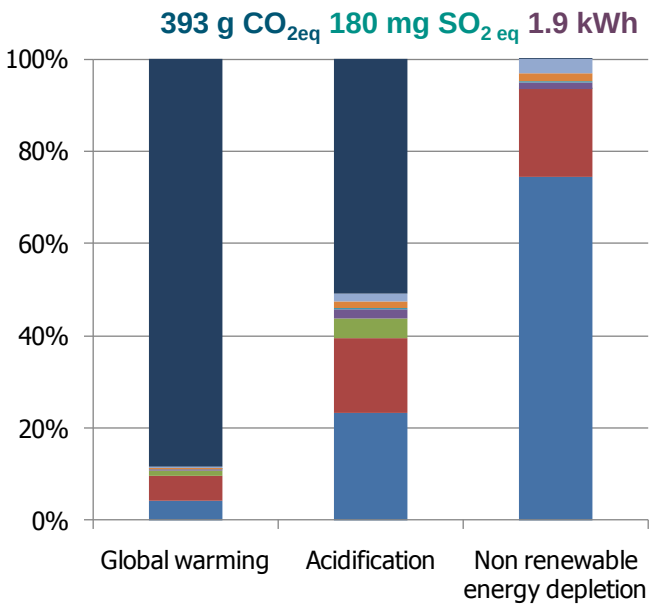


The final use is not necessarily the only significant contributor to all the impacts

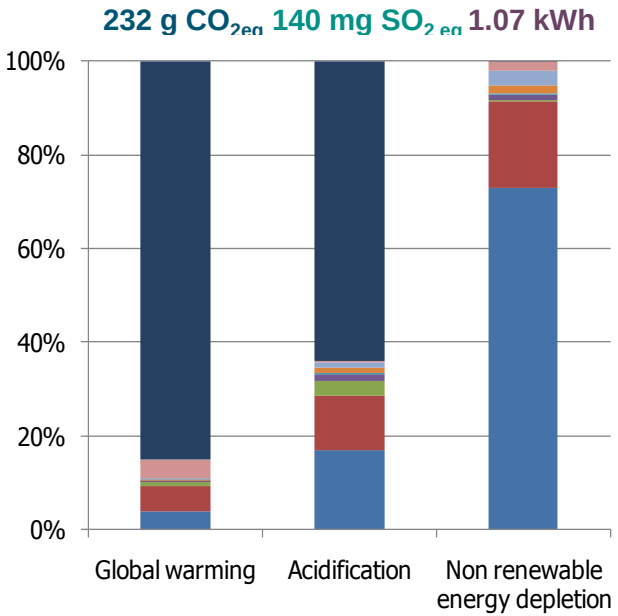
Results on the whole life cycle, including the final use



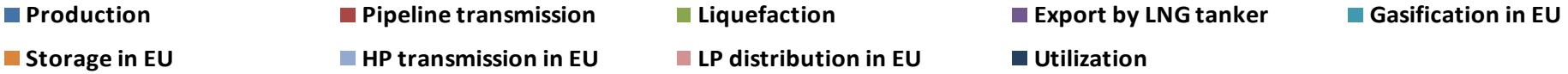
Heat : Domestic use



Electricity production: CCGT



Electricity/Heat: CHP, tertiaire use

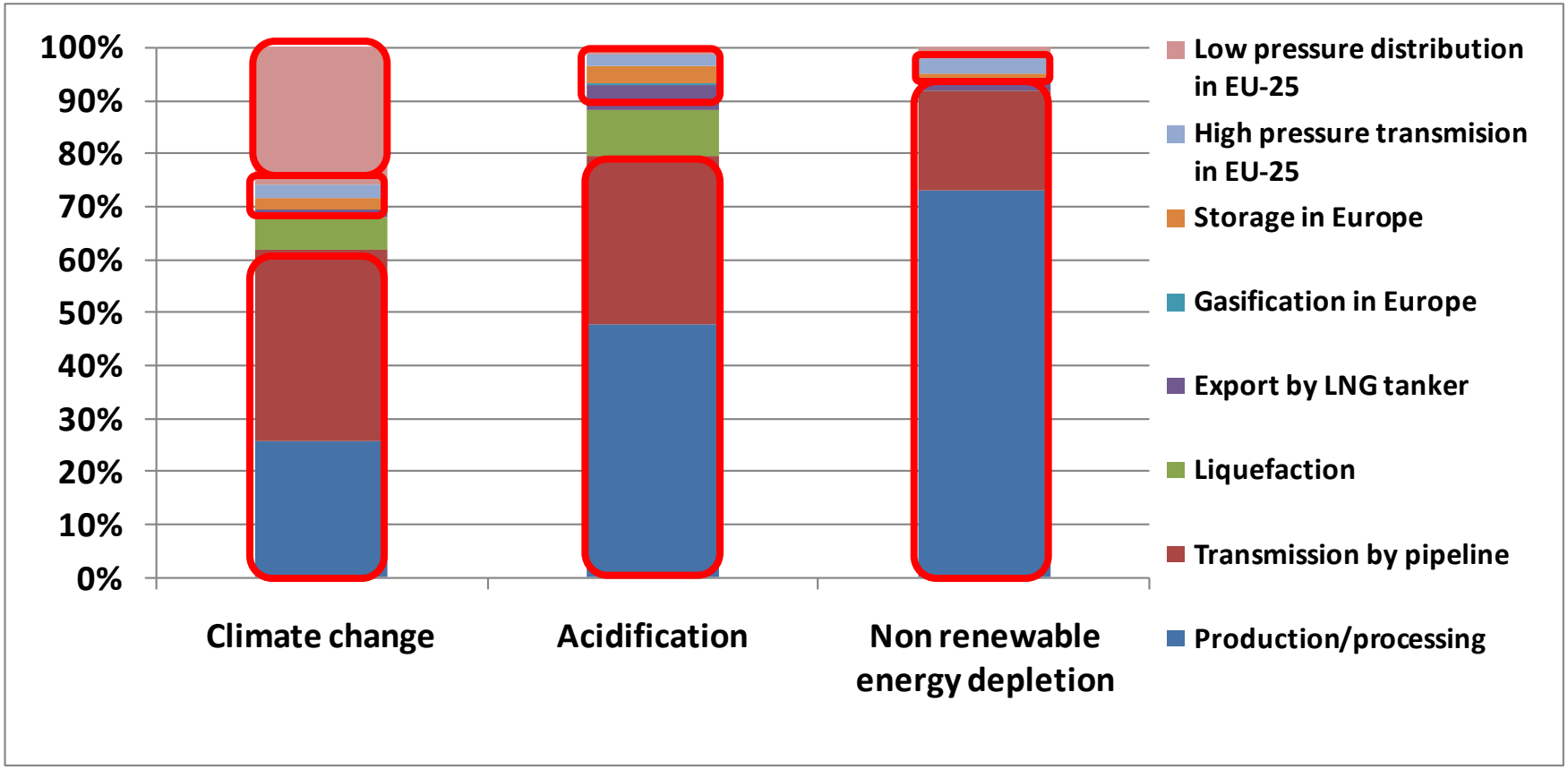


<u>Differences observed between the 3 final uses</u> :

mainly linked to the **efficiency** of the conversion process and to the **type of combustion**

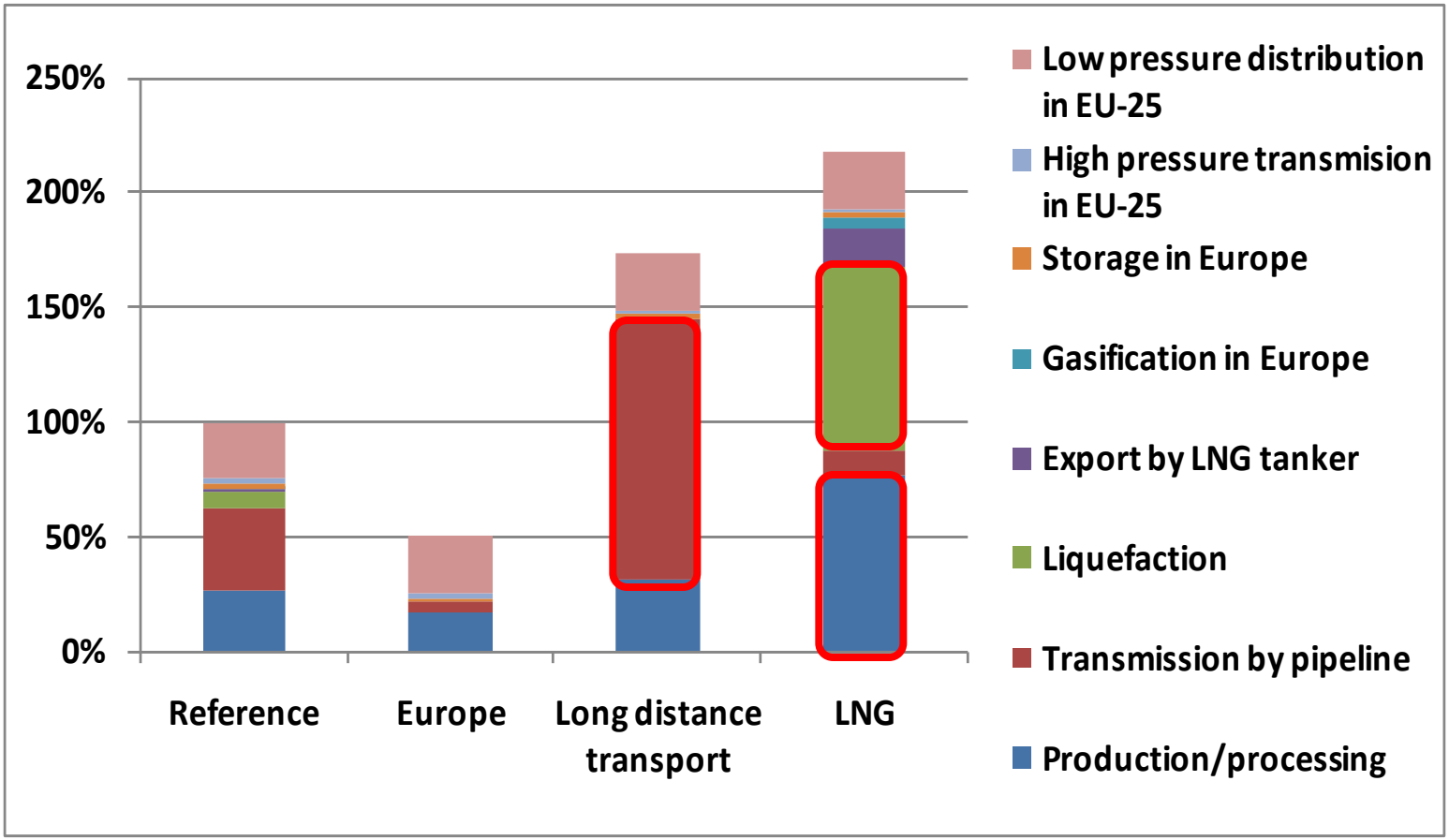
Results : focus on the upstream chain

Different contributions of each step to the 3 impacts categories



Comparison of the repartition of GHG emissions along the upstream chains

GHG emissions ranging from 1 to 4 depending on the NG supply chain



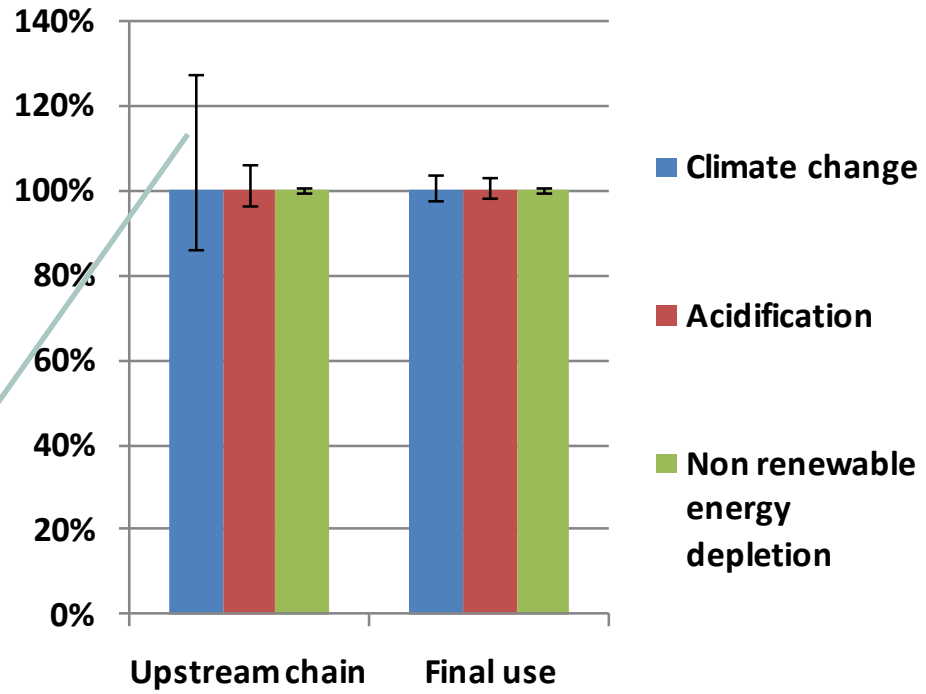
Sensitivity analysis

Main sensitive parameters:

- Methane emissions rate on the long distance export pipeline system during transportation
- Global auto consumption rate during sweetening process
- Compressor efficiencies
- Representativeness of European data

Global confidence gap of the results associated to the low pressure natural gas and to the final use

Most important confidence gap on the climate change, but variations are attenuated by taking into account final use



Influence of the supply mix

One of the main remarks of the peer review :

Potentially low representativeness of the data *6 years after*

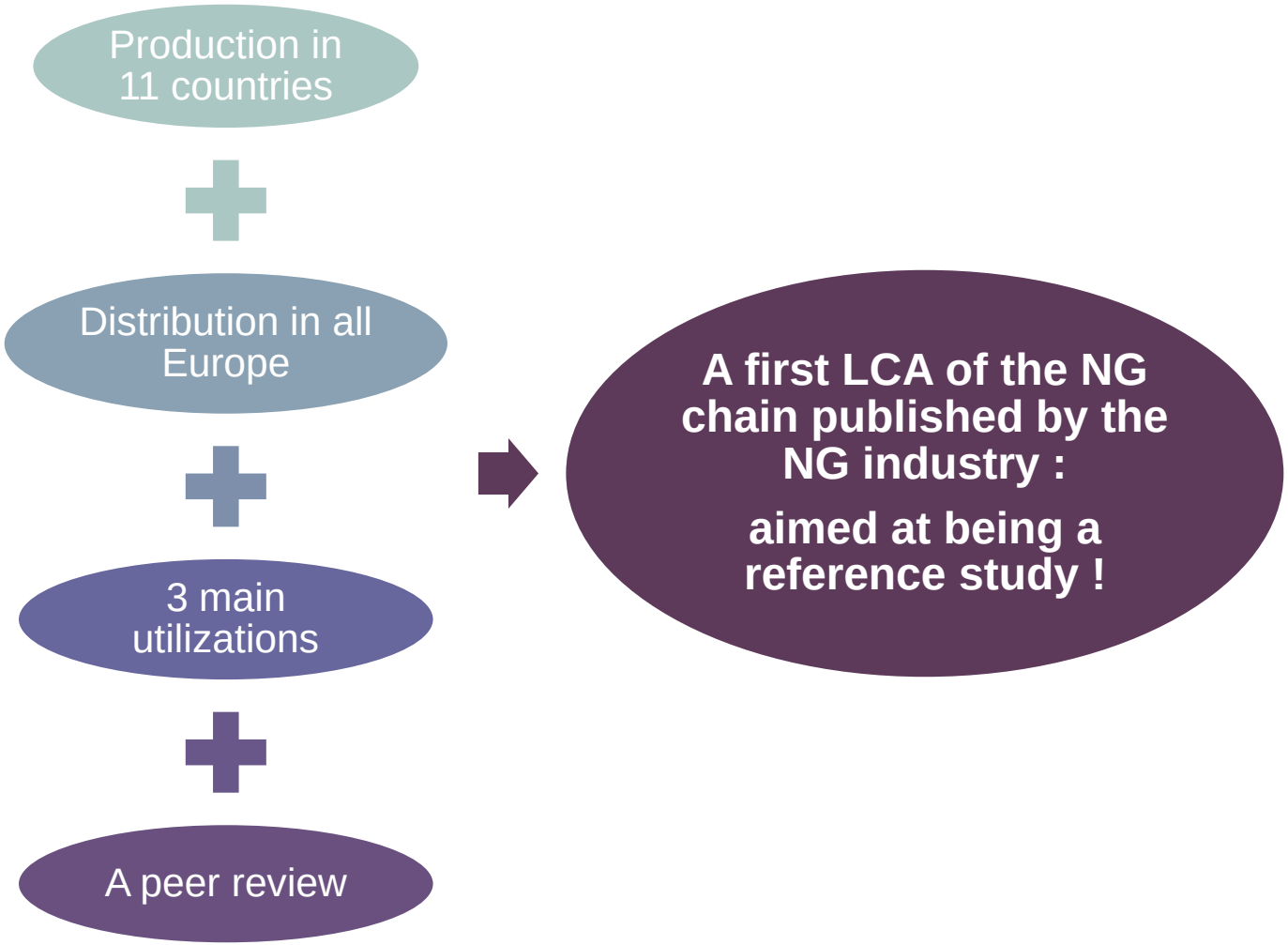
→ Sensitivity analysis realized by adapting the trade movements to 2009

Results :

- The large geographic border reduce variations : compensation between all the countries
- Study still representative of the environmental impacts of the natural gas chain

Impact category	Unit	Variation 2004/2009
Climate change	g CO_{2eq}/MJ	-0.1%
Acidification	mg SO_{2eq}/MJ	2.6%
Non renewable energy depletion	MJ_{total}/MJ	1.2%

Concluding remarks



Concluding remarks

Main difficulty : availability of reliable data on the various steps of the natural gas chain and associated technologies

Simplifications needed…

…but results stay reliable (variation of 4% maximum)

A critical review that guaranties the quality of the evaluation and results

- Required by ISO Standards 14040 and 14044 for all communications
- Realized with an expert panel

Possible improvements of the NG chain identified by the study :

- Developing high efficiency gas combustion systems
- Improving the efficiency of liquefaction units
- Improving compressor efficiencies for long distance transmission
- Reducing gas flaring during production on associated fields
- Reducing leakages along the transport and distribution pipelines

Perspectives…

Beginning 2012

Complementary study on NGV

- In collaboration with NGVA Europe
- Publication of the final report, incl. the 4 NG uses

2012 and beyond

A first result to be promoted…

- Future work of the LCA WG : update of the study, publication…
- Collaboration with the reference LCA database

2015 ?

… and further completed

- Basis for a future work within an international working group (IGU ?)

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Thank you for your attention

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