THE OIL AND PROTEIN SECTORS AS A SOLUTION FOR MEETING GLOBAL CHALLENGES IN 2030

Main conclusions
December 2014

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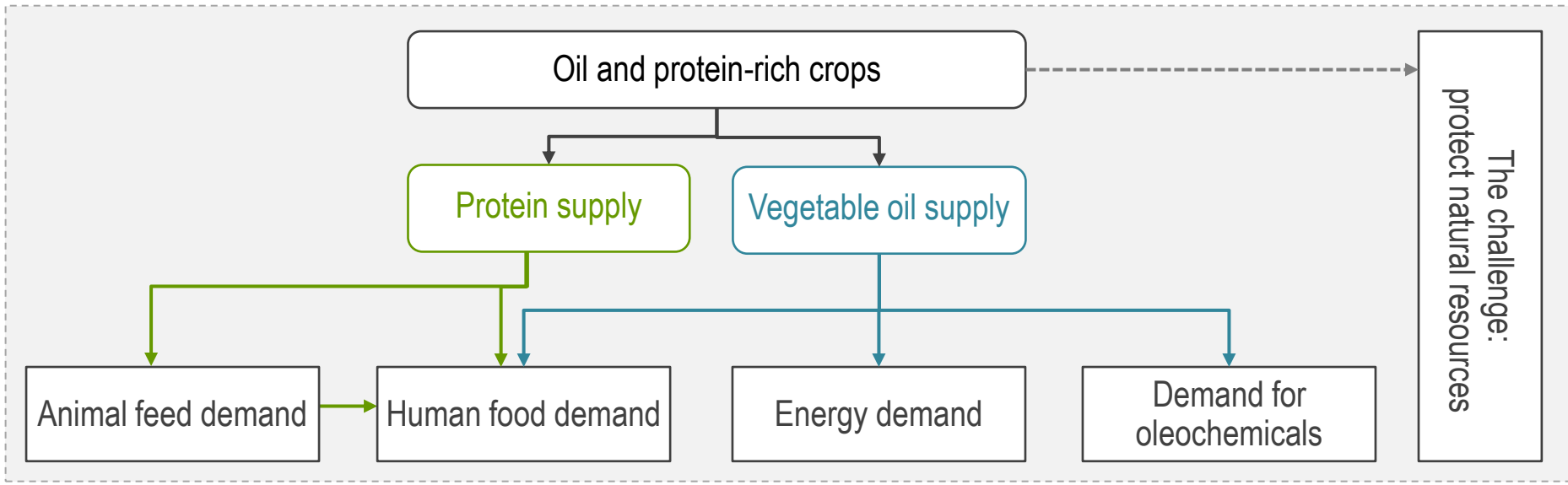
Contents

Methodology: assessing the oil and protein-rich plants sector's ability to meet demand for oil and proteins

Scope: the world in 2030



Approach:

1. Assessing food and non-food demand independently from the supply's ability to meet that demand
2. Assessing the supply based on achievable and sustainable land and yield assumptions
3. Balancing supply and demand based on the limiting factor

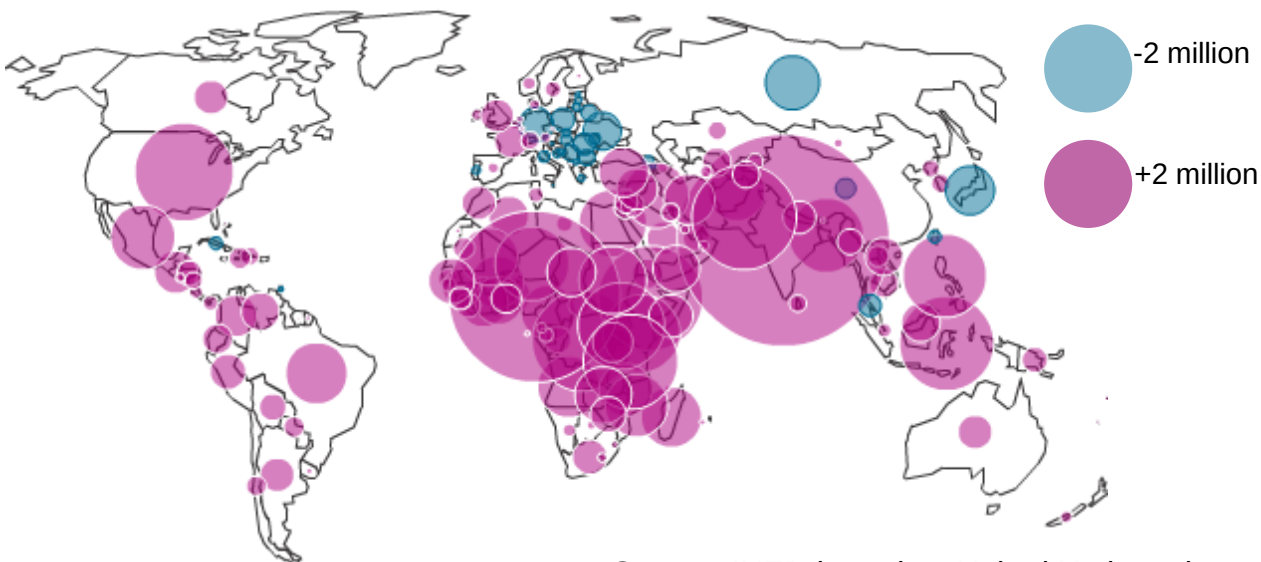
Sources: worldwide reference data (FAO, OECD, IEA, Oilworld, etc.), Avril & BIPE expertise.
Starch is not included in the scope of this research report.

1. FEEDING 8.4 BILLION PEOPLE IN 2030

Feeding 8.4 billion people in 2030, i.e. a 22% increase in food demand compared with 2010 due solely to the effect of population growth

World population

Increase in population by country in 2030



Source: INED based on United Nations data

- Source: United Nations (*medium fertility variant)*
- Nigeria will grow faster than China from 2017.
- Africa: 54% growth between now and 2030, amounting to 23% of the world's population by 2030.
- Growth in China will continue to slow. The country's population will decrease in 2030, for the first time.
- By 2030, the population of some European countries, Russia, Japan, China and Thailand will be decreasing.

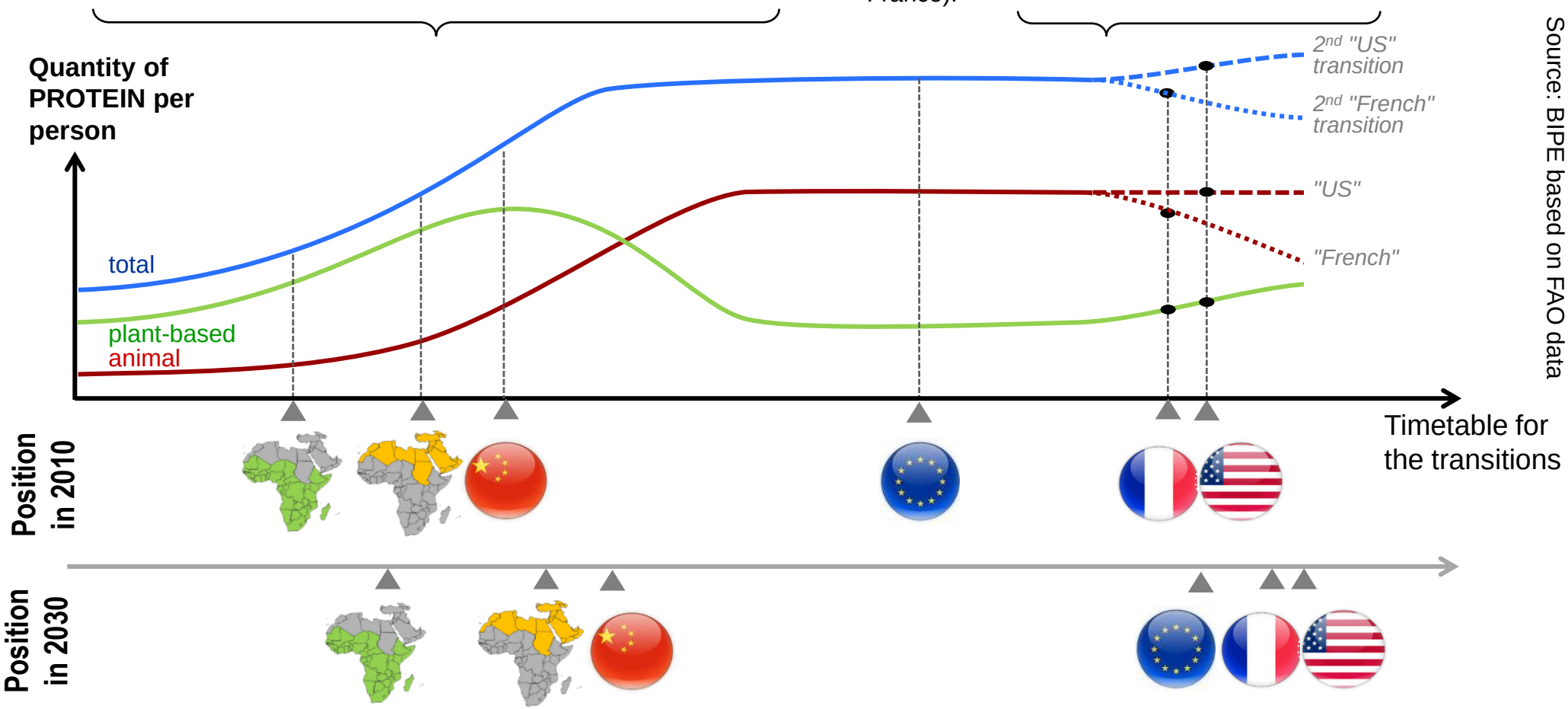
Transition to a protein-based diet: most of the world's population is only at the beginning of the first dietary transition process

First dietary transition

First stage: increase in overall protein demand, initially driven by plant-based sources; growth is then driven by animal protein sources. Second stage: overall demand stabilises, and plant-based proteins are replaced by animal proteins.

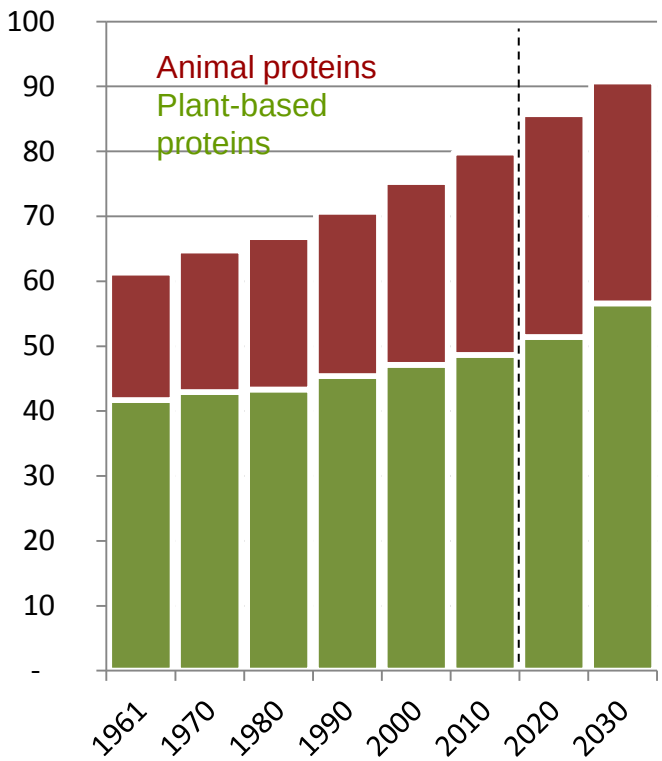
Second dietary transition

Increase in demand for plant-based proteins. Two second transition models: the “US” model (which has already been seen in the United States, the United Kingdom, Germany, Finland and Sweden), and the “French” model (Norway, Denmark, Austria, and France).



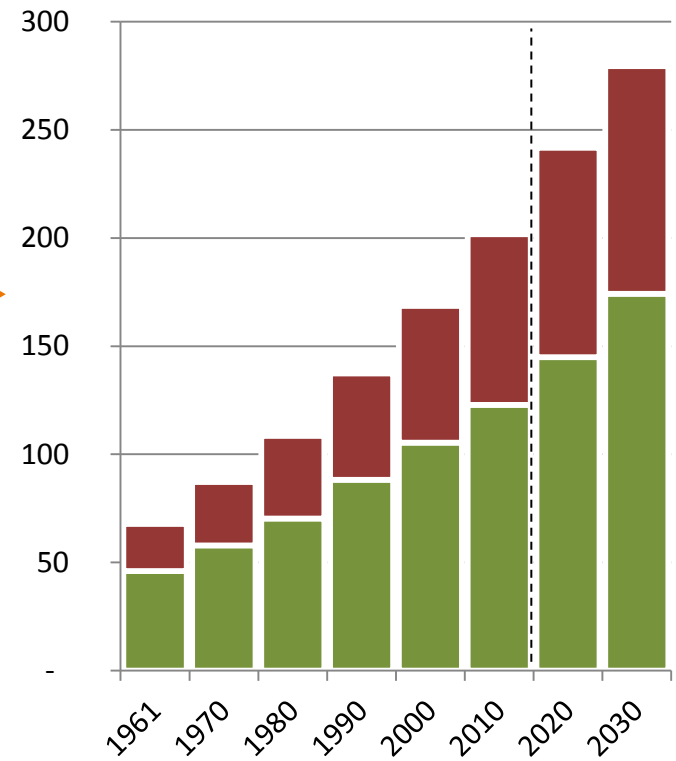
Dietary transitions and population growth will result in a 40% increase in global protein demand by 2030

Daily worldwide demand for plant-based and animal proteins (in g/person/day)



Source: BIPE based on FAO data

Annual worldwide demand for plant-based and animal proteins (in millions of tonnes/year)

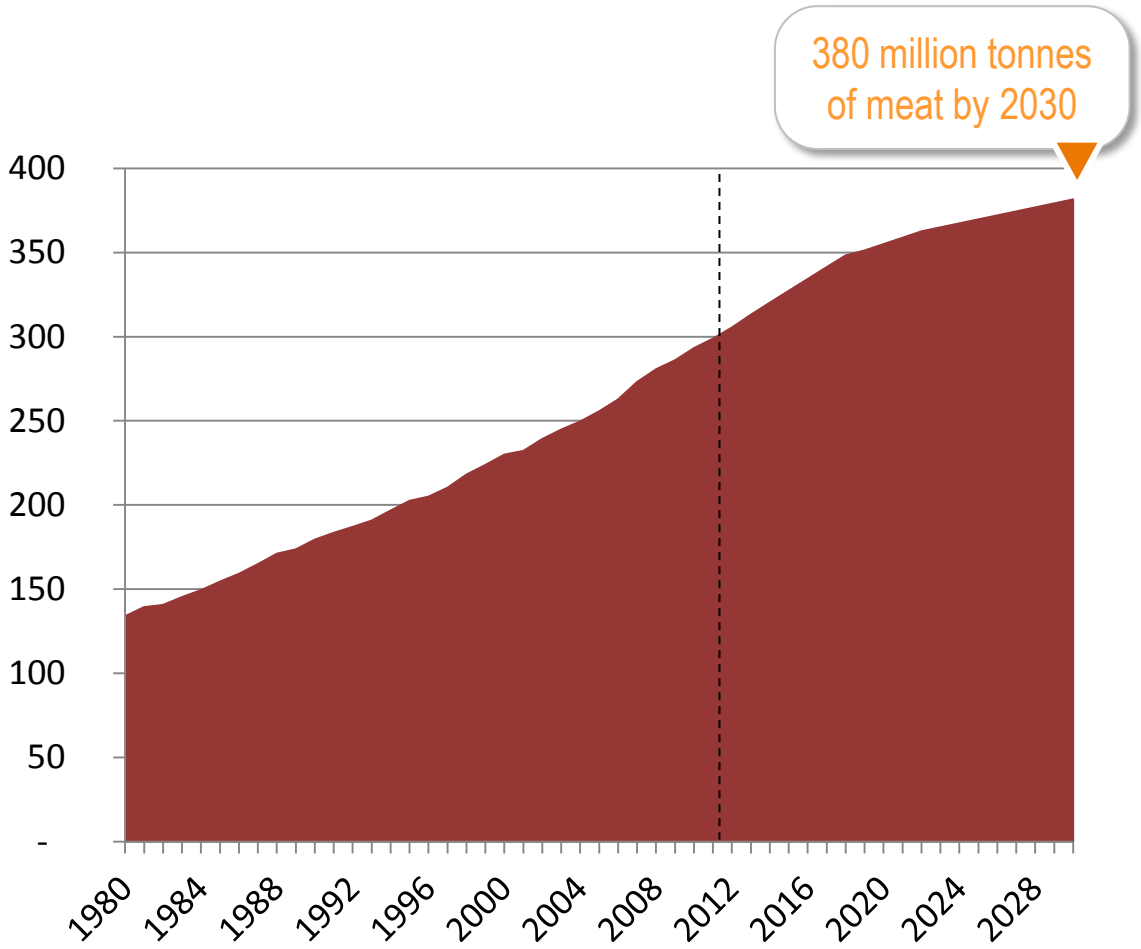


Source: BIPE based on FAO data

- 2010-2030 growth in demand for **plant-based proteins = 43%**, driven by Sub-Saharan Africa and India (1st transition incomplete, and strong demographic growth).
- 2010-2030 growth in demand for **animal proteins = 33%**, relates to the first dietary transition in developing countries. China will specifically account for one third of the growth by 2030 (1st transition almost complete).
- **Population growth** explains **55%** of the increase in demand for **plant-based proteins**, and **68% of the demand** for **animal proteins.**
- Restrictions on oilseed meal supply are slowing the 1st transition, and the increase in the percentage of meat in diets.

A 30% increase in global demand for meat, which will reach 380 million tonnes by 2030 (restrictions on supply from 2020)

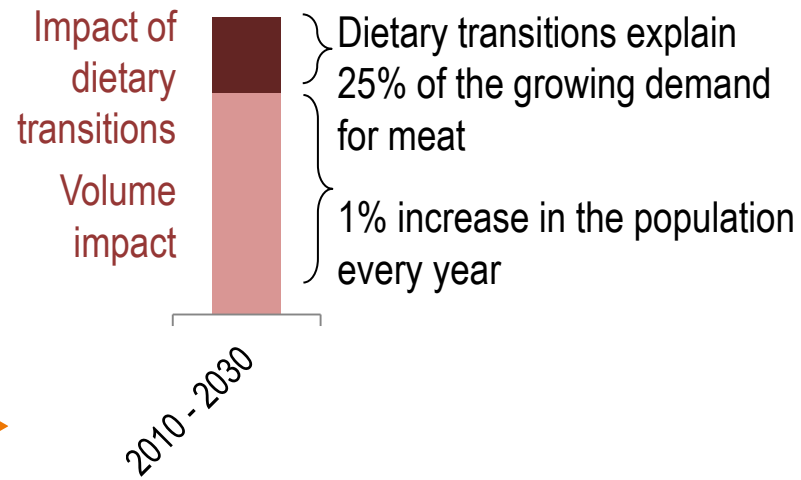
Global meat demand (in millions of tonnes per year)



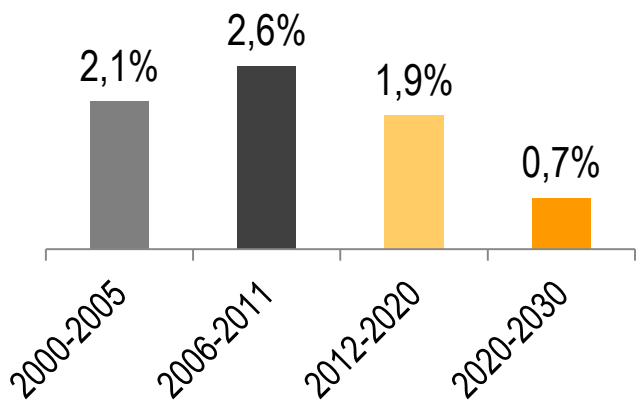
Sources: BIPE based on FAO data

Origins of the growth between 2010 and 2030

annual increase of 1.3% in demand for meat



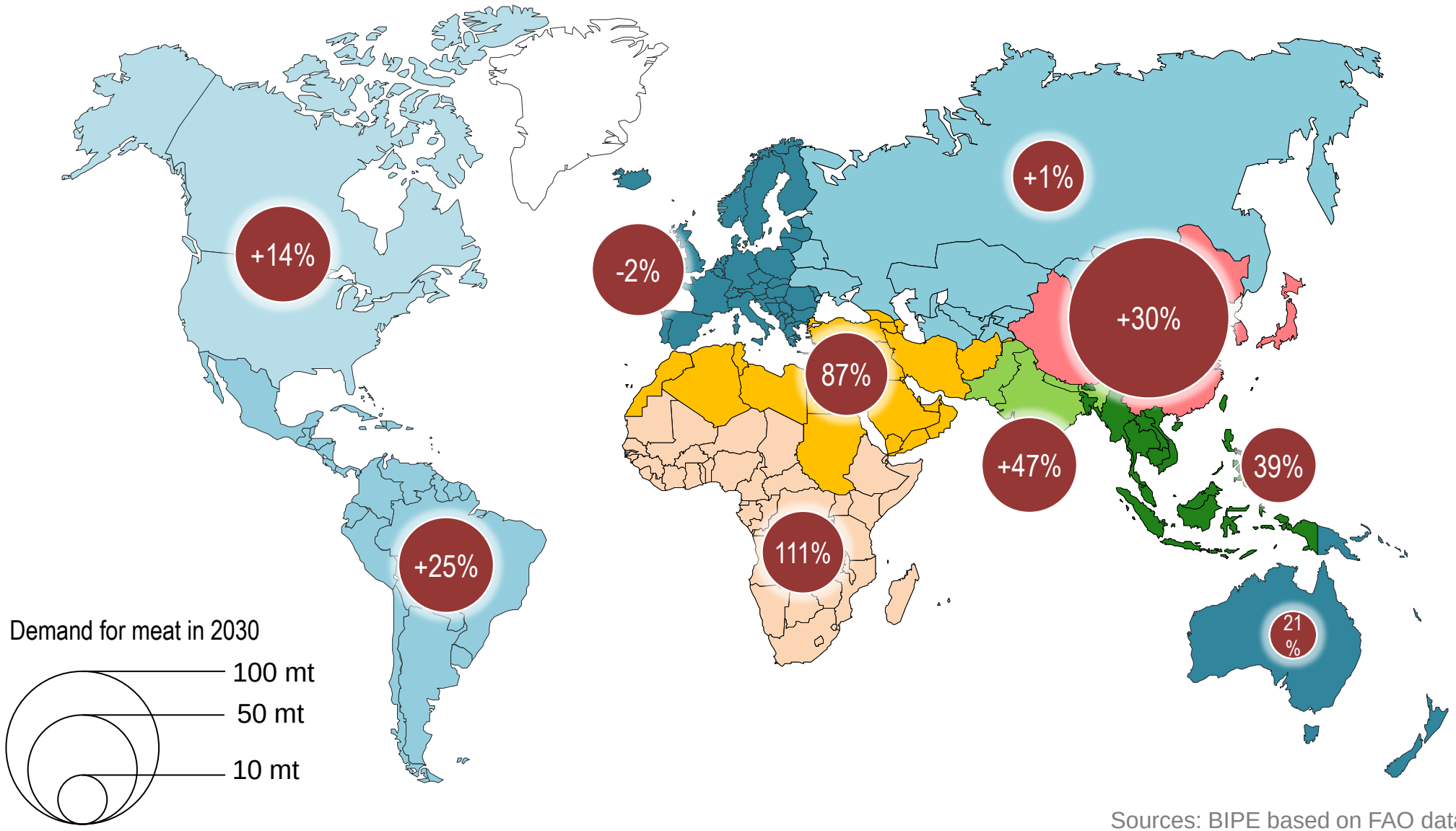
Average annual growth



Growth slows sharply from 2020 due to supply constraints

Sources: BIPE based on FAO data

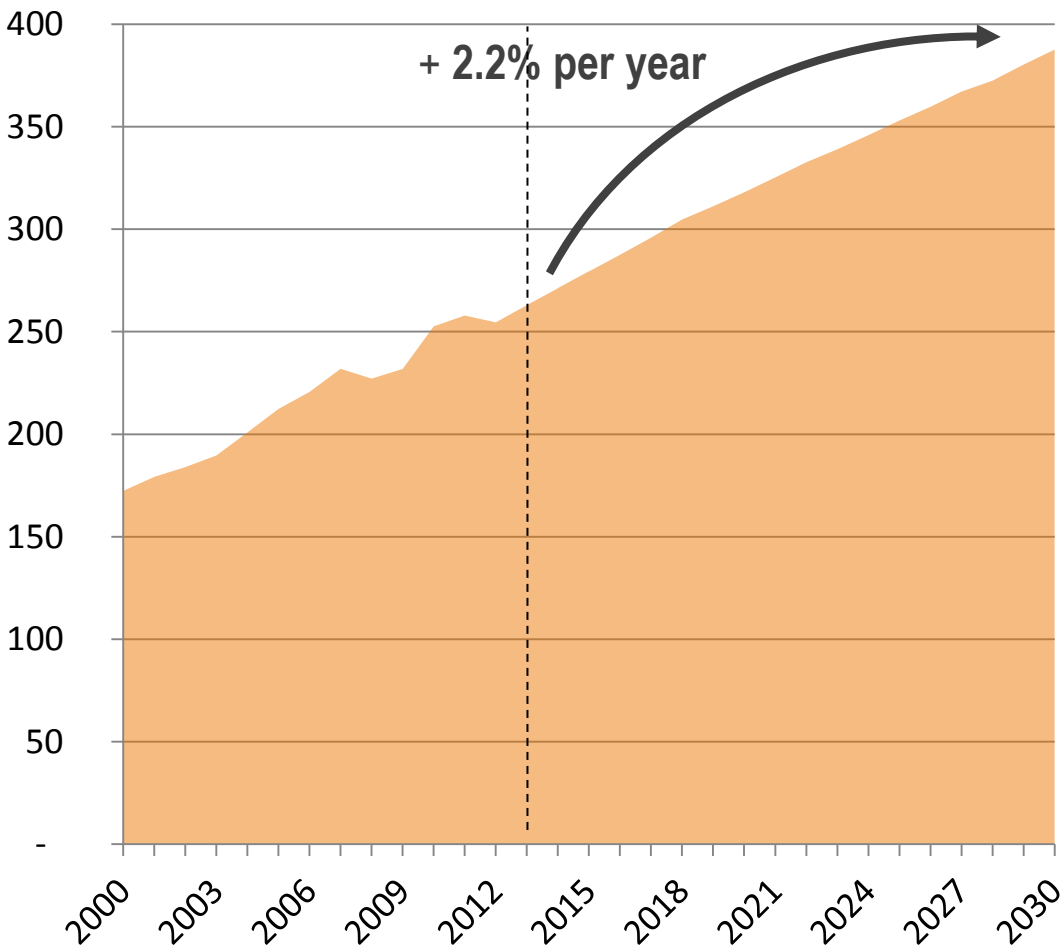
Level of annual demand for meat in 2030 by region, and increase between 2010 and 2030



Sources: BIPE based on FAO data

A 53% increase in worldwide demand for oilseed meal for animal feed between 2010 and 2030

Worldwide demand for oilseed meal for animal feed (in millions of tonnes per year)

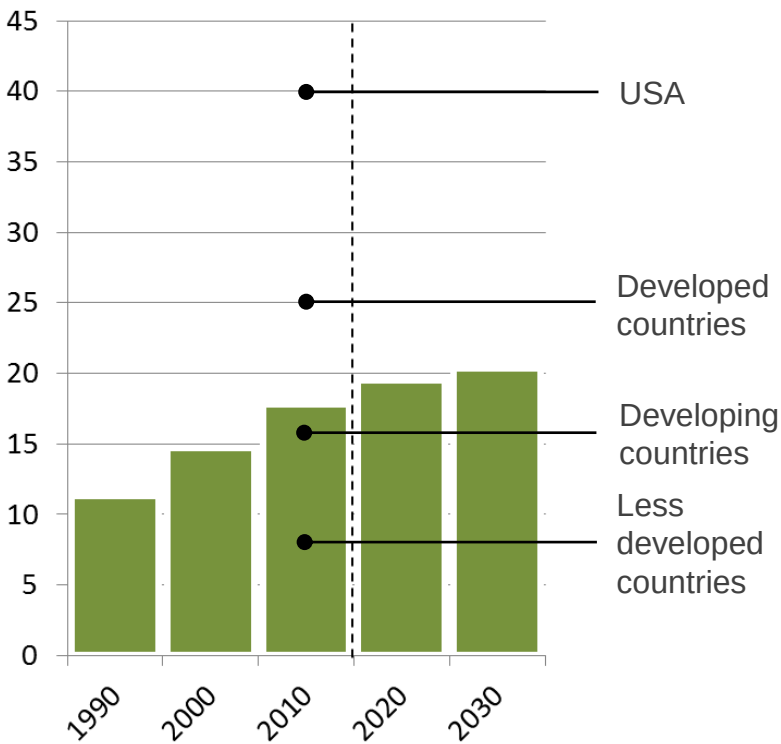


Source: BIPE based on historical FAO data

- From 253 million tonnes of oilseed meal for animal feed in 2010 to **388 million tonnes in 2030**
- **53% increase in worldwide demand** between 2010 and 2030, i.e. average annual growth of 2.2%
- As from 2020, the increase in demand for meat will come exclusively from developing countries, **where the livestock rearing system is not as efficient** as in developed countries. This is why the increase in global demand for oilseed meal will remain high, even though demand for meat will drop sharply.

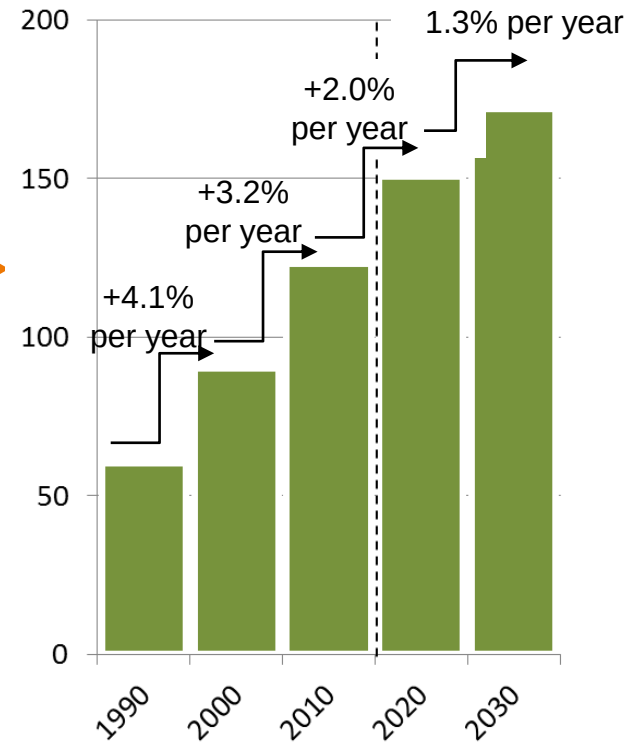
A 39% increase in demand for edible vegetable oils by 2030 which is linked to population growth and to dietary transitions

Annual worldwide vegetable oil demand per person (in kg/year/person)



Source: BIPE based on FAO & OECD data

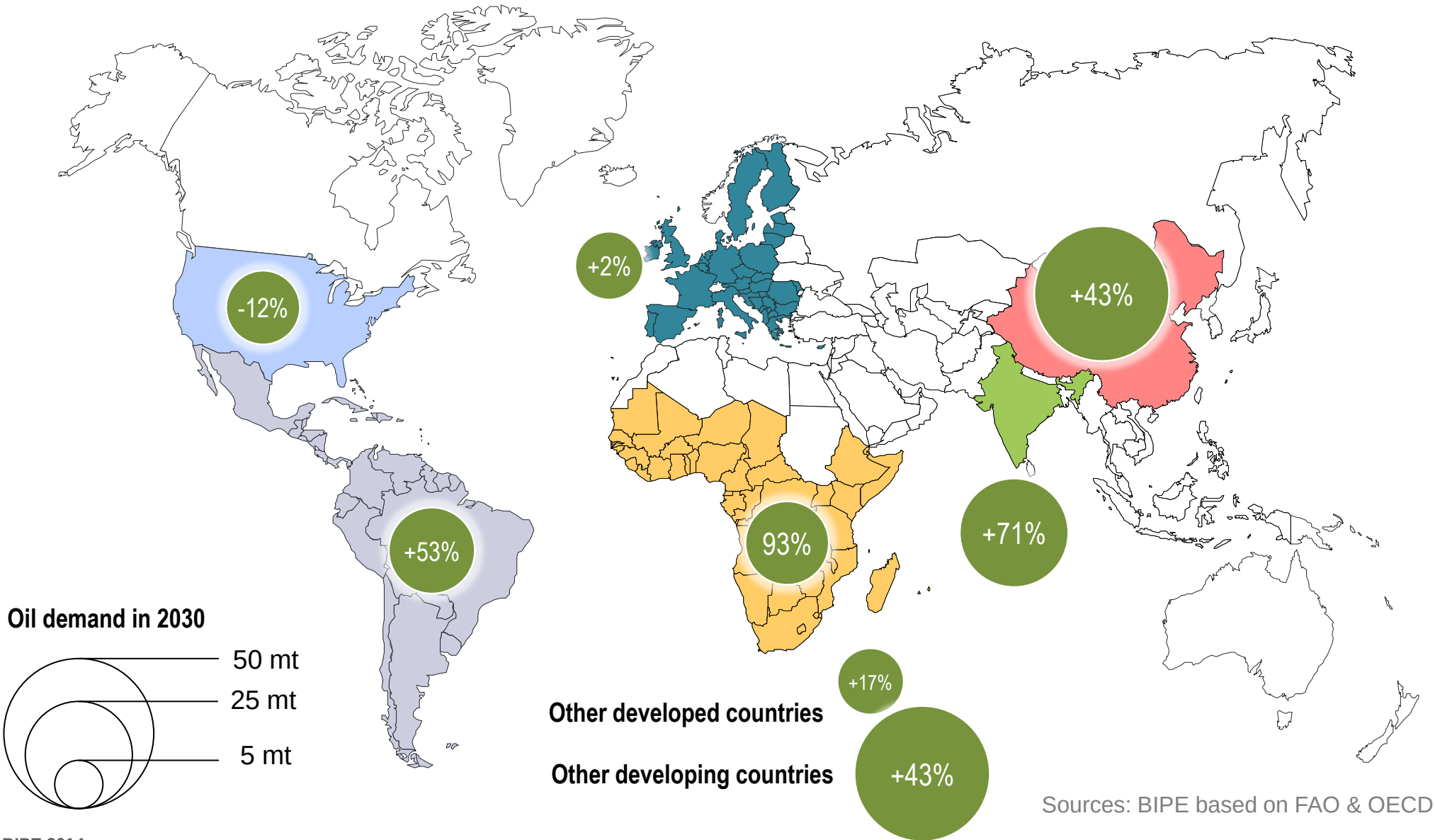
Annual worldwide demand for vegetable oils (in millions of tonnes per year)



- Growth between 2010 and 2030 will primarily be driven by China (slowdown in the second period due to the end of the first transition period)
- Lower growth between 2020 and 2030, which will primarily be driven by Sub-Saharan Africa and India (beginning of the 1st transition and strong population growth)
- Global demand in 2030: 172 million tonnes

Source: BIPE based on FAO & OECD data

Level of annual demand for edible vegetable oils in 2030 by region, and increase between 2010 and 2030

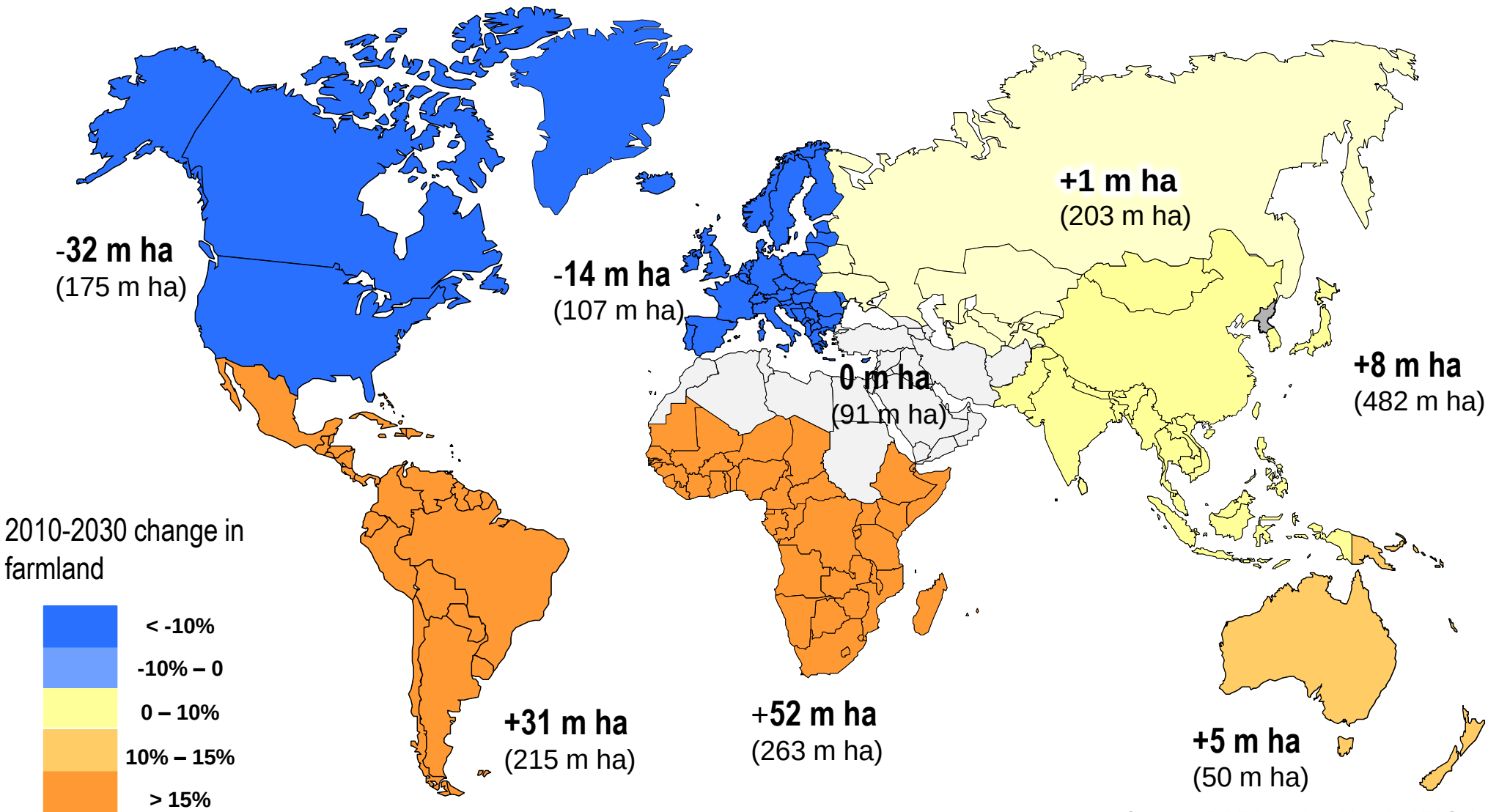


Sources: BIPE based on FAO & OECD data

2. ENSURING THE AVAILABILITY AND SUSTAINABILITY OF SUPPLY

Worldwide 52 million ha increase in farmland compared with the current level of 1,534 million ha, i.e. a 3.4% increase (perennial and annual crops) between 2010 and 2030

Farmland forecasts by region (change between 2010 and 2030, and level in 2030)

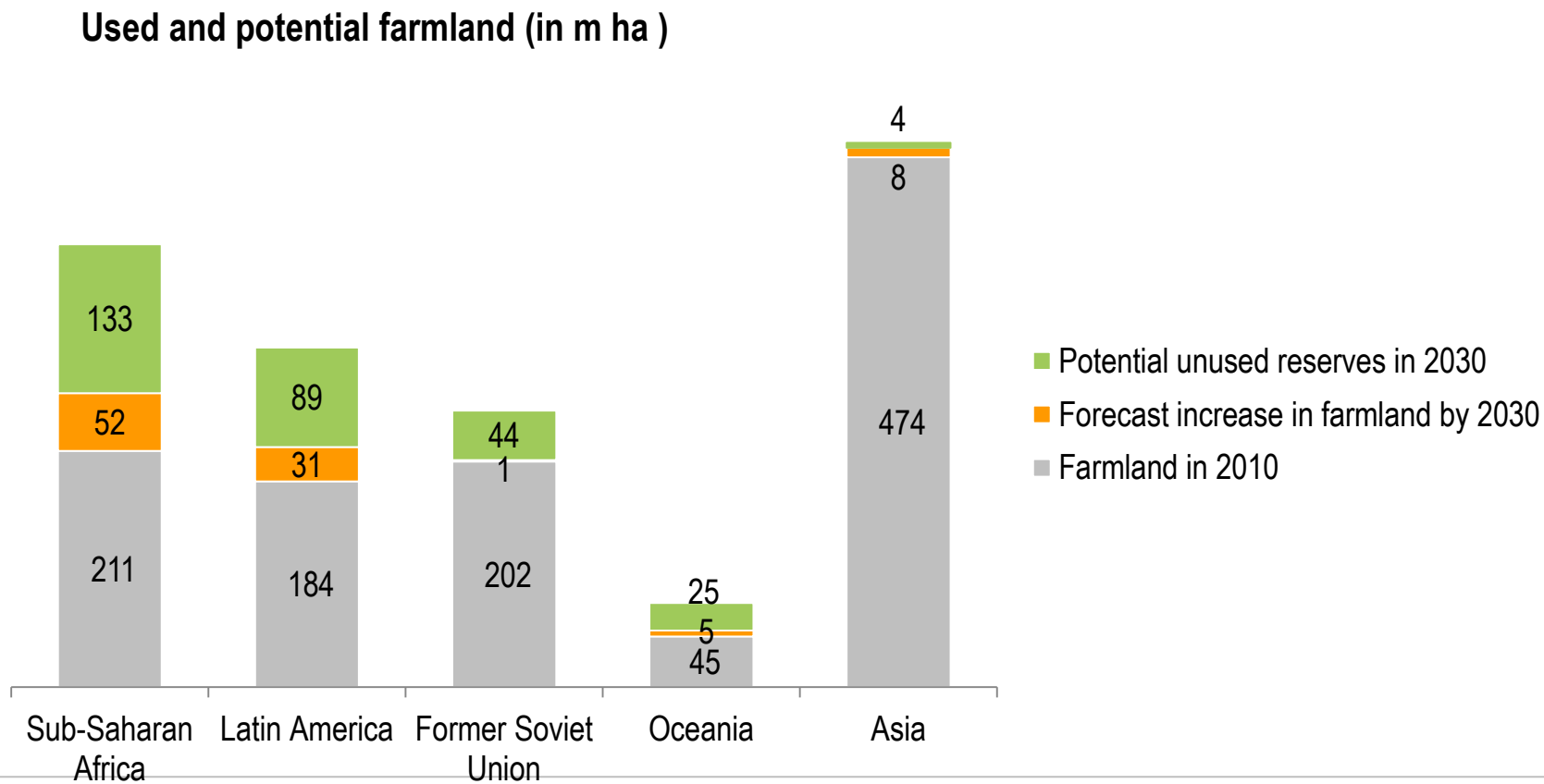


Sources: BIPE based on historical FAO data

Worldwide land reserves are higher than requirements but are not divided equally

Increase in farmland versus potential land reserves

(with no irrigation or crops, excluding protected areas, excluding forests and with a population density of <25 per km², Fischer and Shah 2010)

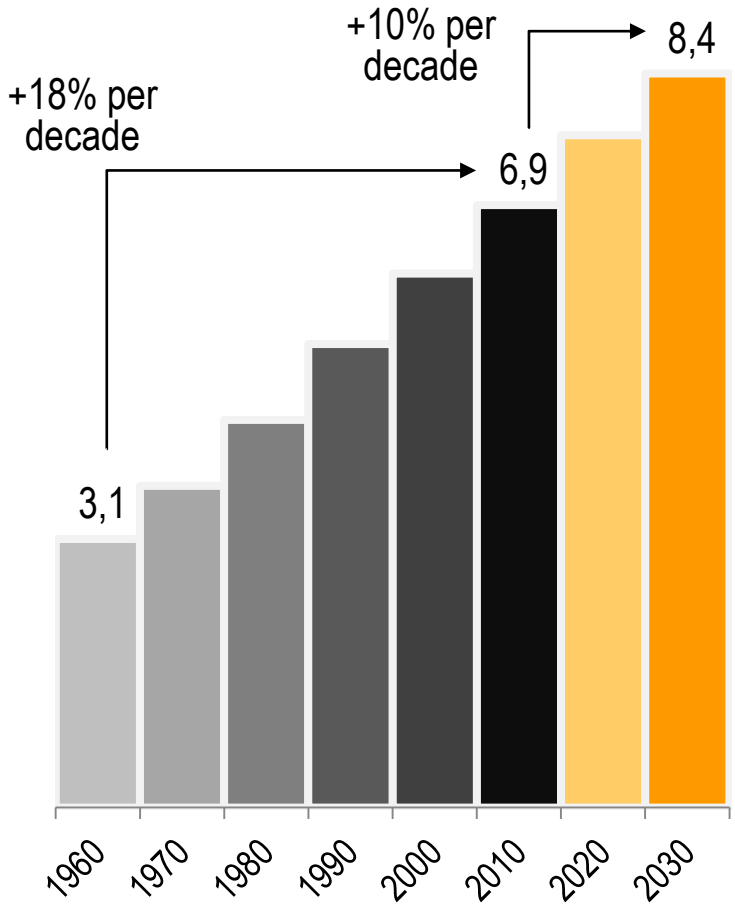


Sources: BIPE, Fischer & Shah 2010, FAO

The geographical areas for potential unused reserved are limited to the following countries → Sub-Saharan Africa: Angola, Burkina Faso, Cameroon, Central African Republic, Chad, Democratic Republic of Congo, Republic of Congo, Ethiopia, Gabon, Kenya, Madagascar, Mali, Mozambique, South Africa, Sudan, Tanzania, and Zambia/ Latin America: Argentina, Bolivia, Brazil, Colombia, Ecuador, French Guiana, Guyana, Mexico, Paraguay, Peru, Suriname, Uruguay, and Venezuela /Former Soviet Union: Belarus, Russian Federation, and Ukraine / Oceaniac: Australia, and Papua New Guinea / Asia: Indonesia, Malaysia, and China.

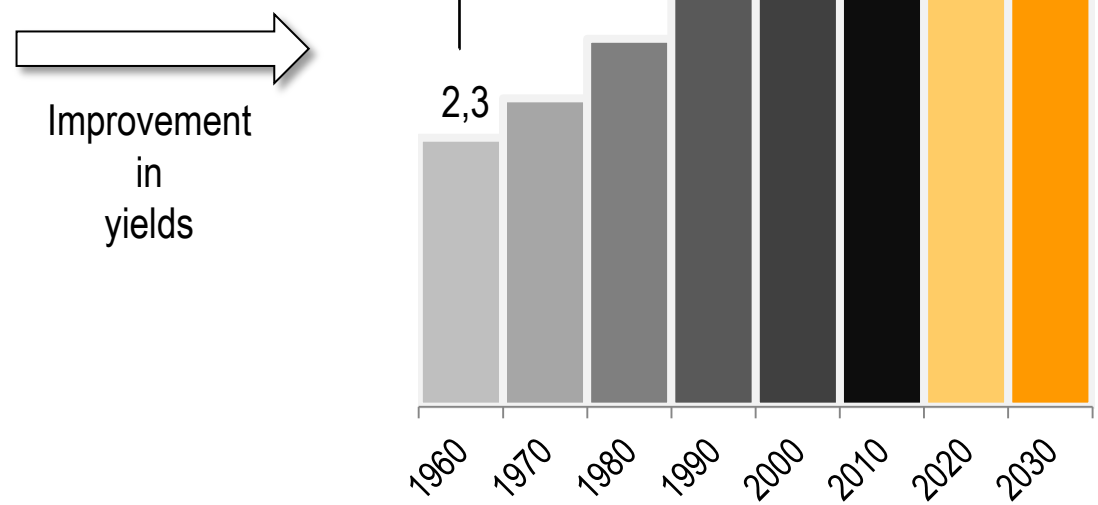
At the worldwide level, 1 farmed hectare will enable almost one additional person to be fed compared with today

World population (in billions)



Source: United Nations

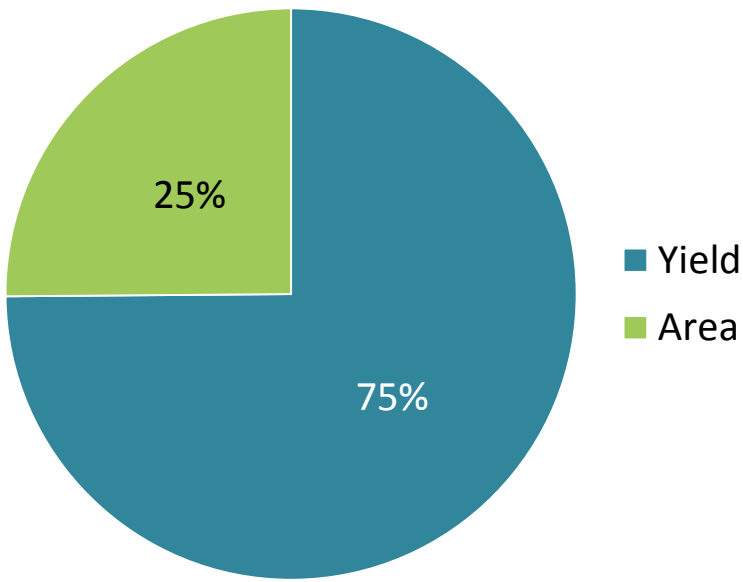
Persons fed per farmed hectare, historical and forecast data (in persons per hectare)



Source: BIPE based on FAO & United Nations data

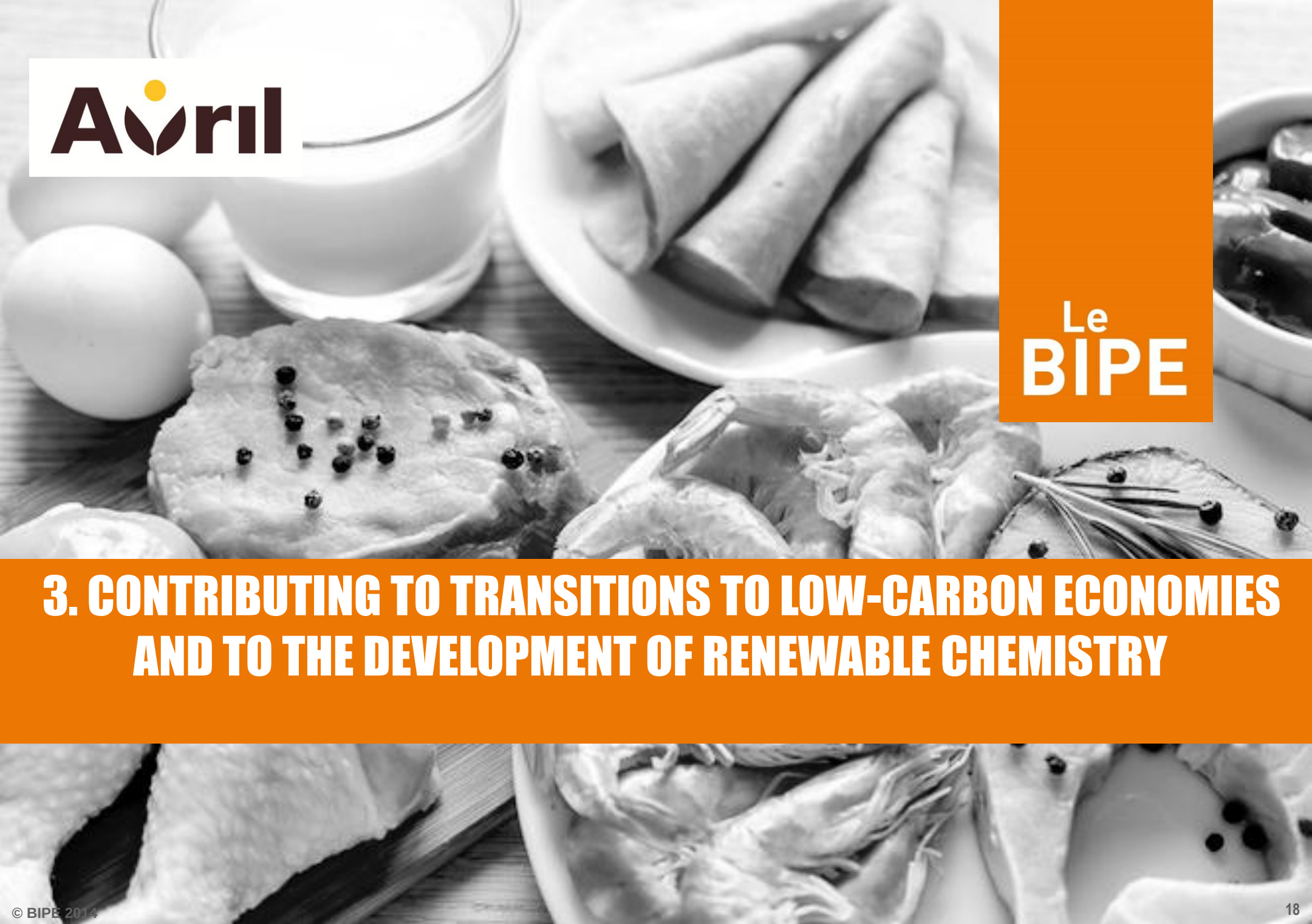
Growth in production of mainland oilseeds will be driven by improving yields

Contribution of global growth factors to the production of rapeseed and sunflower crops for the period between 2010 and 2030



- Increases in rapeseed and sunflower production are explained by:
  - the increase in yields (75%);
  - the increase in farmland (25%).
- An increase in production that is not land-intensive, and is based on improvements in crop varieties and farming techniques.

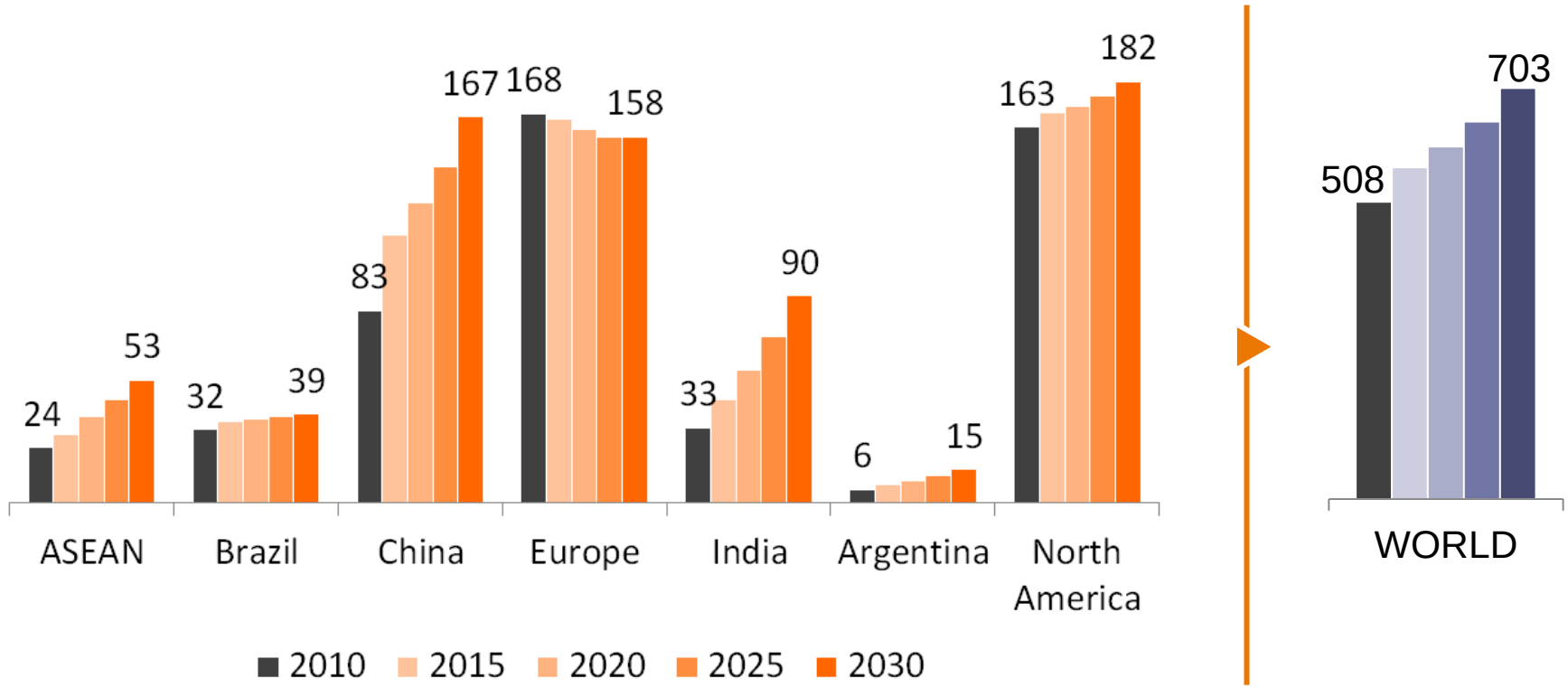
Source: BIPE based on Avril and FAO forecasts



3. CONTRIBUTING TO TRANSITIONS TO LOW-CARBON ECONOMIES AND TO THE DEVELOPMENT OF RENEWABLE CHEMISTRY

38% increase in worldwide diesel demand between 2010 and 2030, three-quarters of which will be driven by China and India

Trend in diesel consumption for transportation between 2010 and 2030, in Mtoe



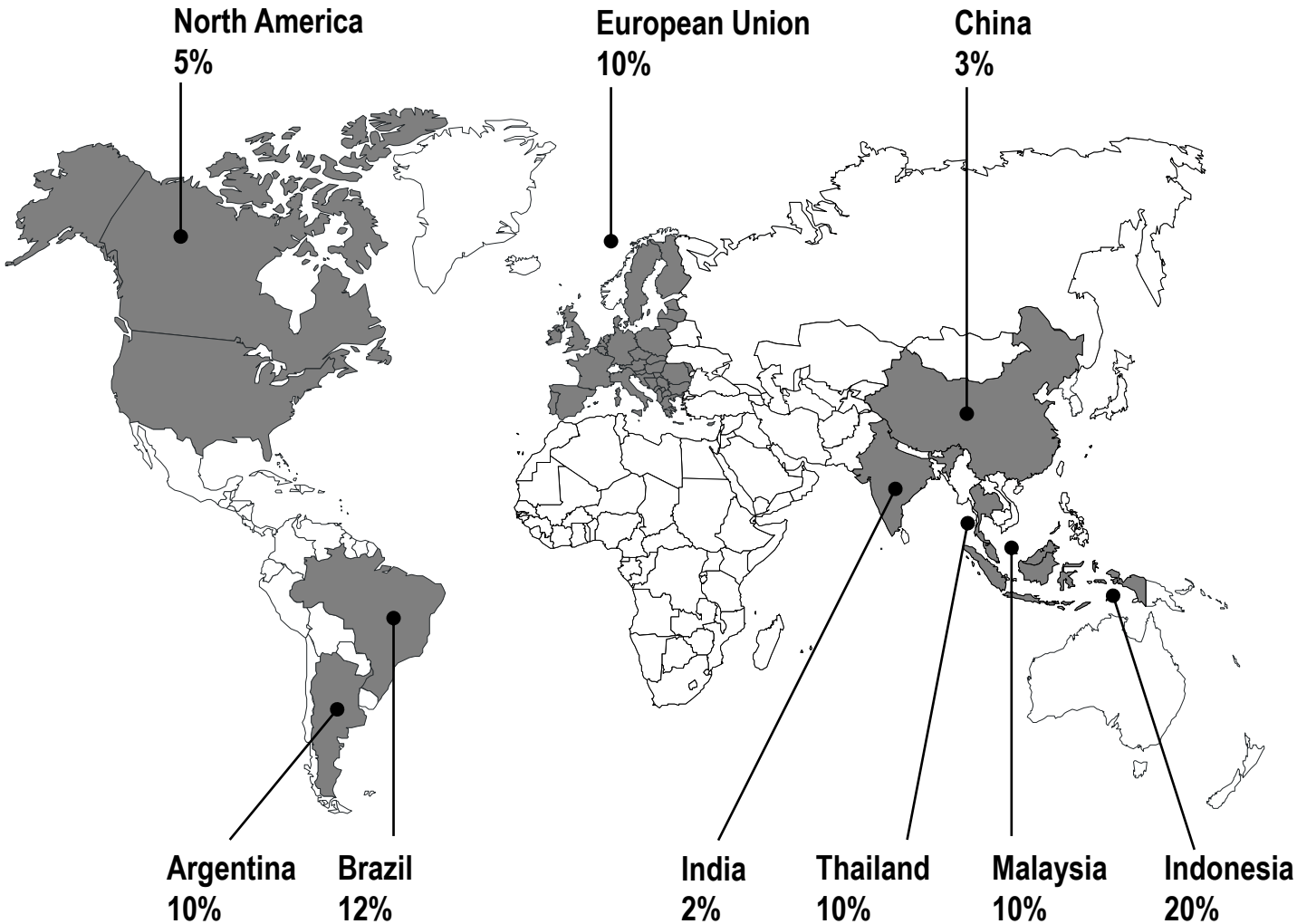
- The consumption of diesel in China will double, driven by the heavy industrial vehicles used for the transportation of consumer goods, at a time when the country is moving from an investment-led to a consumption-led economy.
- In India, diesel consumption will triple, but will be driven by light vehicles, which have overrun the vehicle fleet between 2003 and 2013, attracted by the heavy subsidising of diesel fuel.
- The doubling of consumption in ASEAN countries will be driven by a sharp increase in commercial vehicles, including light vehicles, in the current fleet.
- The increase in the consumption of diesel by heavy vehicles in Europe will not be sufficient to offset the fall in consumption by light vehicles.

Source: BIPE

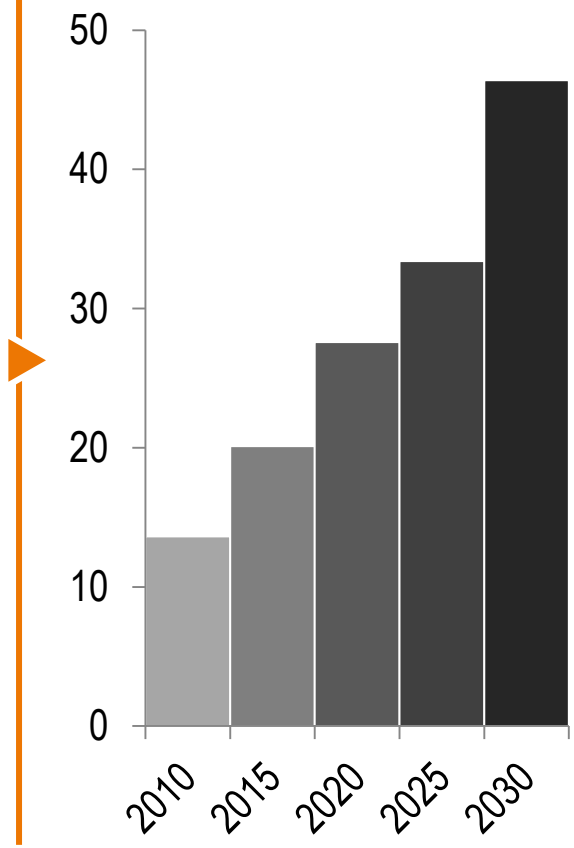
Mix inclusion requirements in Europe, the Americas and Asia will result in global bio-diesel demand of 46 million tonnes in 2030 (conventional & advanced fuel)

Inclusion of bio-diesel by 2030

(all types of bio-diesel: conventional and advanced)



Global bio-diesel demand (in Mtoe)



Source: BIPE

Strong growth in global diesel demand driven by China and India

Global consumption of 46 million tonnes of bio-diesel (conventional and advanced) in 2030

Conventional bio-diesel

- Produced from vegetable oils (palm, soybean, rapeseed oil, etc.)
- Drivers: availability and price of biomass compared with fossil fuel alternatives

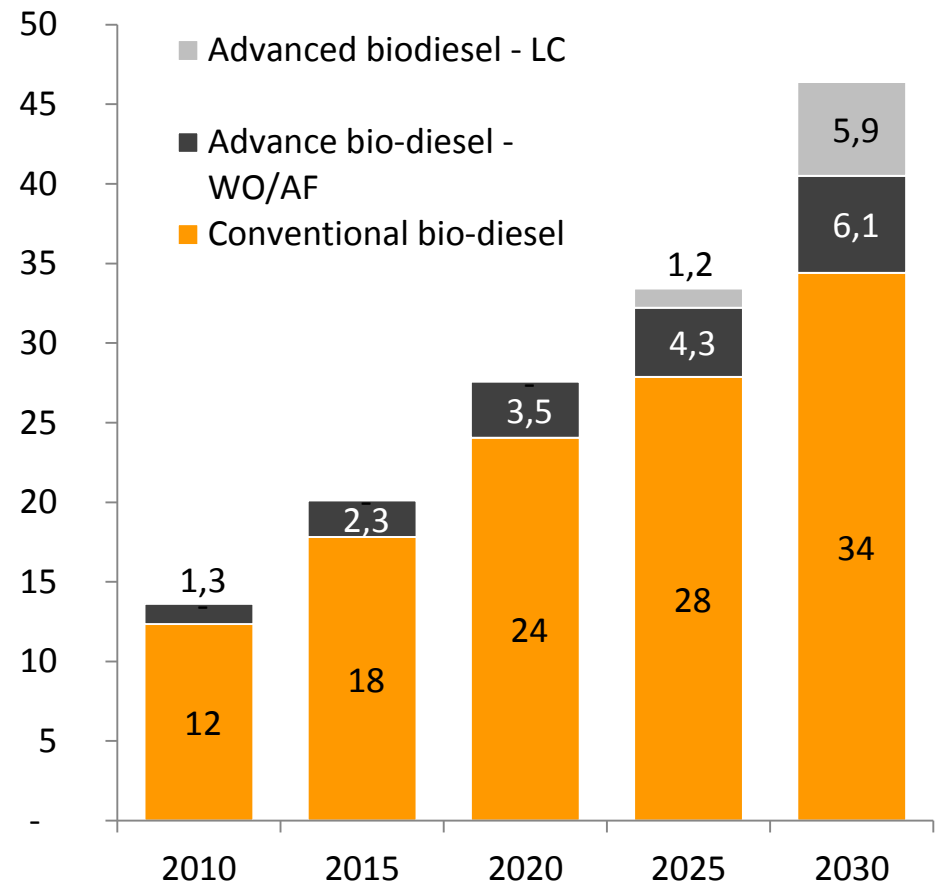
Advanced bio-diesel from waste oils & animal fats

- Produced from waste oils (cooking oils, etc.) or animal fats
- Drivers: no competition with food, limited potential

Advanced bio-diesel from ligno-cellulose

- Produced by using the ligno-cellulose portion of biomass (crop residues, and wood)
- Drivers: no direct competition with food, the technology is not yet mature, and the costs are still too high

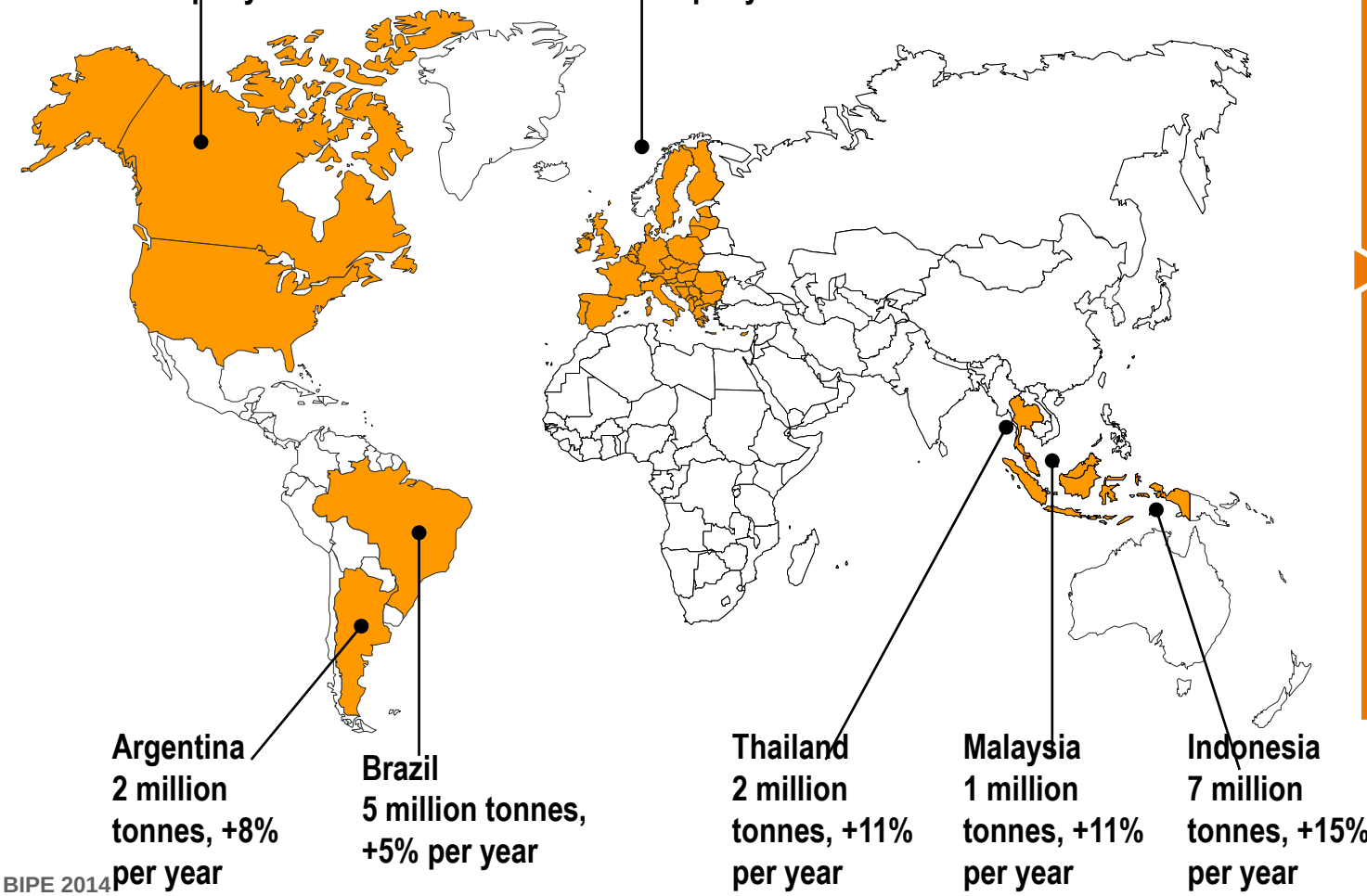
Worldwide bio-diesel technology penetration in 2030 (Mtoe)



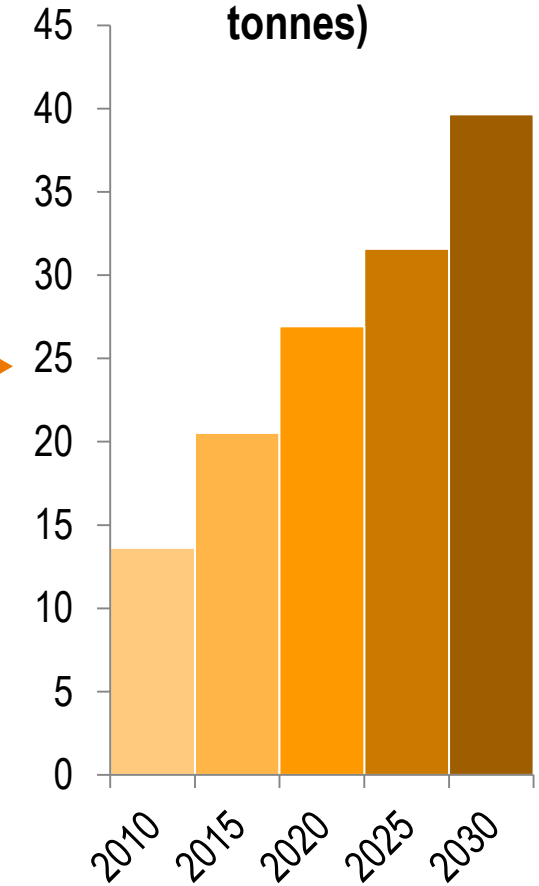
Source: BIPE

Growth in global demand for vegetable oils for the production of bio-diesel will primarily be driven by Asia and North America

Demand for vegetable oils for bio-diesel in 2030, and average annual growth between 2010 and 2030



Global demand for vegetable oils for bio-diesel (in millions of tonnes)

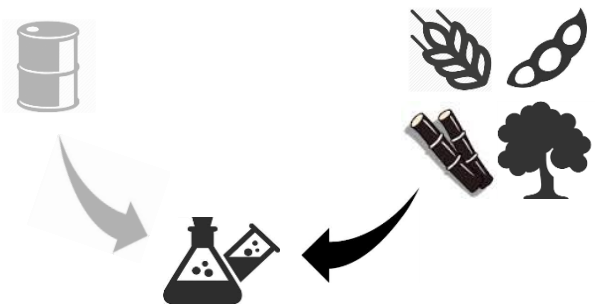


Source: BIPE

Vegetable oils as a way of responding to the development of renewable chemistry: a sector under construction against a background of steeply rising demand

What is it?

The production of chemical compounds, e.g. plastics from **carbon** that is no longer derived from fossil fuels, but **from renewable sources**.



Usable biomass:

- ✓ Starch (cereals, etc.)
- ✓ Sugar
- ✓ Vegetable oils
- ✓ Ligno-cellulose (wood, straw, etc.)

What are the challenges?

Sharply increasing **demand** for products from the chemicals industry, especially in developing countries.

A need to find **alternatives to fossil resources**.

Increasingly stringent **regulations** and **consumer** expectations in terms of the **environment, health, and chemicals**.

What are the opportunities?

A **sector under construction**, that boasts a strong research and development momentum. Synergy with bio-fuels (glycerine is a bio-diesel by-product)

Developing bio-sourced solutions:

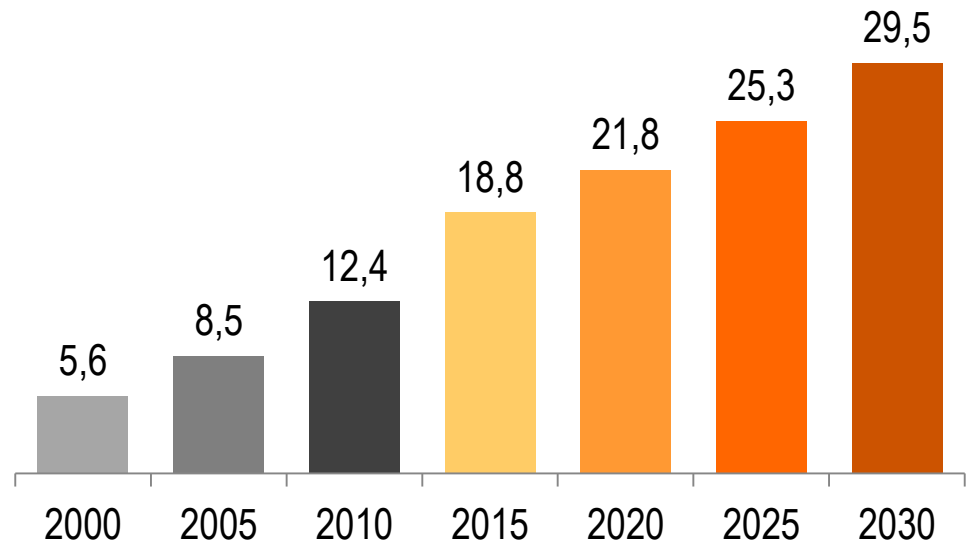
- ✓ To **copy existing fossil fuels**
- ✓ To open the way to **new molecules and functionalities**

Average growth in global demand for vegetable oils for the oleochemicals industry of 4.4% per year between 2010 and 2030

Examples of outlets for vegetable oils in the chemicals industry

Food processing, hygiene, detergents and cleaning products, cosmetics, plastic and rubber, paints and coatings, plant health, etc.

Vegetable oil demand for oleochemicals via long chains (in millions of tonnes)



2010-2030 trend:

+139% increase in demand in 20 years, i.e. +4.4% per year on average

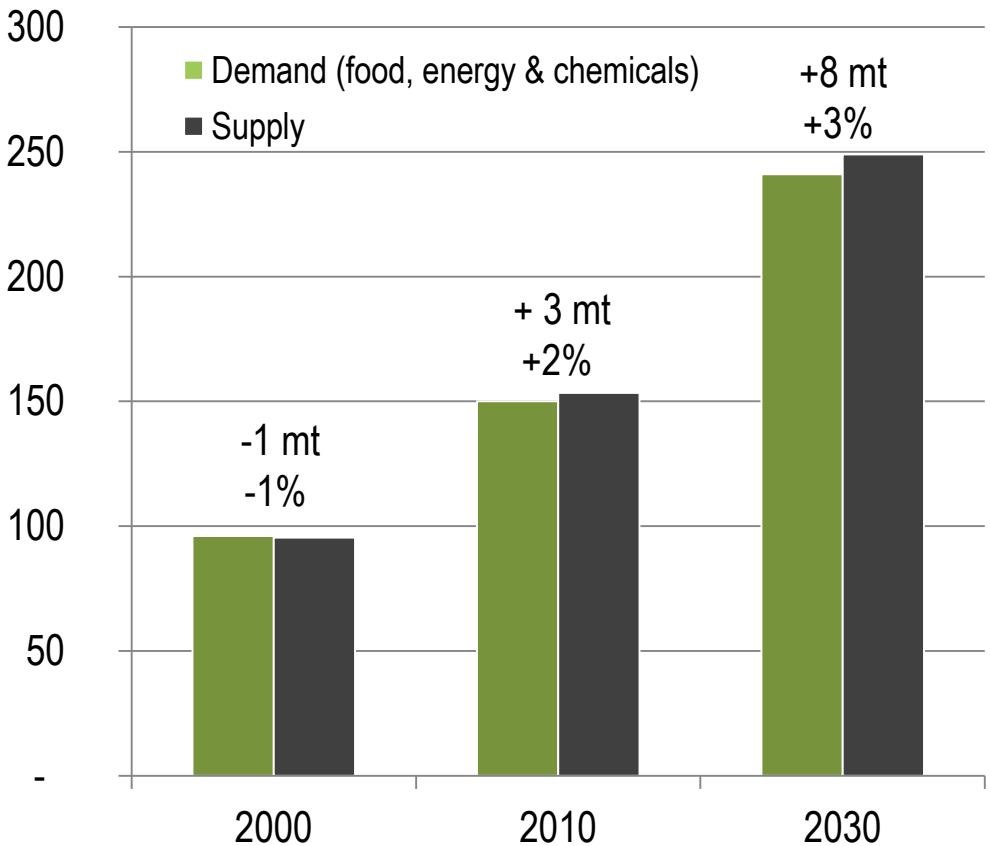
Note: vegetable oils produce long chains and glycerine, which are used in the oleochemicals industry. Glycerine is also a bio-diesel by-product. To avoid double-counting, only the vegetable oil for long chain chemicals has been added to food and energy demand.

The amount of glycerine from biodiesel production and long chains from the oleochemicals industry is and will remain higher than glycerine demand from the chemicals industry.

Source: BIPE

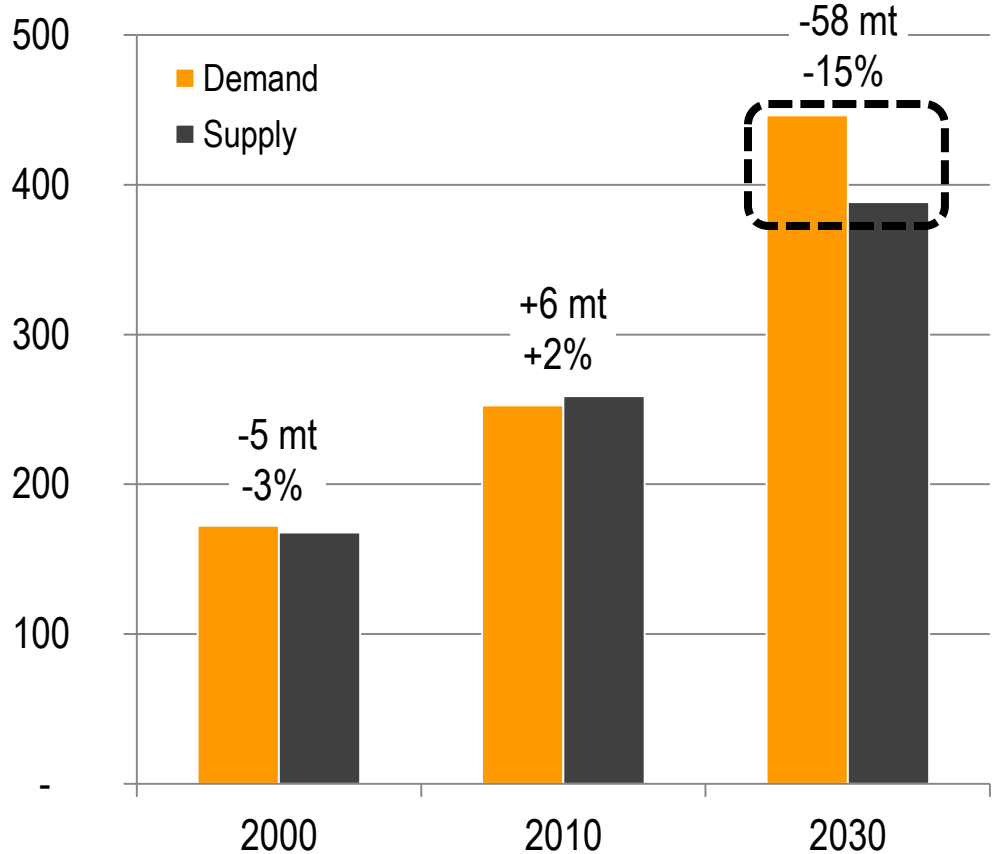
If the demand is not revised, when matched with supply it highlights an oil supply in excess of demand levels, but also a 58 million tonne oilseed meal shortfall in 2030

Demand for and supply of vegetable oils, with no restrictions on demand (in millions of tonnes)



Source: BIPE based on historical FAO data

Demand for and supply of oilseed meal, with no restrictions on demand (in millions of tonnes)

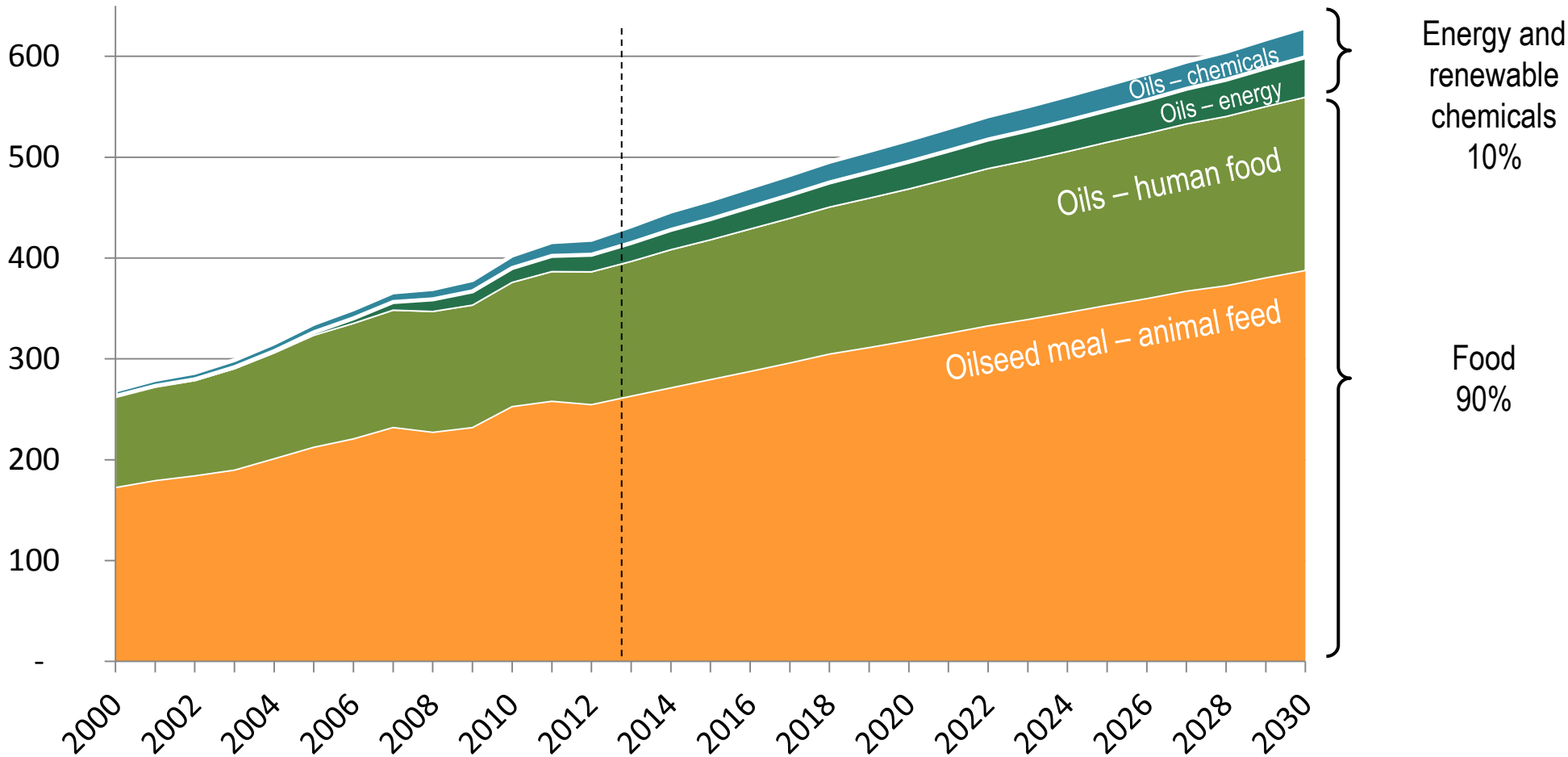


Source: BIPE based on historical FAO data

☛ **Towards restricted demand for meat**

The use of oilseeds in the food industry will account for 90% of worldwide demand for oils and oilseed meal in 2030

Worldwide demand for oilseed products (in millions of tonnes per year)



Source: BIPE

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