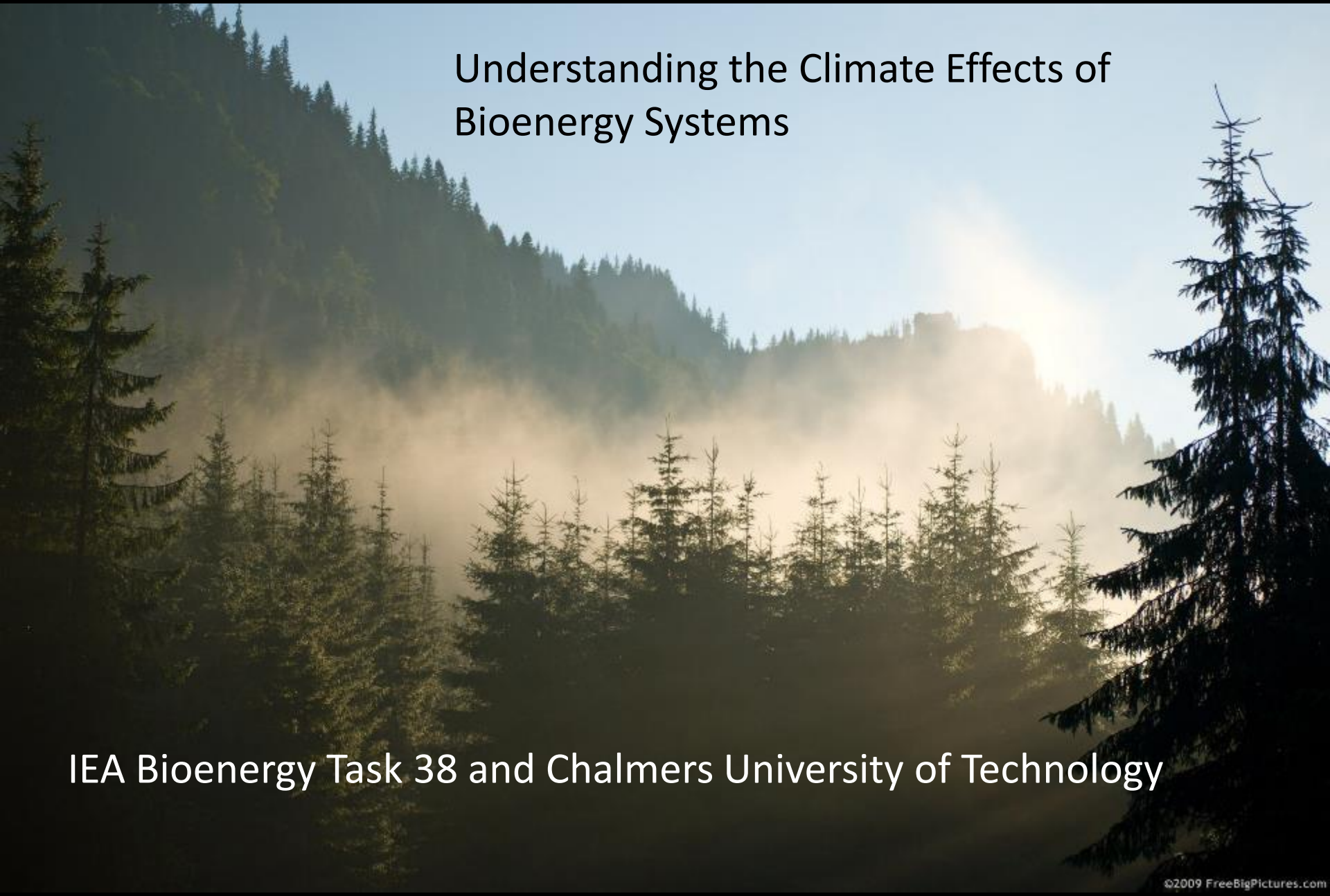
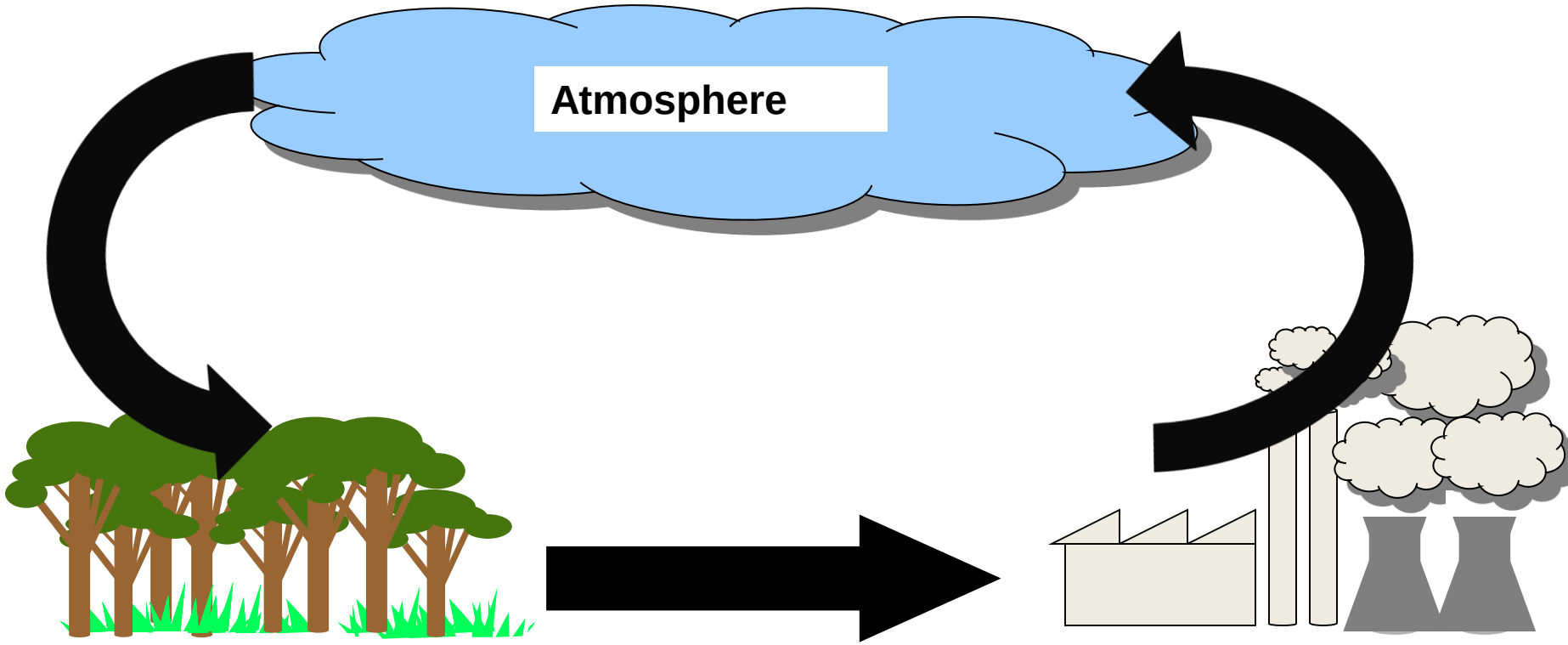
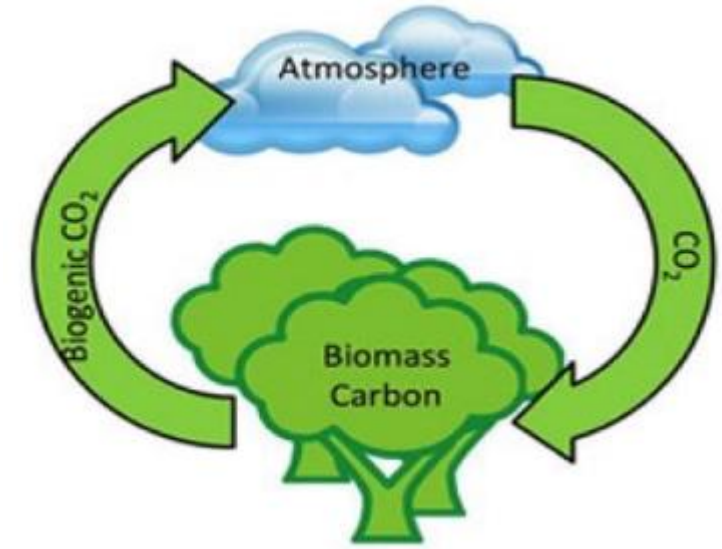

Understanding the Climate Effects of Bioenergy Systems
IEA Bioenergy Task 38 and Chalmers University of Technology
©2009 FreeBigPictures.com



Bioenergy – “carbon neutral”

Bioenergy & carbon neutrality

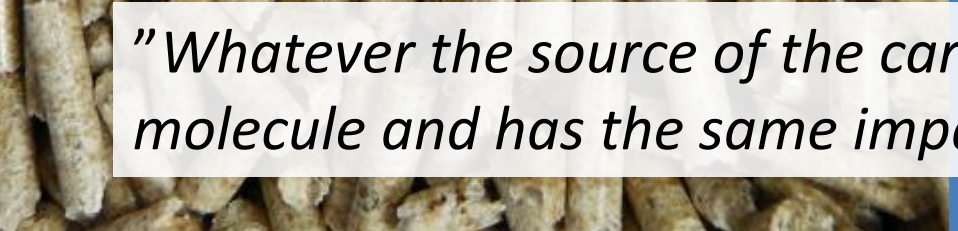
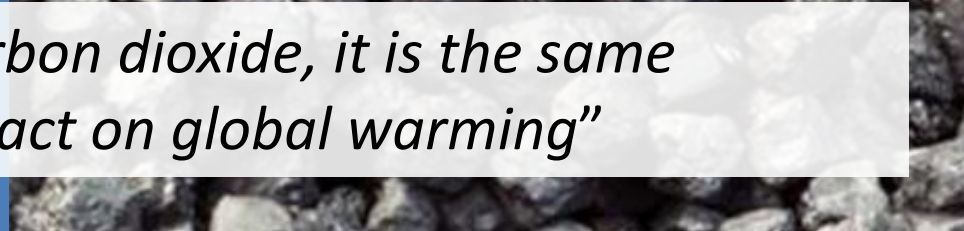


Circular C flow
(but at what time scale?)

Linear C flow





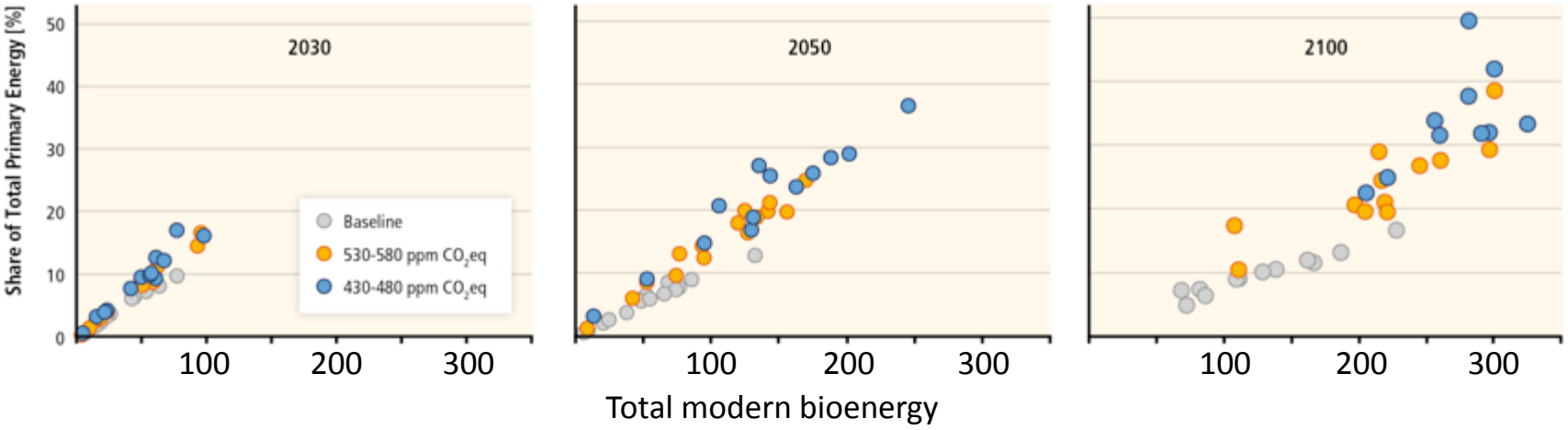
Wood worse than coal?

”Whatever the source of the carbon dioxide, it is the same molecule and has the same impact on global warming”

Bioenergy for climate change mitigation

Integrated assessment modelling indicates that it may be difficult to meet the temperature target set out in the Paris Agreement, unless bioenergy contributes a significant share of energy needs.

This contrasts with some studies that use other assessment frameworks (e.g., LCA) where conclusions indicate that bioenergy does not contribute to climate change mitigation



Source: IPCC AR5

Energy
Volume 20, Issue 11, 1995, Pages 1131-1140

Biomass fuels and forest-management strategies: How do we calculate the greenhouse-gas emissic benefits?

Gregg Marland, Bernhard Schlamadinger

Biomass and Bioenergy
Volume 10, Issues 5–6, 1996, Pages 275-300

The role of forest and bioenergy strategies in the global carbon cycle

Bernhard Schlamadinger*, †, Gregg Marland*

Biomass and Bioenergy
Volume 13, Issue 6, 1997, Pages 359-375

Towards a standard methodology for gre balances of bioenergy systems in compa fossil energy systems

B. Schlamadinger, M. Apps†, F. Bohlin‡, L. Gustavsson§, G. Jungr

Energy Policy
Volume 28, Issue 13, November 2000, Pages 935–946

Project-based greenhouse-gas accounting: guiding principles with a focus on baselines and additionality ☆

Leif Gustavsson[a], Timo Karjalainen[b], Gregg Marland[c], Ilkka Savolainen[d], Bernard Schlamadinger
Mike Apps[f]

Stock changes or fluxes? Resolving terminological confusion in the debate on land-use change and forestry

Annette Cowie[1,2]*, Kim Pingoud[3,4], Bernhard Schlamadinger[5]

Energy- and greenhouse gas-based LCA of biofuel and bioenergy systems: Key issues, ranges and recommendations

Francesco Cherubini[a,*], Neil D. Bird[a], Annette Cowie[b], Gerfried Jungmeier[a],
Bernhard Schlamadinger[c,1], Susanne Woess-Gallasch[a]

Task 38 : Workshops

Task 38 holds regular workshops in participating countries, often in conjunction with other IEA bioenergy tasks.

Växjö, Sweden January 2017
Forest Modelling Workshop

Southeastern USA April 2016
Bioenergy in the Southeastern United States

Berlin, Germany October 2015
Joint Meeting Task 38 – Task 43: Climate Change Effects of Bioenergy

Berlin, Germany October 2015
Quantifying Climate Change Ef

Växjö, Sweden May 2015
Climate Change Effects of Biom

Helsinki, Finland December 20
Forest-based Bioenergy

Copenhagen, Denmark May 2014
Forests, Bioenergy and Climate Change Mitigation

Hunter Valley, Australia November 2013
Building the Future – Biomass for the Environment, Economy and Society

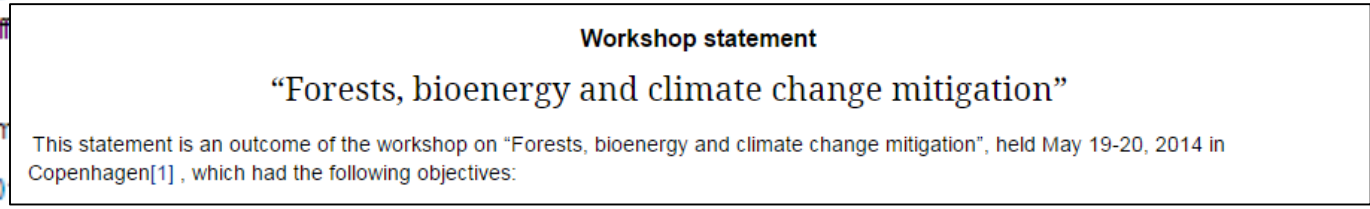
Vienna, Austria, November 2012
Impact of Timing of GHG emissions

Vienna, Austria, November 2012
Linking Policy, Science and Industry

Argonne, USA, April 2012
How to present the timing of emissio

Campinas, Brazil, September 2011
Quantifying and managing land use

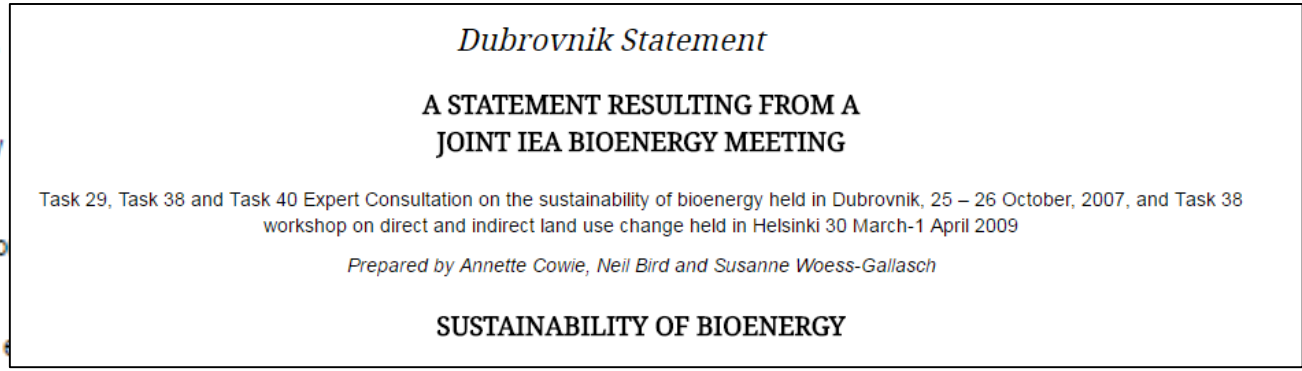
Brussels, Belgium, March 2010
Greenhouse gas emissions from bioenergy systems: impacts of timing, issues of responsibility



Workshop statement

"Forests, bioenergy and climate change mitigation"

This statement is an outcome of the workshop on "Forests, bioenergy and climate change mitigation", held May 19-20, 2014 in Copenhagen[1] , which had the following objectives:



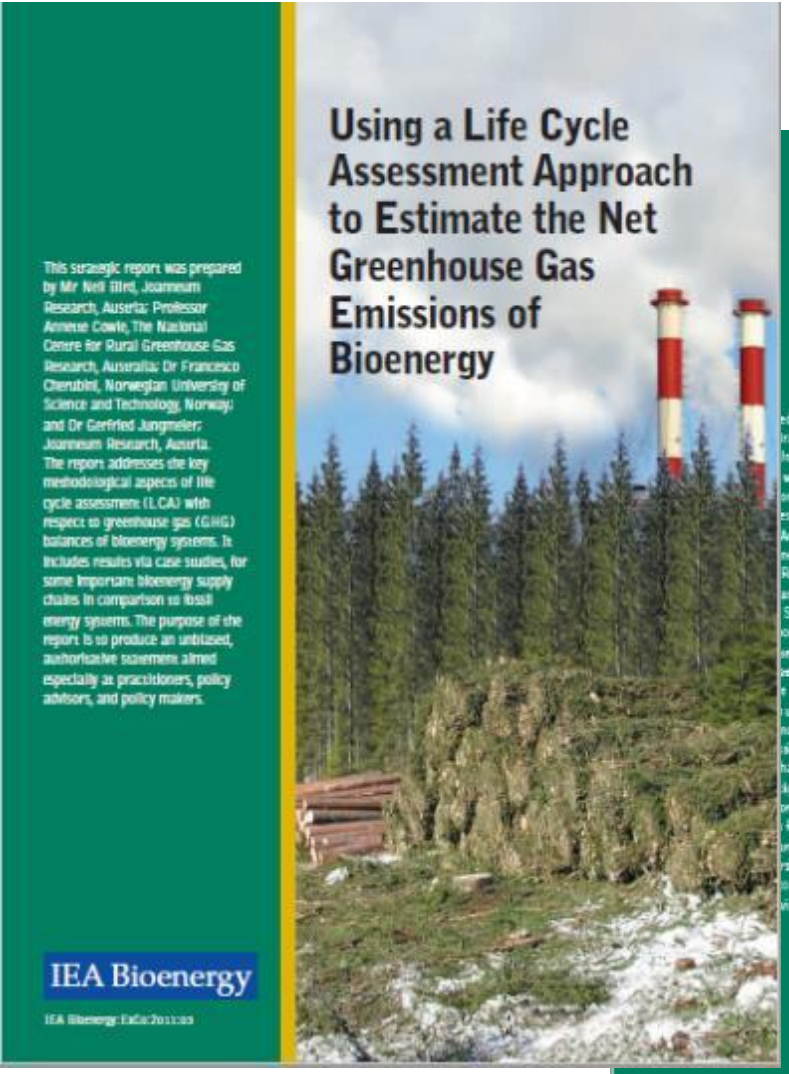
Dubrovnik Statement

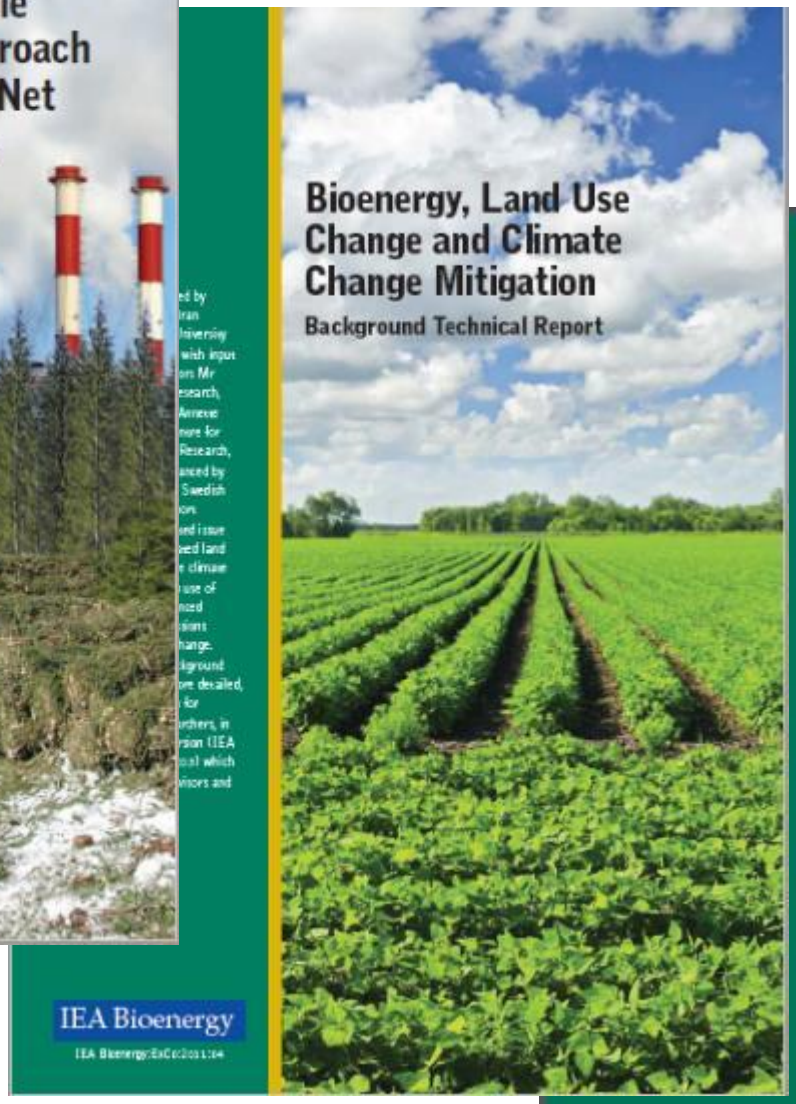
A STATEMENT RESULTING FROM A
JOINT IEA BIOENERGY MEETING

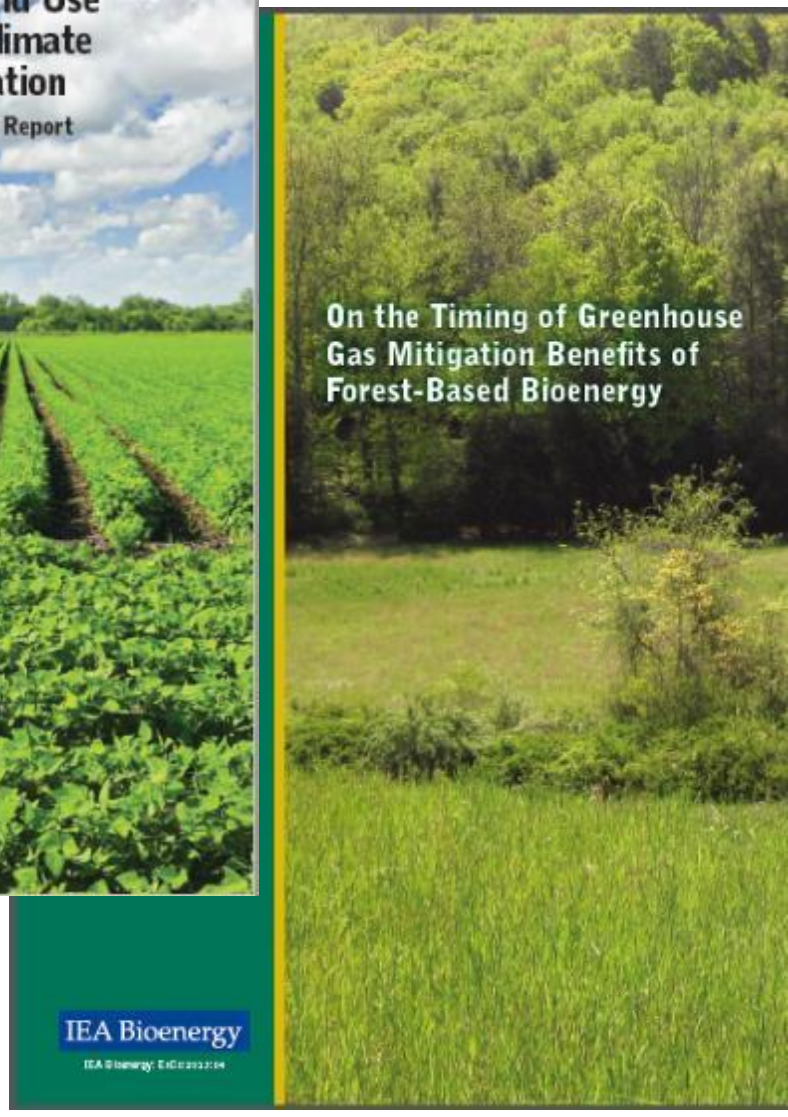
Task 29, Task 38 and Task 40 Expert Consultation on the sustainability of bioenergy held in Dubrovnik, 25 – 26 October, 2007, and Task 38 workshop on direct and indirect land use change held in Helsinki 30 March-1 April 2009

Prepared by Annette Cowie, Neil Bird and Susanne Woess-Gallasch

SUSTAINABILITY OF BIOENERGY


Using a Life Cycle Assessment Approach to Estimate the Net Greenhouse Gas Emissions of Bioenergy
This strategic report was prepared by Mr Neil Bird, Joanneum Research, Austria; Professor Annette Cowie, The National Centre for Rural Greenhouse Gas Research, Australia; Dr Francesco Cherubini, Norwegian University of Science and Technology, Norway; and Dr Gerfried Jungmeier, Joanneum Research, Austria.
The report addresses the key methodological aspects of life cycle assessment (LCA) with respect to greenhouse gas (GHG) balances of bioenergy systems. It includes results via case studies, for some important bioenergy supply chains in comparison to fossil energy systems. The purpose of the report is to produce an unbiased, authoritative statement aimed especially at practitioners, policy advisors, and policy makers.
IEA Bioenergy


Bioenergy, Land Use Change and Climate Change Mitigation
Background Technical Report
IEA Bioenergy


On the Timing of Greenhouse Gas Mitigation Benefits of Forest-Based Bioenergy
IEA Bioenergy

10. We acknowledge support from the key project of the Chinese Academy of Sciences (grant KZCX2-YW-341).

Bioenergy: Counting on Incentives

THE SUGGESTION BY T. D. SEARCHINGER *et al.* ("Fixing a critical climate accounting error," Policy Forum, 23 October 2009, p. 527) to account for CO_2 by "tracing the actual flows of carbon" appears to promote an approach to carbon accounting in which emissions and removals from a forest are determined on the basis of gross atmospheric fluxes between the forest, or forest products, and the atmosphere. This contrasts with the current "stock-change" approach, in which the annual removals or emissions from a country's forest are assumed to be equal to the net change in carbon stocks in biomass and soils of the forest estate.

We share the concern of the authors that a "critical climate accounting error" exists within the Kyoto protocol and could under-

Downloaded from www.sciencemag.org on March

GLOBAL CHANGE BIOLOGY
BIOENERGY

GCB Bioenergy (2012) 4, 617–619, doi: 10.1111/j.1757-1707.2012.01190.x

LETTER

A comment to "Large-scale bioenergy from additional harvest of forest biomass is neither sustainable nor greenhouse gas neutral": Important insights beyond greenhouse gas accounting

RYAN M. BRIGHT*, FRANCESCO CHERUBINI*, RASMUS ASTRUP†, NEIL BIRD‡,

opinion & comment

CORRESPONDENCE:

Policy institutions and forest carbon

management options. Indeed, the value of their paper is that it shows the sensitivity of results to the choice of system boundary and modelling assumptions. The obvious conclusion to be drawn from their study is that current GHG accounting approaches need revision. We suggest that such revisions should be guided by comprehensive assessments that include full life-cycle emissions, compare equivalent scenarios and reflect market dynamics, in order to analyse the potential impacts of policy institutions. ❐

IEA Bioenergy

Response to Chatham House report "Woody Biomass for Power and Heat: Impacts on the Global Climate"

Annette Cowie, Principal Research Scientist Climate, NSW Department of Primary Industries, Australia; Adjunct Professor, University of New England; Leader of Task 38 of the IEA Bioenergy TCP

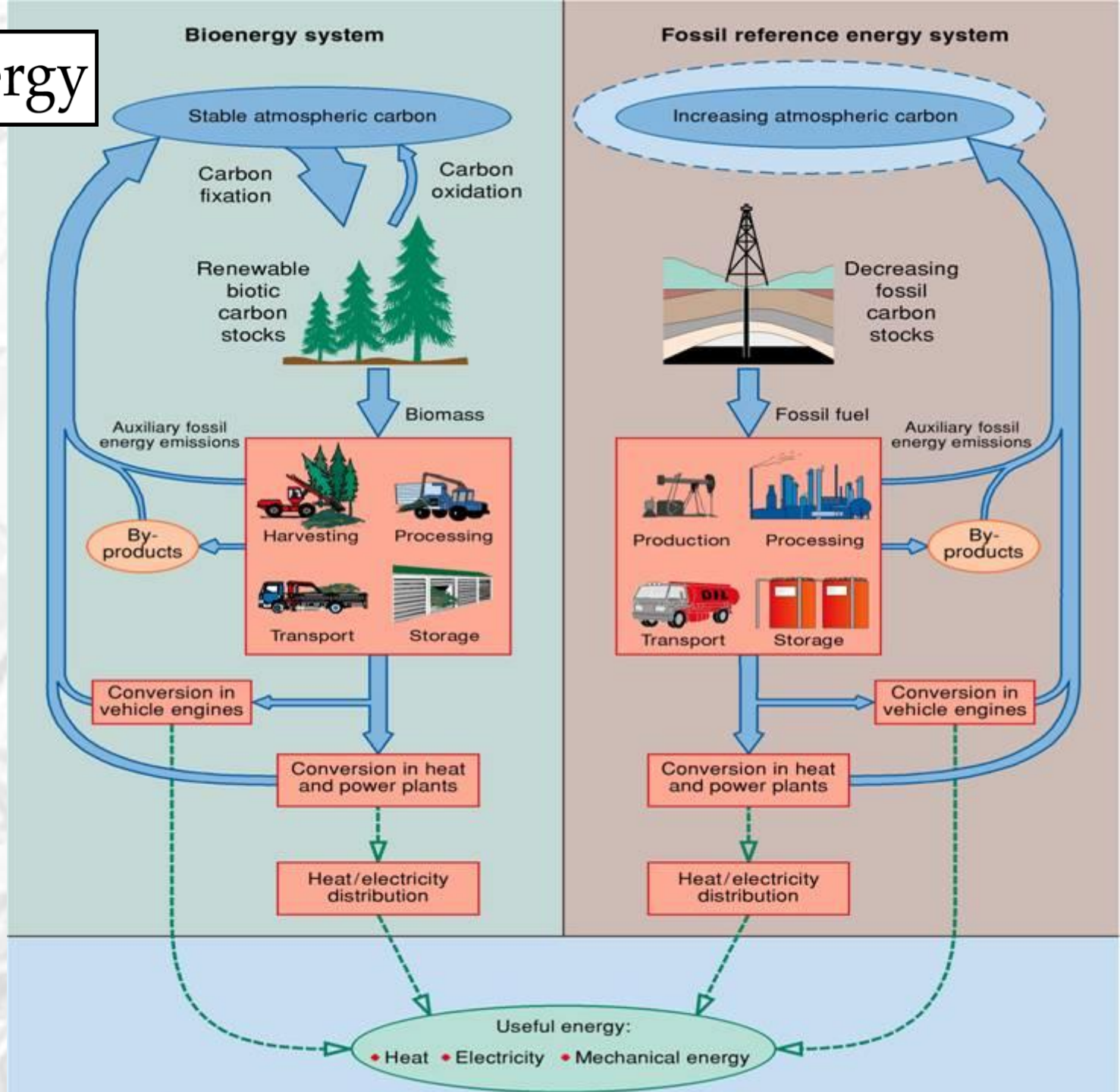
Göran Berndes, Associate Professor, Department of Energy and Environment, Chalmers University of Technology, Sweden; previous leader of Task 43 of the IEA Bioenergy TCP

Martin Junginger, Professor Bio-Based Economy, Utrecht University, the Netherlands; Leader of Task 40 of the IEA Bioenergy TCP

Fabiano Ximenes, Research Scientist, NSW Department of Industry - Lands, Australia

IEA Bioenergy

Task 38



Current debate

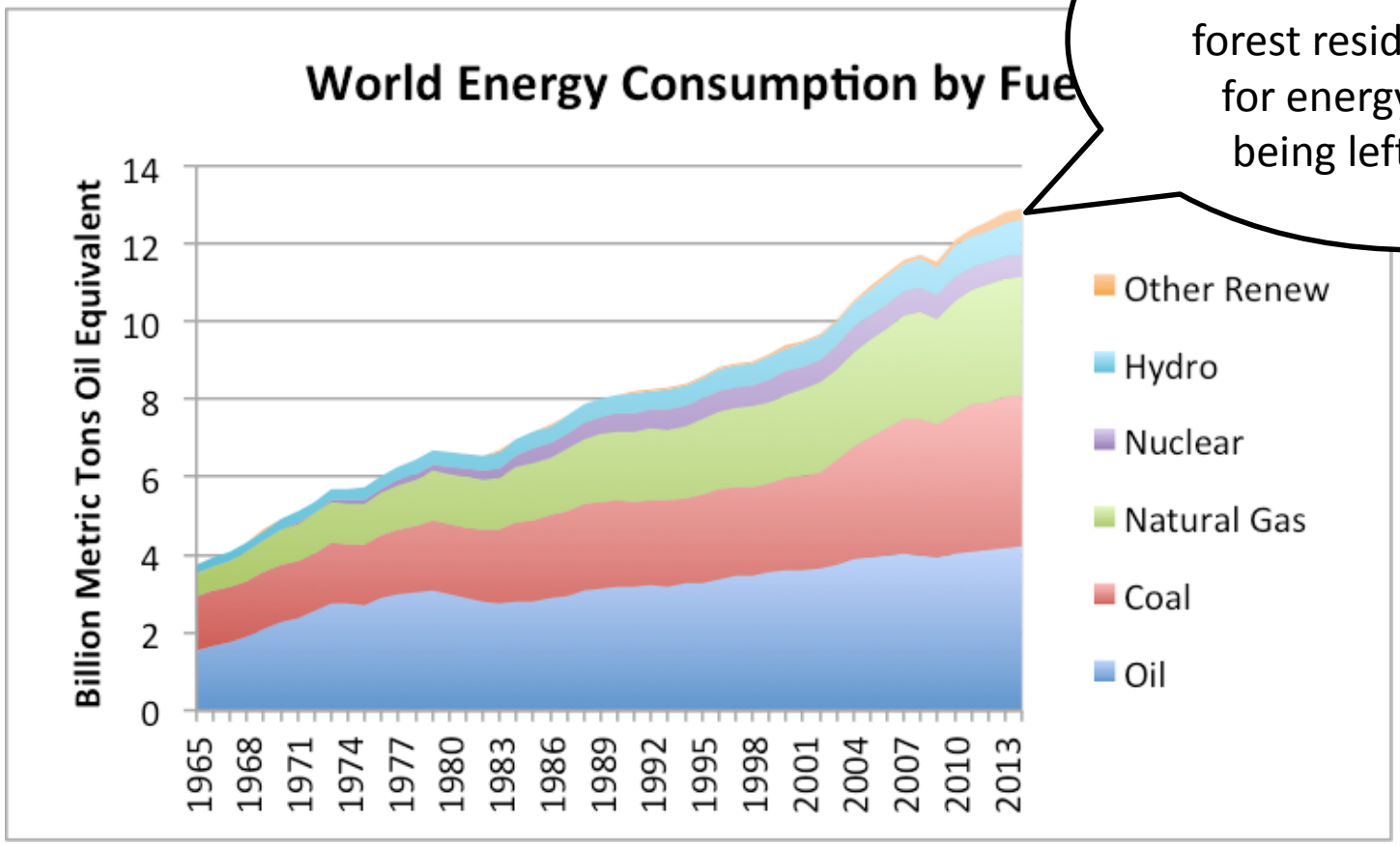
- Spatial scale:
  chip pile/ stand/ forest estate
- Counterfactual:
  reference land use, energy system
- Relevant time frame:
  tipping points/GHG targets/ temperature stabilisation/fast vs slow carbon pools

Different perspectives

- Individual operator vs national government or researcher
- Policy development vs implementation

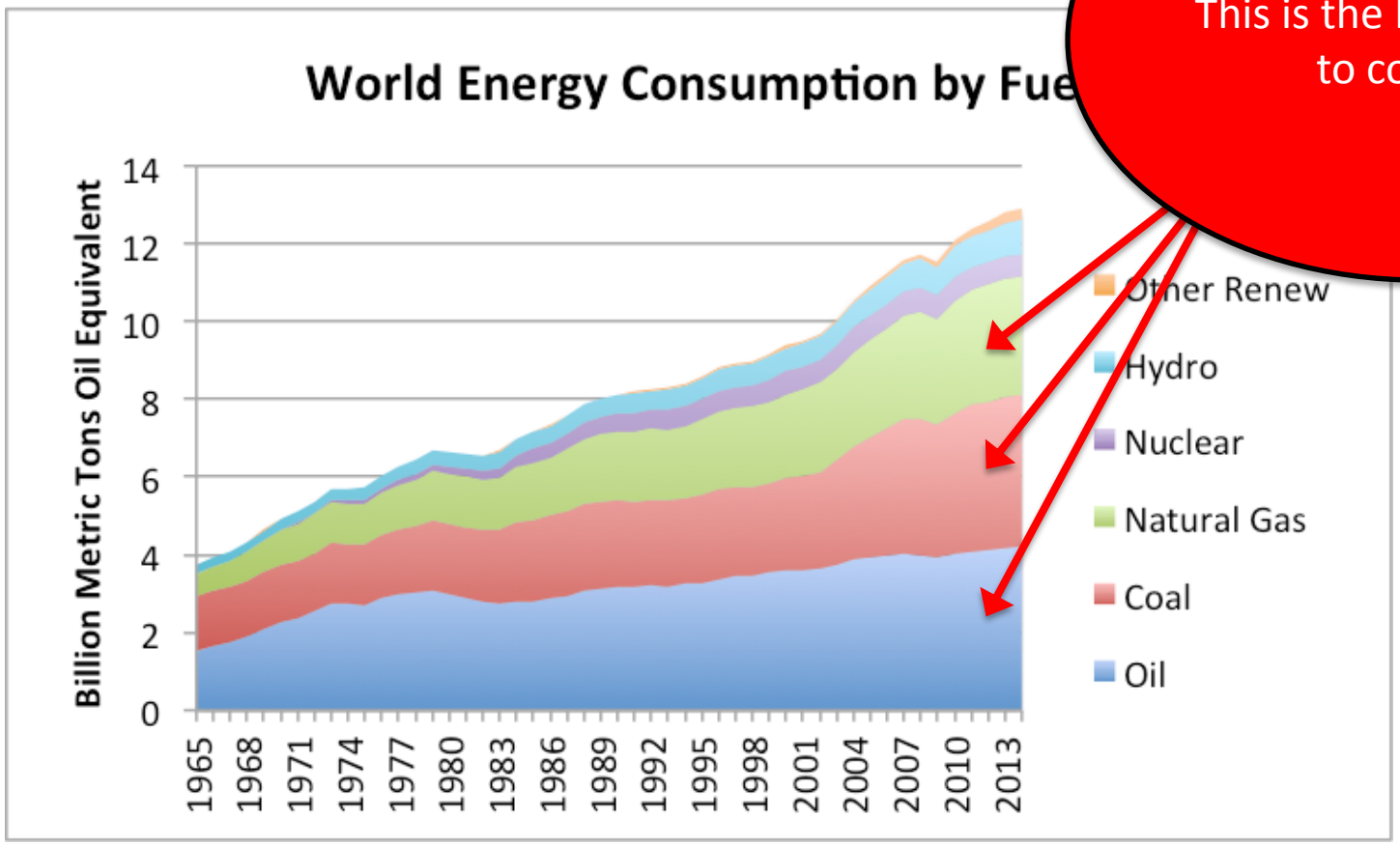
- Stand vs landscape scale
- Reference: Natural system vs managed system
- Start calculation at planting vs at harvest
- Short term vs long term
- Specific stage vs whole life cycle
- Biomass only vs integrated forest product system
- Average vs marginal reference system
- Debt vs investment

There are many relevant questions concerning the contribution of bioenergy to climate change mitigation



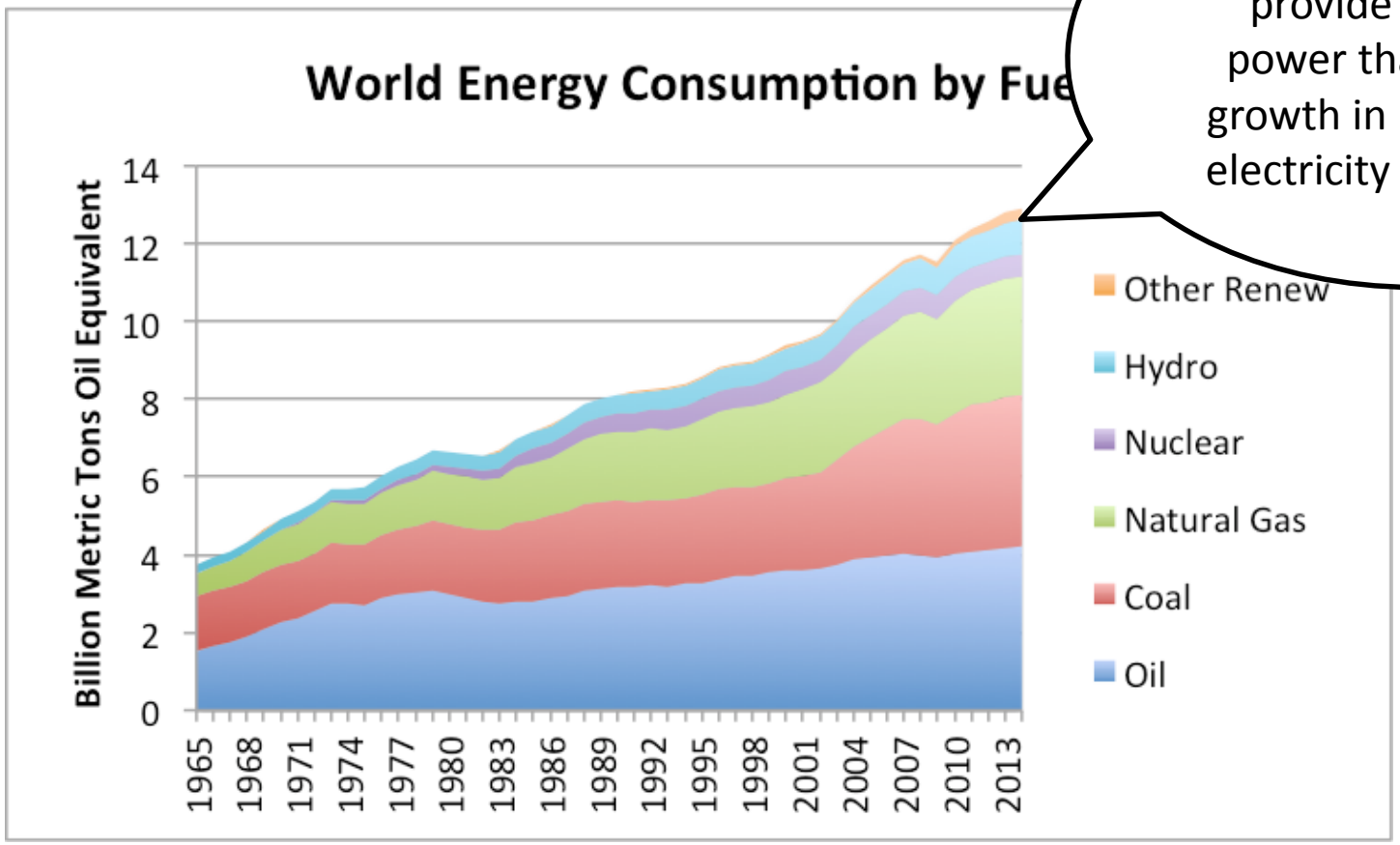
Will we reach our near term GHG target if forest residues are used for energy instead of being left to decay?

There are many relevant questions concerning the contribution of bioenergy to climate change mitigation



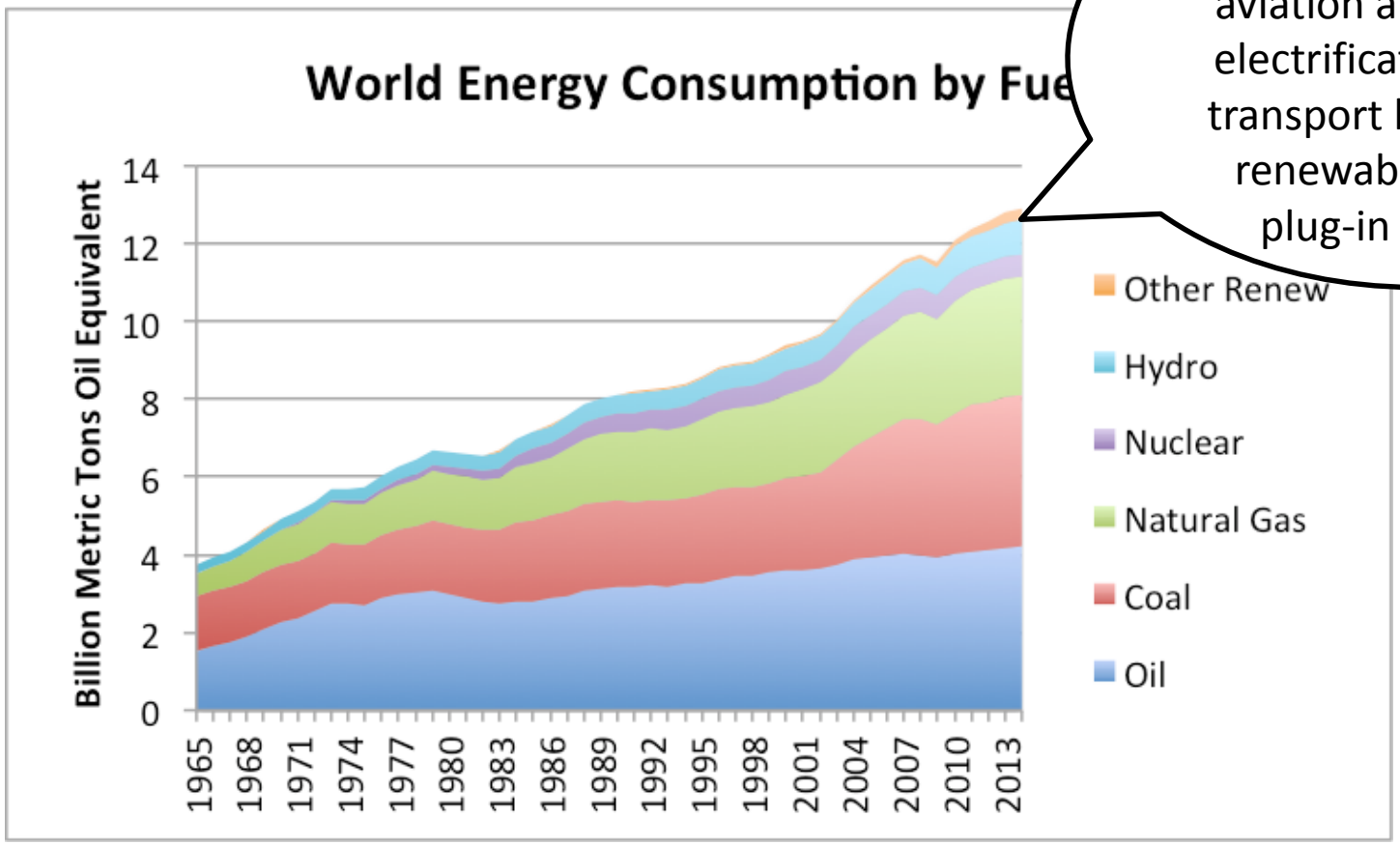
This is the key challenge to consider

There are many relevant questions concerning the contribution of bioenergy to climate change mitigation



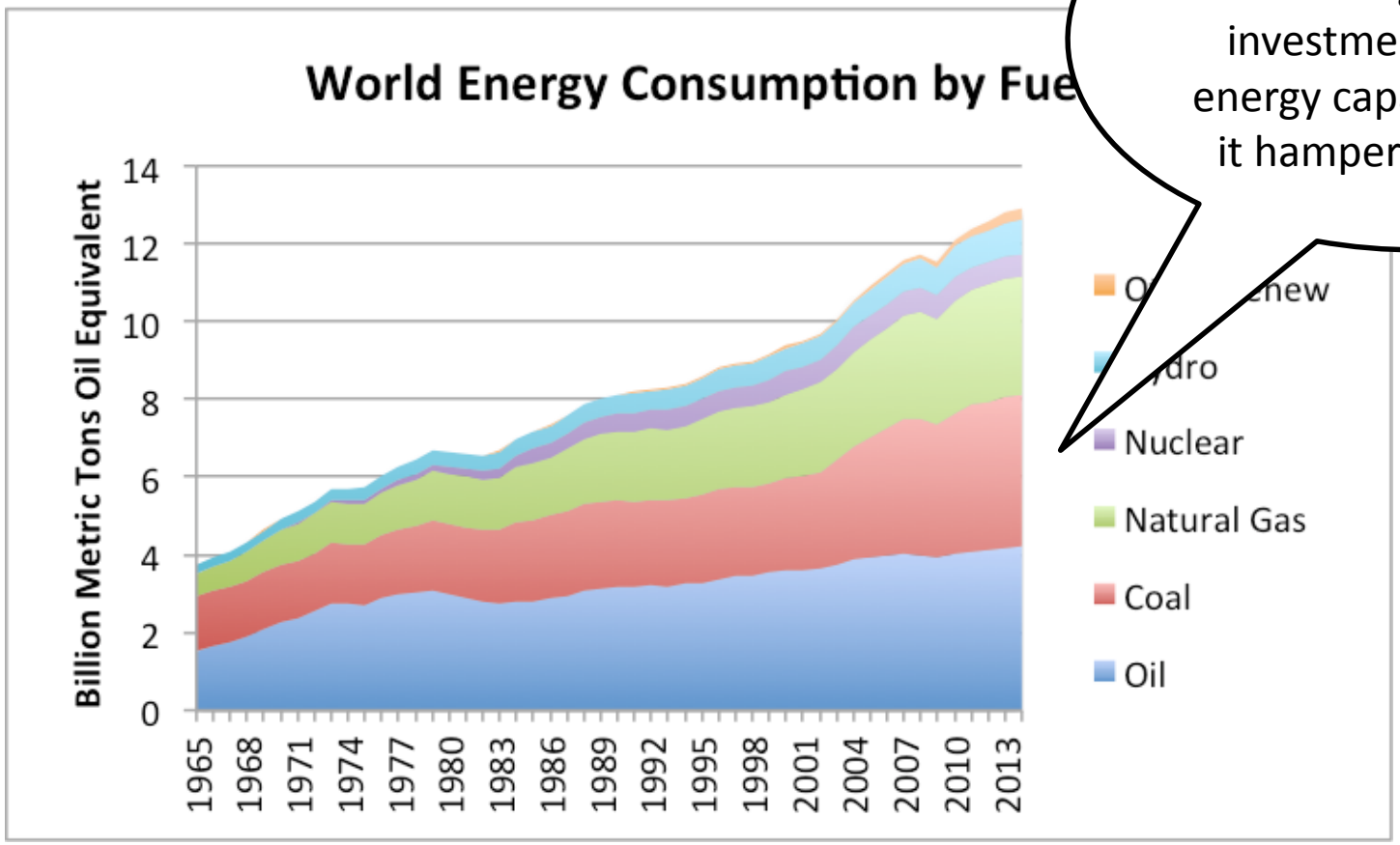
How can bioelectricity provide balancing power that facilitate growth in intermittent electricity generation?

There are many relevant questions concerning the contribution of bioenergy to climate change mitigation



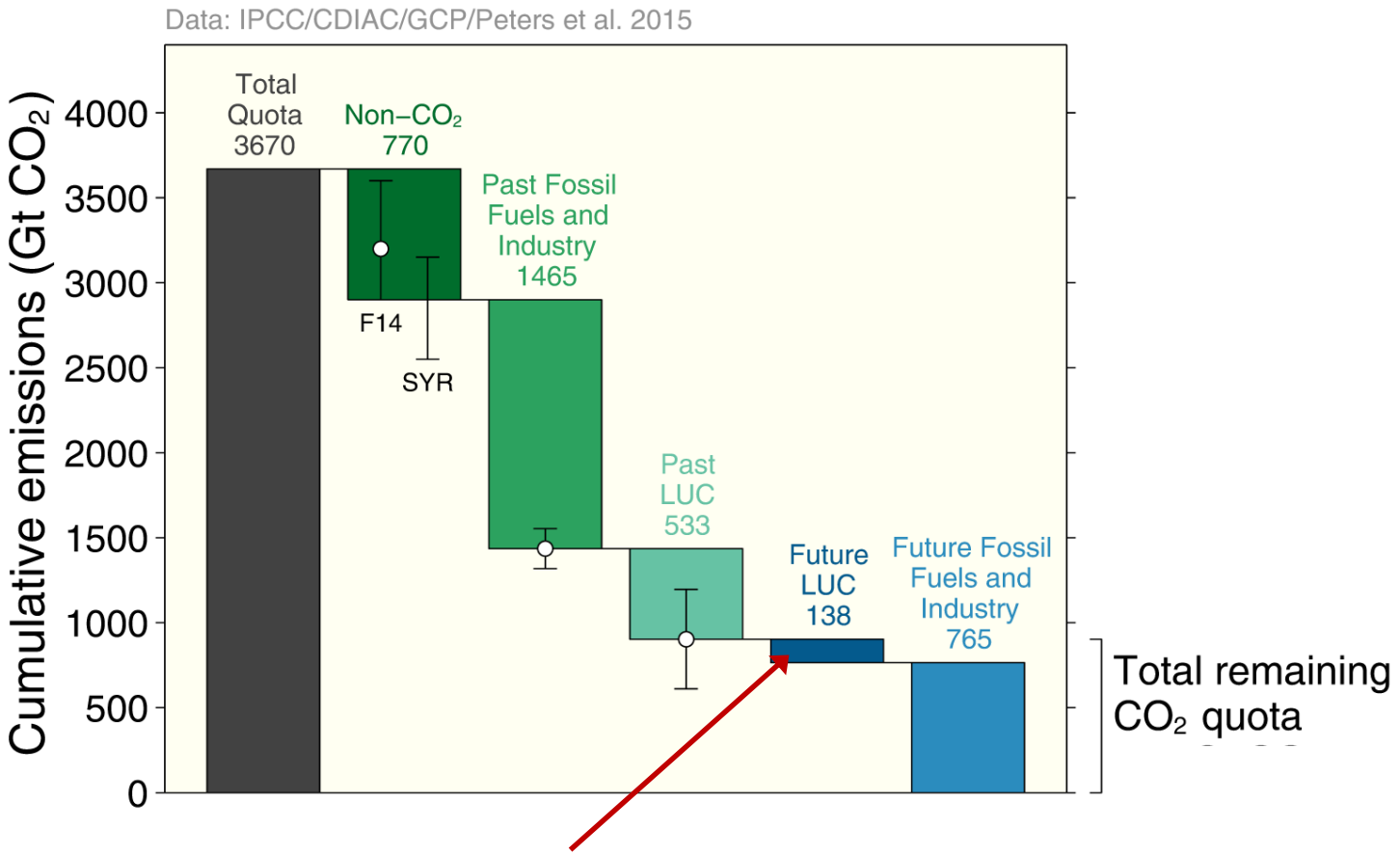
How can biofuels support fossil free aviation and facilitate electrification of road transport by providing renewable fuels for plug-in vehicles?

There are many relevant questions concerning the contribution of bioenergy to climate change mitigation



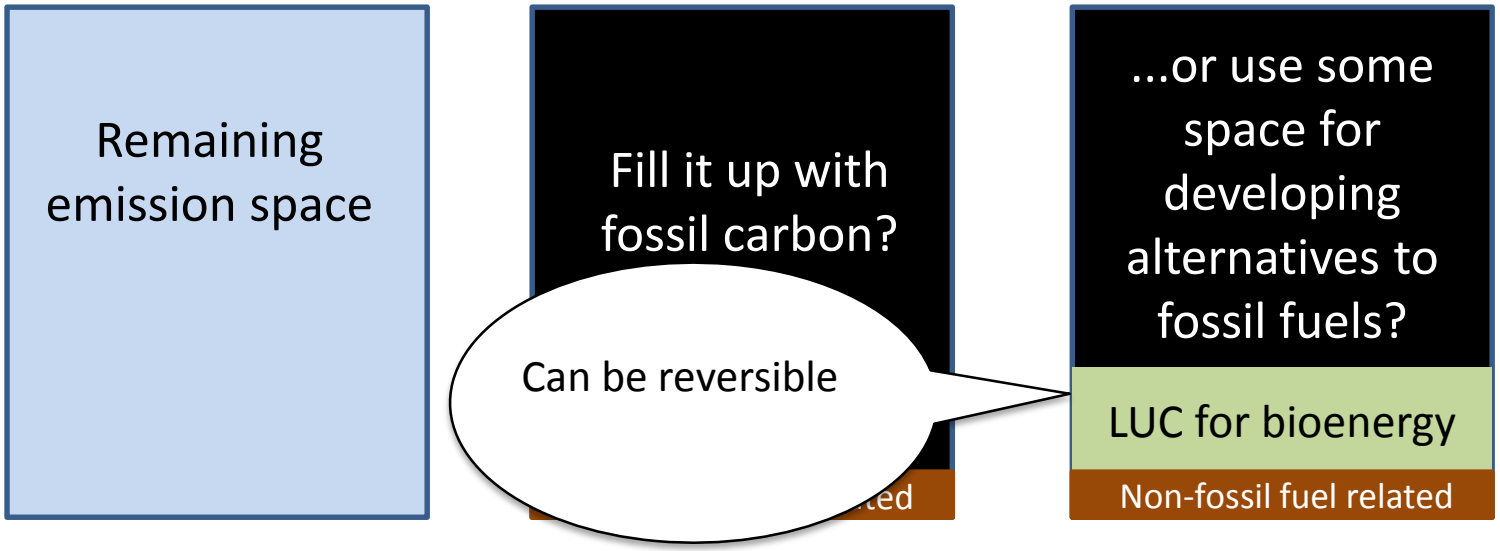
Will investments in bioenergy reduce investments in fossil energy capacity? Or will it hamper other RES?

There are many relevant questions concerning the contribution of bioenergy to climate change mitigation

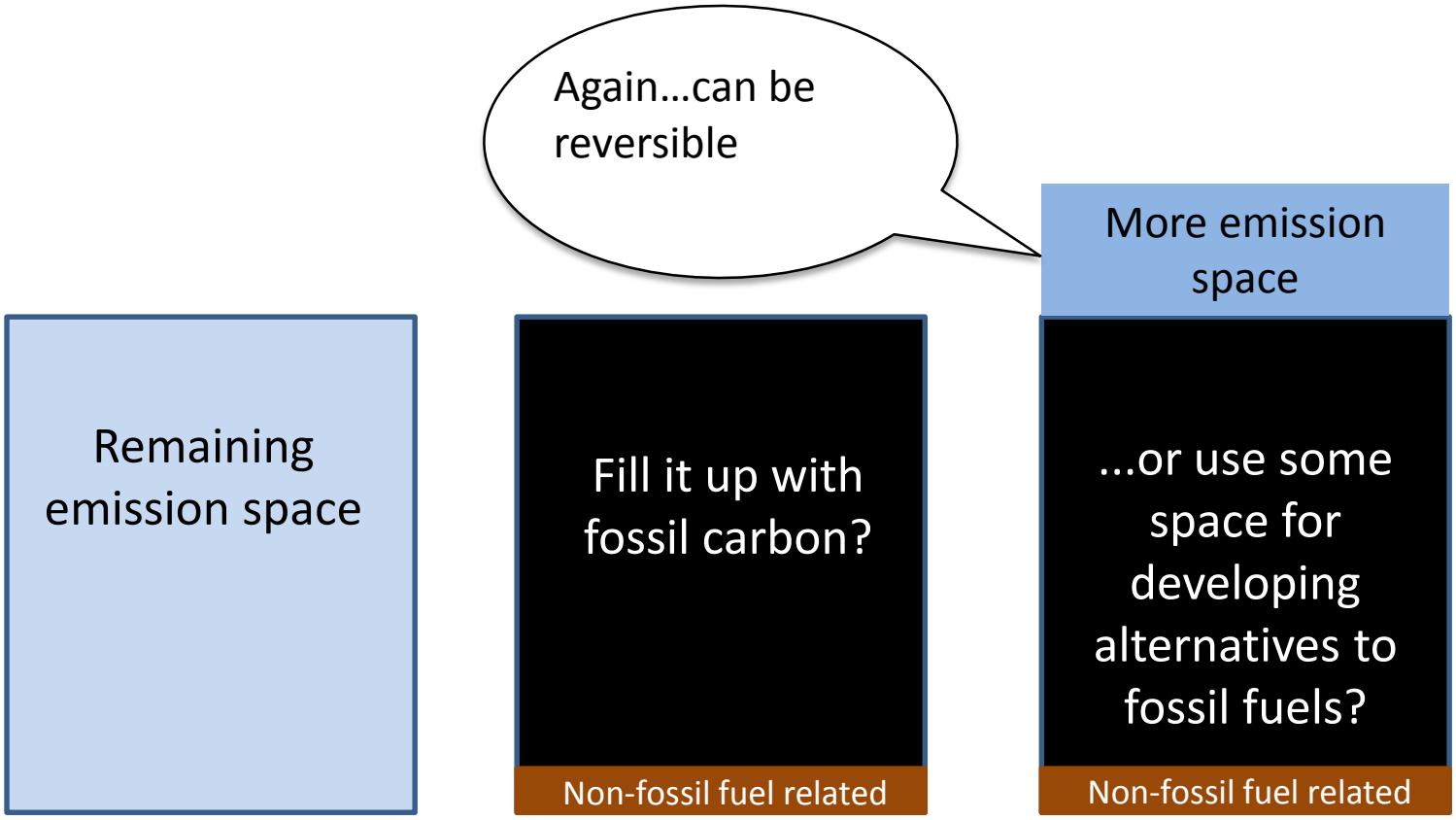


Is it ok to use some of the quota for expanding bioenergy systems?

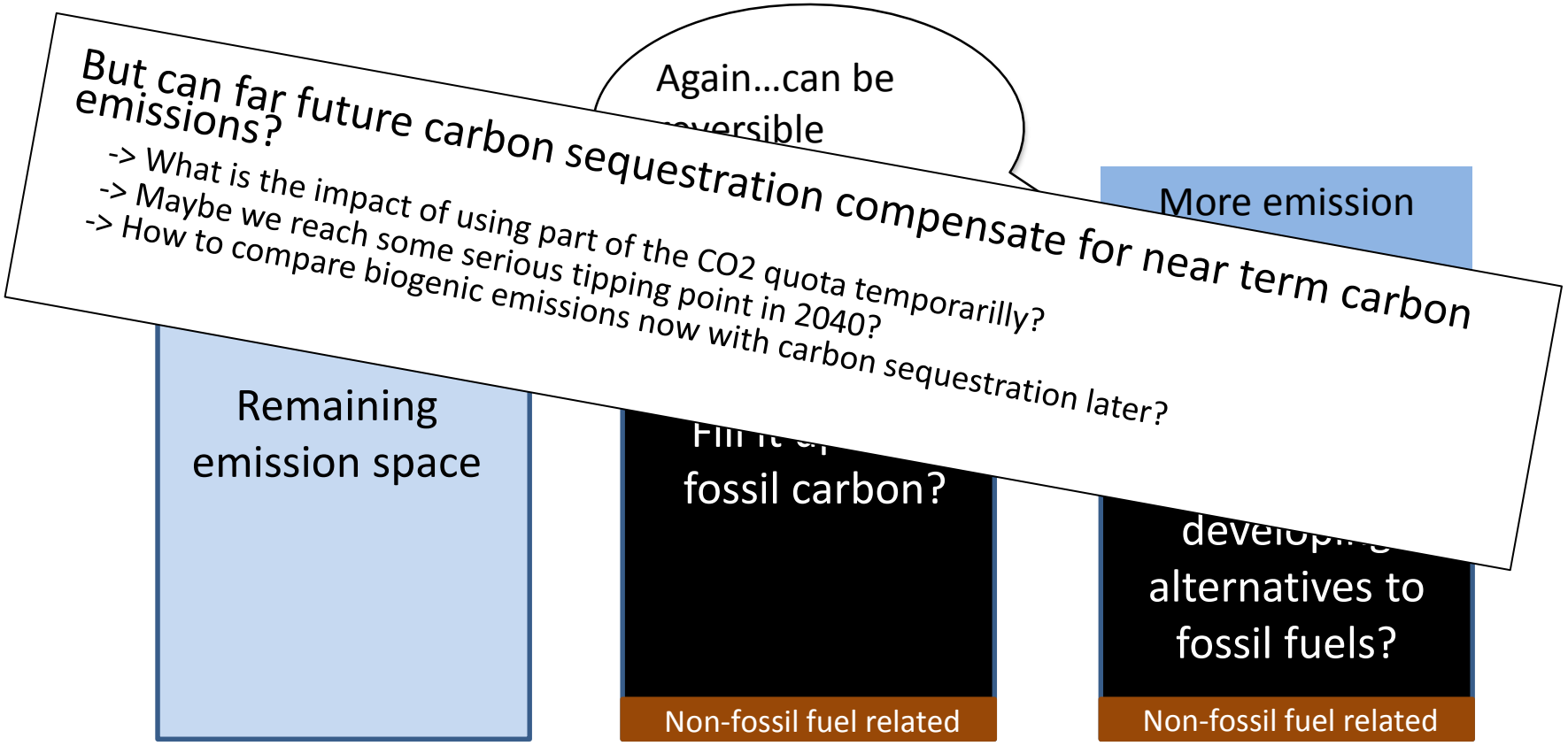
If carbon stock reductions occur, this needs to be considered when weighting the benefits and drawbacks of developing a bioenergy industry to provide renewable energy supply



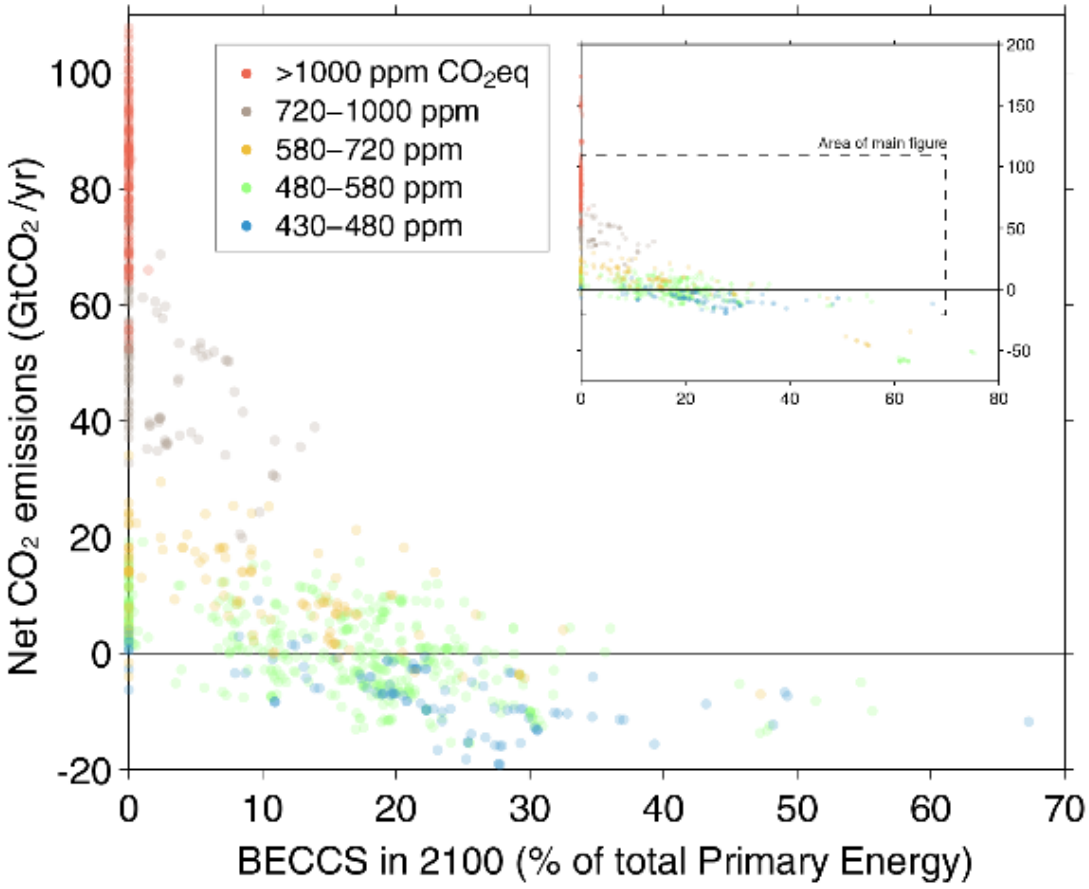
If carbon stock gains occur, this needs to be considered when weighting the benefits and drawbacks of developing a bioenergy industry to provide renewable energy supply



If carbon stock gains occur, this needs to be considered when weighting the benefits and drawbacks of developing a bioenergy industry to provide renewable energy supply



What if bioenergy expansion, causing carbon budget overshoot, paves the way to negative emissions through BECCS?



Scenarios from IPCC Fifth Assessment Report

BECCS is used in over half of scenarios, but ~40% have net positive emissions in 2100

~90% of 2ºC and ~35% of other mitigation scenarios have net negative emissions in 2100

Source: doi:10.1038/nclimate2392

Gothenburg workshop

Focus of discussion:

- significance of timing of carbon emissions and sequestration associated with bioenergy systems
- what insights does climate science provide concerning bioenergy in the context of temperature targets, carbon budget / emission space, timing of peak emissions and peak warming
- how bioenergy contributes to transformation pathways
- modelling and assessment of bioenergy with carbon capture and storage (BECCS)

Alternative research approaches

- Life cycle assessment (LCA)
- Integrated assessment models (IAM)
- Energy systems modelling
- Economic modelling…

Gothenburg workshop: Aims

- Improve understanding of alternative approaches for studying climate effects of bioenergy
- Clarify roles of LCA, energy system modelling, climate science (& other methods?) in informing policy development for bioenergy
- Synthesise thinking: collate ideas on appropriate application of different approaches, thoughts on future research