



BEFS

Bioenergy and Food
Security Projects

The Bioenergy and Food Security Approach of FAO

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RENEWABLE ENERGY TRAINING PROGRAM , MODULE 8 | BIOENERGY
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Outline

- Definition
- Phases of bioenergy pathways
- Current global use
- Potential within national energy portfolios





Bioenergy, What do we mean?



What is bioenergy?

According to FAO's unified terminology:

- **Bioenergy** is all energy derived from *biofuels*, which *are fuels derived directly or indirectly from Biomass....*
*.....and biomass are materials of **recent** biological origin including plant materials and animal waste*.*

Therefore biofuels can come in:

Form	Commonly known samples:
Liquid	Bioethanol, biodiesel, straight vegetable oil
Gaseous	Biogas or syngas
Solid	Firewood, charcoal, briquettes , pellets

Bioenergy : “Traditional” and “Modern”



“Traditional” bioenergy

- Biomass that can be directly converted for final energy through combustion, e.g. fuelwood, residues, animal dung and forest products.
- biofuels that are produced from biomass using simple techniques and technologies, e.g. charcoal and biogas.

These are combusted in stoves, furnaces or open fires to provide **heat energy** for cooking, comfort and for small-scale agricultural and industrial processing, typically in developing countries.

“Modern” bioenergy TBD

- Biofuels that are produced through employment of advanced conversion technologies, e.g. pellets, briquettes, liquid biofuels.

These are used for **heat and electricity** production as well as liquid biofuels for **transport** and are used primarily in developed countries.

Some General Features of comparison between Traditional and Modern Bioenergy

Characteristic	Traditional	Modern
Energy Density		<i>Higher</i>
Energy efficiency ¹	2-20 %	65 - 80 %
Environmental at:		
Feedstock	Low-high ³	Low- high
Biofuel production		Low - medium
Bioenergy ² consumption	Low-high	Low

¹Efficiency is from conversion to consumption; ²Feedstock includes production or collection; ³Environmental impacts are high for traditional once indoor pollutions and health impacts

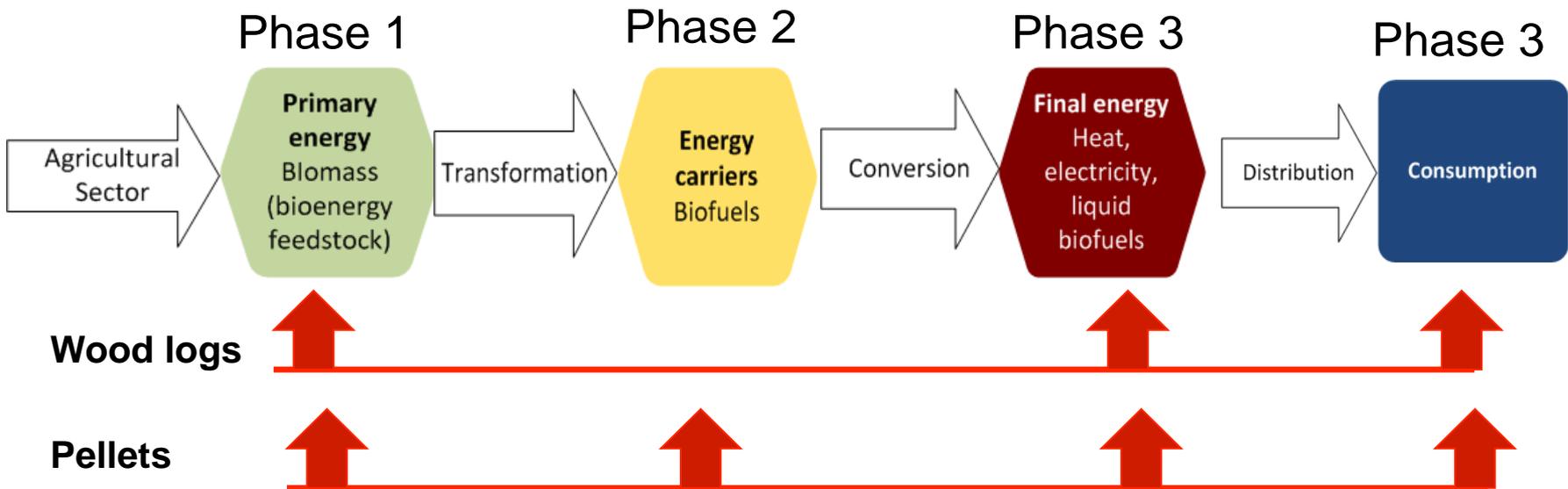




From biomass To bioenergy

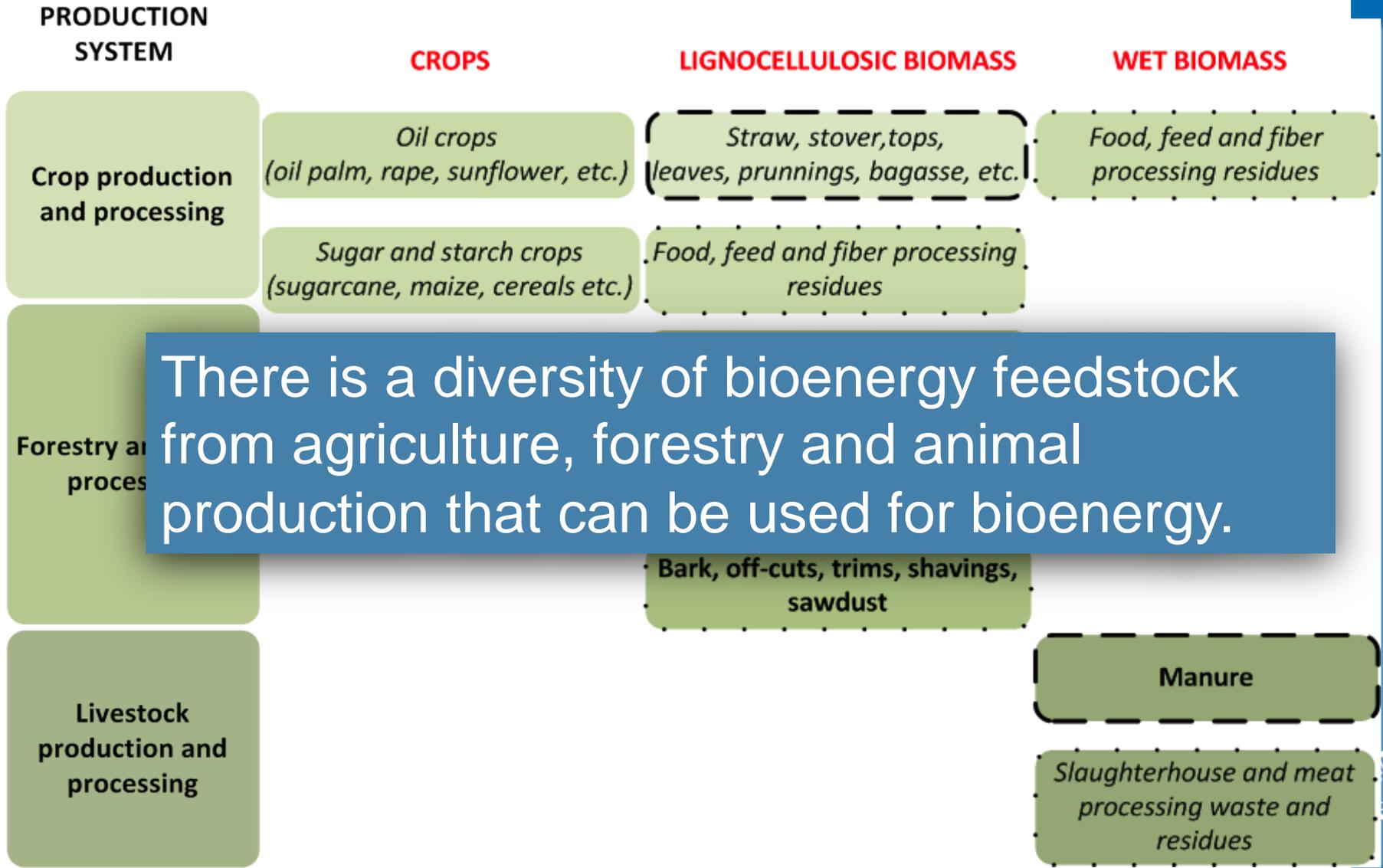
Bioenergy: From Production to Consumption

Converting biomass to energy for consumption requires from two to four phases. These are:



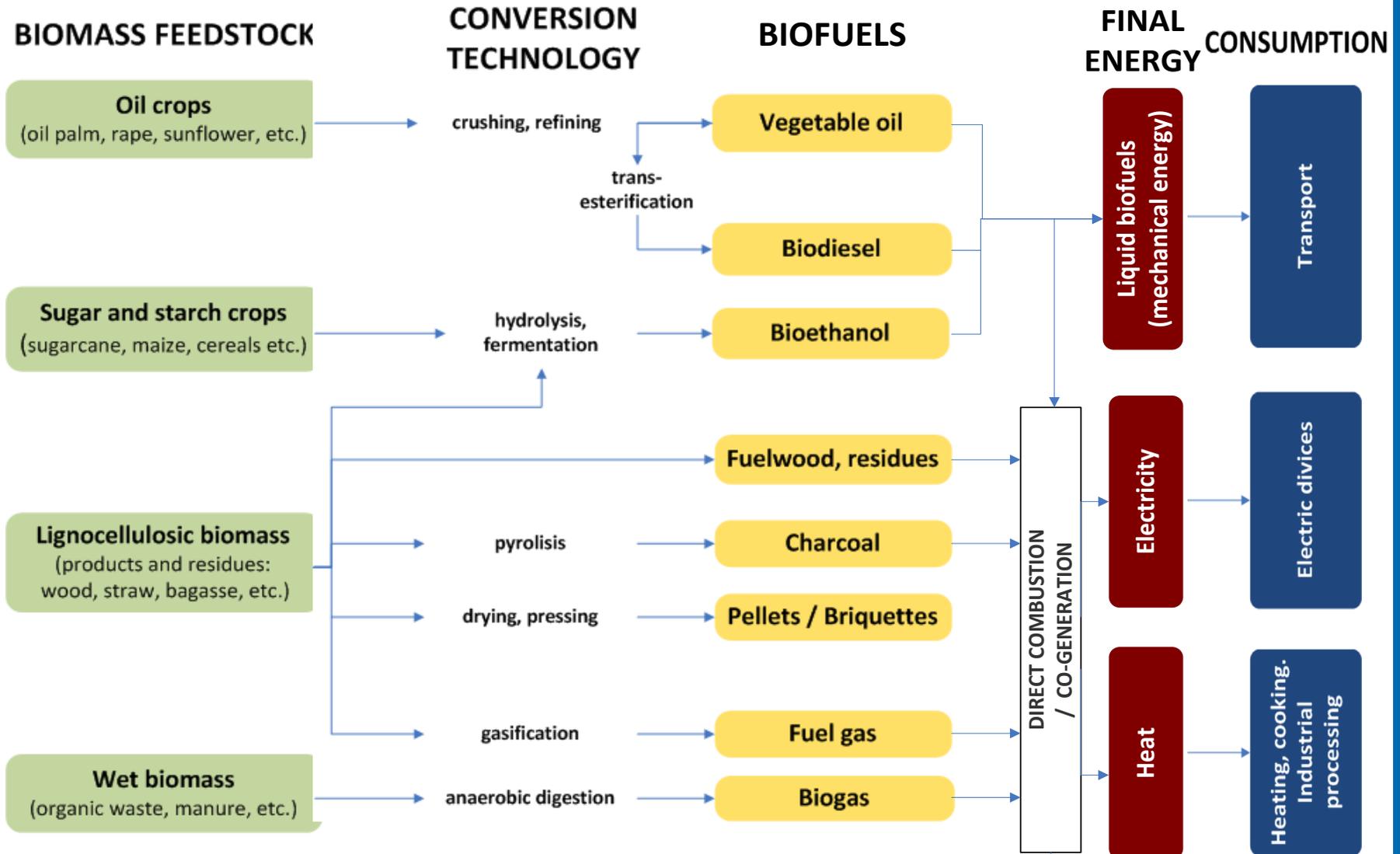
- The number of phases depends on the type of biofuel
- Energy pathways of other renewable energies *do not* include the two initial phases.

Phase 1: the bioenergy feedstock



There is a diversity of bioenergy feedstock from agriculture, forestry and animal production that can be used for bioenergy.

Phase 2 to phase 4: from bioenergy feedstock to final energy use



Final energy to consumption across economic sectors



Biofuel	Energy end user			
	Residential sector		Industry & services	Transport
	Household level	Community level		
Vegetable oil (SVO)	Cooking, machinery, electricity generation	Electricity generation		X
Biodiesel	Machinery, electricity production			X
Bioethanol	Cooking (ethanol gel)			X
Fuelwood, residues	Cooking, heating	Co-gen. electricity/heat	Co-gen. electricity/heat	
Charcoal	Cooking, heating		Industrial processing	
Pellets	Heating	Co-gen. electricity/heat	Co-gen. electricity/heat	
Briquettes	Cooking, heating			
Fuel gas			Co-gen. electricity/heat	
Biogas	Cooking, lightning	Co-gen. electricity/heat	Co-gen. electricity/heat	



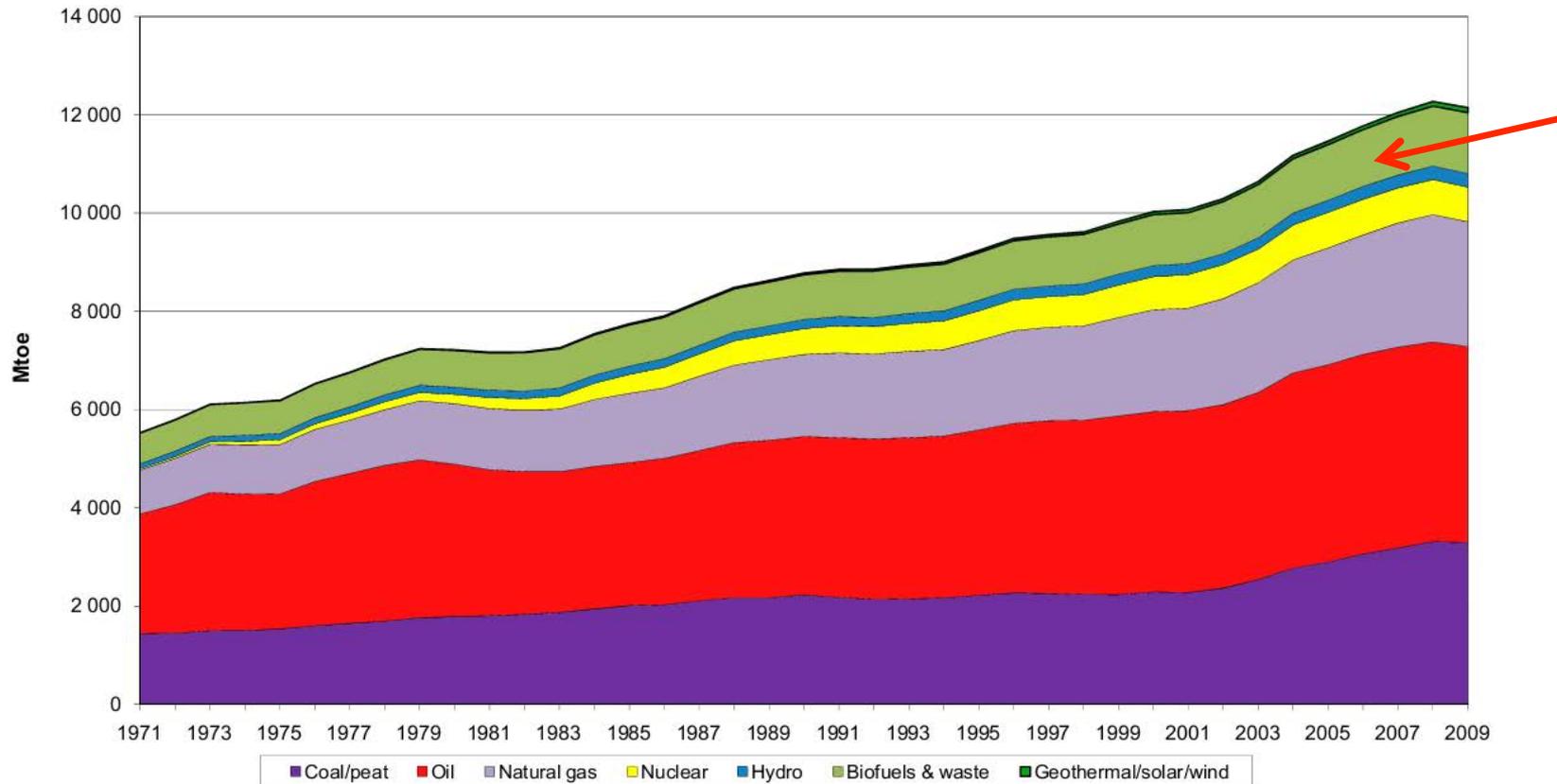


Bioenergy in today's Energy Mix





Total Global Primary Energy Supply



* Excluding electricity trade.

Biofuels and Waste represented about 10% of the world's energy in 2009

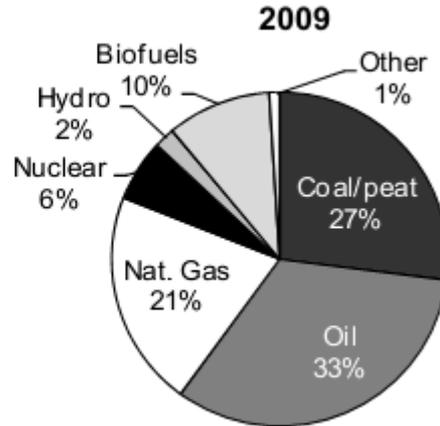
Biofuels and Waste: "Biofuels & waste is comprised of solid biofuels, liquid biofuels, biogases, industrial waste and municipal waste. Note that for biomass commodities, only the amounts specifically used for energy purposes (a small part of the total) are included in the energy statistics."



Current status of bioenergy use: *Total primary energy supply - World*



Total primary energy supply by fuel

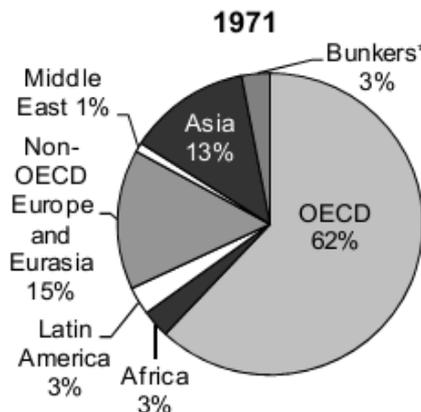


12 150 Mtoe

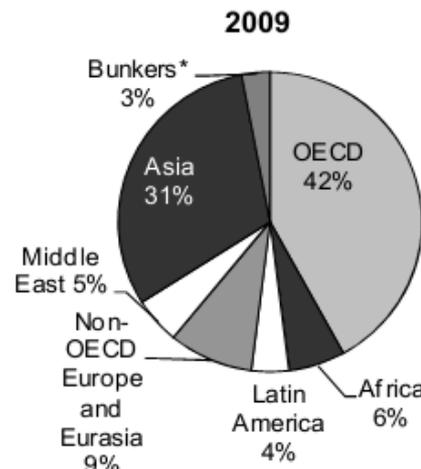
At the Global level

- Biofuels and waste have a relatively low share when compare to other sources.
- But over the past 38 years the production volume has doubled from about 600 to 1 200 Mtoe.

Total primary energy supply by region



5 532 Mtoe



12 150 Mtoe

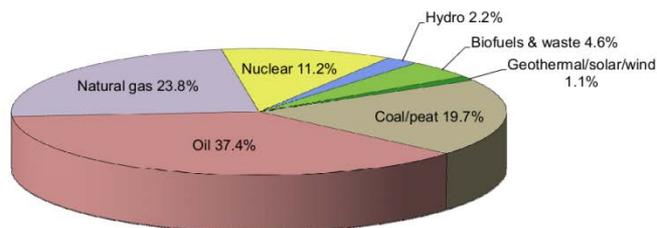
At the Regional level

- Global TPES has more than doubled between 1971 and 2009
- The share of TPES for Asia increased from 13% to 31 %
- China's share in TPES in 2009 was 19%
- TPES in Africa has increased from 3% to 6%

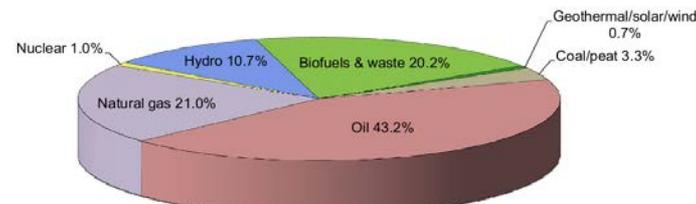
The importance of bioenergy in TPES across regions in 2009



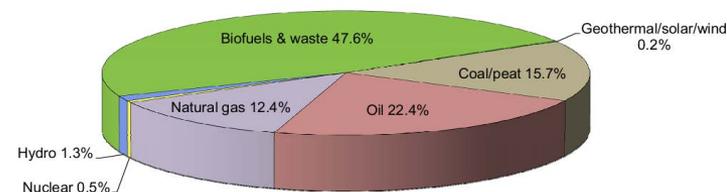
OECD34 excl Estonia/Slovenia before 1990



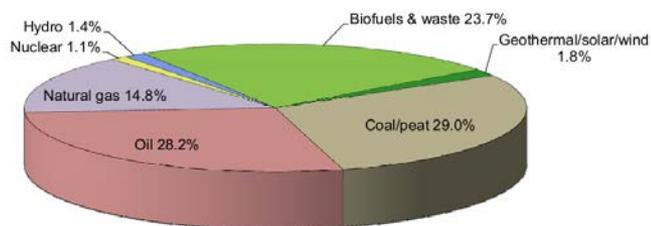
Latin America



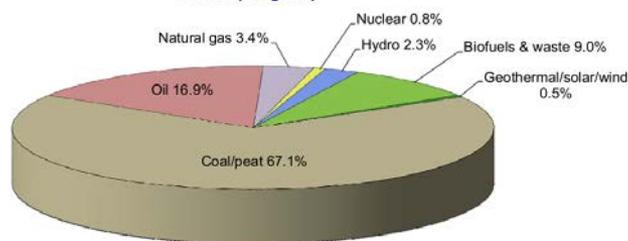
Africa



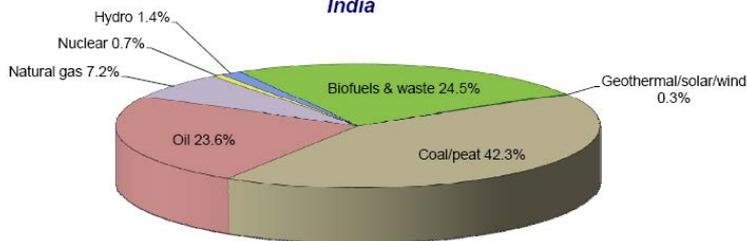
Asia excluding China



China (Region)



India



Share in TPES	OECD34	Latin America	Asia (ex.China)	China	Africa
Biofuels and waste	4.6%	20.2%	23.7%	9.0%	47.6%



Trends in bioenergy consumption

Bioenergy consumption has been increasing due to growing energy demand

Key drivers include:

- population growth
- economic growth
- climate change mitigation
- energy security
- ***Industrial countries***
 - deliberate policies to support renewable energy related mainly to national energy security and environmental concerns
- ***Emerging economies***
 - main driver economic growth
 - in some countries there is a decline in share of bioenergy in TPES due to diversification of energy supplies.
- ***Developing countries***
 - main driver population growth
 - limited access to affordable alternative energy sources leading to continued reliance on the use of traditional bioenergy





Bioenergy's potential role in a country's energy mix

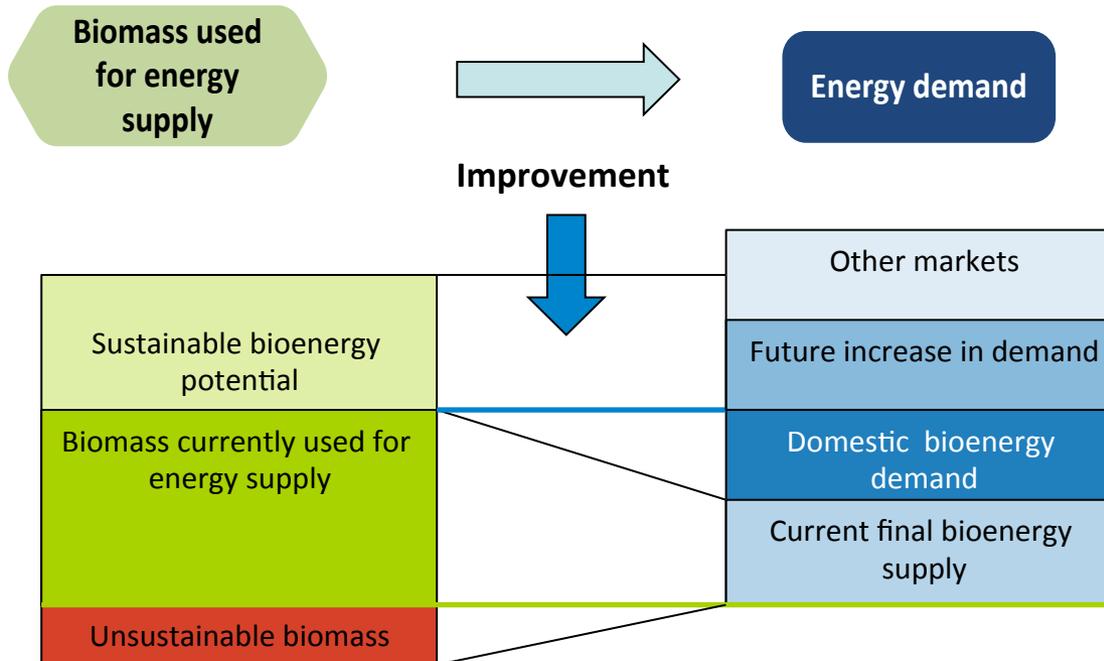
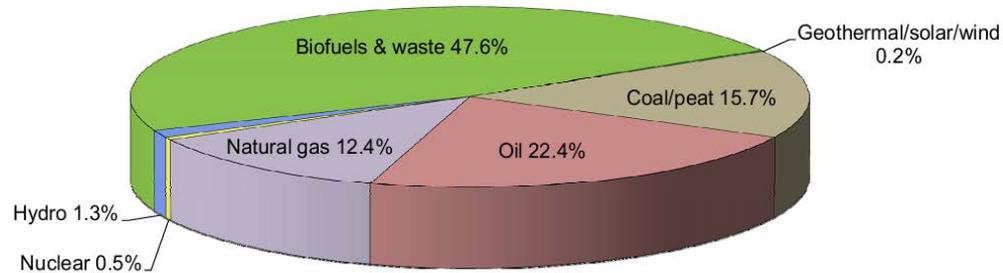
Improvement potential in the use of bioenergy resources

The highest potential for bioenergy is in ***developing countries and emerging economies*** where greater opportunities exist for:

- Moving from unsustainable to sustainable use of natural resources
- Utilizing currently underused or non-used natural resources
- Improving the efficiency of energy use by employing energy efficient conversion and consumption technologies
- Increasing energy availability and accessibility



Improvement potential in the use of bioenergy resources (contd.)

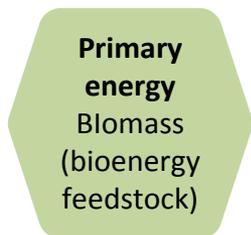


Sustainable Bioenergy: Opportunities for improvement



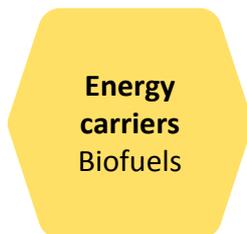
Interventions targeting:

Phase 1



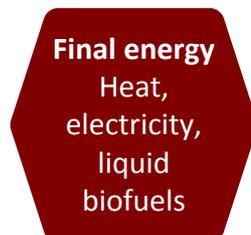
- Increase in agricultural yields
- Establishment of sustainable forest management
- etc...

Phase 2



- Improvement / establishment of conversion technologies
- Improvement / establishment of transmission and distribution systems and networks (infrastructure)
- etc...

Phase 3



- Improvement of energy efficiency
- Provision of "modern" bioenergy appliances
- etc...

Phase 4



For a transition from inefficient to a well functioning bioenergy sector, the improvements should take place at all stages of bioenergy pathway

Planning and prioritizing bioenergy intervention



□ Assessment of the current status

- *Existing energy supply – demand relations*
 - Current and future energy demands
 - Energy mix, imported vs domestic fuel production
 - Energy access and reliability
- *Status of the bioenergy supply*
 - Current role of bioenergy in supplying the demand of different sectors
 - Sustainable availability of biomass resources and its bioenergy potential
 - Bioenergy role in supplying sustainable energy today and in the future
 - Infrastructure
 - Opportunities to implement energy efficiency interventions along supply chain today and in the future

Planning and prioritizing bioenergy intervention (contd.)

□ Defining the right policies

- Identifying the objectives for developing sustainable bioenergy such as increase energy access, rural development, energy diversification.
- Establishing Inter-institutional dialogues both at technical and policy level.
- Understanding the risks, opportunities and trade offs associated with different bioenergy interventions.



What we have learned?

- Biofuels are not only liquid biofuels i.e. bioethanol and biodiesel but are much broader and can be used to produce heat, mechanical and electrical energy.
- There is a diverse range of biomass in the agricultural sector that can be used to produce bioenergy sustainably.
- Traditional bioenergy has a very important role in most developing countries.
- Modern bioenergy can supply a number of energy demands depending on the chosen pathway.
- Developing countries and emerging economies have a greater opportunities for *improvements in Bioenergy development*.
- Modern bioenergy can be associated with modernization and environmental sustainability, however, it requires capital, skills, technology, infrastructure, inputs and a certain level of development.

