



Cerulogy

# Biofuels – an honest debate

Technology, carbon and policy

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# Introductions



- Chris Malins
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- Previously:
  - Fuels Lead for the International Council on Clean Transportation 2010-2016
  - Communications Specialist for the UK Renewable Fuels Agency 2008-2010
- PhD in Applied Mathematics, Sheffield University

<https://scholar.google.co.uk/citations?user=Y16zidkAAAAJ&hl=en&oi=ao>

# Biofuels, a policy driven market: three public policy objectives

- ▶ Climate change mitigation
  - ▶ Biofuels are 'renewable'
  - ▶ (Can have) lower lifecycle emissions than fossil fuels
- ▶ Energy security
  - ▶ Biofuels produced domestically/not in oil producer countries
  - ▶ Diversify supply, manage risk?
- ▶ Rural development
  - ▶ 2003: decoupling of the Common Agricultural Policy
  - ▶ 2003: Biofuel Directive



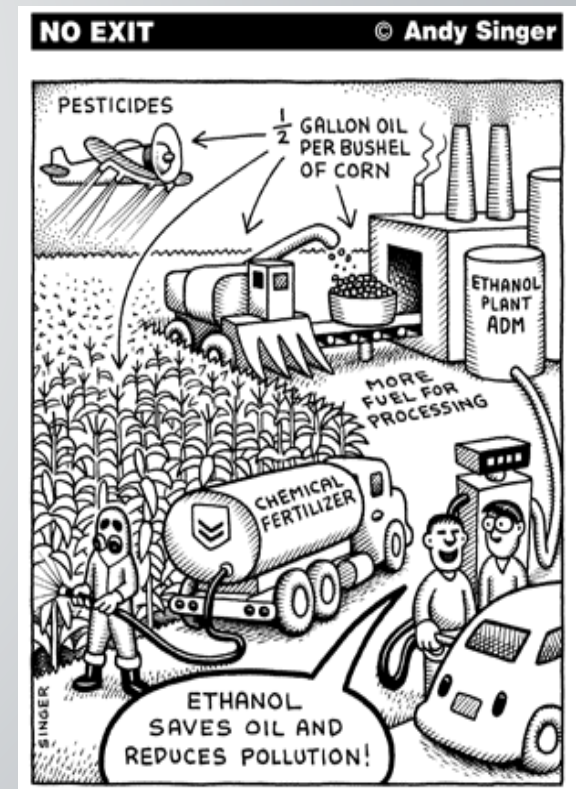
# What does it mean to say a biofuel delivers a 'carbon saving'?

- ▶ What *precisely* is the question that we're asking when we ask about the carbon intensity of a biofuel?
  - ▶ "How much carbon dioxide is emitted from vehicles when they combust biofuels (compared to fossil fuels)?"
  - ▶ "What are the greenhouse gas emissions associated with the processes required to produce biofuels (compared to fossil fuels)?"
  - ▶ "What is the net change in global emissions when we use biofuels instead of fossil fuels?"
  - ▶ "What is the net change in global emissions resulting from the implementation of a particular biofuel policy?"
- ▶ If you don't understand the question you're asking, you're liable not to get the right answer

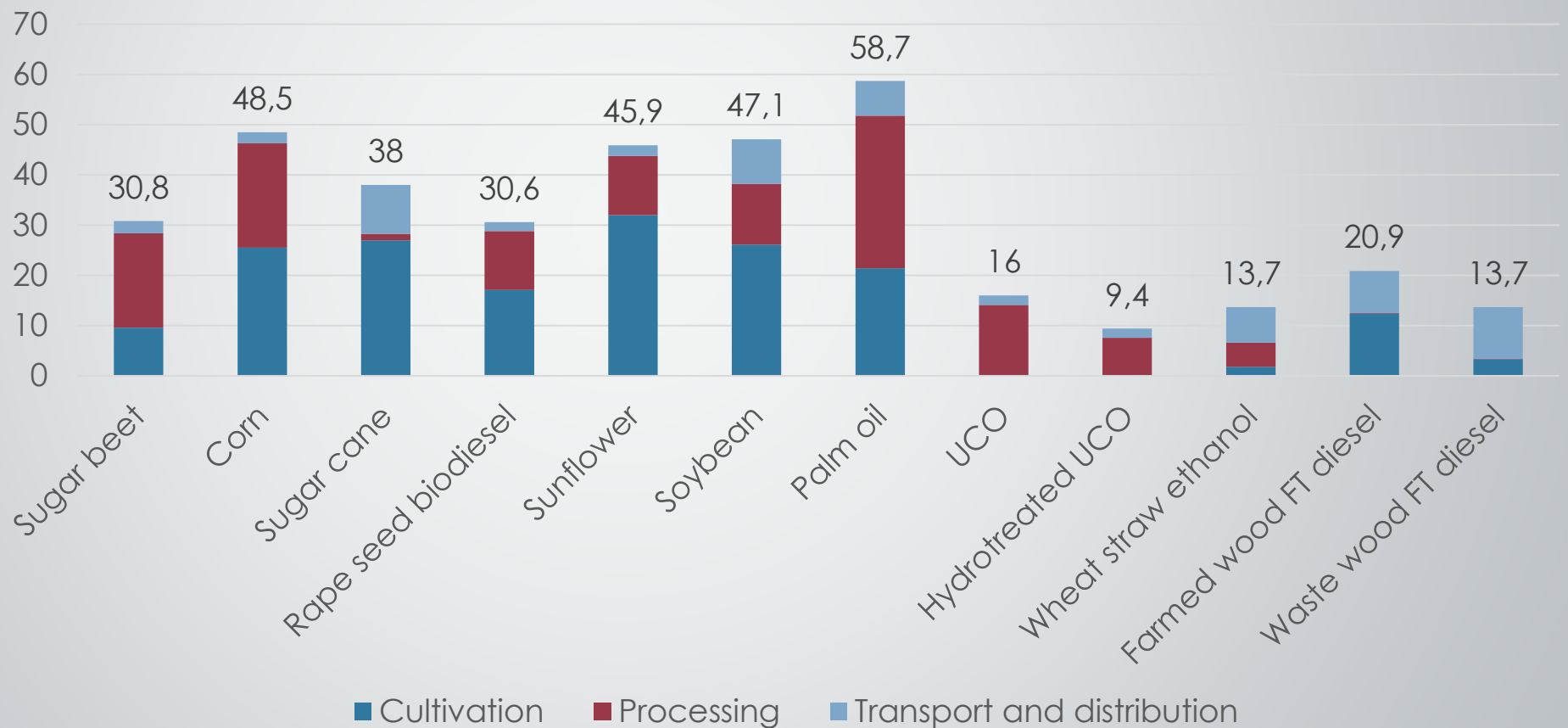


# Attributional lifecycle analysis

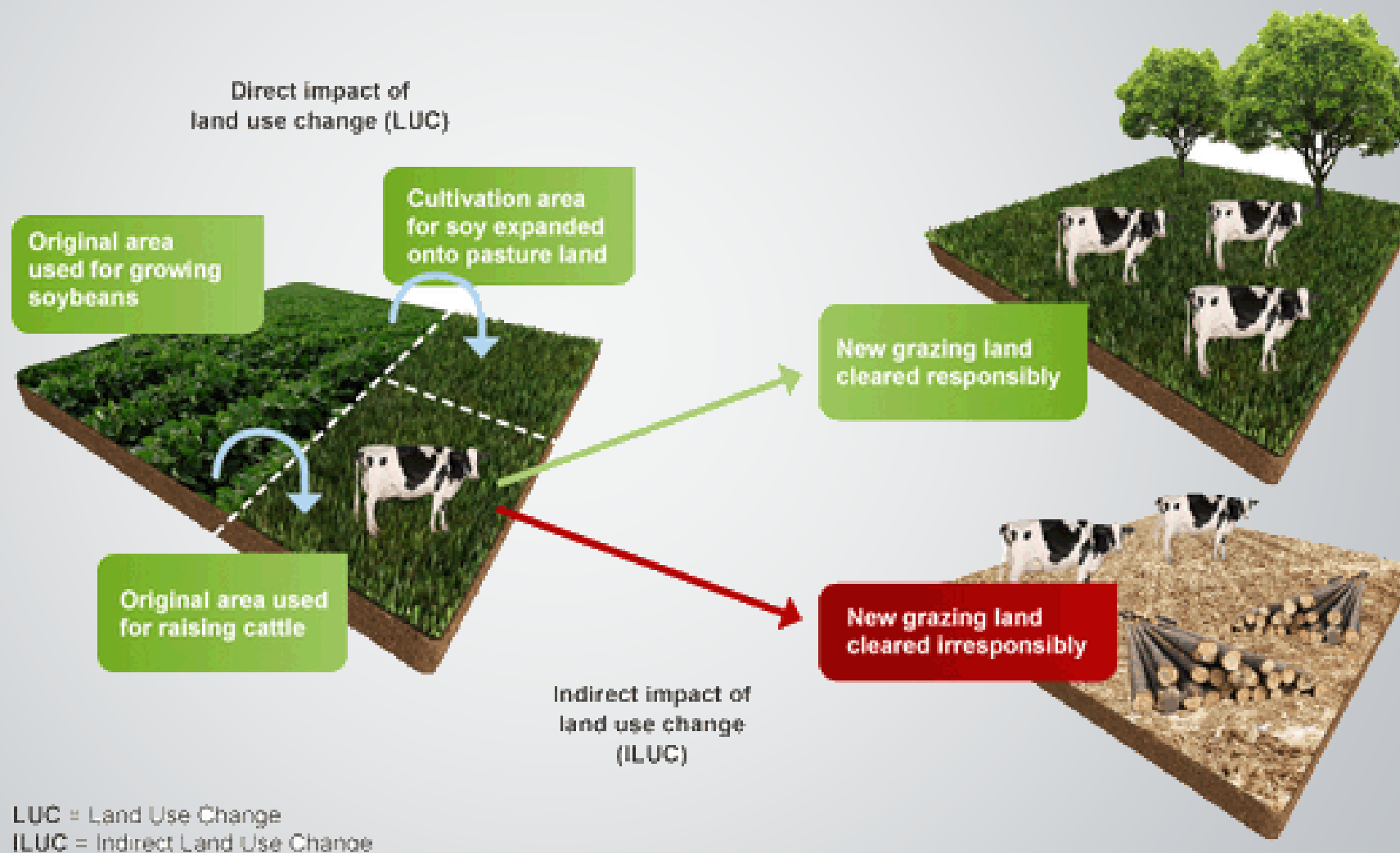
- ▶ Sum emissions associated with the processes producing a unit of fuel
  - ▶ ['Direct' land use change]
  - ▶ Cultivation/collection
  - ▶ Transport
  - ▶ Processing
  - ▶ Distribution
  - ▶ Petroleum displacement



# Example pathway carbon intensities from RED II

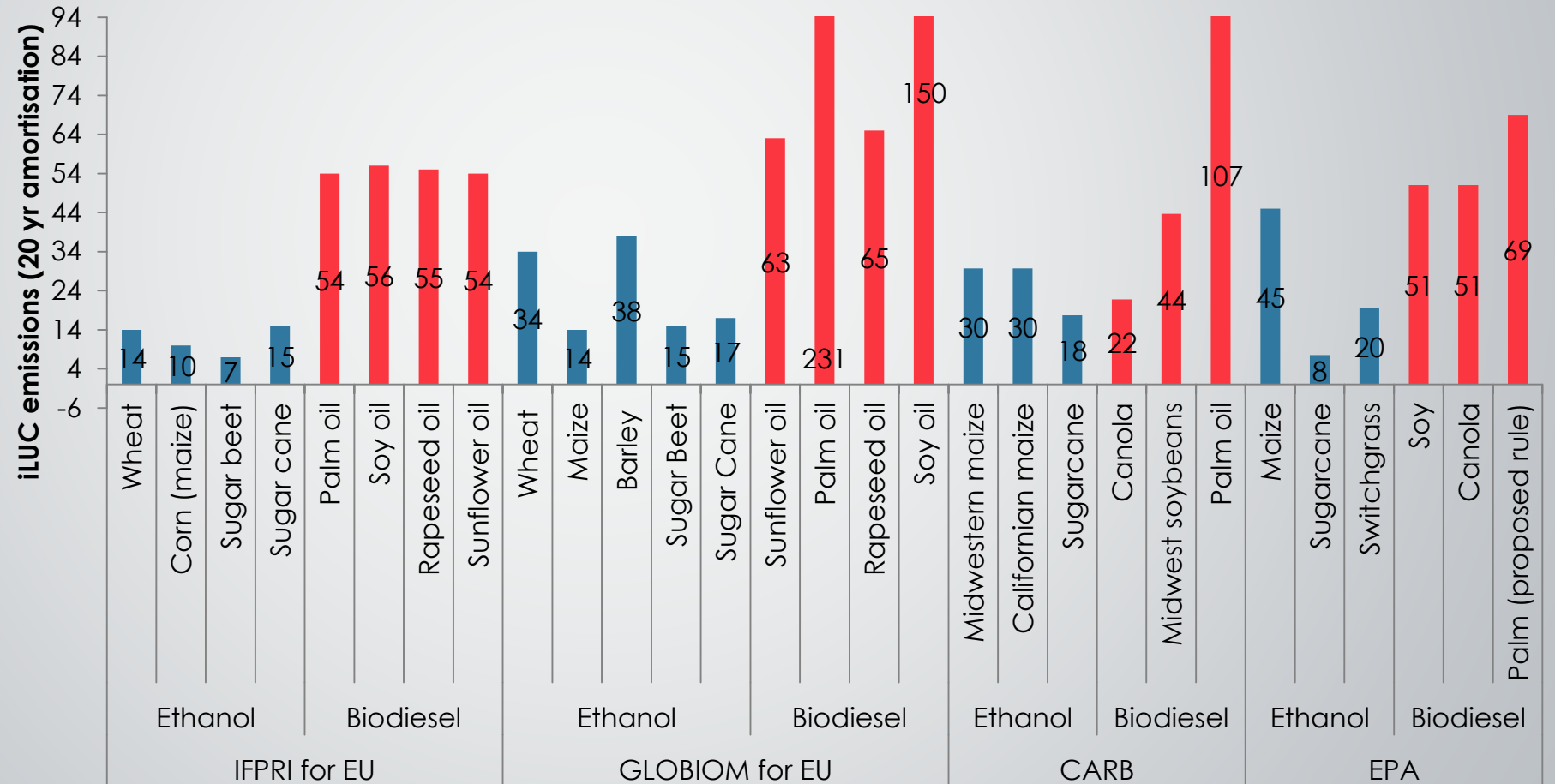


# Consequential LCA and ILUC

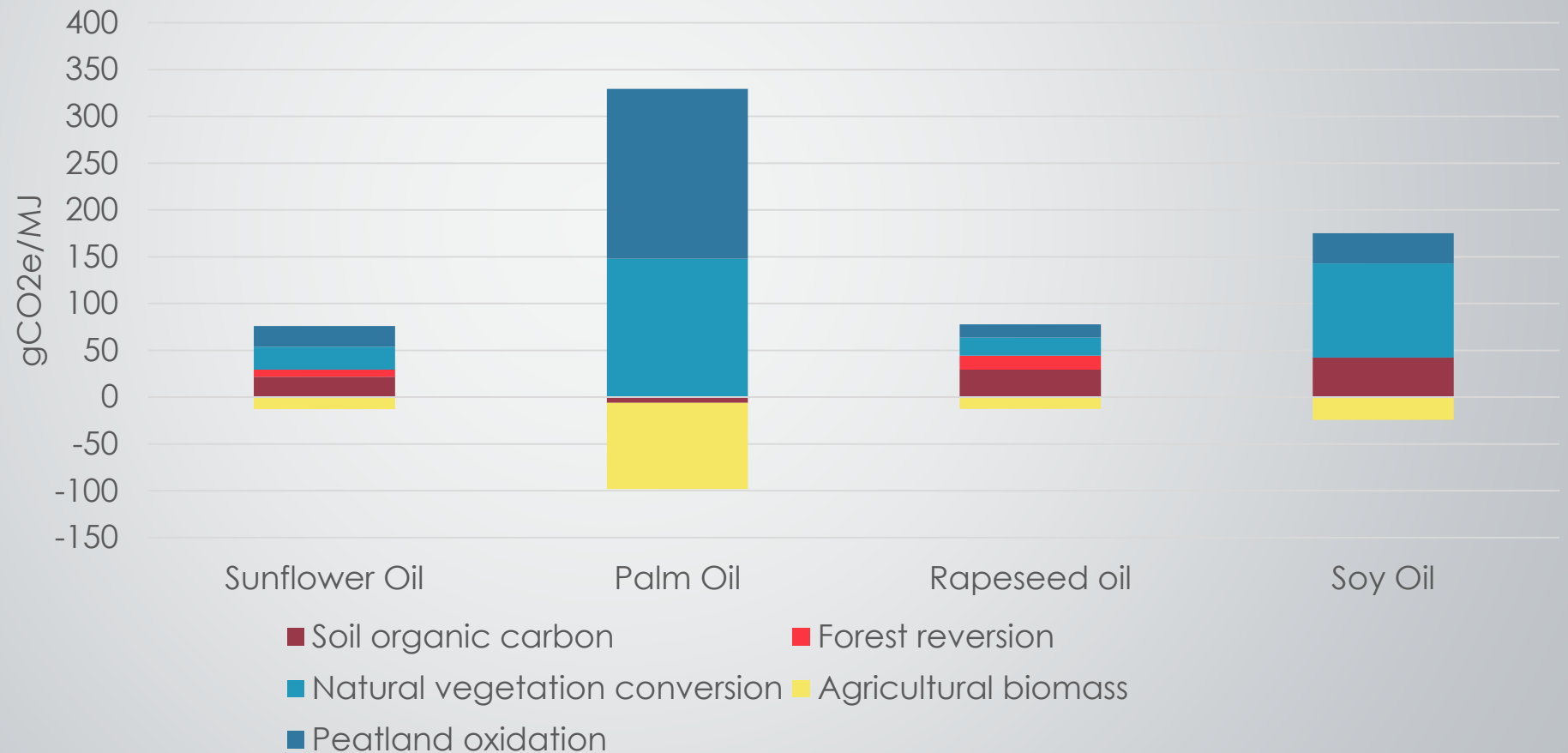




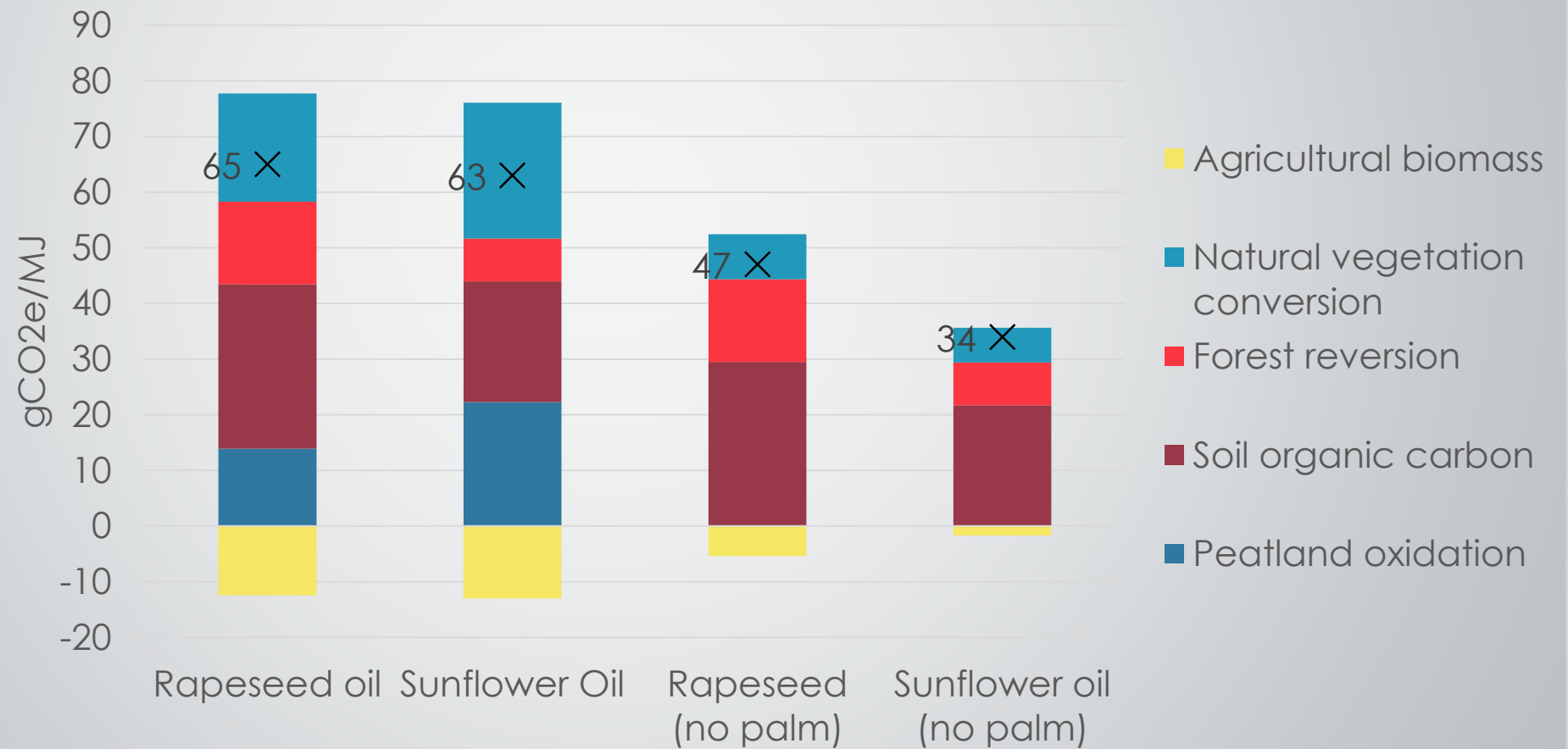
# Indirect land use change estimates from regulatory studies



# ILUC – would everything be fine if we just got away from palm oil?



# Not really – both IFPRI-MIRAGE and GLOBIOM still bad for biodiesel



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# The 'second' generation

Sustainability and outlook

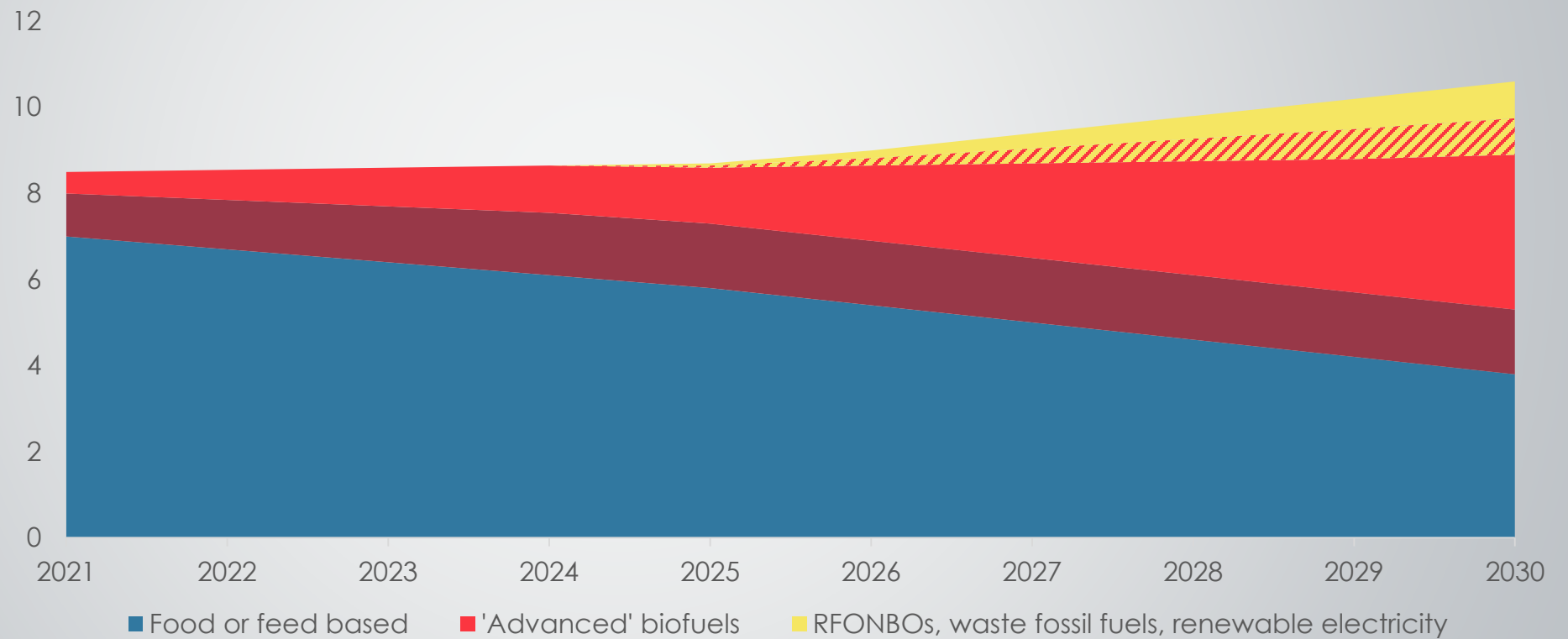


# What is 'advanced'?

- ▶ Drop-in fuels?
- ▶ Technologies not yet commercialised?
- ▶ Low calculated carbon intensity?
- ▶ Better sustainability profile?
- ▶ Not competing with food?
- ▶ In Europe, the focus is non-food feedstocks that require technologies beyond fermentation/transesterification
  - ▶ Transition from food-based to non-food-based fuels



# Renewable energy use to 2030 (% of EU transport energy consumption)

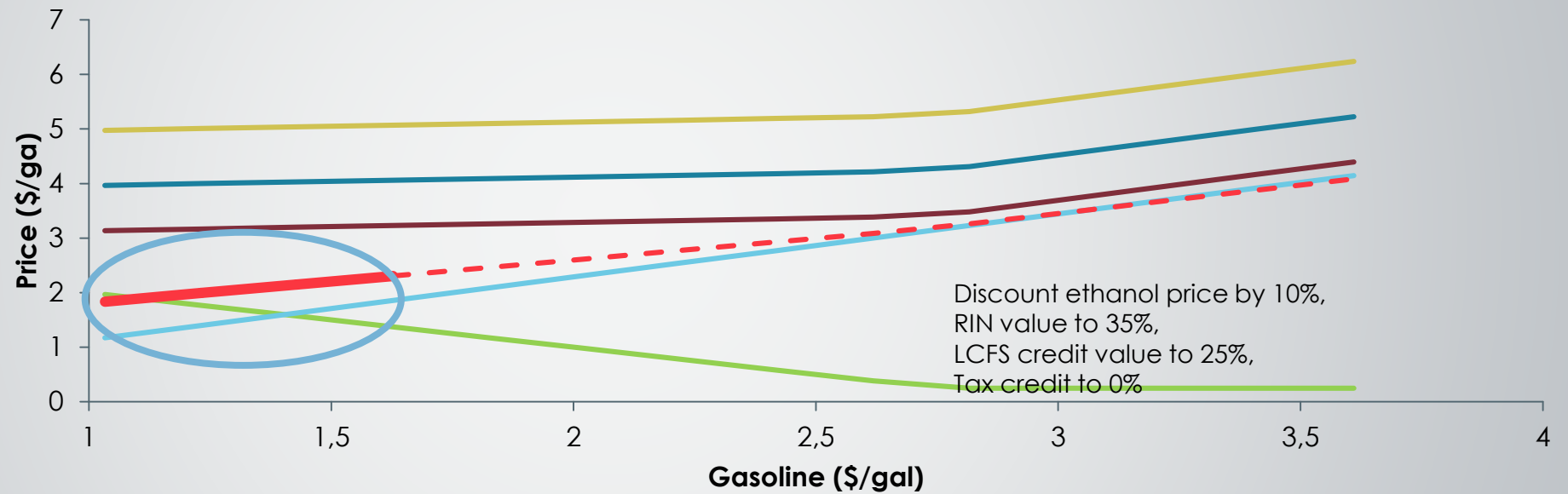


# What does this mean?

- ▶ At least 100 new commercial cellulosic biofuel facilities by 2030
  - ▶ Perhaps 25-50 billion euros of investment
- ▶ Another 50 or more commercial facilities from power-to-liquids, bacterial CO fermentation, and other eligible technologies
  - ▶ Another 10-30 billion euros of investment
- ▶ Requires major expansion of cellulosic feedstock supply chain
- ▶ Requires clear and stable value proposition



# Value confidence matters (U.S. example)



- Cellulosic Ethanol Waiver Prices (CWCs)
- Projected Brazilian Sugarcane Ethanol Prices
- Cellulosic Ethanol Price with RIN
- Cellulosic Ethanol in California
- Cellulosic Ethanol in California with 2GBPTC
- Discounted Expected Cellulosic Ethanol Price





# A few final questions

- ▶ Are biofuels and fossil fuels held up to comparable scrutiny?
  - ▶ By and large, we are asking the right questions of different fuels
  - ▶ E.g. indirect effects of fossil fuel production are **relatively** unimportant
- ▶ What about food versus fuel?
  - ▶ Food-based biofuel production does impact food markets
  - ▶ Disagreement will continue about whether impacts are proportionate to benefits
- ▶ Are 'advanced' fuels really so much better?
  - ▶ Evidence suggests generally lower indirect emissions and low direct emissions
  - ▶ Still environmental and social risks – e.g. use of whole trees problematic
- ▶ What about blend walls?
  - ▶ The ethanol blend wall will remain a potentially limiting factor through the 20s



# Where next in Europe?

- ▶ Policy debate likely to focus on:
  - ▶ Size of targets
  - ▶ Definition of 'advanced' fuels
  - ▶ Role of food-based fuels, especially ethanol
- ▶ Outlook for investment will continue to be muted by uncertainty about policy outcomes and value
  - ▶ RED II finalised by ... 2019?
  - ▶ Member State implementations in place by ... early 2020s?
  - ▶ Any ongoing sustainability debate will create additional uncertainty (cf. <http://www.theicct.org/series/Biofrontiers>)





# Thanks!

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