

Overview on How Sustainability of Bioeconomy Has and Should be Addressed at Global and National Levels

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Outline

1. Links between Bioeconomy and the SDGs
2. FAO's Overview of Sustainability in Bioeconomy Strategies
3. How to Achieve Sustainable Bioeconomy - Examples of Challenges and Opportunities
4. How to Measure Achievements in Bioeconomy Development - The Indicator Issue
5. FAO's Work on Sustainable Bioeconomy Guidelines
6. Some Key Messages on Sustainable Bioeconomy Development

1. Links between Bioeconomy and the SDGs



Bioeconomy not Sustainable *per se* - SDG Challenges and Opportunities



SDG 7: Sustainable Energy for All

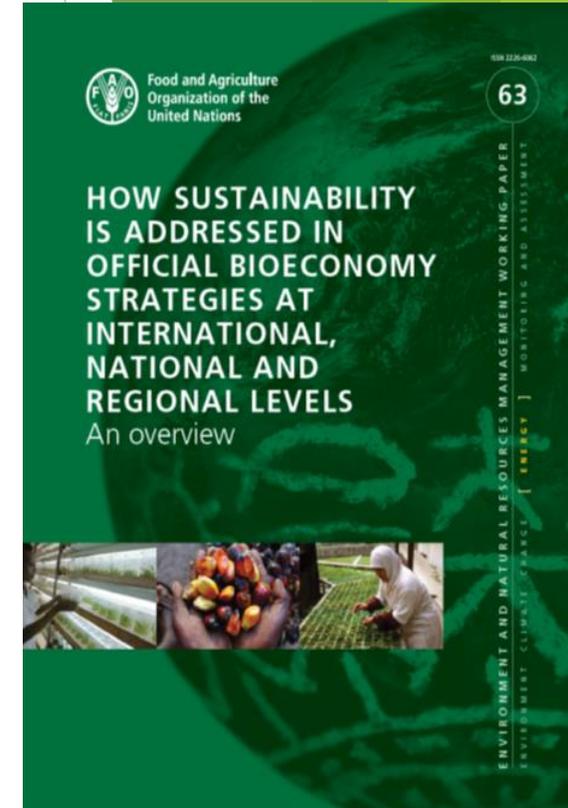
Bioenergy to improve access to modern energy services and reduce the use of fossil fuels

Competition between the use of biomass for energy and food and feed

2. FAO's Overview of Sustainability in Bioeconomy Strategies

FAO's Overview on How Sustainability has been Addressed in Bioeconomy Strategies at different Levels

- ▶ Undertaken from April to September 2016
- ▶ 20 Bioeconomy Strategies (4 International, 12 National, 4 Sub-national)
- ▶ Categories: Environmental Sustainability, Socio-economic Sustainability, Competition/Synergies between biomass end use sectors, Food security, Enabling factors)
- ▶ Includes both overview/gap analysis of:
 - Sustainability issues in bioeconomy strategies; and
 - Bioeconomy Action Plans and Approaches



Summary of Gap Analysis on Sustainability in Bioeconomy Strategies

✓ = The issue is addressed

CATEGORIES	INTERNATIONAL	INTERNATIONAL	INTERNATIONAL	INTERNATIONAL	NATIONAL	NATIONAL	NATIONAL	NATIONAL	NATIONAL	NATIONAL	NATIONAL	NATIONAL	NATIONAL	NATIONAL	NATIONAL	NATIONAL	NATIONAL	NATIONAL	REGIONAL	REGIONAL	REGIONAL	REGIONAL	REGIONAL	REGIONAL
Environmental sustainability		✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Socio-economic sustainability		✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Competition/ synergies among biomass end-use sectors		✓	✓		✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Food security			✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Enabling Factors		✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
		Baltic Sea Region - 2015-2018 Strategy and Action Plan Towards a BSR Bioeconomy (2015)	EU - Innovating for Sustainable Growth. A Bioeconomy for Europe (2012)	OECD - The BE to 2030. Designing a Policy Agenda (2009)	West Nordic Countries - Future Opportunities for Bioeconomy in the West Nordic Countries (2014)	Argentina - La Bioeconomía en la Argentina: Oportunidades y Desafíos (2015)	China - Development Plan for the Bio-Industry (2012)	Denmark - Denmark as Growth Hub for a Sustainable Bioeconomy (2014)	Finland - The Finnish Bioeconomy Strategy (2014)	Germany - National Policy Strategy on Bioeconomy (2014)	Japan - The Biomass Industrialization Strategy (2012)	Malaysia - The Bioeconomy Transformation Programme (2012)	The Netherlands - Framework memorandum on the Biobased Economy (2012)	Russia - BIO-2020 (2012)	South Africa - The Bio-economy Strategy (2013)	Spain - Spanish Bioeconomy Strategy: Horizon 2030 (2016)	USA - National Bioeconomy Blueprint (2012)	Baden-Württemberg (Germany) - Bioeconomy. Baden-Württemberg Path Towards a Sustainable Future (2013)	British Columbia (Canada) - British Columbia Bio-economy (2011)	Flanders (Belgium) - Bioeconomy in Flanders (2014)	Scotland (UK) - The Biorefinery Roadmap for Scotland (2015)			

Some Findings about Sustainability from Nordic Countries Bioeconomy Strategies

Environmental

- ▶ Climate change *resilience/adaptation* is mentioned in the West Nordic Countries document
- ▶ *Secure tenure of land, water and other productive natural resources* is *not an important factor*, except from the West Nordic Countries document - property rights in the cultivation of algae and respect of the Sámi people rights.

Socio-economic

- ▶ *Finnish strategy* mentions willingness to become a *hub for new products and innovation*
- ▶ *Finland* and the *Nordic Countries'* strategies strongly stimulate the *market for functional food (nutraceuticals)* for social health and well-being
- ▶ *Rural development* is a key issue in the *Finnish strategy*

Food security

- ▶ *Denmark prioritises food production* within the bioeconomy

Common Elements in three Nordic Region Bioeconomy Actions Plans

CATEGORIES		<i>Stand-alone documents</i>		<i>Strategic objectives and measures</i>			<i>List of actions and actors</i>				
		EU	Spain	Flanders	Germany	US ¹	Baltic Sea Region	Finland	Russia	Scotland	W. Nordic Countries
R+D+I (Research, Development and Innovation)	Knowledge enhancement and transfer	✓	✓	✓	✓	✓	✓	✓	✓		
	PPPs (for business innovation)	✓	✓	✓	✓	✓	✓			✓	✓
	Human capacity development	✓		✓	✓	✓			✓		
Stakeholder engagement		✓	✓	✓	✓	✓	✓	✓			✓
Markets and competitiveness	Policy alignment and coherence	✓	✓	✓	✓	✓	✓	✓	✓		✓
	Identification of possible value chains and feedstocks	✓	✓	✓	✓		✓	✓	✓	✓	✓
	Setting up industrial networks	✓	✓	✓	✓	✓	✓		✓	✓	
	Labelling and consumer awareness	✓	✓	✓	✓		✓	✓		✓	
	Public procurement and mandates/regulations	✓	✓	✓		✓	✓	✓		✓	

Findings on Three Nordic Region Bioeconomy Action Plans

Stakeholder engagement

- ▶ The *Baltic Sea Region* plan includes a *steering group* to support forums and prepare the annual “State of Bioeconomy”
- ▶ The *Finnish* document mentions an action for setting a *process of stakeholder involvement in regulations development*

Markets and competitiveness

- ▶ *Finland* Action Plan includes:
 - *Roadmaps on future global demand* and sustainability challenges in trends
 - Creation of *cooperation platforms* among cross-sectorial activities to improve their competitiveness in the international market, with the allocation of Structural Funds
 - *Importance of communications* to influence consumer choices highlight on sustainability of products and support to the replication of good practices
 - *Public procurement*, including criteria

Findings on Three Nordic Region Bioeconomy Action Plans

Markets and competitiveness

- ▶ The *Baltic Sea Region* document refers to specific actions to *identify good green procurement practices and procedures*

Examples of decentralized implementation mechanisms- Regional programmes for hubs development

- ▶ The *ScanBalt BioRegion* is a successful example a *mega-cluster partnership* in the Baltic Sea Region

Overview of Sustainability in Bioeconomy Strategies-Main Conclusions

RE: Strategies

- ▶ **Significant interest** in bioeconomy at different levels world wide confirmed
- ▶ **Sustainable bioeconomy: easier said than done** and no 'one size fits all' solutions
- ▶ Most current **bioeconomy strategies** are very broad
- ▶ Common **weaknesses** of strategies include **land use, water and waste management, competition between different uses of biomass, energy security and small-scale farmer inclusion**

RE: Implementation

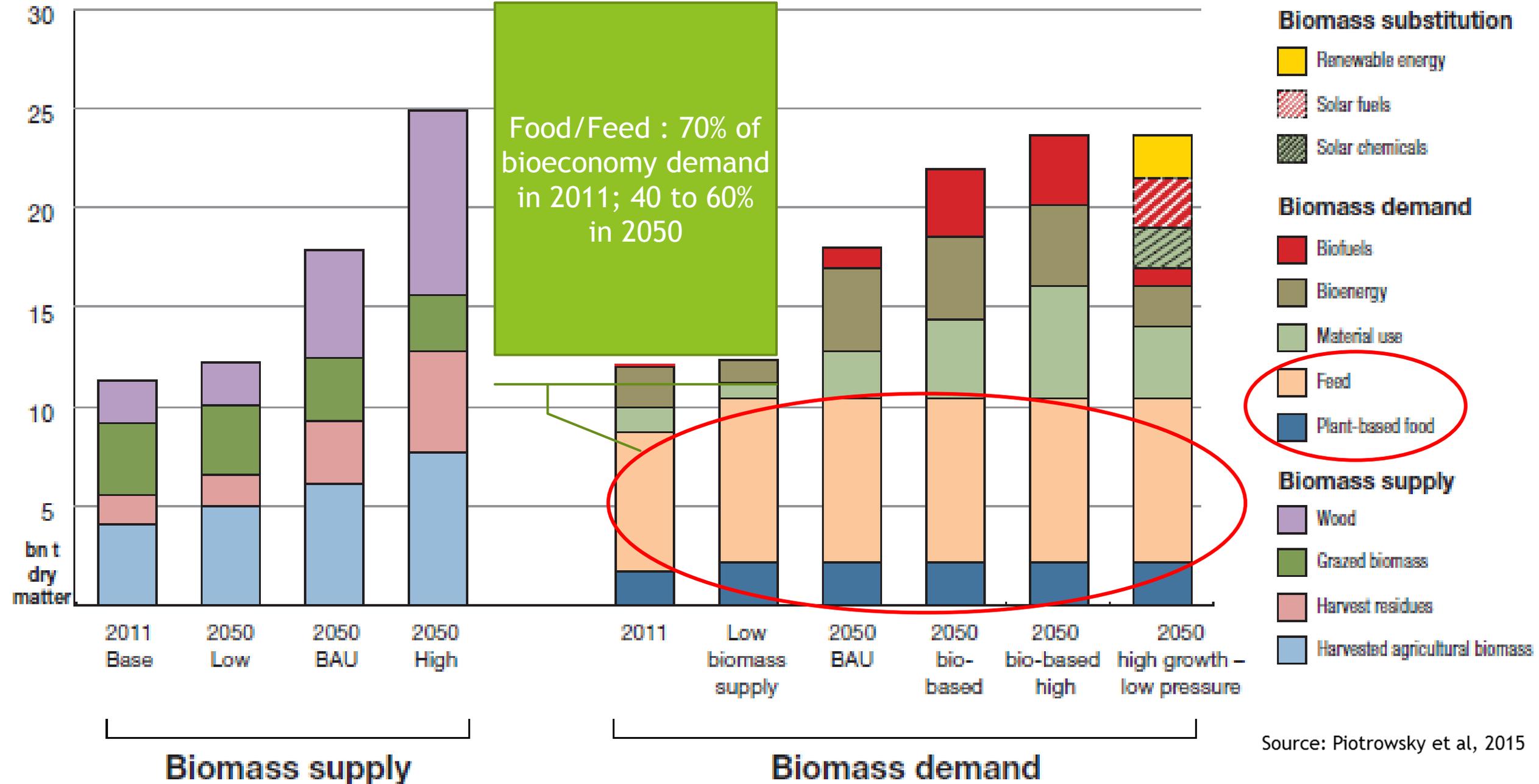
- ▶ Efforts towards implementation through **action plans only in a few cases**
- ▶ **A lot of knowledge** on pitfalls and success factors for biomass production stage, much less for **biomaterial production/use and disposal / end of life stages**
- ▶ **Messy picture and pragmatism needed** regarding **sustainability standards**

3. How to Achieve Sustainable Bioeconomy

Examples of Challenges and Opportunities

- * Food**
- * Cascading use of biomass**
- * Climate Change**

Food is and will be a/the Major Component of Global Bioeconomy



Food Security is Relevant to Nordic Countries

- ▶ Maybe *not so much* in terms of *food insecurity* in Nordic countries
- ▶ But Nordic countries have *a lot to offer* to others regarding food security
 - *Exports of food* (fish)
 - *Know how* on important aspects of agrifood chains - for instance:
 - *Biogas* from livestock in *Denmark*
 - *Geothermal energy* for *post-harvest operations* in *Iceland*
 - *Use of all parts of fish* in *Norway, Iceland* and *Greenland*

Ensuring food security

“ Food security exists when all people, at all times, have physical and economic access to sufficient safe and nutritious food that meets their dietary needs and food preferences for an active and healthy life”

1996 World Food Summit

Four dimensions	Explanations
AVAILABILITY	The <i>‘supply side’</i> of food security: Levels of production, stocks and net trade Often not the main issue because <i>globally there is enough food to feed the world. But often the main/only dimension considered</i>
ACCESS	<i>Economic</i> and <i>physical access</i> to food: Enough income to buy food/food prices, accessible markets, enough land <i>Often a key, if not the key issue but often overlooked</i>
UTILIZATION	<i>Quality of food</i> : What type of food and how people use it Key aspects include enough sustainable energy for <i>proper cooking</i> and <i>nutrition aspects</i> Currently, globally roughly <i>as many malnourished</i> people as <i>undernourished people</i>
STABILITY	<i>Stability of the three other dimensions over time</i>

Examples of links between bioeconomy on food AVAILABILITY

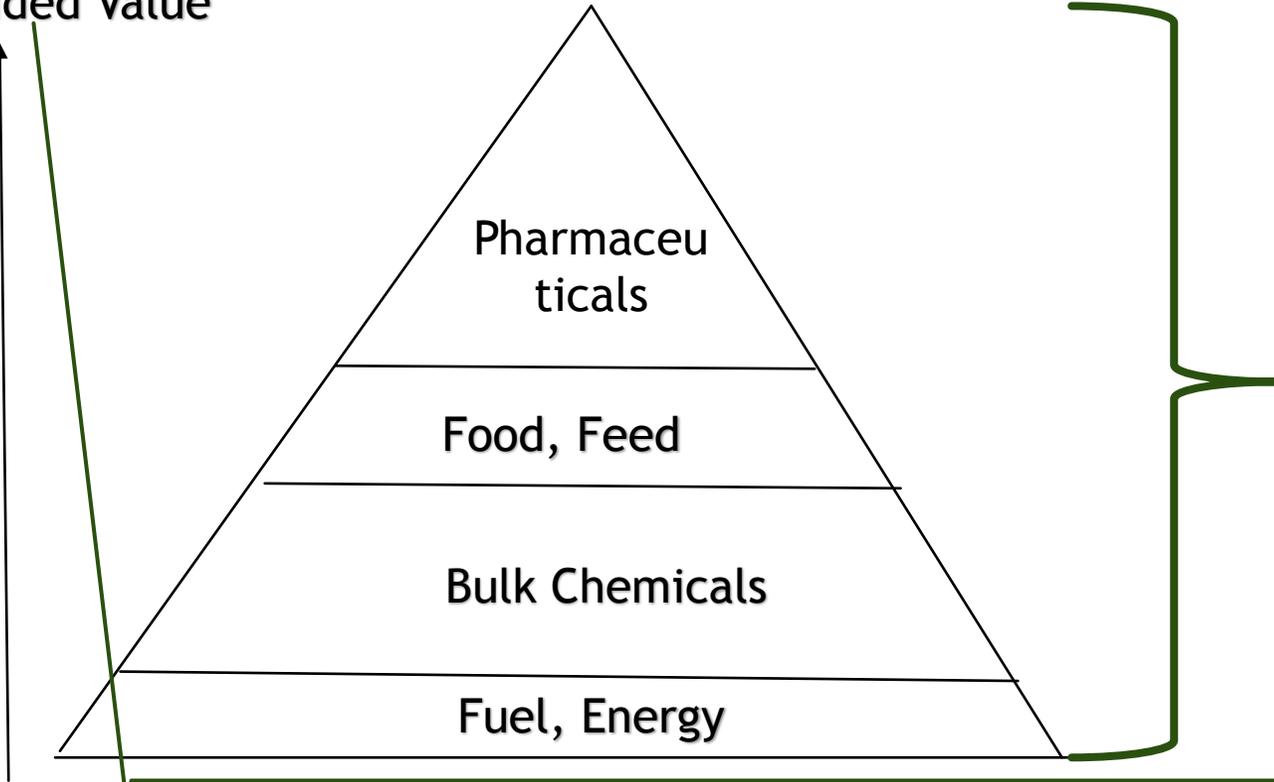
- ▶ + Investments to sustainably increase yields of non-food goods can also increase food availability (e.g. sugarcane ethanol in Brazil)
- ▶ - Land used for the production of non-food goods (including 2ndG biofuels) can compete with land needed to produce food
- ▶ - Biomass residues not a panacea! Risk of competition in the use of residues between soil management/food production, animal feed, bioenergy and biomaterials
- ▶ + Production of non-food goods can increase availability of food/feed as by-product (e.g. DDGS from corn) and the reverse is also true (e.g. biogas)

Examples of links between bioeconomy and food ACCESS

- ▶ + Income from the production of non-food goods and bioeconomy jobs can help local people to buy food
- ▶ - Non-responsible investments in bioeconomy can lead to a reduction in land access by local farmers to produce food
- ▶ +/- Increase in food prices caused by the production of non-food goods **will negatively affect net food buyers** but will positively affect net food sellers

Vertical cascading use of biomass- Easier said than done!

Added Value



- Production of every type of product requires energy !
- And it should be sustainable, renewable energy - hence also bioenergy!

Whose and What value? Resource efficiency / Income (also to buy food) / Costs / Needs (e.g. energy needed for cooking, algae for food or feed)

- ▶ ***It all depends on local circumstances!*** The *sequence* of use of biomass should be ***decided*** through an ***inclusive local multi-stakeholder process***
- ▶ Also consider ***horizontal cascading (biorefineries)***

BE stages	Climate change mitigation	Carbon Sequestration	Climate change adaptation
Biomass production	<ul style="list-style-type: none"> - GHG emissions from biomass production + Precision agriculture to optimize agricultural practices 	<ul style="list-style-type: none"> + Carbon sequestration through good soil and water management - Reduced soil carbon if too much biomass removed 	<ul style="list-style-type: none"> + Higher diversity in applications increases security, stability and farmers' resilience - climate change impacts leads to displacement of biomass production
Bio-material production	<ul style="list-style-type: none"> + Most bio-products reduce GHG emissions compared to their petrochemical counterparts + Significant improvements in efficiencies of new biotech pathways possible 	<ul style="list-style-type: none"> + Future carbon capture and use technologies will use renewable CO₂ sources 	<ul style="list-style-type: none"> + Employment and value added to rural areas
Bio-material use (cascading)	<ul style="list-style-type: none"> + Long-living products show lowest GHG emissions - A lot of energy to recycle products may add GHG emissions 	<ul style="list-style-type: none"> + Long living products show long sequestration + Cascading use can expand CO₂ sequestration 	<ul style="list-style-type: none"> + Specific benefits from locally used (traditional) bio-based products
End of Life	<ul style="list-style-type: none"> + energy from incineration substitutes fossil energy +/- Biodegradation may require a lot of energy 		<p style="text-align: center;">Adapted from Nova Institute, 2017</p>

4. How to Measure Achievements - Indicators for different stages of the value chain

Stages of the bioeconomy value chain

Stage 1: Biomass
production

Stage 2: Bio-
material production

Stage 3: Bio-
material use

Stage 3:
Disposal/end of life



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graph LR; S1[Stage 1: Biomass production] --> S2[Stage 2: Bio-material production]; S2 --> S3a[Stage 3: Bio-material use]; S3a --> S3b[Stage 3: Disposal/end of life];
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Impact Indicators

- ▶ At *biomass production* stage: *A lot of systems* that *cover more or less the same things* - So a bit *confusing* at times
- ▶ At *biomaterial production & use* stage: *Many less* - emphasis on *energy use & bio-based content*
- ▶ At *disposal/end of life* stage: *Mot much*
- ▶ *Measuring* these indicators is often *expensive* and *takes time*
- ▶ Several systems concern the *impacts of specific programmes* (e.g. EU, Germany)

What to do?

Do we need anything else?

If so, what and how to go about it?

Maybe a stepwise process - Start with performance indicators and global systems as proxy indications

- ▶ *Performance indicators to measure the quality of implementation of good practices* combining
 - **Quantity** (e.g. number of hectares under good practice X, number of companies using good practice Y)
 - **Quality** in the implementation of these good practices

Such indicators **acknowledge** and **measure progress**

As a result **progress reward** can be **included in incentives**

But one needs a **threshold level**

- ▶ **Global systems**: Indications based for instance on **remote sensing** (e.g. combine regular fire monitoring with land cover maps to assess availability and use of crop residues)

Maybe a stepwise process - Start with performance indicators and global systems as proxy indications

Such *proxy systems*

- ▶ provide *preliminary indications* at regular periods of time between measurements of impact
- ▶ *allow for corrections* before measuring impacts
- ▶ Are much *less costly* and *time consuming*



5. FAO's work on Sustainable Bioeconomy Guidelines

Background of FAO's work on Sustainable Bioeconomy Guidelines

- ▶ *FAO received a mandate to coordinate international work on 'food first' sustainable bioeconomy* from 62 Ministers present at the 2015 Global Forum for Food and Agriculture (GFFA) in Berlin
- ▶ FAO has received *support from the Government of Germany to develop guidelines on sustainable bioeconomy development* (Phase 1: 2016; Phase 2: 2017-mid 2020)

Results of phase 1 of the project on sustainable bioeconomy guidelines (Nov 2015 - October 2016)

- ▶ ***International Multi-stakeholder Working Group on Sustainable Bioeconomy:*** 17 members so far - 6 countries (NL, GE, US, ARG, SA, MA), German Bioeconomy Council, EU, OECD, CIAT, UNEP, WWF, Nordic Council of Ministries, EU Bioeconomy Public-Private Consortium, Wageningen University, WBCSD and FAO
- ▶ ***Overview of how sustainability is addressed in about 20 bioeconomy strategies*** (regional, national and sub-national) - published in September 2016
- ▶ ***Principles and Criteria for Sustainable Bioeconomy***

Agreed elements of phase 2 of the project on sustainable bioeconomy guidelines (2017 to mid-2020)

- ▶ ***Lessons*** from ***examples*** of successful and problematic experiences in bioeconomy development
- ▶ A compilation of ***good bioeconomy practices***
- ▶ A report on ***policies to promote good bioeconomy practices***
- ▶ A ***'toolbox' on sustainable bioeconomy***, building to a large extent on the FAO sustainable bioenergy toolbox (at least for biomass production stage)

Agreed elements of phase 2 of the project on sustainable bioeconomy guidelines (2017 to mid-2020)

- ▶ **Agreed indicators on impacts and performance of good bioeconomy practices**
 - **Combining impact and proxy indicators** is the current direction for FAO guidelines on sustainable bioeconomy
 - But these are early days and **more thinking** and **collaboration are needed to achieve something practical yet robust**
- ▶ **Outreach: Presentation and validation of the sustainable bioeconomy guidelines** (P&Cs, good practices, supporting policies, toolbox and indicators) at **regional level** and with **different stakeholder groups**

Some Lessons for the Development of Bioeconomy Strategies

- ▶ It does not start from scratch and should not reinvent wheels - It should build on existing knowledge and fill gaps with innovations where needed
- ▶ It will have to combine general aspects (e.g. aspirational Principles and Criteria) with enough flexibility to adapt solutions to local conditions
- ▶ It should be coordinated through a coordinated multistakeholder national/international mechanism
- ▶ It should be supported by a massive communication effort to gain sufficient societal acceptance

FAO's Key Messages on Sustainable Bioeconomy Development

- ▶ Links between bioeconomy and food security are *complex, multifaceted* and *context-specific*
- ▶ *We must embrace this complexity with context specific assessment* rather than oversimplifying the reality with overreliance on models and global studies - as often done with bioenergy - because
- ▶ *We have tools to address this complexity* - including those related to sustainable bioenergy

FAO's Key Messages on Sustainable Bioeconomy Development

- ▶ *Food First' bioeconomy*: Yes but need to *consider ALL dimensions of food security*, not just food availability/production
- ▶ We should make sure that *bioeconomy does not leave anyone behind*
- ▶ So let's go for '*Bioeconomy that Works for People, Food Security and Climate Change*'
- ▶ This requires *multistakeholder* and *internationally-coordinated efforts*
- ▶ *FAO is playing its part* and is *ready to keep doing it*

Questions & Feedback Welcome

Thank you for your attention

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