



European
Commission

**21st European Forum
on Eco-innovation**

Eco-innovation for air quality

**Key messages and
summary of the event**



***5–6 February 2018
Sofia, Bulgaria***

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1. Introduction

The 21st European Forum on Eco-innovation, co-organised by the European Commission (EC) and the Ministry of Environment and Water from the Republic of Bulgaria, took place under the auspices of the Bulgarian Presidency of the Council of the EU and, therefore, addressed a rising political priority for both Brussels and Sofia.

The Forum's focus was on eco-innovations that play a key role in addressing air quality issues by providing cleaner technologies and new business and governance models based on more scientific knowledge and effective monitoring.

Europe's air quality has improved over time but, at the same time, it continues to give cause for severe concern: the European Environment Agency (EEA) estimates that more than 400000 premature deaths occur each year in the EU due to air pollution and poor air quality.

The EU is tackling air quality using a number of measures, such as new national emission ceilings and low-emission mobility proposals, the Energy Union, reform of the Common Agricultural Policy, and new air pollution limits for large combustion plants. It also dedicates substantial EU funding to projects to reduce air pollution.

Strong regulations and enforcement are crucial to driving action, and also for the further development and deployment of new solutions. Member States are obliged to monitor and assess ambient air quality, comply with air quality standards and make sure that information on air quality is made public. The persistent breaches of air quality requirements are also being strictly followed up by the European Commission. Bulgaria has made air quality one of the priorities of its EU presidency. It is placing special emphasis on air pollution from solid fuel domestic heating, the main source of emissions of particulate matter in Bulgaria.

Eco-innovations are vital to addressing the air quality challenge. They can create cleaner technologies, inspire new business models and jobs, make policy more (cost-)effective, and improve scientific knowledge and monitoring. Their socioeconomic benefits can be considerable.

In Sofia, a record number of participants (over 500, more than twice the Forum's usual number) came together to discuss how to promote eco-innovation and improve air quality in energy, transport and agriculture.

Participants had the opportunity to give their views on how EU, national and local air quality and eco-innovation policy could be improved. 37 case studies were presented (see the full list on page 8 and 14). Municipalities, companies and other experts discussed new technologies, businesses and governance models, with a view to accelerating their deployment across Europe.

The transport, energy and agriculture sectors were identified as major sources of air pollution, and the Forum participants had the opportunity to share successfully introduced new technologies and innovative business and governance models that address local, regional and national air quality issues in these sectors. Air pollution from domestic solid fuel heating, and the measures to curb it, received special attention from the participants. The case study presentations demonstrated that, beyond its environmental benefits, eco-innovation also contributes to a more competitive and high-tech economy, new market opportunities and higher employment.

During the Forum participants paid special attention to the main mechanisms for financial support (Horizon 2020, SME Instrument, LIFE Programme, EU Funds for Competitiveness) and the existing opportunities for the transition to a green economy. It was stressed that there is a need for additional efforts on the publication and dissemination of successful projects that have received financial support, to encourage their further replication and to attract and facilitate applications from countries with low success rates.

2. Key messages

Air quality is a matter of vital importance for European citizens, industry, city and national authorities, and also the European Commission. Air quality is rising up the political agenda in Europe and the action cannot be delayed.

Eco-innovation on air quality plays a key role in addressing air quality issues by providing cleaner technologies and new business and governance models based on more scientific knowledge and effective monitoring. Solutions are available, there is no technological barrier to cutting air pollution. The challenge is their deployment, scaling up and replication; bringing them to those parts of Europe that have not benefitted so far. Public procurement can help through boosting demand and creating economies of scale for the most promising solutions.

There is a role for the EU to help scale up eco-innovations, in particular by facilitating, and making better use of eco-innovation as an enabling tool for air quality policies. Funding from the EU plays an important role; encouraging and facilitating applications from countries with low success rates is necessary.

Awareness and cooperation also play a key role. Citizens have to be involved. There is an urgent need for awareness-raising, easy-to-understand explanations of air pollution and what causes it, and support and incentives for behavioural change (e.g. less car use in city centres). Municipalities' cooperation with the private sector and EU national-level interplay are vital drivers of success.

Agriculture must not be neglected in the battle for clean air. Energy and transport are the biggest cause of poor air quality in cities but the agricultural sector is also an important source of particulate matter as ammonia contributes to the formation of (secondary) particulates.

One big challenge is to fully implement and enforce the rules that are already in place. Increasingly, technology can also make a difference by providing new tools to reinforce air quality monitoring and assessment.

Business can play a positive role in tackling air pollution. Companies are looking for clear, reliable standards that give them a framework within which to innovate. Beyond the environmental benefits eco-innovation also contributes to a more competitive and high-tech economy, new market opportunities and higher employment.



clean air

3. Framing the Forum: an introduction to air quality



Air quality is a priority for both the European Commission and Bulgaria. The latest Eurobarometer survey (autumn 2017) shows that air quality is the second most important environmental issue for Europeans after climate change. At the end of 2017, a separate survey showed that 59% of Bulgarians see poor air quality as their top environmental problem.

'Europe's air quality has improved, but there is a long way to go. The European Commission will work more on enforcement, regulations, monitoring, financial support and promoting best practice.'

Daniel Calleja Crespo, Director-General for the Environment at the European Commission. He highlighted that, beyond the air quality policy, the EU Energy Union is another major initiative with clear positive effects on air quality. The Commission's mobility packages also have significant air quality co-benefits. The EU is also giving maximum priority to air quality, Calleja said, through its funding programmes.

The EU is currently carrying out a 'fitness check' of the EU's ambient air quality directives. These set binding standards and objectives for the main air pollutants.

The Forum's discussions help reflections on questions such as: *'What has been the impact of new technological developments on the implementation of the AAQ Directives?'; 'Which good practices, particularly in terms of the cost-effective implementation of the directives in Member States, can be identified?'*

'It's already perfectly possible to clean Europe's air. For transport, for agriculture, for energy, solutions are within reach.'

Karmenu Vella, EU Environment Commissioner

For Bulgaria, air quality is one of the priorities for its EU presidency. It will discuss air quality — including the results of the Forum — at the informal environment ministerial meeting in Sofia in April. At home, the country's top priority is to reduce air pollution from **low-quality domestic heating**. Over half of all Bulgarian households use solid fuels (coal, briquettes and wood) to heat their homes. In cities like Sofia, this is the main cause of particulate matter (PM₁₀ and PM_{2.5}), Dr Neno Dimov, Minister of Environment and Water in Bulgaria, announced to the Forum that he intends to introduce new standards for solid fuels and the stoves that burn them. One of the challenges is to do this while combatting energy poverty.

'Air quality is about quality of life. We need good governance and solid science to strike a balance between the public interest and the cost to business, local communities and individuals.'

Dr Neno Dimov



Like the EU, Bulgaria is also targeting cleaner transport. It will direct some EU funds to eco-innovation in renewable fuels and new vehicle combustion systems, said Dr Dimov. The goal is to create an industrial electric vehicle cluster. Bulgaria's national innovation fund is also providing support. The government is promoting green mobility in public transport, with the purchase of electric buses in Sofia for example. New air pollution monitoring stations are being deployed.

Eco-innovative solutions present a toolbox for politicians, new horizons for science, new opportunities for business, and a cleaner, healthier environment, said **Ivelina Vassileva**, Chairperson of the Environment and Water Committee at Bulgaria's National Assembly. She emphasised that air pollution is a common problem without a common solution. In stark contrast to Western European countries, about 54% of Bulgarians use solid fuels for heating and of the 300000 vehicles newly registered each year, 270000 are second-hand, she pointed out.

Vassileva told the Forum she saw opportunities in entrepreneurship based on digitalisation, science-business-government interaction, behavioural change in local communities and Bulgaria's transition to a circular, innovative economy.

Iskra Mihaylova, a Bulgarian MEP, *emphasised the need to think beyond 2020, with discussions on the EU's next Multiannual Financial Framework (MFF) getting underway in Brussels. Innovation — including in the field of environment — is expected to be at the core of the next EU budget*, she said. MEPs will work to make this budget more effective, flexible and understandable. Mihaylova wants different strands of EU financial support — grants and loans, the European Fund for Strategic Investments (EFSI) and structural funds, environment and urban development programmes — to be combined, and matched by private capital.

Sofia's Deputy Mayor, **Yoanna Hristova**, *emphasised that the fight for clean air requires support from all stakeholders*. Sofia is the first municipality in Bulgaria to have an air quality improvement programme. Half of the city's trams and regular buses have been retrofitted with filters. Two level crossroads have been built. The heating systems of kindergartens, schools and other public premises have been replaced with state-of-the-art alternatives.

Monitoring all of the major pollutants has given the municipality a clear idea of the main sources of pollution, Hristova said: 57% comes from public transport and 20% from home heating. The city is working to inform inhabitants. It has developed an early warning system that tells citizens what pollution levels are on a daily basis. It has initiated a pilot project to introduce filters into households and is tackling illegal waste burning. A third underground line is under construction and the city is introducing a 'green ticket' for public transport and an 'eco-schools' programme.



Ivelina Vassileva



Iskra Mihaylova



Yoanna Hristova

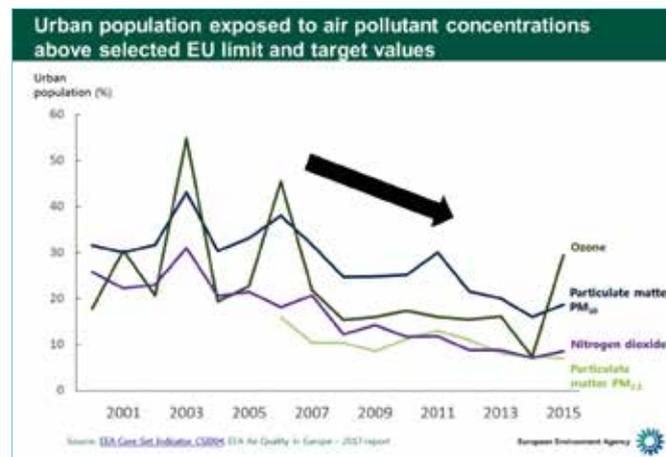
The European Environment Agency (EEA) and European Commission have created a **European Air Quality Index** that allows citizens to check their own air quality situation. With up-to-the-minute data from more than 2000 monitoring stations across Europe, the Index gives an indication of air quality based on five key pollutants: particulate matter (PM_{2.5} and PM₁₀), ground-level ozone (O₃), nitrogen dioxide (NO₂) and sulphur dioxide (SO₂). Users can check overall air quality or measurements per pollutant. The service was launched in November 2017 and reported over 700000 visitors in its first few weeks



Paul McAleavy

THE FACTS:

Significant parts of Europe's urban population are routinely exposed to air pollutant concentrations above and well above EU and WHO standards respectively.



The EEA produces an annual Air Quality in Europe report, which estimates the number of people exposed to harmful air pollution and its health impacts (The 2017 edition had a special focus on agriculture). Air quality is the single largest health risk in Europe, McAleavy said, with heart disease and stroke the most common causes of premature death (responsible for about 80% of cases). PM_{2.5} causes about 400000 deaths a year and NO₂ another 75000.

PM_{2.5} causes the greatest damage to human health in Europe. These are particulates suspended in air that are so small they can measure less than 1/30th the diameter of a human hair and sometimes pass straight into the bloodstream, like oxygen. Ground-level ozone is formed by chemical reactions triggered by sunlight, involving pollutants from natural gas extraction, landfill, transport and household chemicals. Spikes in ozone correspond to hot summers. NO₂ is formed mainly by combustion — power plants and car engines for example.

'The good news is that, in general terms, Europe's air quality has improved considerably since the 1970s and that trend has continued in the last two decades. But the problem has not gone away — Europe has not complied with its own legislation and mostly falls short of WHO guidelines.' Paul McAleavy, Head of Air and Climate Change, European Environment Agency (EEA).

'Europe's air quality has improved because the scientific evidence is getting better, the public is better informed (and therefore more demanding), technology has improved, and legislation works.' Paul McAleavy, also cited the case of banning lead in petrol.

The main sources of air pollution are energy, agriculture and transport. A few years ago, the EEA calculated that half the air pollution damage in Europe came from just 191 (mainly coal-fired) industrial installations. Policymakers in Bulgaria are right to target residential heating but must also keep these large-scale energy challenges at the top of their agenda, said McAleavy. Agriculture is often overshadowed, he added, but is an important emitter of ammonia and PM, NO₂ and methane (which contributes to ozone formation). Road transport is the biggest cause of NO₂. In 2015, 22 out of 28 Member States exceeded the EU's annual limit values for NO₂ — and 89% of the excesses were recorded at traffic stations. PM standards are also systematically exceeded across Europe, with 20 Member States reporting excesses in 2015. The three PM pollution hotspots are northern Italy, Poland and Bulgaria.

The EEA started working with 12 cities — including Bulgaria's Plovdiv — in 2013 to understand their challenges around better air quality. Five years on, it is working with the same cities to see what solutions have been put in place and what effect they have had.

STAKEHOLDER VIEWS:

Business has a crucial role to play both in eco-innovation and the fight against air pollution. Improving air quality fits with the goals of the Bulgarian Business Leaders Forum. Chairman **Iravan Hira**, Managing Director at Hewlett Packard (HP) Bulgaria, explained that *his organisation aims at making Bulgaria an attractive place to work and live in.*

HP is a recognised leader in environmental protection, Hira added, with goals for 2025 that include a 50% share of renewables in its power supply and an increase in the energy performance of its product portfolio by a factor of 30. The company also provides an Internet of Things platform and sensors to help others optimise their operations, for example a Malaysian palm oil plantation.

Air pollution is not just a European problem. **Elizabeth Press** from the International Renewable Energy Agency (IRENA) noted that over 80% of people living in urban areas are exposed to air pollutants above WHO-approved levels. That figure rises to nearly 100% in low- and middle-income countries, she said. Globally, air pollution causes eight million premature deaths a year (compared to 400,000 in Europe).

It also costs a lot. In 2010, the cost of outdoor pollution alone was USD6 trillion (and almost EUR1 billion in the EU). This could rise to USD8.8 trillion a year in 2030, Press said. Yet air pollution is not taken into account in calculations of how much the low-carbon energy transition will cost, she said. *'This is not part of our way of calculating GDP. These numbers are just somewhere on the side. They exist in isolation, and when we talk about costs of energy transition and the transformation that needs to take place this is a side issue.'* Elizabeth Press, IRENA

Around the world, 140 countries have made a commitment to renewables in their Nationally Determined Contributions (NDCs) under the Paris Agreement. The aggregate is 'way below' what already exists in country plans however, Press said. In other words, countries are doing more than their NDCs suggest. In Europe, a 34% renewable energy target for 2030 is 'totally feasible', Press said.

In Paris, the region's independent air pollution observatory AIRPARIF, has created '**an innovation accelerator dedicated to air quality**'. AIRLAB was launched on 20 September 2017 out of a common desire among municipal, regional, private and citizen stakeholders to improve Parisian air quality — and corner new markets.

'Air quality businesses are growing rapidly at a global scale, with major opportunities.' **Pierre Pernot**, Head, Partnerships and Digital Team, AIRPARIF

AIRLAB is part of AIRPARIF's five-year strategic plan. Its goal is to accelerate air quality improvements in Paris by 1) stimulating innovation (both technical and social), 2) building a committed community of stakeholders, 3) identifying new levers for action, and 4) the technical evaluation of projects to demonstrate their impact.

AIRLAB's steering committee includes local and regional authorities, plus large companies such as SNCF, Veolia, EDF, Engie and Air Liquide. Its 'user community' is made up of start-ups, SMEs, NGOs and research consortia. AIRLAB's first five priorities are: indoor air quality, behavioural change, smartphone apps, traffic flow sensors, and more efficient heating.



Paul McAleavey, Iravan Hira, Elizabeth Press and Pierre Pernot

4. Energy and air quality: 18 case studies

See online recordings of a selection of the case studies: https://www.youtube.com/watch?v=WsVwYUazb0I&list=PLIzqPSxpstTlhTGD3Xh3_nnTk4H9fbuj2&index=4.

'We will not solve the air quality problems if we do not have the right energy policy in Europe.'

Daniel Calleja Crespo, Director-General for Environment at the European Commission

Energy case studies presented at the Forum included: innovative scrubbers, refrigeration systems and stoves; new power supply systems, air quality monitoring concepts and policies; awareness-raising 'eco-managers'; smart cities; and industrial initiatives in metal manufacturing and flue gas treatment.

During the **afternoon of the first day**, participants had the opportunity to attend three out of 18 case studies that showcased companies, municipalities, and public and private sector initiatives that have succeeded in developing and deploying effective new technologies, or innovative business and governance models, for the reduction of air pollution originating from energy use:

- 1) **Wood burning impact on air quality in Lombardy - Analysis and perspectives:**
Guido Lanzani, Head of Air Quality Unit, Environmental Monitoring Area, ARPA Lombardia, Italy
- 2) **Improving air quality through smart solutions - The GrowSmarter project:**
Gustaf Landahl, Head of Department, Environment and Health Administration/Planning and environment department, City of Stockholm, Sweden
- 3) **Smart Clean Air City project — l'Aquila:**
Paolo Tripodi, Board of Directors, Chief Innovation & Technology Officer, IS CLEAN AIR, Italy
- 4) **The LIFE-IP PREPAIR project — Po regions engaged with air policy:**
Katia Raffaelli, Project Manager LIFE IP PREPAIR, Emilia-Romagna Region, General Directorate for Territorial and Environmental Care
- 5) **Helsinki Air Quality Testbed — New groundbreaking concepts for air quality monitoring and citizen services:**
Hannamari Jaakkola, Business Development Manager, Vaisala Oyj, Finland
- 6) **Residential wood burning and the smart cities approach in mitigating its impacts:**
Eleni Athanasopoulou, Research Fellow, Institute for Environmental Research and Sustainable Development, National Observatory of Athens (NOA), Greece
- 7) **CleanOx for Cleaner Air:**
Tunç Görüney, Corporate Energy and Environmental Manager, Şişecam, Turkey
- 8) **CLEAN HEAT project — Pollution from residential burning; impact and solutions:**
Jens Hürdler, Project Manager Transport and Air Quality, Environmental Action Germany (DUH)
- 9) **iSCAPE – Improving the Smart Control of Air Pollution in Europe:**
Dr Salem Gharbia, Post-doctoral Research Fellow, University College Dublin
- 10) **EU H2020 programme:**
Vincenzo Gente, Project Officer, Executive Agency for Small and Medium-sized Enterprises (EASME)
- 11) **Activities of Ecomanagers within the LIFE IP MALOPOLSKA:**
Joanna Kiersnowska, LIFE Project Specialist, Air Quality Unit in Environmental Department, Marshal Office, Malopolska Region, Poland
- 12) **Sustainable Lead Production at KCM AD:**
Yavor Kehaiov, Director "Occupational Health and Safety, Environment & Management Systems", KCM AD, Plovdiv, Bulgaria
- 13) **Advanced flue gas treatment technology:**
Pierluigi Cassaghi, SOLVAir Regulation and Business Development Manager, Solvay S.A., France
- 14) **EXERON - Sustainable green power supply on seven continents:**
Elena Gatcheva, VP Strategic Partnerships, International Power Supply AD, Bulgaria
- 15) **Rocket Heater Gamera – Highly efficient wood stoves:**
Zhivko Stefanov, Executive Director, AGNON LTD, Bulgaria
- 16) **Ingersoll Rand Climate Commitment – Investment in new technologies for a sustainable today and tomorrow:**
Dermott Crombie, Vice President, Strategic Initiatives, Ingersoll Rand
- 17) **20 years track of environment projects in Aurubis Bulgaria:**
Krum Neykov, Gas Cleaning Installation Manager, Aurubis Bulgaria
- 18) **Plastics, an innovative enabler of energy efficiency and climate protection:**
Giuseppe Riva, Director Mediterranean Region, PlasticsEurope



Find details of all cases studies of session 2 on the Forum website: http://ec.europa.eu/environment/ecoinnovation2018/1st_forum/case-studies_02_en.html.

5. Spotlight on Bulgaria: domestic heating

In this session, Professor **Nikolay Kozarev**, Head of the Department of Environmental Engineering at the University of Chemical Technology and Metallurgy, Sofia, Bulgaria, explained the challenge Bulgaria faces from low quality domestic heating. Forum participants offered creative solutions.

Professor Kozarev has 42 years of experience in mathematical modelling and 25 in air and water pollution. He outlined two air quality control programmes developed by his university for Sofia, the first in 2011–14 and the second in 2015–20. The city's NO₂ problem has been solved, but the PM10 problem remains, he said. Why? The municipality took measures to clean up transport (the big NO₂ emitter), but domestic heating is becoming a bigger PM polluter every year. A lot of people have decided to go back to solid fuel heating, Kozarev explained, after not being able to pay for central heating and gasification.

Nevertheless, he believes that 'very soon' the annual average concentration of PM will meet the required standards. The problem is the excesses of the daily average concentration. It is this that the second air quality control programme addresses. *'Unfortunately we have 150 days of heating a year,' Kozarev said. 'People burn wood, coal and other unregulated materials. A lot of people burn everything, even clothes.'*

'Transport will not be a problem for Sofia for very long — for another 1–2 years maybe — but with heating the problem is still very serious, I would say severe. We need measures to go back to central heating. This does not make the air dirty.' Nikolay Kozarev.

Sofia's air pollution is exacerbated by external sources (e.g. dust from the Sahara), the city's encirclement by mountains (poor ventilation), many streets and boulevards lying parallel to the prevailing winds (poor dispersion of pollutants) and a high percentage of calm conditions (ditto). In addition, the chimneys are low, and the velocity and temperature of the exhaust gases is low, so pollutants stay in the lower layer of the atmosphere.



Professor Nikolay Kozarev

nair

AUDIENCE PROPOSALS:

Suggestion: Give subsidies to those who cannot afford central heating and stop them burning tyres, clothes, etc.

Response: Very good idea. I've suggested it myself. But who is prepared to pay 100–200 lev (EUR50–100) a year for that?

Suggestion: The domestic heating system represents a huge density of emission points, like traffic. Install a network of pollution absorbers.

Response: That could work in a room but not in the atmosphere.

Follow-up: Yes, it could, only the volume is different.

Suggestion: Optimise combustion and after-treatment, as has been done for large and medium-sized combustion plants, and vehicles.

Response: Yes, you can optimise combustion, but only in industrial units. You cannot optimally control a grandmother's home heating.

Follow-up: They did it with cars — they said that the Panda, the smallest car, could not lower its emissions, but it could. I am convinced it's possible to improve combustion (even for small units).

Suggestion: Immediately get the state to sponsor chimney filters, buy time to shift to district heating and heat recovery from industry.

Response: I don't think everyone will clean the filters regularly.

Follow-up: It could be monitored and done by the municipality.

Response: I think it will cost quite a lot of money — EUR2000 to buy one, and then you have to clean it every year. Better channel that money to central heating.

Follow-up: It's working for cars — first you put in a catalytic converter to cut emissions, then you develop the (alternative) technology.

'Installing filters on chimneys to reduce emissions from residential heating is like using genetic engineering to make horses faster to continue using them as cars. We are in the 21st century and should act accordingly, including using appropriate fuels. Wood and coal are not among them.' A participant

Suggestion: Make sure the price of clean energy (electricity, district heating, gas) is lower so that people can afford it. No one will burn wood if they can afford to buy clean energy.

Response: I agree. The cleaning equipment can sometimes be much more expensive than the production equipment.

Suggestion: Create an artificial wind to help disperse the pollutants (inspired by Santiago, Chile).

Conclusion, Professor Kozarev: *'The solution to our problem can only be a political one. It could be put into operation immediately and solve our problem — otherwise we will give a lot of money to the EU [in air quality fines]. Instead let us give it to the people.'*

6. Agriculture and air quality

There is scope to reduce air pollution from agriculture, which still accounts for up to a fifth of the particulate matter in cities (via ammonia). Innovative actions to reduce ammonia emissions include various ways of optimising fertiliser use and the acidification of slurry.

Member States and regions can reduce ammonia emissions through Rural Development Programmes (RDP).

Agriculture has become a leading source of air pollution, especially ammonia. Around 95% of all ammonia emissions in the EU come from agriculture, mainly livestock manure and chemical fertiliser. The emissions travel and react to form particulate matter. Ammonia deposition also contributes to eutrophication and soil acidification.

Ammonia emissions have come down by about a quarter since the 1990s and in its new National Emission Ceilings (NEC) directive, the EU mandates another 19% decrease by 2030, relative to 2005. That is the EU average; different Member States have to provide different levels of reduction depending on the local situation. The directive targets big farms because the main cause of ammonia emissions is livestock and 70% of the animals are bred in 10% of the farms.

The NEC directive requests the European Commission to facilitate access to funding to help reduce ammonia. EU funds are available through rural development policy. Total public commitments for climate change and air quality under the RDP are EUR2 billion for 2014–20. There are 28 programmes in 16 Member States to reduce ammonia. DG AGRI encourages national and regional authorities to use the RDP funds for ammonia reduction.

There are several proven ways to reduce ammonia, from changing animals' diets to covering stored manure and injecting it directly into the soil rather than spreading it on land. Most of the RDP measures to are investments (e.g. to cover manure stores) and agri-environment-climate measures (e.g. to inject slurry directly into the soil). Some climate measures also reduce ammonia emissions (e.g. the construction of biogas facilities).

The type and application of mineral fertiliser can be optimised to reduce ammonia emissions.

Mineral fertilisers are responsible for just over a fifth (22%) of the ammonia emissions from agriculture. Different fertilisers have different impacts. Urea has high ammonia losses for example, because the nitrogen in it takes more time to be converted into a form that is accessible to the plant. If there was a complete shift from urea to calcium ammonium nitrate, that would lead to a 63% reduction in ammonia from fertiliser use. This has been identified by UNECE's Task Force on Reactive Nitrogen as an option for farmers.

'Out of the 22% of ammonia emissions caused by fertiliser use, 63% could be reduced by looking more into the form of nitrogen farmers are using.' Tiffanie Stéphanie, Agriculture and Environment Manager, Fertilizers Europe

Farmers can also optimise their application of fertilisers. This includes: incorporate urea immediately — at best one hour after application or even better, inject it straight into the soil; check the weather — if the soil is wet, there are fewer ammonia losses; go for a split application.

The UNECE suggests that if farmers continue with urea, they also add inhibitors — agronomic additives that minimise ammonia losses. *'About 70% of the ammonia losses can be reduced if urea is applied with an inhibitor,'* Tiffanie Stéphanie, told the Forum. The new EU fertiliser regulation that is currently being negotiated in Brussels will open up trade in agronomic additives and inhibitors. Farmers could start using these in slurry or manure too, before spreading it. In this way, the fertiliser industry could contribute to reducing emissions from livestock.

For Fertilizers Europe, the main driver for ammonia reductions is policy (e.g. the NEC directive). Conversely, one of the barriers may be farmers' limited investment capacity, as they are squeezed between decreasing producer prices and increasing consumer and policymaker demands.

'What price are we prepared to pay for the food we eat? Do we take air pollution impacts into account?' Tiffanie Stéphanie



Tiffanie Stéphanie



Peter Demeyer

Some Member States are stimulating eco-innovations to mitigate ammonia emissions from animal housing.

The EU's NEC and Natura 2000 (nature protection) directives are driving the reduction of ammonia emissions from animal housing, **Peter Demeyer**, Advisor at the Institute for Agricultural and Fisheries Research (ILVO) in Flanders, told the Forum. Flanders, the Netherlands, Denmark and Germany are frontrunners, though he expects the issue to become important throughout the EU.

For example, in Flanders, the NEC directive has led to a requirement for every building housing poultry or pigs to have low ammonia emissions. The farmer is required to use an approved system that reduces ammonia emissions by at least 50%. Such requirements are driving innovations in housing systems. Demeyer suggested that EU tests and protocols for such eco-innovations would be helpful. He also suggested pooling resources.

'It would be a good idea to look at pooling test facilities [for innovations] because they are very expensive. Throughout the EU we should make an inventory, look for complementarity, and perform joint measurements.' Peter Demeyer

In Flanders, stakeholders are grouped together and supported with public funds to encourage them to innovate. One example is VEMIS, a five-year-old consortium that studies air emissions from animal husbandry. It is starting a new project in September to identify innovative low-emission systems for broiler chickens. The project came about after VEMIS found that 90% of laying hens are in low-emission housing versus just 30% of broilers — and the reason is a lack of approved emission-reduction systems for broilers!

Meanwhile, a new Flemish innovation fund created last year is aimed at farmers only. It contains EUR23 million and will cover up to 40% of a project's costs. Examples of technologies tested so far include a modified manure scraper system and pocket digester, air scrubber systems, and a smart manure separation system (they all cut ammonia emissions by about 20%).

ATMOSYS is a new, freely available web-based system to assess the local impact of agro-industry and traffic.

The Flemish Institute for Technological Research (VITO), has developed a web-based support system to assess the local impact of air emissions. The goal was to develop a transparent, standardised approach for use in Environmental Impact Assessments (EIAs) for new permits. The new system has been in place since 2011 and is freely available to environmental consultants. They can upload their own data into the standardised model and get emissions data back.

Since 2011, almost all EIAs in Flanders have used the new system (more than 1300 simulations). The benefits to the user are: 1) they have access to a state-of-the-art system certified by the government; 2) it's free; 3) they no longer have the hassle of updating background data, etc. The government meanwhile, knows that all the EIAs it gets come from its own validated system. The standardised EIAs are easier to assess.

There is interest from regions abroad to use the system, which is possible with local input data. VITO recommends that the tool is owned by local or regional authorities and made available for free to experts that have to prepare air quality plans, or consultancies that have to prepare EIAs.

'With the help of the EU's Copernicus [environmental data] and LIFE programmes this system can be deployed almost anywhere in Europe.'

Stijn Janssen, Program Manager, Environmental Modelling, VITO

Agriculture contributes to urban air pollution (via ammonia) and climate change (via methane).



Stijn Janssen

'It's important to highlight that 10–20% of the PM concentration in cities is due to ammonia emitted on our agricultural land. PM has a very large transboundary effect.' **Margherita Tolotto**, Air and Noise Policy Officer, European Environmental Bureau (EEB)

Ammonia and methane emissions from agriculture are on the rise today, Margherita Tolotto, warned the Forum. Methane is a powerful greenhouse gas that also reacts to form ground-level ozone. Agriculture is responsible for over half its emissions in Europe, mainly due to ruminants, manure and slurry.

Tolotto cited progress on ammonia in Denmark, the Netherlands and Flanders, highlighting efficient manure management (housing and spreading), improved application of urea or its substitution by ammonium nitrate, and behavioural changes, such as eating less meat. To reduce methane, Tolotto suggested the promotion of anaerobic digestion, adapting animal feed and, again, a change in diet.

She welcomed a requirement for Member States to consult the public when they prepare their national air pollution control programmes under the NEC directive. She regretted however that methane is excluded (although the Commission had proposed to include it) and that the emission reduction goal for ammonia is only 19% (the Commission had proposed 25%). Like other speakers, she argued that policies work, taking the eradication of SO_x in Europe as an example.

Slurry acidification is an efficient technique for reducing ammonia emissions.

Denmark has achieved a paradigm shift in ammonia emissions since it introduced an environmental protection programme in 1990. By the end of 2015, Danish ammonia emissions were down to 40%. Better manure management technologies have cut the consumption

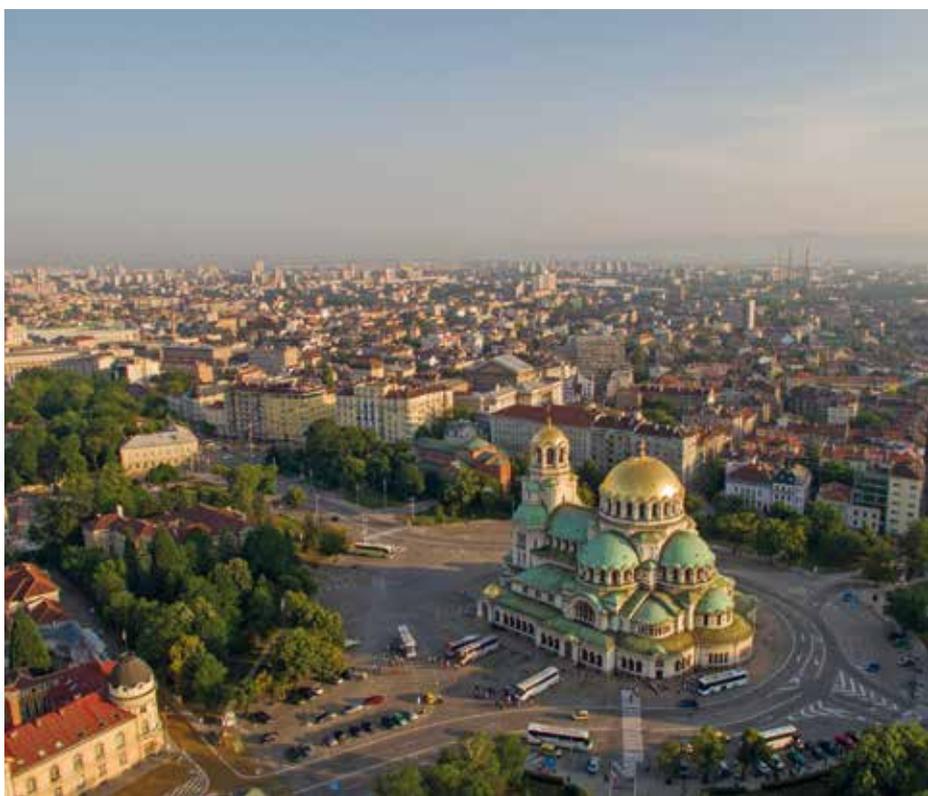
of nitrogen in mineral fertilisers by about 50%, saving Danish farmers about EUR100 per hectare and improving animal health, working conditions, and the environment. The health costs saved by reducing ammonia emissions reach EUR20–30 per tonne of nitrogen in many EU countries.

One of the techniques applied in Denmark is slurry acidification. About one fifth of Danish slurry is acidified prior to application. In the UK, slurry acidification is in the 2017 BREF (best available technology reference document) for reducing ammonia from the intensive rearing of poultry and pigs. It has the added benefit of reducing greenhouse gas emissions (methane, nitrous oxide and hydrogen sulphide).

The slurry is acidified in a fully automated, closed system (no risk for the farmer) by adding a very small amount of sulphuric acid. NH₃ is converted to NH₄, trapping the nitrogen. The technique can reduce ammonia emissions by over 50% for cow slurry and nearly two-thirds for pig slurry.



Margherita Tolotto



7. Transport and air quality: 19 case studies

See online recordings of a selection of the case studies: https://www.youtube.com/watch?v=0FZJppX7rmM&index=7&list=PLIzqPSxpstTlhTGD3Xh3_nnTk4H9fbuj2.

Find details of all cases studies of session 4 on the Forum website: http://ec.europa.eu/environment/ecoinnovation2018/1st_forum/case-studies_04_en.html.

Air quality standards are exceeded in 130 cities across Europe. Domestic heating, agriculture and industry are to blame. But traffic is the biggest problem in urban areas. It is responsible for nearly half the NO₂ emissions, for example. Solutions being implemented include greening public transport, building bike lanes, creating an electric vehicle charging infrastructure, and introducing low-emission zones and congestion charge

Transport case study topics included: Low Emission Corridors, alternative fuels (gas, hydrogen and electricity, also for bikes and delivery vehicles), sharing economy concepts, traffic management, remote sensing technologies (including measuring car emissions as they pass), pollution-free public transport and sustainable commuting.

During the **morning of the second day**, participants had the opportunity to attend three out of 19 case studies that showcased companies, municipalities, and public and private sector initiatives that have succeeded in developing and deploying effective new technologies, or innovative business and governance models for reducing air pollution originating from transport:

Examples:



Case study 10



Case study 19

- 1) **Brenner Lower Emission Corridor (LIFE project):**
Laura Pretto, *Technical civil servant, Italy, environmental protection agency (APPA), Autonomous Province of Trento, Italy*
- 2) **SIGEIF Mobilités — Developing a broad network of natural gas vehicle (NGV) refuelling stations in the Paris region:**
Jean-Marc Brimont, *Head of Brussels Office, GRTgaz*
- 3) **Global system for sustainable traffic emissions management with RSD Technology:**
Dolores Hidalgo, *R&D Projects Scientific Manager, Fundación CARTIF*
- 4) **How we eliminated the NOx problem from Copenhagen buses:**
Annika Isaksson, *CEO, Amminex Emissions Technology, Sweden*
- 5) **SME Instrument:**
Marco Rubinato, *Project Officer, EASME, Executive Agency for SMEs - European Commission*
- 6) **LIFE FOR SILVER COAST – Integrated mobility solutions:**
Antonino Tripodi, *CEO, UNeed.IT/Technical manager, LIFE_SC project, Italy*
- 7) **Putting organisational travel planning into practice – Sustainable commuting and its upscaling to municipal level:**
Csaba Mezei, *Project manager, Expert (Smart Cities and Mobility), Regional Environmental Center for Central and Eastern Europe (REC)*
- 8) **IMPROVE LIFE project is testing measures that can reduce PM concentrations in platforms and inside trains:**
Teresa Moreno, *Senior Researcher, Spanish National Research Council (CSIC)*
- 9) **Innovative PV 2 DC grid solutions in the Public Transport Grid:**
Krasen Mateev, *Chief Operations Officer, SolarPro Holding AD, Bulgaria*
- 10) **The future of urban mobility:**
Galin Bonev, *Founder and CEO, ElJoy Bikes, Bulgaria*
- 11) **Sofia Urban Challenge – The first open innovation initiative on clean air in Bulgaria:**
Mariyana Hamanova, *Founder and Managing Partner, Cleantech Bulgaria*
- 12) **Electric vehicle car sharing and charging stations infrastructure:**
Stefan Spassov, *CEO, eMobility International (Eldrive); Ride Share Bulgaria (SPARK)*
- 13) **Speedy electric vehicle fleet for city deliveries:**
Danail Danailov, *Member of the Board (responsible for strategy and business development), Speedy JSC, Bulgaria*
- 14) **An innovative method for solid particle filter cleaner and catalysts:**
Angel Stanev, *Marketing Manager, Innovation, DPF Cleaning Machine, Bulgaria*
- 15) **Shell - helping to reduce air quality impacts from transport:**
Kamelia Slaveykova, *Country Chair, Shell Bulgaria & Greece*
- 16) **LIFE 'N Grab HY!: Hydrogen electric hybrid refuse collection vehicles to enhance air quality and reduce noise:**
Stefan Neis, *Project Manager, WaterstofNet VZW*
- 17) **Improving air quality through better, cleaner and more efficient fuels:**
Ewa Abramiuk-Lété, *Secretary General, European Fuel Oxygenates Association (EFOA)*
- 18) **Assessment of public health co-benefits from traffic related emission policies in Thessaloniki (ICARUS project):**
Prof. Dimosthenis A. Sarigiannis, *Director, Environmental Engineering Laboratory, Chemical Engineering Department, Aristotle University of Thessaloniki University, School of Engineering, ICARUS Coordinator, Greece*
- 19) **Remote sensing — Measuring emissions from cars as they pass by:**
Herbert Woopen, *Lawyer, EU Representative, OPUS, Germany*

8. Financial support for clean air

There are many EU funds relevant to air quality available between now and 2020:

- EUR1.9 billion for air quality in cohesion funds
- more than EUR60 billion for energy, transport and infrastructure more generally
- EUR300 million in the environmental LIFE Programme
- the Juncker Plan for growth and jobs
- EUR11 billion of research money going to air quality, directly or indirectly

'We really need more prioritisation of air quality in structural funds so local authorities are able to upscale all this innovation.' **Joana Cruz**, Policy Advisor for Environmental Affairs, Eurocities

'We have a lot of tools available at EU level but they're not always used. It probably has something to do with user friendliness but there is also the challenge of making sure priorities are channeled through those funds.' **François Wakenhut**, Head of the Clean Air Unit, Directorate-General for the Environment, European Commission



THE EU H2020 PROGRAMME is one of the largest R&D programmes in the world, with a total budget of EUR77 billion for 2014–20. It has already delivered more than EUR20 billion for over 11000 grants. The last three-year work programme for 2018–20 foresees an investment of EUR30 billion. It is built upon four mutually reinforcing areas: low-carbon, circular economy, digitalisation and security. These are inspired by the EU's political priorities and implemented through 'virtual' horizontal calls. Other cross-cutting priorities with a dedicated budget are: migration, batteries and blue growth.

Air quality and innovation relate to both the low-carbon and circular economy priorities. There is EUR3 billion set aside for the former. Air quality is a very transversal topic that can benefit indirectly from many research projects, a Commission official said, including climate policy modelling, greening Europe's building stock and transport, improving local heating and cooling, and urban regeneration. The EC's Executive Agency for Small and Medium-sized

Enterprises (EASME) manages parts of Horizon 2020, as well as the SME Instrument and the LIFE Programme (see next page).



THE EU'S SME INSTRUMENT is a funding scheme that will provide more than EUR3 billion, from 2014 to 2020, for SMEs with an innovative idea, and the ambition and capacity to grow. There are three phases. In phase one, applicants have six months to provide a first feasibility study, with up to EUR50000 and three days of coaching from the EU. The object of phase two is a more developed business plan. Applicants have up to two years, with EUR500000 – EUR2.5 million and 12 days of coaching from the EU. Phase three is a 'business acceleration service', which includes the possibility of attending workshops (abroad), meeting business angels, etc.

Projects are evaluated according to three criteria: *market impact* (How many jobs will it create? How much value is added?), *excellence* (Is there really a market for it? Investor interest?) *implementation* (Is the applicant the right person for the job? Does he/she have the skills, knowledge and competence to make it?). The innovation must be at Technology Readiness Level (TRL) 6 (i.e. it has to be proven to work) at least.

New in 2018 is the European Innovation Council, which aims at encouraging wider participation in the SME Instrument. As a result, the threshold for acceptance has been increased from 12 to 13 (out of 15 points) for phase 2, and applicants for the latter will now have interviews in Brussels. In the past, there were many topics, each with their own budget; now, there is just one big budget. The good news is that this budget is going up: from EUR480 million in 2018 to EUR601 million in 2020. That said, the competition is stiff: less than 10% of applicants are ultimately successful. Italian and Spanish applicants do best. The only Bulgarian project in phase 2 is Endurosat One, which foresees the launch of a satellite to help students work on space topics.



Joana Cruz



François Wakenhut



THE EU'S LIFE PROGRAMME provides financial help for environmental action. It has been running for 25 years and has supported almost 5000 projects. LIFE was split into 'environment' and 'climate' in 2014, when the EC's DG Environment underwent a similar split. Most of the projects it supports are still 'traditional', although it has expanded to support technical assistance, capacity building, preparatory projects, NGO grants, etc.

In the environment part, there are three priority areas: environment and resource efficiency, nature and biodiversity, and environmental governance and information. In the climate part, the focus is on: mitigation, adaptation and, again, governance and information. LIFE has a budget of EUR3.5 million for 2014–20, with three-quarters of that reserved for environment (and just over half of that for nature and biodiversity).

Every citizen in the EU can apply; in practice that means SMEs, NGOs, public administrations, research institutes, etc. Applications are evaluated with an emphasis on replicability/transferability, long-term sustainability and EU added value (e.g. quantifiable environmental impact). Projects should not be focused on research, large infrastructure or rural/regional development (for which other funds exist).

The most common 'traditional' project rewards 1–5 beneficiaries with an EU contribution of EUR500,000 to EUR1.5 million at a co-funding rate of 60% (up to 75% for nature projects). 'Integrated' projects — a new type — are much larger in scale. The idea is that they are led by stakeholders who have to implement environmental and climate plans and strategies. Here, 2–10 beneficiaries typically receive EUR10–15 million, again at a co-funding rate of 60%.

LIFE has a new emphasis on close-to-market projects and explicitly reaching out to the private sector. The Commission's policy officer in charge of the programme reassured the Forum, however, that its overall focus is not changing. LIFE in Bulgaria: 31 projects to date, most of those (23) nature related. This represents EUR45 million of investment, of which EUR35 million has been contributed by the EU. An example of what has been funded is a new technology in the glass sector that reduces NO₂ emissions by 90% and CO₂ emissions by 23%.

Finally, **Kalin Marinov**, Deputy Director General for **European Funds for Competitiveness** at Bulgaria's Ministry of Economy, presented Bulgaria's national instrument to support business innovation and competitiveness. Like other such programmes, it is open to EU-registered companies but if approved, they must be registered in Bulgaria.

Bulgaria's programme has five priorities; Marinov focused on two — innovation and technology development, and energy/resource efficiency. He emphasised that the goal is not only to support individual eco-innovative projects, but eco-innovative companies. Several companies present at the Forum (e.g. Exeron) have received support. The programme's total budget is close to EUR1.3 billion, with most of that provided to businesses as grants (and a fifth to a quarter in financial instruments, i.e. loans, equity support).

The main strategic instrument underpinning the innovation and technology development pillar is Bulgaria's smart specialisation strategy (as required by the European Commission). Competition for funding is substantial. In 2016, a special call for start-ups awarded EUR15 million to 82 companies (out of more than 800 applicants). In total, the programme has spent more than EUR6 billion on 24 projects in energy/transport cleantech, and another EUR4.6 billion on 14 projects exploring intelligent appliances, homes, systems, and cities. Some calls are currently open; more will come.

9. Way forward – panel discussion closing the Forum

A successful clean air policy requires five pillars: regulations, enforcement, support programmes, awareness raising and technology, concluded Andrzej Gula, President of the Institute of Environmental Economics. Many participants testified to the power of policy.

'Awareness raising without regulation does not work. We got rid of leaded petrol not because of awareness raising but because of regulations.'

Andrzej Gula

But Gula also noted that air quality is a top priority in Poland today because its people spoke up. Krakow is the first city in Poland to ban coal and wood — they will be illegal from September 2019.

People do not tolerate poor air quality anymore, concurred François Wakenhut, Head of the Clean Air Unit, Directorate-General for the Environment, European Commission.

'Solutions are there. The question is: do we act in what we know?' François Wakenhut

'Why is air quality not always prioritised? Probably also because of the political return on investments. It is easier sometimes to build a new road than to fix a transition towards clean mobility or energy efficiency.' François Wakenhut

Tackling air pollution requires cooperation. It calls for solutions across different sectors, presided over by different levels of governance, said Joana Cruz, Policy Advisor for Environmental Affairs at Eurocities. 'Very few cities in Europe can solve their air pollution problem alone,' added Anna Engleryd, Chair, UNECE Convention on Long-range Transboundary Air Pollution (CLRTAP). She agreed with Cruz that more work is needed across policy areas. She also warned that ammonia is the only pollutant not helped by policies in other areas.

'We need coherence in policy at local and national level. When national air quality plans are being developed, let's co-develop them with cities.' Joana Cruz

Boyan Rashev, Managing Partner at denkstatt Bulgaria, a consultancy with a focus on sustainability, suggested that the right question to ask is not what makes the air dirty but what makes it clean. He argued that the US has clean air thanks to cheap gas and electricity (and very low proportions of biomass in residential heating and diesel cars). European electricity is expensive because of the climate, and anti-nuclear and anti-shale policies, he suggested.

'I really want air quality to be a top priority for the European Commission, not a hostage of climate policy.' Boyan Rashev

Others disagreed with the alleged contradiction between climate and air quality policy. Gula argued that there can be win-win policies. Poland is a perfect example, he said. Wakenhut also said he believed the EU was building 'very strong win-wins'. It is up to Member States to define their own priorities when it comes to structural funds, he added. Engleryd pointed out that air quality dominates climate change in many parts of the world — notably Asia — and that it is also rising up the political agenda in Europe. The health benefits of clean air need to be monetised, she said.

'In Europe, I think that health ministries need to be more actively involved in the clean air debate than they have been so far.' François Wakenhut



Boyan Rashev

Peter Woodward (moderator),

'We need to work on local, regional, national and hemispheric scale as air quality and pollutants behave.' Anna Engleryd



Gula warned that health benefits cannot be easily attributed to the people who have to make choices over what to burn because they



Andrzej Gula



Atanaska Nikolova

struggle with their high energy bills. *'We need policies that address energy poverty,'* he told the Forum. *'We want clean air but we don't want to introduce policies that would make the poorest households suffer.'* A World Bank study has shown that previous subsidy regimes in Poland (e.g. to improve boilers), mostly benefited those who could have afforded the investment anyway.

Cruz described 'almost an Iron Curtain' in air quality between the West and East of Europe. This is mainly due to the different implementation of climate and energy targets, she said. She noted that cities can feel the cost of dirty air in different ways.

'It's a political cost not to act. When an election comes around it's right there at the top of the agenda.' Joana Cruz

'You cannot buy clean air but you can save a lot of money by working towards clean air. I think that's something local authorities have understood.' François Wakenhut

'I think it would be a mistake to argue that there is a lot more we need to understand or develop before we can act. The issue is to scale up some of the innovation that is available and ensure proper replication.' François Wakenhut

Rashev warned that it is a mistake to think that 'we can buy ourselves out of our air quality problems'. Many rich cities — Stuttgart, Paris, London — struggle with dirty air because they have the wrong policies in place, he said. Cruz said it is important that there are funds for innovation at the local/urban level. Standards matter too, to trigger innovation, she added. Gula agreed, citing the EU eco-design regulation as an example.

Behavioural change is a big step, but a necessary one, Engleryd added. Finally, she also singled out public procurement as a potential aid: 'Big buyers such as cities can get together and say "we want this kind of a product".' Wakenhut cited the EU's revised clean vehicle directive as a good example. Rashev warned however, that 'public procurement is food for corruption in countries like Bulgaria'.

FURTHER QUOTES:

'Clean air is not a purely environmental issue — it is a complex, integrated issue which has its own economic, social, technological and health aspects.' Atanaska Nikolova, Deputy Minister of Environment and Water of Bulgaria

'Eco-innovations are often accompanied by difficulties in the field of competition with well-established traditional technologies. That's why we have to significantly expand the knowledge basis, the analysis and the assessment capacities we have.' Atanaska Nikolova

'Born in science, developed by business, spread by local authorities, for citizens.' A participant

'We can live weeks without food, days without water but we can't live more than minutes without air. We have to act.' A participant

'We can use, biomass and pellets in a way that is not harmful, but we need to make sure that the proper standards are in place.' Andrzej Gula

EXHIBITORS

One of the European forum on Eco-innovations objective is to disseminate eco-friendly ideas and encourage innovation through communication and sectors. This 21st European Forum on eco-innovation gave again the opportunity to several companies and organisations to showcase their projects, initiatives and products.



Shell

Eco-marathon cars



Shell

Framing drawings from student's (finalists) competition 'Green transport of the future'



Experts Ltd

Innovation DPF Cleaning machine



Agnon Ltd

Wood stoves on the principle of the rocket mass heater



AID

Air pollution Intelligent Defense



DG Environment/EASME/UNECE information stand



In addition to the exhibitors mentioned above, the following projects were also featured:

LIFE Programme;

PREPAIR project and their Air Quality Plan;

Electric bicycles, made in Bulgaria (Eljoy Bikes);

IPS reference projects;

exposition of flue gas cleaning technologies, their results, the possible combinations -

SOLVair solutions (Solvay);

charging stations for electric vehicles (**Elprom EMZ**);

a new ground-breaking **Air Quality Testbed** in the city of Helsinki (**Vaisala Oyj**),

presentation of **KCM** new lead and zinc smelter facility (**KCM**) and patented solution in the form of innovative **Nano Structured Fuel Additive (NanoBoost)**.

Full details of the Forum programme, pictures, videos and presentations can be found at:
Forum website: http://ec.europa.eu/environment/ecoinnovation2018/1st_forum/

Useful Links

Eco-innovation Action Plan
<http://ec.europa.eu/environment/ecoap/>

European Commission
DG Environment
<http://ec.europa.eu/environment>

Eco-innovation
<http://ec.europa.eu/environment/eco-innovation/>

European Commission's air quality page
<http://ec.europa.eu/environment/air/quality/>

Circular economy
http://ec.europa.eu/environment/circular-economy/index_en.htm

EASME -
Executive Agency for SMEs
<https://ec.europa.eu/easme/>

MOEW -
Bulgarian Ministry of Environment and Water
www.moew.government.bg

MOEW press release:
<https://eu2018bg.bg/en/news/361>

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For further information

Visit the official Eco-innovation Action Plan (EcoAP) website for the latest information on:

- Policies and actions,
- Innovative technologies,
- Funding resources,
- Links and forthcoming events,
- EcoAP news (newsletters and platform) and other communication tools.

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#EcoApForum

The forum is co-organised by:

