

Linkages between the Sustainable Development Goals (SDGs) and the GBEP Sustainability Indicators for Bioenergy (GSI)

Technical Paper for the GBEP Task Force on Sustainability

- DRAFT VERSION -

prepared for



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Background

The GBEP Task Force on Sustainability (TFS) was reopened in May 2015 with a new scope of work agreed by the GBEP Partners, with the focus to enhance the practicality of the GBEP Sustainability Indicators for Bioenergy (GSI) by producing an implementation guide to complement the “Global Bioenergy Partnership Sustainability Indicators for Bioenergy” report¹.

As agreed at the 13th Meeting of the TFS, it is important to understand the GSIs in the context of the **Sustainable Development Goals** (SDGs). As a contribution to this, a Technical Paper is being prepared to highlight the linkages between the SDGs and the GSIs and to determine how they may be mutually reinforcing.

Purpose of this Draft and Next Steps

This **draft** provides preliminary findings of the paper, aiming to seek feedback from GBEP members, especially those participating in the workshop July 3-4, 2017 in Bonn, Germany.

After the workshop, a final version will be prepared for approval during the 2017 GBEP meeting in Rome.

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Any error, misconception or omission remains the responsibility of the authors.

¹ GBEP (2011) The GBEP Sustainability Indicators for Bioenergy. Global Bioenergy Partnership. Rome
http://www.globalbioenergy.org/fileadmin/user_upload/gbep/docs/Indicators/The_GBEP_Sustainability_Indicators_for_Bioenergy_FINAL.pdf

1 Biomass and the SDGs

The 17 SDGs² represent a **normative framework** which could be used to “define” sustainable development in general – and their 169 targets give quantitative steps towards achieving the goals. Each country will have to “translate” the SDGs into its own development agenda – and to report to the UN on respective achievements.

There is a multitude of **indicators** for the SDGs, i.e. quantitative or qualitative expressions to “measure” achieving the goals and targets which are to be used on the national scale.

The SDGs are meant to give orientation for the future global development – but disregarding the relevance of biomass for the global food, feed, fibre and energy systems (see Figure 1 in Annex), the SDGs do **not make any reference** to biomass, or bioenergy, or biofuels – and neither to more “modern” concepts such as biorefineries.

Yet bioenergy - as part of the overall use of biomass (i.e. the “bioeconomy”) is expected to **increase globally** (see Figure 2 in Annex) driven by several SDGs, but could also be subject to sustainability safeguards from other SDGs, as indicated in Table 1.

² The SDGs are part of the Resolution adopted by the UN General Assembly on 25 September 2015 “Transforming our world: the 2030 Agenda for Sustainable Development” (UN 2015b)

Table 1 Role of the SDGs for biomass supply and use

SDG	Key wording	Driver	Safe-guard
	End poverty in all its forms everywhere	(✓)	(✓)
	End hunger, achieve food security and improved nutrition and promote sustainable agriculture	✓	✓
	Ensure healthy lives and promote well-being for all at all ages	(✓)	(✓)
	Ensure inclusive and equitable quality education and promote lifelong learning opportunities for all		
	Achieve gender equality and empower all women and girls	(✓)	(✓)
	Ensure availability and sustainable management of water and sanitation for all	(✓)	(✓)
	Ensure access to affordable, reliable, sustainable and modern energy for all	✓	(✓)
	Promote sustained, inclusive and sustainable economic growth, full and productive employment and decent work for all	✓	(✓)
	Build resilient infrastructure, promote inclusive and sustainable industrialization and foster innovation	(✓)	
	Reduce inequality within and among countries		
	Make cities and human settlements inclusive, safe, resilient and sustainable	✓	(✓)
	Ensure sustainable consumption and production patterns	✓	(✓)
	Take urgent action to combat climate change and its impacts	✓	✓
	Conserve and sustainably use the oceans, seas and marine resources for sustainable development	(✓)	(✓)
	Protect, restore and promote sustainable use of terrestrial ecosystems, sustainably manage forests, combat desertification, and halt and reverse land degradation and halt biodiversity loss	✓	✓
	Promote peaceful and inclusive societies for sustainable development, provide access to justice for all and build effective, accountable and inclusive institutions at all levels		(✓)
	Strengthen the means of implementation and revitalise the global partnership for sustainable development	(✓)	(✓)

Source: own elaboration based on SDKP (2015). **Bold text:** SDG related to energy; (✓) = partially relevant

Table 1 can be explained as follows:

- SDG 1 (end poverty) is a partial driver (e.g., through increased investments in bioenergy to foster rural employment, and respective income), but also a partial safeguard (e.g., regarding land grabbing).
- SDG 2 (end hunger) will increase biomass for food & feed, but can also act as a safeguard due to promoting **sustainable** agriculture and improve the integration of bioenergy into agriculture (e.g., agroforestry, intercropping).
- SDG 3 (health) can be a driver for more biomass through substitution of fossil fuel for cooking and heating, and may be a safeguard for respiratory diseases due to reducing health impacts from “traditional” biomass use
- SDG 6 (water) is a partial driver due to improved waste water treatment which implies increased supply of biogas.
- SDG 7 (sustainable energy for all) and particularly Target 7.2 “*By 2030, increase substantially the share of renewable energy in the global energy mix*” are the key driver for increasing demand for bioenergy, but as this SDG explicitly calls for **sustainable** energy, it could also be a safeguard.
- SDG 8 (sustainable growth and employment) could be a partial driver, especially in biomass-rich countries and rural areas seeking economic development through biomass supply and use.
- SDG 11 (sustainable cities) can be a partial driver, as it implies increased sustainable housing (using biomaterials for construction), and also a potential safeguard if cities require **sustainable** provision of biomass, e.g. through procurement rules.
- SDG 12 (sustainable consumption and production) will be a driver though increased use of biomaterials, and potentially safeguarding biomass sourcing.
- SDG 13 (combat climate change) is a driver, as biomass is (under certain conditions) a low-GHG option for energy and materials, and also a safeguard in avoiding high-carbon options (e.g. biomass from conversion of grasslands, or deforestation).
- SDG 14 (oceans and marine resources) may be both a partial driver, and a partial safeguard if aquatic biomass is developed for biomaterials, and bioenergy supply.
- SDG 15 (life on land) can be a partial driver (restoring degraded land through biomass), and also a safeguard (protecting biodiversity, reducing land degradation).
- SDG 16 (peaceful and inclusive societies) has the potential to become a partial safeguard if institutions are accountable and take into consideration biomass sustainability.
- SDG 17 (global partnerships) may imply both increased biomass use, and sustainability safeguards for biomass if e.g. GBEP’s GSI receive more attention.

With the exception of SDGs 4 and 10, all SDGs are – with more or less relevance - linked to biomass, both as drivers, or safeguards. To determine the implication of the SDGs for biomass, **all** these drivers and potential safeguards need to be reflected in an **integrated way**.

2 The GSIs for Bioenergy and the SDGs

The GSIs give a broad scope of sustainability considerations covering all three “pillars”, i.e. environment, social and economic aspects (see Table 2).

Table 2 The GBEB Sustainability Indicators for Bioenergy

Environmental pillar	Social pillar	Economic pillar
1. Life-cycle GHG emissions	9. Allocation and tenure of land for new bioenergy production	17. Productivity
2. Soil quality	10. Price and supply of a national food basket	18. Net energy balance
3. Harvest levels of wood resources	11. Change in income	19. Gross value added
4. Emissions of non-GHG air pollutants, including air toxics	12. Jobs in the bioenergy sector	20. Change in consumption of fossil fuels and traditional use of biomass
5. Water use and efficiency	13. Change in unpaid time spent by women and children collecting biomass	21. Training and re-qualification of the workforce
6. Water quality	14. Bioenergy used to expand access to modern energy services	22. Energy diversity
7. Biological diversity in the landscape	15. Change in mortality and burden of disease attributable to indoor smoke	23. Infrastructure and logistics for distribution of bioenergy
8. Land use and land-use change related to bioenergy feedstock production	16. Incidence of occupational injury, illness and fatalities	24. Capacity and flexibility of use of bioenergy

Source: GBEP (2011)

The GSIs are accompanied by descriptions of concepts, data sources and methodologies³. In the following subsections, the linkages of the SDGs (and their targets and indicators) will be discussed for each of the three GSI pillars⁴.

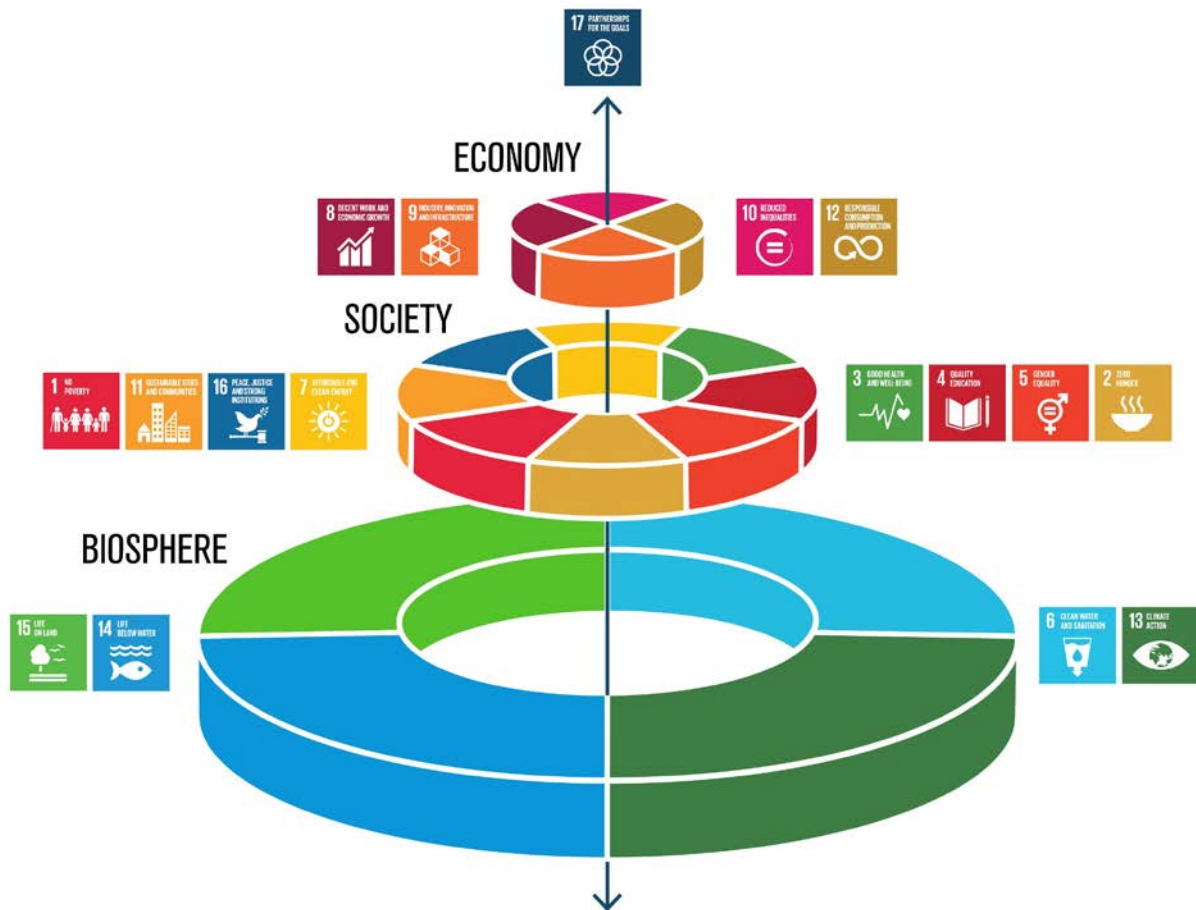
³ See Footnote 1 for details.

⁴ For a reverse representation, i.e. a table with the SDGs, their targets and indicators, and the related GSIs, see Annex.

The SDGs, on the other hand, are not structured into specific areas or pillars of sustainability – the UN has just “listed” them.

Yet, work of the Stockholm Resilience Institute grouped the SDGs into three “levels” which are similar to the GSI “pillar” structure, as indicated in Figure 1.

Figure 1 Conceptual Structuring of the SDGs



Source: Stockholm Resilience Institute

The bottom “biosphere” can be seen as representing the ecological pillar (4 SDGs), while “society” and “economy” represent the social (8 SDGs) and economic (4 SDGs) pillars. The “top” SDG 17 is not to be seen as the tip of a pyramid, but as transcending the structure.

2.1 Environmental Pillar

Table 3 SDGs and the GBEB Sustainability Indicators for Bioenergy: Environmental Pillar

GSI Environmental pillar	SDG and Target(s)	Indicator	Tier
1. Life-cycle GHG emissions Lifecycle greenhouse gas emissions from bioenergy production and use, as per the methodology chosen nationally or at community level, and reported using the GBEP Common Methodological Framework for GHG Lifecycle Analysis of Bioenergy 'Version One'	Goal 13. Take urgent action to combat climate change and its impacts Target 13.2 Integrate climate change measures into national policies, strategies and planning	13.2.1 Number of countries that have communicated the establishment or operationalization of an integrated policy/strategy/plan which increases their ability to adapt to the adverse impacts of climate change, and foster climate resilience and low greenhouse gas emissions development in a manner that does not threaten food production (including a national adaptation plan, nationally determined contribution, national communication, biennial update report or other)	III
	Goal 9. Build resilient infrastructure, promote inclusive and sustainable industrialization and foster innovation Target 9.4 By 2030, upgrade infrastructure and retrofit industries to make them sustainable, with increased resource-use efficiency and greater adoption of clean and environmentally sound technologies and industrial processes, with all countries taking action in accordance with their respective capabilities	9.4.1 CO ₂ emission per unit of value added	I
2. Soil quality Percentage of land for which soil quality, in particular in terms of soil organic carbon, is maintained or improved out of total land on which bioenergy feedstock is cultivated or harvested	Goal 2. End hunger, achieve food security and improved nutrition and promote sustainable agriculture Target 2.4 By 2030, ensure sustainable food production systems and implement resilient agricultural practices that increase productivity and production, that help maintain ecosystems, that strengthen capacity for adaptation to climate change, extreme weather, drought, flooding and other disasters and that progressively improve land and soil quality	2.4.1 Proportion of agricultural area under productive and sustainable agriculture	
	Goal 15. Protect, restore and promote sustainable use of terrestrial ecosystems, sustainably manage forests, combat	15.3.1 Proportion of land that is degraded over total land area	III

	desertification, and halt and reverse land degradation and halt biodiversity loss Target 15.3 By 2030, combat desertification, restore degraded land and soil, including land affected by desertification, drought and floods, and strive to achieve a land degradation-neutral world		
3. Harvest levels of wood resources Annual harvest of wood resources by volume and as a percentage of net growth or sustained yield, and the percentage of the annual harvest used for bioenergy	Goal 15. Protect, restore and promote sustainable use of terrestrial ecosystems, sustainably manage forests, combat desertification, and halt and reverse land degradation and halt biodiversity loss Target 15.2 By 2020, promote the implementation of sustainable management of all types of forests, halt deforestation, restore degraded forests and substantially increase afforestation and reforestation globally	15.2.1 Progress towards sustainable forest management	III
4. Emissions of non-GHG air pollutants, including air toxics Emissions of non-GHG air pollutants, including air toxics, from bioenergy feedstock production, processing, transport of feedstocks, intermediate products and end products, and use; and in comparison with other energy sources	Goal 11. Make cities and human settlements inclusive, safe, resilient and sustainable Target 11.6 By 2030, reduce the adverse per capita environmental impact of cities, including by paying special attention to air quality and municipal and other waste management	11.6.1 Proportion of urban solid waste regularly collected and with adequate final discharge out of total urban solid waste generated, by cities 11.6.2 Annual mean levels of fine particulate matter (e.g. PM _{2.5} and PM ₁₀) in cities (population weighted)	
5. Water use and efficiency 5.1 Water withdrawn from nationally-determined watershed(s) for the production and processing of bioenergy feedstocks, expressed as the percentage of total actual renewable water resources (TARWR) and as the percentage of total annual water withdrawals (TAWW), disaggregated into renewable and non-renewable water sources	Goal 6. Ensure availability and sustainable management of water and sanitation for all Target 6.4 By 2030, substantially increase water-use efficiency across all sectors and ensure sustainable withdrawals and supply of freshwater to address water scarcity and substantially reduce the number of people suffering from water scarcity	6.4.1 Change in water-use efficiency over time 6.4.2 Level of water stress: freshwater withdrawal as a proportion of available freshwater resource	III
6. Water quality 6.1 Pollutant loadings to waterways and bodies of water attributable to fertilizer and pesticide application for bioenergy feedstock cultivation, and expressed as a percentage of pollutant loadings from total agricultural production in the watershed	Goal 6. Ensure availability and sustainable management of water and sanitation for all Target 6.3 By 2030, improve water quality by reducing pollution, eliminating dumping and minimizing release of hazardous chemicals and materials, halving the proportion of untreated wastewater and substantially increasing recycling and safe reuse globally	6.3.1 Proportion of wastewater safely treated 6.3.2 Proportion of bodies of water with good ambient water quality	III
7. Biological diversity in the landscape	Goal 2. End hunger, achieve food security and improved nutrition and promote sustainable agriculture	2.4.1 Proportion of agricultural area under productive and sustainable agriculture	

7.3 Area and percentage of the land used for bioenergy production where nationally recognized conservation methods are used	Target 2.4 By 2030, ensure sustainable food production systems and implement resilient agricultural practices that increase productivity and production, that help maintain ecosystems, that strengthen capacity for adaptation to climate change, extreme weather, drought, flooding and other disasters and that progressively improve land and soil quality		
	Goal 15. Protect, restore and promote sustainable use of terrestrial ecosystems, sustainably manage forests, combat desertification, and halt and reverse land degradation and halt biodiversity loss Target 15.8 By 2020, introduce measures to prevent the introduction and significantly reduce the impact of invasive alien species on land and water ecosystems and control or eradicate the priority species	15.8.1 Proportion of countries adopting relevant national legislation and adequately resourcing the prevention or control of invasive alien species	III
8. Land use and land-use change related to bioenergy feedstock production 8.1 Total area of land for bioenergy feedstock production, and as compared to total national surface and agricultural and managed forest land area 8.2 Percentages of bioenergy from yield increases, residues, wastes and degraded or contaminated land 8.3 Net annual rates of conversion between land-use types caused directly by bioenergy feedstock production	Goal 15. Protect, restore and promote sustainable use of terrestrial ecosystems, sustainably manage forests, combat desertification, and halt and reverse land degradation and halt biodiversity loss Target 15.1 By 2020, ensure the conservation, restoration and sustainable use of terrestrial and inland freshwater ecosystems and their services, in particular forests, wetlands, mountains and drylands, in line with obligations under international agreements	15.1.1 Forest area as a proportion of total land area 15.1.2 Proportion of important sites for terrestrial and freshwater biodiversity that are covered by protected areas, by ecosystem type"	I

Source: IINAS compilation

2.2 Social Pillar

Table 4 SDGs and the GBEB Sustainability Indicators for Bioenergy: Social Pillar

GSI Social pillar	SDG and Target(s)	Indicator	Tier
9. Allocation and tenure of land for new bioenergy production Percentage of land – total and by land-use type – used for new bioenergy production where: <ul style="list-style-type: none"> a legal instrument or domestic authority establishes title and procedures for change of title; and the current domestic legal system and/or socially accepted practices provide due process and the established procedures are followed for determining legal title 	Goal 1. End poverty in all its forms everywhere Target 1.4 By 2030, ensure that all men and women, in particular the poor and the vulnerable, have equal rights to economic resources, as well as access to basic services, ownership and control over land and other forms of property, inheritance, natural resources, appropriate new technology and financial services, including microfinance	1.4.2 Proportion of total adult population with secure tenure rights to land, with legally recognized documentation and who perceive their rights to land as secure, by sex and by type of tenure	III
	Goal 2. End hunger, achieve food security and improved nutrition and promote sustainable agriculture Target 2.3 By 2030, double the agricultural productivity and incomes of small-scale food producers, in particular women, indigenous peoples, family farmers, pastoralists and fishers, including through secure and equal access to land, other productive resources and inputs, knowledge, financial services, markets and opportunities for value addition and non-farm employment	2.3.1 Volume of production per labour unit by classes of farming/pastoral/forestry enterprise size 2.3.2 Average income of small-scale food producers, by sex and indigenous status	III
10. Price and supply of a national food basket Effects of bioenergy use and domestic production on the price and supply of a food basket, which is a nationally defined collection of representative foodstuffs, including main staple crops, measured at the national, regional, and/or household level, taking into consideration: <ul style="list-style-type: none"> changes in demand for foodstuffs for food, feed and fibre; changes in the import and export of foodstuffs; changes in agricultural production due to weather conditions; changes in agricultural costs from petroleum and other energy prices; and 	Goal 1. End poverty in all its forms everywhere Target 1.1 By 2030, eradicate extreme poverty for all people everywhere, currently measured as people living on less than \$1.25 a day	1.1.1 Proportion of population below the international poverty line, by sex, age, employment status and geographical location (urban/rural)	I
	Goal 2. End hunger, achieve food security and improved nutrition and promote sustainable agriculture Target 2.1 By 2030, end hunger and ensure access by all people, in particular the poor and people in vulnerable situations, including infants, to safe, nutritious and sufficient food all year round Target 2.c Adopt measures to ensure the proper functioning of food commodity markets and their derivatives and facilitate timely access to market	2.1.1 Prevalence of undernourishment 2.1.2 Prevalence of moderate or severe food insecurity in the population, based on the Food Insecurity Experience Scale (FIES) 2.c.1 Indicator of food price anomalies	I

the impact of price volatility and price inflation of foodstuffs on the national, regional, and/or household welfare level, as nationally determined	information, including on food reserves, in order to help limit extreme food price volatility		
11. Change in income Contribution of the following to change in income due to bioenergy production: 11.1 wages paid for employment in the bioenergy sector in relation to comparable sectors 11.2 net income from the sale, barter and/or own-consumption of bioenergy products, including feedstocks, by self-employed households/individuals	Goal 1. End poverty in all its forms everywhere Target 1.2 By 2030, reduce at least by half the proportion of men, women and children of all ages living in poverty in all its dimensions according to national definitions	1.2.1 Proportion of population living below the national poverty line, by sex and age 1.2.2 Proportion of men, women and children of all ages living in poverty in all its dimensions according to national definitions	I
	Goal 8. Promote sustained, inclusive and sustainable economic growth, full and productive employment and decent work for all Target 8.5 By 2030, achieve full and productive employment and decent work for all women and men, including for young people and persons with disabilities, and equal pay for work of equal value	8.5.1 Average hourly earnings of female and male employees, by occupation, age and persons with disabilities 8.5.2 Unemployment rate, by sex, age and persons with disabilities	II
	Goal 10. Reduce inequality within and among countries Target 10.1 By 2030, progressively achieve and sustain income growth of the bottom 40 per cent of the population at a rate higher than the national average	10.1.1 Growth rates of household expenditure or income per capita among the bottom 40 per cent of the population and the total population	I
12. Jobs in the bioenergy sector 12.1 Net job creation as a result of bioenergy production and use, total and disaggregated (if possible) as follows: o skilled/unskilled 12.2 Total number of jobs in the bioenergy sector and percentage adhering to nationally recognized labour standards consistent with the principles enumerated in the ILO Declaration on Fundamental Principles and Rights at Work, in relation to comparable sectors o temporary/indefinite	Goal 8. Promote sustained, inclusive and sustainable economic growth, full and productive employment and decent work for all Target 8.2 Achieve higher levels of economic productivity through diversification, technological upgrading and innovation, including through a focus on high-value added and labour-intensive sectors Target 8.3 Promote development-oriented policies that support productive activities, decent job creation, entrepreneurship, creativity and innovation, and encourage the formalization and growth of micro-, small- and medium-sized enterprises, including through access to financial services	8.2.1 Annual growth rate of real GDP per employed person	I
		8.3.1 Proportion of informal employment in non-agriculture employment, by sex	II
13. Change in unpaid time spent by women and children collecting biomass Change in average unpaid time spent by women and children collecting biomass as a result of switching from traditional use of biomass to modern bioenergy services	Goal 5. Achieve gender equality and empower all women and girls Target 5.4 Recognize and value unpaid care and domestic work through the provision of public services, infrastructure and social protection policies and the promotion of	5.4.1 Proportion of time spent on unpaid domestic and care work, by sex, age and location	II

	shared responsibility within the household and the family as nationally appropriate		
14. Bioenergy used to expand access to modern energy services 14.1 Total amount and percentage of increased access to modern energy services gained through modern bioenergy (disaggregated by bioenergy type), measured in terms of energy and numbers of households and businesses 14.2 Total number and percentage of households and businesses using bioenergy, disaggregated into modern bioenergy and traditional use of biomass	Goal 7. Ensure access to affordable, reliable, sustainable and modern energy for all Target 7.1 By 2030, ensure universal access to affordable, reliable and modern energy services Target 7.2 By 2030, increase substantially the share of renewable energy in the global energy mix	7.1.1 Proportion of population with access to electricity 7.1.2 Proportion of population with primary reliance on clean fuels and technology 7.2.1 Renewable energy share in the total final energy consumption	I
15. Change in mortality and burden of disease attributable to indoor smoke Change in mortality and burden of disease attributable to indoor smoke from solid fuel use, and changes in these as a result of the increased deployment of modern bioenergy services, including improved biomass-based cookstoves	Goal 3. Ensure healthy lives and promote well-being for all at all ages Target 3.9 By 2030, substantially reduce the number of deaths and illnesses from hazardous chemicals and air, water and soil pollution and contamination	3.9.1 Mortality rate attributed to household and ambient air pollution	I
16. Incidence of occupational injury, illness and fatalities Incidences of occupational injury, illness and fatalities in the production of bioenergy in relation to comparable sectors	Goal 8. Promote sustained, inclusive and sustainable economic growth, full and productive employment and decent work for all Target 8.8 Protect labour rights and promote safe and secure working environments for all workers, including migrant workers, in particular women migrants, and those in precarious employment	8.8.1 Frequency rates of fatal and non-fatal occupational injuries, by sex and migrant status 8.8.2 Level of national compliance of labour rights (freedom of association and collective bargaining) based on ILO textual sources and national legislation, by sex and migrant status	I

Source: IINAS compilation

2.3 Economic Pillar

Table 5 *SDGs and the GBEB Sustainability Indicators for Bioenergy: Economic Pillar*

GSI Economix Pillar	SDG and Target(s)	Indicator	Tier
17. Productivity Productivity of bioenergy feedstocks by feedstock or by farm/plantation <ul style="list-style-type: none"> • Processing efficiencies by technology and feedstock • Amount of bioenergy end product by mass, volume or energy content per hectare per year □ Production cost per unit of bioenergy 	No linkage		
18. Net energy balance Energy ratio of the bioenergy value chain with comparison with other energy sources, including energy ratios of feedstock production, processing of feedstock into bioenergy, bioenergy use; and/or lifecycle analysis	No linkage		
19. Gross value added Gross value added per unit of bioenergy produced and as a percentage of gross domestic product	Goal 7. Ensure access to affordable, reliable, sustainable and modern energy for all Target 7.3 By 2030, double the global rate of improvement in energy efficiency	7.3.1 Energy intensity measured in terms of primary energy and GDP	I
	Goal 8. Promote sustained, inclusive and sustainable economic growth, full and productive employment and decent work for all Target 8.1 Sustain per capita economic growth in accordance with national circumstances and, in particular, at least 7 per cent gross domestic product growth per annum in the least developed countries	8.1.1 Annual growth rate of real GDP per capita	I
	Goal 9. Build resilient infrastructure, promote inclusive and sustainable industrialization and foster innovation Target 9.4 By 2030, upgrade infrastructure and retrofit industries to make them sustainable, with increased resource-use efficiency and greater adoption of clean and environmentally sound technologies and industrial processes, with all countries taking action in accordance with their respective capabilities	9.4.1 CO ₂ emission per unit of value added	I

20. Change in the consumption of fossil fuels and traditional use of biomass <ul style="list-style-type: none"> • Substitution of fossil fuels with domestic bioenergy measured by energy content and in annual savings of convertible currency from reduced purchases of fossil fuels • Substitution of traditional use of biomass with modern domestic bioenergy measured by energy content 	Goal 12. Ensure sustainable consumption and production patterns Target 12.2 By 2030, achieve the sustainable management and efficient use of natural resources	12.2.1 Material footprint, material footprint per capita, and material footprint per GDP	II
		12.2.2 Domestic material consumption, domestic material consumption per capita, and domestic material consumption per GDP	II
21. Training and re-qualification of the workforce Percentage of trained workers in the bioenergy sector out of total bioenergy workforce, and percentage of re-qualified workers out of the total number of jobs lost in the bioenergy sector	No linkage		
22. Energy diversity Change in diversity of total primary energy supply due to bioenergy	Goal 7. Ensure access to affordable, reliable, sustainable and modern energy for all Target 7.3 By 2030, double the global rate of improvement in energy efficiency	7.3.1 Energy intensity measured in terms of primary energy and GDP	I
23. Infrastructure and logistics for distribution of bioenergy Number and capacity of routes for critical distribution systems, along with an assessment of the proportion of the bioenergy associated with each	No linkage		
24. Capacity and flexibility of use of bioenergy <ul style="list-style-type: none"> • Ratio of capacity for using bioenergy compared with actual use for each significant utilization route • Ratio of flexible capacity which can use either bioenergy or other fuel sources to total capacity 	No linkage		

Source: IINAS compilation

3 Perspectives for Applying the GSI in the Process of National SDG Implementation

This section will discuss how the national implementation of the SDGs **could benefit** from the GSIs - and *vice versa*.

- To be written after the July 3-4 workshop -

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Annex: SDGs and GBEP Indicators


Table 6 Aggregated mapping of interlinkages between the SDGs, their targets and indicators, and the GBEP Sustainability Indicators for Bioenergy


Sustainable development goals, targets and indicators				GBEP Sustainability Indicators for Bioenergy (GSI)
SDG	Target	Indicator	Tier	GSI
	1.1	1.1.1	I	10. Price and supply of a national food basket
	1.2	1.2.1 1.2.2	I	11. Change in income
	1.4	1.4.2	III	9. Allocation and tenure of land for new bioenergy production
	2.1	2.1.1 2.1.2	I	10. Price and supply of a national food basket
	2.3	2.3.1 2.3.2	III	9. Allocation and tenure of land for new bioenergy production
	2.4	2.4.1	III	7. Biological diversity in the landscape + 2. Soil quality
	2.c	2.c.1	II	10. Price and supply of a national food basket
	3.9	3.9.1	I	15. Change in mortality and burden of disease attributable to indoor smoke
	5.4	5.4.1	II	13. Change in unpaid time spent by women and children collecting biomass
	6.3	6.3.1 6.3.2	III	6. Water quality
	6.4	6.4.1 6.4.2	III	5. Water use and efficiency
	7.1	7.1.1 7.1.2	I	14. Bioenergy used to expand access to modern energy services
	7.2	7.2.1	I	14 (see above) + 22. Energy diversity
	7.3	7.3.1	I	19. Gross value added + 22. Energy diversity
	7.a	7.a.1	III	all GBEP work
	8.1	8.1.1	I	19. Gross value added
	8.2	8.2.1	I	12. Jobs in the bioenergy sector
	8.3	8.3.1	II	12. Jobs in the bioenergy sector
	8.5	8.5.1 8.5.2	II	11. Change in income
	8.8	8.8.1 8.8.2	I	16. Incidence of occupational injury, illness and fatalities
	9.4	9.4.1	I	1 + 19
	10.1	10.1.1	I	11. Change in income
	11.6	11.6.1 11.6.2	II	4. Emissions of non-GHG air pollutants, including air toxics
	12.2	12.2.1 12.2.2	II	20. Change in the consumption of fossil fuels and traditional use of biomass
	13.2	13.2.1	III	1. Lifecycle GHG emissions
				




Sustainable development goals, targets and indicators				GBEB Sustainability Indicators for Bioenergy (GSI)
SDG	Target	Indicator	Tier	GSI
	15.1	15.1.1 15.1.2	I	8. Land use and land-use change related to bioenergy feedstock production
	15.2	15.2.1	III	3. Harvest levels of wood resources
	15.3	15.3.1	III	2. Soil quality
	15.8	15.8.1	III	7. Biological diversity in the landscape
			I-III	GBEP work in general


Source: IINAS compilation


Table 7 Detailed mapping of interlinkages between the SDGs, their targets and indicators, and the GBEP Sustainability Indicators for Bioenergy



Sustainable development goals, targets and indicators				GBEB Sustainability Indicators for Bioenergy (GSI)		
SDG		Target	Indicators	Tier	GSI	Description
	Goal 1. End poverty in all its forms everywhere	1.1 By 2030, eradicate extreme poverty for all people everywhere, currently measured as people living on less than \$1.25 a day	1.1.1 Proportion of population below the international poverty line, by sex, age, employment status and geographical location (urban/rural)	I	10. Price and supply of a national food basket	Effects of bioenergy use and domestic production on the price and supply of a food basket, which is a nationally-defined collection of representative foodstuffs, including main staple crops, measured at the national, regional, and/or household level, taking into consideration: - changes in demand for foodstuffs for food, feed, and fibre; - changes in the import and export of foodstuffs; - changes in agricultural production due to weather conditions; - changes in agricultural costs from petroleum and other energy prices; and - the impact of price volatility and price inflation of foodstuffs on the national, regional, and/or household welfare level, as nationally-determined
		1.2 By 2030, reduce at least by half the proportion of men, women and children of all ages living in poverty in all its dimensions according to national definitions	1.2.1 Proportion of population living below the national poverty line, by sex and age 1.2.2 Proportion of men, women and children of all ages living in poverty in all its dimensions according to national definitions	I	11. Change in income	Contribution of the following to change in income due to bioenergy production: 11.1 wages paid for employment in the bioenergy sector in relation to comparable sectors 11.2 net income from the sale, barter and/or own-consumption of bioenergy products, including feedstocks, by self-employed households/individuals




Sustainable development goals, targets and indicators				GBEB Sustainability Indicators for Bioenergy (GSI)	
SDG	Target	Indicators	Tier	GSI	Description
		1.4 By 2030, ensure that all men and women, in particular the poor and the vulnerable, have equal rights to economic resources, as well as access to basic services, ownership and control over land and other forms of property, inheritance, natural resources, appropriate new technology and financial services, including microfinance	1.4.2 Proportion of total adult population with secure tenure rights to land, with legally recognized documentation and who perceive their rights to land as secure, by sex and by type of tenure	III	9. Allocation and tenure of land for new bioenergy production Percentage of land – total and by land-use type – used for new bioenergy production where: - a legal instrument or domestic authority establishes title and procedures for change of title; and - the current domestic legal system and/or socially accepted practices provide due process and the established procedures are followed for determining legal title
	Goal 2. End hunger, achieve food security and improved nutrition and promote sustainable agriculture	2.1 By 2030, end hunger and ensure access by all people, in particular the poor and people in vulnerable situations, including infants, to safe, nutritious and sufficient food all year round	2.1.1 Prevalence of undernourishment 2.1.2 Prevalence of moderate or severe food insecurity in the population, based on the Food Insecurity Experience Scale (FIES)	I	10. Price and supply of a national food basket see above
		2.3 By 2030, double the agricultural productivity and incomes of small-scale food producers, in particular women, indigenous peoples, family farmers, pastoralists and fishers, including through secure and equal access to land, other productive resources and inputs, knowledge, financial services, markets and opportunities for value addition and non-farm employment	2.3.1 Volume of production per labour unit by classes of farming/pastoral/forestry enterprise size 2.3.2 Average income of small-scale food producers, by sex and indigenous status	III	9. Allocation and tenure of land for new bioenergy production see above
		2.4 By 2030, ensure sustainable food production systems and implement resilient agricultural practices that increase productivity and production, that help maintain ecosystems, that strengthen capacity for adaptation to climate change, extreme weather, drought, flooding and other disasters and that progressively improve land and soil quality	2.4.1 Proportion of agricultural area under productive and sustainable agriculture	III	7. Biological diversity in the landscape + 2. Soil quality 7.3 Area and percentage of the land used for bioenergy production where nationally recognized conservation methods are used 2. Percentage of land for which soil quality, in particular in terms of soil organic carbon, is maintained or improved out of total land on which bioenergy feedstock is cultivated or harvested



Sustainable development goals, targets and indicators				GBEB Sustainability Indicators for Bioenergy (GSI)	
SDG	Target	Indicators	Tier	GSI	Description
		2.c Adopt measures to ensure the proper functioning of food commodity markets and their derivatives and facilitate timely access to market information, including on food reserves, in order to help limit extreme food price volatility	II	10. Price and supply of a national food basket	see above
	Goal 3. Ensure healthy lives and promote well-being for all at all ages	3.9 By 2030, substantially reduce the number of deaths and illnesses from hazardous chemicals and air, water and soil pollution and contamination	I	15. Change in mortality and burden of disease attributable to indoor smoke	Change in mortality and burden of disease attributable to indoor smoke from solid fuel use, and changes in these as a result of the increased deployment of modern bioenergy services, including improved biomass-based cookstoves
	Goal 5. Achieve gender equality and empower all women and girls	5.4 Recognize and value unpaid care and domestic work through the provision of public services, infrastructure and social protection policies and the promotion of shared responsibility within the household and the family as nationally appropriate	II	13. Change in unpaid time spent by women and children collecting biomass	Change in average unpaid time spent by women and children collecting biomass as a result of switching from traditional use of biomass to modern bioenergy services
	Goal 6. Ensure availability and sustainable management of water and sanitation for all	6.3 By 2030, improve water quality by reducing pollution, eliminating dumping and minimizing release of hazardous chemicals and materials, halving the proportion of untreated wastewater and substantially increasing recycling and safe reuse globally	III	6. Water quality	6.1 Pollutant loadings to waterways and bodies of water attributable to fertilizer and pesticide application for bioenergy feedstock cultivation, and expressed as a percentage of pollutant loadings from total agricultural production in the watershed 6.2 Pollutant loadings to waterways and bodies of water attributable to bioenergy processing effluents, and expressed as a percentage of pollutant loadings from total agricultural processing effluents in the watershed

Sustainable development goals, targets and indicators				GBEB Sustainability Indicators for Bioenergy (GSI)	
SDG	Target	Indicators	Tier	GSI	Description
	6.4 By 2030, substantially increase water-use efficiency across all sectors and ensure sustainable withdrawals and supply of freshwater to address water scarcity and substantially reduce the number of people suffering from water scarcity	6.4.1 Change in water-use efficiency over time 6.4.2 Level of water stress: freshwater withdrawal as a proportion of available freshwater resources	III	5. Water use and efficiency	5.1 Water withdrawn from nationally-determined watershed(s) for the production and processing of bioenergy feedstocks, expressed as the percentage of total actual renewable water resources (TARWR) and as the percentage of total annual water withdrawals (TAWW), disaggregated into renewable and non-renewable water sources
 Goal 7. Ensure access to affordable, reliable, sustainable and modern energy for all	7.1 By 2030, ensure universal access to affordable, reliable and modern energy services	7.1.1 Proportion of population with access to electricity 7.1.2 Proportion of population with primary reliance on clean fuels and technology	I	14. Bioenergy used to expand access to modern energy services	14.1 Total amount and percentage of increased access to modern energy services gained through modern bioenergy (disaggregated by bioenergy type), measured in terms of energy and numbers of households and businesses 14.2 Total number and percentage of households and businesses using bioenergy, disaggregated into modern bioenergy and traditional use of biomass
	7.2 By 2030, increase substantially the share of renewable energy in the global energy mix	7.2.1 Renewable energy share in the total final energy consumption	I	14 (see above) + 22. Energy diversity	see above 22 Change in diversity of total primary energy supply due to bioenergy
	7.3 By 2030, double the global rate of improvement in energy efficiency	7.3.1 Energy intensity measured in terms of primary energy and GDP	I	19. Gross value added + 22. Energy diversity	19 Gross value added per unit of bioenergy produced and as a percentage of gross domestic product 22 Change in diversity of total primary energy supply due to bioenergy

Sustainable development goals, targets and indicators				GBEB Sustainability Indicators for Bioenergy (GSI)		
SDG		Target	Indicators	Tier	GSI	Description
		7.a By 2030, enhance international cooperation to facilitate access to clean energy research and technology, including renewable energy, energy efficiency and advanced and cleaner fossil-fuel technology, and promote investment in energy infrastructure and clean energy technology	7.a.1 International financial flows to developing countries in support of clean energy research and development and renewable energy production, including in hybrid systems	III	all GBEP work	
	Goal 8. Promote sustained, inclusive and sustainable economic growth, full and productive employment and decent work for all	8.1 Sustain per capita economic growth in accordance with national circumstances and, in particular, at least 7 per cent gross domestic product growth per annum in the least developed countries	8.1.1 Annual growth rate of real GDP per capita	I	19. Gross value added	see above
		8.2 Achieve higher levels of economic productivity through diversification, technological upgrading and innovation, including through a focus on high-value added and labour-intensive sectors	8.2.1 Annual growth rate of real GDP per employed person	I	12. Jobs in the bioenergy sector	12.1 Net job creation as a result of bioenergy production and use, total and disaggregated (if possible) as follows: o skilled/unskilled 12.2 Total number of jobs in the bioenergy sector and percentage adhering to nationally recognized labour standards consistent with the principles enumerated in the ILO Declaration on Fundamental Principles and Rights at Work, in relation to comparable sectors o temporary/indefinite
		8.3 Promote development-oriented policies that support productive activities, decent job creation, entrepreneurship, creativity and innovation, and encourage the formalization and growth of micro-, small- and medium-sized enterprises, including through access to financial services	8.3.1 Proportion of informal employment in non-agriculture employment, by sex	II	12. Jobs in the bioenergy sector	see above

Sustainable development goals, targets and indicators				GBEB Sustainability Indicators for Bioenergy (GSI)		
SDG		Target	Indicators	Tier	GSI	Description
		8.5 By 2030, achieve full and productive employment and decent work for all women and men, including for young people and persons with disabilities, and equal pay for work of equal value	8.5.1 Average hourly earnings of female and male employees, by occupation, age and persons with disabilities 8.5.2 Unemployment rate, by sex, age and persons with disabilities	II	11. Change in income	see above
		8.8 Protect labour rights and promote safe and secure working environments for all workers, including migrant workers, in particular women migrants, and those in precarious employment	8.8.1 Frequency rates of fatal and non-fatal occupational injuries, by sex and migrant status 8.8.2 Level of national compliance of labour rights (freedom of association and collective bargaining) based on ILO textual sources and national legislation, by sex and migrant status	I	16. Incidence of occupational injury, illness and fatalities	Incidences of occupational injury, illness and fatalities in the production of bioenergy in relation to comparable sectors
	Goal 9. Build resilient infrastructure, promote inclusive and sustainable industrialization and foster innovation	9.4 By 2030, upgrade infrastructure and retrofit industries to make them sustainable, with increased resource-use efficiency and greater adoption of clean and environmentally sound technologies and industrial processes, with all countries taking action in accordance with their respective capabilities	9.4.1 CO ₂ emission per unit of value added	I	1 + 19	1. Lifecycle greenhouse gas emissions from bioenergy production and use, as per the methodology chosen nationally or at community level, and reported using the GBEP Common Methodological Framework for GHG Lifecycle Analysis of Bioenergy 'Version One' 19 Gross value added per unit of bioenergy produced and as a percentage of gross domestic product
	Goal 10. Reduce inequality within and among countries	10.1 By 2030, progressively achieve and sustain income growth of the bottom 40 per cent of the population at a rate higher than the national average	10.1.1 Growth rates of household expenditure or income per capita among the bottom 40 per cent of the population and the total population	I	11. Change in income	<i>Weak linkage; possible proxy?</i>

Sustainable development goals, targets and indicators					GBEB Sustainability Indicators for Bioenergy (GSI)	
SDG		Target	Indicators	Tier	GSI	Description
	Goal 11. Make cities and human settlements inclusive, safe, resilient and sustainable	11.6 By 2030, reduce the adverse per capita environmental impact of cities, including by paying special attention to air quality and municipal and other waste management	11.6.1 Proportion of urban solid waste regularly collected and with adequate final discharge out of total urban solid waste generated, by cities 11.6.2 Annual mean levels of fine particulate matter (e.g. PM _{2.5} and PM ₁₀) in cities (population weighted)	II	4. Emissions of non-GHG air pollutants, including air toxics	Weak linkage; possible proxy?
	Goal 12. Ensure sustainable consumption and production patterns	12.2 By 2030, achieve the sustainable management and efficient use of natural resources	12.2.1 Material footprint, material footprint per capita, and material footprint per GDP 12.2.2 Domestic material consumption, domestic material consumption per capita, and domestic material consumption per GDP	II	20. Change in the consumption of fossil fuels and traditional use of biomass	20.1 Substitution of fossil fuels with domestic bioenergy measured by energy content and in annual savings of convertible currency from reduced purchases of fossil fuels 20.2 Substitution of traditional use of biomass with modern domestic bioenergy measured by energy content
	Goal 13. Take urgent action to combat climate change and its impacts	13.2 Integrate climate change measures into national policies, strategies and planning	13.2.1 Number of countries that have communicated the establishment or operationalization of an integrated policy/strategy/plan which increases their ability to adapt to the adverse impacts of climate change, and foster climate resilience and low greenhouse gas emissions development in a manner that does not threaten food production (including a national adaptation plan, nationally determined contribution, national communication, biennial update report or other)	III	1. Lifecycle GHG emissions	see above

Sustainable development goals, targets and indicators				GBEB Sustainability Indicators for Bioenergy (GSI)	
SDG	Target	Indicators	Tier	GSI	Description
 Goal 15. Protect, restore and promote sustainable use of terrestrial ecosystems, sustainably manage forests, combat desertification, and halt and reverse land degradation and halt biodiversity loss	15.1 By 2020, ensure the conservation, restoration and sustainable use of terrestrial and inland freshwater ecosystems and their services, in particular forests, wetlands, mountains and drylands, in line with obligations under international agreements	15.1.1 Forest area as a proportion of total land area 15.1.2 Proportion of important sites for terrestrial and freshwater biodiversity that are covered by protected areas, by ecosystem type	I	8. Land use and land-use change related to bioenergy feedstock production	8.1 Total area of land for bioenergy feedstock production, and as compared to total national surface and agricultural and managed forest land area 8.2 Percentages of bioenergy from yield increases, residues, wastes and degraded or contaminated land 8.3 Net annual rates of conversion between land-use types caused directly by bioenergy feedstock production
	15.2 By 2020, promote the implementation of sustainable management of all types of forests, halt deforestation, restore degraded forests and substantially increase afforestation and reforestation globally	15.2.1 Progress towards sustainable forest management	III	3. Harvest levels of wood resources	3.1 Annual harvest of wood resources by volume and as a percentage of net growth or sustained yield 3.2 Percentage of the annual harvest used for bioenergy
	15.3 By 2030, combat desertification, restore degraded land and soil, including land affected by desertification, drought and floods, and strive to achieve a land degradation-neutral world	15.3.1 Proportion of land that is degraded over total land area	III	2. Soil quality	Percentage of land for which soil quality, in particular in terms of soil organic carbon, is maintained or improved out of total land on which bioenergy feedstock is cultivated or harvested
	15.8 By 2020, introduce measures to prevent the introduction and significantly reduce the impact of invasive alien species on land and water ecosystems and control or eradicate the priority species	15.8.1 Proportion of countries adopting relevant national legislation and adequately resourcing the prevention or control of invasive alien species	III	7. Biological diversity in the landscape	7.2 Area and percentage of the land used for bioenergy production where nationally recognized invasive species, by risk category, are cultivated
 Goal 17. Strengthen the means of implementation and revitalize the Global Partnership for Sustainable Development			I-III	GBEP work in general	

