



NORTH ENERGY

KEY FACTORS AFFECTING GREENHOUSE GAS BALANCES OF BIOENERGY SYSTEMS

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Key Factors

- ❁ Calculation Methodologies
 - ❁ Co-Product Allocation
 - ❁ Systems Boundaries
 - ❁ Reference Systems
 - ❁ Land Use Change
- ❁ Soil Nitrous Oxide Emissions
- ❁ Biomass Feedstocks and Technology
- ❁ Future Challenges for Assessing Sustainability

Effect of Calculation Methodologies

❁ Evaluation of Total Greenhouse Gases (GHG):

- ❁ Carbon Dioxide, Methane and Nitrous Oxide

- ❁ Other GHG Emissions?

- ❁ Varying Global Warming Potentials (GWPs)

❁ Calculation Methodologies:

- ❁ Life Cycle Assessment (LCA)

- ❁ International Standard ISO 14040 Series

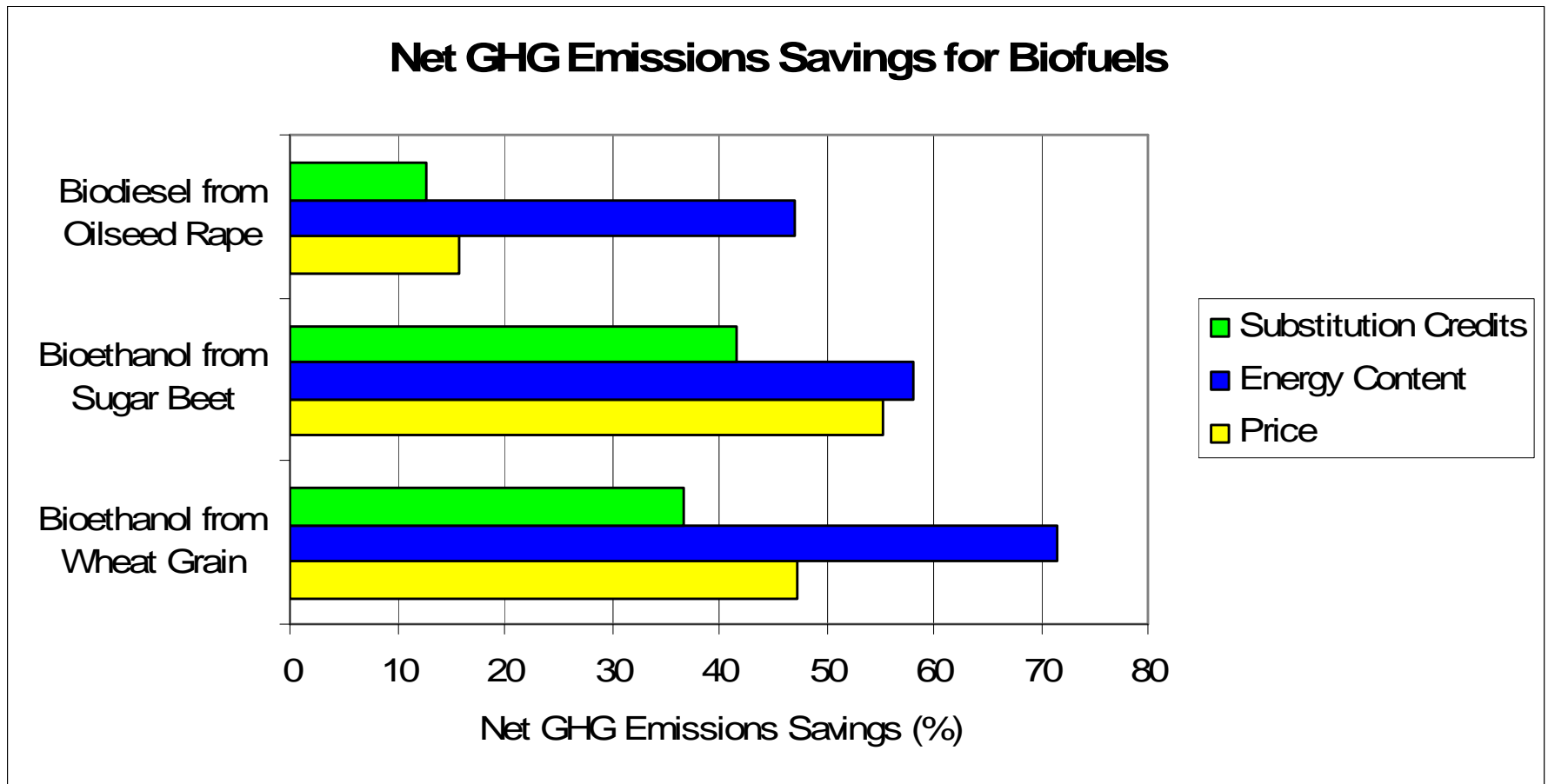
- ❁ British Standard PAS 2050

- ❁ Renewable Fuels Agency Technical Guidance

- ❁ European Commission Renewable Energy Directive

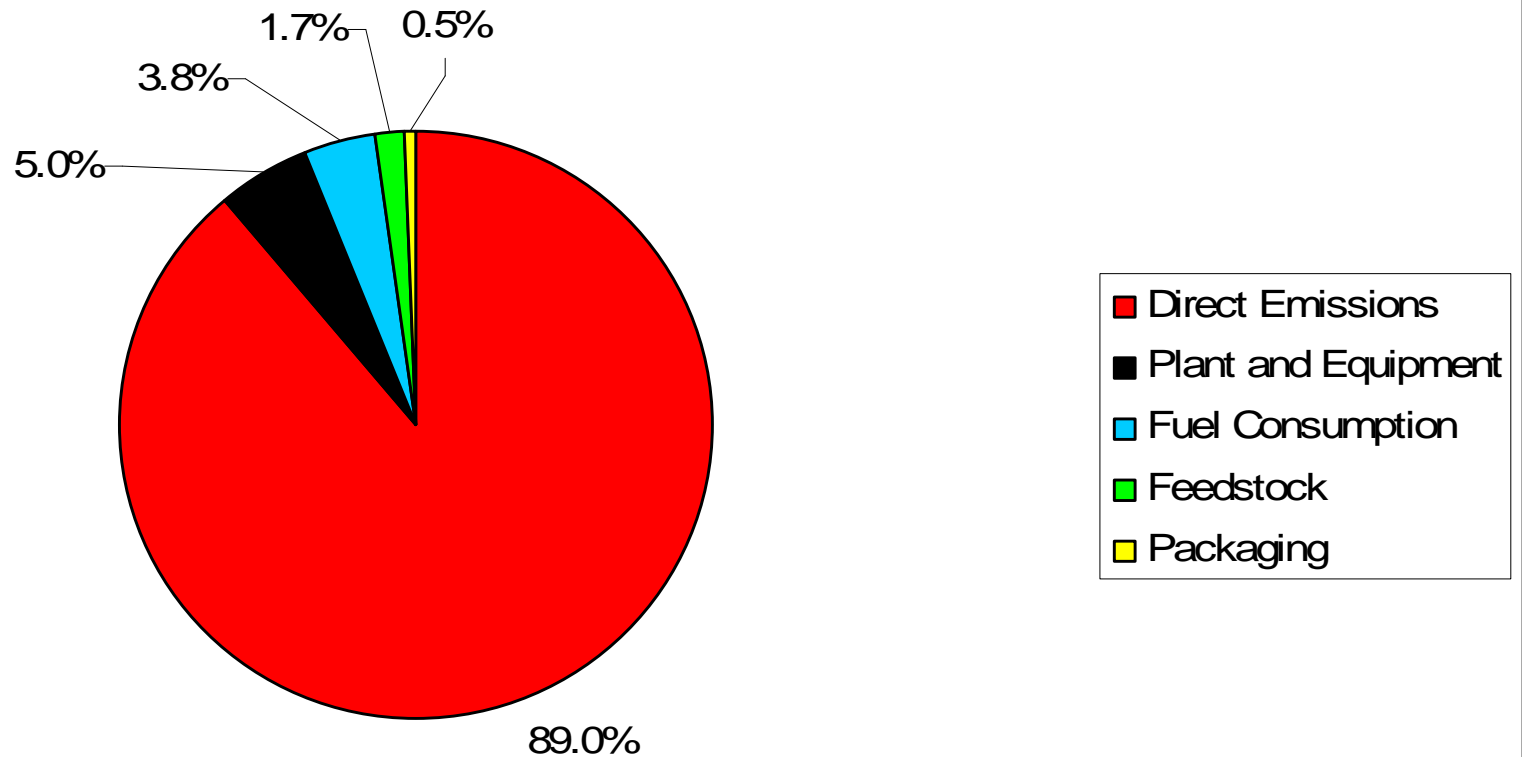
- ❁ Biofuels ✓ Bioenergy X

Co-Product Allocation



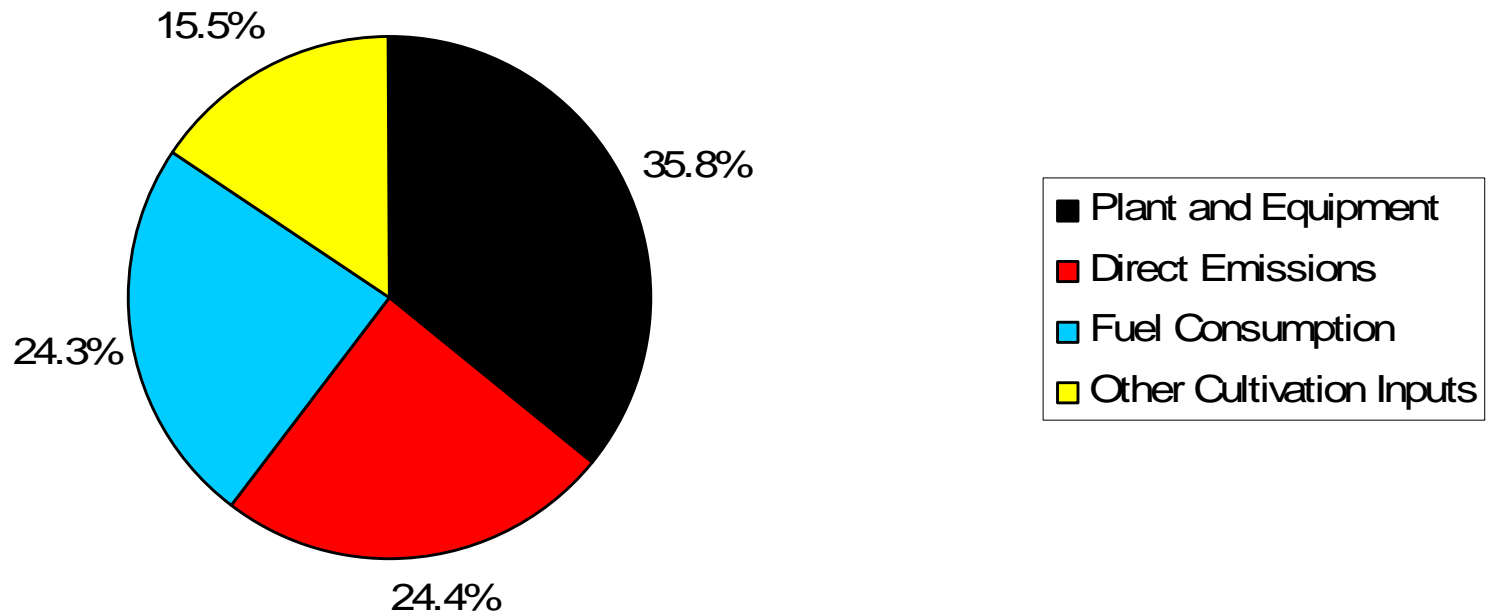
Effect of System Boundaries: Plant and Equipment - I

Total GHG Emissions for N Fertiliser Manufacture

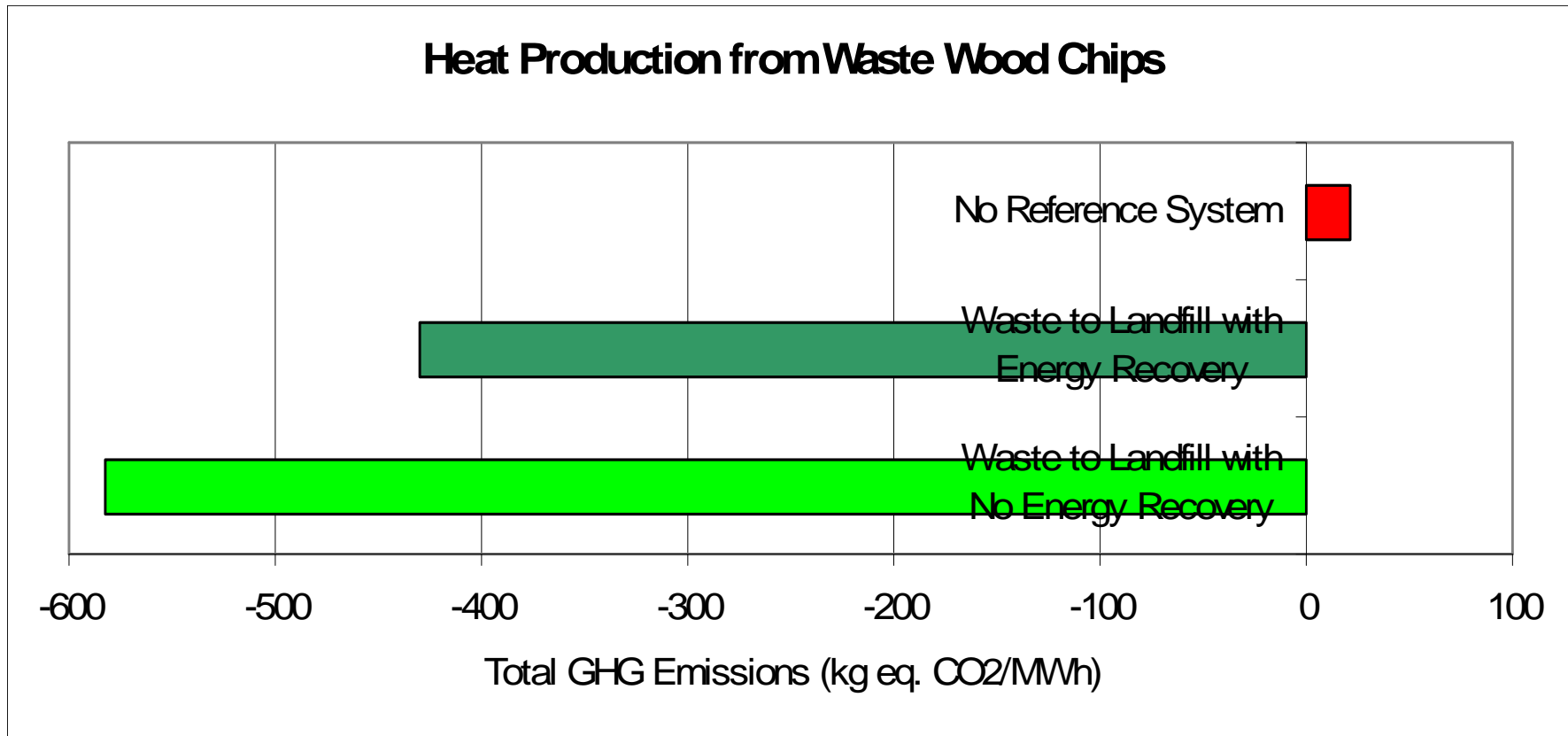


Effect of System Boundaries: Plant and Equipment - II

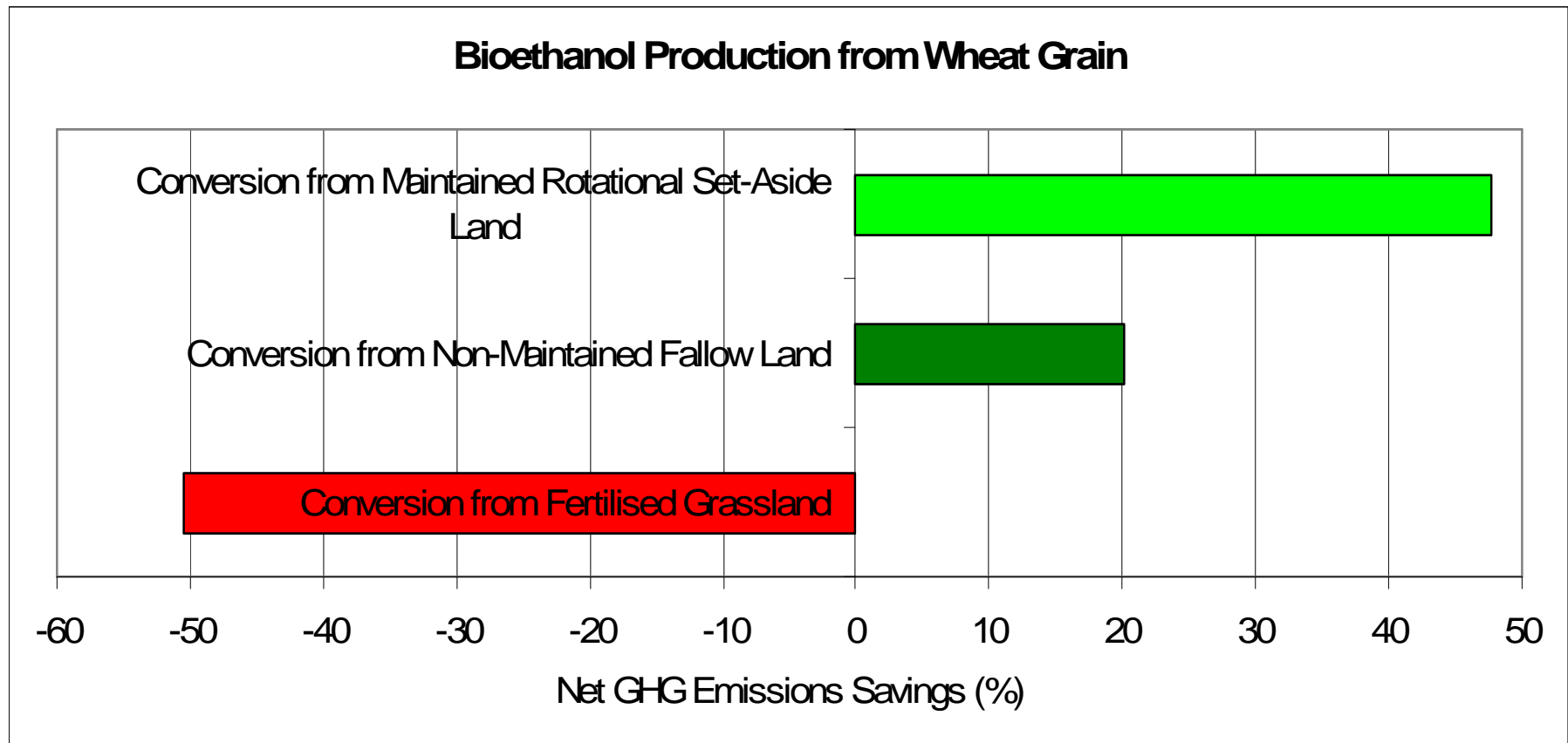
Total GHG Emissions for Heat from SRC Wood Chips



Effect of Reference Systems: Waste Disposal

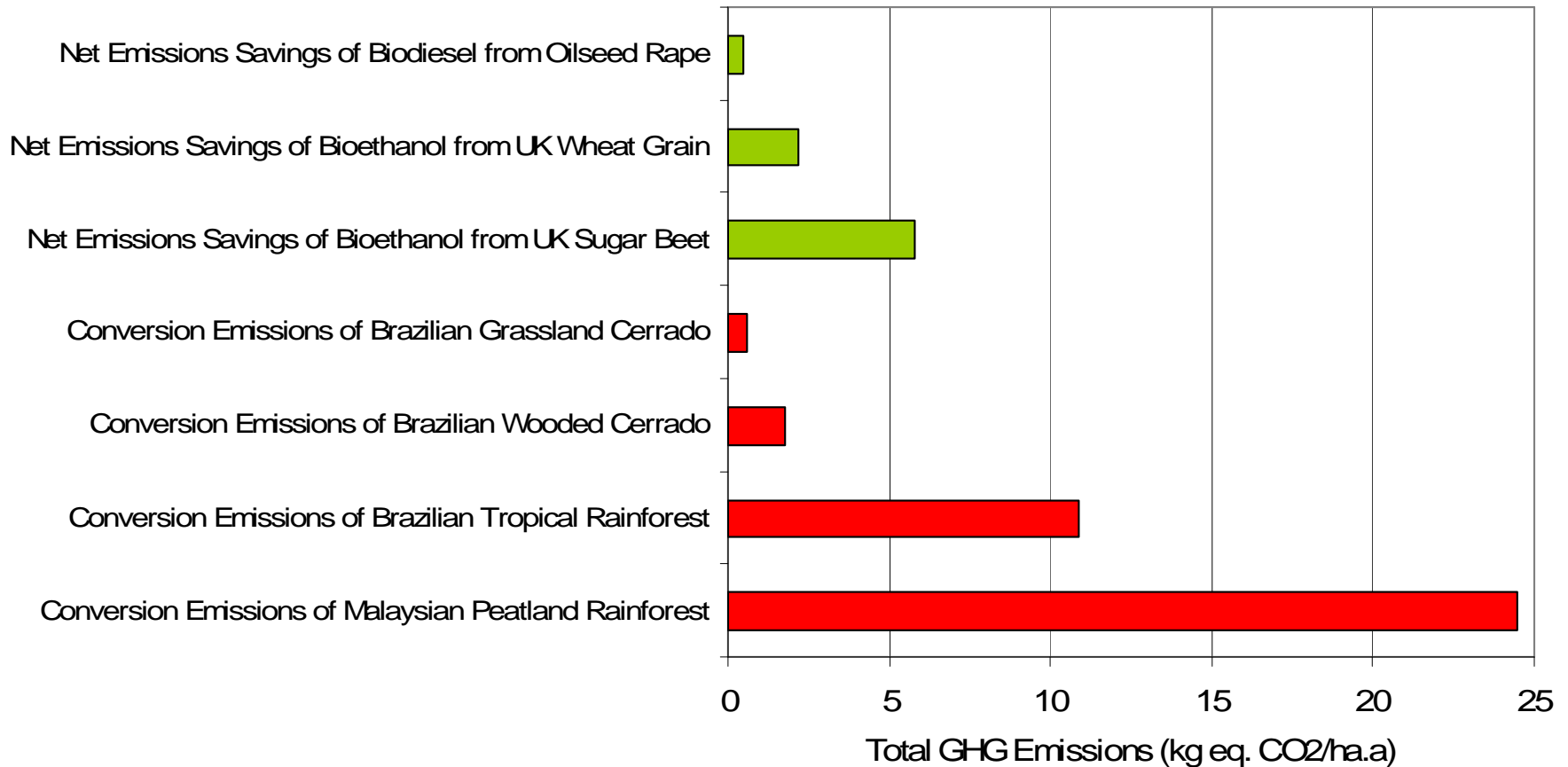


Effect of Reference Systems: Direct Land Use Change

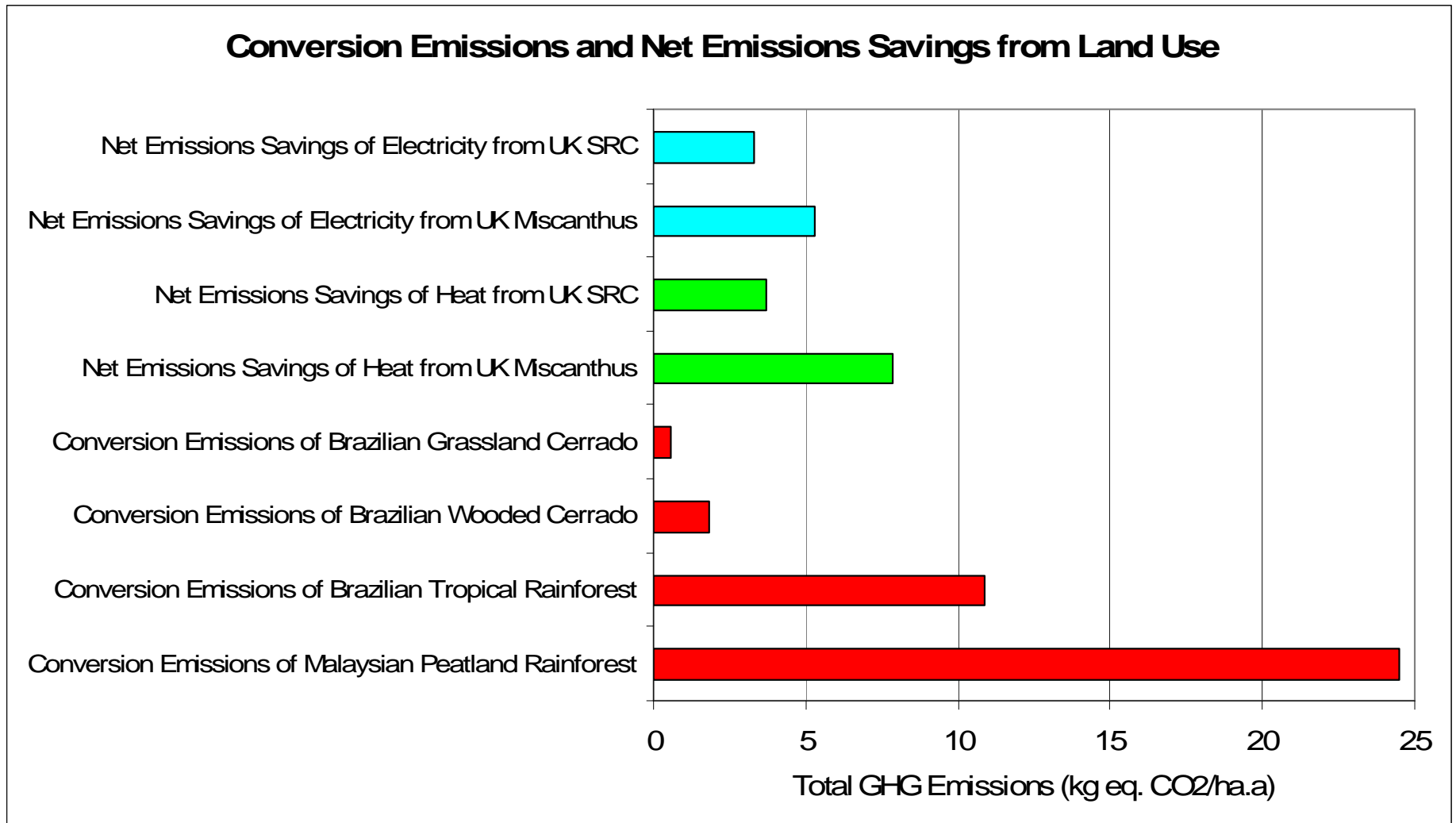


Effect of Reference Systems: Indirect Land Use Change - I

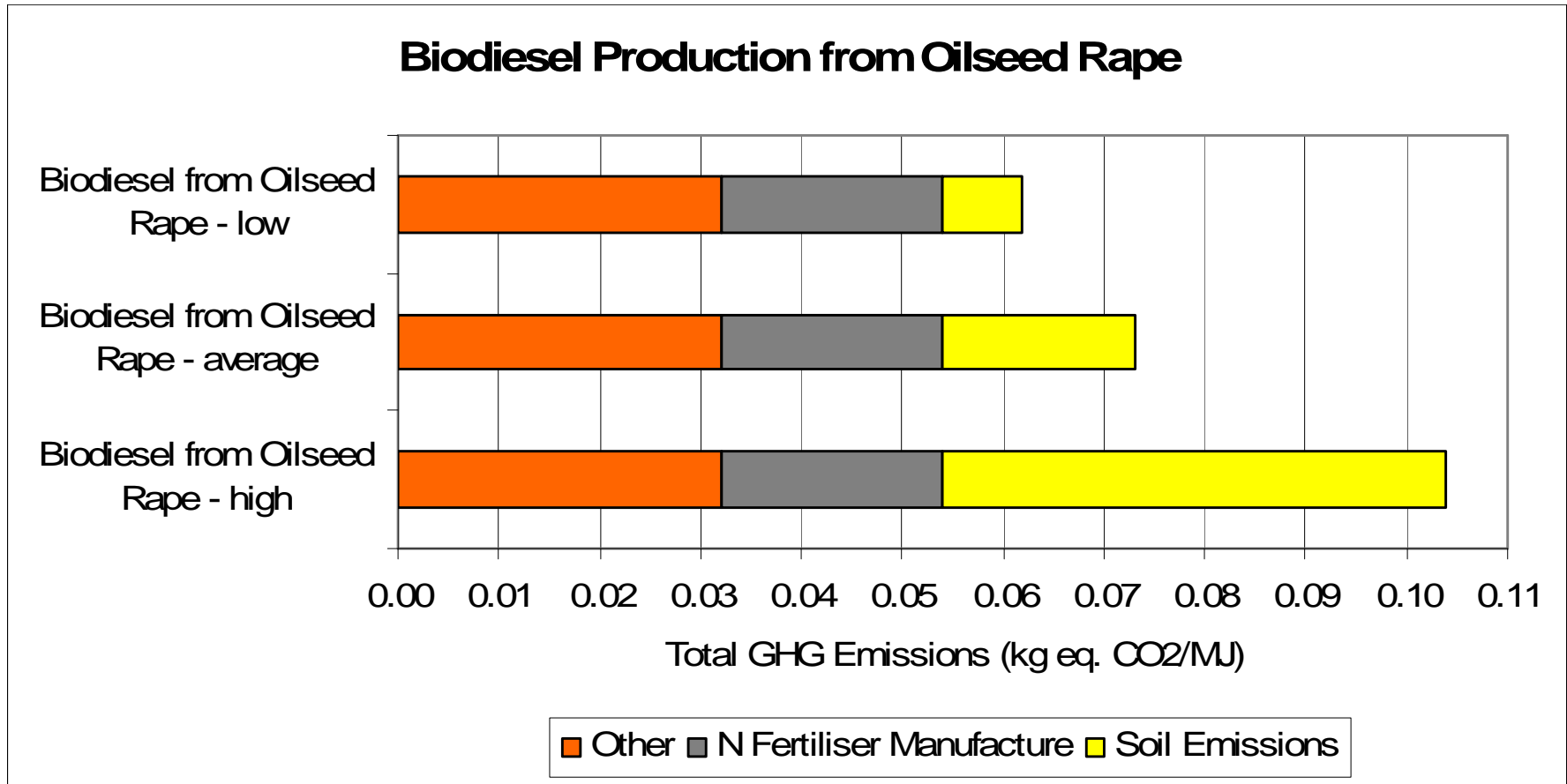
Conversion Emissions and Net Emissions Savings from Land Use



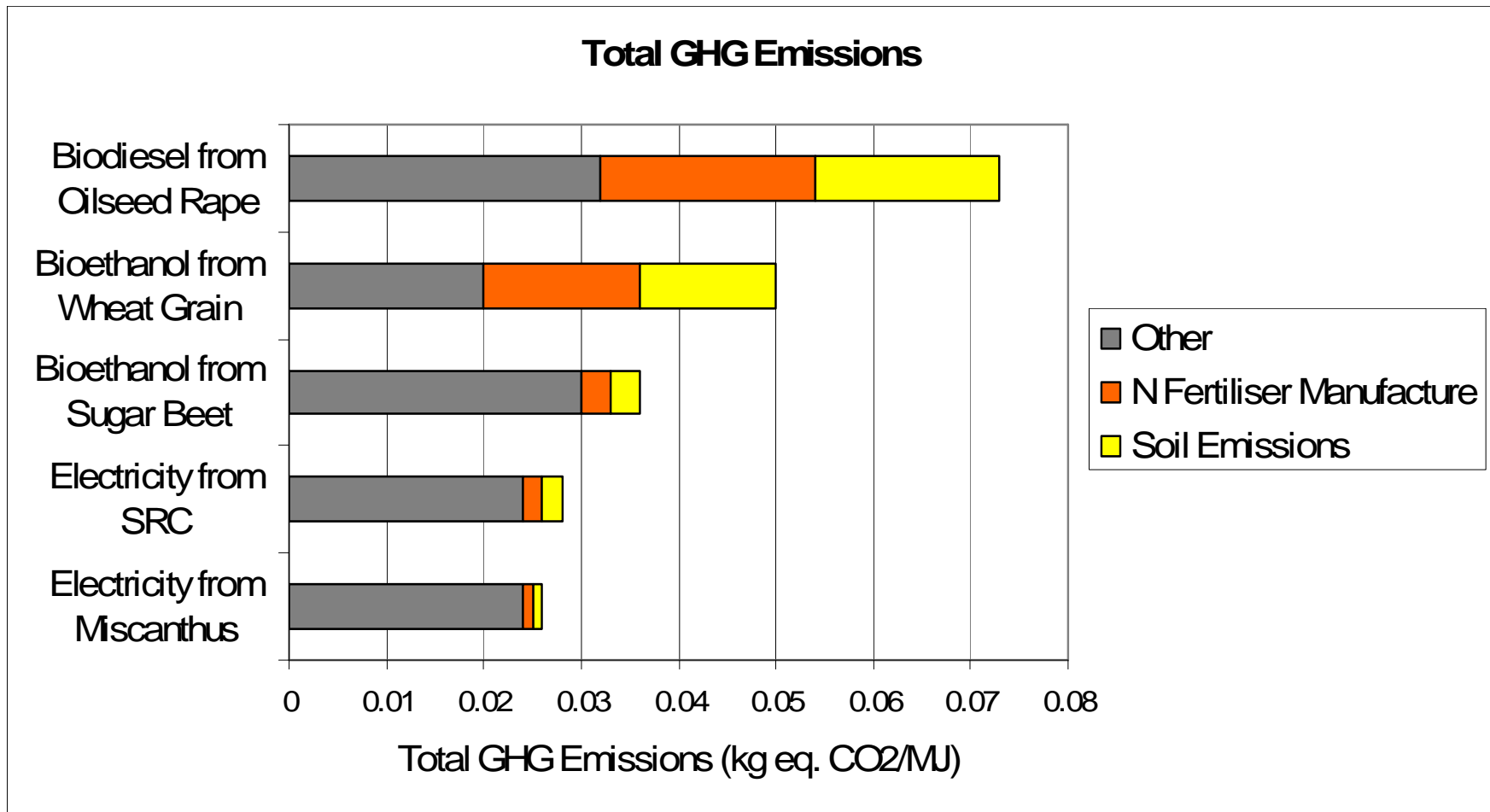
Effect of Reference Systems: Indirect Land Use Change - II



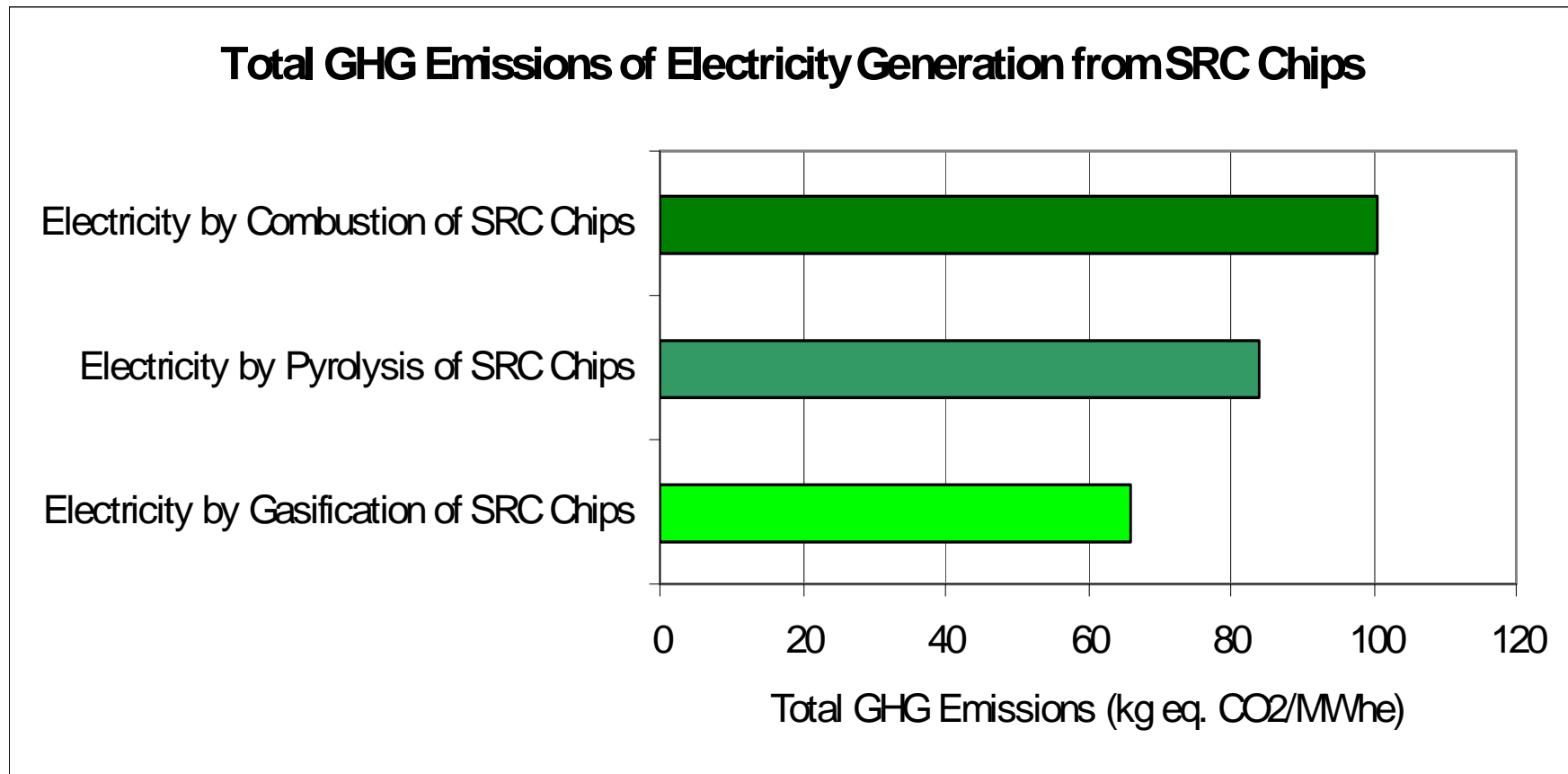
Effect of Soil Nitrous Oxide Emissions: Uncertainty in IPCC Tier 1 Values



Effect of Soil Nitrous Oxide Emissions: Biomass Feedstock

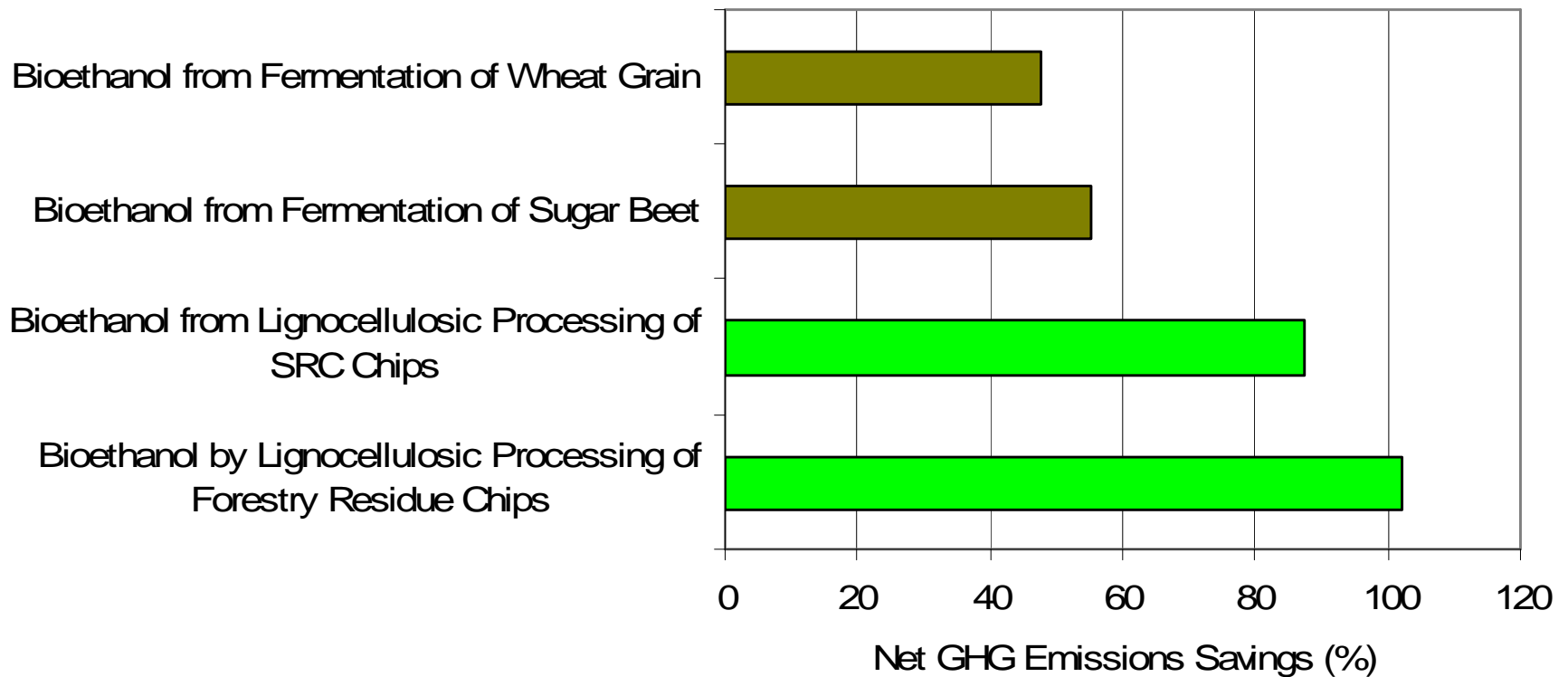


Effect of Biomass Feedstock and Technology: Electricity Generation



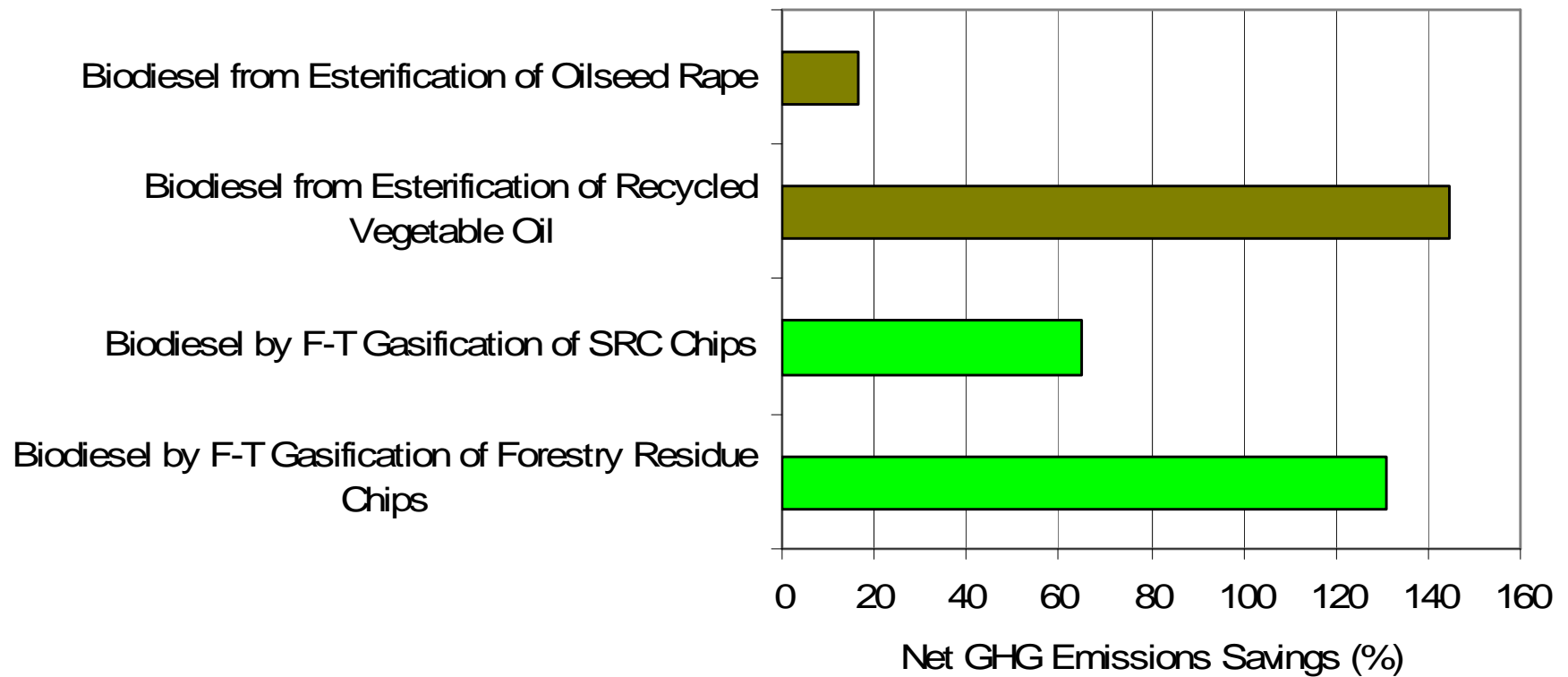
Effect of Biomass Feedstock and Technology: Bioethanol Production

Current and Future Bioethanol Production



Effect of Biomass Feedstock and Technology: Biodiesel Production

Current and Future Bioethanol Production



Future Challenges for Assessing Sustainability

- ✿ GHG Emissions = global climate change only
- ✿ Unified and universal calculation methodology
- ✿ Common, extensive and regularly-updated database
- ✿ Resolution of scientific uncertainties
- ✿ Widespread acceptance of results
- ✿ Transparency in calculations



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Thank you for your attention
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