

The contribution of sustainable bioenergy to a just and inclusive energy transition of agrifood systems

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Global Bioenergy Partnership

Food and Agriculture Organization of the United Nations (FAO)



Photo credits: FAO/Tiziana Pirelli

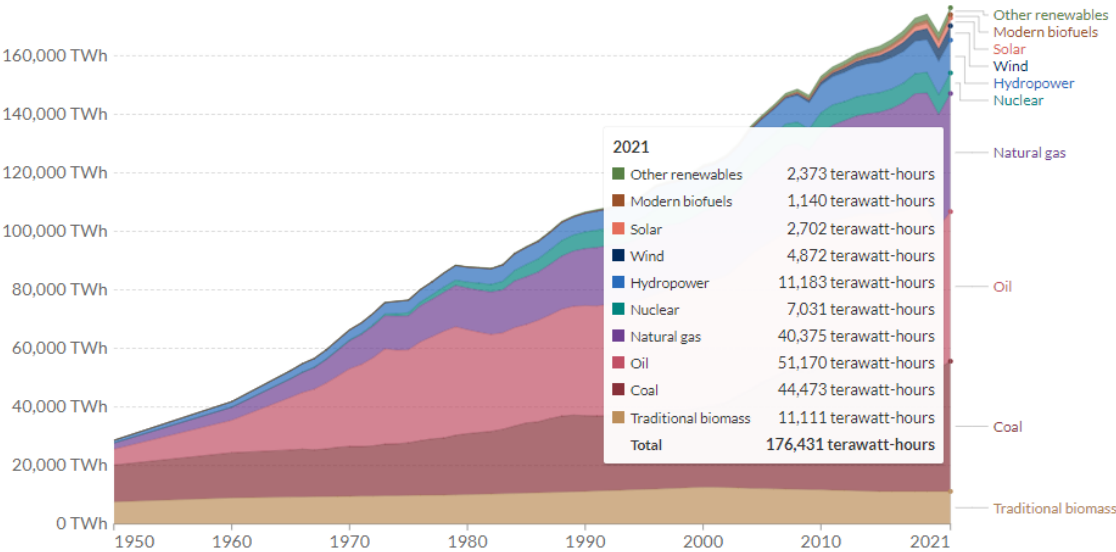
Schools beyond regions and borders
18 March 2024

Energy demand is increasing

Global primary energy consumption by source

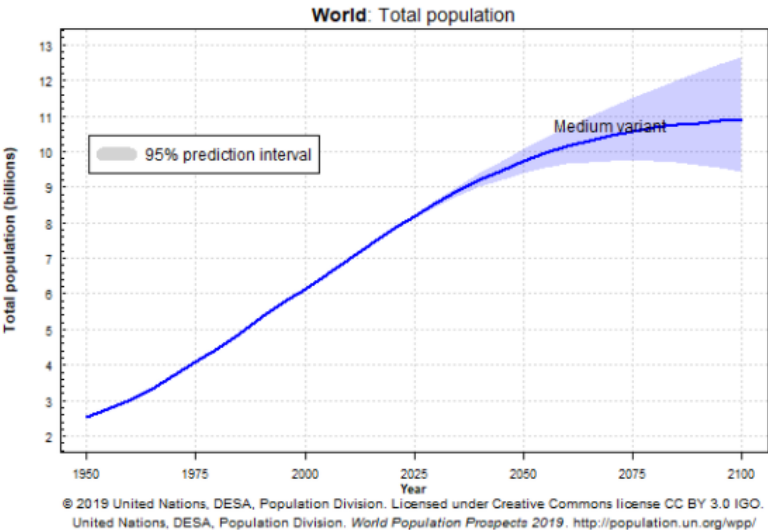
Primary energy is calculated based on the 'substitution method' which takes account of the inefficiencies in fossil fuel production by converting non-fossil energy into the energy inputs required if they had the same conversion losses as fossil fuels.

All together ☐ Relative



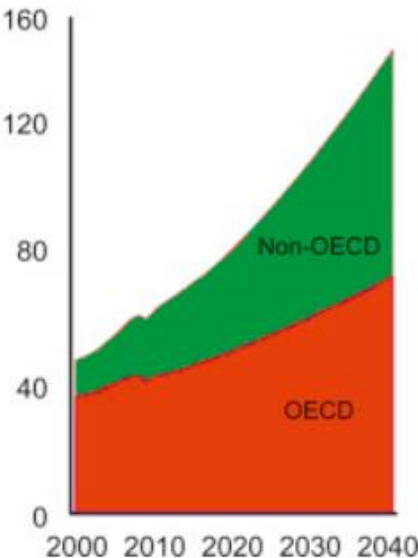
Source: Our World in Data based on Vaclav Smil (2017) and BP Statistical Review of World Energy

OurWorldInData.org/energy • CC BY



Strong population growth

World GDP doubles Trillions of 2010 dollars

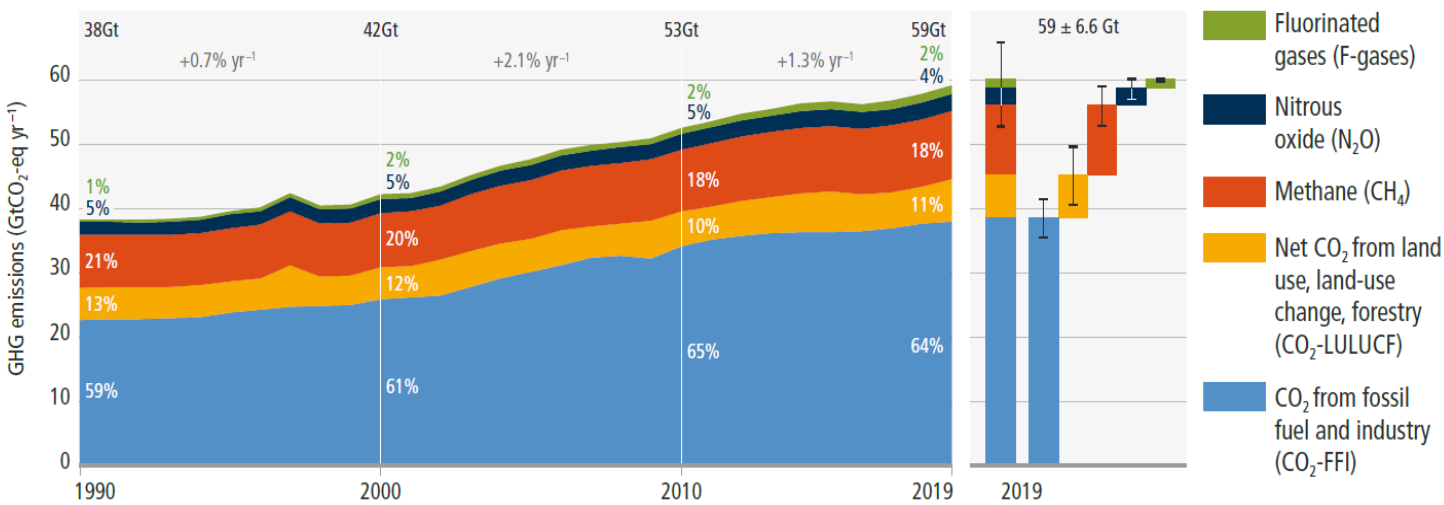


Significant increase of domestic GDP in Least Developed Countries

ExxonMobil: 2018 Outlook for energy: A View to 2040.

Contribution of Energy to global GHG emissions

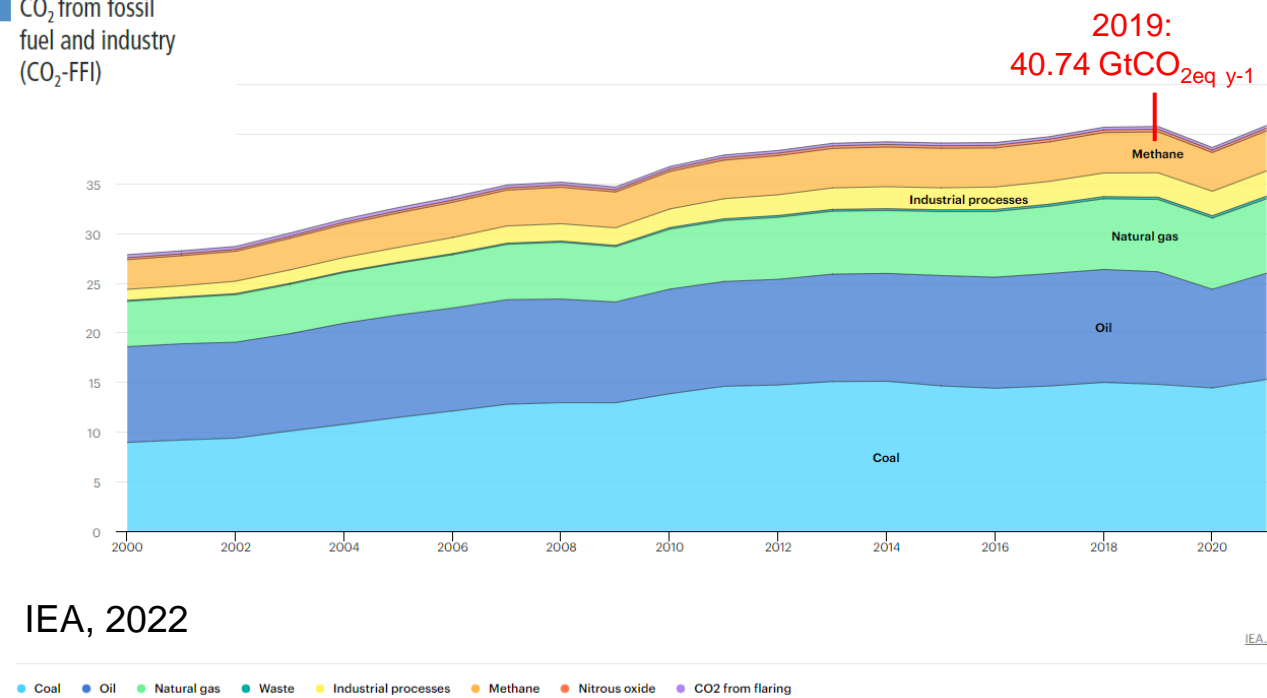
Global net anthropogenic GHG emissions 1990-2019



IPCC, 2022

Energy accounts for more than 2/3 of total GHG emissions globally (IEA, 2021)

Energy related GHG emissions, 2000-2021



IEA, 2022

GHG emissions from the transport sector

☀️ **The transport sector** is responsible for about **23% of global anthropogenic GHG emissions**, and causes air pollution, noise pollution and habitat fragmentation.

☀️ Transport's share of total national GHG emissions range from up to **30% in high income economies** to **less than 3% in Least Developed Countries (LDCs)**.

Transport demand in Europe, between 2000 and 2019, increased by...

+20%

in passenger travel

+86%

in air travel

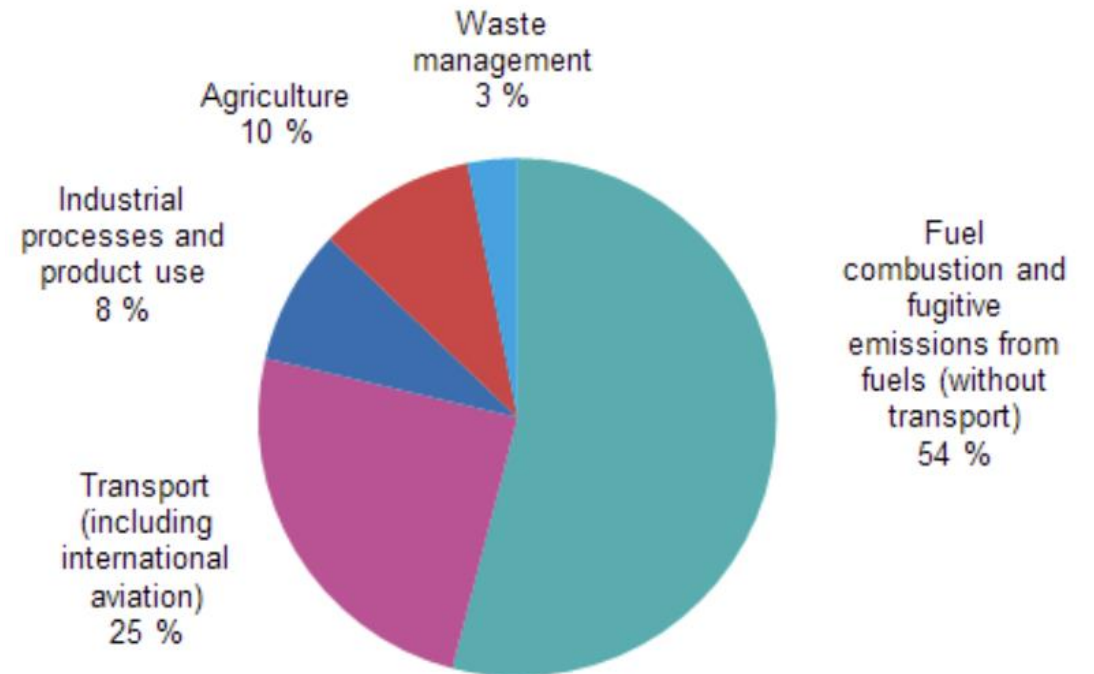
+18%

in car transport

+22%

in freight transport

GHG emissions from the transport sector in Europe



EC,2021. Available at: https://climate.ec.europa.eu/eu-action/transport-emissions_en

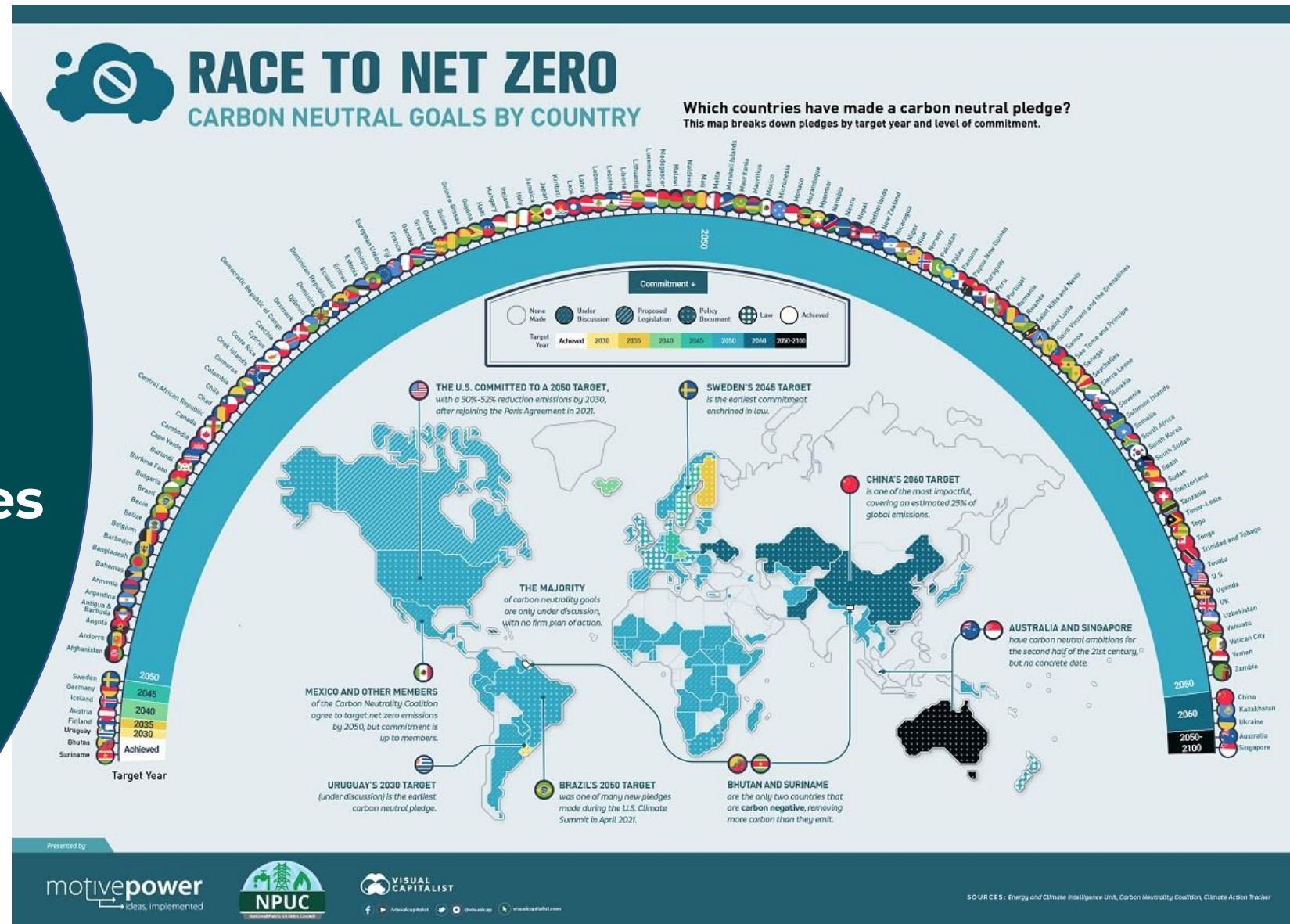
GHG emissions from agrifood systems

Agrifood systems need energy at each step to produce and bring our food from farm to fork

- ☀️ 30% of the world energy is used within agrifood systems;
 - ☀️ 33 % of the emissions from the agrifood systems are the result of energy use;
 - ☀️ 70% of these emissions occurs after farm gate (transport, process, package, ship, store and retail);
 - ☀️ About 1/3 of food is lost or wasted along the agrifood chain:
 - ☀️ **14 percent of food is lost** from harvest up to, but not including retail.
 - ☀️ **17 percent is wasted** at the retail and consumer levels.
- much of this energy is subsequently wasted

Global climate pledges

The Paris agreement and the Net Zero Pledges



More than **140 countries** have committed to C neutrality

Sustainable development requires an integrated approach: **The UN 2030 Agenda**

- ☀️ Adopted by all UN Member States in September 2015;
- ☀️ An ambitious plan **to eradicate poverty in all its forms**; and
- ☀️ To **promote economic prosperity, social development and environmental protection on a global scale**;
- ☀️ **17 Sustainable Development Goals (SDGs)** structured around 5 pillars of the 2030 Agenda: People, Planet, Prosperity, Peace, and Partnerships

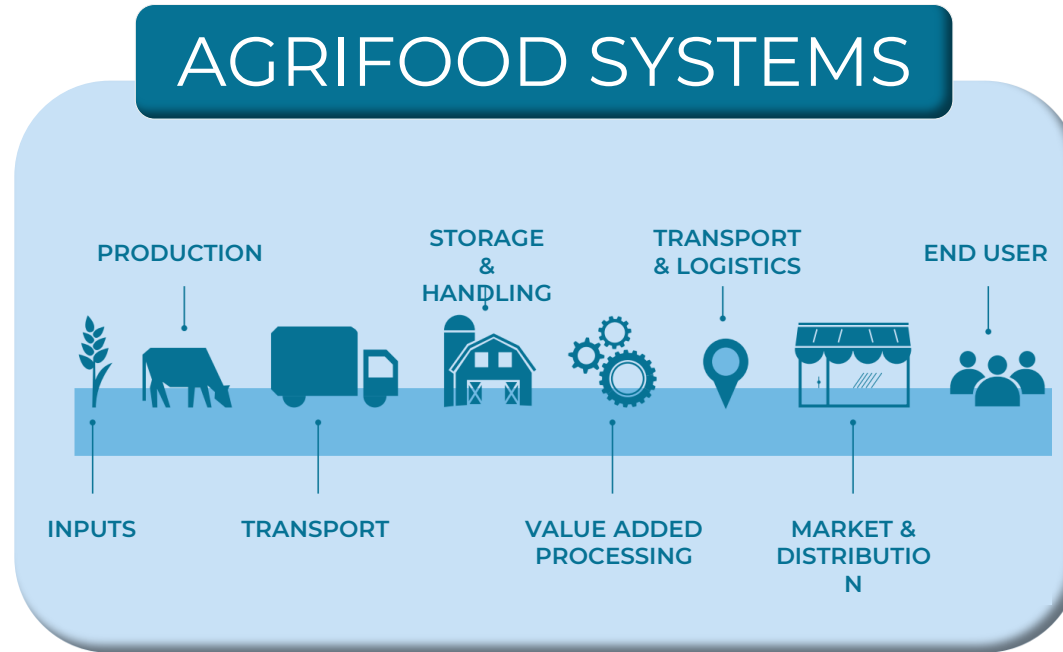


FAO's Strategic Framework 2022 - 2031

Objective: Support the 2030 Agenda

Transformation
to MORE

- Efficient
- Inclusive
- Resilient
- Sustainable



Better
production



Better
nutrition



Better
environment

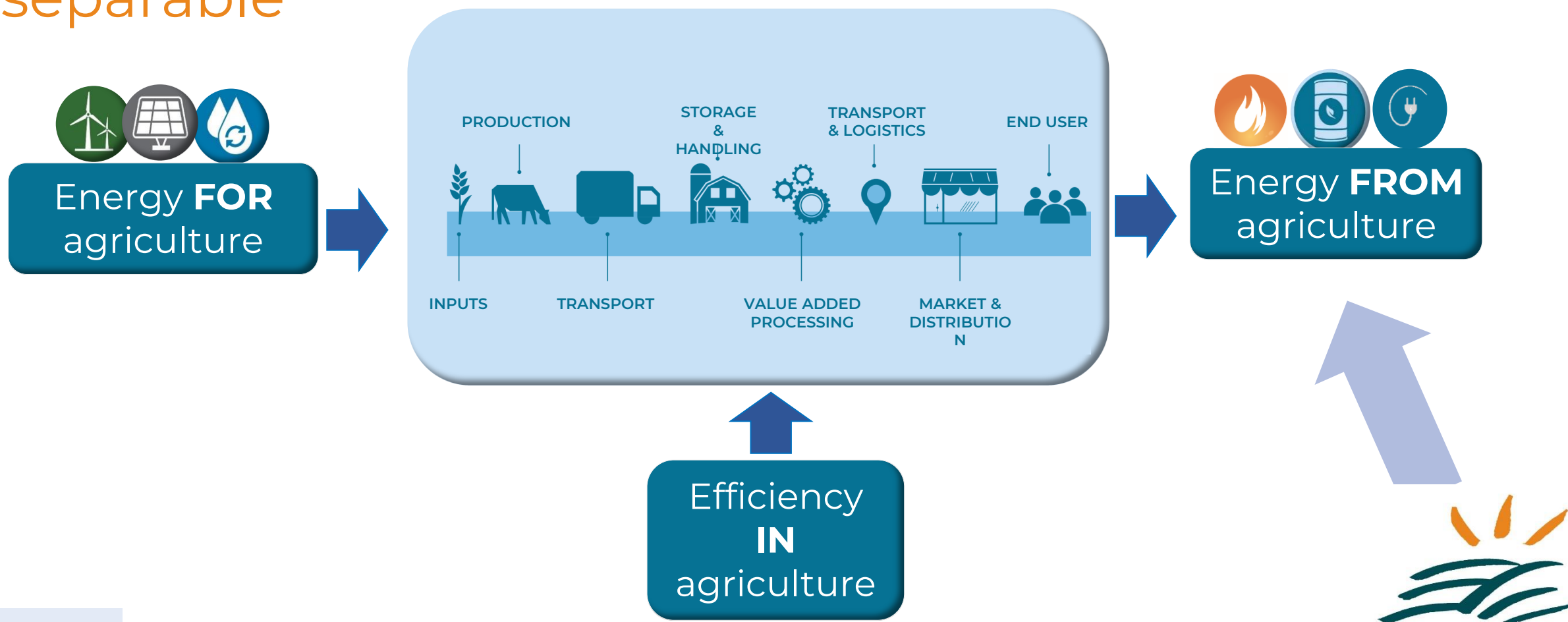


Better life

...leaving no one behind


FAO's Energy-Smart Agrifood System (ESAS) Programme


Food security, energy security and climate change are inseparable



What is bioenergy?

 **Bioenergy** is energy obtained from biomass.

 **Biomass** is material, from plant and animal origin, that constitutes the feedstock to produce bioenergy.

 **Bioenergy is a renewable energy** → derived from organic material that can be renewed relatively quickly (in the lifetime of a person) → higher potential to reduce GHG emissions compared with non-renewable fossil fuels.

Traditional bioenergy Vs Modern bioenergy

- commonly characterized by a very **low efficiency (around 10% - 20%)** and **unsustainable provision**.
- It includes the use of fuelwood, charcoal, animal dung and agricultural residues burned for heat and cooking purposes at household level.



- It has **various forms** (solid, liquid, gas)
- It is characterised by its **efficiency**.
- It includes improved cooking solutions, liquid biofuels, industrial co-generation and bio-refineries, biogas and biomethane production, anaerobic digestion, pellet and briquettes heating systems, etc.



Types of 'modern' bioenergy

Solid biofuels:

- e.g. **improved feedstock** such as wood chips, pellets, briquettes, charcoal (when efficiently produced) used to feed improved cooking systems as well as industrial combustion, gasification, combined Heat and Power (CHP) plants



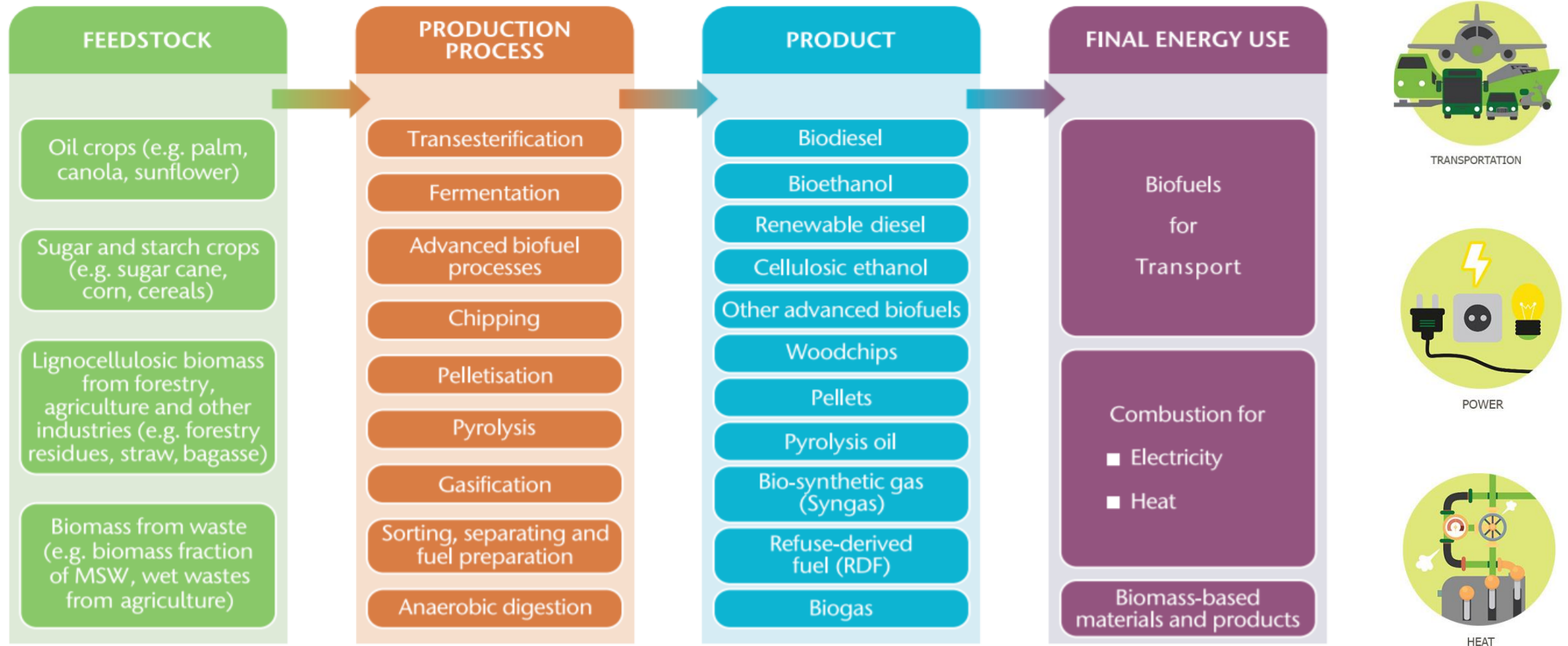
Liquid biofuels

- e.g. transport fuels (bioethanol, biodiesel), power production, domestic uses, used as such (e.g. hydrous ethanol) or blended with fossil fuels.

Gaseous biofuels:

- biogas and biomethane from anaerobic digestion; syngas from gasification

Modern bioenergy pathways



Sustainability is Key

- ☀️ Focusing on **SUSTAINABILITY** IS KEY to take out the best of opportunities;
- ☀️ Knowing **country context** is key to recognize and valorize locally available natural resources, habits and traditions;
- ☀️ Assessment shall take into account both **public and private objectives**, as well as **competitive uses of biomass resources**



The Global Bioenergy Partnership GBEP



The Global Bioenergy Partnership (GBEP)

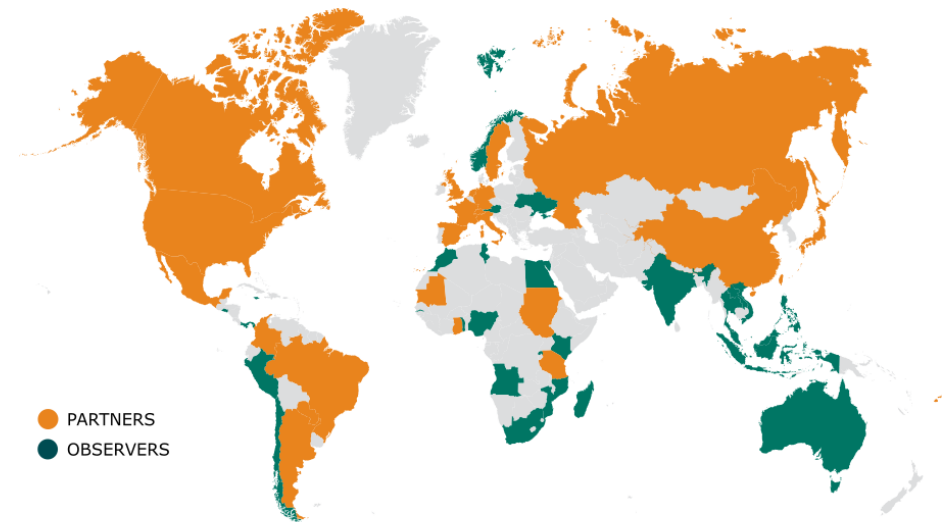
☼ International initiative

☼ Established to implement the commitments taken by the G8 in 2005

☼ to support "biomass and biofuels deployment, particularly in developing countries where biomass use is prevalent".

☼ **Argentina and Italy** are the co-Chairs. FAO is a founding partner and hosts its Secretariat at FAO HQ in Rome.

☼ **39 Partners** (including 23 countries and 16 international organizations and institutions) **and 48 Observers** (Governments and International Organizations)



Focus on SUSTAINABILITY

GBEP has developed the most widely recognized and agreed set of **indicators** for the **assessment and monitoring of bioenergy sustainability**



Characteristics:

- ☀ Science based
- ☀ Address all forms of bioenergy
- ☀ Voluntary – not legally binding

Objectives:

- ☀ To facilitate the harmonization of sustainability assessments
- ☀ To inform/support policy formulation

GBEP sustainability indicators (GSI) for all types of bioenergy



ENVIRONMENTAL

1. Life-cycle GHG emissions
2. Soil quality
3. Harvest levels of wood resources
4. Emissions of non-GHG air pollutants, including air toxics
5. Water use and efficiency
6. Water quality
7. Biological diversity in the landscape
8. Land use and land-use change related to bioenergy feedstock production



SOCIAL

9. Allocation and tenure of land for new bioenergy production
10. Price and supply of a national food basket
11. Change in income
12. Jobs in the bioenergy sector
13. Change in unpaid time spent by women and children collecting biomass
14. Bioenergy used to expand access to modern energy services
15. Change in mortality and burden of disease attributable to indoor smoke
16. Incidence of occupational injury, illness and fatalities










ECONOMIC

17. Productivity
18. Net energy balance
19. Gross value added
20. Change in consumption of fossil fuels and traditional use of biomass
21. Training and re-qualification of the workforce
22. Energy diversity
23. Infrastructure and logistics for distribution of bioenergy
24. Capacity and flexibility of use of bioenergy

Links between GSI and SDGs

☀️ All GSIs from the environmental and social pillars and the majority from the economic pillar are linked to SDGs and their targets and indicators

☀️ GSI implementation can support data collection for SDG monitoring

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 II	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	II III	6. Water quality
	6.4	6.4.1 6.4.2	II I	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. Bioenergy used to expand access to modern energy services 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 I	11. Change in income
	8.8	8.8.1 8.8.2	I III	16. Incidence of occupational injury, illness and fatalities

Source: Fritsche et al. 2018

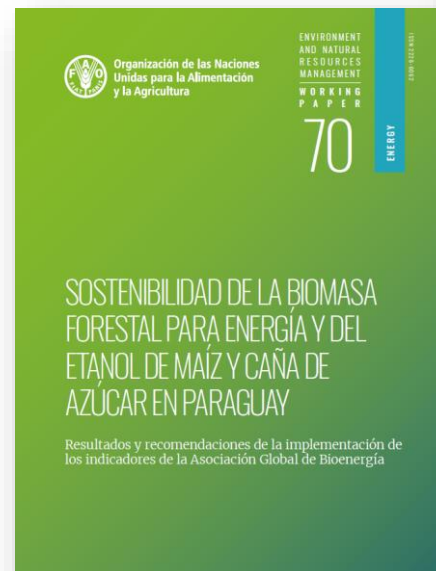
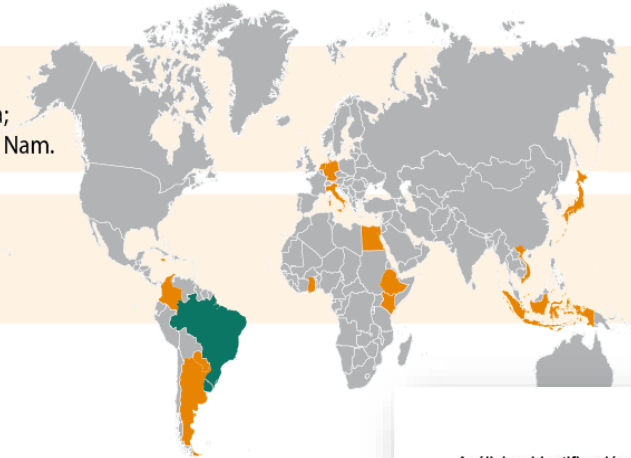
Implementation of the GSI

15 countries have implemented the GSIs

2 countries are in the process of implementation

● **IMPLEMENTED:** Argentina; Colombia; Egypt; Ethiopia; Germany; Ghana; Indonesia; Italy; Jamaica; Japan; Kenya; Netherlands; Paraguay; Viet Nam.

● **IMPLEMENTATION PHASE:** Brazil; Uruguay.



Análisis e identificación de indicadores de sostenibilidad relevantes definidos por GBEP para las cadenas de producción de energía en base a residuos de biomasa forestal, biodiesel y bioetanol en Uruguay

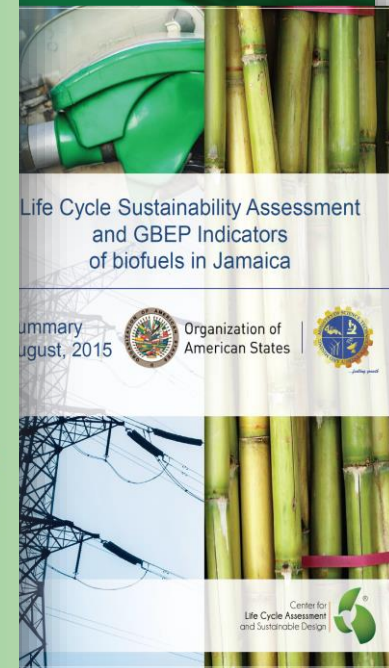
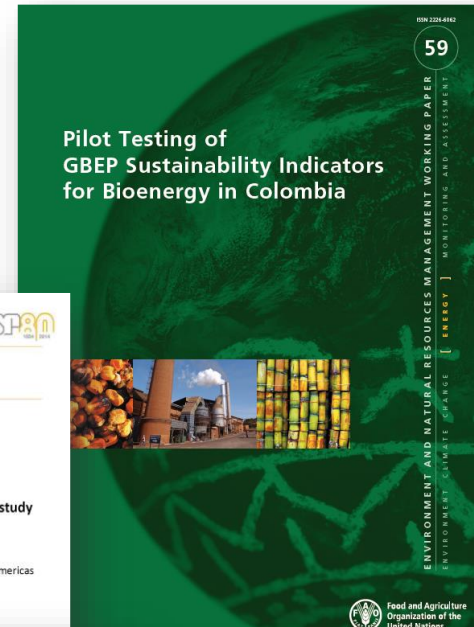
SEGUNDO INFORME:
Propuesta metodológica y fuentes de información

Proyecto FAO – MIEM

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Enero 2015





Outcomes from GSI implementation on
wood energy value chain in PARAGUAY

Implementation of GSIs in PARAGUAY: Woody biomass for energy

	Sectors	From... (t/y)	...to (t/y)
Demand	Household	4 100 000	6 100 000
	Industrial	4 415 000	6 047 000
	Total	8 515 000	12 147 000
Sustainable forest biomass supply for bioenergy production	Total	927 560	1 162 365
Net balance	Total	-7 587 440	-10 984 635

Author's elaboration based on MOPC, VMME y GIZ, 2013

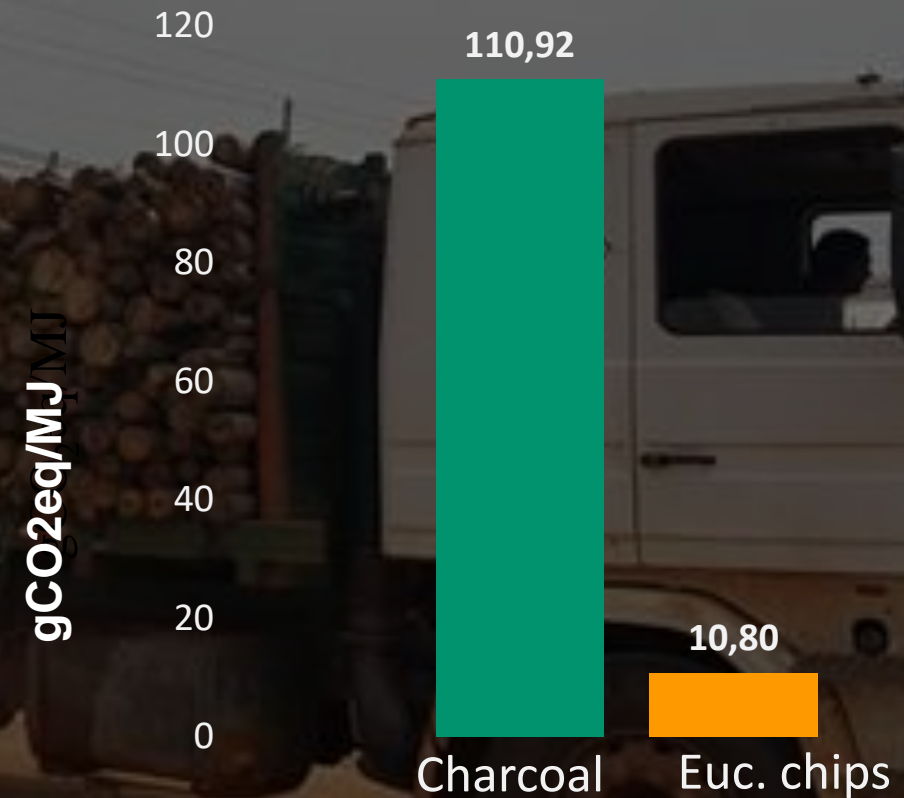
The supply of wood from sustainable production is **not sufficient** to cover its current demand at household and industrial levels

This negative balance is one of the major drivers of deforestation in Paraguay after forest conversion to agricultural land and pastures

Eucalyptus chips from sustainably managed short rotation coppice vs charcoal from native forests

Eucalyptus chips for bioenergy	gCO ₂ eq/MJ
Use	0.40
Processing	0.10
Transport	2.00
Cultivation	5.20
LUC	3.10
Total	10.80

Author's elaboration as part of LCA for Ind. 1



Results of LCA assessment along the wood energy pathways (GHG emissions)

Recommendations

- ☀️ Incentivize the **sustainable management of productive native forests**, for example, through the adoption of policies and appropriate incentives for SFM practices.
- ☀️ Maximise **control over, and sanction of, deforestation and illegal trade** of forest products and by-products.
- ☀️ Guarantee the **traceability** of biomass products and by-products (e.g. charcoal);
- ☀️ Encourage SRC plantations
- ☀️ Promote, within the **National Energy Efficiency Plan**, the introduction of improved biomass cookstoves for households, and at the industrial level the use of chips instead of fuelwood and charcoal.



Modern wood energy as a
contribution to
Forest Landscape Restoration in
SUB-SAHARAN AFRICA

Wood energy has been recognized as the most important (and critical) bioenergy pathway in Togo and Ghana.

Traditional bioenergy value chains have devastating effects on forest landscapes

☀️ Inefficient production and use

☀️ Demand is higher than sustainable supply

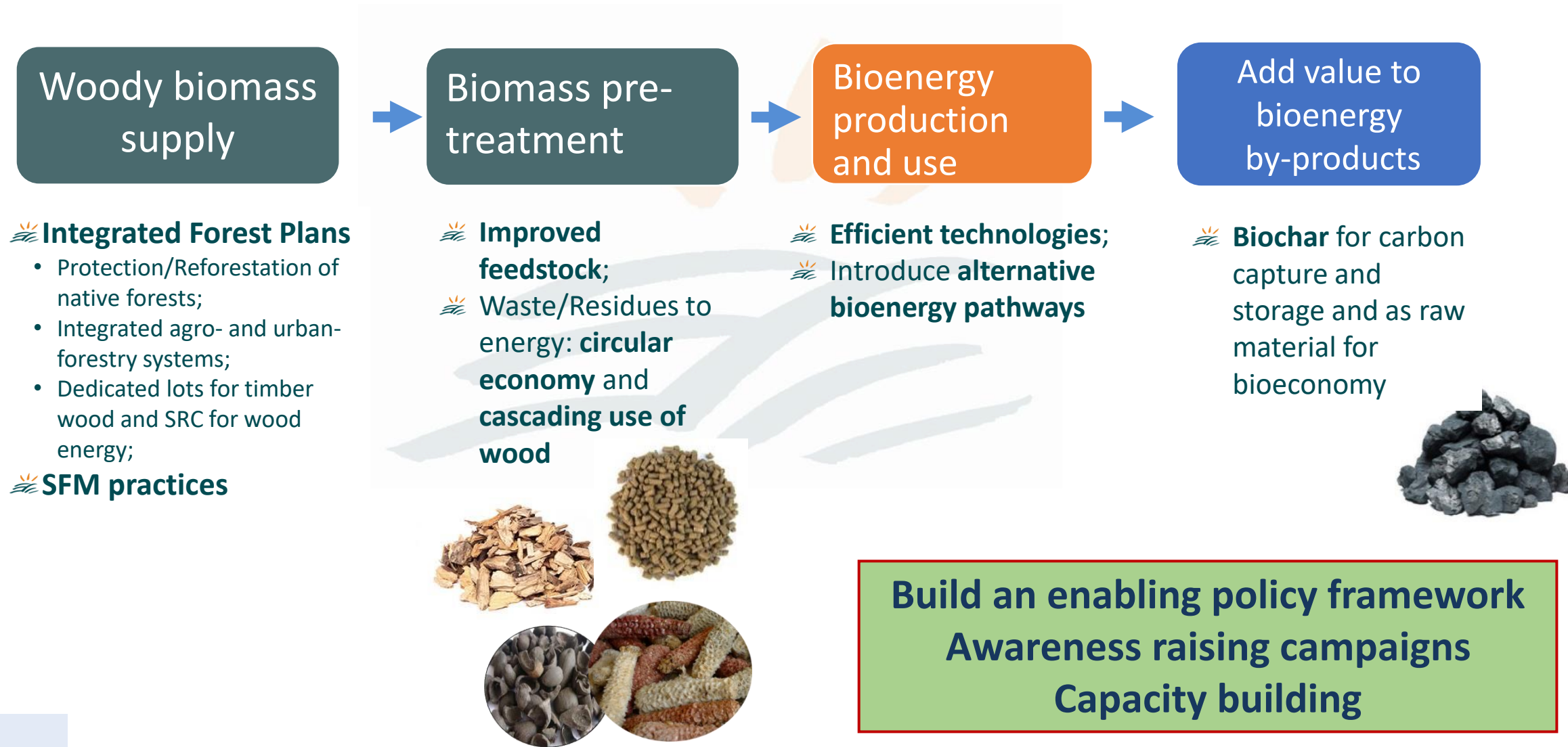
Modern wood energy is key to reduce the pressures on forests and contribute to FLR



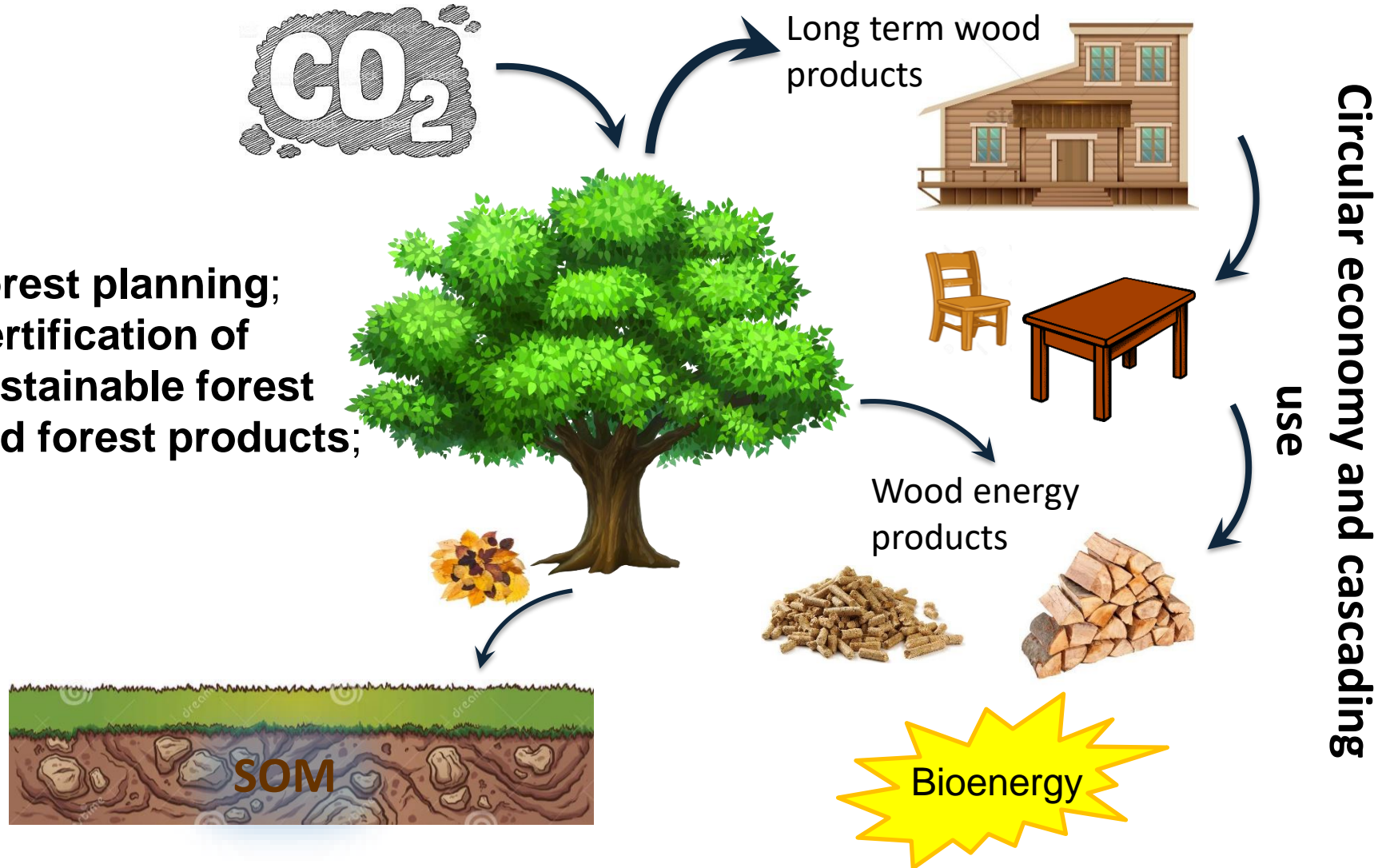
Stakeholder consultations' reports available on [FAO](#) and [GBEP](#) websites



Sustainable wood energy can have positive interlinkages with Forest Landscape Restoration

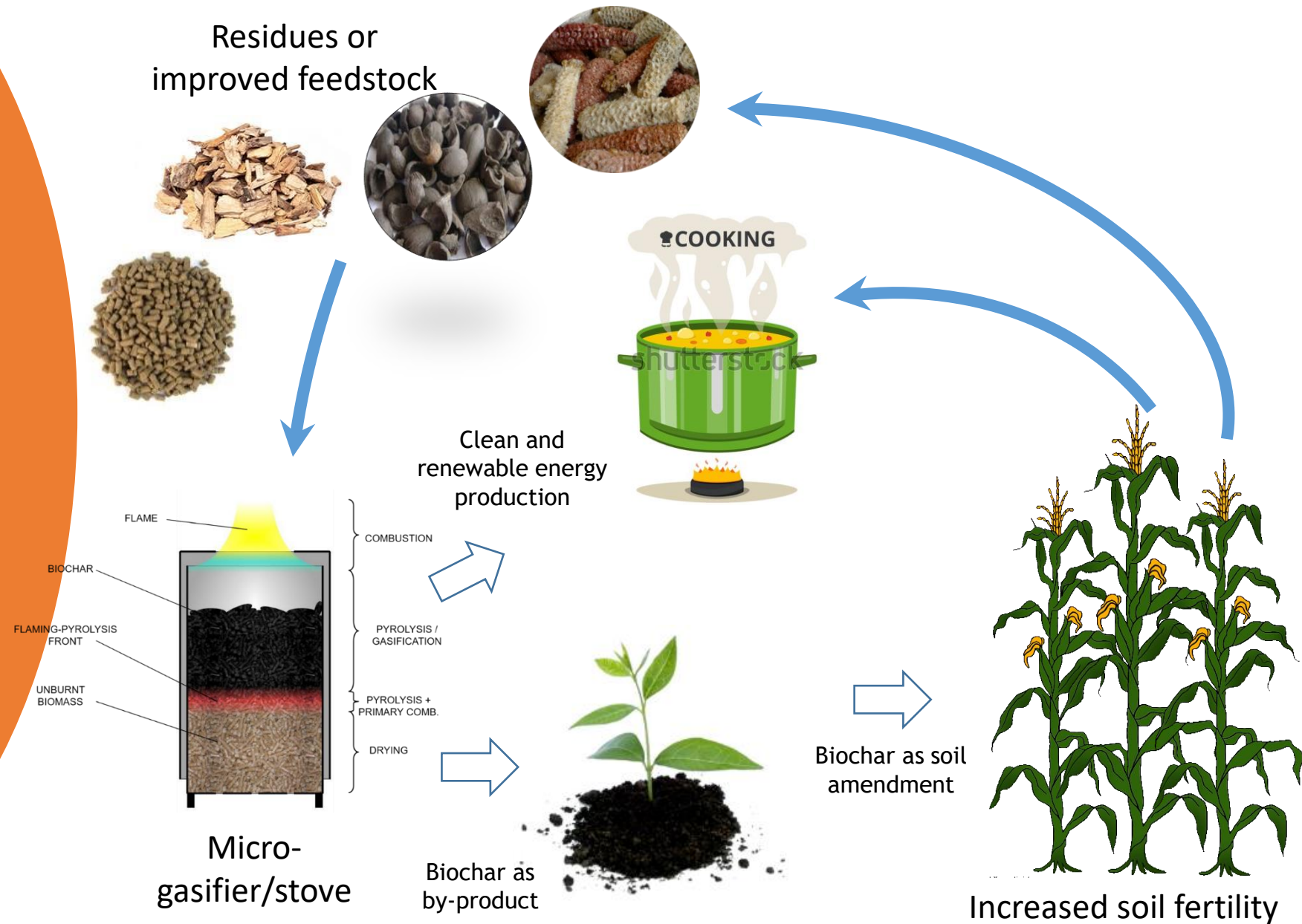


- Forest planning;
- Certification of sustainable forest and forest products;



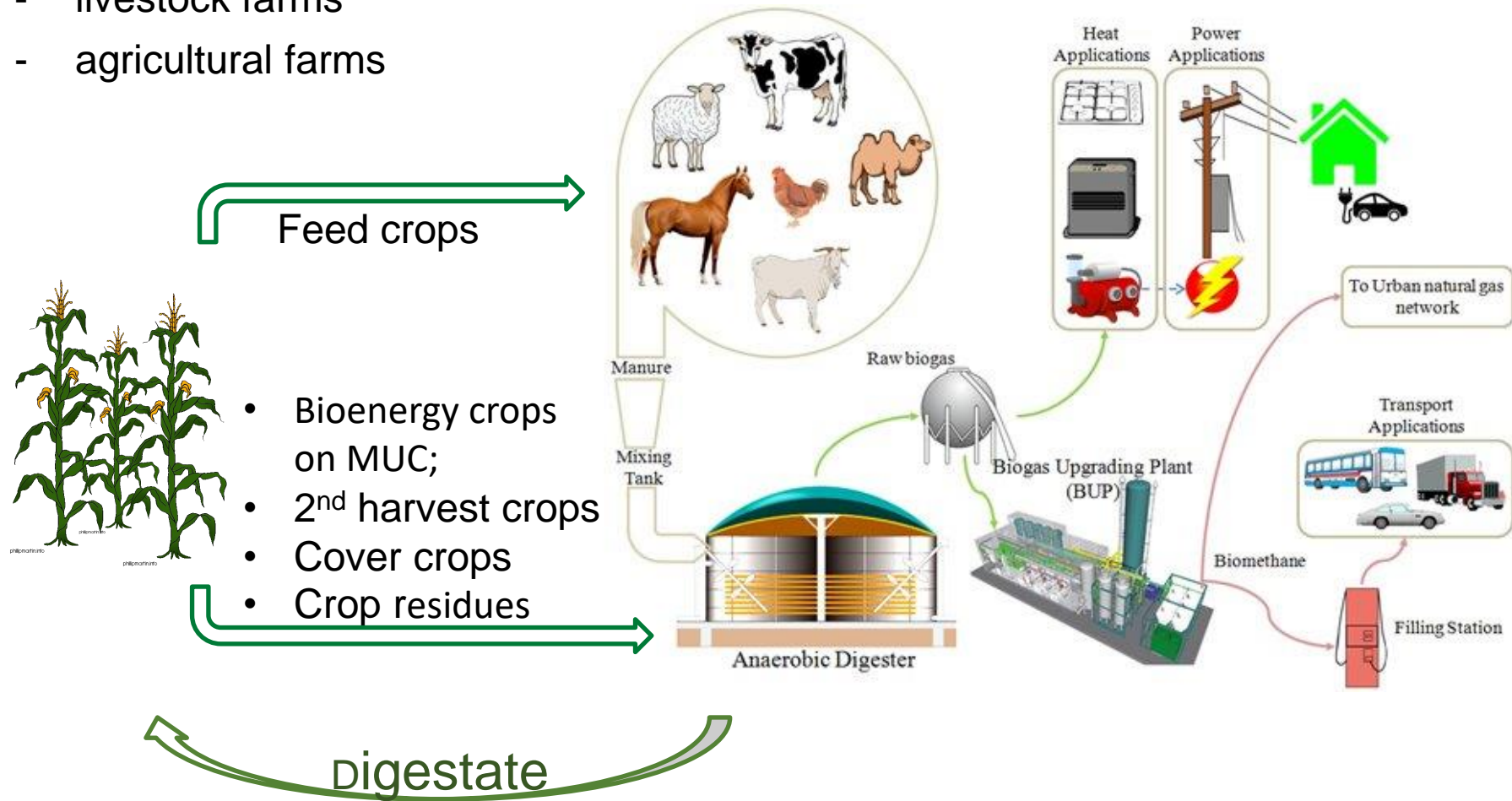
Microgasification for Integrated Food and Energy Systems

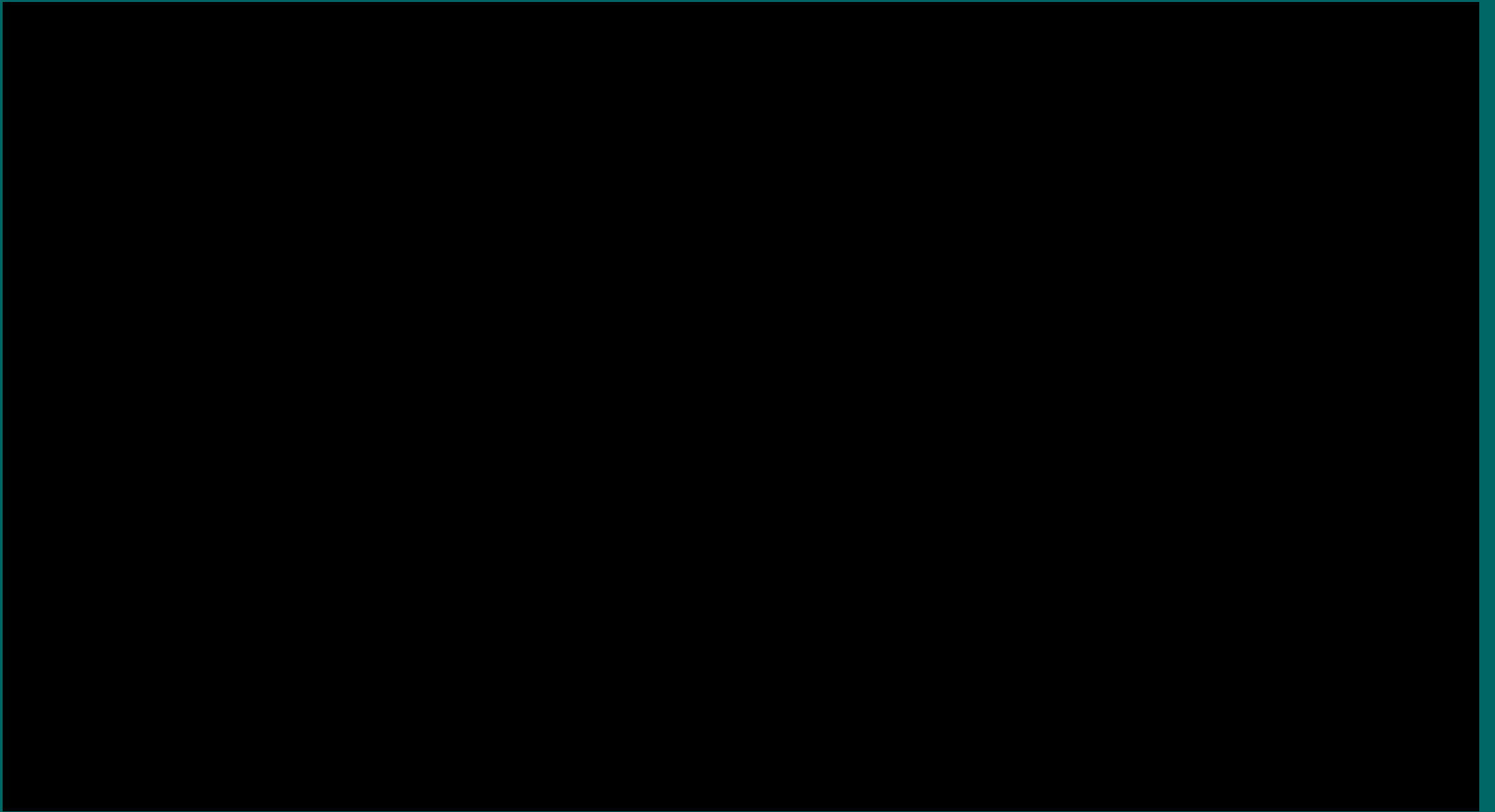
- ⇒ Clean cooking energy
- ⇒ Fuel **affordability**
- ⇒ Local **availability**:
reduce time spent
collecting fuelwood
- ⇒ Reduced dependence
on fuel import
- ⇒ Add value to **waste and
residues**
- ⇒ New **job** opportunities
- ⇒ Recycle of nutrients
- ⇒ **Biochar** as soil
amendment



Biogas systems to improve the sustainability of

- livestock farms
- agricultural farms







11th GBEP Bioenergy Week

17-21 June 2024, FAO HQ (Rome, Italy)

11th GBEP Bioenergy Week

BIOENERGY FOR GLOBAL SUSTAINABLE DEVELOPMENT



17 June 2024	18 June 2024	19 June 2024	20 June 2024	21 June 2024
GBEP-YUNGA Bioenergy Week Youth Day	Bioenergy at the science-to-policy interface	Bioenergy in the context of the broader bioeconomy	Bioenergy for climate change mitigation and energy access	Field Visit
<div>Welcome session</div> <div>Bioenergy Discovery Circuit</div> <div>Bioenergy Lectures</div>	<div>Opening</div> <div>Bioenergy policy and strategy</div>	<div>Bioenergy in multifunctional integrated agrifood systems</div> <div>Bioenergy for value addition on marginal lands</div>	<div>Bioenergy for decarbonization of transport and industry</div> <div>Bioenergy in urban and rural energy systems</div>	Field Visit
Lunch	Lunch	Lunch	Lunch	
<div>Bioenergy Lectures (cont'd)</div> <div>Presentation of the 2024 GBEP Youth Award</div>	<div>Bioenergy policy and strategy – Roundtable: Governance of Sustainable Bioenergy Policies</div> <div>Data, tools and models to inform policies for sustainable bioenergy</div>	<div>Bioenergy for residues management and waste disposal</div> <div>Bioenergy by-products for a circular bioeconomy</div>	<div>Enhancing access to modern clean energy: Bioenergy for Clean cooking</div> <div>Key messages and conclusions</div>	Field Visit (cont'd)

GBEP-YUNGA Bioenergy Youth Day

17 June 2024



Food and Agriculture
Organization of the
United Nations

SUSTAINABLE
DEVELOPMENT
GOALS



YUNGA
LEARNING AND
ACTION SERIES

working for Zero Hunger



Energy Challenge Badge

Bioenergy supplement



FAO :: GLOBAL BIOENERGY PARTNERSHIP



Bioenergy Discovery circuit

-  **Energy Future Supplement**
Aston University - UK
-  **Recycling of agrifood residues for biogas, biomethane and soil amendment.**
Council for Agricultural Research and Economics - Italy
-  **Ethanol for clean cooking**
PIVOT - USA - and KOKO Network - Kenya
-  **Innovative processes to enhance the environmental and economic sustainability of advanced liquid biofuels.**
University of Perugia - Italy
-  **Microgasification of solid biomass for clean cooking.**
World Bioenergy Association

*“Change will not come if we wait
for some other person or some
other time. We are the ones we've
been waiting for. We are the
change that we seek”.*

Thank you for your attention

FOR MORE INFORMATION



<https://www.fao.org/in-action/global-bioenergy-partnership/en>



GBEP-Secretariat@fao.org

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