

# 26<sup>th</sup> World Gas Conference

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Life Cycle Assessment as a Decision Support Tool within TOTAL

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TOTAL



# LCA must have one or several outcomes

## STRATEGY

- S1. Develop purchasing strategies
- S2. Determine R&D products priorities
- S3. Assess investments and major production site projects
- S4. Add an environmental dimension to macro-economic approaches
- S5. Assess the performance of families of products
- S6. Evaluate new technologies, new production lines and acquisitions
- S7. Implement a policy

## R&D

- R1. Evaluate a technology
- R2. Eco-design of products and applications
- R3. Evaluate a portfolio of new technologies
- R4. Determine eco-efficiency
- R5. Aid in product homologation and certification
- R6. Identify lines of research focused on attaining sustainable growth
- R7. Evaluate investments in material and equipment
- R8. Participate in publically funded research projects

## LOBBYING

- L1. Anticipate national or international regulations
- L2. Challenge an inappropriate regulation
- L3. Aid lawyers in the Commercial Court
- L4. Participate in standardization processes
- L5. Participate in professional associations and federations
- L6. Support upstream technical lobbying

LCA

## COMMUNICATION

- C1. Prevent inept communication
- C2. Explain Total's actions
- C3. Lend credibility to environmental actions
- C4. Test scenarios
- C5. Increase corporate visibility
- C6. Promote responsible behaviour

## MARKETING & COMMERCIAL

- M1. Contribute to environmental product communication
- M2. Determine a product's environmental performance
- M3. Satisfy clients' environmental expectations
- M4. Develop product labels and environmental declarations
- M5. Respond to attacks
- M6. Communicate "first"
- M7. Contribute to the preparation of commercial documents

- Overarching question

**« With regards to the current (and numerous) energy sources, does shale gas represent a significant environmental risk and therefore should it be exploited and used in Europe? »**



## Shale Gas LCA: Objectives of the project

- 1) Assess the literature to find the sources of potential impacts
  - What is the average production of a well?
  - How much GHG emissions should be expected?
  - How much fugitive emissions should be expected after sealing of the well?
- 2) Evaluate the environmental profile, the carbon footprint and the water footprint of a shale gas exploitation (from well to powerplant gate)
- 3) Compare shale gas with coal, conventional natural gas and LNG for electricity production.



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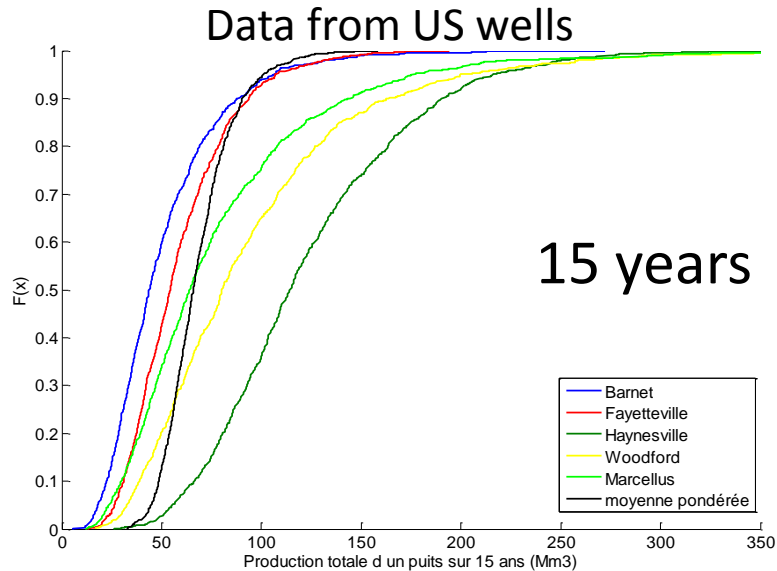
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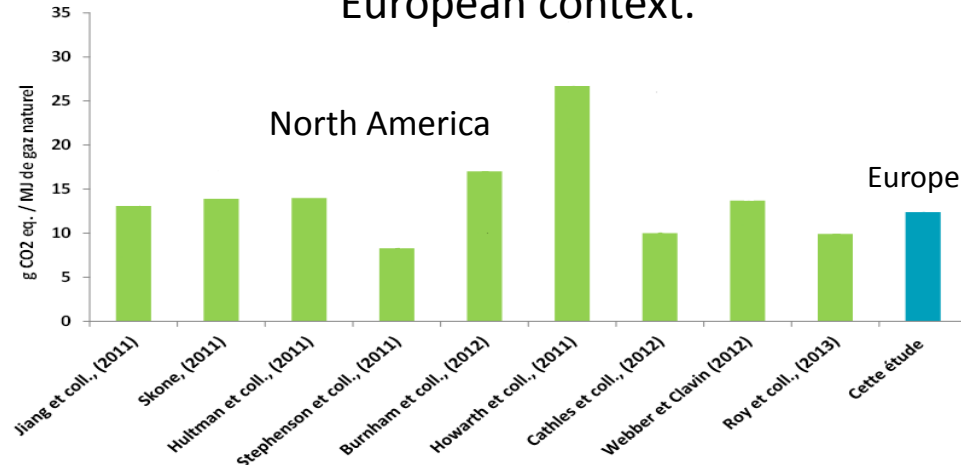
## 1) What is the average production of a well?



- Significantly variable:  
25 to 250  $\text{Mm}^3$ /well lifetime

## 2) How much GHG emissions should be expected?

North American data adapted to the European context.



- No significant differences between GHG emissions level.

# Shale gas LCA: Comparison of energy sources

## Attributional LCA



## Consequential LCA



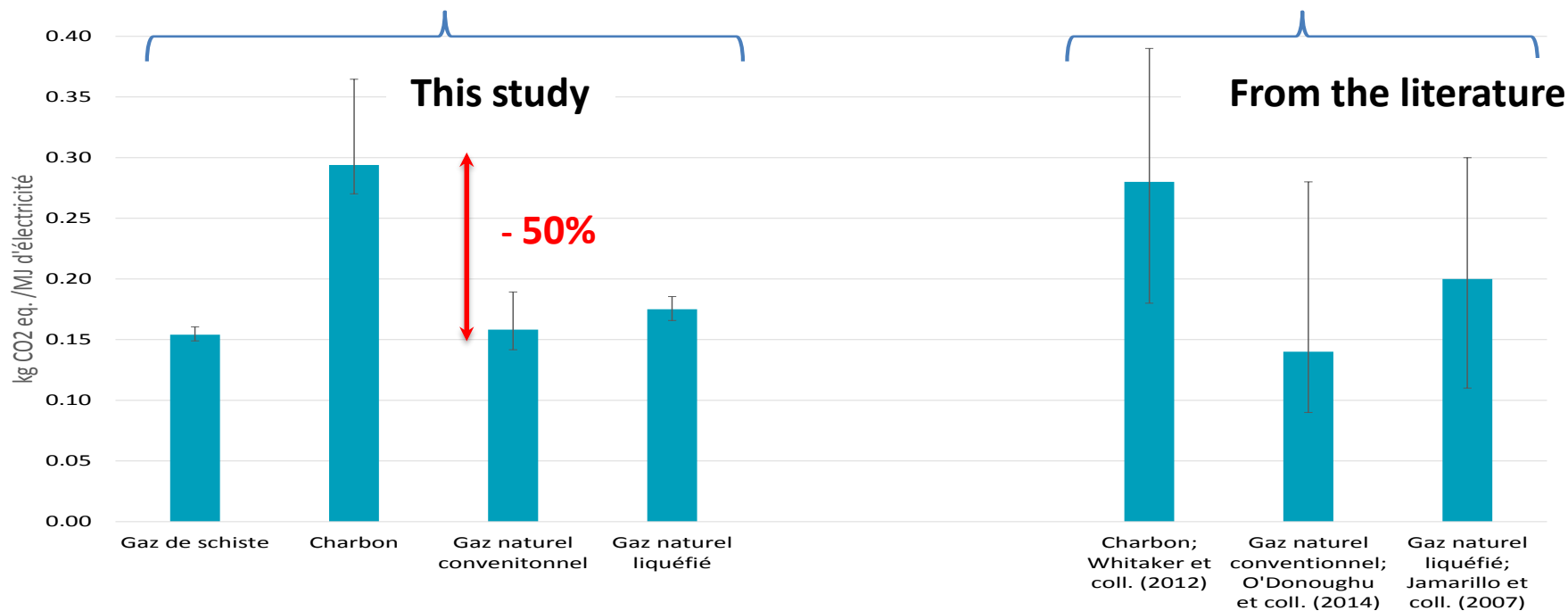
- Simple comparison of energy sources.
- Cannot be used to assess a large scale shift in the energy supply, hence answering the overarching question

- Used to assess the consequences of a large scale shift in the energy supplies
- Dependant on the established consequential scenario

# Shale gas LCA: Attributional results: GHG emissions of electricity production

Cette étude

Provenant de la littérature



- Shown shale gas in « this study » include an 1.1% fugitive emissions
- Coal from « This study » includes methane atmospheric emissions in the order of 0.2 to 13.6 kg CH<sub>4</sub>/ton coal, depending on the geographical context.

# Shale Gas LCA: Consequential LCA comparison scenarios

- **Russian coal substitution:**
  - Russian coal is substituted for European shale gas;
  - Russia diminishes coal production accordingly.
- **European coal substitution:**
  - European coal is substituted for European shale gas;
  - Europe diminishes coal production accordingly.
- **Russian conventional natural gas substitution:**
  - Russian conventional natural gas is substituted for European shale gas;
  - Russia sells natural gas production to China;
  - China substitutes Chinese coal;
  - Chinese coal production decreases accordingly.





## Shale Gas LCA: Consequential LCA comparison scenarios (continued)

- **European conventional natural gas substitution:**
  - European conventional natural gas is substituted for European shale gas;
  - Europe diminishes conventional natural gas production.
  
- **LNG substitution:**
  - Qatar LNG imports are substituted for European shale gas;
  - Qatar sells LNG to China;
  - China substitute Chinese coal;
  - Chinese coal production decreases accordingly.



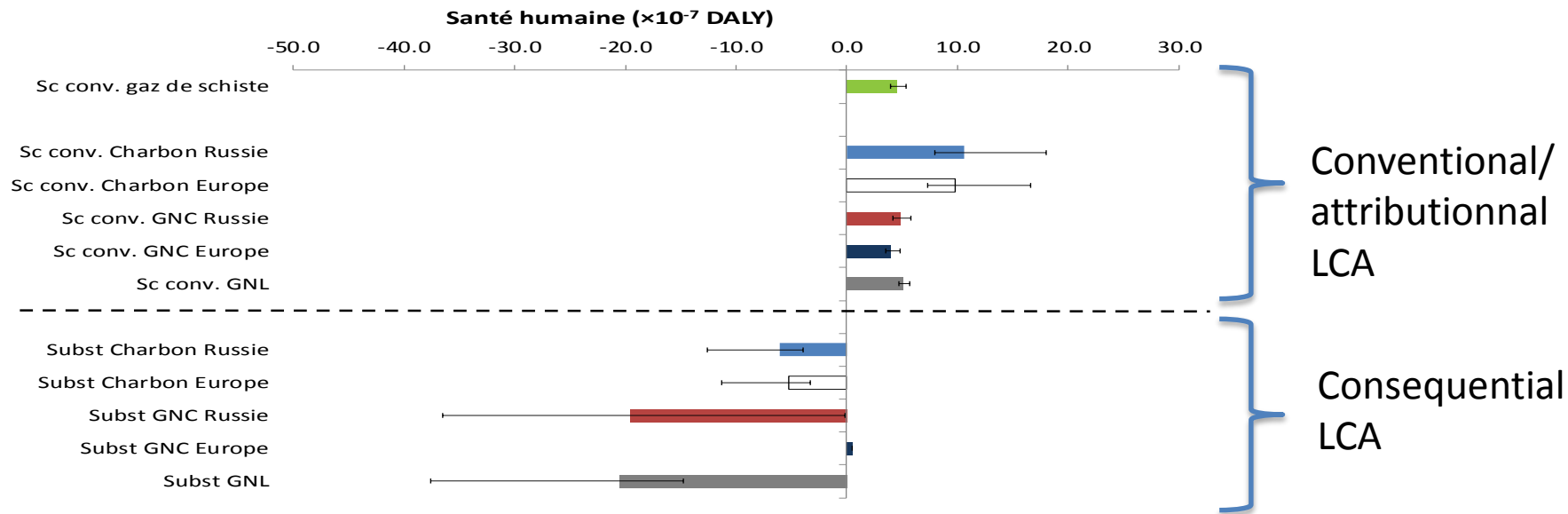
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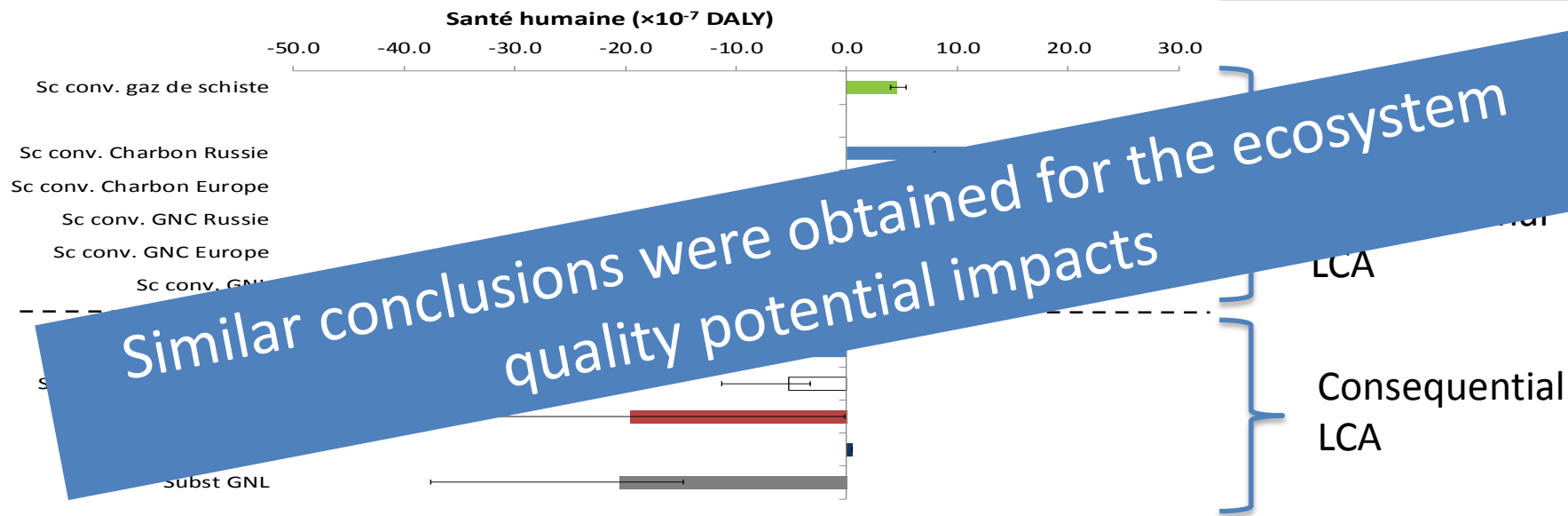
# Comparison of shale gas with other energy sources (electricity production): *IMPACT World+ human health potential impacts*



**If attributional LCA:** Russian and European coal shows more potential impacts than European shale gas, Russian natural gas and Qatar LNG

**If consequential LCA:** Substitution of Russian and European coal, Russian natural gas and Qatar LNG for European shale gas was shown beneficial (according to the tested scenarios).

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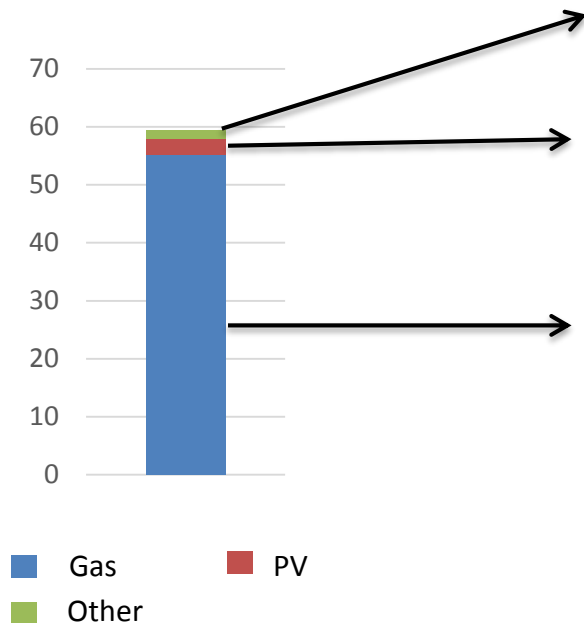


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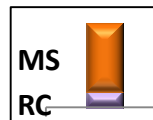
## Other case study: CO2 avoided emissions

### Mt CO2 eq in 2014



**Total Ecosolutions\***  
**0,7 Mt**

*\*Excluding PV emissions avoided*



**PV avoided emissions**  
**3 Mt (1.3 GWc)**

**Gas avoided emissions**

**55 Mt (6063 Mcf/d)**

For Total ecosolution CO2 avoided is estimated when compared with the standard products and services

For Gas and PV, CO2 avoided depends on each country energy mix consumption (minus « low cost / must run » part of the mix) (sources BP Statistical Review).

Calculated on whole life cycle. Based on UNFCC CDM methodology.

- Total Ecosolution CO2 benefit is described in the labellisation files verified by external auditor
  - PV and Gas indicators have been calculated with Deloitte and are auditable.
- Sources: LTP 2014 - equity productions; on whole life cycle