Airborne Particles Kill

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Research strategy for progressive environmental technology

Environmental technology is an area where Sweden has good opportunities for development and growth. But in order to meet competition globally, Swedish companies and researchers must cooperate. And research ought to be interdisciplinary and consider entire systems, not only individual products.

This good advice is stated in the Swedish research strategy for environmental technology which Formas and Vinnova have jointly drawn up. In the spring, a joint call will be made for new applications for research and development funds. Around MSEK 45 is to be invested over the period 2007–2008. The intention is that the business community should commit the same funds and that small and medium companies should participate.

In the research strategy a broad definition of environmental technology is given: "Environmental technology comprises products, systems, processes and services which provide clear environmental advantages in relation to existing or alternative solutions, seen in a life cycle perspective." This definition is fully in line with the definition of environmental technology in the EU ETAP (Environmental Technologies Action Plan). The intention is to move the focus from products to entire systems, resource efficiency and sustainable development.

The research strategy proposes that investments in the field of environmental technology should concentrate on areas where Sweden has special expertise. These are spatial planning, transport for a sustainable society, energy technology, environmental protection, bioresources, and advanced lightweight materials. Social science research that provides knowledge on needs, markets and user preferences is also to be included.

There is great interest in environmental technology on the part of the business community and the authorities. For example, Sweden is among the best in managing emissions and toxic compounds in products and industrial processes. But the Swedish innovation system also has weaknesses. The domestic market is small, and most companies in treatment technology, refuse management and renewable energy are small.

To strengthen environmental technology, what is therefore needed is cooperation, foresighted initiatives by the government, public procurement that takes account of environmental performance, and support for research and development. ●

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Airborne particles kill

By Mats Bohgard and Erik Swietlicki

At least 100,000 people in Europe and 5000 in Sweden die prematurely every year after they had been exposed to polluted airborne particles. This is shown by the most recent estimates.

Methods for assessing the significance of traffic and energy production for the environment and health are improving. This was stated at a network symposium on particles from road traffic and from the combustion of biofuels that was held last autumn at Lund University. During the symposium, computer models from the Swedish Meteorological and Hydrological Institute SMHI were presented; using these models, environmental departments of local authorities can assess the effects of traffic emissions and biomass combustion. A new measuring instrument which makes it possible for the uptake of particles by humans to be measured was also presented (see p. 6). The results of various toxicological and epidemiological studies were also reported. We are beginning to acquire good knowledge about emissions and the properties of the particles that are emitted.

There is no doubt that the particulate content of the air is of great importance for public health. Vehicular traffic and combustion in conjunction with energy production are significant sources. In Sweden, a large proportion of the mass concentrations in the urban street environments come from the abrasion of carriageways by studded tyres. A relatively large proportion of particles come from other countries.

Keep an eye on nanoparticles

Although we know much more today about sources and the effects of airborne particles, there is still a lot we have no answer for. For example, the regulations concerning environmental quality consider only the mass concentration of particles. There is however good reason to believe that particles from different sources pose different risks and that newly produced particles are more toxic than those that have been transported in the air for a long time.

The mass concentration units PM2.5 and PM10 (the total mass per cubic metre of air that is smaller than 2.5 and 10 micrometres respectively) are fairly coarse units in view of the complexity of particle composition. In step with developments in engine technology, treatment technology, combustion technology and fuels, the significance of these PM units will change due to the changes in chemical composition, particle size and shape.

Nanoparticles which normally contribute very little to the total mass (and therefore have little influence on PM values) are attracting increasing attention. There are studies which show that these very tiny particles can cross the air-blood barrier of the alveoli, and that they can cross the blood-brain barrier.

Vehicle exhausts and the abrasion of carriageways by studded tyres emit polluted particles which affect human health. Today there is no doubt about the relationship between the particulate content of air and public health. Photographer: Lasse Pettersson/Greatshots.

Measuring techniques

To deal with these problems and to reduce morbidity/mortality due to exposure to particulate matter, radical measures are needed at a number of levels in society. We need technological development, more precise environmental quality codes and other measures at societal level with regard to energy and traffic planning and other physical planning.

There is also a need for continued interdisciplinary research in order to maintain, and create, a good basis for these measures. What is needed are

- Knowledge of atmospheric physics and chemistry which are of fundamental importance for understanding.
- New measuring techniques that provide reliable characterisations relevant to health and environment.
- Research into the relationship between exposure and health effects is also important (epidemiology and toxicology).
- Fundamental technical research into combustion, thermodynamics, material technology of road surfacings and tyres, internal combustion engines, fuels, wood burning boilers, etc.
- Research at societal level into traffic systems, attitudes and behaviours, the effects of regulations and codes, risk communication, etc. ●

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Further reading:
A summary of the network symposium and all papers can be found on the website http://www.fysik.lu.se/eriksw/natverket2006/lund-natverket2006.htm

Facts

Network symposia at Lund University are held to give researchers, development engineers, research administrators and the authorities the opportunity to meet and exchange experiences concerning the health and environmental effects of the energy and transport sectors.