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PlasticsEurope
Association of Plastics Manufacturers

Renewable Energy – the power of the elements

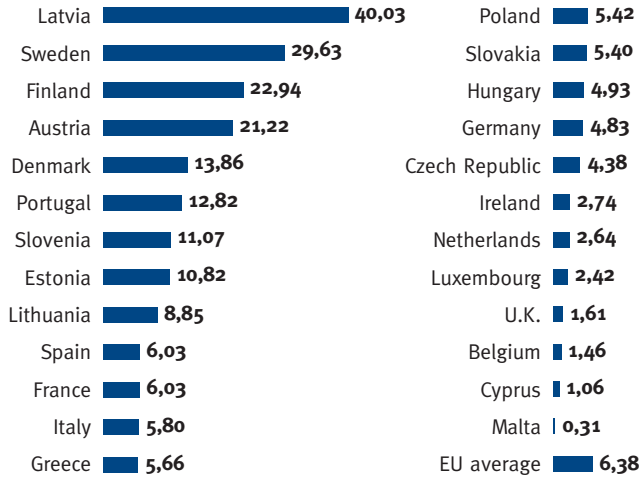
Plastics
The Material for the 21st Century

Tapping new energy sources with polymer materials

It is becoming increasingly important to provide the global population with clean and efficient energy. Plastics are indispensable when it comes to generating electricity. Polymer materials are used for the production of rotor blades for wind turbines and for pipes that feed hydroelectric power stations, but they are also found in the diaphragms of fuel cells or in biomass storage tanks. Plastics are the basic material for solar cells, collector boxes and pipe insulation and as such they open up new ways of generating energy in applications such as photovoltaics. Last but not least, the electricity thus produced flows in cables covered with a plastic sheathing.

Europe has a leading role in tapping new sources of renewable energy. At their summit meeting in March 2007, Europe's Heads of State and Government agreed that all twenty-seven EU member states are to significantly increase the share of renewable energy in their overall energy balance by 2020.

Share of renewable energy in the primary energy consumption of the European Union in per cent. As at 2005



Source: EU commission

Tapping solar power, ...

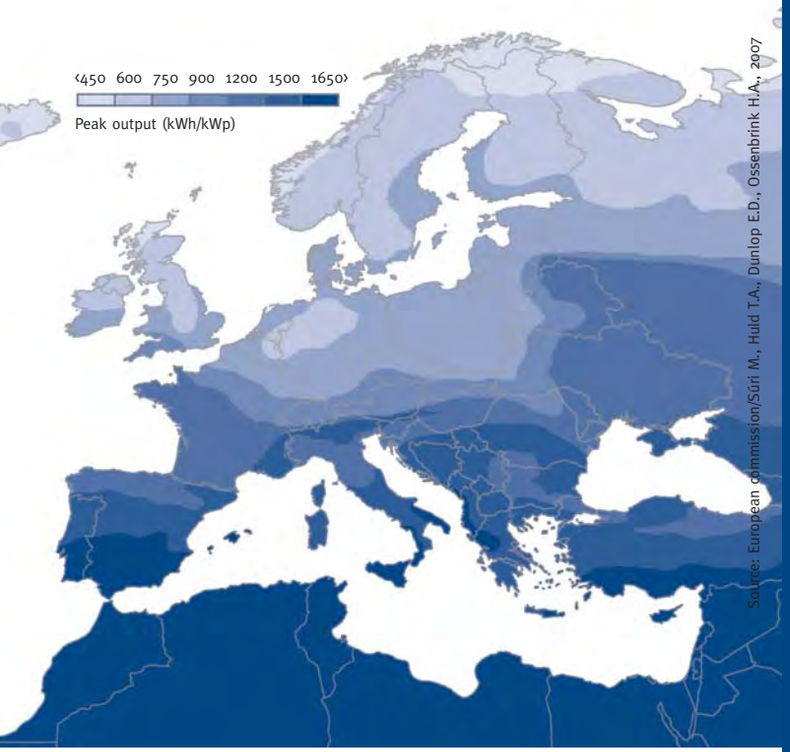
Not only has the production of wind turbines for power generation been booming, photovoltaic applications are also on the advance. According to a study conducted by Greenpeace, solar energy can become the power source for up to two billion people within the next twenty years. The European Photovoltaic Industry Association (EPIA) expects the global photovoltaic market to grow at an average of 37 % every year by 2010 alone.

... providing it for day-to-day use ...

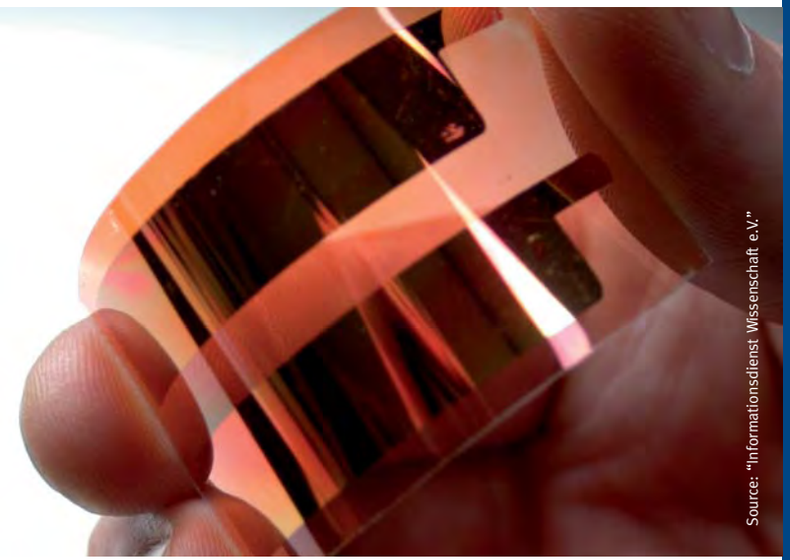
Solar modules made from plastics are already suitable for series production and day-to-day deployment. The most frequently used types are laminate structures combining plastic film with glass. They are used for applications such as solar roof panels for covering inclined roofs, cladding or UV-protection elements.

... and relieving the burden on the environment

In future, plastics-based solar cells may be used for applications such as the power supply for mobile electronics, power-generating clothing or in flexible roll-up solar panels. The potential of environmental solar power using plastic components is far from exhausted.



Solar power generation potential in Europe



Würzburg University, Germany, is one of many conducting research into flexible solar cells made from plastics as an innovative material for power generation.

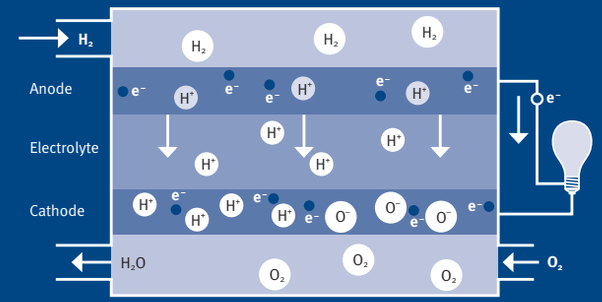
The fuel cell – the steam engine of the 21st century

Fuel cells convert hydrogen and oxygen into electric power, heat and water and can be used wherever electricity is required: in the household, in civil protection, for the efforts of police and fire brigade as well as for power and propulsion systems for boats, cars, lorries and buses. The revolutionary impact of the fuel cell on 21st century power supply is expected to be on a par with that of the steam engine during the period of industrialisation.

Plastic membrane as an electrolyte

A plastic membrane inside the fuel cell separates hydrogen from oxygen. Without this separation, the two elements would react with each other and produce water. At the anode, the hydrogen electrons and protons are separated by means of catalysis. The protons are conducted through the membrane to the cathode, but the electrons are forced to travel in an external circuit via electrically conductive electrodes to the cathode. On the cathode catalyst, hydrogen molecules react with the electrons and oxygen to form water. The circuit is closed. The electric current flows as long as hydrogen and oxygen are supplied at the anode and the cathode.

Functional principle of a fuel cell



H_2 = Hydrogen molecule, **H^+** = Hydrogen ion, **O_2** = Oxygen molecule, **O^-** = Oxygen ion, **H_2O** = Water
e^- = Electron
Source: Initiative Brennstoffzelle

An important contribution to the protection of fossil fuels

Polymers in fuel cells all over the world make an important contribution to the long-term sustainability of a reliable energy supply and protect nature and the environment. Because fuel cells are highly efficient, low in emission, low in noise and low in maintenance.

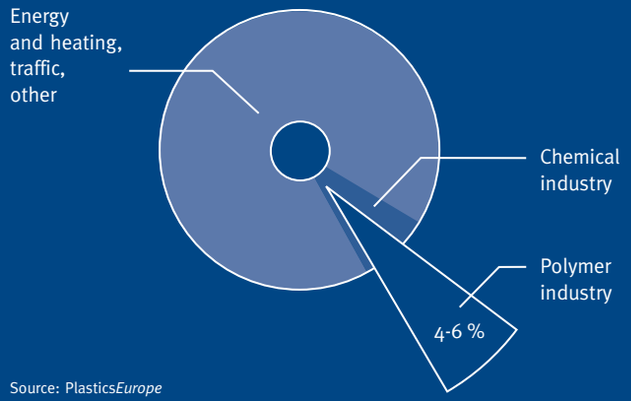
mobile	stationary		portable
cars lorries buses	public power supply	minor consumption	notebooks mobile phones etc.
other vehicles	industrial power supply	domestic energy	emergency power camping etc.

Fuel cells supply energy for stationary, mobile and portable applications.
Source: ForschungsAllianz BrennstoffZellen Baden-Württemberg

Plastics save energy.
Plastics protect the climate!

- Plastics production consumes only a small amount of raw material. As they use up only between 4 % and 6 % of the total amount of crude oil and natural gas consumed, plastics have a relatively low demand.
- Plastic products have a long service life, high wear resistance and the energy consumed for their development is fairly low.
- The production of plastics is straightforward and cost-efficient.
- Plastics are lightweight: compared with many other materials such as glass, metal or ceramics, they save a significant amount of weight.
- Plastics are stored energy. The energy used for heating, for example, is irretrievably lost: the energy stored in the plastic product can be re-used for generating heat power in combined heat and power stations as well as for many other industrial processes.
- In many applications, plastics contribute to saving energy.

Crude oil and natural gas consumption in Western Europe



Source: Plastics*Europe*

Use little energy for the production of plastics.
Save a lot of energy by using them!

The global population is growing and the demand for energy is rising proportionately. Fossil energy sources however, are by no means inexhaustible. A heightened awareness of environmental concerns demands a new approach and new ideas. Therefore, European research is focussing on tapping and using regenerative energy sources.

Plastics open up new ways of generating energy and protecting our climate. Used in solar energy or in fuel cell engineering, polymers are the material of the 21st century, because that is what laminate structures and membranes are made of. These components

- help generate an electric current from solar energy alone. The more regenerative the source of energy, the longer our resources will keep us supplied.

- do not emit any pollutants when used in applications such as the fuel cell. As a regenerative energy source they have basically no impact on the climate; for without Co_2 emissions also greenhouse effects are being reduced.

As polymers help tap regenerative energy sources, they save a lot of oil – in every solar power system, in every fuel cell. Only about 4 % to 6 % of Europe's total consumption of crude oil and natural gas is used for the production of plastics. These polymers help generate energy with innovative methods and also help save energy.

Use a little energy for the production of plastics.
Save a lot of energy by using them!

Plastics – think differently about energy

Saving energy, protecting resources, securing the future

The leaflet *Renewable Energy – the power of the elements* is part of a series of information brochures and leaflets on energy published by Plastics*Europe*.

Also available:

Brochure
Plastics – think differently about energy
Leaflet
Mobility – how to make travelling easier on the environment
Construction and Housing – perfect climate protection for houses and apartments
At Home – making people's lives easier. And Nature's, too.
Packaging – the best protection with less and less material