Designing sustainable biomass supply chains

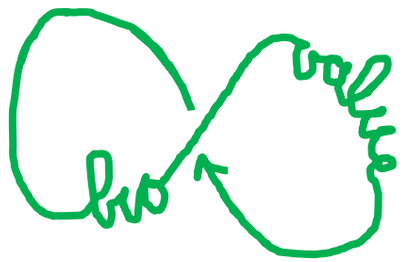
University Ambassador Brazil

Professor Science Communication TU Delft

Section leader Biotechnology and Society

Department of Biotechnology

Flagship Manager BE-Basic ‘embedding BBE in society’

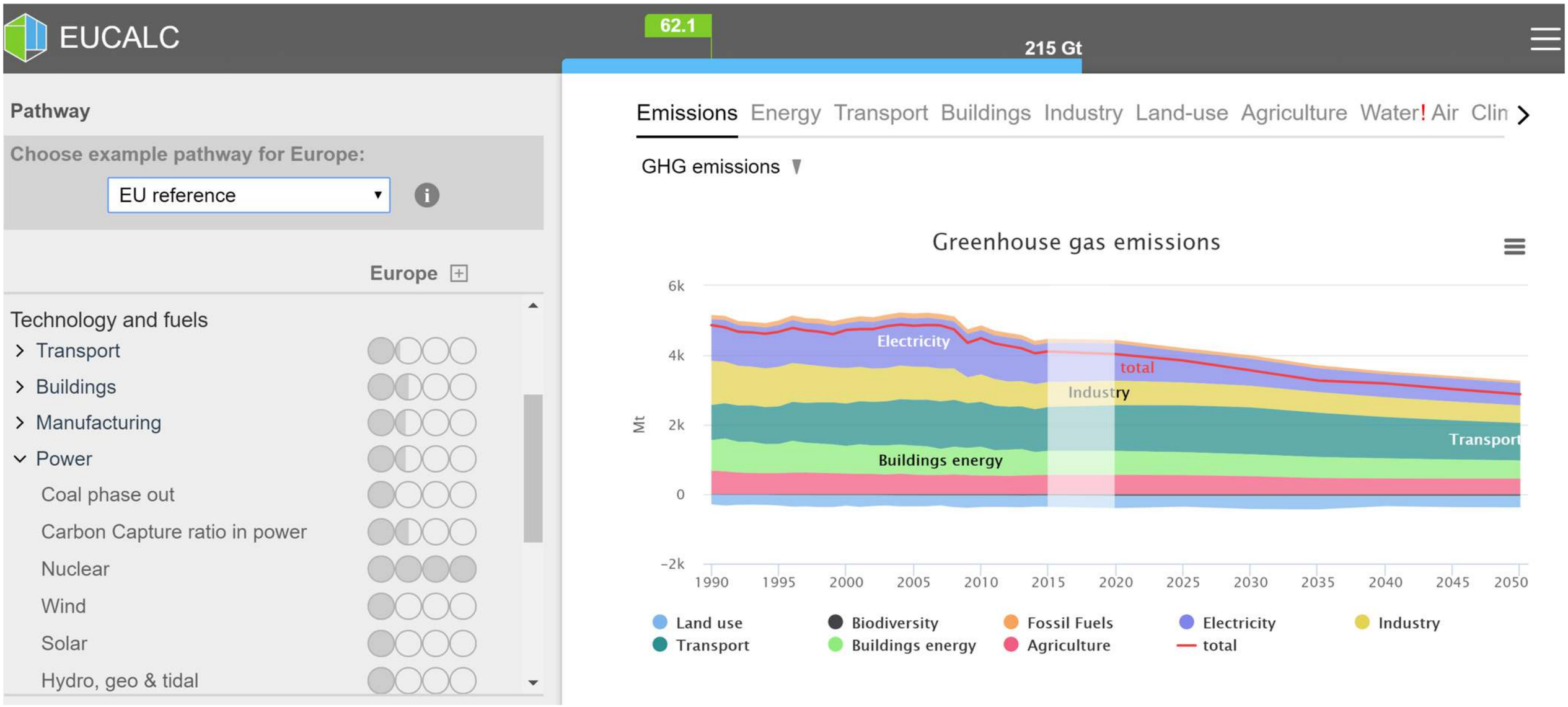


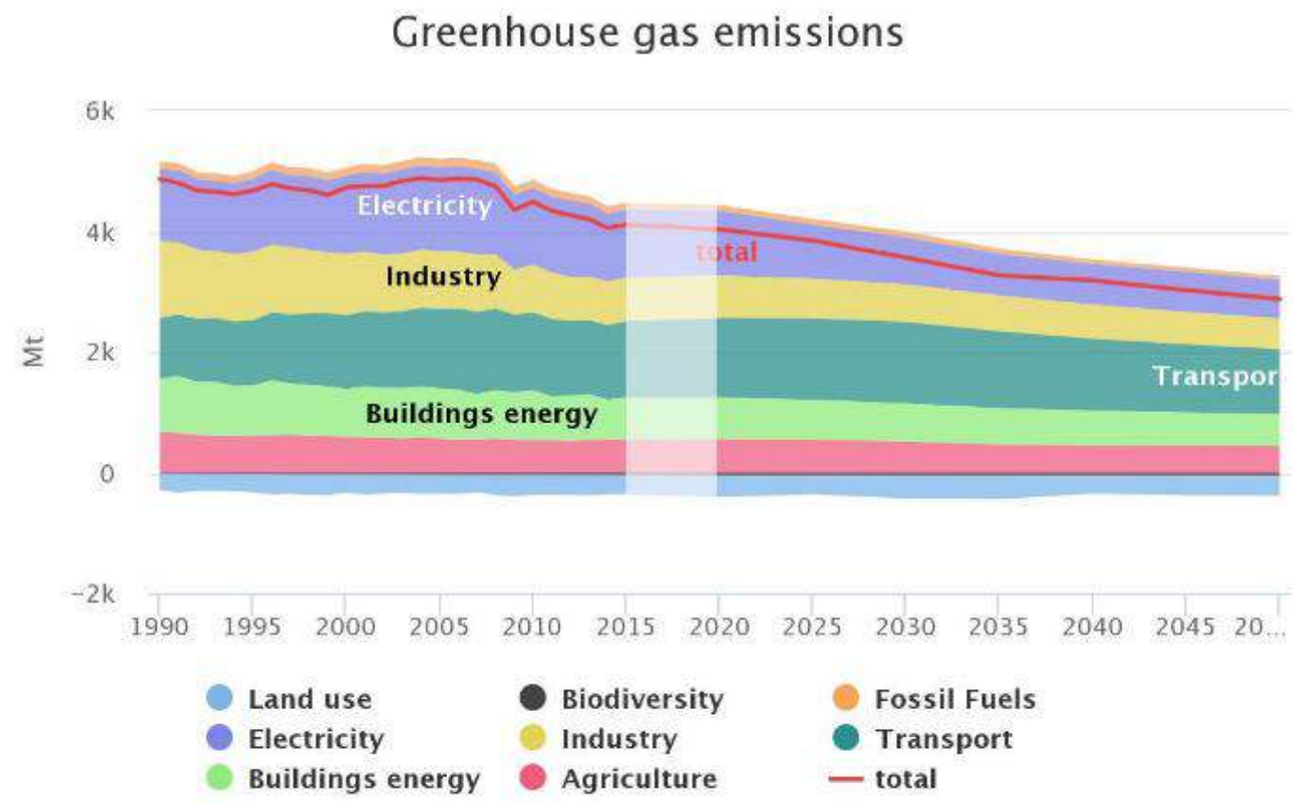
Distinguished Lorentz Fellow, KNAW-NIAS

P.Osseweijer@tudelft.nl

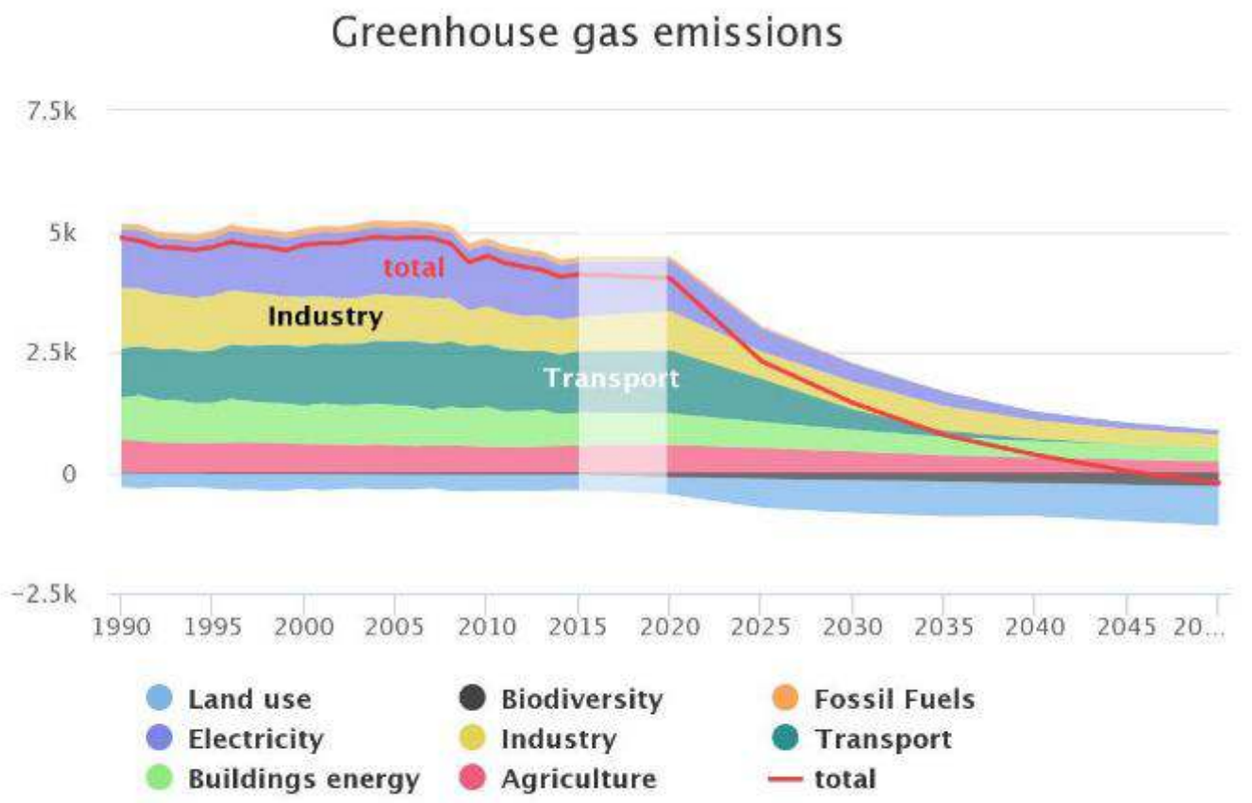
25-11-2019

http://tool.european-calculator.eu



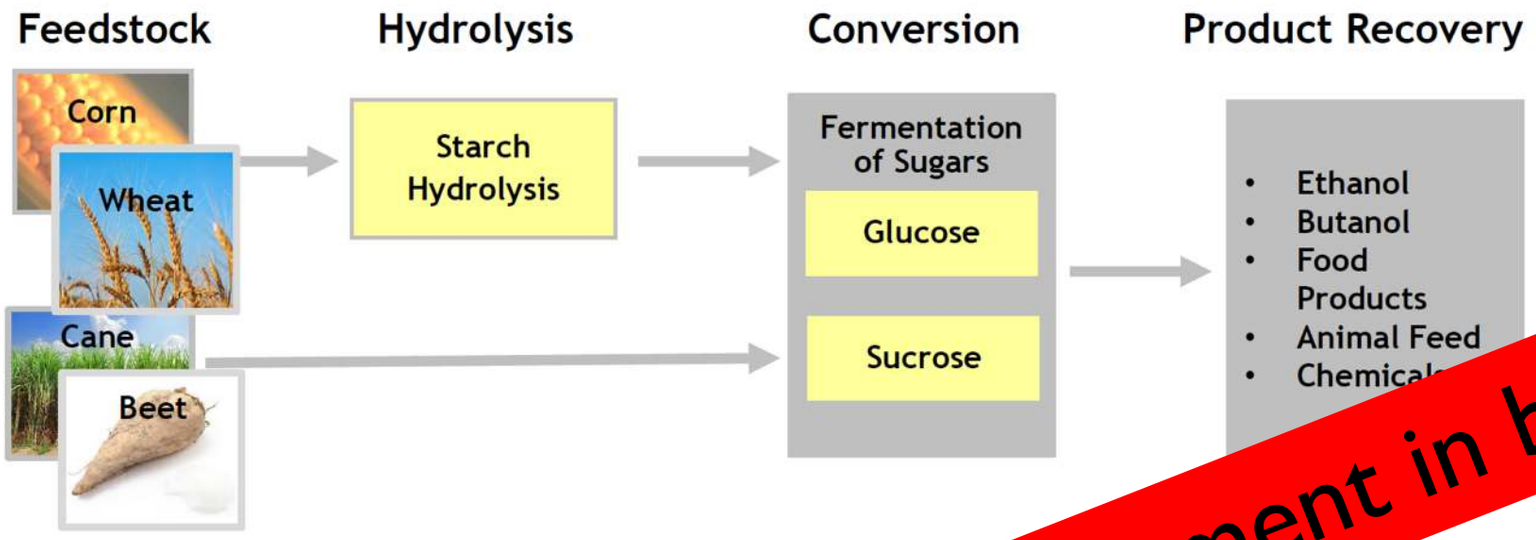


EU Reference scenario



Ambitious scenario

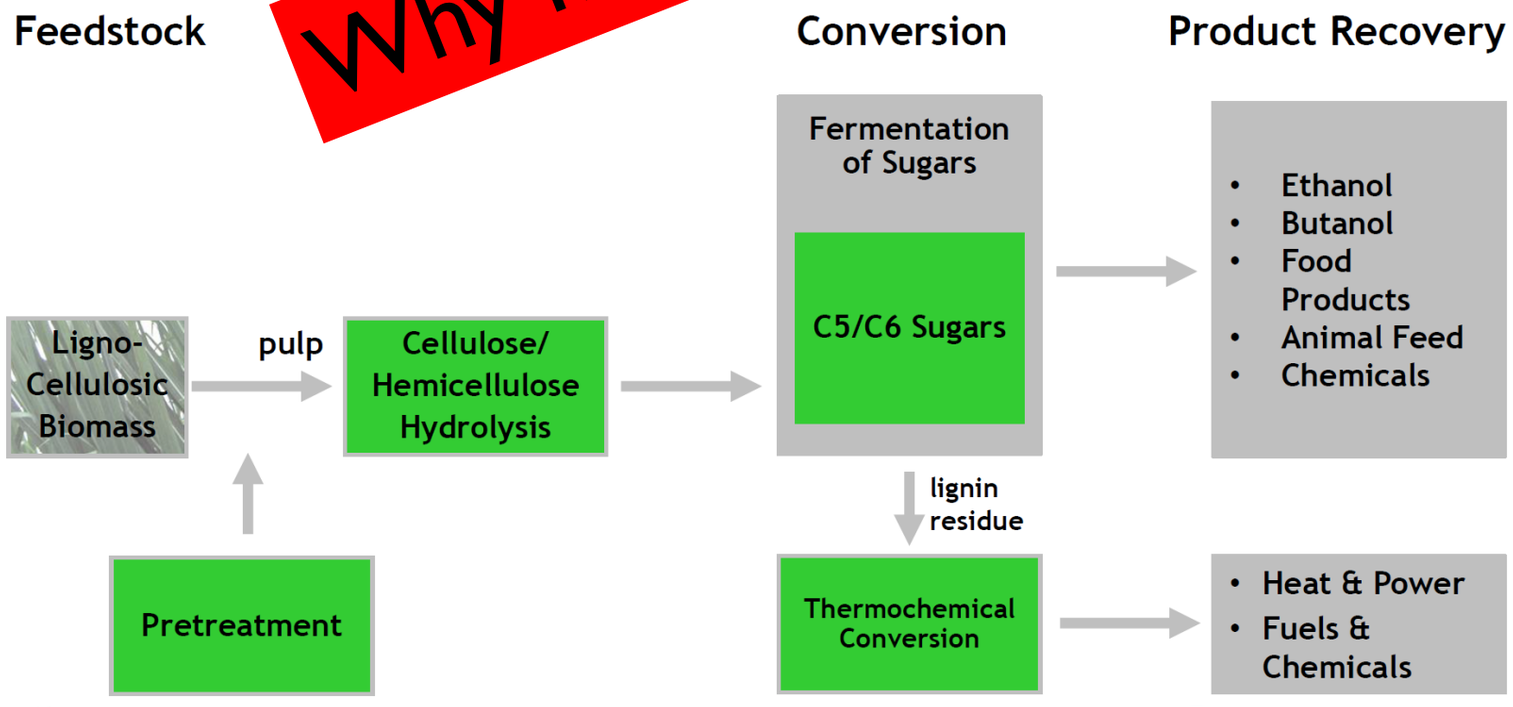
Generation 1: Bioethanol and other bio-products from corn/wheat/cane/beet/…



Why no more investment in biorefineries

900-1000 factories

Generation 2a: Non-f…hanol and other bio-prod…



Less than 10

Noorman, DSM, 2017

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And so much in Windmills?


biodiversity
not
biofuels
biomass
bioplastics
International Day of Action
against the Bioeconomy
environmentalpaper.org/
bioeconomy-day-of-action

AD Nieuws Regio Sport Sh

Binnenland Buitenland Politiek Economie Gezond Biz

Hout ligt klaar om te worden verbrand in een biomassacentrale in Cuijk. © Paul Rapp

Onderzoek: biomassa zorgt voor hogere uitstoot dan kolen

De Eerste Kamer moet vandaag het kabinet afhelpen van de illusies over biomassa, schrijven Fenna Swart en Martin Luiga.

Fenna Swart en Martin Luiga 5 november 2019, 10:29

DL+ Plus-artikelen zijn exclusief voor abonnees van De Limburger. Verder le

‘Biomassa is niet duurzaam, maar doodt mensen’

26-10-2019 om 06:18 door Chris van Mersbergen | Bron: AD

De Amercentrale in Geertruidenberg. © Lex van Lieshout

‘Miljardensubsidies voor biomassa zijn weggegooid geld’

Afgelopen zomer demonstreerden kinderen tegen de grootste biomassacentrale van Nederland ten oosten van Amsterdam © Jean-Pierre Jans

‘Biomassa is bom onder het klimaat’

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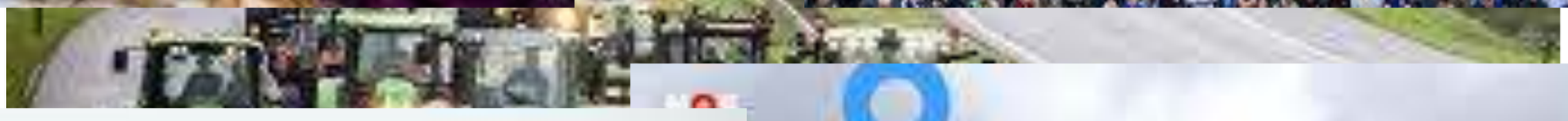
We can go follow the trend…



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major assumptions

- There is not enough land available
- Food prices related to biofuel production
- Biofuels do not contribute to less GHG emissions

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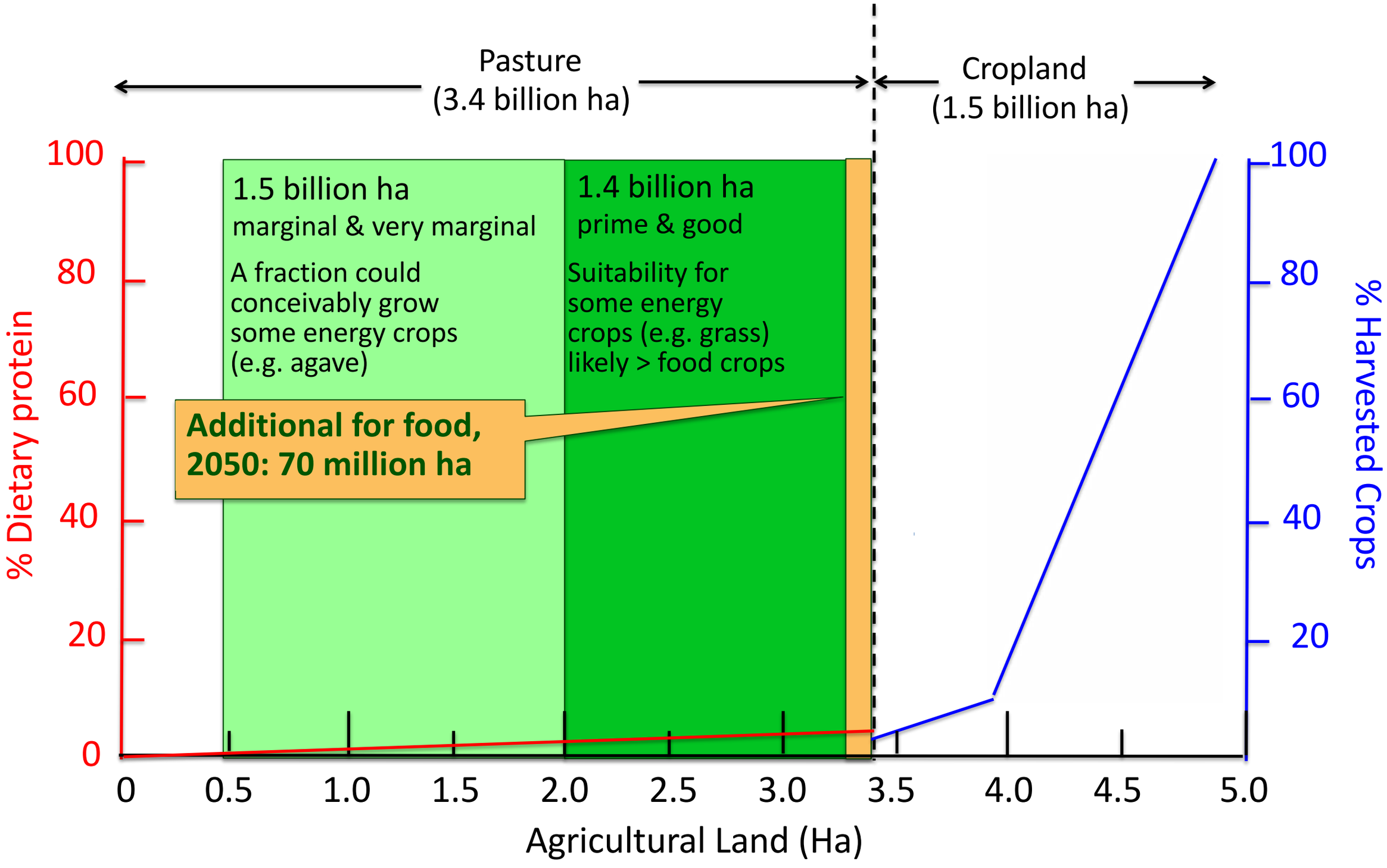
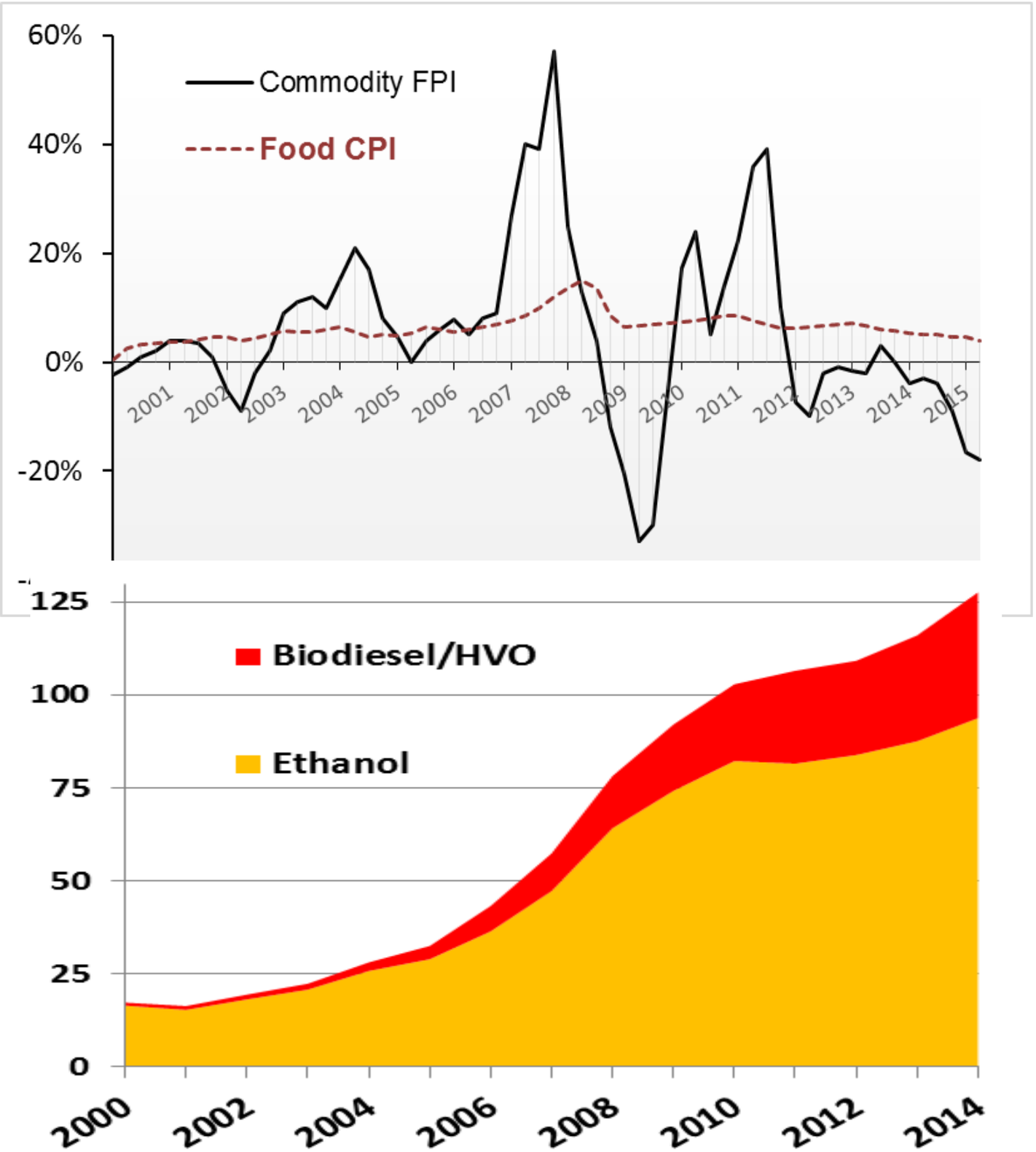
At a global level, there is lots of land available beyond what is needed for food.

Additional land needed for food production in 2050 (FAO)



Added land needed for food in 2050: 5% of prime and good land not used for row crops now.
Lee Lynd, Darthmouth College 2015, Jeremy Woods, Imperial College, 2016

Did biofuel expansion drive increased food prices?



Between 2005 and 2015:

- Global population increased by nearly 1 billion (810 million),
- Biofuel production increased by more than 200% (245%),
- Global food commodity prices decreased by about 18%, and;
- The prices consumers paid for food remained roughly the same.

[Source: Kline et al, 2016. GCB]

Fig. 2: Global biofuel consumption (billion liters) 2000-2014 grew steadily, although fuel ethanol production dipped slightly in 2010-2012 due to global recession and poor weather in Brazil (in 2011) and the U.S. (in 2012). Still, average annual growth in global production over 2009-2014 remained robust, at 5.2% and 11% for fuel ethanol and biodiesel, respectively (REN21, 2015). Chart based on IEA, 2015, and REN21, 2015.

Published Online February 7 2008
Science 29 February 2008:
Vol. 319 no. 5867 pp. 1238–1240
DOI: 10.1126/science.1151861

REPORT

Use of U.S. Croplands for Biofuels Increases Greenhouse Gases Through Emissions from Land-Use Change

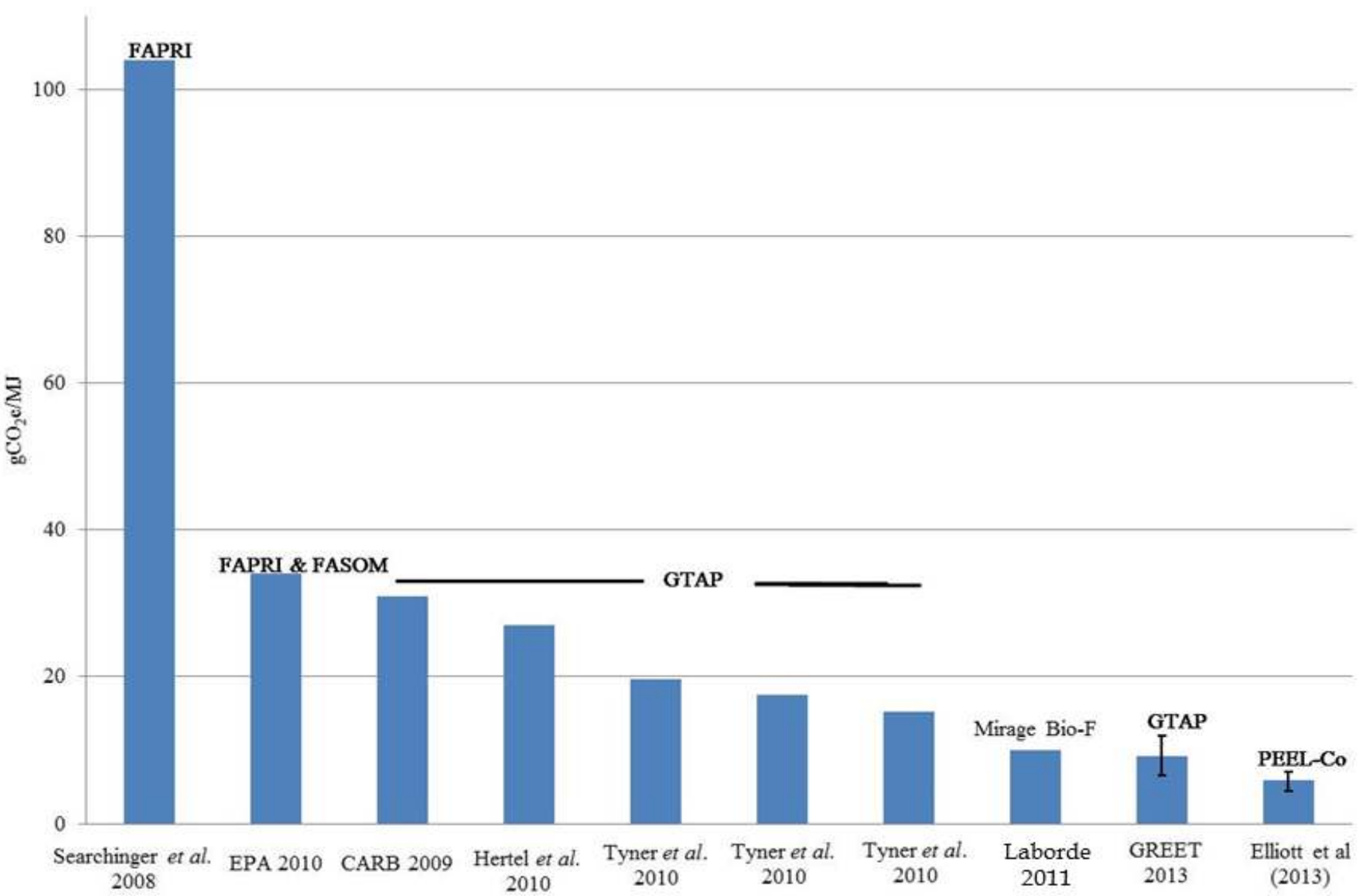
Timothy Searchinger[1,*], Ralph Heimlich[2], Jacinto Fabiosa[4], Simla Tokgoz[4], Dermot

± Author Affiliations

* To whom correspondence should be ad

ABSTRACT

Most prior studies have found that sub because biofuels sequester carbon thr to count the carbon emissions that occ convert forest and grassland to new cr By using a worldwide agricultural mod that corn-based ethanol, instead of pr over 30 years and increases greenhous U.S. corn lands, increase emissions by and highlights the value of using wast



…the magnitude of iLUC was [previously] felt to be large enough to negate the GHG emission benefits of an otherwise low-emitting biomass-based fuel supply chain. Five years later, this is no longer the case. (Macedo et al).

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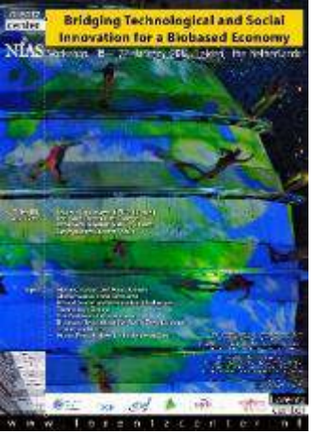


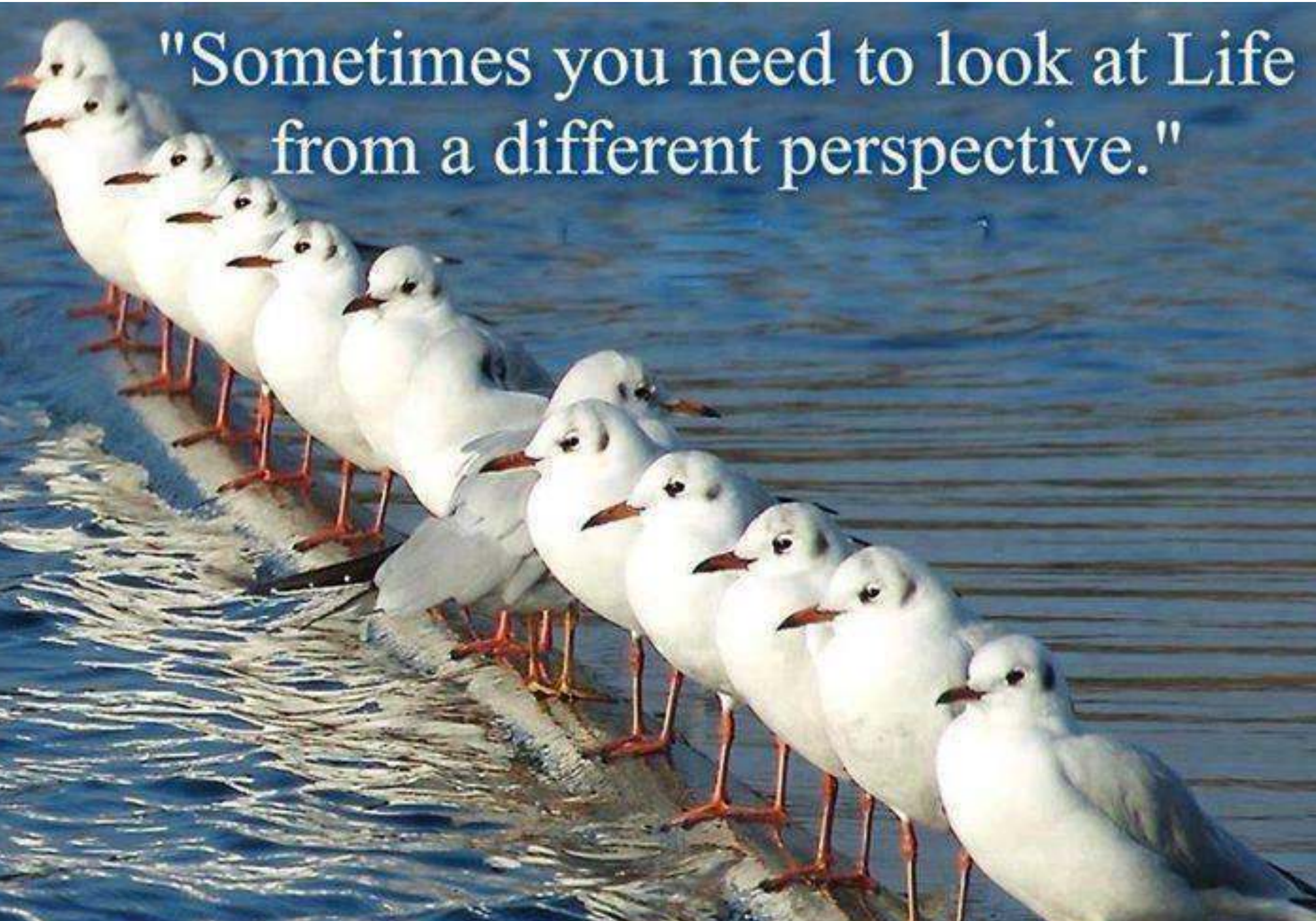
In public debates:

Rational quantified data on environmental impact

~~=~~ answer emotional concerns

What is good?

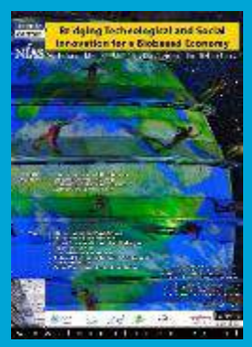
- **Moral concepts**
- **Cultural differences**
- **Public emotions**


"Sometimes you need to look at Life
from a different perspective."

Sustainable development

1. What is 'good'? – moral aspects
   - Scientific uncertainty, trust, values, just distribution, perceptions, interests

FOCUS



2. How do we get there? – perspectives for action
   - What do we need? Technology, infrastructure
   - Who needs to do what? Incentives, support

3. How to make choices? – political arena

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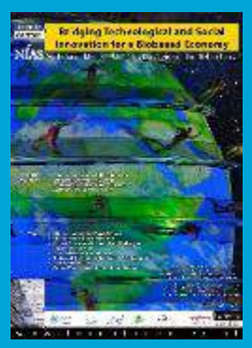
FOCUS

- What is ‘good’? – moral aspects

  - Scientific uncertainty, trust, values, just distribution, perceptions, interests



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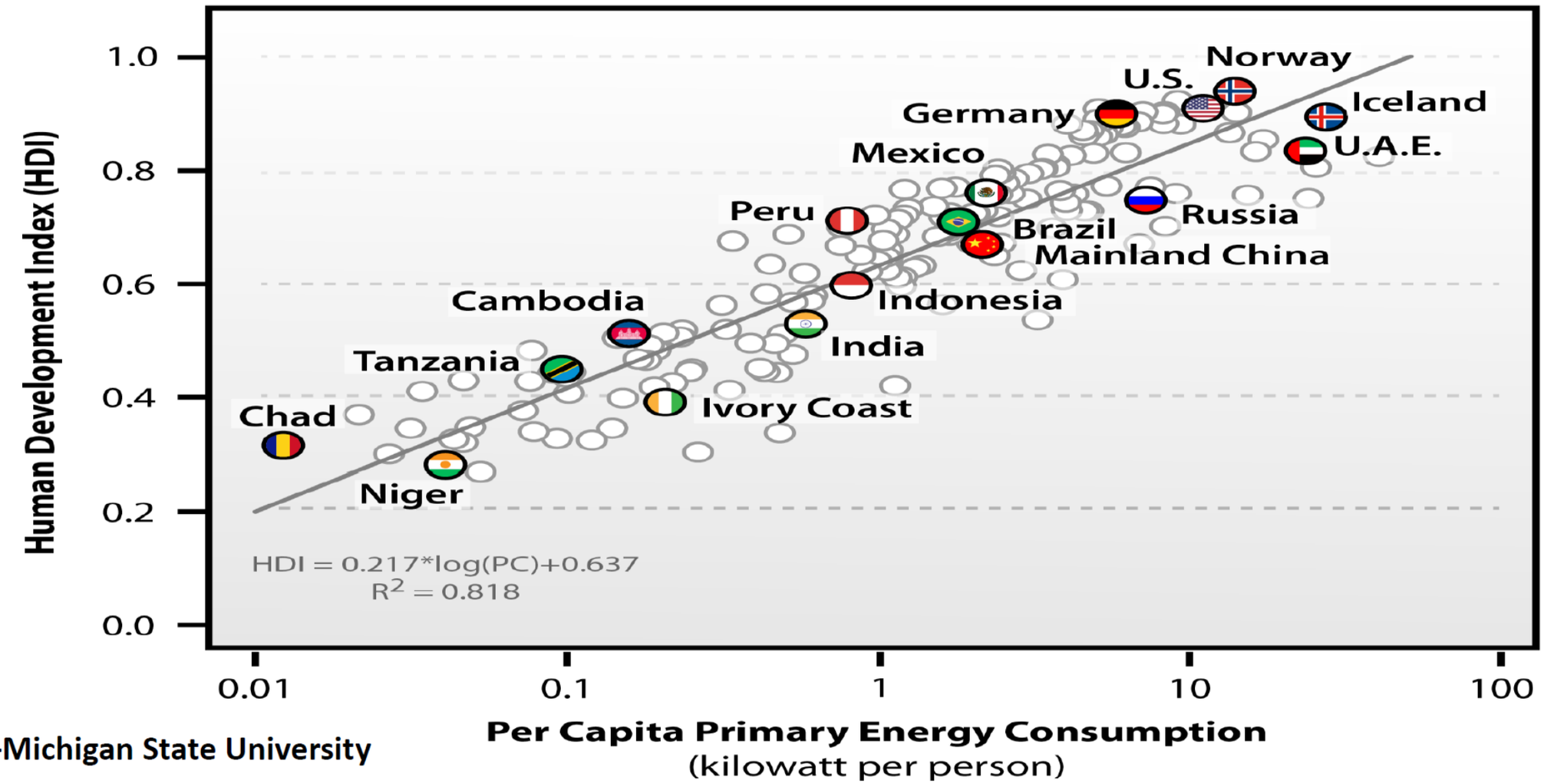
Energy Consumption & Human Well Being are Linked:

No Countries have Both High HDI and Low Energy Use



Bruce Dale–Michigan State University

No enough energy (including fuels)for everybody, even with nowadays population

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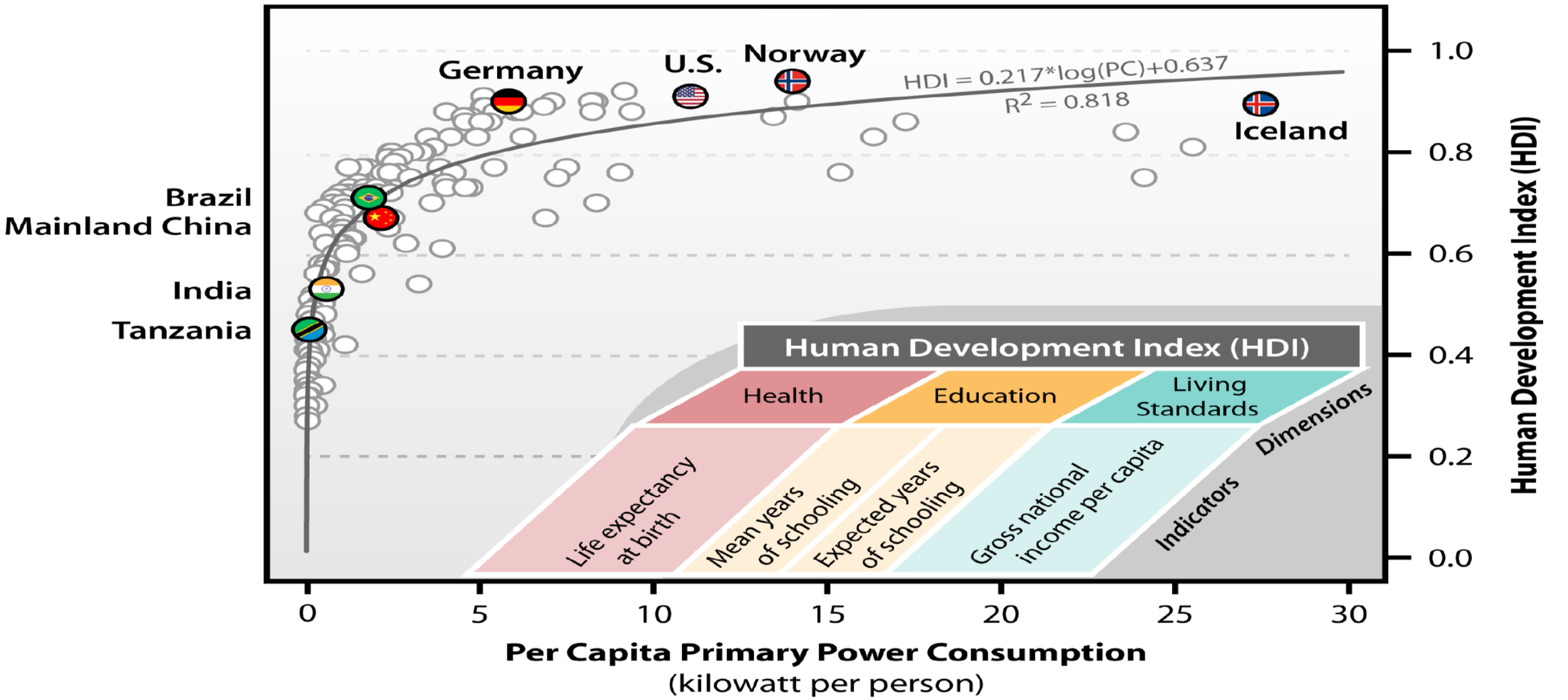
Energy Consumption & Human Well Being are Linked



By Bruce Dale–Michigan State University

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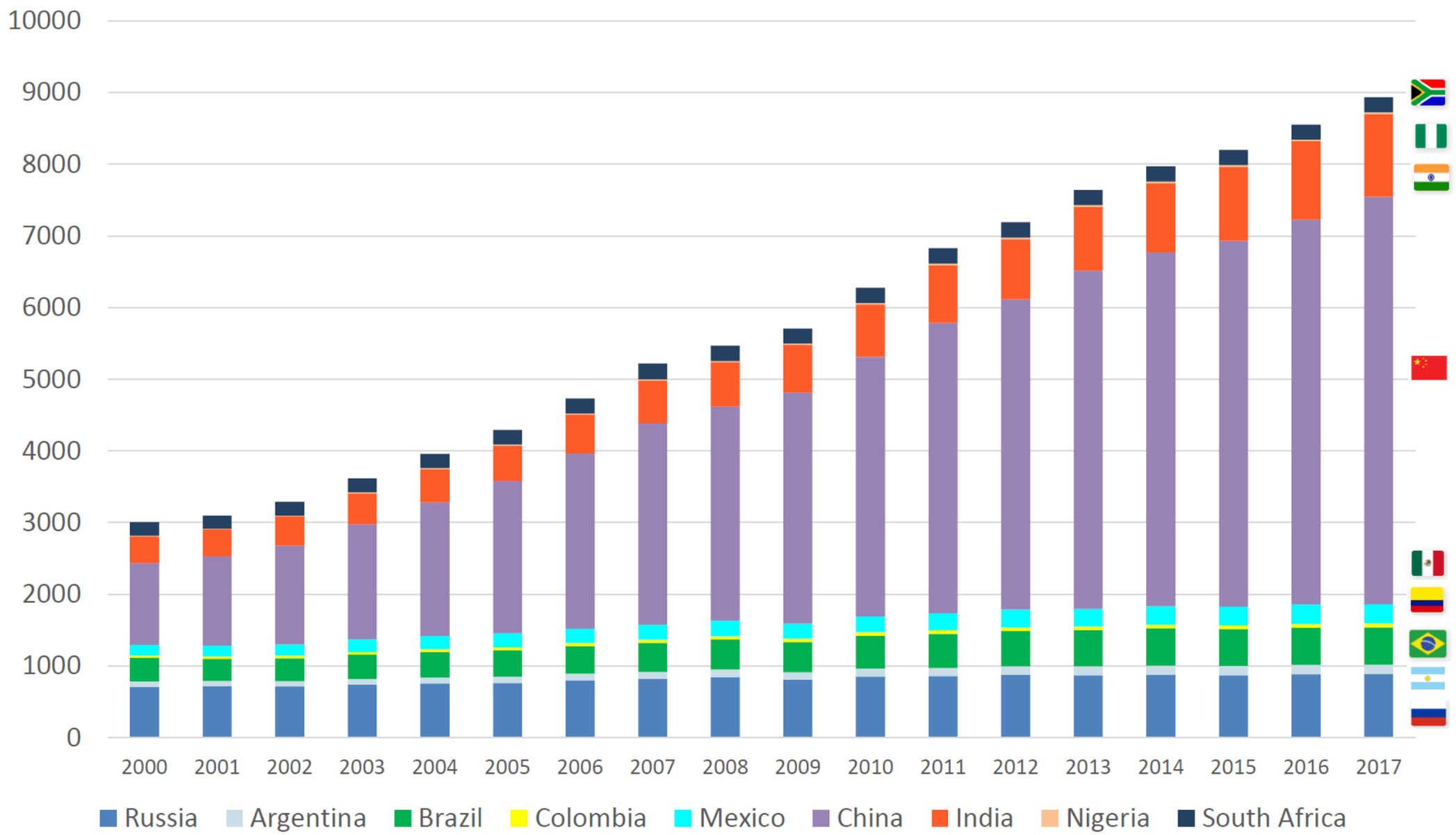
Electricity domestic consumption (TWh)



Ortiz P.A. and Maciel Filho R. IEA, Sweden 2019

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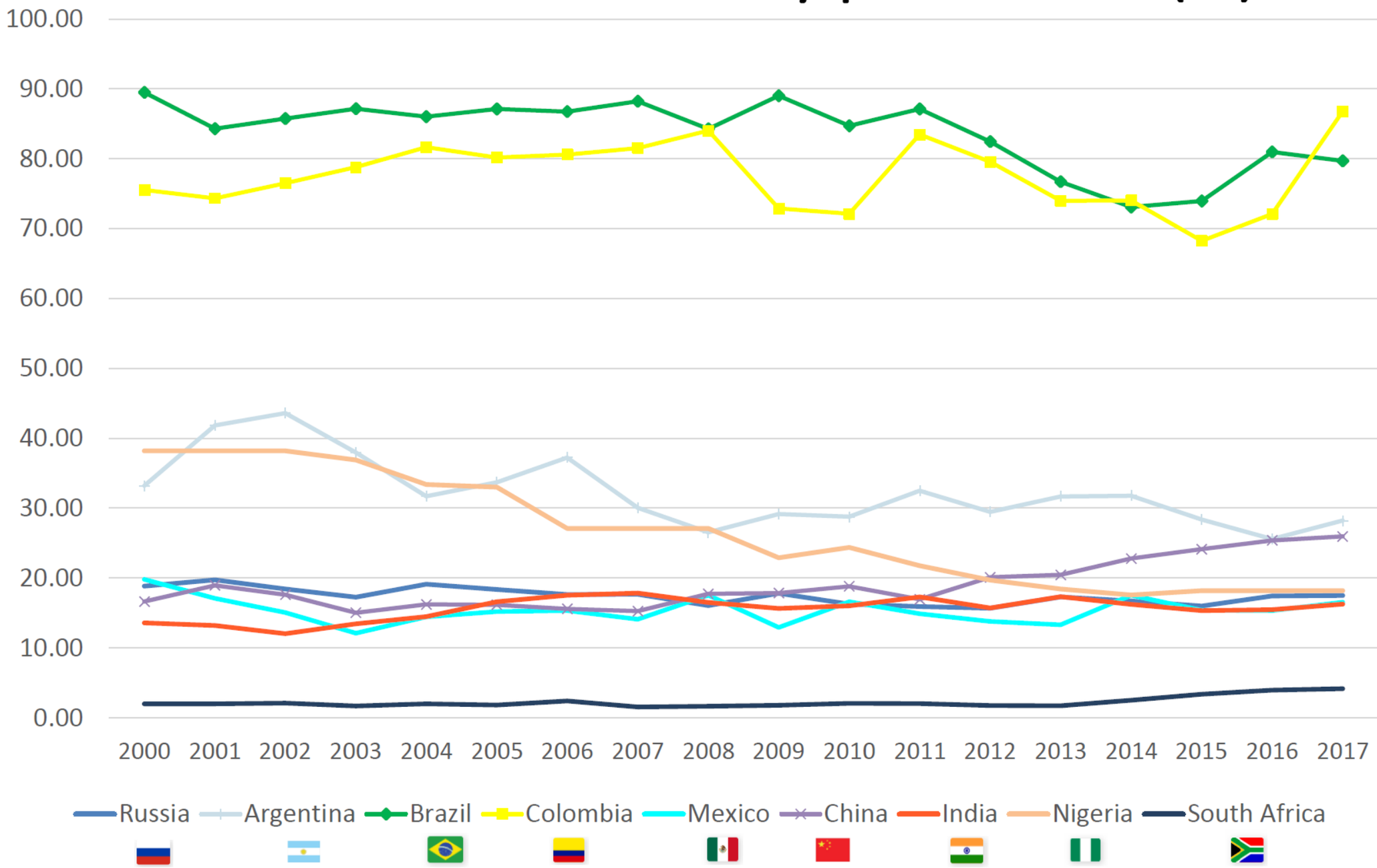
Share of renewables in electricity production (%)



Ortiz P;A. and Maciel Filho R. IEA, Sweden 2019

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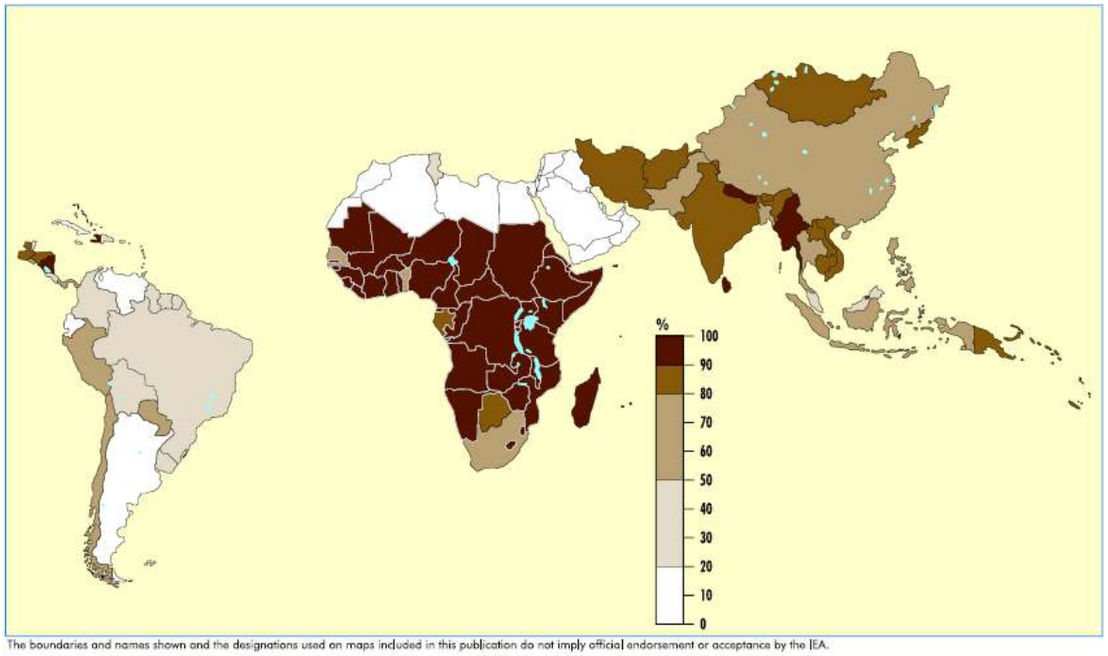
Trends…

- Growing world population
- Growing consumerism
- Youth peak – 1,8 B people under 18 in SSA
- 15 M entering workforce every year – 33.000/day!
- Less developed countries: 80% unemployed

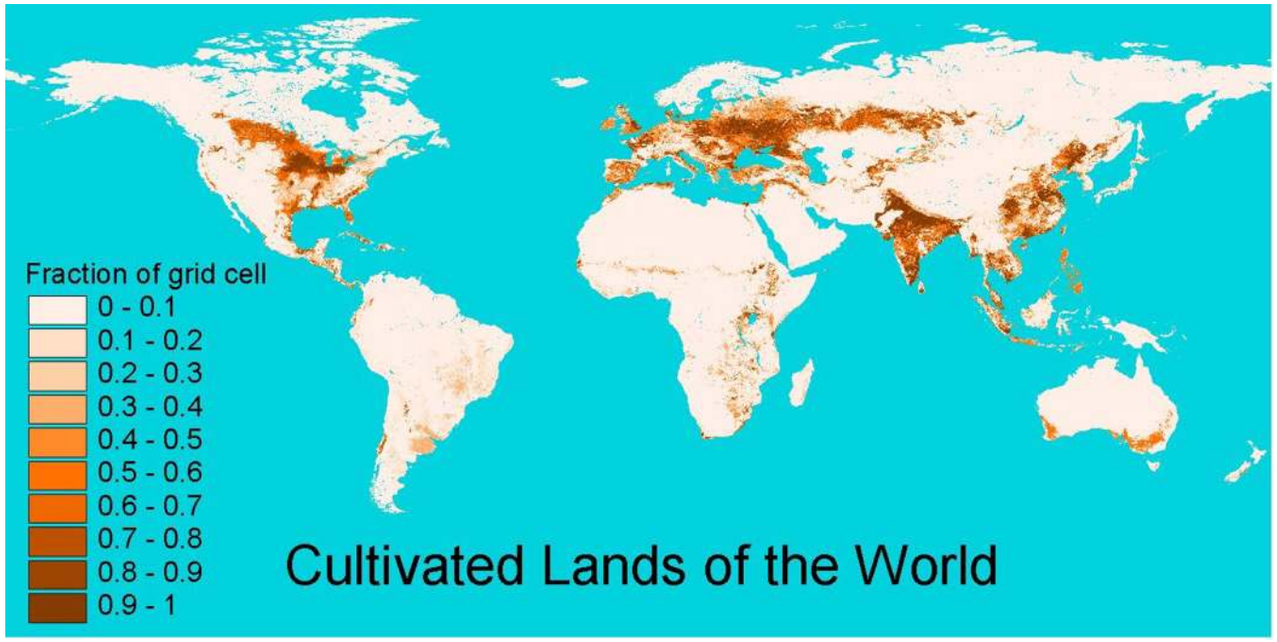
- ❖ food and energy insecurities still affect nearly one billion people
- ❖ 75 % live in rural areas, where fertile land is available
- ❖ Coincides with unsustainable traditional use of biomass

Majority available land in areas where technology can improve sustainable practices



The boundaries and names shown and the designations used on maps included in this publication do not imply official endorsement or acceptance by the IEA.

Source: IEA databases.



Traditional use of biomass

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Food *in*security is directly related to poverty

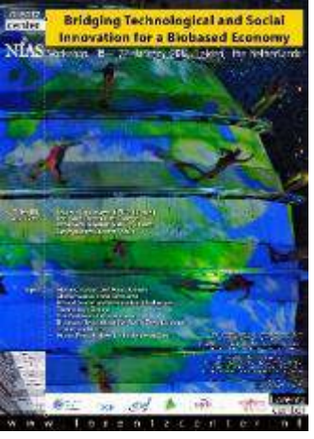
- **One out of two** children live in poverty -> growing population

Eradication of ***poverty is key for sustainability***

This requires *science, technology, investment* and *equal distribution*

Sustainable bioenergy production can stimulate rural development; provide employment, infrastructure, energy security and social development



- If we agree with the social goals; **then social goals** need to be part of the R&D agenda

- We need more examples of **feasible**, **small scale - high tech** solutions which are tailored to needs of local communities

- Rural development to **include bioenergy and products for social development**

Action required…

- Jobs delivering income and political stability
- Renewable energy from own resources
- **Education!**
- Entrepreneurship

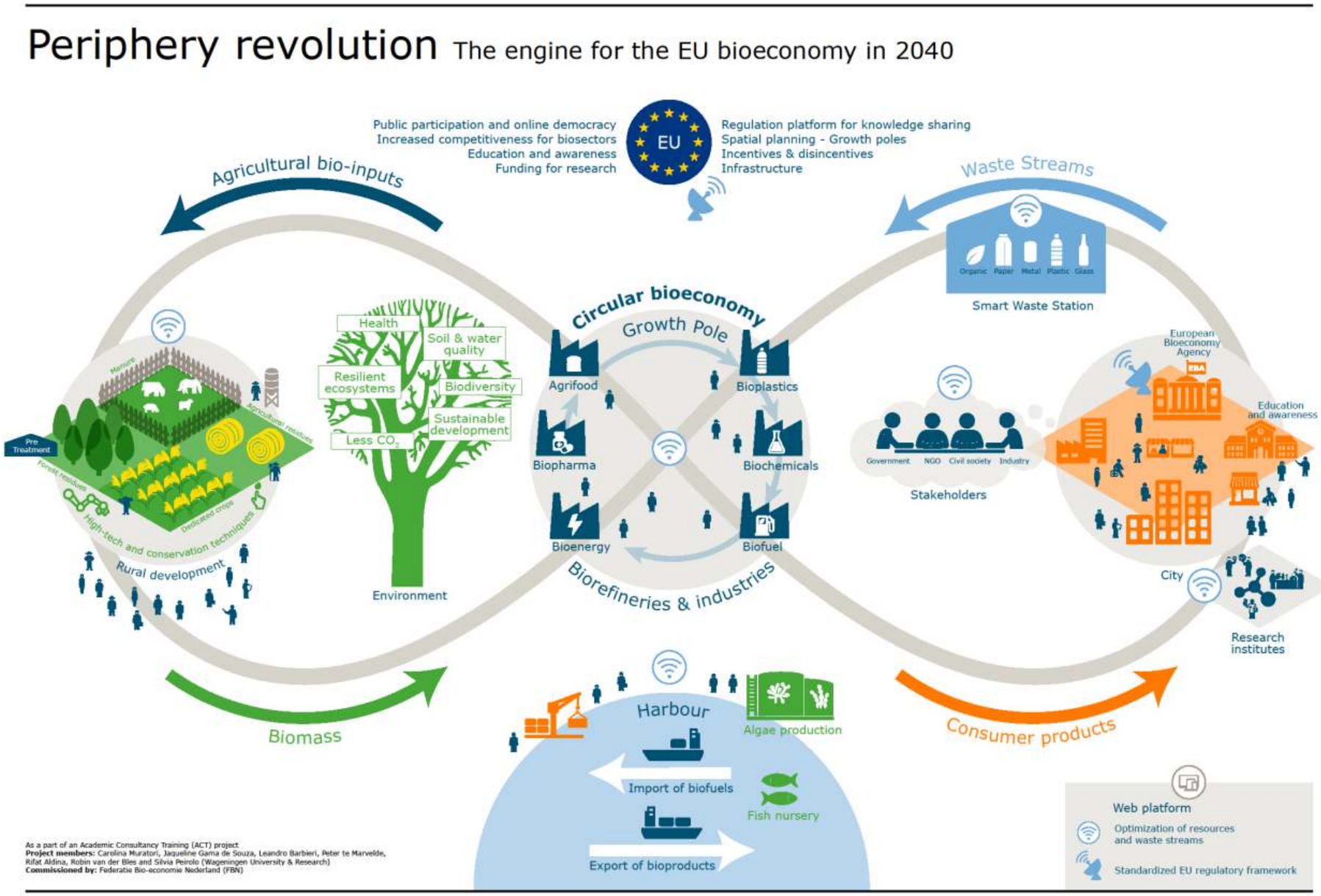
Cost economy to **value** economy

Problem is

- Energy security
- Climate change
- Food security
- Sustainable environment
- Urbanisation
- Social development
- Health
- Well being
- ……..

Need a different, circular business model

Sustainable BIOHUB



BIOHUB ambitions

- Sustainable agriculture
  - Nutrient recycling
  - Landscape management for improved biodiversity, soil quality
- Social & rural development
- Biomass mobilisation – feedstock security

Build biodiversity

Bring biomass

Bunk emissions

BioHUB

Input “residual streams”
Output: Electricity, heat, clean water, nutrients

Food
Biomass
Food
Biomass
Food
Biomass
Food
Biomass
Food
Biomass
Food
Biomass

Biomass collection

Training
Education

Hydrolysable “pellets”

Biochar

Bio Refinery EU

Farming equipment
“Lease concept”

Decentralized units
“Lease concept”
Operated locally

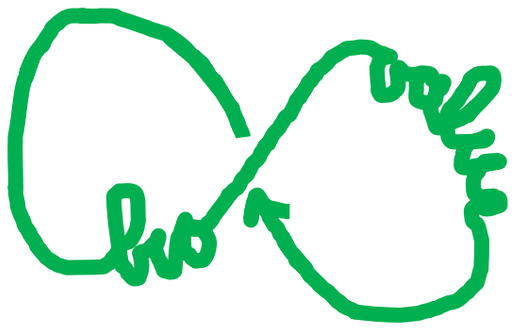
Education	1 MEuro	10x	
Mechanisa-tion	2 MEuro		
Pre-treatment	10 M		o
Local energy producti			15 MEuro
		1x	220 MEuro
			Total: 365 MEuro
re arbor)	*100 MEuro*	*10x*	*1000 MEuro*

Overall reduction on Capex: 30 Euro / ton CO_2

O,6 Mton CO2/year reduction with biorefinery

ACTION for development

- Combine local stakeholder involvement with technological innovation
- Design new business models
- Focus on durable agricultural development
- And learning for further local innovation and linked social development



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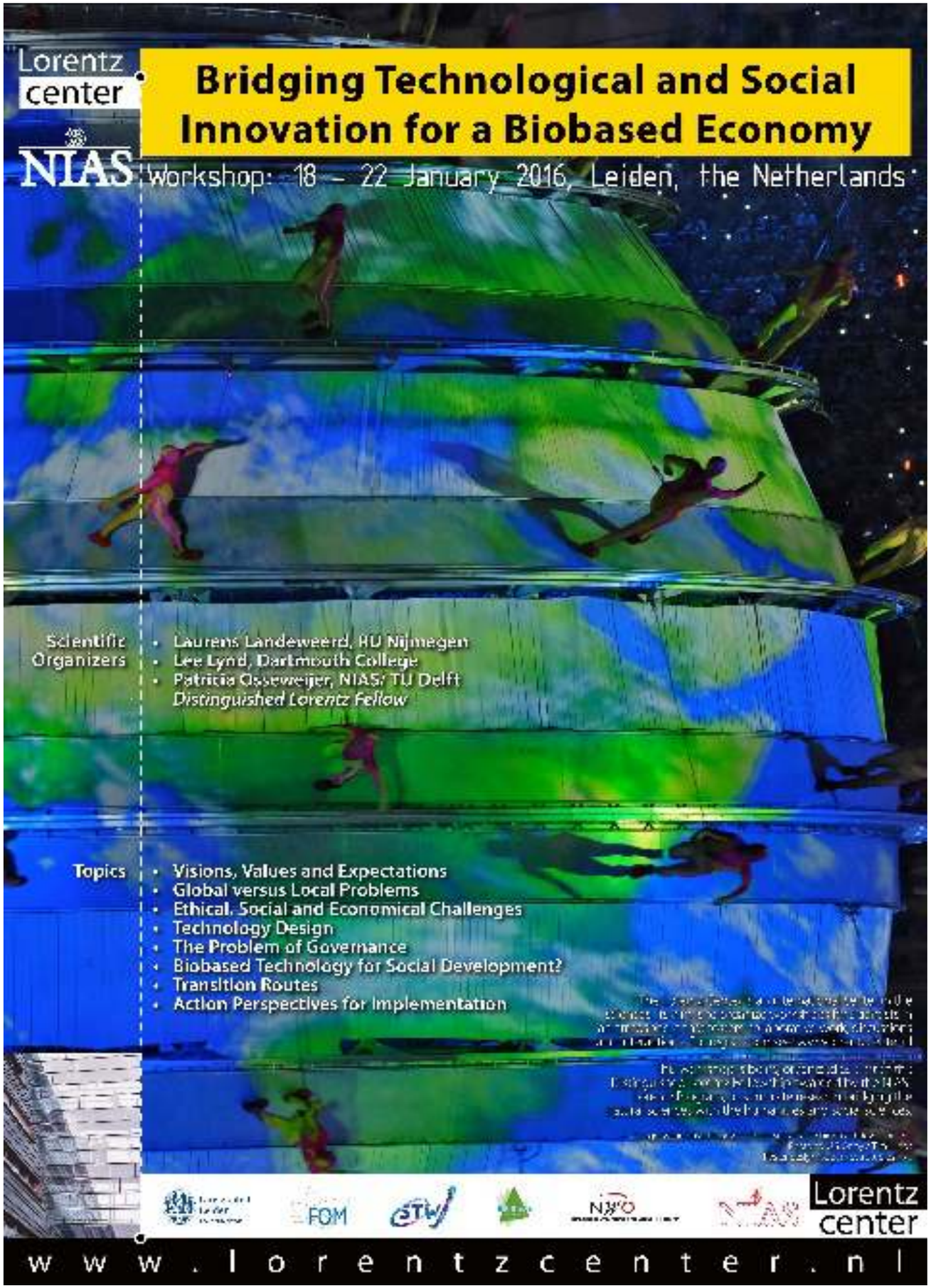
Lorentz center
NIAS
Bridging Technological and Social Innovation for a Biobased Economy
Workshop: 18 – 22 January 2016, Leiden, the Netherlands
Scientific Organizers
• Laurens Landeweerd, RU Nijmegen
• Lee Lynd, Dartmouth College
• Patricia Osseweijer, NIAS/ TU Delft
Distinguished Lorentz Fellow
Topics
• Visions, Values and Expectations
• Global versus Local Problems
• Ethical, Social and Economical Challenges
• Technology Design
• The Problem of Governance
• Biobased Technology for Social Development?
• Transition Routes
• Action Perspectives for Implementation
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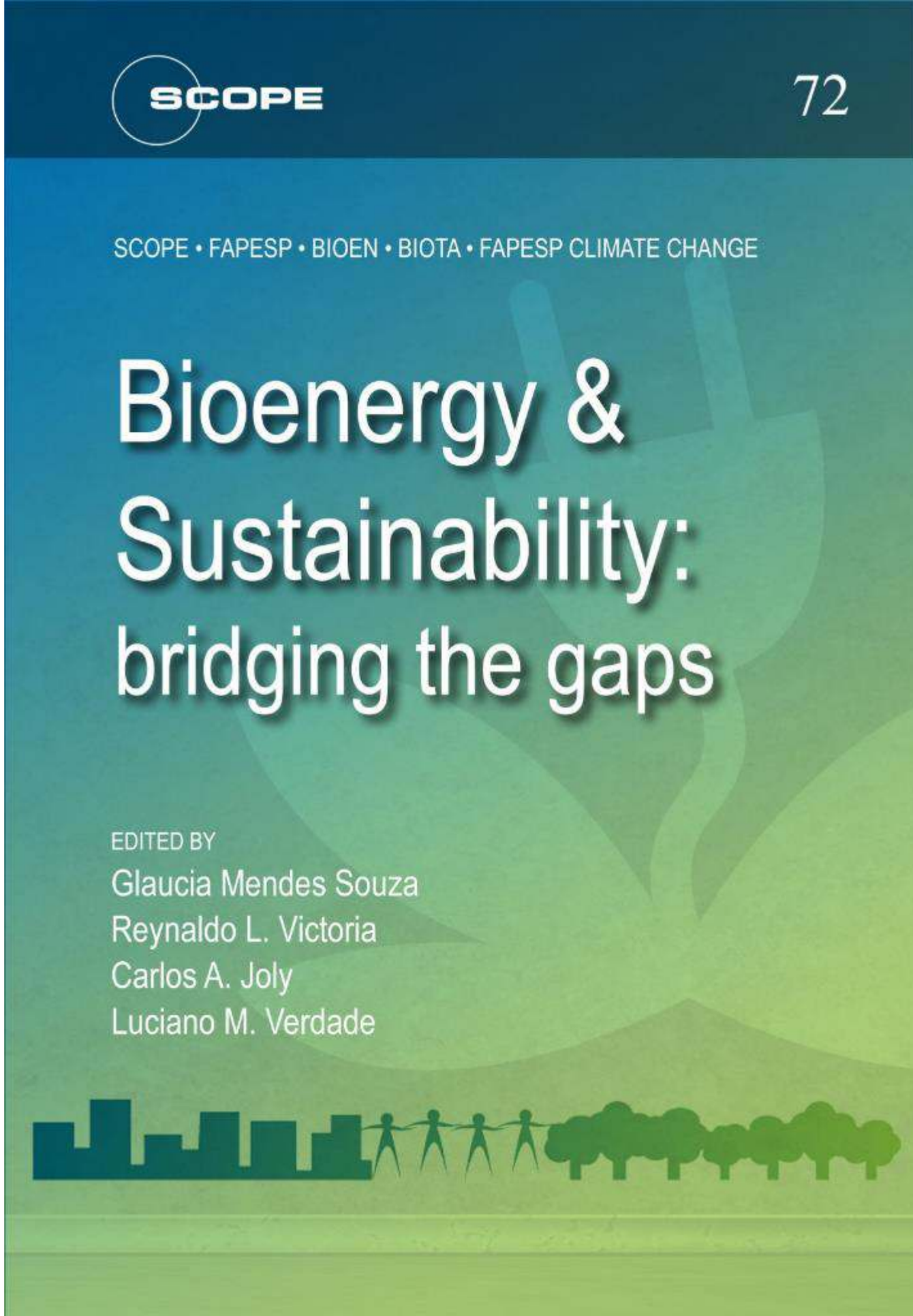
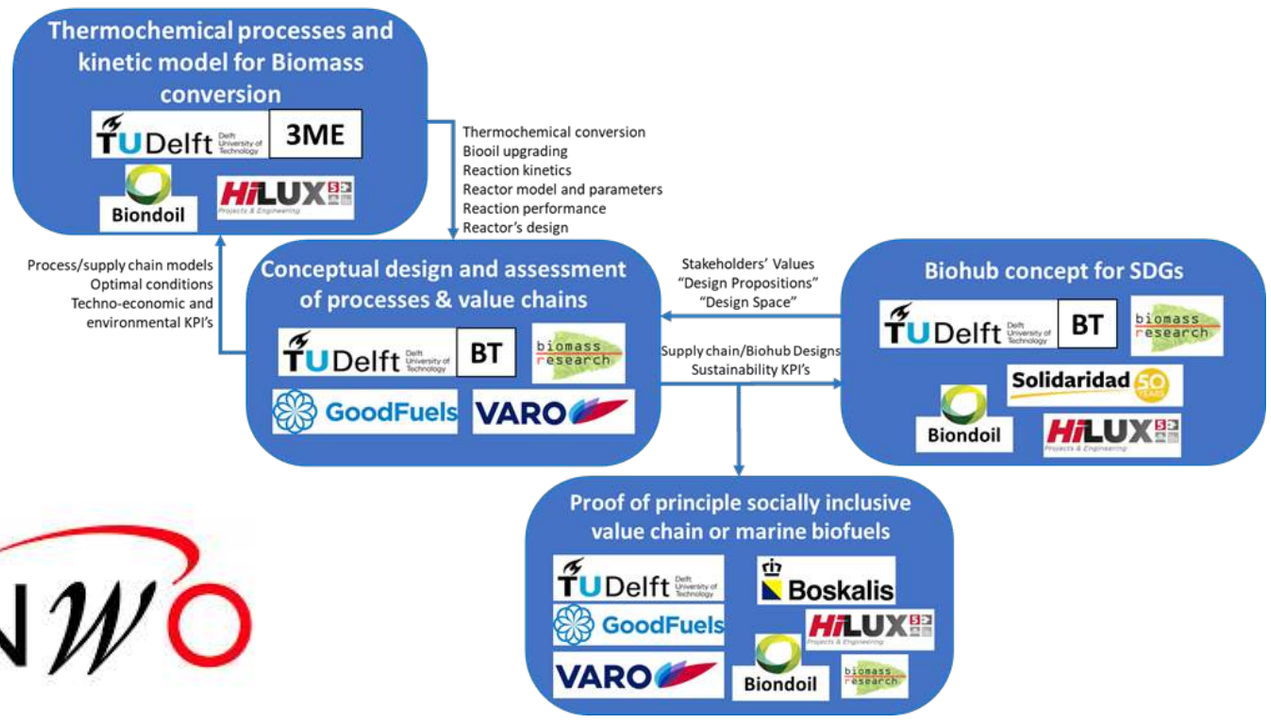


Value from Biomass: clean shipping fuels

- Thermochemical process + kinetic model
- Conceptual design and assessment value chains (incl testing fuels)
- Biohub concept development
- **Proof of principle for socially inclusive value chains of marine biofu**




Thank you all
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