Impact Objectives

- Review air modelling methodologies used in different countries to analyse strengths and weaknesses
- Design an integrated assessment modelling framework, including robust guidelines for best practice
- Communicate with stakeholders and policy makers new knowledge about emission abatement assessments

A breath of fresh air

Science and evidence-based environmental monitoring and scenario testing by the APPRAISAL project is supporting the EU's Air Policy Review, and ultimately developing optimal policy responses to the impacts of poor air quality

Motivated by hundreds of thousands of EU residents prematurely dying every year from air pollution and huge pressures on ecosystem areas from exposure to excess nitrogen, the European Commission in 2008 set a directive in regard to the exceedance of pollutants in ambient air: 'Member States shall ensure that air quality plans are established ... in order to achieve the related limit values of target values'. This presented Member States with the challenge of identifying what the best data, models, methodologies and tools are to design air quality plans. In order to provide a consistent approach to this directive across the EU, the Air Pollution Policies for Assessment of Integrated Strategies at Regional and Local Scales (APPRAISAL) project was initiated, taking an integrated assessment modelling (IAM) approach that combines scientific knowledge of natural and social sciences in order to deliver new knowledge about managing air quality and its impacts.

The aim for the programme is to consolidate and assess the wide range of modelling approaches Member States have been taking to air quality and to make them more easily accessed by decision-makers. The 15 university, institution and organisation partners working on this project are from 11 countries spread across Europe, including Italy, Belgium, Finland, France, Greece, Portugal, Poland, Spain, Germany and the United Kingdom, offering a wide representation of countries involved in developing and implementing air quality management measures. All of

The design and assessment of abatement measures in action

GREAT PORTO AREA

The Great Porto Area was used as a case study by the APPRAISAL project to predict how successful specific air quality abatement measures might be. The area covers 1024 square kilometres and is home to more than 1.2 million people. The team drew on a large database of reduction technologies collected by the International Institute for Applied Systems Analysis (IIASA) known as GAINS, including values for the years 2010, 2015, 2020 and 2025, with costs and emissions effects. The list of available technologies in this database was used and the main sectors identified. By extending existing evaluations it was possible to model the predicted changes in PM10 for the Great Porto Area using a 2 by 2 square kilometre spatial resolution.

BRUSSELS CAPITAL REGION

Measures to improve the air quality for more than 1.1 million people living in the Brussels Capital Region which covers 161 square kilometres were proposed by Brussels Environment. Costs and emission reduction estimations were prepared for 13 abatement measures, with nine for traffic and four for domestic heating. By applying the RIAT+ software decision-makers could identify the most cost-effective air reduction policies. Using the AURORA chemical transport model, the team were able to set base emissions at the year 2009 with a 1 kilometre resolution covering 20 vertical layers up to 5 kilometres. The RIAT+ software enables the identification of precursor emissions from local and surrounding sources within the area isolated.

the APPRAISAL partners' staff are highly experienced in air quality and health impacts assessment.

GATHERING KNOWLEDGE

The work packages have been split into two main stages: 1) assessment/review and guidance development; and 2) testing/communication. The APPRAISAL team are looking at air quality policy impacts, including air quality compliance through public health, climate change, emission reduction costs and ecosystems, and using a two-tiered approach to integrated air management. The focus is on compliance with air quality limit values for levels of particulate matter 10 micrometres or less in diameter (PM10) and NO_2 in air quality management zones within Europe. The two-tiered approach includes assessing the impacts of proposed actions through scenario analysis and identifying effective emission reduction measures through an optimised approach. For example, the traffic scenario analysis involves the new EURO standard for vehicle fleets and energy measures, such as bus investment, bicycle paths and lower speeds on highways.

The APPRAISAL website offers a portal for stakeholders to contribute to the IAM review, to share their knowledge on any requirements, and to support the guideline development. Stakeholders fill out an online questionnaire, including questions about their perspectives on synergies among national, regional and local approaches, air quality assessment and planning, health impact assessment approaches, as well as uncertainty, robustness and validation in the methodologies applied. Having access to communicate with stakeholders, in particular policy makers, is essential to the success of this project, because it allows the consortium to connect with these decision-makers at key points to check on the robustness and practicality of the recommendations and outcomes.

IAM FRAMEWORK

The analysis of the existing measures to comply with legislation clearly shows that by 2025 there will be a change from the general non-compliance seen across Europe in 2010 to more geographically discrete areas of non-compliance. This means that costly Europe-wide approaches may have lesser benefit overall than regional approaches using locally based tools to support air quality management plans, such as low emission zones and special fuels for captive fleets. Scenario analysis has been the preferred approach at the local and regional level for designing air quality plans, where experts are used to ascertain reduction measures which are then tested. The challenge with this approach is that it does not take into consideration cost effectiveness.

Another component of this initiative is the design of an IAM framework. The purpose is to ensure integration of all the components, as well as to design guidelines for best practice. The work identified two possible decision pathways: scenario analysis and optimisation. The benefit of the optimisation process is that abatement costs and impacts are being compared so that a set of measures which is the most cost-effective is found. The framework allows internal and external costs to also be considered in the evaluation process for measures. Two test cases formed the final stage of APPRAISAL and were used to enable assessment of the value of abatement measures in real terms and confirm the robustness of the guidelines. For two locations, Brussels-Capital Region and the Great Porto Area, the practical application of RIAT+ software was used to test real-life scenarios. RIAT+ was developed during the European Commission's LIFE09 OPERA project to help decision-makers choose the most cost-effective air pollution reduction policies and this software is also being applied in Alsace, Lombardia, and Emilia-Romanga.

THE IMPORTANCE OF HIGH QUALITY LOCAL DATA

Through these investigations the team found that social and political factors can strongly influence the success of air quality measures, leading them to conclude that all IAM tools need to address these elements as early on as possible in their development. In addition, it was recognised that high value data on the local air quality is essential to implement comprehensive integrated air quality management. Most of the recommendations from APPRAISAL in regard to future research are related to the decision process. In particular, this involves including socioeconomic aspects in the analysis, as well as non-technical measures and improving the integration of air quality and climate change policies into the IAM framework. Recommendations have also been provided on the EU air quality plan review process, including aligning the ways that local emission inventories are developed and captured, ways to consider external emission sources, promoting the use of modelling tools, and working on the exposure estimates so that health impacts can better be addressed.

There is a great deal of interest in the outcomes of APPRAISAL, with a wide range of parties keen to hear the results of the emission abatement assessment. For this reason, dissemination of the knowledge gathered is an important part this work. This is being achieved through a number of channels, including publication of papers in relevant industry journals, such as *Atmospheric Environment and the Journal of the American Medical Association*. In addition

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to APPRAISAL Conferences, the first of which was held in Brussels in late 2013, staff have presented at other conferences, portals and workshops, including Green Week 2013, the Task Force on Integrated Assessment Modelling, and ECOWEB, a gateway to European eco-innovations funded by EC-FP7.

This work has fed directly into the European Commission's clean air policy package adopted late in 2013, which includes a range of supporting measures of improved air quality in cities linked to the management measures and optimal policy responses identified by APPRAISAL. All stakeholders and policy makers now have access to a database where methodologies and systems are collated, including links to EU air quality policy, exposure analysis, and health impact assessment projects. As a direct result of these efforts Member States are now far better equipped to apply a wide range of modelling methods to ultimately improve the air quality and health of their residents.

APPRAISAL Project Coordinator
Dr Marialuisa Volta

Dr Marialuisa Volta is an Associate Professor within the Department of Mechanical and Industrial Engineering at the University of Brescia. After receiving her MSc degree in Electronic Engineering from the Politecnico di Milan in 1994 and her PhD in Information Engineering from University of Brescia in 1999, she has continued to focus her research on complex systems modelling and control and planning within the area of environmental systems.

As well as being the coordinator of APPRAISAL, she also coordinated the Regional Integrated Assessment Tool (RIAT) and has been the principal investigator for several national and European projects, including the Operational Procedure for Emission Reduction Assessment (OPERA) initiative and QUITSAT, a pilot project to define a system for monitoring, forecasting and planning air quality for the Italian Space Agency.

With more than 100 papers published in international journals, books and conference proceedings, Volta is a highly experienced researcher and is often called upon to be a part of regional task forces, including as a national delegate on the UNECE LRTAP Task Force on Integrated Assessment Modelling, as a member of the International Federation of Automatic Control Technical Committee on Modelling and Control of Environmental Systems and of the National Integrated Assessment Modelling network.

Project Insights

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SEVENTH FRAMEWORK PROGRAMME

Appraisal project