

Introduction

The energy, transport and primary production sectors are the cornerstones of economic and social life in every country. Although different, these three sectors are closely linked and function as a coherent system.

The Energy

Energy is the ability to produce work. It is necessary for the operation of economic activities, machines, infrastructure and transport.

Energy Categories:

- Primary energy: produced directly by nature (sun, wind, waterfalls, natural gas, lignite).
- Secondary energy: derived from the processing of primary energy (electricity, biofuels, heat).

Energy is needed for the production of goods, transport, heating/cooling, food storage and processing, and infrastructure support.

The combination of smart grids and storage enables more sustainable and efficient use of energy across the whole spectrum from production to distribution.

Smart grids are electricity systems that integrate information and communication technologies to intelligently manage energy demand, generation and distribution. They help to ensure grid stability, reduce losses and integrate renewable energy sources.

Energy storage is critical for managing the volatility of renewables and for energy autonomy. Storage technologies include lithium batteries, hydrogen systems and pumped storage.

Energy in Primary Production

Primary production includes agriculture, livestock, fishing, forestry and mining. All these activities consume energy, mainly in the form of fuel and electricity.

Energy-intensive procedures:

- Agriculture: Machinery, irrigation pumps, greenhouse lighting and heating.
- Livestock farming: Heating, feeding, cooling.
- Fisheries: Fuel for boats, electricity for refrigerators.

- Mining: Excavators, pumps, transport equipment.

The primary sector is not only a consumer of energy, but can also produce energy through:

- Biomass: Crop residues, wood, manure → biogas or thermal energy production.
- Biofuels: Crop such as sunflower and rapeseed → biodiesel production.
- Renewable Energy Sources (RES): Photovoltaics, wind turbines, geothermal energy.

New technologies such as smart grids and energy storage allow for more stable and efficient energy management.

Smart grids allow farmers to monitor and regulate the energy consumption of their installations (greenhouses, irrigation pumps, refrigerators), harness energy from photovoltaic panels and sell surplus energy back to the grid.

Storage allows energy to be used when it is most needed (e.g. at night, during peak periods), improving system stability and reducing costs. It is also used to charge electric farm equipment and vehicles.

Energy and Transport

Transport is directly dependent on energy. Vehicles, ships, planes and trains need fuel or electricity to move.

Types of transport energy:

- Oil/Gasoline: Trucks, cars, buses.
- LNG και fuel oil: Ships.
- Electricity: Electric trains, cars.

Transport and Primary Production

Transfers are necessary for the:

- Distribution of agricultural products.
- Transport of raw materials and supplies.
- Export of products to international markets.

Increases in energy prices directly affect transport costs and the price of finished products.

The cycle of interdependence

The relationships between the three sectors are cyclical and bidirectional:

- Energy enables the production and transport of goods.
- Production depends on the distribution of goods.
- Transport requires energy resources.
- Production can provide energy through biomass or renewable energy sources.

For example, a greenhouse:

- It uses energy for heating and lighting.
- Products are transported by trucks to urban centers.
- Crop residues are processed for biomass.

Energy is the link between production and transport. Primary production needs energy and can contribute to its production. Transport is vital to the economy and relies on energy. No production is possible without energy, no energy can be harnessed without transport and no society can progress unless these three sectors work together.

Description

The mission of the teams is to build and program autonomous robots that will be able to help people respond to the Global Trends and Challenges in terms of production and transport of products in relation to the cost of energy required, but also the environmental impact of the interdependence of all three sectors.

Global Challenges

- Increasing Energy Demands
 - Use of robots and automated systems increases energy consumption.
 - Global demand for energy leads to energy crises.
- Environmental Impacts
 - Transport and industry contribute to climate change through CO₂ emissions.
 - Pollution from mass production and overexploitation of natural resources.

Global Trends

- Automation and Robotics in Production
 - Robots that seed, water, harvest.
 - Automated machines in livestock and fisheries.
 - Use of drones and Artificial Intelligence in crop monitoring.
- Robotic Systems in Transport
 - Autonomous trucks, transport drones.
 - Robotic storage systems and smart logistics.
- Transition to Renewable Energy
 - Solar, wind and bioenergy in agriculture and transport.
 - Efforts to reduce dependence on fossil fuels.
- Globalization of the Supply Chain
 - Products are moved over long distances with complex transport networks.
 - Development of international markets and trade routes.

General Rules

The game will be played with 2 variations:

- A simpler one (**Beginners**), aimed at beginner students
- A more difficult one (**Advanced**), aimed at students who want to compete in the **WRO 2026 World Robot Olympiad**. This category is divided into three age groups, the boundaries of which are listed below.

Team Definition and Age categories:

1. A team consists of 2 or 3 students.
2. A team is led by a coach.
3. A team with one team member and a coach is not considered a team and cannot participate.
4. A team may only participate in one of the beginner or advanced categories.
5. Each student may participate in one of the beginner or advanced categories.
6. The minimum age of a coach is 18 years old.
7. Coaches may work with more than one team.
8. The age groups in **the beginner's category** are:
 1. Students 8-16 years old (in the 2026 season: birth year 2010-2018)
9. The age groups in **the advanced category** are:
 1. **Elementary**: Students 8-12 years old (in the 2026 season: birth year 2014-2018)
 2. **Middle School**: Students 11-15 years old (in the 2026 season: birth years 2011-2015)
 3. **High School**: Students 14-19 years old (in the 2026 season: birth years 2007-2012)
10. The maximum age reflects the age of the participant in the calendar year of the race, not his/her age on the day of the race.