FAO's work on climate change *Energy*

Food and Agriculture Organization of the United Nations

ENERGY, AGRICULTURE AND CLIMATE CHANGE

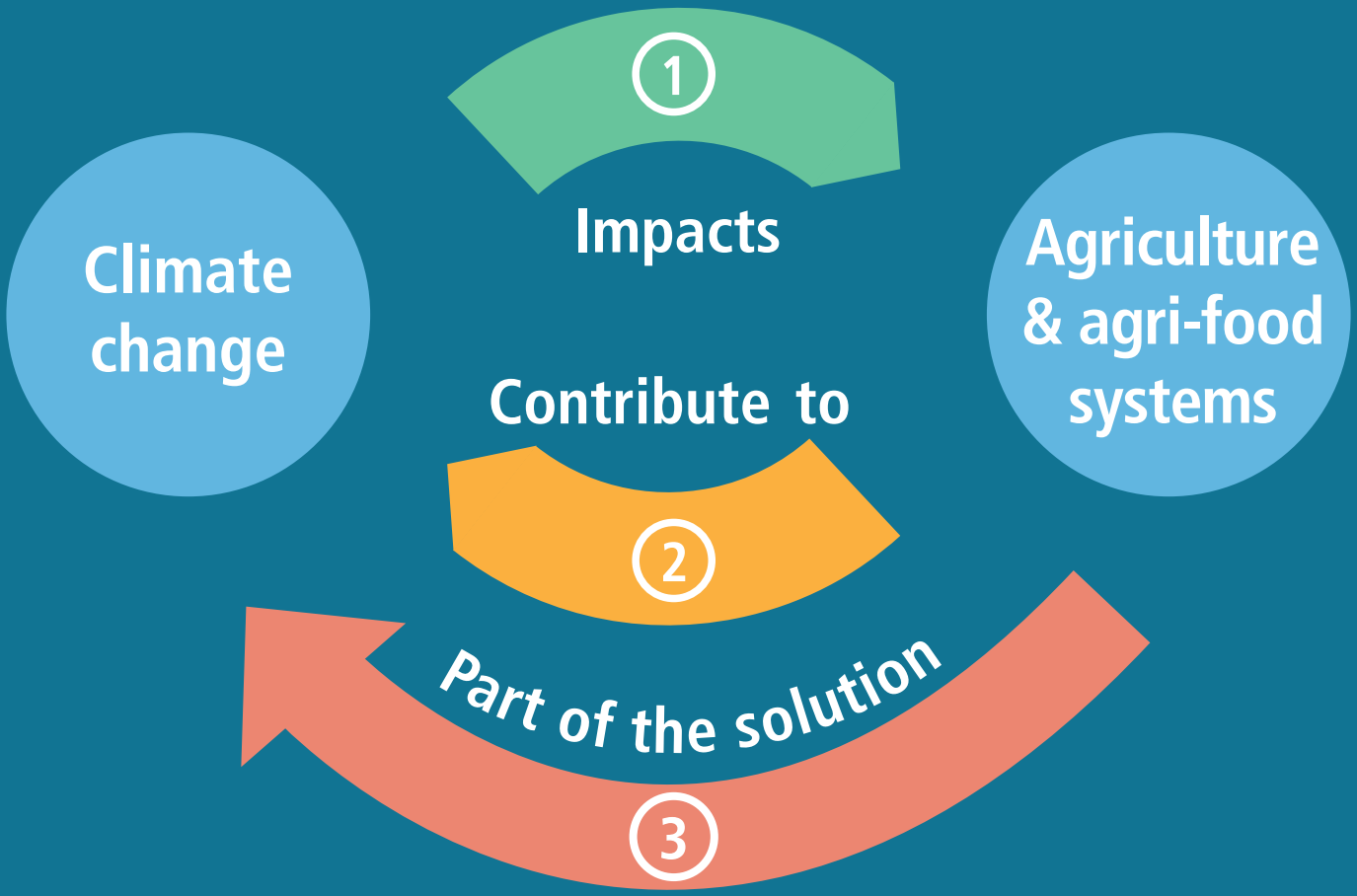
Towards energy-smart agriculture

Energy, agriculture and climate change, are intricately linked. Energy is required at each step of the food value chain to produce food and to meet the growing demand for food. Agricultural food systems currently rely heavily on fossil fuels to operate. The increasing use of fossil energy in agriculture leads to increasing GHG emissions from the agricultural sector, which in turn impacts agricultural production itself. At the same time, access to modern energy is inadequate in many parts of agri-food chains in developing countries. Change is possible through improving access to energy, more efficient use of energy, and increased use of renewable energy in agriculture, including sustainable bioenergy from agri-food systems. This can have the dual benefit of providing sustainable energy input to agriculture thereby increasing productivity while limiting contributions to climate change.

FAO through its Energy Smart Food for People and Climate (ESF) program helps countries promote energy-smart agri-food systems. This is done through the identification, planning and implementation of appropriate energy, water, food security and climate-smart strategies that spur agricultural growth and rural development. (FAO Website)

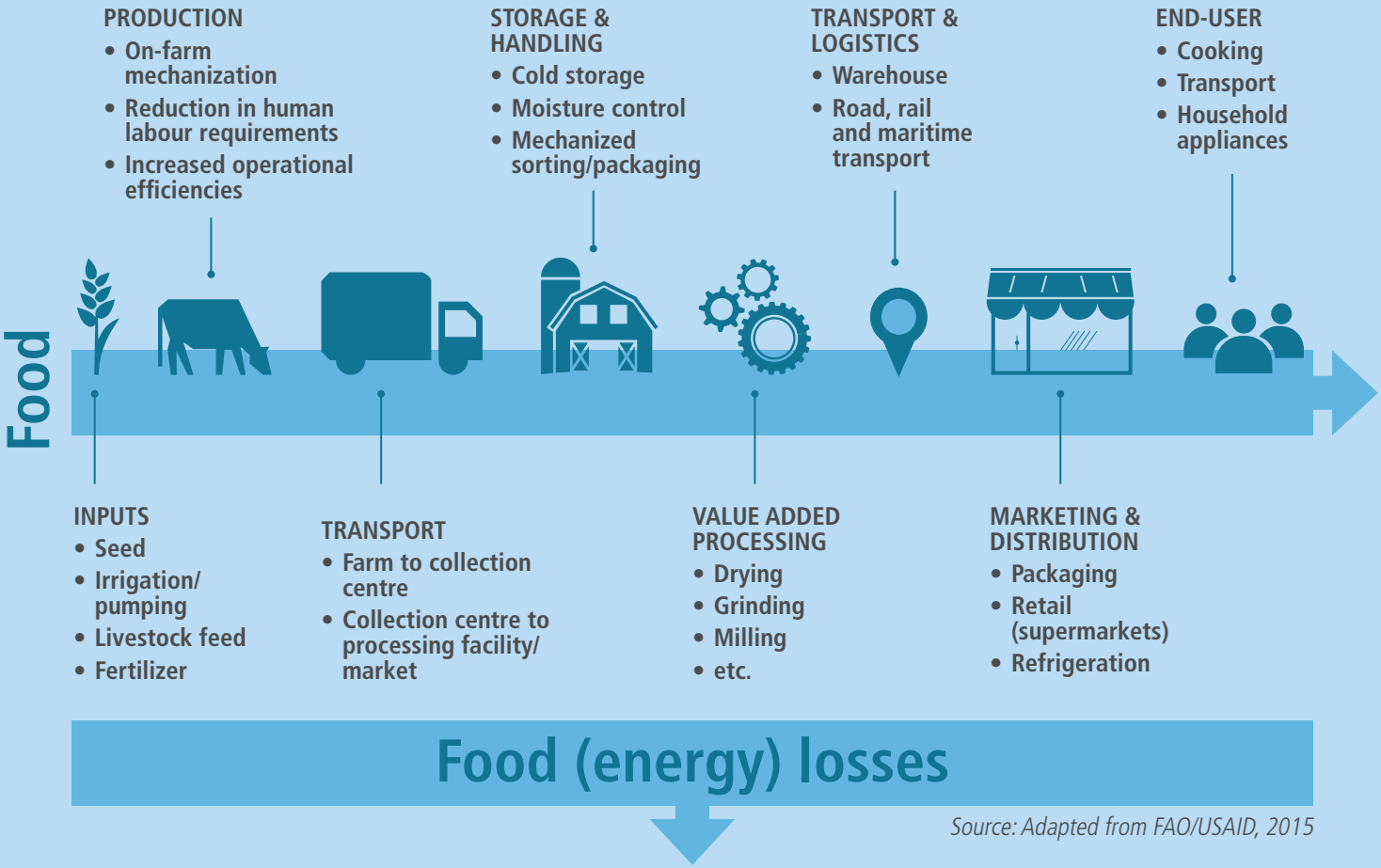
Agriculture and climate change: a three-way link

Agriculture is both impacted by climate change and a source of GHG emissions. In addition, agriculture can play a role in strategizing against climate change by being a source of renewable energy and by using less fossil fuels throughout the agri-food chain.



The agri-food chain

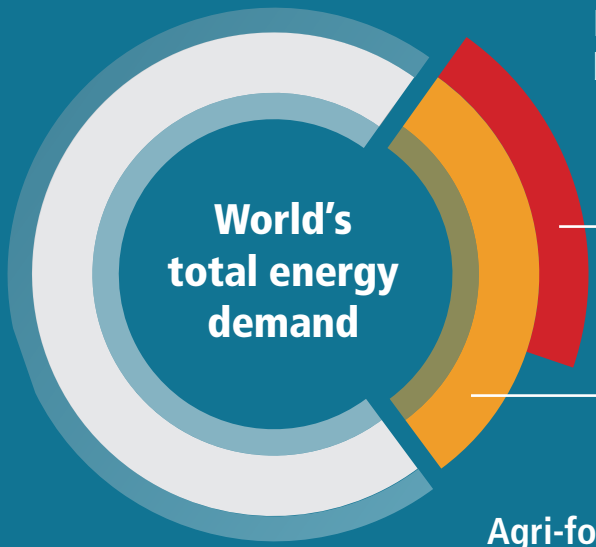
Energy use varies along the different steps of the agri-food chain. Interventions focused on the value chain may allow energy use to be more efficient, cost effective and when possible, to use low carbon fuels.



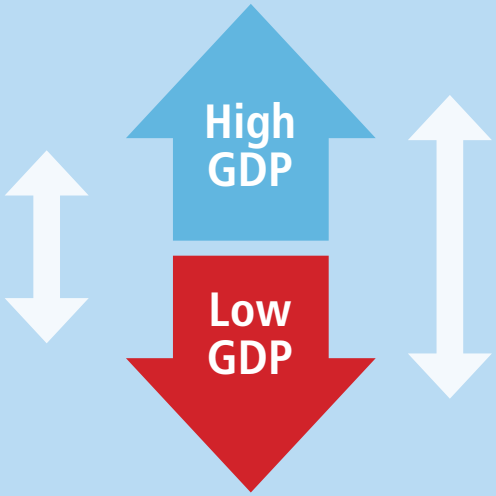
Source: Adapted from FAO/USAID, 2015

Energy use in the agri-food chain

The agri-food chain accounts for around 30 percent of the world's total energy demand, out of which about **70 percent is beyond the farm gate.**

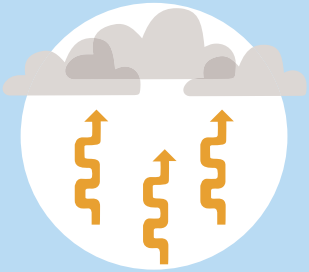


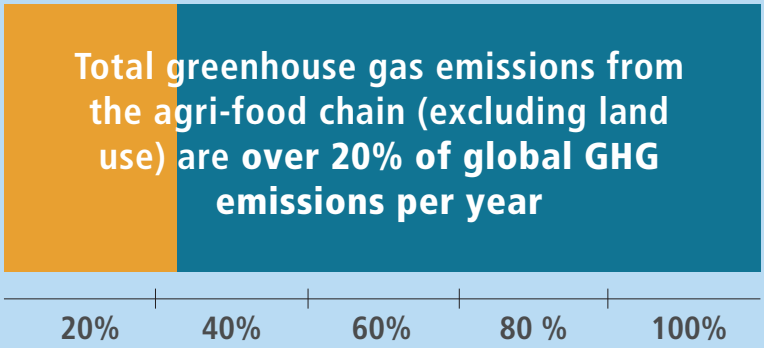
Source: FAO/USAID, 2015. Based on FAO, 2011.



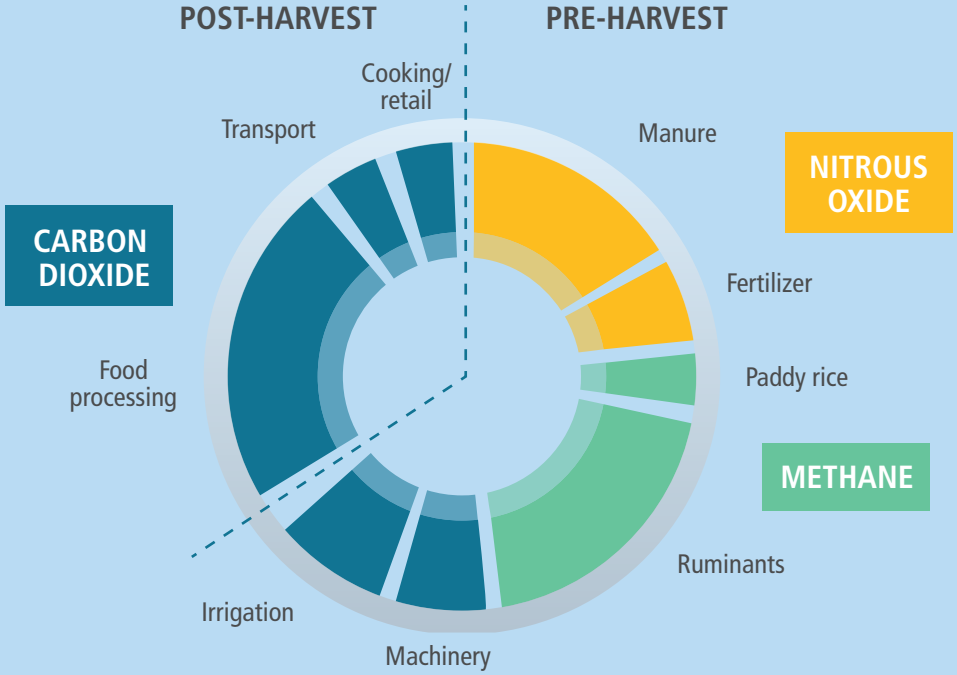
Shares of energy consumption at each step of the chain **vary significantly between high and low GDP countries.**

Emissions from agri-food chain



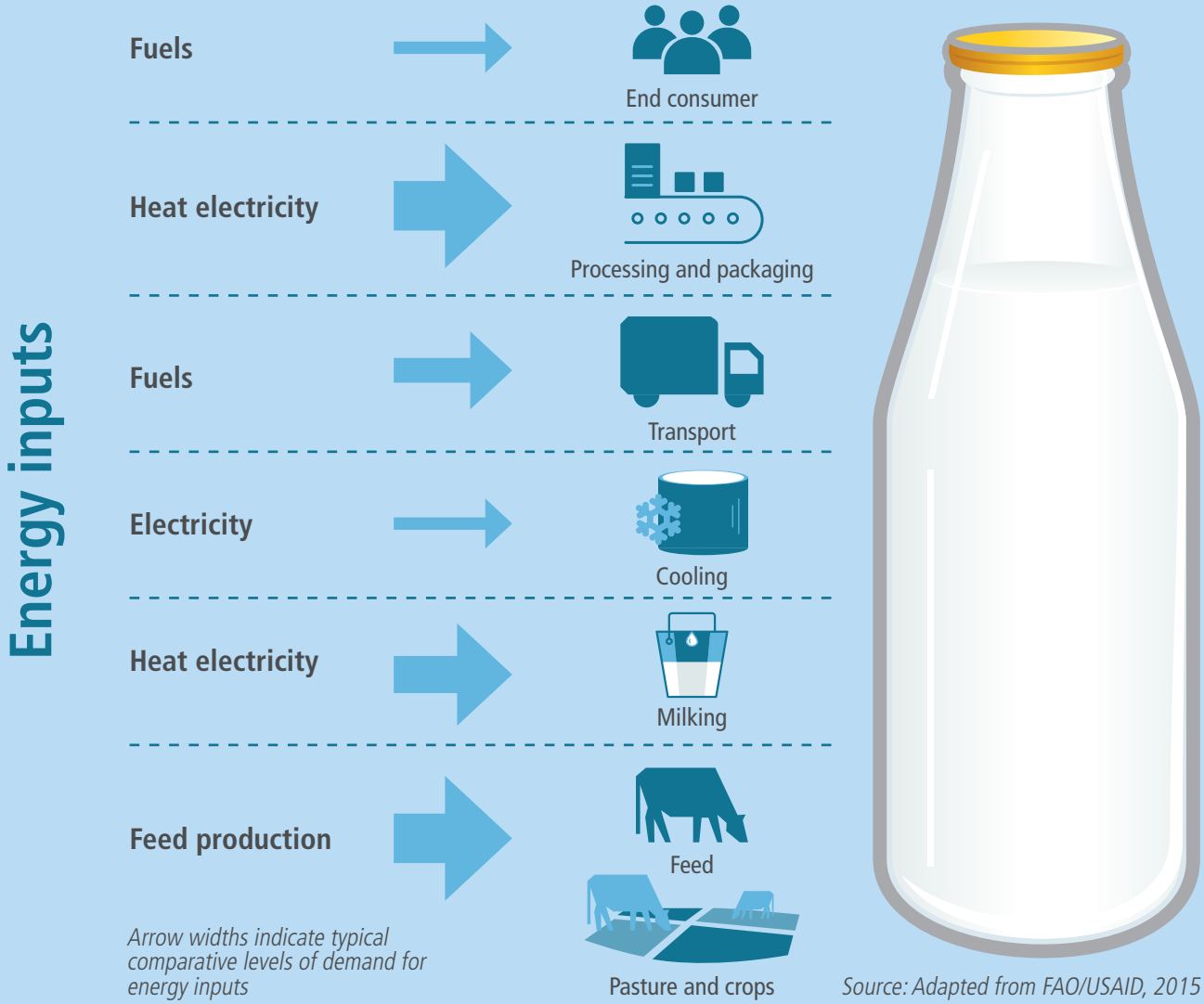


Variations in shares of the three main gases



Source: FAO/USAID, 2015. Based on data from: IPCC, 2014 and FAO, 2011

The role of energy in agri-food chains: example from milk



Source: Adapted from FAO/USAID, 2015

Challenge

As the global population continues to increase, food production will have to grow to meet the increase in demand.

Energy consumption to produce food and related GHG emissions is expected to increase by 2030

by 2050 60% more food will be required

Source: FAO/USAID, 2015. Based on UNSD Energy Statistics Database 2015 and FAO Food Consumption projections to 2030 (Alexandratos N. and Bruinsma J. 2012.).

How can agriculture be made energy smart?

- By improving access to modern energy services in agri-food systems
- Better energy efficiency
- Gradual increase in the use of renewable energy
- Using a Water-Energy-Food nexus approach in implementing the above

Examples of increasing energy and resource efficiency and/or use of renewable energy in agri-food systems

- ✓ **Solar irrigation**
- ✓ **Wind water pumping**
- ✓ **Solar / bioenergy drying and heating**
- ✓ **Solar food processing**
- ✓ **Evaporative cooling**
- ✓ **Solar absorption cooling**
- ✓ **Geothermal heating**
- ✓ **Optimizing fertilizer use**
- ✓ **Conservation agriculture**
- ✓ **Drip irrigation**
- ✓ **Precision agriculture**

Choosing what to eat can influence energy and GHG footprints

Different food products can have significantly different impacts on energy resources and therefore GHG emissions

MAIZE - 200g

70 gCO_2eq

690 kilojoules

RICE - 150g

80 gCO_2eq

2 070 kilojoules

MILK - 200g

560 gCO_2eq

560 kilojoules

CHEESE - 200g

2 760 gCO_2eq

7 600 kilojoules

CHICKEN - 150g

780 gCO_2eq

2 800 kilojoules

BEEF - 150g

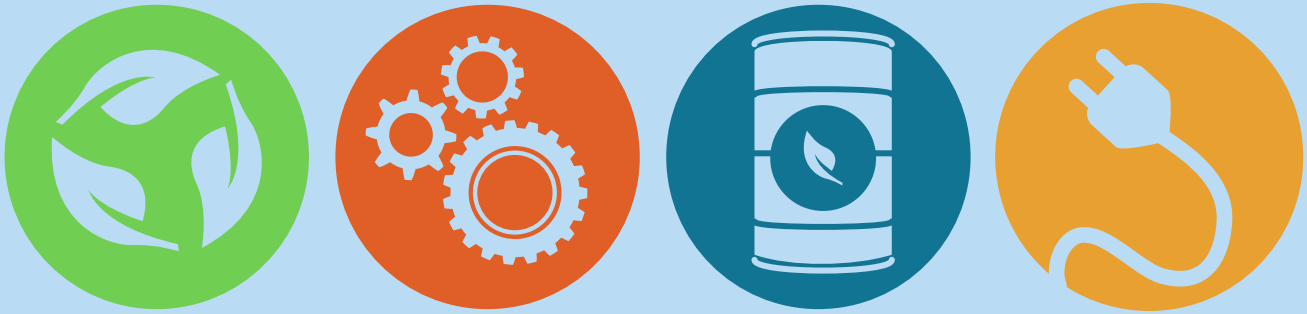
10 170 gCO_2eq

7 650 kilojoules

The values presented are indicative only and may vary considerably depending on the production system and location. Energy values are calculated comparing a large number of literature sources, but these are at time very specific by location and farming system. GHG gas emissions are calculated applying the default IPCC emission factors for diesel, electricity and natural gas together with information about emissions based on FAOSTAT 2014, Opio et al. (2013) and Gerber et al. (2010). Energy and emissions considered are just those associated with on-farm production and the energy demand for food processing and preparation.

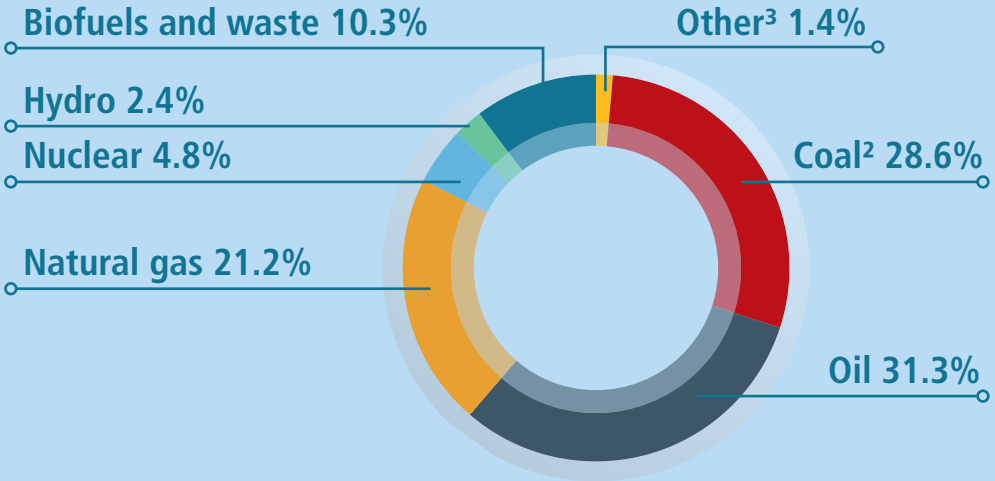
Sustainable bioenergy: a possible way to increase use of renewable energy in agriculture

In addition to food, agriculture can also provide biomass that can be sustainably converted to bioenergy.



How much bioenergy is produced globally?

World[1] total primary energy supply - 2014



1. *World includes international aviation and international marine bunkers*
2. *In these graphs, peat and oil shale are aggregated with coal*
3. *Includes geothermal, solar, wind, heat, etc.*

Source: IEA, 2016

Over half of all wood produced in the world is used for energy

Source: SOFO, 2014

How does FAO help?

The Energy-Smart Food for People and Climate (ESF) Program helps countries promote energy-smart agri-food systems through the identification, planning and implementation of appropriate energy, water, food security and climate-smart strategies that spur agricultural growth and rural development.

FAO has developed methodologies, tools and integrated support packages that stakeholders can utilize to make informed decision on energy and agricultural linkages

The Energy-Smart Food for People and Climate (ESF) Programme

Examples of ESF's activities

Energy use in food value chain:

FAO helps countries to identify and analyse sustainable energy interventions in agri-food chains. This includes developing a standard approaches to undertake the cost-benefit analysis of selected agri-food technologies.

Sustainable bioenergy support package:

The support package includes different elements, which can be used independently or together at different stages within the decision-making and monitoring processes of bioenergy development to ensure sustainable bioenergy development in countries.

The Water-Energy-Food Nexus:

The nexus assessment methodology proposes a way to carry out a WEF nexus assessment to understand the interactions between water, energy and food systems in a given context, and evaluate the performance of a technical or policy intervention in this given context.

www.fao.org/climate-change

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