



Biofuels and Renewables Sustainability and Bioenergy Standards

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It's not what to think, it's how to think

A Latte

208 liters per cup

Lid



Cup

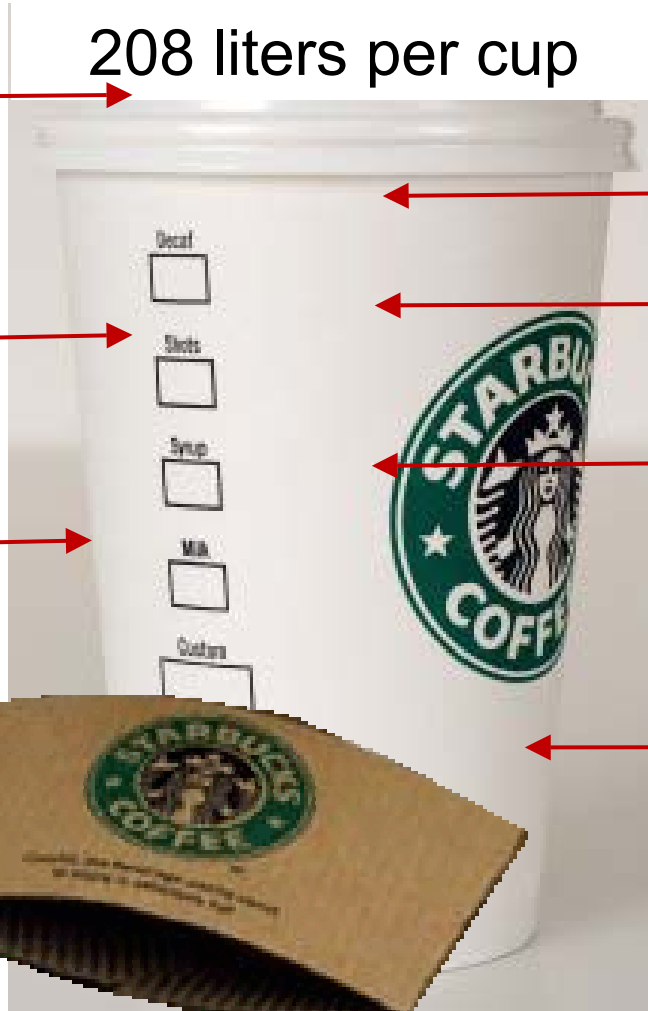


Energy

Wrapper



= 1 liter



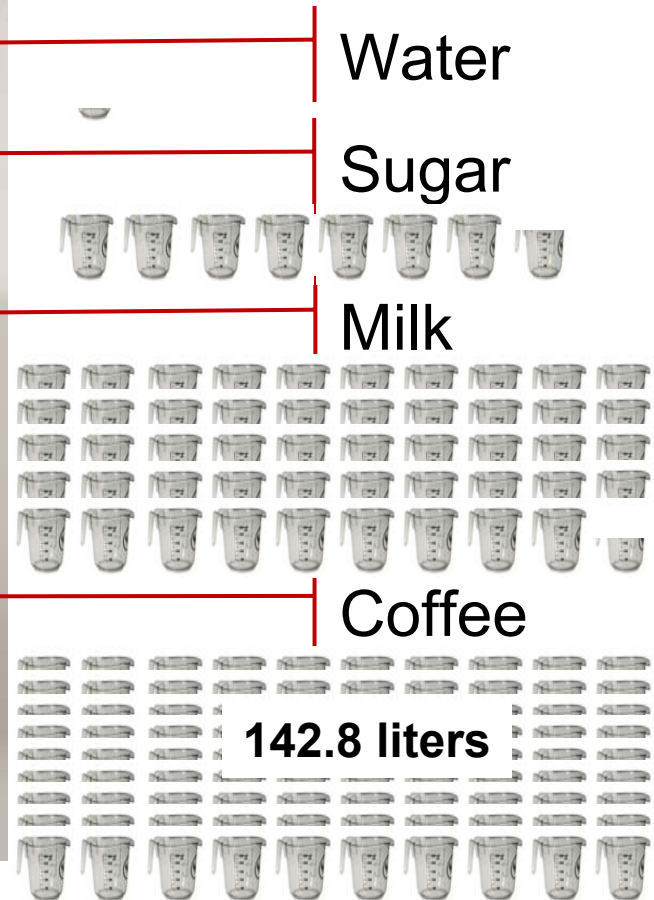
Water

Sugar

Milk

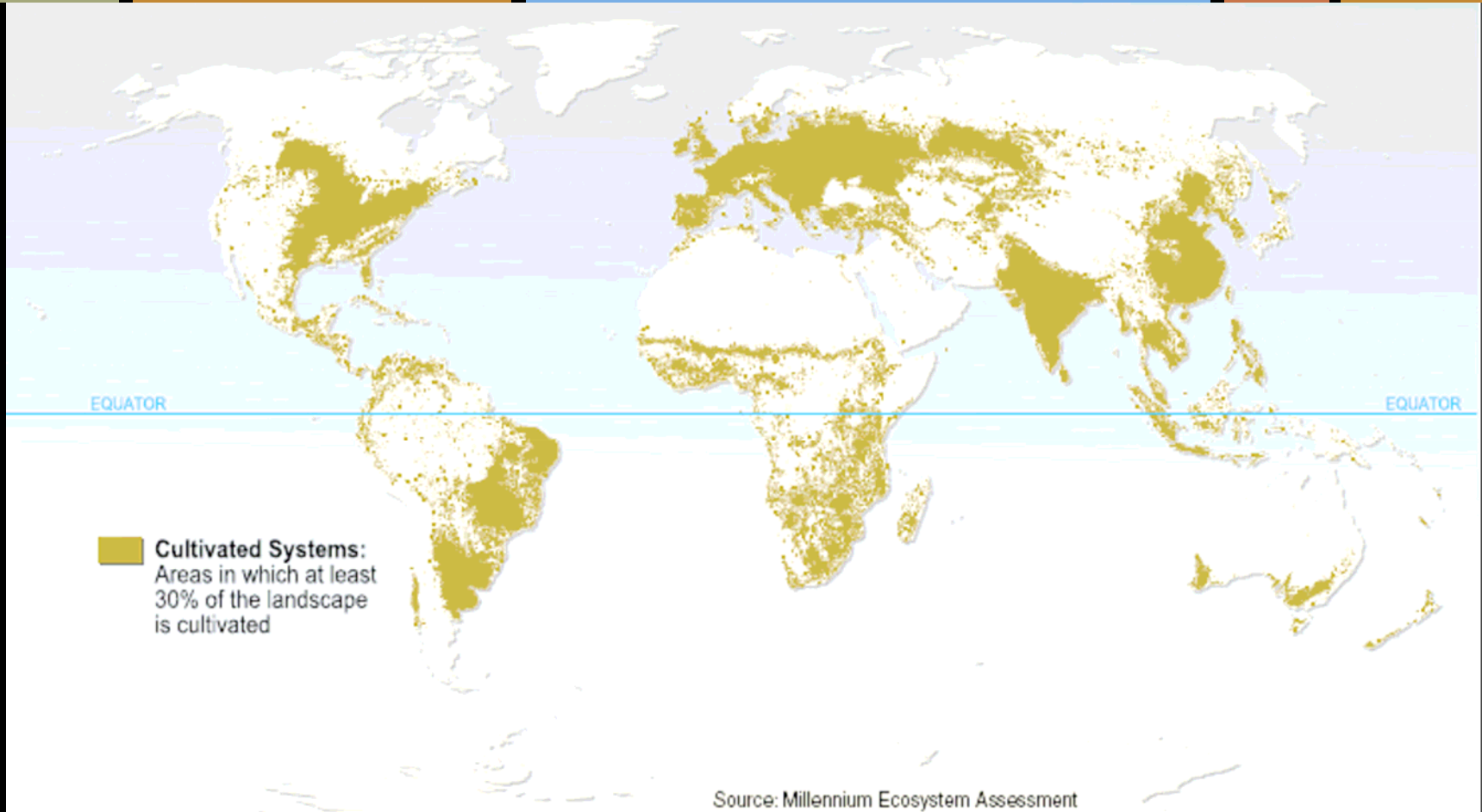
Coffee

142.8 liters





Agriculture's Global Footprint



33% of earth's surface in crops or grazing but 55% of habitable area



World Agriculture and the Environment

- Habitat loss—55% and counting
- Water take—70% of human use, >60% wasted
- Loss of soil—half of topsoil lost globally; 70-90% of farmers loose more carbon/year than put back
- Agro-chemicals—more used in agriculture than any other industry
- Pollution—more than any other human activity
- Climate change—25-40% of greenhouse gases that contribute to climate change

And now there is the issue of biofuels and renewables



Bioenergy from Agriculture

■ Biodiesel

- Palm oil
- Canola/Rape
- Soy
- Jatropha
- Castor oil
- Sunflower
- Safflower

■ Bioethanol

- Sugarcane
- Sugar beet
- Corn/Maize
- Wheat
- Grapes

■ Cellulosic Ethanol

- Crop residue (rice, wheat, corn, sorghum)
- Perennial grasses
- Temperate tree plantations
- Tropical tree plantations

■ #2 Heating/Furnace Oil

- Palm oil

■ Renewable Energy

- Crop residue
- Temperate tree plantations
- Tropical tree plantations



Key Environmental Impacts

Impacts / hectare and impacts / liter

- Habitat and biodiversity loss
- Net carbon impacts (footprint or LCA)
- Soil health and erosion
- Water use and effluents
- Agrochemicals and total toxicity
- Air Pollution
- Net energy
- GHG and
- Processing



Focus—Better Practices or Performance?





Some Key Issues for Each Throughput

- Cost of production
 - Compared with petroleum-based products
 - Compared with each other
- Energy
 - Total energy yields per hectare
 - Net energy per hectare
 - Non-renewable energy requirements (direct and embedded)
- Subsidies or tariffs
- Which can improve most (e.g. management, genetics)?
- Which can be grown on degraded lands?



Standards for Bioenergy

- Global and for multiple crops—“Meta-standards”
- Principles, Criteria, Indicators, and Standards
- Strategic—target key impacts
- Measurably reduce impacts (e.g. focus on results not BMPs)
- Developed through transparent and multi-stakeholder processes
- On-farm and cumulative impacts



Global Context

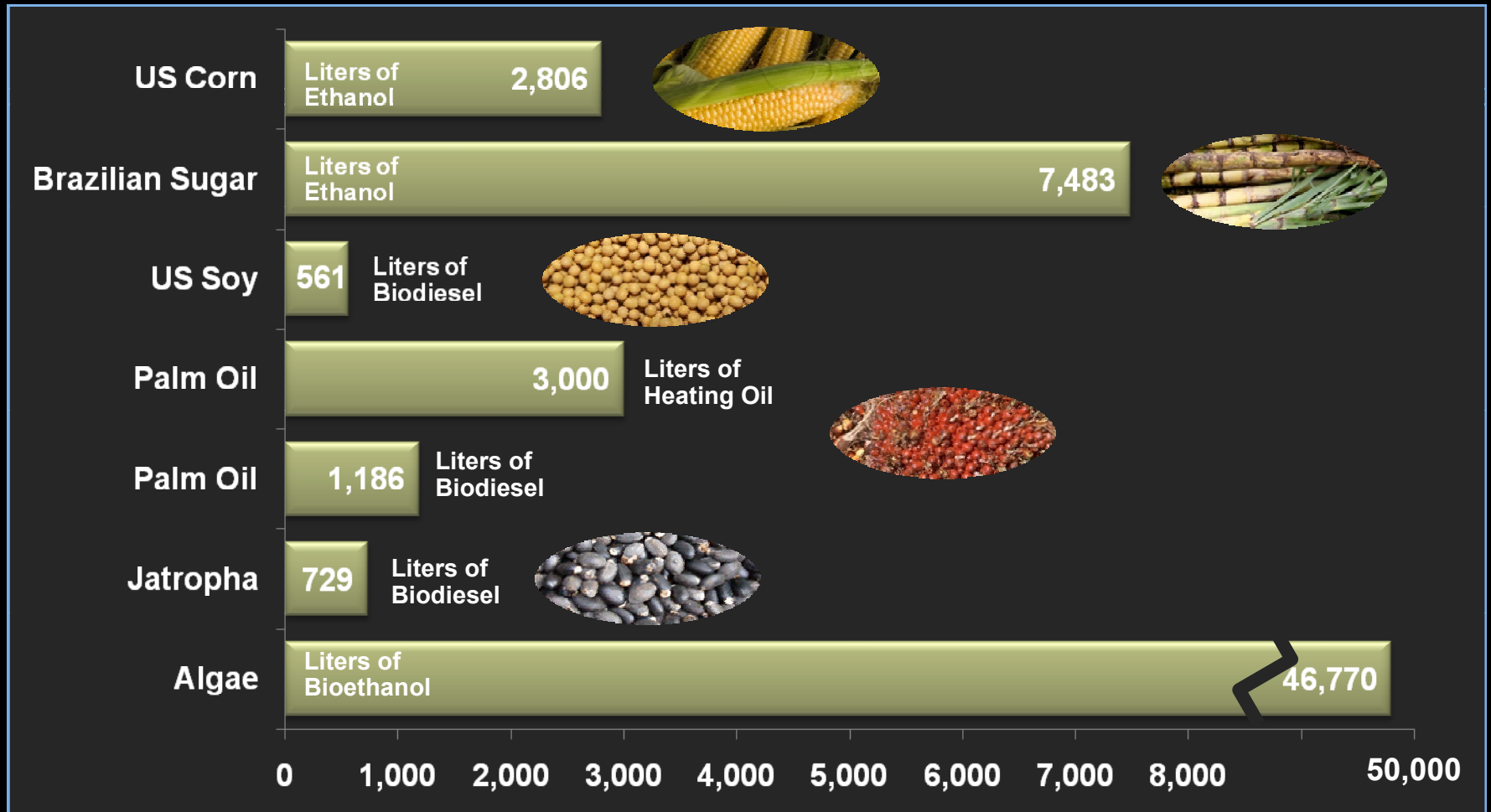
- Lack of comparable data to make informed decisions
- No agreed on methodology
 - To compare across throughputs
 - To make lifecycle analyses
- Focus is on price and profitability, not sustainability or net impacts
- Need to anticipate impacts—where will production shift in 20 years?
- What crops will dominate biofuels—which are dead ends?

Goals:

- Understand how to think about these issues, not what to think.
- Focus research efforts on key issues to enable comparisons.

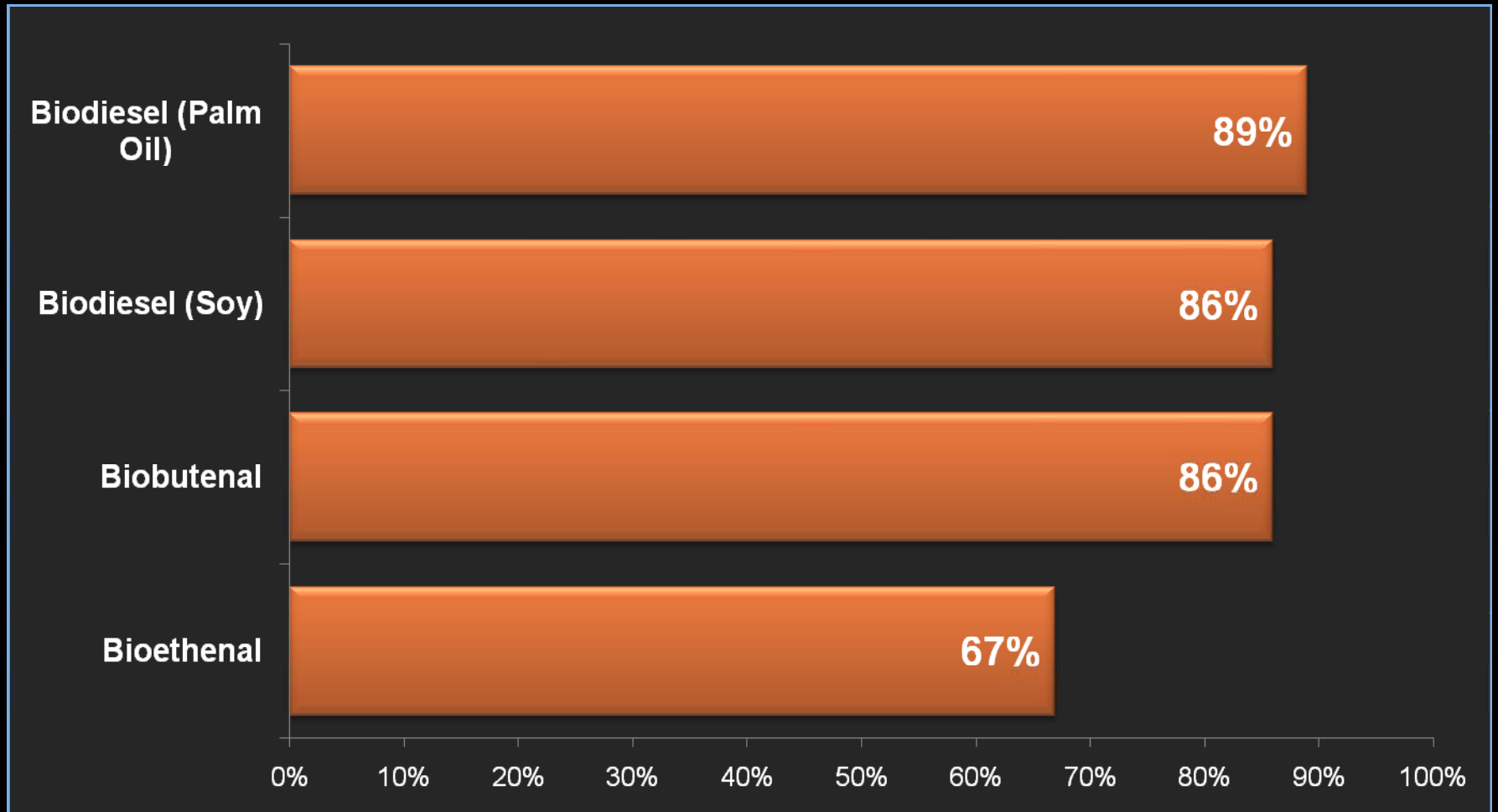


Energy Productivity (Liters / Hectare / Year)



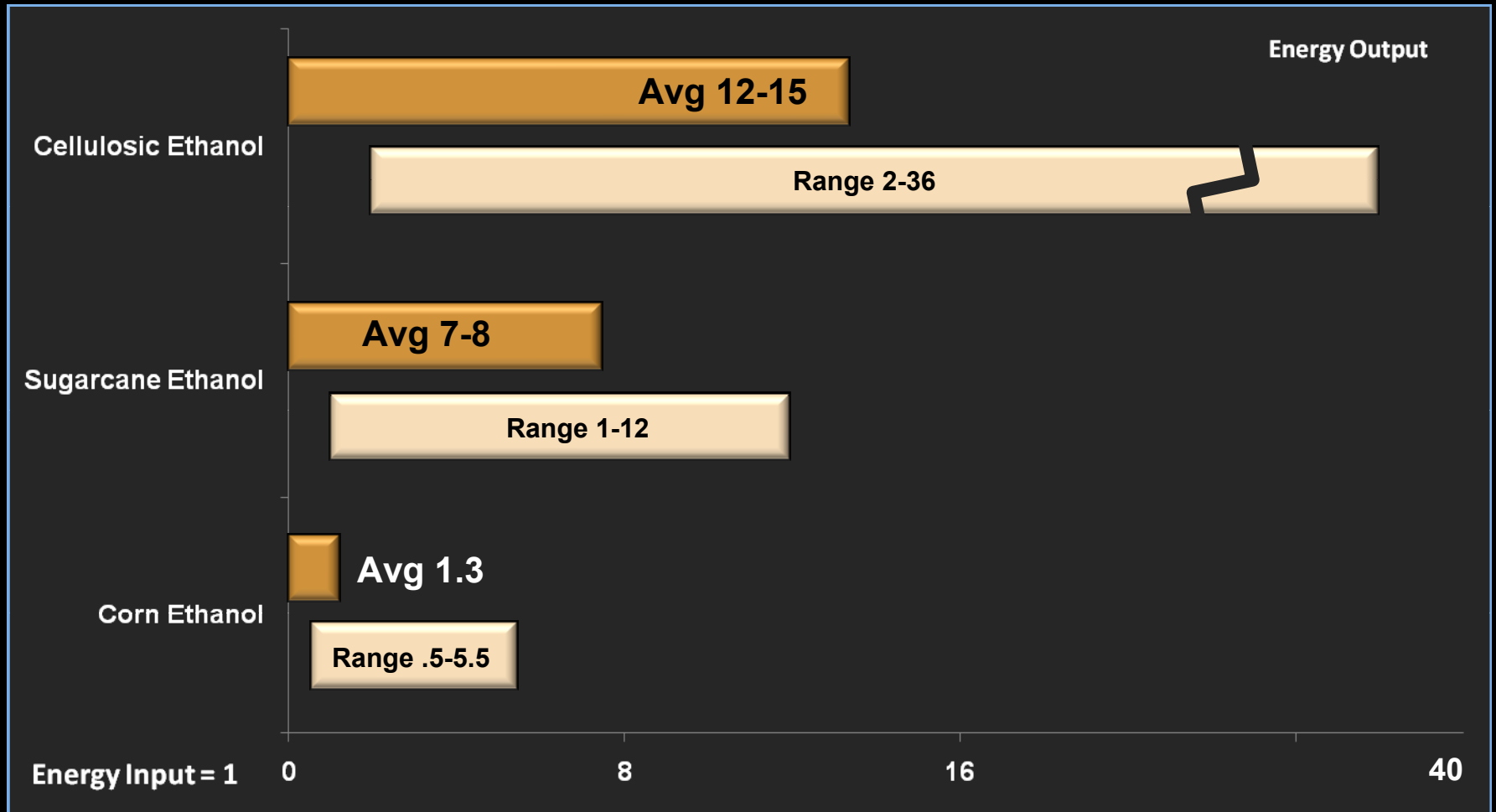


Energy Efficiency of Biofuels Compared to Petroleum



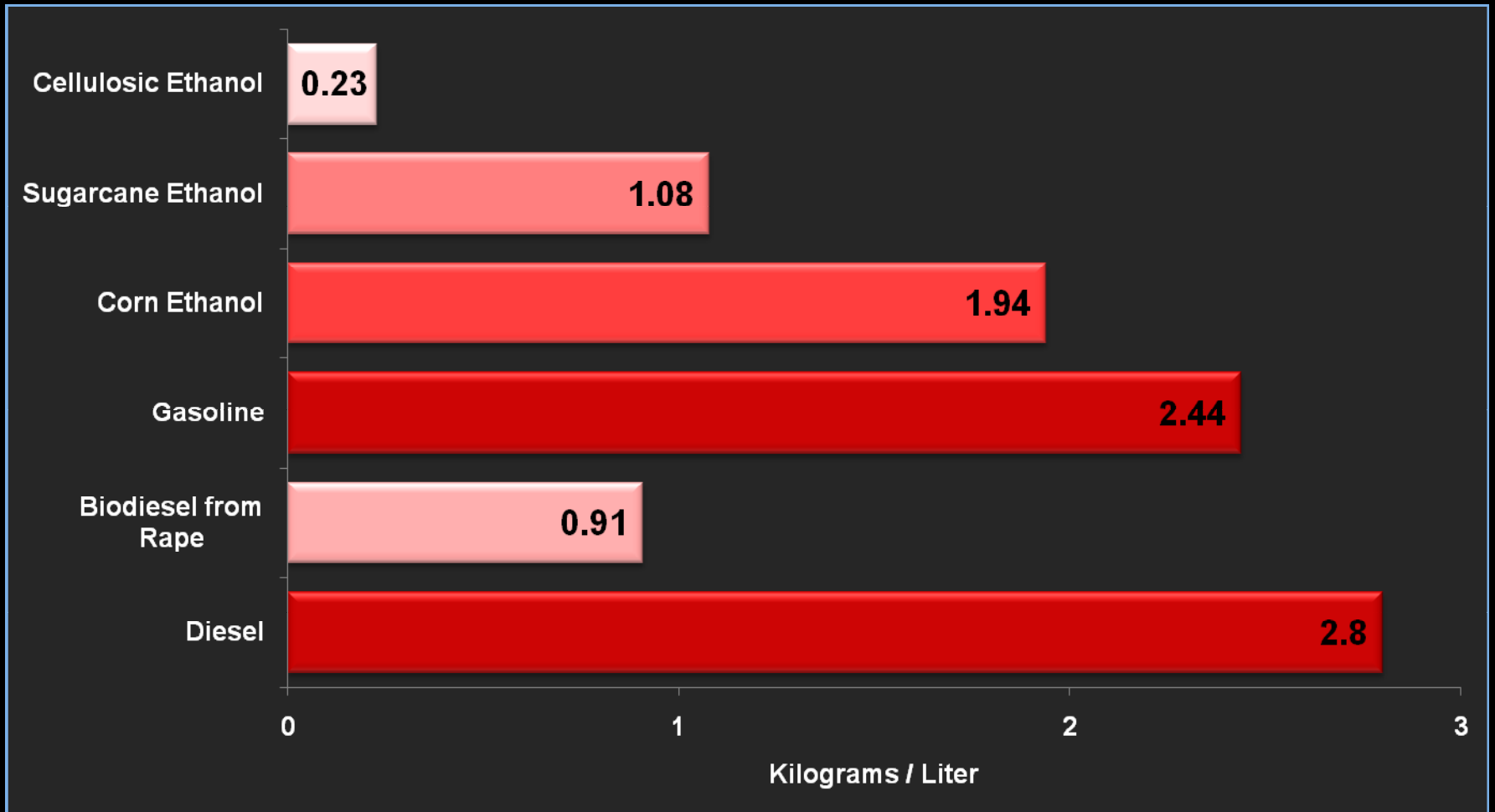


Energy Input to Energy Output



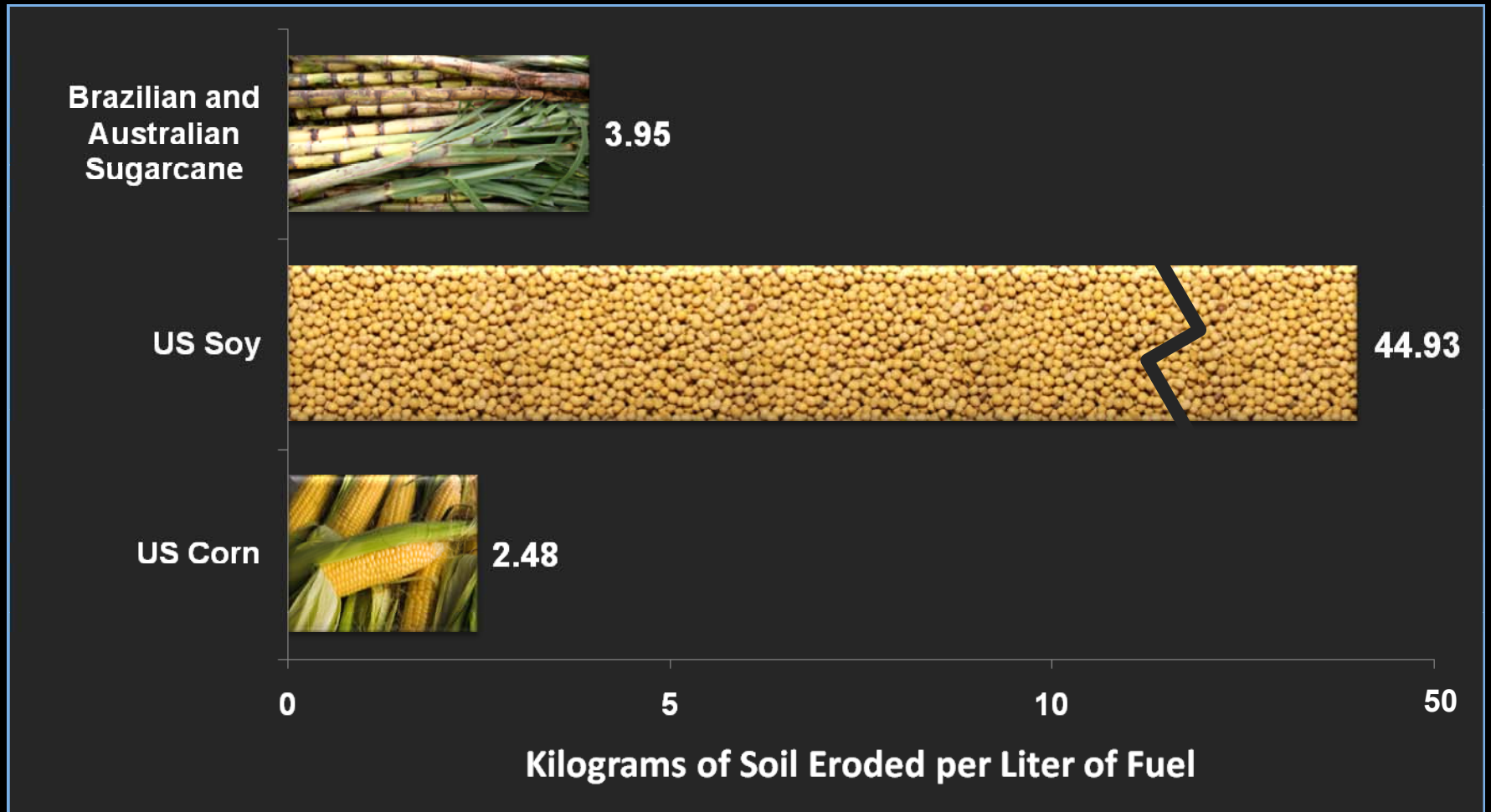


Greenhouse Gas Production





Soil Impacts





Each Commodity Has Key Issues

- Sugarcane
 - Burning fields
 - Displacement
- Corn/Maize
 - Energy in/out and source of energy for processing
- Palm oil
 - Deforestation
 - No sulphur, less N₂O
- Soy and canola
 - Soil erosion
 - Crop rotation
- Cellulosic
 - Non-food, monocrop perennials—no food by-products or ability to shift focus
 - Direct and indirect habitat loss

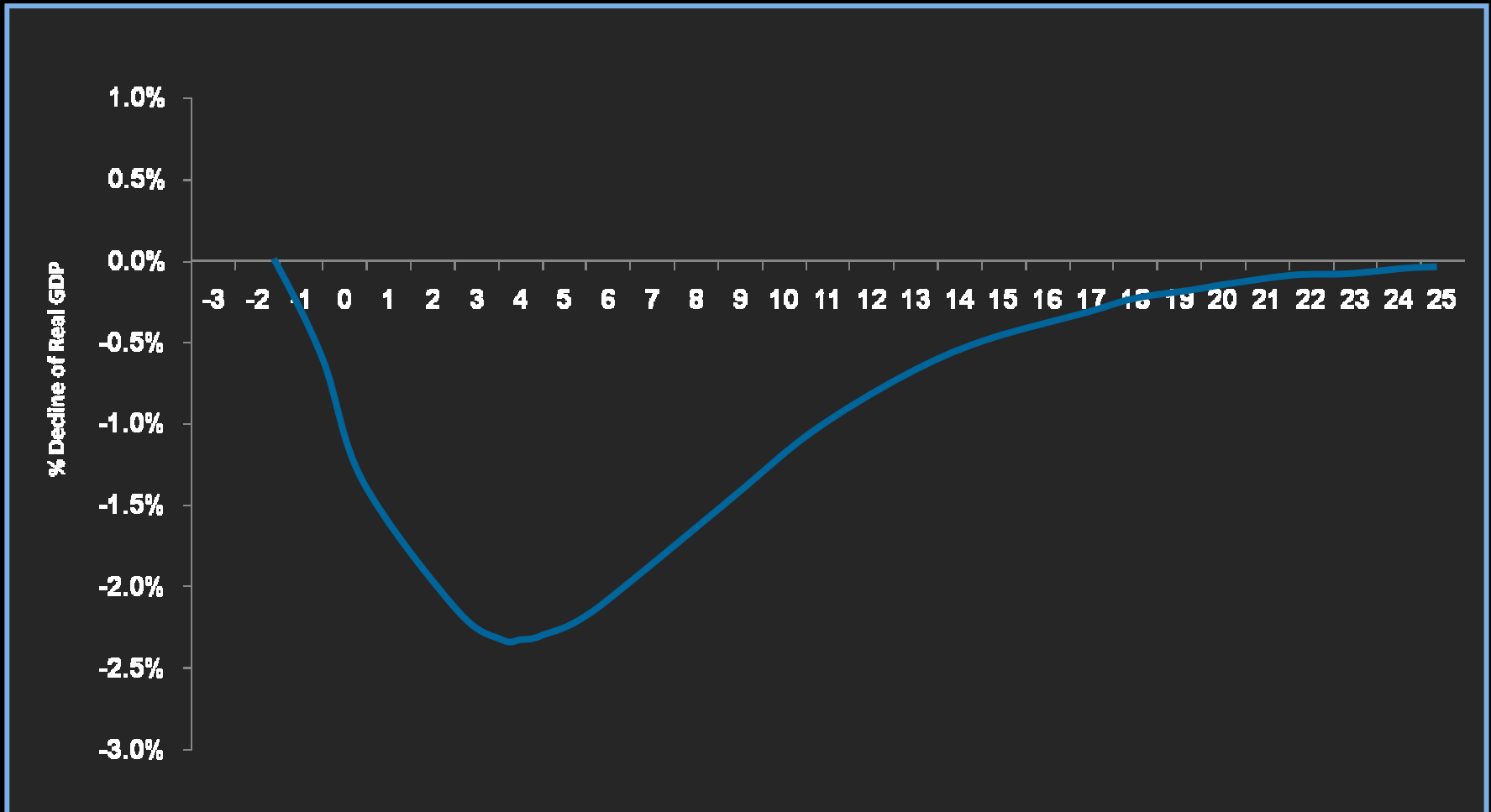


Key Issues for Any Standards

- Reasonable people will disagree—need to build consensus
- Appropriate unit for standards
 - Farm
 - Processing plant
 - Watershed or landscape
- Standards Performance
 - Minimum performance for all issues
 - Average performance
 - Continuous improvement (e.g. 10, 30, and 50% GHG reductions over time)
- A single meta-standard for all bioenergy



World Commodity Price Shocks and GDP

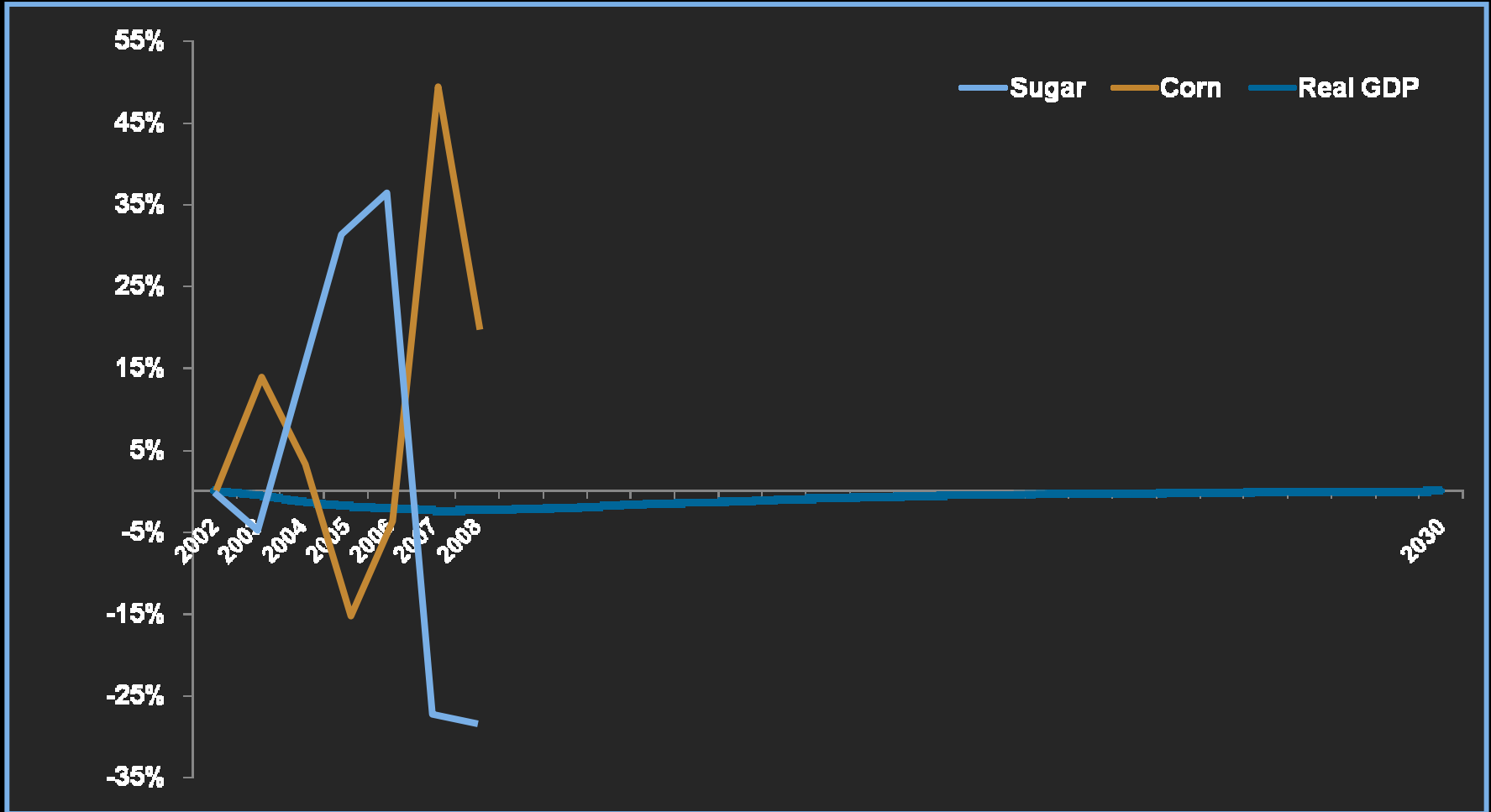


Note. Figure shows the impact of a two standard deviation change of the country-specific commodity price index (Deaton Miller index) on real output (GDP) in a typical low-income country. The impact is the percent change in GDP for low income countries, on average.

Source: World Bank staff calculations



Recent Sugar and Corn Prices—And the Future?



Note. Figure shows the impact of a two standard deviation change of the country-specific commodity price index (Deaton Miller index) on real output (GDP) in a typical low-income country. The impact is the percent change in GDP for low income countries, on average.

Source: World Bank staff calculations



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