Environmental Science & Policy xxx (2016) xxx–xxx

Contents lists available at ScienceDirect

Environmental Science & Policy

journal homepage: www.elsevier.com/locate/envsci

Air quality integrated assessment modelling in the context of EU policy: A way forward

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ARTICLE INFO

Article history:
Received 15 November 2015
Received in revised form 19 April 2016
Accepted 30 May 2016
Available online xxx

Keywords:
Guidance
Local air quality
Air quality policy
Source apportionment
Emission inventories
DPSIR

ABSTRACT

In the EU-FP7 project APPRAISAL the current practice for integrated assessment modelling (IAM) of air quality in the EU was reviewed, limitations were identified and guidance for improvements was provided. In this article we present the guidance proposed by APPRAISAL. This guidance takes into account that a single IAM solution does not exist but that the different elements of the IAM methodology can be addressed in more or less detail taking into account the available data, the regional/local specificities, the financial resources and the actual purpose of the assessment.

1. Introduction

Although the air quality in Europe has significantly improved over the last decades, there are still in certain zones exceedances of limit or target values as set by the European Air Quality Directive (AQD) (2008/50/EC). For the zones where these exceedances occur member states have to submit Air Quality Plans (AQP) to the Commission. These AQP have to outline the abatement measures that will be implemented to ensure compliance to the limit values as well as the improvement in air quality to be expected due to these measures. To support the design of these AQP different integrated assessment modelling (IAM) methodologies have been developed. Such an IAM can provide the following information which is required for an AQP:

- an analysis of the factors responsible for the exceedance (e.g. transport, including cross-border transport, formation of secondary pollutants in the atmosphere) and the relative importance of these different contributing sources;
- details of possible measures for the improvement of air quality with an estimate of the improvement of air quality planned and of the expected time required to attain these objectives.

Furthermore IAM can also support air quality policy makers through:

- a cost-benefit analysis of the proposed AQ improvement strategies to ensure that cost efficient strategies are selected;
- extending the quantification of the effects of AQ improvement measures by also considering the impact on human health or the environment and accounting for the costs incurred by these impacts;

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http://dx.doi.org/10.1016/j.envsci.2016.05.024
1462-9011/

Table 1
Number of AQP and research reports for which data is contained in the APPRAISAL database ordered by Member State.

Country	Number	Country	number
Belgium	8	Poland	5
Finland	1	Portugal	9
France	4	Spain	2
Germany	11	Sweden	1
Greece	1	The Netherlands	1
Italy	4	United Kingdom	9
Luxemburg	1	Unknown	2

- providing information on the uncertainty and robustness of the air quality assessment and selected emission reduction or other air quality improvement strategies.

In the APPRAISAL EU FP7 project various aspects of the IAM methodologies used by the European Member States for the assessment of air quality (AQ) at the regional and local scale were reviewed. During this review, information was collected in a database on existing AQP and research projects, designed in the context of the AQD. Currently the database contains 59 contributions from 13 Member States (Table 1). The database can be consulted online through the project website (www.appraisal-fp7.eu). Based on the information in this database weaknesses in current practices were then identified and possible ways to improve these methodologies were proposed. One of the results of the project is a guidance document based on the insight gained through the review database, the experience of the different APPRAISAL partners and the evaluation of a number of practical IAM applications. The focus of this paper will be to discuss the main topics addressed in this guidance document. To our knowledge, this is the first comprehensive guidance document for the local scale application of IAM published to date.

As a general causal framework to describe the interactions between society and the environment, the European Environmental Agency (EEA) has adopted the Driver-Pressure-State-Impact-Response (DPSIR) scheme (EEA, 1999). Because of its ability to integrate knowledge across different disciplines and to formalize different decision alternatives, the application of the DPSIR framework has considerable potential for bridging the gap between scientific disciplines as well as linking science to policy and management (Lewison et al., 2016). DPSIR is at times criticised for not being able to capture the real world complexity of interactions (Gobin et al., 2004). Exactly this simplicity however has the advantage of promoting understanding and communication in a policy meaningful way. APPRAISAL proposes to map the key elements of an IAM approach for local AQ in the general DPSIR scheme (Guariso et al., 2016).The different elements of the DPSIR scheme for an IAM for AQ and their relation to each other are illustrated in Fig. 1.

For an AQ IAM the different blocks of the DPSIR scheme can be described as:

- DRIVERS : the key activities that result in pollutant emissions (e.g. traffic, residential heating);
- PRESSURES : the pollutant emissions;
- STATE : the air quality i.e. the concentrations and deposition of pollutants;
- IMPACTS : the consequences of the air quality for human health or the environment;
- RESPONSES : the available measures to reduce the impacts.

In practice, there is not a standard solution for IA. An IAM has to take into account the available data, the regional/local specificities, the financial resources and the actual purpose of the assessment. Therefore each of the DPSIR blocks can be represented with different levels of detail. The level of detail is here defined as a measure of the methodology used to describe the elements of the system, including the interactions between these elements. The highest level of detail most often implies a better description of the block and a better knowledge of the parameters on which to act. In general, more detail will however also require more detailed input data and modelling tools and this will often place higher demands

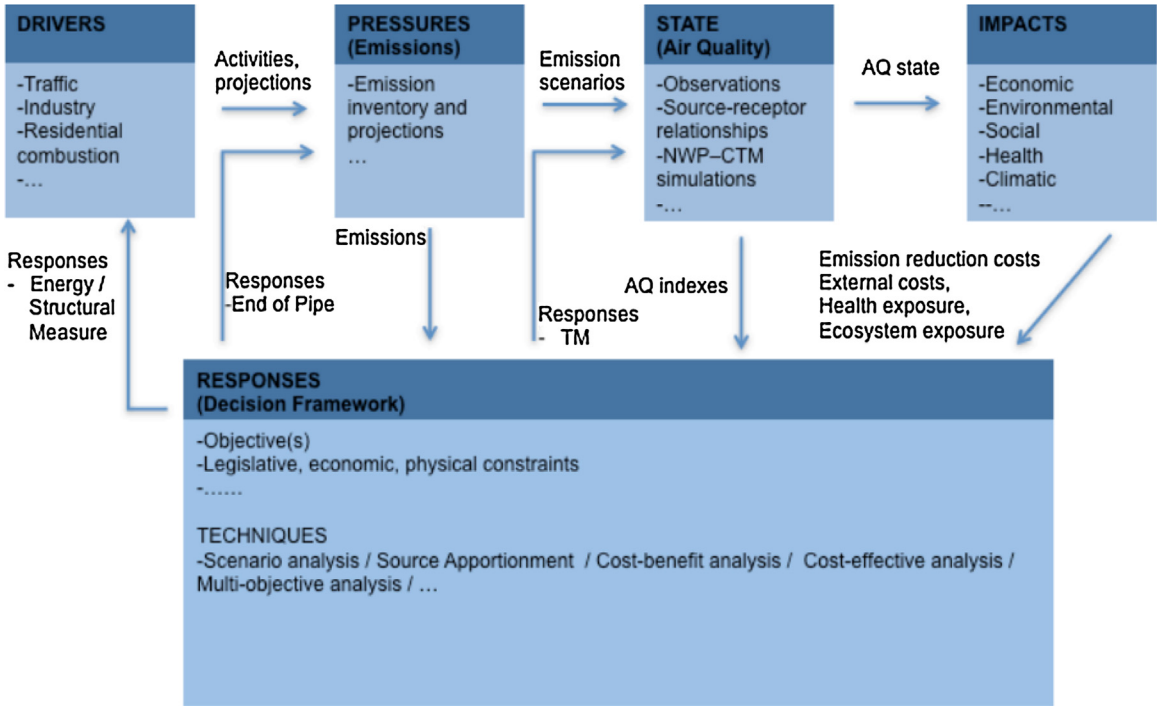

Fig. 1. The DPSIR scheme adapted to IAM for AQ at regional/local scale. TM: technological measures.

Please cite this article in press as: P. Viaene, et al., Air quality integrated assessment modelling in the context of EU policy: A way forward, Environ. Sci. Policy (2016), http://dx.doi.org/10.1016/j.envsci.2016.05.024