IEA Bioenergy

Overview of results from the IEA Bioenergy Inter-task project on realizing sustainable supply chains

Prof. Dr. Martin Junginger
Utrecht University
Leader of IEA Bioenergy Task 40

Why a inter-task project?

- A lot of work on the sustainability of bioenergy systems has been carried out by various IEA Bioenergy tasks in the past years
- Several joint projects & workshops in past 6 years between mainly tasks 38, 40 & 43 on sustainability-related topics
- No comprehensive effort to bring together various output

3 Objectives:

1. To provide an overview of calculation methods & tools to assess the sustainability of various biomass and bioenergy supply chains and discuss needs, possibilities and limitations of a global, uniform/harmonized framework

3 Objectives:

2. To compare and assess the effectiveness and efficiency of a variety of approaches on

how to govern and verify sustainability of biomass supply chains

3. To understand the positions and underlying motivations of stakeholder groups relative to their perceptions of bioenergy and inform dialogues/discussions to avoid misconceptions about bioenergy

IEA Bioenergy

Objectie 2

Trust and Legitimacy in Sustainability Governance of Bioenergy Supply Chains

Strategic Inter-Task study, commissioned by IEA Bioenergy

Maha Mansoor, York University
Inge Stupak, University of Copenhagen
Tat Smith, University of Toronto

Aim

Suggest how sustainability governance systems can be analyzed to better understand how the design is linked to legitimacy, and ultimately, the achieved sustainability

Approach

Review and develop terms and conceptual frameworks to facilitate analysis of sustainability governance systems in the context of bioenergy and the bioeconomy

Sustainability governance

Sustainability governance refers to the set of regulatory processes, mechanisms, and organizations that seek to influence sustainable actions and outcomes.

Trust

The willingness to be vulnerable to the actions of another, or belief of the community that a given governance institution and its conduct are appropriate

Receiving /achieving →	Individuals, the public		Organizations in the market		Governments	
Granting ↓	Type of trust granted to individuals by…	Strategies of individuals to achieve trust of….	Type of trust granted to organizations by….	Strategies of organizations to achieve trust of…	Type of trust granted to governments by…	Strategies of governments to achieve trust of…
Individuals The public	Inter-personal trust	Agreements on how to work together	License to operate	CSR	Legitimacy, tax payments	Quality of Government, democracy
Organi-zations	Bought goods and services	Resignation from naming and shaming campaigns	Trust in the supply chain	Agreements on how to work together	Economic prosperity, tax payments	Political stability, Quality of Government
Govern-ments	Freedom, equality, welfare	Law-abiding behavior	License to operate	Law-abiding behavior	International relations	Agreements on how to work together

Inspired by Burlea and Tome (2013)

Legitimacy

Society accepting a governance institution as an authoritative figure that may appropriately influence the actions of societal actors, that are also willing to obey the rules of the governing institution.

Legitimacy		
Input	Output	Throughput
Gaining consent of actors through their participation and involvement in the governance system	Gaining the approval of actors through success of the governance system in what it attempts to achieve.	Efficiency of the administrative aspects that compose governance institutions

Legitimacy granted to a governance institution means that society sees the actions of the governance institution as proper and desirable.

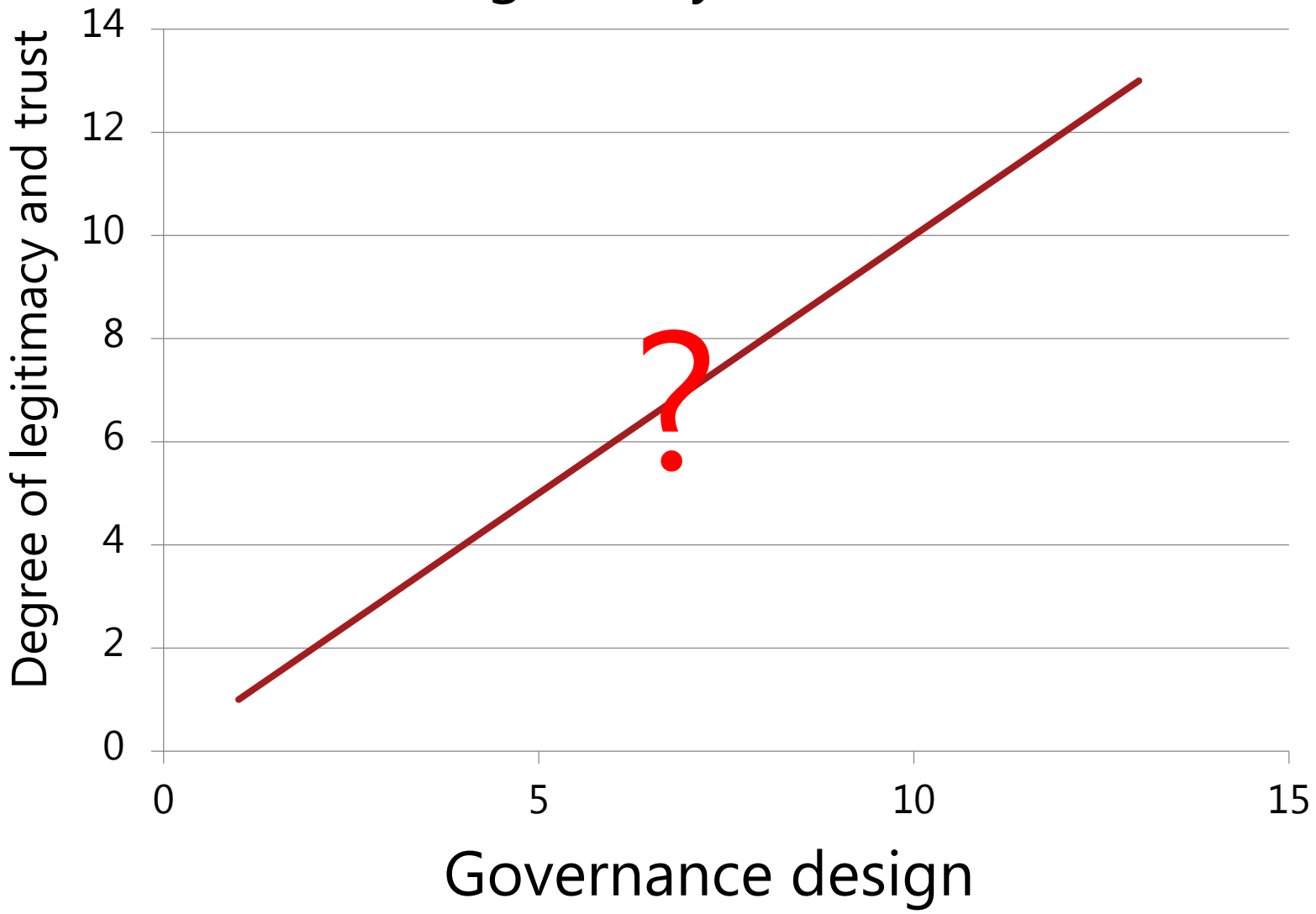
Suchman (1985)

Phases of the levels of trust and legitimacy

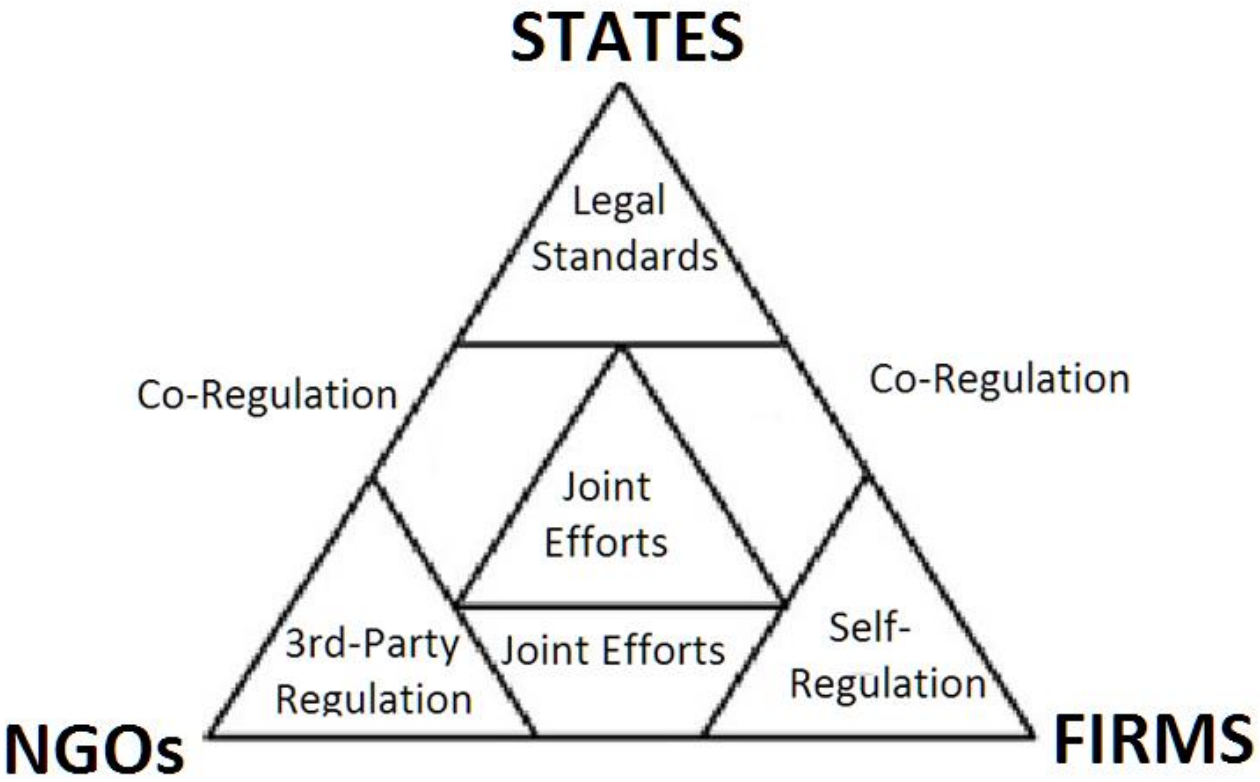
	Description	Input	Throughput	Output
Phase I: Emergence of systems	Creation of the first few sustainability governance systems	Low - Limited participation from all relevant stakeholders in the creation of the first governance system	Low - No standards in place to determine the adequacy of the processes	Low - firms closest to standards meeting them
Phase II: Increased use of systems	Proliferation of governance systems; broader use of the governance systems; not "accepted" form of showing sustainability	Low – More actors getting involved but governance systems unclear how to utilize the expertise of actors and how to maximize their contributions.	Low/Medium - The proliferation and widespread use is leading to some systems to develop more efficient processes than others	Low – Governance systems enact low standards in order to attract firms but low standards = low effectiveness
Phase III: Maturity	Increased uptake of governance systems; certain systems respond to popular critiques; accepted form of showing sustainability	Medium - Increased levels of participation from all actors, however, adequate stakeholder engagement is still be lacking	Low – Governance system is making its internal auditing systems more efficient	Low/Medium – Actors feel that there is more room for improvement in how governance system affects change
Phase IV: Saturation	Trust and legitimacy is granted, but it is not set in stone. Requires continuous engagement with stakeholders.	High - All actors feel adequately represented in the governance institutions	Medium/High – Efficient use of auditing systems	Medium/High - All actors feel that rules are adequately ensuring the sustainability of bioenergy

How to move to the next phase?

Correlation between governance design and legitimacy and trust?



Analysing involved a**ctors**



Abbott and Snidal (2009)
c.f. Mansoor et al (2016)

Analysing the policy setting

		Flexibility		
		Voluntary Optional or recommended policies encouraging action	**Elective** Choose method of compliance to a general mandatory policy goal	**Mandatory** Specific action required
Precision	**Managerial** Managerial, procedural systems	System or plan based. Flexible	System or plan based. Semi-flexible	System or plan based. Semi-flexible
	Compliance Compliance with BMPs	BMP based. Flexible	BMP based. Semi-flexible	BMP based. Inflexible
	Measured Measurement, monitoring, inventory to record data	Measurement-based Flexible	Measurement-based Semi-flexible	Measurement-based Inflexible
	Substantive Explicit on-the-ground targets and thresholds	Goals defined with specific suggestions for actions listed Flexible	Specific goals can be obtained through several methods. Semi-flexible	Policy requirements requiring specific actions Inflexible

Inspired by McDermott et al. 2009

Other design elements

- Enforcement system
- Monitoring system
- Chain of custody design
- Level of transparency
- Communication strategy

Universiteit Utrecht

Legend		
	✓	Covered in the legislation
	±	Partly covered in the legislation
	→	Plans to be covered in the future
	×	Not covered in legislation

National sustainability equirements for solid biomass

	RO, RHI, CfDs - UK	GCs - BE	IA - DK	SDE+ NL
I. Strictness of legislation	Legally binding	Legally binding	Voluntary	Legally binding (when implemented)
II. Timeline of implementation	End of 2015	Already implemented	2016	2018
III. Sustainability Criteria Coverage				
A. Greenhouse Gas Emission	✓	✓	✓	✓
B. Land Use:				
B1. Sustainable Forest Management:				
Legal, sustainable sourcing	✓	±	✓	✓
Forest productivity & well-functioning	✓	×	✓	✓
Biodiversity protection	✓	×	✓	✓
Ecosystems conservation	✓	×	✓	✓

Source: T. Mai-Moulin, UU

Universiteit Utrecht

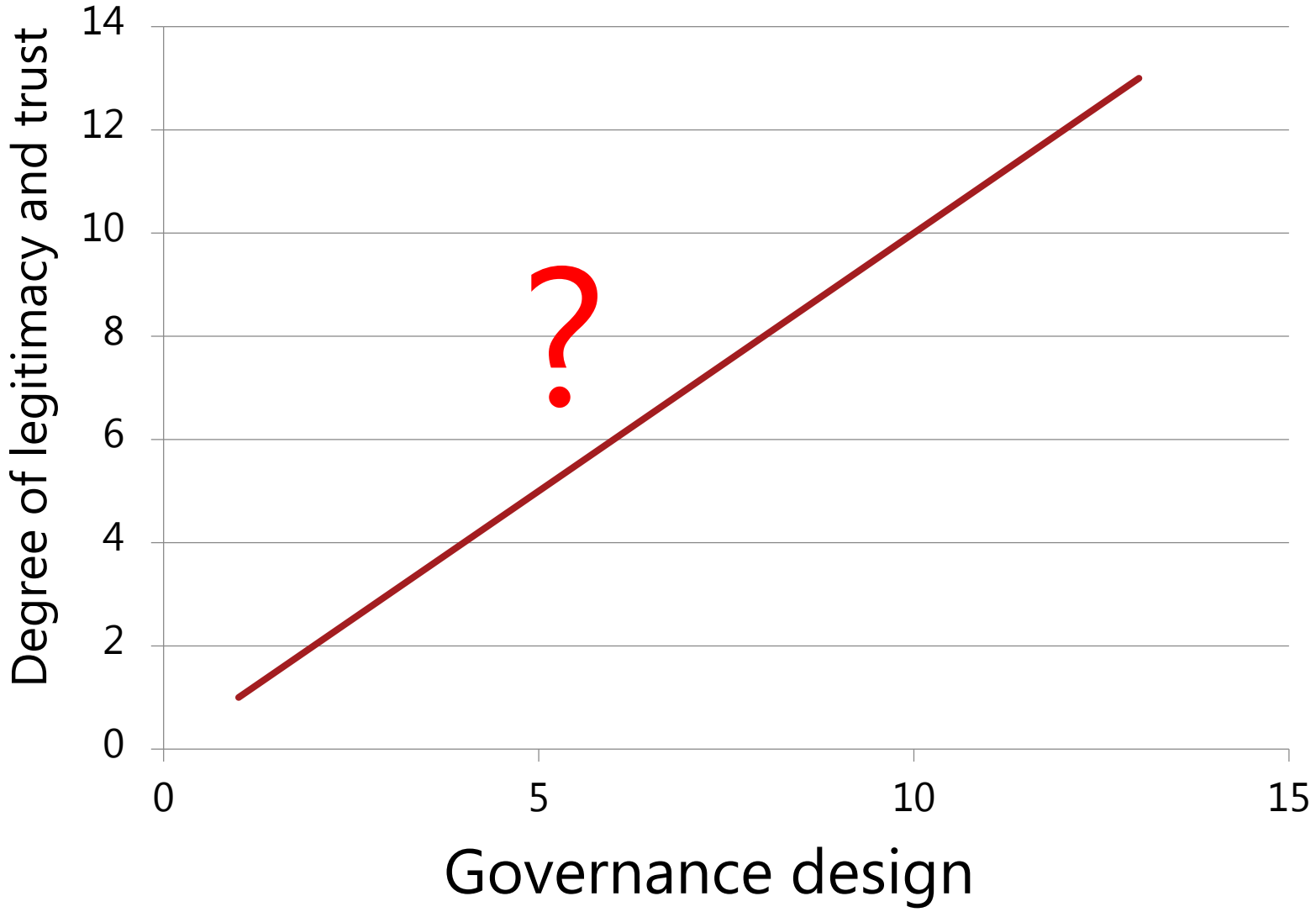
Legend	
✓	Covered in the legislation
±	Partly covered in the legislation
→	Plans to be covered in the future
×	Not covered in legislation

National sustainability requirements for Solid Biomass (continued)

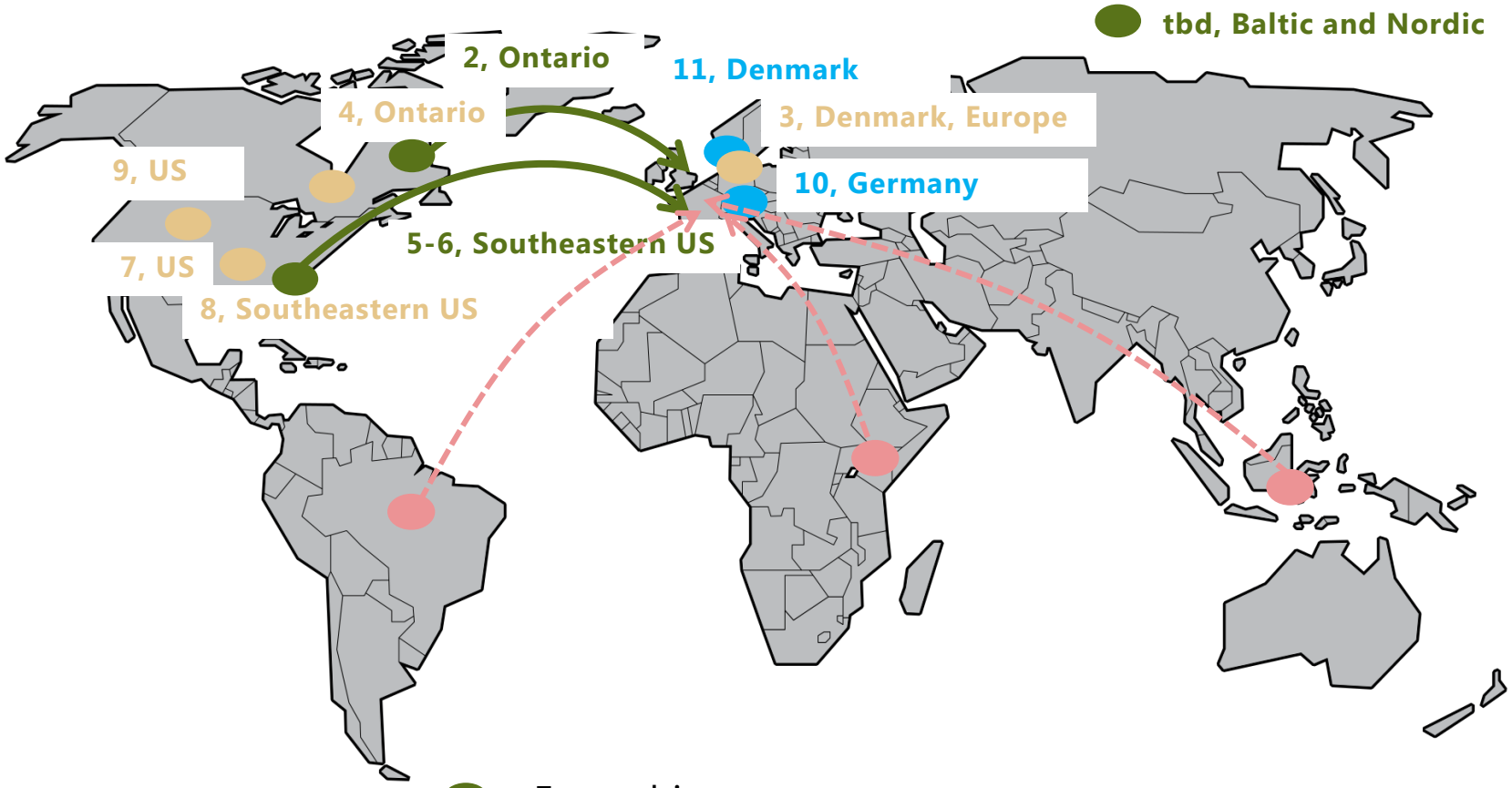
	RO, RHI, CfDs - UK	GCs - BE	IA - DK	SDE+ NL
B2. Land criteria	✓	×	×	✓
B3. iLUC	×	×	→	✓
C. Other sustainability requirements				
C1. Fuel classification	✓	±	→	✓
C2. Carbon debt	×	→	→	✓
C3. Compliance with laws & local rights	✓	±	✓	✓
C4. Chain of Custody	✓	±	✓	✓
C5. Mass balance	✓	✓	→	✓
C6. Cascading use of biomass	×	→	→	→
C7. Feedstock competition prevention	×	±	±	✓
IV. Recognition of other voluntary international schemes	✓ (FSC, PEFC, SBP)	± (FSC, PEFC)	✓ (FSC, PEFC, SBP)	→ To be identified

Source: T. Mai-Moulin, UU

Correlation between governance design and legitimacy and trust?



Objective 2 case studies



- Forest biomass
- Agricultural biomass
- Biogas
- Complementary Task 43 study on regional approaches to governance/Jinke van Dam and Rocio Diaz-Chavez

Objective 2 case studies – overview and status

No	Supply chain	Preliminary short title	PI	Status
1	Conceptual framework	Trust and legitimacy	Smith, Stupak (UoT, UoC)	Draft in revision
2	Forestry, Ontario	Advanced SFM governance in Ontario	Smith (UoT)	Draft in revision
3	Agriculture Europe	Sustainability governance of the bioeconomy – agricultural crops and residues in Denmark and Europe	Bentsen (UoC),	First draft available
4	Agriculture, Canada	Sustainability governance of the bioeconomy – agricultural crops and residues in Canada	Lalonde (CJ Ag)	Draft in revision
5	Forestry, SE US	Approaches to document sustainable bioenergy in the SE US wood pellet industry	Kittler (Pinchot)	Survey interviews completed, in depth interviews being planned
6	Forestry SE US	Aggregated indicators to measure and communicate progress towards SFM	Dale, Kline (ORNL)	Follows DoE work
7	Agriculture, US	Policy analysis of governance for sustainable agricultural biofuel in the US	Gan (Texas A&M)	Draft in revision
8	Agriculture, US	Measuring progress towards sustainable agricultural management for bioenergy	Kline, Dale (ORNL)	Follows DoE work
9	Agriculture, US	Measuring sustainability of corn stover removal	Nair (INL)	Paper published, more to come
10	Biogas, Germany	Sustainability governance of biogas through three phases of development	Schaubach, Thrän, Horschig (DBFZ)	Work expanded, Thomas Horschig included
11	Biogas, Denmark	The impact of the legislative framework on the implementation of biogas	Al-Seadi (Biosantech)	Draft in revision
12	Synthesis	Improving legitimacy of governance for sustainable bioenergy - challenges and recommendations	Stupak, Smith (UoC, UoT)	First outline planned for end of 2017

IEA Bioenergy

Objective 3 goals:

- *Understand positions and underlying motivations of stakeholder groups relative to their perceptions of bioenergy*
- *Inform dialogues/discussions to avoid misconceptions and gain trust in bioenergy*

IN PRACTICE:

1. **Identify** relevant stakeholders (in different bioenergy value chains)
2. **Communicate** with stakeholders via questionnaires, interviews and meetings to understand their viewpoints, decisions and influence to the bioenergy value chains
3. **Compare** stakeholders' positions, viewpoints and influence in different bioenergy value chains
4. **Provide recommendations** on how to gain (further) support from stakeholders for sustainable bioenergy value chains management

SE US noncorporate forest land owners' perspectives regarding wood-based energy (conclusions to date)

S
o

- energy as long as
  1. Land health is not compromised
  2. The price is right

BIOENERGY
GCB Bioenergy (2017) 9, 1296–1305, doi: 10.1111/gcbb.12445

OPINION

Status and prospects for renewable energy using wood pellets from the southeastern United States

VIRGINIA H. DALE[1], KEITH L. KLINE[1], ESTHER S. PARISH[1], ANNETTE L. COWIE[2], ROBERT EMORY[3], ROBERT W. MALMSHEIMER[4], RAPHAEL SLADE[5], CHARLES TATTERSALL (TAT) SMITH JR[6], THOMAS BENTLY (BEN) WIGLEY[7], NICLAS S. BENTSEN[8], GÖRAN BERNDES[9], PIERRE BERNIER[10], MIGUEL BRANDÃO[11], HELENA L. CHUM[12], ROCIO DIAZ-CHAVEZ[13], GUSTAF EGNELL[14], LEIF GUSTAVSSON[15], JÖRG SCHWEINLE[16], INGE STUPAK[8], PAUL TRIANOSKY[17], ARNALDO WALTER[18], CARLY WHITTAKER[19], MARK BROWN[20], GEORGE CHESCHEIR[21], IOANNIS DIMITRIOU[14], CASPAR DONNISON[22], ALISON GOSS ENG[23], KEVIN P. HOYT[24], JENNIFER C. JENKINS[25], KRISTEN JOHNSON[26], CHARLES A. LEVESQUE[27], VICTORIA LOCKHART[28], MARIA CRISTINA NEGRI[29], JAMI E. NETTLES[3] and MARIA WELLISCH[30]
[1]Center for BioEnergy Sustainability, Environmental Sciences Division, Oak Ridge National Laboratory, Oak Ridge, TN 37831-6036, USA, [2]NSW Department of Primary Industries, University of New England, Armidale, NSW, Australia, [3]Weyerhaeuser Company, Vanceboro, NC 28586, USA, [4]SUNY College of Environmental Science and Forestry, Syracuse, NY 13210, USA, [5]Imperial College London, London, SW7 2AZ, UK, [6]University of Toronto, Toronto, ON M5S 3B3, Canada, [7]National Council for Air and Stream Improvement (NCASI), Clemson, SC 29634, USA, [8]University of Copenhagen, DK-1958 Frederiksberg C, Denmark, [9]Chalmers University of Technology, SE-41296, Göteborg, Sweden, [10]Canadian Forest Service, Québec G1V 4C7, QC, Canada, [11]Institute of Soil Science and Plant Cultivation, 24-100, Pulawy, Poland, [12]National Renewable Energy Laboratory (NREL), Golden, CO 80401-3305, USA, [13]Centre for Environmental Policy, Imperial College London, SW7 2AZ, London, UK, [14]Swedish University of Agricultural Sciences, SE-750 07, Uppsala, Sweden, [15]Linnaeus University, 351 95, Växjö, Sweden, [16]Thünen Institute of International Forestry and Forest Economics, 21031, Hamburg, Germany, [17]Sustainable Forestry Initiative, Inc., Washington, DC 20037, USA, [18]State University of Campinas (UNICAMP), 13083-860, Campinas, SP, Brazil, [19]Rothamsted Research, Harpenden AL5 2JQ, UK, [20]University of the Sunshine Coast, Maroochydore DC, Qld 4558, Australia, [21]North Carolina State University (NCSU), Raleigh, NC 27695, USA, [22]University of Southampton, Southampton SO17 1BJ, UK, [23]Bioenergy Technologies Office, U.S. Department of Energy (DOE), Washington, DC 20585, USA, [24]University of Tennessee, Forest Resources AgResearch and Education Center, Oak Ridge, TN 37830, USA, [25]Enviva LP, Bethesda, MD 20814, USA, [26]Bioenergy Technologies Office, U.S. Department of Energy, Golden, CO 80401, USA, [27]Innovative Natural Resource Solutions, LLC, Antrim, NH 03301, USA, [28]Resource Management Service, LLC, Birmingham, AL 35242, USA, [29]Argonne National Laboratory (ANL), Argonne, IL 60439, USA, [30]Agriculture and Agri-Food Canada (AAFC), Ottawa, ON K1A 0C5, Canada

Abstract

The ongoing debate about costs and benefits of wood-pellet based bioenergy production in the southeastern United States (SE USA) requires an understanding of the science and context influencing market decisions associated with its sustainability. Production of pellets has garnered much attention as US exports have grown from negligible amounts in the early 2000s to 4.6 million metric tonnes in 2015. Currently, 98% of these pellet exports are shipped to Europe to displace coal in power plants. We ask, 'How is the production of wood pellets in the SE USA affecting forest systems and the ecosystem services they provide?' To address this question, we review current forest conditions and the status of the wood products industry, how pellet production affects ecosystem services and biodiversity, and what methods are in place to monitor changes and protect vulnerable systems. Scientific studies provide evidence that wood pellets in the SE USA are a fraction of total forestry operations and can be produced while maintaining or improving forest ecosystem services. Ecosystem services are protected by the requirement to utilize loggers trained to apply scientifically based best management practices in planning and implementing harvest for the export market. Bioenergy markets supplement incomes to private rural landholders and provide an incentive for forest management practices that simultaneously benefit water quality and wildlife and reduce risk of fire and insect outbreaks. Bioenergy also increases the value of forest

Correspondence: Virginia H. Dale, tel. +1 865 576 8043, fax +1 865 576 3989, e-mail: dalevh@ornl.gov

nd

35.00%
Data in Brief 13 (2017) 278–290
Contents lists available at ScienceDirect
Data in Brief
journal homepage: www.elsevier.com/locate/dib

mberland variables used to assess tions in two Southeastern United heds☆

a,b,*, Virginia H. Dale a,b, Emma Tobin c,

ainability, Environmental Sciences Division, Oak Ridge National Laboratory,
disciplinary Research and Graduate Education, The University of Tennessee,
, The University of Tennessee, Knoxville, TN 37996, USA

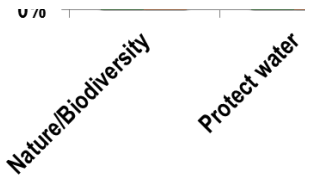
ABSTRACT

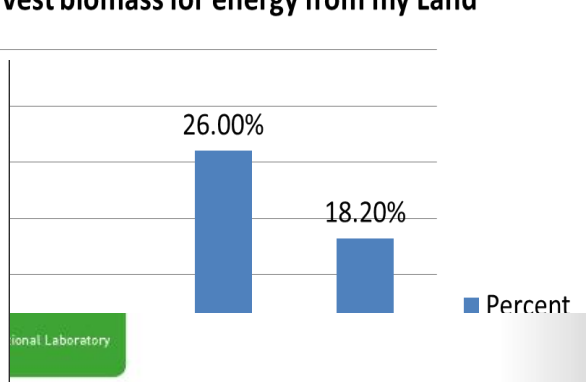
The data presented in this article are related to the research article entitled "How is wood-based pellet production affecting forest conditions in the southeastern United States?" (Dale et al., 2017) [1]. This article describes how United States Forest Service (USFS) Forest Inventory and Analysis (FIA) data from multiple state inventories were aggregated and used to extract ten annual timberland variables for trend analysis in two case study bioenergy fuelshed areas. This dataset is made publically available to enable critical or extended analyses of changes in forest conditions, either for the fuelshed areas supplying the ports of Savannah, Georgia and Chesapeake, Virginia, or for other southeastern US forested areas con-

http://dx.doi.org/10.1016/j.foreco.2017.03.022

* Corresponding author at: Center for BioEnergy Sustainability, Environmental Sciences Division, Oak Ridge National Laboratory, Oak Ridge, TN 37831, USA.
E-mail address: parishes@ornl.gov (E.S. Parish).

http://dx.doi.org/10.1016/j.dib.2017.05.048
2352-3409/





let production affected Southeastern US forests?

arish, Virginia H. Dale and Keith L. Kline, Center for Bioenergy Sustainability,
tal Sciences Division, Oak Ridge National Laboratory

port volumes
eastern United
to Europe have
ince 2009,
erns about
onmental
s pellets are
uce carbon
slow global
placing coal
wer plants.
rs on both
antic Ocean
ased pellet
ht lead to
US forests
r and soil
nger sensitive
as birds,
nakes—and
Stakeholders
assed concern
pellet
accelerate
nd in which
erating mixed
pine forests
E US are being
ntation pine

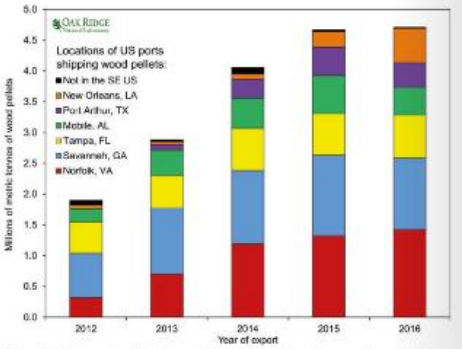


Figure 1: US International Trade Commission data show that US exports of wood pellets to Europe for bioenergy grew to 4.7 million metric tonnes in 2016. The Southeastern US region supplies nearly all of these pellets, and over half of them are shipped from the ports of Savannah, Georgia, and Norfolk, Virginia.

Laboratory
recently
he US Department
st Service to
ons to concerns
harming
researchers

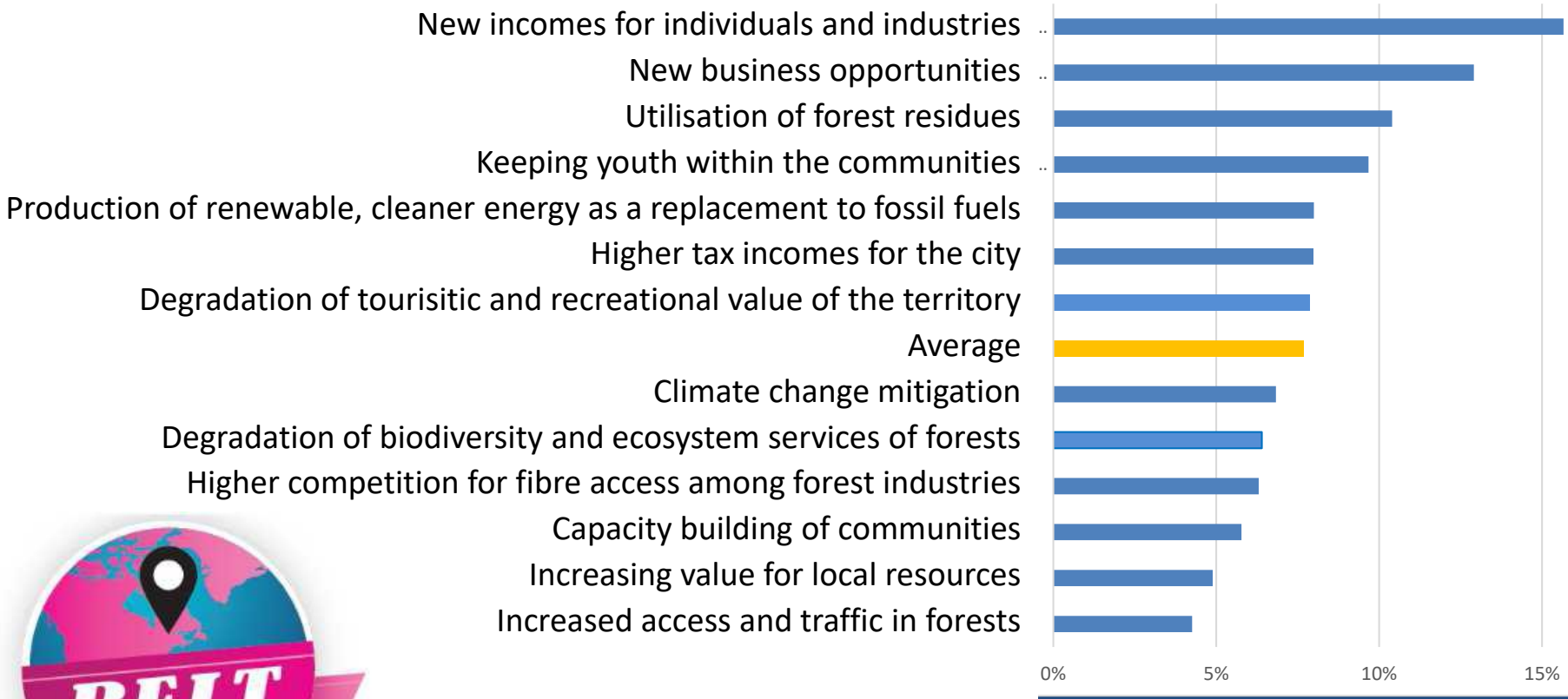
International Trade Commission data for wood pellets show that over half of all US pellet exports to Europe have been shipped from these two SE US ports.

Timberland is defined by the US Forest Service as "the nonreserved forest land capable of producing at least 20 cubic feet of commercial wood volume per acre per year" (i.e., 1.4 cubic meters of commercial wood volume per hectare per year). The reserved forest land excluded from the timberland designation includes land set aside for parks and conservation, where forest harvesting activities are not allowed. The majority of productive timberland in the SE US is privately owned and managed by a variety of interests ranging from family land owners to large real-estate investment corporations.

The Savannah fuelshed contains some of the most intensively managed pine plantations in the United States, while the Chesapeake fuelshed area contains both pine plantations and mixed hardwood stands. The Savannah fuelshed

Oak Ridge National Laboratory researchers conducted an analysis of two forested landscapes that produce a large share of US wood pellets being shipped to Europe.

Expectations (both positive and negative) towards the future forest biorefinery, E. Thiffault



B.E.L.T
La Tuque
Bioénergie

IEA Bioenergy

IEA Bioenergy **Inter-task project**
Measuring, governing and gaining support for sustainable bioenergy supply chains

POSITION, PERCEPTIONS AND VISION OF STAKEHOLDERS ON BIOENERGY SUSTAINABILITY:

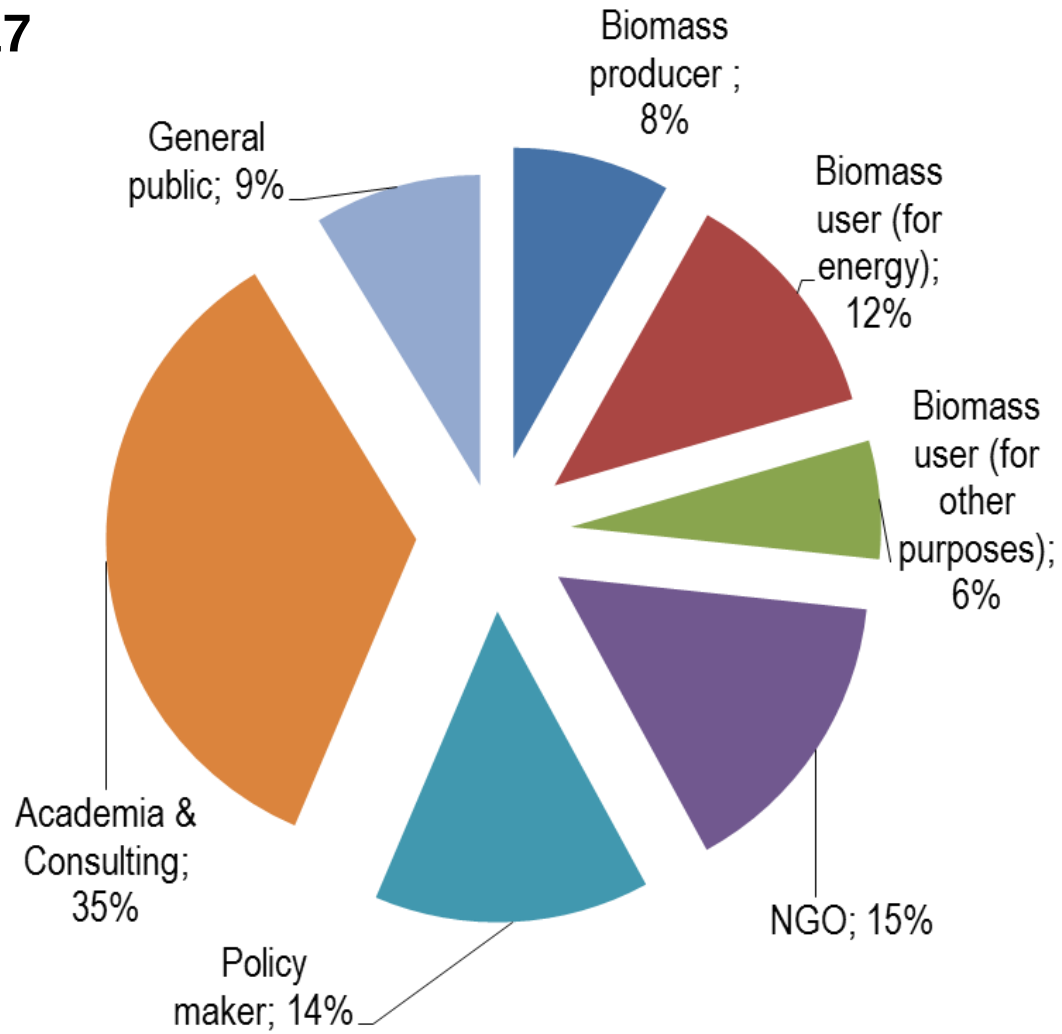
METHODOLODY AND INTERMEDIATE RESULTS

Thuy Mai-Moulin
Uwe Fritsche
Martin Junginger

IEA Bioenergy

General questionnaire – Online results

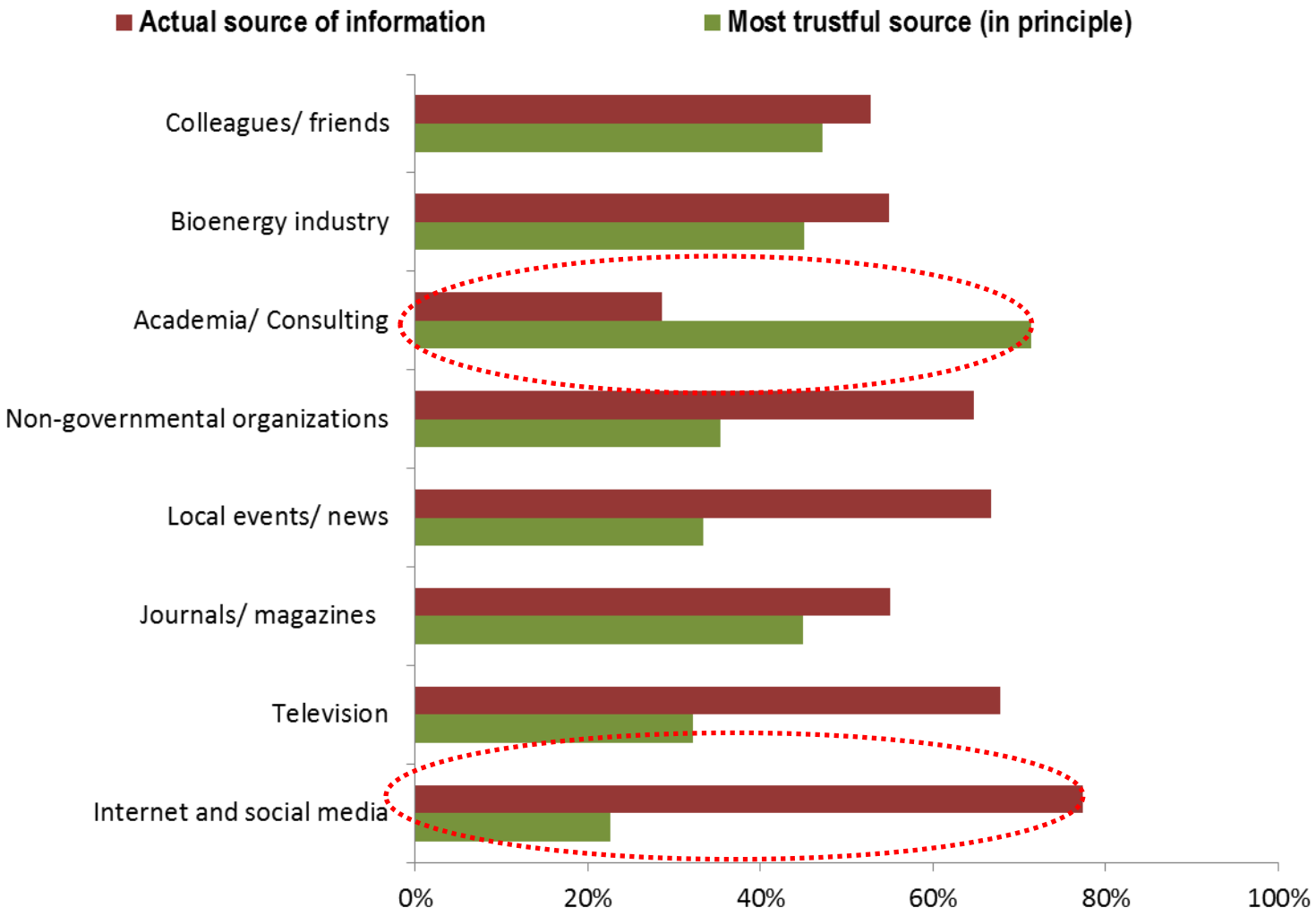
- **196 responses**
- **Apr 17- Dec 17**



IEA Bioenergy

General questionnaire – Online results

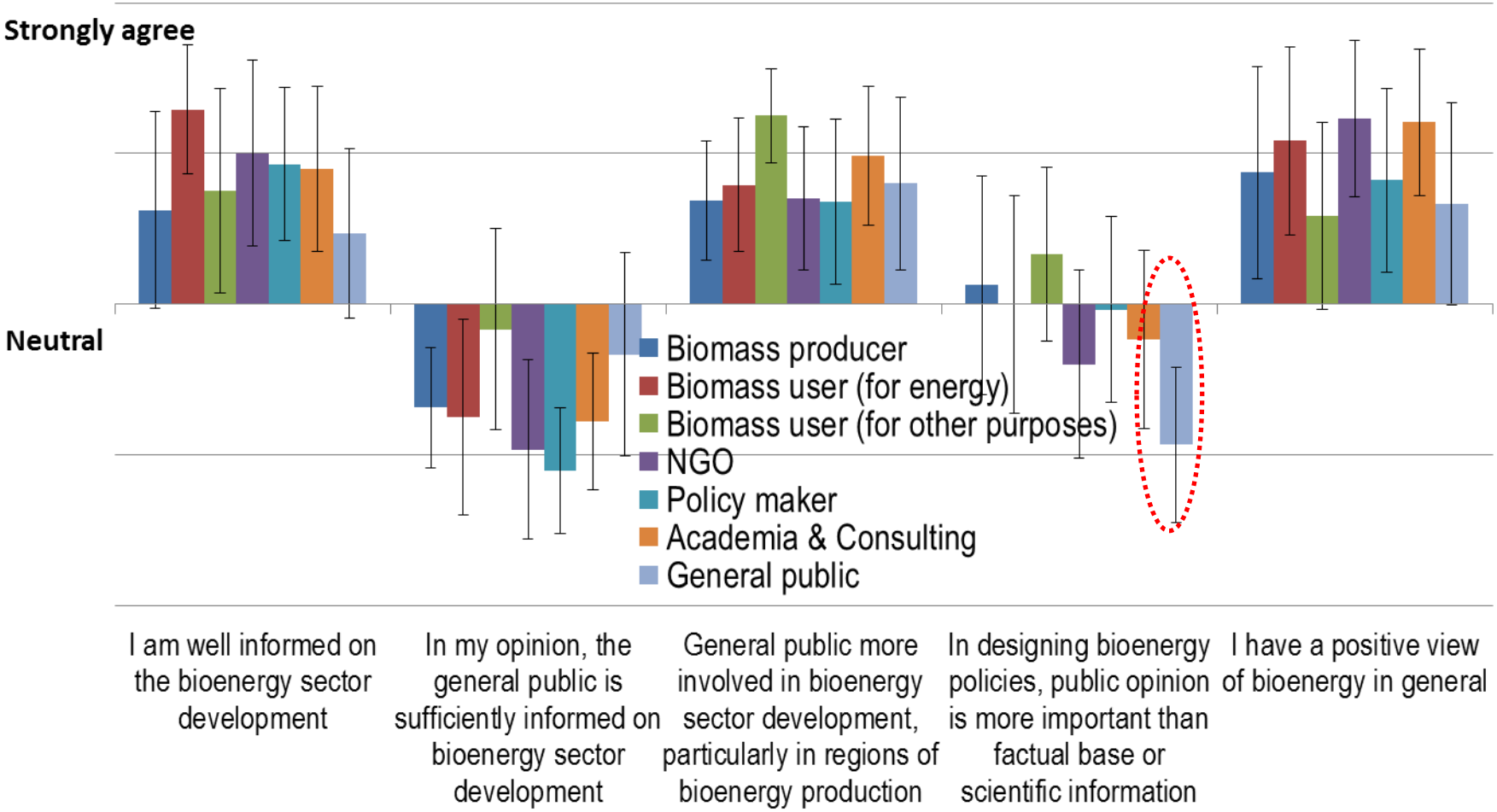
a. Source of information



IEA Bioenergy

General questionnaire

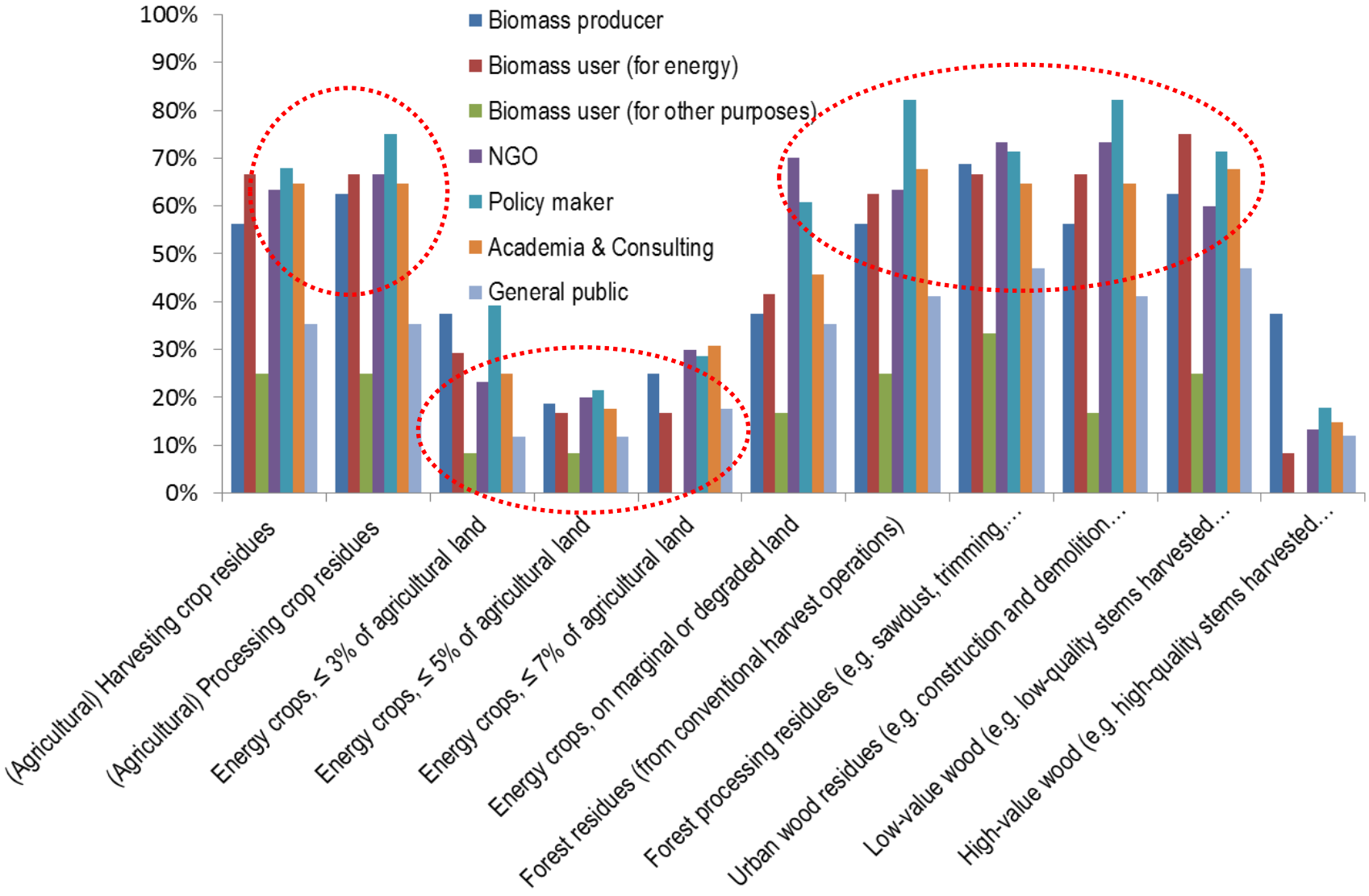
b. Awareness & public involvement



IEA Bioenergy

General questionnaire

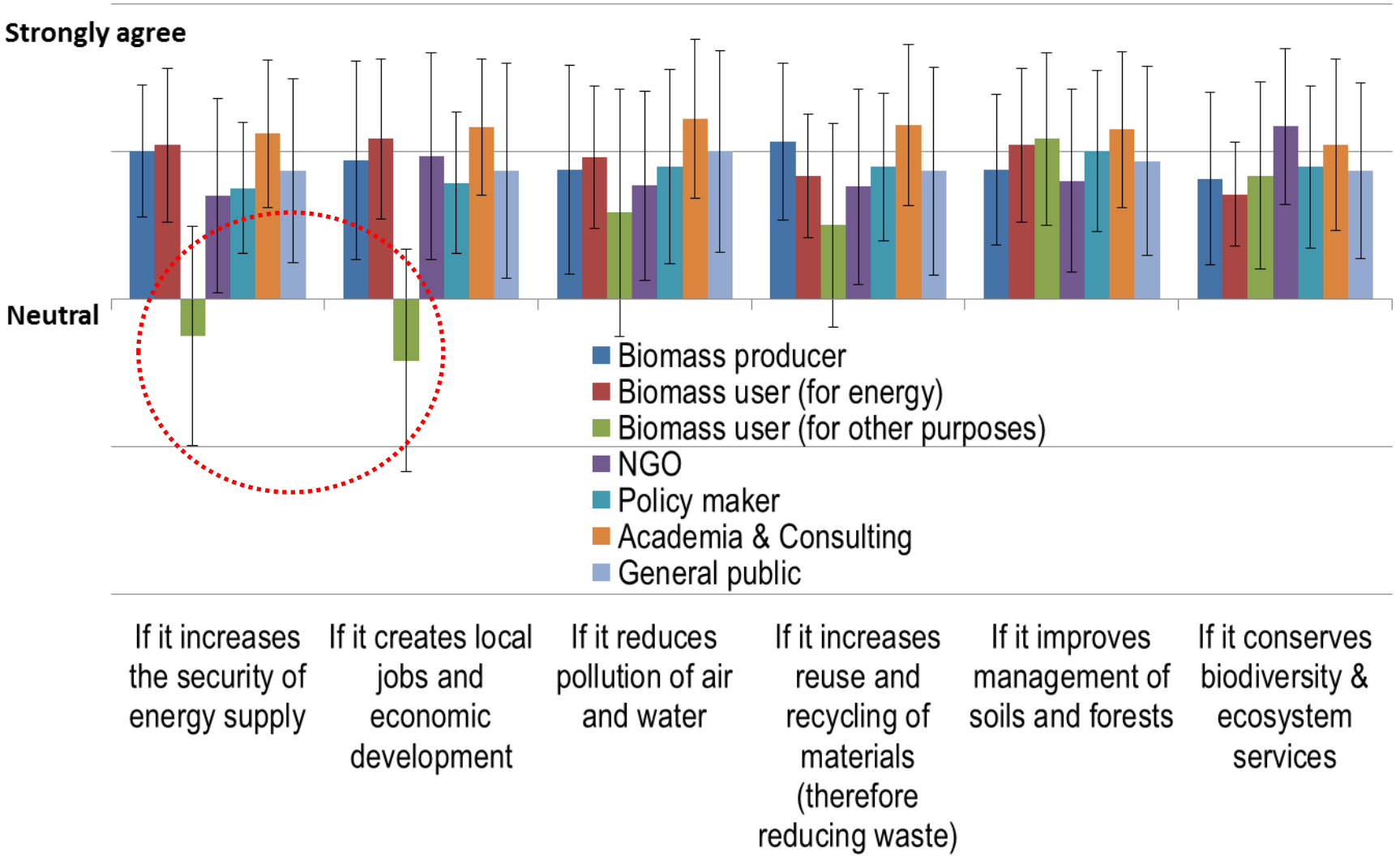
c. Feedstock



IEA Bioenergy

I. General questionnaire

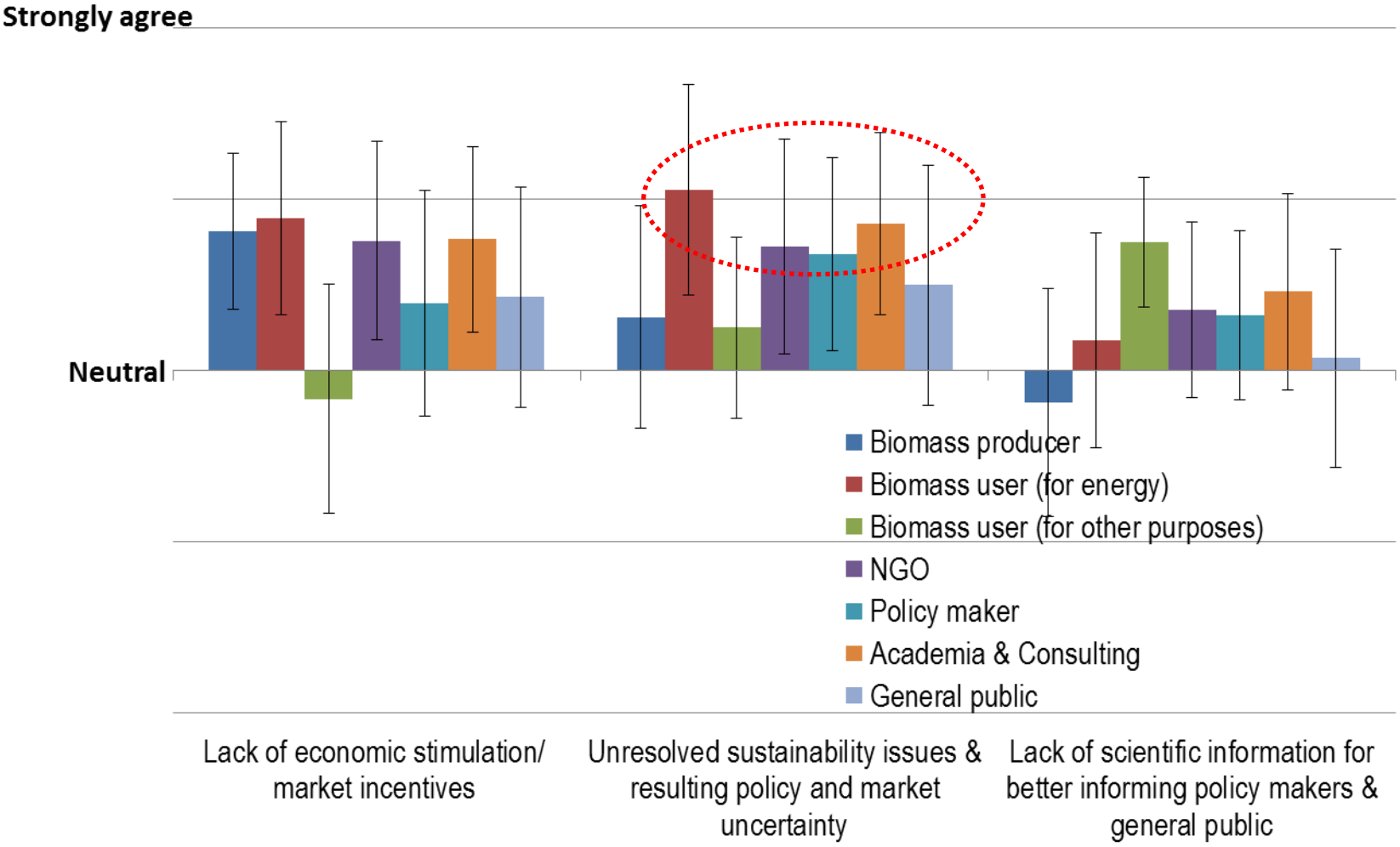
d. Support for the bioenergy sector



IEA Bioenergy

I. General questionnaire

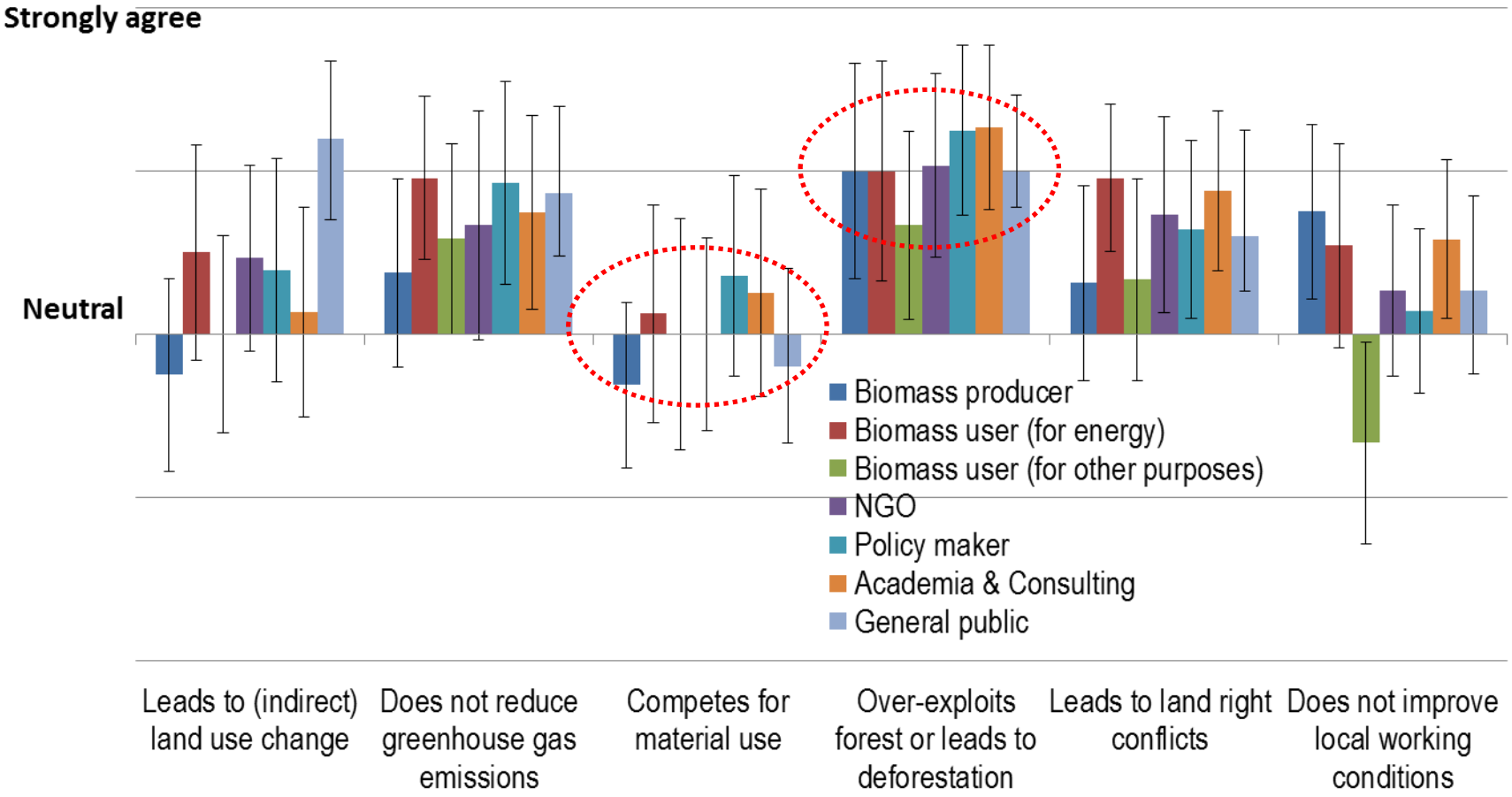
e. Barriers



IEA Bioenergy

General questionnaire

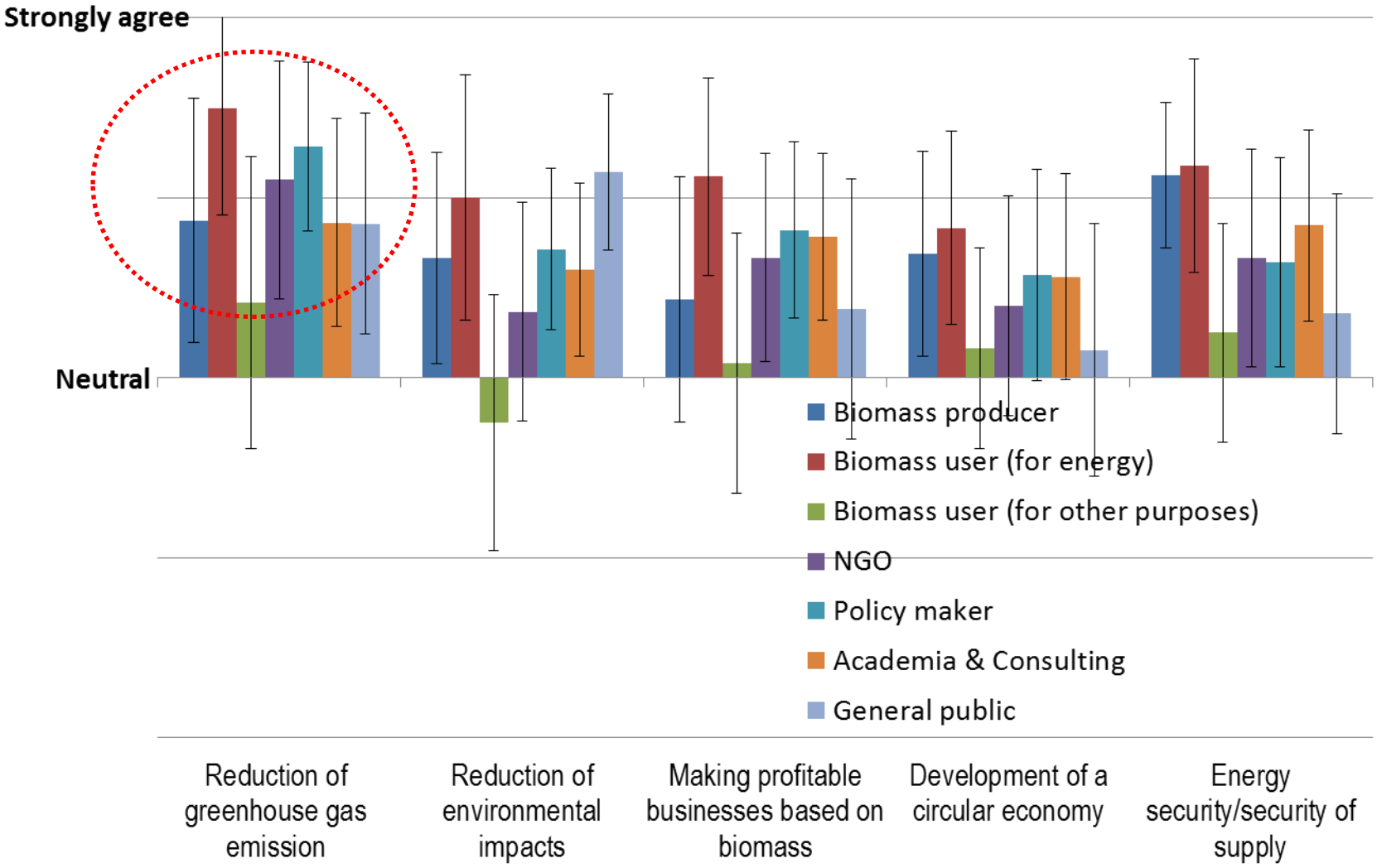
f. Opposition



IEA Bioenergy

General questionnaire

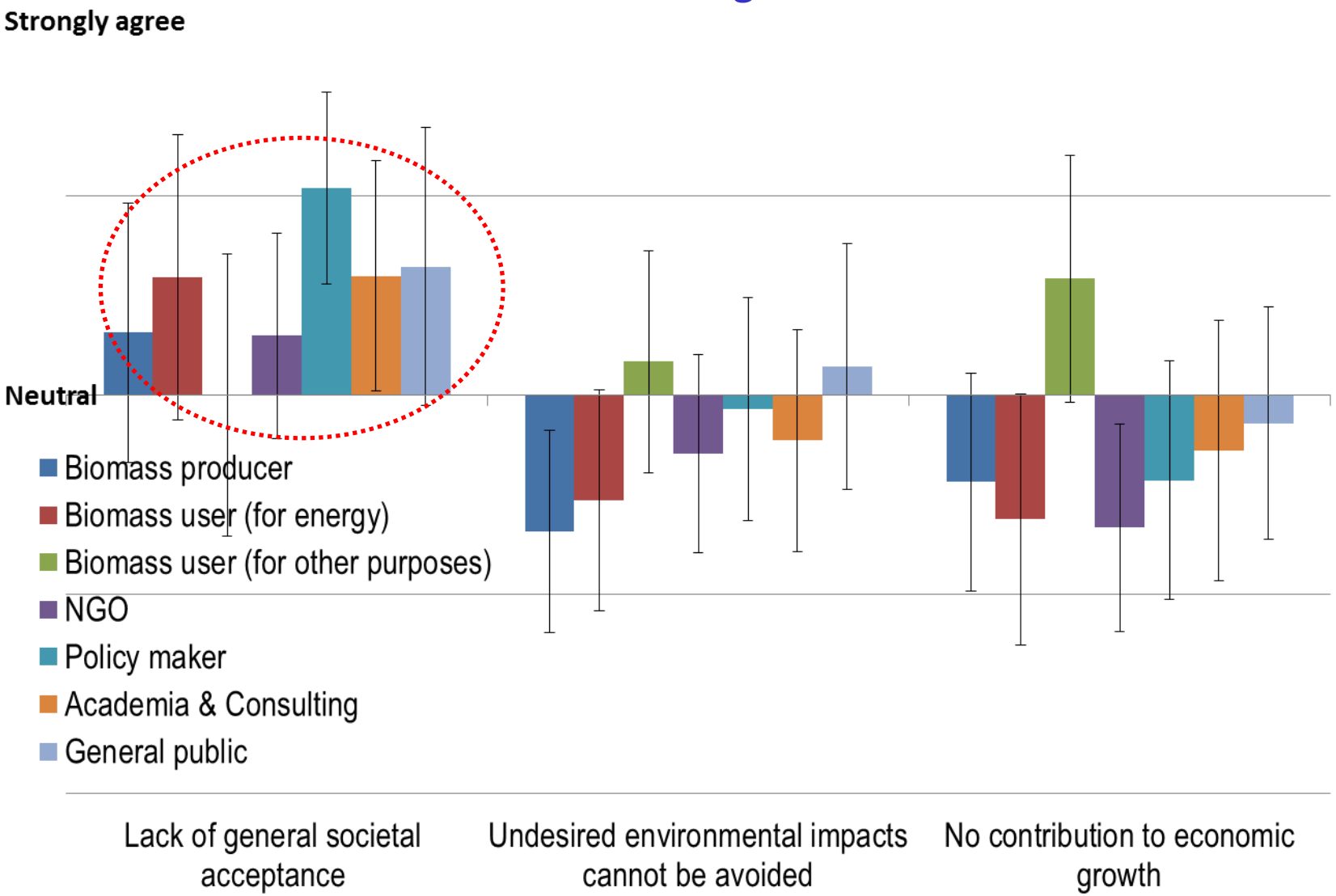
g. Drivers



IEA Bioenergy

General questionnaire

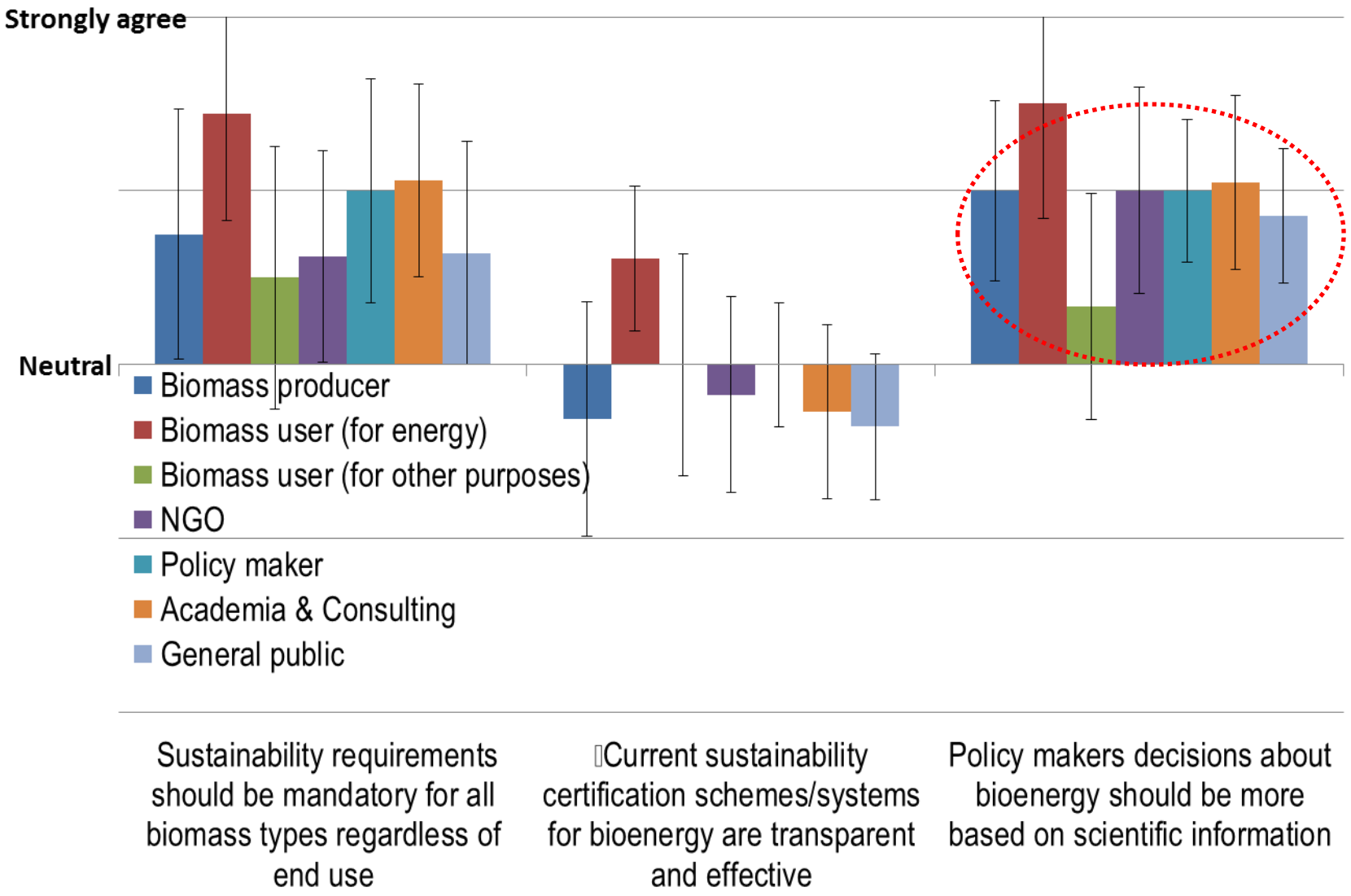
f. Challenges



IEA Bioenergy

I. General questionnaire

f. How to gain (more) support



IEA Bioenergy

General questionnaire - Summary

- ***General public is not well aware*** of bioenergy development. Public role should be more enhanced.
- As the most trustful source of information, ***academia and consulting should have a more active role*** in dissemination and communication
- **Feedstock mobilisation**: energy crops on agiculturl land are not iwidely accepted, but geographical location can play a role. More details on iLUC measurements needed
- **Viewpoints of sectors (biochemicals, biomaterials) different**: competition for feedstocks, subsidies for bioenergy are of concerns
- **Key barriers/ drivers and challenges**:
  - General public acceptance
  - sustainabilility requirements (GHG emissions reduction);
  - market and policy uncertainty

IEA Bioenergy

Final thoughts

- Biomass sustainability assurance systems have been developed over past 25 years, on local, national and international level, also for non-energy purposes
- But this does not by default lead to more trust and legitimacy…
- And it has created a patchwork rules, regulations, certification systems
- (more) harmonisation needed

IEA Bioenergy

More information

All published outputs o the inetrtask project are available at

www.

Including papers and workshop presentations / proceedings

IEA Bioenergy

Continuation of work in 2019-21 by new task: Climate and sustainability effects of bioenergy within the broader bioeconomy

Objectives

- identify and address critical issues related to the **climate and other sustainability effects of bioenergy and biobased products and systems**
- promote sound development for bioenergy as an integral component of the overall bioeconomy. Will be achieved by providing analyses that **support well-informed decisions** by land owners, communities, businesses, governments and others.
- Increase understanding of the environmental, social and economic impacts of producing and using biomass for bioenergy, **within the broader bioeconomy**.
- A central aspect concerns the **development and application of science-based methodologies and tools** for assessing the effects of biobased systems.

IEA Bioenergy

Climate and sustainability effects of bioenergy within the broader bioeconomy

Overall lead: Göran Berndes (Chalmers Univ.)

WP1 – Metrics, methods, and tools for assessing climate change effects of bioenergy (Annette Cowie, Univ. of New England)

WP2 – Metrics, methods and tools for assessing sustainability effects of bioenergy excl. climate change effects, (Floor van der Hilst, Utrecht Univ.)

WP3 – Sustainability stakeholders and implementation approaches / governance (Uwe Fritsche, IINAS)

Interested? Contact Göran Berndes (goran.berndes@chalmers.se)

IEA Bioenergy

Panel debate

Question 1:

Are current sustainability schemes and safeguards sufficient to ensure sustainable biomass production and use in the East/South-East Asian region? If not, which other sustainability criteria / schemes would you like to see implemented?

IEA Bioenergy

Panel debate

Question 2:

In the EU and North America, there have been ongoing & controversial discussion between scientists, industry, NGO and policy makers on the sustainability of liquid and solid biomass. These discussions have had a serious impact on bioenergy deployment in these regions. Do you foresee a similar development in Asia? If so, how can this be avoided or mitigated?