

Innovative biomaterials

We are living in an era in which biotechnology and many new materials are being developed due to the intense research being done in this field. Replacement of non-renewable materials by renewable options brings about new business opportunities and product concepts. It is increasingly important to enter the constantly changing market to take full advantage of the new discoveries in biotechnology.

Research into **biomass-based materials** • has been a major area of focus for more than ten years, along with the continuous development in biotechnical methods to produce value-added products, including bio-based polymers for paper and natural fuels for energy production.

Biomaterials for energy production

Due to declining fossil fuel stocks, the need to protect the environment and our increasing energy demands, science and technology have had to find alternative energy resources. Currently, biomass and food waste are considered the ideal renewable **feedstock** for the production of fuels all over the world. These renewable materials are used for the production of biopolymers, bioplastics and bioethanol.

Biomolecules such as peptides and proteins are under research to create new nanomaterials to improve the efficiency of photovoltaic energy devices such as solar cells and other electronic devices. **Bioproteins** can also be used for non-biological material applications. Biomaterials have also been used as materials for electrodes in rechargeable lithium batteries • because the nanostructure of these materials **enhances** their electrochemical activity, thereby improving battery performance.



Forestry residues

Forest biomass

Renewable composite materials can be produced using forest biomass from healthy forests too. Small trees and other forest biomass can be processed directly in the forest, turning them into small solid pieces of wood such as **strands**, **flakes**, chips, particles and fibres that can be used to make composite products for the construction industry, such as laminated **lumber**, **plywood**, structural composite lumber and moulded materials. Forest biomass can also be combined with other resources to make new materials; taking advantage of the unique properties of each resource. Non-construction composites can also be created, such as geotextiles, filters, packaging and nano-materials.

delay: *ritardo*

to enhance: *migliorare*

feedstock: *materia prima*

flake: *fiocco*


lumber: *legname*

plywood: *compensato*

strand: *filamento*

Biomass is a renewable organic material that comes from plants and animals. It contains stored chemical energy from the sun.

Lithium batteries are widely used in portable consumer electronic devices and in electric vehicles ranging from full sized vehicles to radio controlled toys.

4  **PAIR WORK** Look at the chart below and describe the data following the prompts.

How Electricity is Generated: Country Comparison

	USA	UK	ITALY
Population (million)	321	64	62
Annual consumption, kwh (billion)	3832	319	303
From natural gas	30%	30.2%	34%
From solar	1%	1.2%	9%
From hydro	7%	1.8%	22%
From nuclear	20%	19%	0%
From biomass	2%	6.8%	10%

- What is the annual consumption of energy (kWh) in the USA, UK and Italy?
- What is the percentage of the consumption of solar energy in the three countries?
- Which country has the highest consumption of energy from natural gas?
- Why is there no consumption of nuclear energy in Italy?
- Which country has the lowest use of biomass as an energy source?
- What is the source of “hydro” energy?

2  Read the text and fill in the gaps with the given words.

human • heating • combustion • power • variety • material • generate • digestion • methods • gas

Biomass for Electricity Generation

Biomass is used for heating, electric **1.** generation and combined heat and power. The term biomass includes a large **2.** of materials, including wood from various sources, agricultural residues and animal and **3.** waste.

Biomass can be converted into electric power using several different **4.** The most common is the direct combustion of biomass **5.**, such as agricultural waste or woody materials. Other options include gasification and anaerobic digestion. Gasification produces a synthesis gas by **6.** the biomass with less oxygen than is necessary for complete combustion. Anaerobic **7.** produces a renewable natural **8.** when organic matter is decomposed by bacteria in the absence of oxygen. Different methods work better with different types of biomass. Typically, woody biomass such as wood chips and pellets are combusted or gasified to **9.** electricity. Corn and wheat residues are compressed for **10.** or converted into a gas using anaerobic material-handling equipment.

Adapted from: <https://www.wbdg.org/resources/biomass-electricity-generation>

3  Answer the questions.

1. Why is the development of biotechnical methods so important?
2. Why do science and technology have to find alternative energy sources?
3. What are biomolecules used for?
4. Why have biomaterials also been used as electrode materials in lithium batteries?
5. How can renewable composite materials be produced?
6. How can small trees and forest biomass be processed and used?