NET ZERO 2050

RESEARCH & INNOVATION FOR AGRICULTURE IN THE EU:

WHERE TO INVEST NOW FOR NET-ZERO EMISSIONS BY 2050

Strategic importance of decarbonising European agriculture by 2050:

- European agriculture accounts for nearly 10% of overall GHG emissions, emitting 464 million metric tonnes of CO_2-equivalent.
- GHG emissions from agriculture are below 1990 levels, yet reductions have slowed over the past decade. However, 39% of total agricultural emissions from European demand occur outside the EU.
- Europe has the second highest global rate of food losses and waste per capita totalling 280 kg/person/year.
- Agriculture, forestry and land use (AFOLU) are key contributors to overall efforts towards net-zero emissions in the EU, reducing own emissions and increasing net sinks.
- The EU Common Agriculture Policy (CAP) needs to recognise the knowledge-intensive benefits of agroecology, address the differences in the technologies available and production-reducing options for mitigation among regions.
- Changes in dietary habits toward more plant-rich diets are necessary. Current high consumption of livestock products is responsible for 90% of food-related methane and nitrous oxide emissions.

Investments in innovation are key to decarbonising European land use and agriculture

Innovation area	Priority areas for innovation investments
Society	Integration of consumer data into food production models and processes
Smart farming systems	Precision-agriculture through high resolution data
	Precision-fermentation to program micro-organisms to produce complex organic molecules
	Energy efficient electrification of machinery and appliances
	Multi-purpose cropping systems to regenerate of marginal/abandoned/degraded land.
Meat alternatives	Cell-based and plant-based meats
Eco-solutions	Sustainable organic fertilisers, biopesticides, mineral foliar applications, and anaerobic soil disinfestation
	Bio-based and biodegradable chemicals and materials
Waste	Conversion into regenerative bioproducts
	Capture and of CO_2 and clean digestate from biorefinery and bioenergy plants
	Transformative technologies to obtain high-quality compost
Land use	Soil organic carbon storage and ecosystem restoration
	Agroforestry and silvopasture techniques
	Reduced or zero-tillage technologies
Sector interconnection	Methods to take advantage of the interconnectivity of carbon, nitrogen and phosphorous flows

Case Study

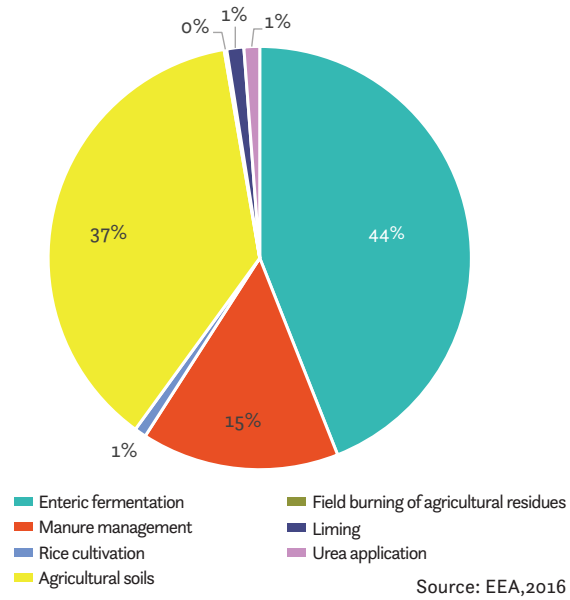
Developing new methods to make real meat in a sustainable, healthy and animal-friendly way

mosa meat

Founded in 2016, start-up Masstricht-based Mosa Meat is responsible for creating the world's first cell-based burger.

- **Mosa Meat production methods include taking some cells from an animal to then cultivate them in a growth medium containing nutrients and naturally-occurring growth factors to create meat. In essence, animal meat without the animal.**
- **The company can produce 800 million strands of muscle tissue from a single sample from a cow. That is enough to make 80,000 burgers.**
- **At present, Mosa Meat is working on creating a scalable production system, and intends to construct a pilot factory by 2021.**

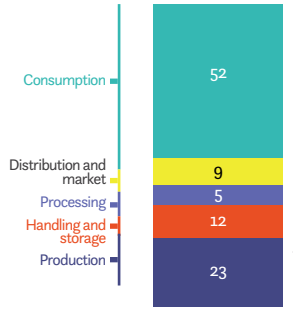
Percentage estimates of production-related GHG emissions from European agriculture

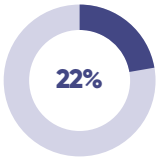


Source: EEA,2016

Where food loss and waste occurs along the food supply chain

Percentage of calories lost or wasted





Share of total food available that is lost or wasted

NOTE: Numbers may not sum 100 due to rounding. Data are for the year 2009

Source: WRI analysis based on FAO (2011)

"Training, innovation and co-operation will also be fostered, as these are key to ensuring the dissemination of innovative practices which can reconcile the needs for food at fair price and environmental and climate concerns."

Janusz Wojciechowski,
European Commissioner for Agriculture

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The agriculture sector can effectively support climate action

An emission reduction hierarchy may be necessary to direct and support actions across the sector. Approaches entail:

1. Avoid emissions in: Types of commodities produced, consumption of livestock and other carbon-intensive products. Elimination of food waste
2. Reduce emissions where they cannot be avoided through: Resource-efficiency production, lower per-unit GHG emissions of commodities, seasonal production
3. Recovery of emissions through: Carbon sequestration on agricultural land, and circular bioeconomies that reduce the need for new inputs

Demand side R&I priorities

- Through better planning and risk assessment, determine food waste and assess:
  - Crops needed;
  - Crops viable as climatic conditions change.
- Promote the circular bioeconomy to improve sustainability in the agriculture sector:
  - Ensure developments take place within ecological limits and don't pressure resources;
  - Deploy of carbon farming innovations;
  - Standards to reduce demand for GHG-intensive imports;
  - Initiate method to measure, report and price GHG emissions at the farm and eco-restoration levels.
- Spur dietary shifts through:
  - Development of meat and dairy substitutes;
  - Use consumer behaviour metadata to enable switch to locally sourced plant-rich diets.

Supply side R&I priorities

- Ensure a target-driven agriculture to:
  - Guarantee a proportionate contribution towards net-zero emissions;
  - Provide clarity on the boundaries of the ecosystem services.
- Internalisation of climate related impacts into the cost of food commodities and products.
- Include sustainable forest systems for the substitution of emissions-intensive products.
- Jumpstart the bioeconomy by facilitating supply and use of renewable energy, agricultural by-products, wastes, residues and other non-food raw materials.
- Increase energy efficiency in farm equipment.
- Rely on artificial intelligence to deliver improved and shorten supply chains to reduce food storage and spoiling.
- Promote agroforestry in rural development programmes.
- Promote nitrification technologies and strategies.

R&I investments need an aligned policy environment to decarbonise agriculture

1. Define synergy measures and practices under the 2020 EU CAP that help achieve climate goals and provide clarity to investors, farmers and policy makers
2. Develop appropriate inputs for agroecology, and increase adoption rates of credit & technology packages for land sharing and land sparing
3. Base carbon farming schemes on results to avoid emissions and sequester carbon
4. Develop standards for monitoring GHG embedded in international trade of agricultural goods, and plurilateral trade agreements that reward low-carbon producers
5. Identify clear mitigation potential estimates and increase understanding of the scale of unavoidable emissions
6. Initiate a carbon tax for cheaper imported goods due to lesser climate requirements
7. Align EU climate finance with farmer adaptation practices, avoided deforestation policies, and uptake of productivity-enhancing technologies

Case Study

Robots on the farm: Precision agriculture at European hazelnut orchards

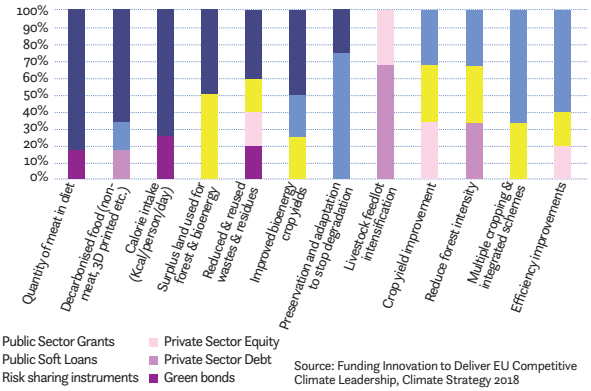
PANTHEON SCADA for Agriculture

Thanks in part to a Horizon 2020 grant that helps fund a consortium called Pantheon, these are the newest additions to life on a European hazelnut orchard.

Launched in 2017, Pantheon – which includes a handful of universities and industrial partners from Italy, Belgium and Germany – is building an integrated farming system that uses unmanned aerial and ground robots. These robots move through and above orchards to collect data and perform typical farming operations like pruning.

By collecting data and feeding it into a central computer, the technologies and methods Pantheon is developing can help automatically adjust irrigation levels and aid agronomists in making more data-backed decisions. This has the potential to improve energy efficiency, lower water usage and increase orchard yields.

Finance Instruments needed to decarbonise EU AFOLU according to expert survey



Source: Funding Innovation to Deliver EU Competitive Climate Leadership, Climate Strategy 2018

Participant Institutions:

CLIMATE & STRATEGY PARTNERS

E3G

This report has been commissioned by the European Climate Foundation (ECF). It is part of the Net-Zero 2050 series, an initiative of the ECF with contributions from a consortium of experts and organisations. The objective of Net-Zero 2050 is to start building a vision and evidence base for the transition to net-zero emission societies in Europe and beyond, by mid-century at the latest. The Paris Agreement commits us to making this transition, and long-term strategic planning shows that many of the decisions and actions needed to get us on track must be taken imminently. With acknowledgement of the source, reproduction of all or part of the publication is authorised, except for commercial purposes. For more information, please contact Erica Hope, Erica.Hope@europeanclimate.org