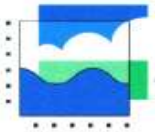
CML-IE



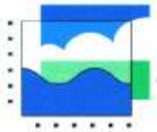
LCA as a policy supporting tool

the case of GHG emissions from chains of electricity from biomass

Conference “Environmental Life Cycle Assessment (LCA) as a Tool for Evaluating the Sustainability of Ecosystem Services”

University of Bath, July 9, 2008

Ester van der Voet & Lauran van Oers, CML Leiden University

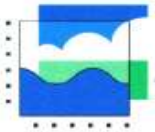


Contents

- Biobased energy policy and sustainability criteria
- LCA-based GHG calculators
- Some results
- Methodological choices and their consequences
- Implications for policies

Biobased energy policies and sustainability criteria

- Bio-based energy: important part of renewable energy policies in Europe
- Lately, recognition of drawbacks >> development of sustainability criteria
- The Netherlands: Commissie Cramer criteria
  - » Large number of sustainability criteria, PPP
  - » Presently developed: greenhouse gas balance



LCA-based GHG calculators

- GHG calculators under development in UK, Germany, NL, ...?
  - » biofuels
  - » bio-electricity and heat
- International debate in EU
  - » methodological issues
  - » intended use of calculators
- Draft Directive EU
  - » Guidelines on data and methodology for GHG calculators

- CML: commissioned by SenterNovem to develop GHG calculator for bio-electricity and heat to support Dutch bio-based energy policy
- Dutch biofuel calculator developed by Ecofys and CE

LCA-based GHG calculators

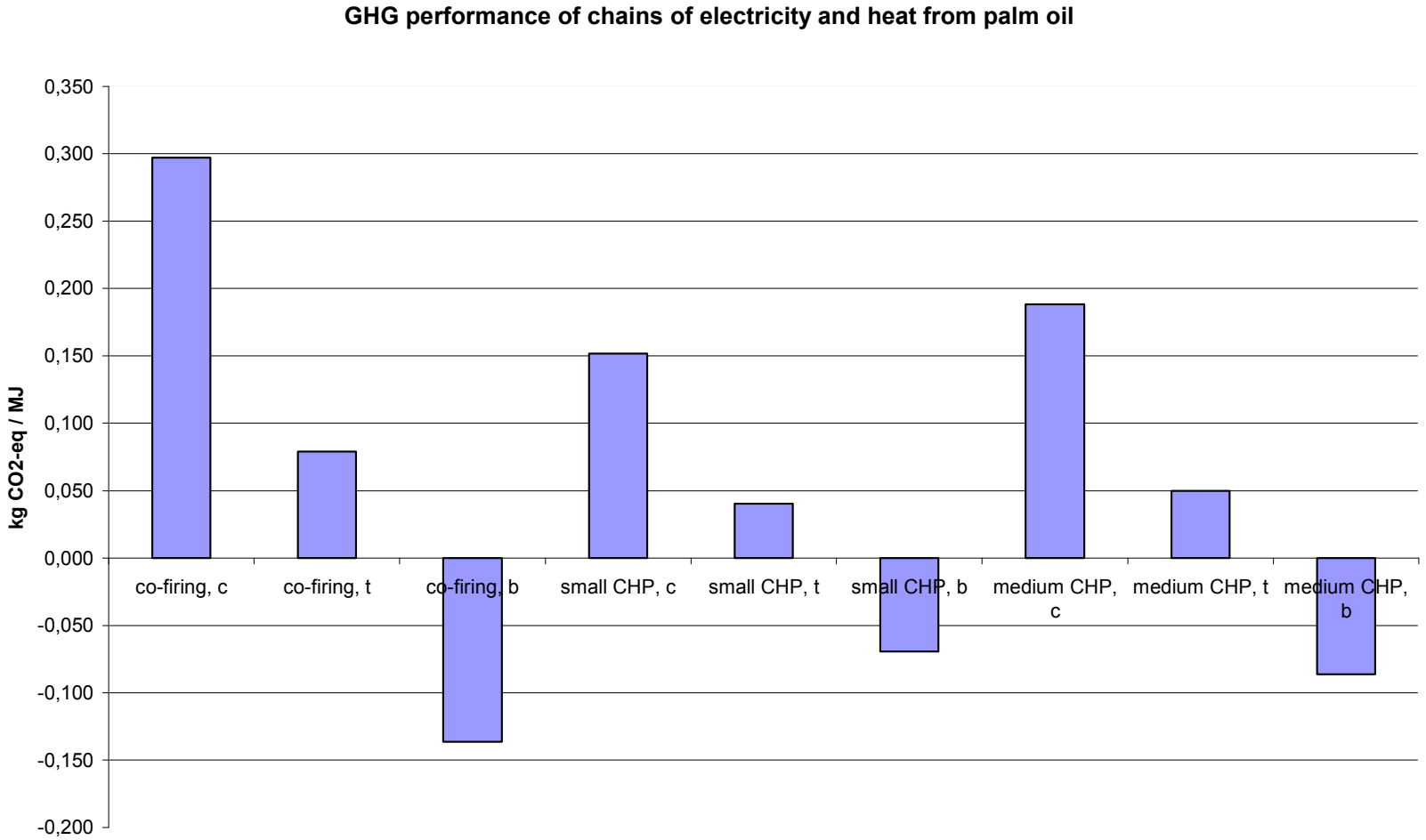
- Dutch GHG calculator for bio-electricity and heat:

- LCA-based: cradle-to-grave chains of electricity / heat
- Including GHG emissions (CO_2, CH_4, N_2O) in all life-cycle stages
- Adding them up to a total: chain GHG performance
  - » kg CO_2-equivalent per MJ electricity / heat
  - » Improvement compared to fossil reference
- Data from “generally accepted” sources
- Calculator based on LCA software: CMLCA >> E-LCA
- Publication of Technical Specification, Appendices, software and database by July 15: www.senternovem.nl

LCA-based GHG calculators

- Feedstocks
  - » Pure plant oils (PPO: palm oil, rape seed oil and soybean oil):
  - » Wood residues (wood chips, wood pellets and waste wood from construction)
  - » Agricultural crops (maize, grass)
  - » Agricultural residues (manure, straw, potato remains)
  - » Waste from the food industry (swill, animal fat & bone meal)
  - » Municipal solid waste (MSW, GFT, landfill gas)
  - » Sewage sludge
- Conversion processes
  - » (co-)firing
  - » CHP
  - » digestion
  - » gasification
  - » green gas production

Some results: electricity and heat from palm oil



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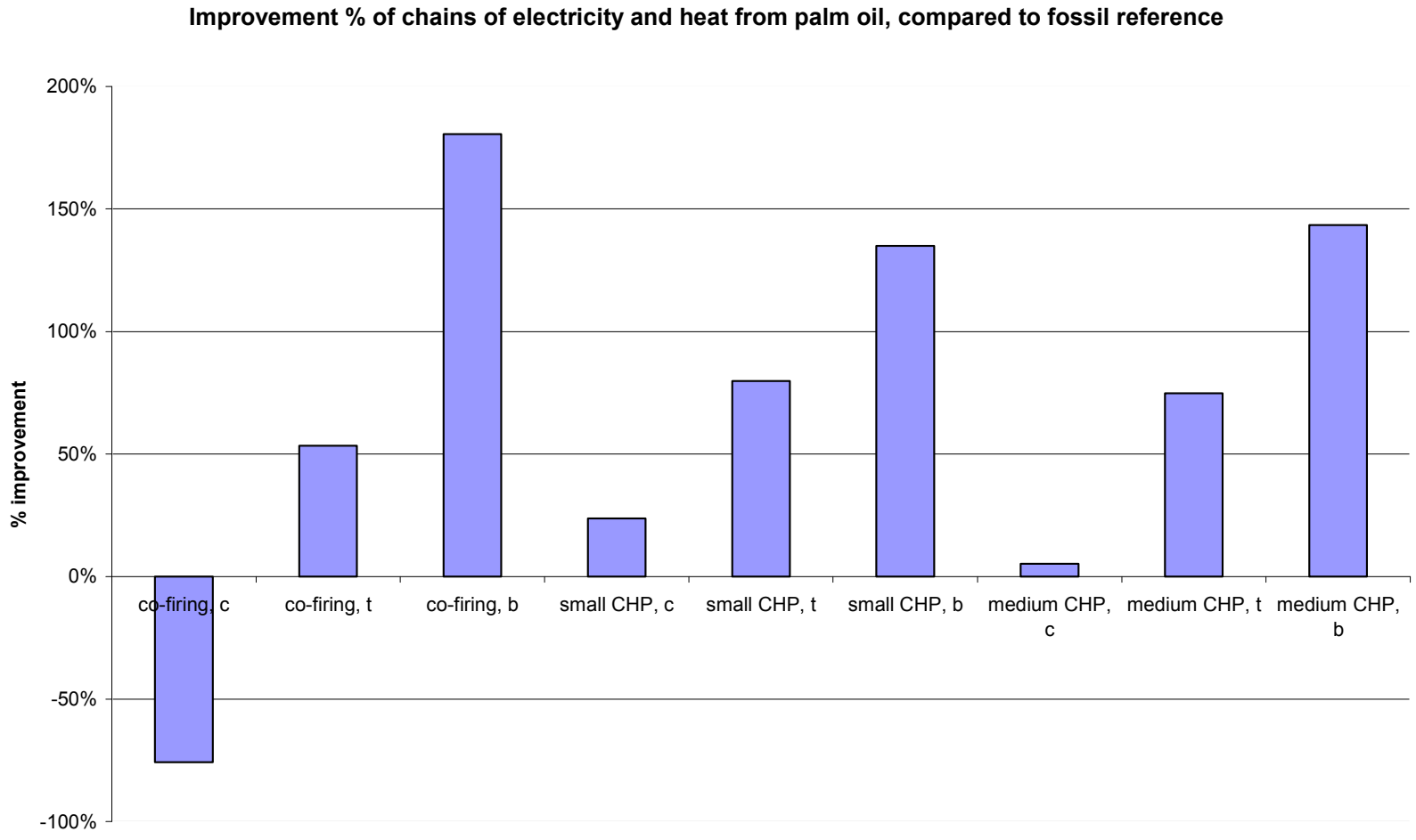
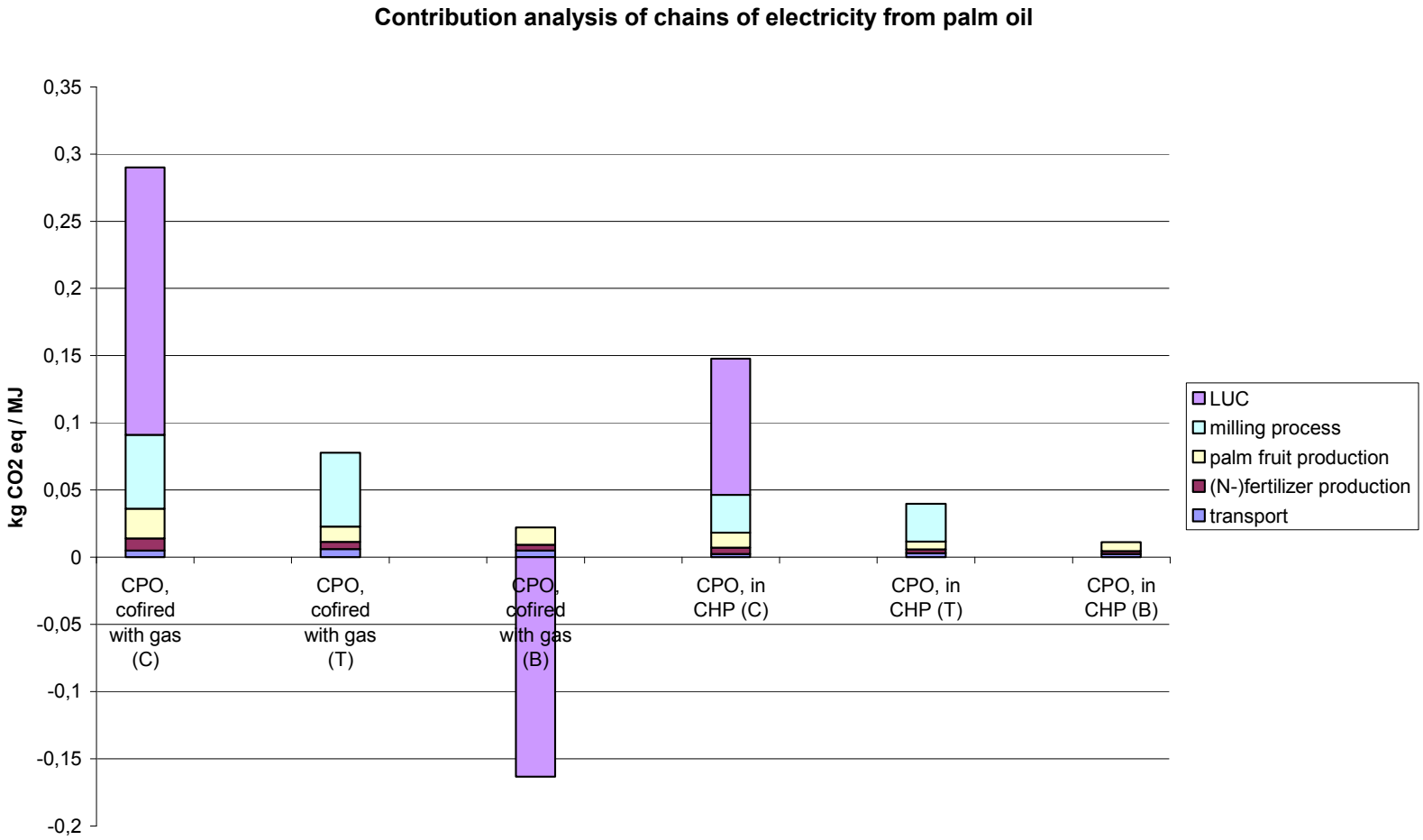
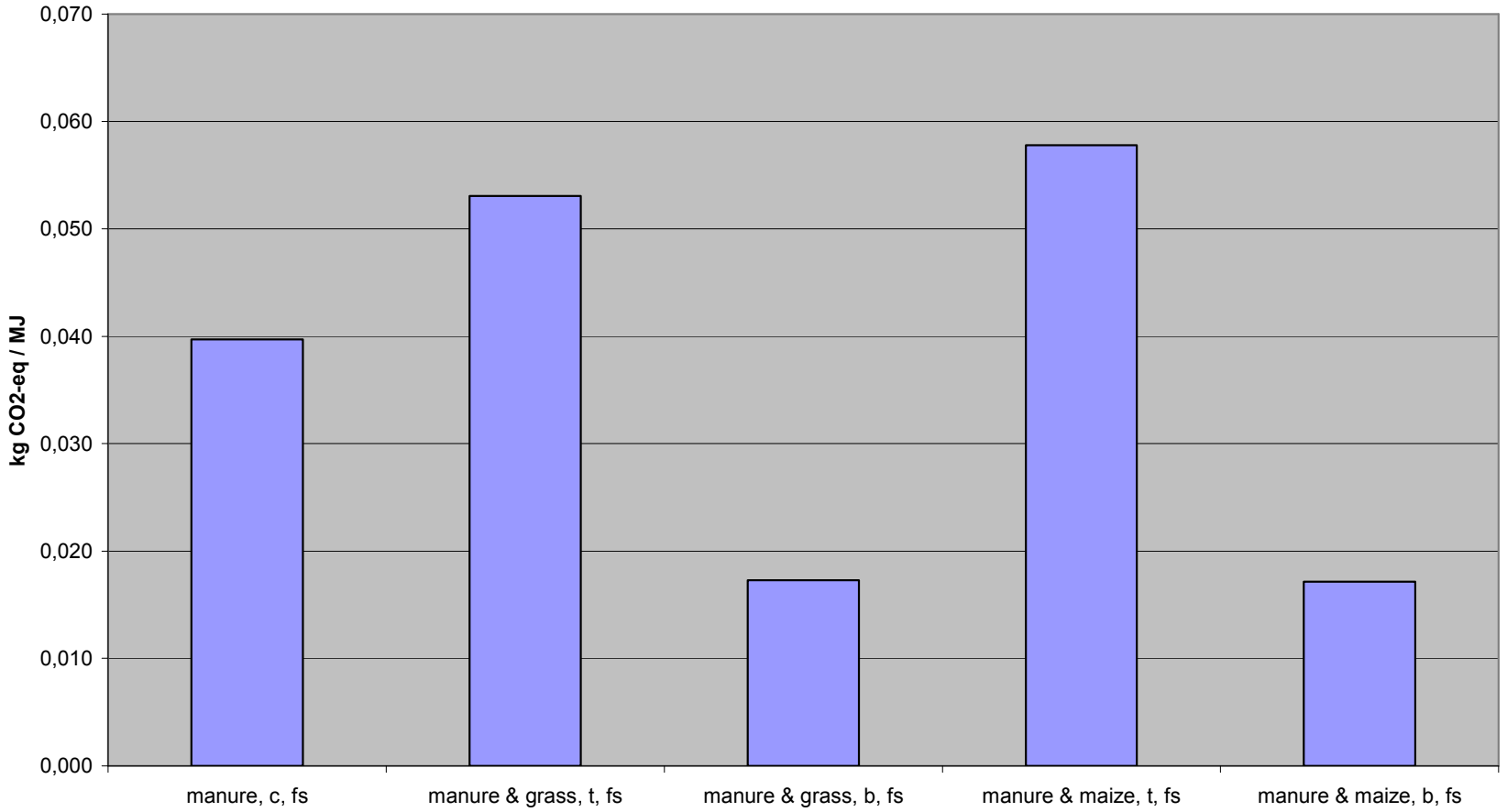


Some results: electricity and heat from palm oil

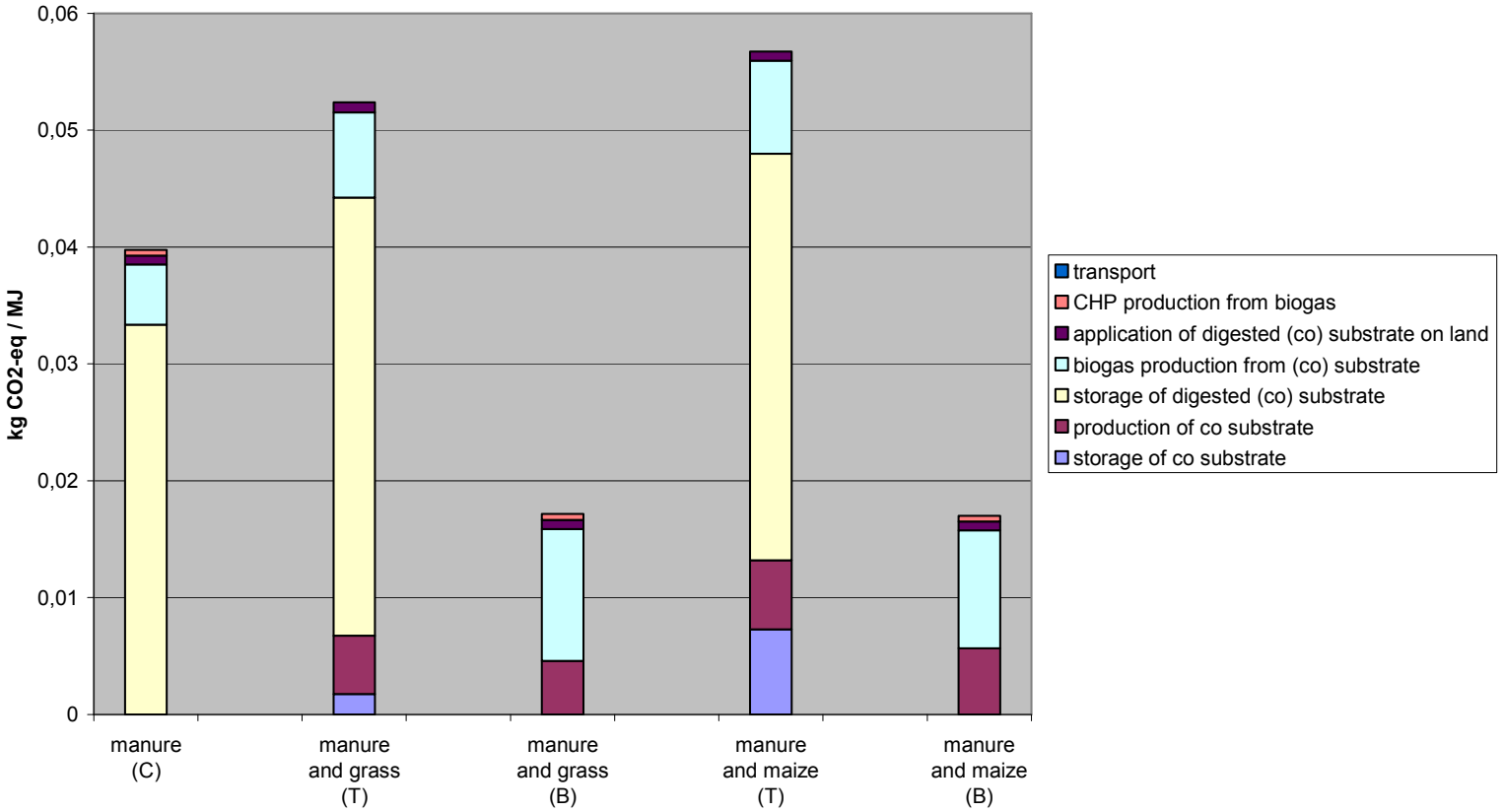


Some results: chains of digestion, farm scale

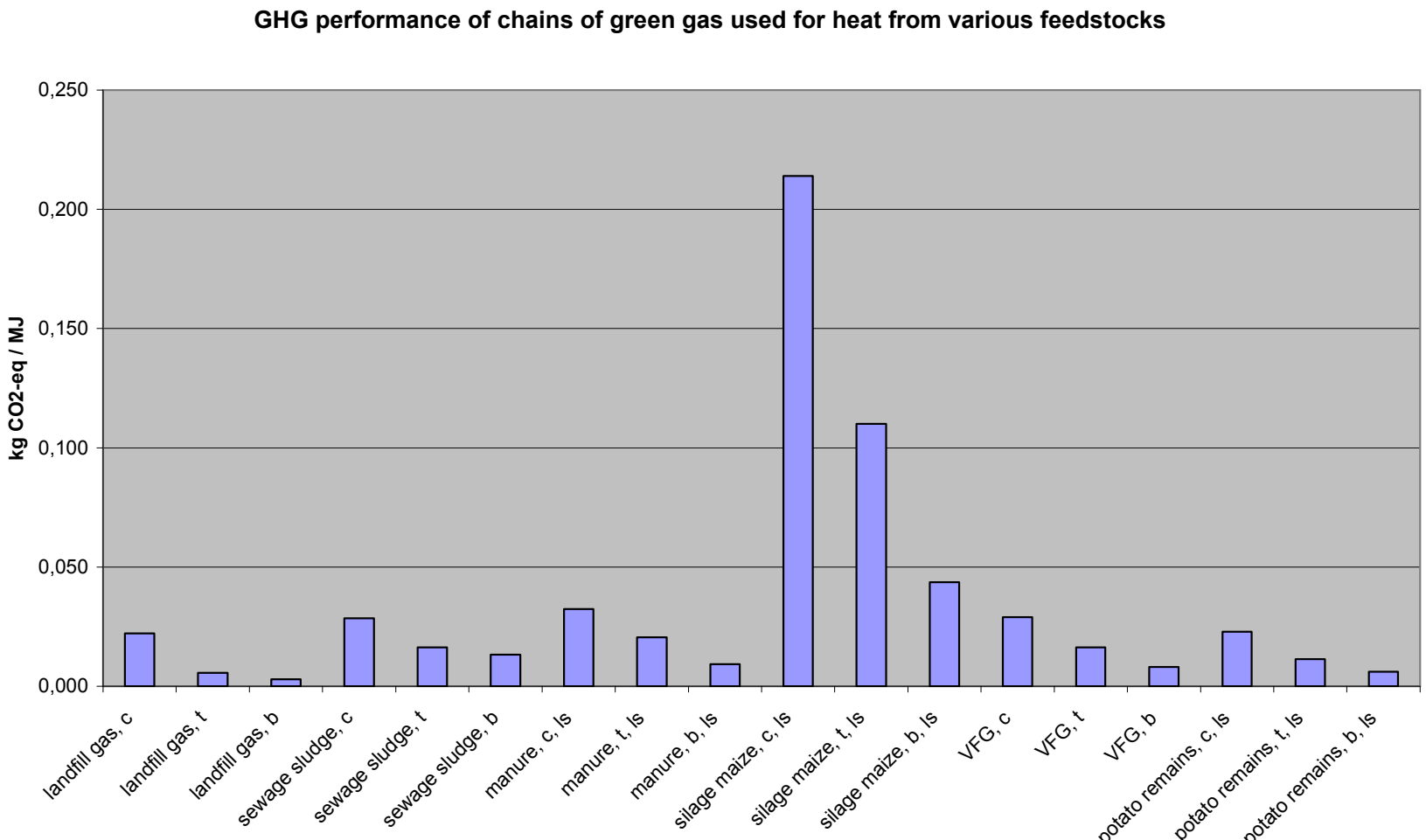
GHG performance of chains of electricity from farm scale digestion and CHP of various feedstocks



Some results: chains of digestion, farm scale

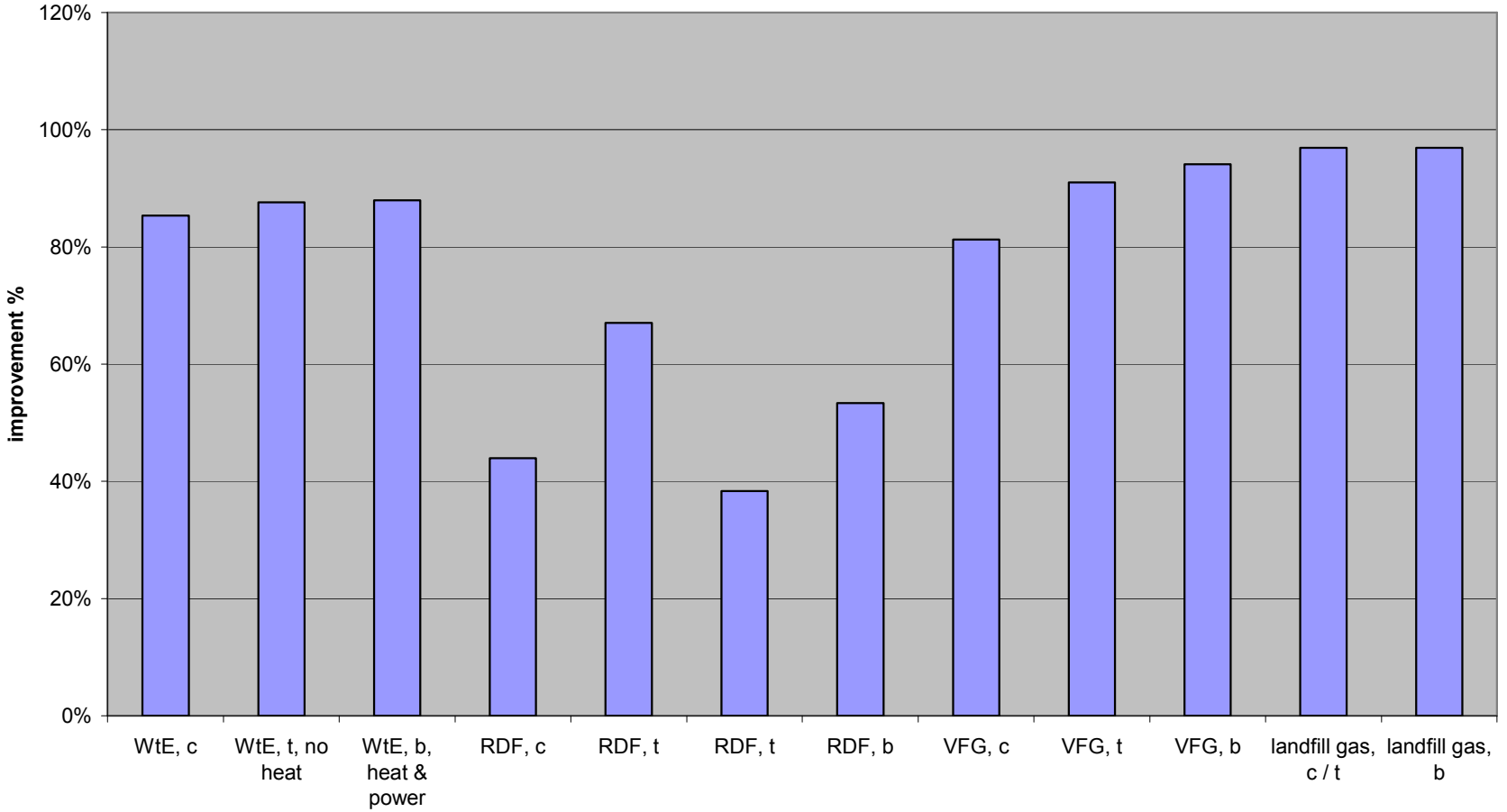


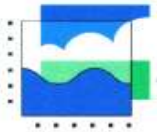
Some results: heat from green gas



Some results: electricity from MSW

Improvement % of chains of electricity from MSW and CHP, compared to fossil reference

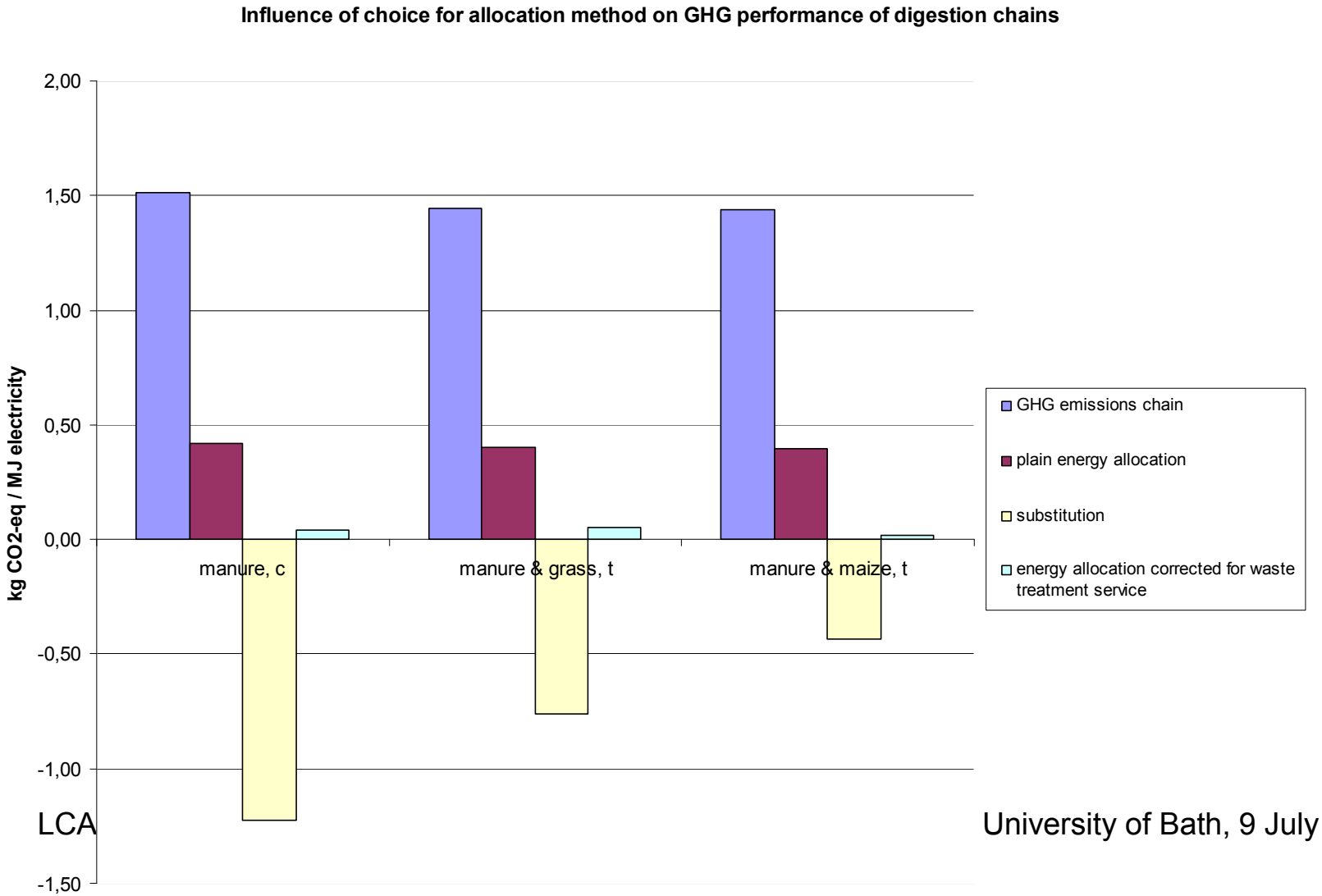




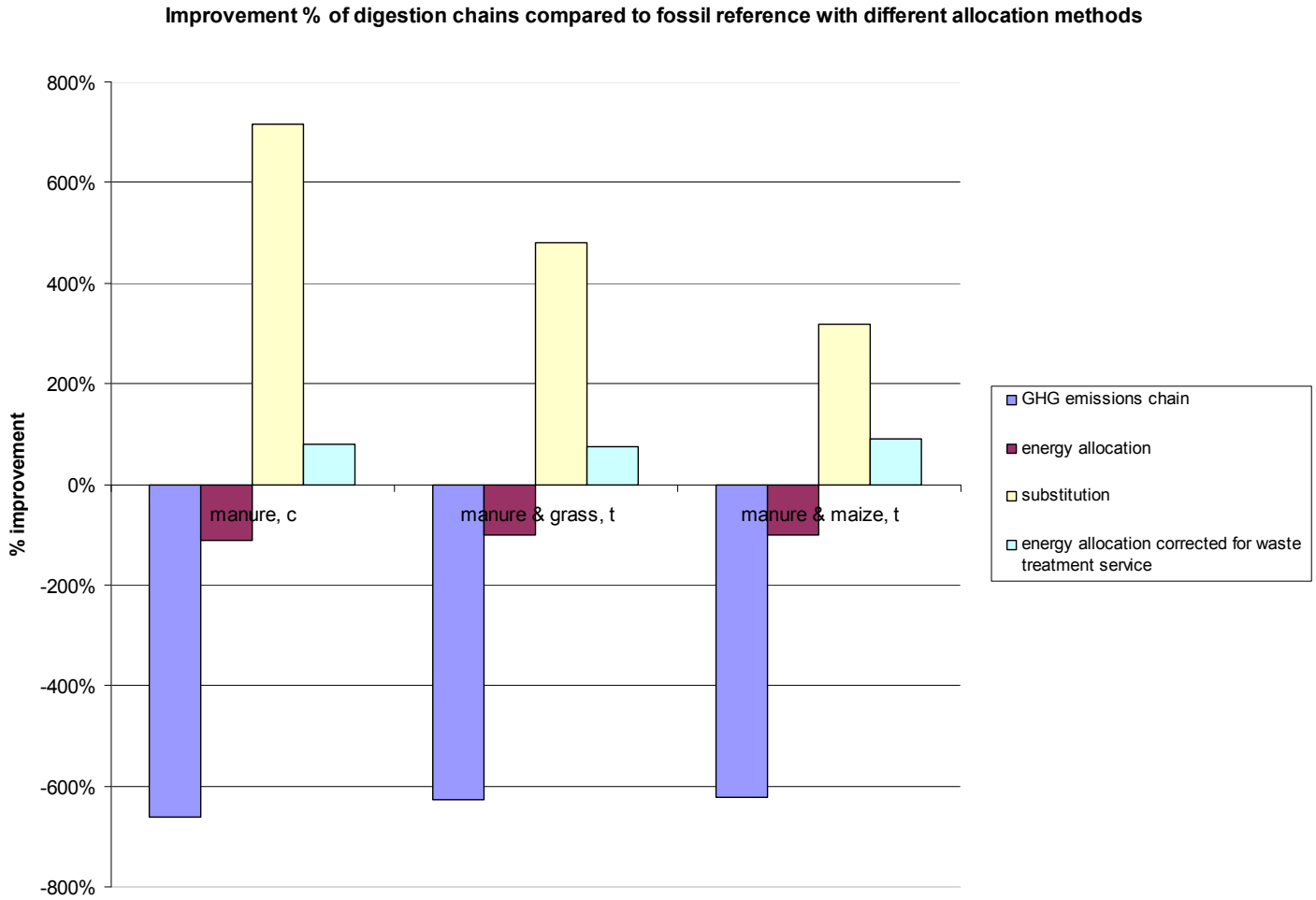
Some results

- Chains of electricity / heat from waste generally score well
  - » due to cut-off of production chain ...
  - » ... and allocation of part of process emissions to “service waste treatment”
- A lot depends on methodological choices, especially allocation in case of multi-output processes
  - » this can reverse results completely!

Methodological choices: influence of allocation



Methodological choices: influence of allocation



Consequences for policy supporting use

- Allocation is a choice: no uncertainties to be reduced
- So far no generally accepted method
- Countries disagreed
  - » UK: substitution “closest to reality”
  - » Germany: energy allocation “most robust”
  - » Netherlands: economic allocation “widest applicability and link with economic driving forces”
- EU followed Germany
  - » Intended use for subsidies does not allow variable outcomes
  - » Is alright for energy crops, first generation technology
  - » Is problematic for waste and residue feedstocks
  - » Solutions sought within the energy allocation framework: possible, but artificial
- International debate ongoing

Consequences for policy supporting use

- LCA-based calculators useful for general policy support and harmonisation:
  - » Agreement on description of energy chains
  - » Agreement on technology descriptions
  - » Framework for collection and improvement of data
  - » Easy to expand to other environmental impacts
- Also:
  - » Contribution analysis relevant for improvement of performance
- But use for subsidies / taxes not yet advisable
  - » Sensitivity for allocation choices
  - » Not yet sufficiently debated and agreed on
  - » Risk for manipulation of outcomes
  - » No level playing field for all feedstocks / conversion processes