

# The enviro-engineers

*Professor Czeslawa Rosik-Dulewska, from the Polish Academy of Science, describes how environmental engineering takes a multidisciplinary approach to tackling green issues...*

One should be aware that the complete elimination of the negative impact of human civilisation on the biosphere is not possible. Nevertheless, certain actions that will mitigate the negative anthropogenic effects can be taken, and this is where environmental engineering has a vital role to play. Environmental engineering is a scientific discipline using engineering methods, and thus its development is based on technologies, natural sciences, jurisprudence and economics. It establishes principles of rational natural resource management, as well as forecasting, evaluation, prevention and remediation of the results of human activity.

What is more, environmental engineering creates proper technological conditions and methods that help to maintain the natural environment and restore the balance disturbed by environmental disasters, the improper exploitation of minerals, business activity, etc.

By its nature, environmental engineering is included in issues involving sustainable development, which – strictly tied with the wellbeing and satisfaction of the basic needs of both the present and future generations as an inherent part of ecosystems – is a principle of superior importance. Therefore, environmental engineering and the protection of the environment have a great influence on human health through their role in the elimination of environmental hazards. Scientific research in the field is a response to the environmental problems. It generally concerns air protection, waste disposal, water supply and sewage management or reclamation of degraded areas. It also develops necessary methods and technologies.



Environmental research and its implementations are interdisciplinary. Directly related to the eco-problems, they employ knowledge from basic sciences such as biology, biochemistry, chemistry and physics. This allows for assessment of the level of pollution in the hydrosphere, atmosphere and lithosphere, (ie. in all components of the environment) and for the finding of proper solutions.

Environmental engineering develops and applies methods for forecasting the state of the environment involving mathematical modelling and managing of data on the current state of the environment.

The main objectives of environmental engineering and protection include:

- **Water and Sewage Treatment:** water treatment for municipal and industrial purposes, technologies for water recovery from sewage, integrated methods for the removal of nitrogen, carbon and phosphorous compounds, the use of new filtering materials, and the optimisation of waterworks and sewage systems;
- **Hydrology and Water Management:** assessment of water resources and their variability, the description of extreme hydrological phenomena (including floods and droughts), modelling of hydrological processes, planning protection against floods, water management, assessment of the environmental impact of water reservoirs and silting processes;
- **Waste Neutralisation:** the modelling and management of systems of waste neutralisation, utilisation and recycling;



*Environmental engineering helps restore the balance disturbed by human activity and natural disasters*

- **Air Protection:** the application of hi-tech methods for the reduction of air pollution, identification of combustion byproducts and the observation of photochemical smog;
- **Thermal engineering:** thermodynamics and heat transfer, alternative sources of energy, hi-tech energy processing technologies, heat engineering systems, modelling of heat transfer in buildings;
- **Air-conditioning and ventilation:** projecting of air-conditioning and ventilation systems and appliances, forming indoor microclimate with simultaneous reduction of energy demand, thermal energy recovery;
- **Bioremediation:** using microorganisms to treat water, soil and air, bioindication of environmental poisons;
- Control of noise and vibrations in the human habitat;
- **Design guidelines:** domestic and industrial wastewater treatment plants, landfills, waste neutralisation plants, water intakes, pump stations, waterworks and sewage systems, reservoirs, protected zones of water intakes, hydrotechnical development of catchment areas;
- Mathematical modelling of water, sewage and gas migration in the environment and their purification processes.

There are 25 universities of technology and natural sciences and at least five scientific institutes in Poland developing the theory and practice of environmental engineering. Students are educated according to the actual needs of the

job market in order to solve practical environmental problems. Several thousand scientists and engineers work in Poland in the field of environmental protection, and some of the work of Polish researchers is conducted in co-operation with foreign scientific institutions. Such broad co-operation allows for comprehensive problem-solving and facilitates better recognition of the social, economic and legal mechanisms that shape relations between humans and the environment.

The conclusion to be drawn concerns environmental engineering as well: ensuring sustainable development depends on our knowledge and awareness of how ecosystems and geosystems work, and on our ability to carry out research and take actions to mitigate the negative impact of human civilisation on the environment.



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