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Reflecting on the Implementing Geological Disposal Technology Platform as a knowledge network and potential scenarios for stakeholder involvement

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Preface on InSOTEC

InSOTEC is a three-year collaborative social sciences research project funded under the European Atomic Energy Community's 7th Framework Programme FP7/2007-2011, under grant agreement n°2699009.[1] The project aims to generate a better understanding of the complex interplay between the technical and the social in radioactive waste management (RWM) and, in particular, in the context of the design and implementation of geological disposal (GD).

In doing so, InSOTEC wants to move beyond the social and technical division by treating RWM and GD as 'socio-technical' challenges.

ON THE INTERTWINEMENT BETWEEN THE SOCIAL AND THE TECHNICAL

As of the 1980's, a new strand of social scientific research emerged, which considered the social world to be shaped or influenced just as much by the technology it uses, as that technology itself is shaped by its social environment (e.g. Bijker et al., 1987; Callon et al., 1986; Elliot, 1987; Latour, 1986; Law, 1986; MacKenzie and Wajcman, 1985). From a Science and Technology Studies (STS) perspective, actions and decisions take place within hybrid collectives, that is, combinations of what we usually call the social (human actors, relationships, norms, groups, values, etc.) and things deemed technical (technical equipment, measures, calculations, tools, texts, etc.) (Callon and Law, 1989: 78). When we look at the making and design of aircrafts, bicycles, ships, buildings, nuclear reactors, light bulbs, diesel motors, or bridges, what we see is that beyond what might look like mere technical questions lie assemblages of humans and non-humans, subjects and objects, the social and the technical. In this sense, "artifacts have politics" (Winner, 1986): artifacts embody political visions of society and, at the same time, they have consequences upon the ways in which humans relate to each other and to their environment. Consequently, when actors modify and translate their interests they simultaneously modify and translate the knowledge and technological artifacts they use, develop and believe in, as well as their identities as actors. This is a reason to talk about socio-technical combinations instead of technical aspects on the one side and social aspects on the other, or about a technical 'content' surrounded by a social 'context'. What goes on in an innovation process is mutual adaptation between many factors gathered together in one and the same process, where involved actors - whether engineers, politicians or engaged citizens - do not separate between what is usually defined as technical and social factors. On the contrary, they know that they have to include both technical and social aspects in order to be successful. For many technologies, the relationship between social and the technical indeed has become stable, relatively unambiguous and not open to fundamental controversy. Today it would be hard to imagine a world without cars, microwaves or the

[1] InSOTEC partners are: University of Antwerp (Belgium), University of East Anglia (UK), OEKO Institute (Germany), Göteborg University (Sweden), CNRS – Ecole des Mines de Paris (France), MTA TK (Hungary), GMF (Spain), University of Tampere (Finland), University of Jyvaskylan (Finland), University of Ljubljana (Slovenia), Charles University (Czech Republic), Merience Strategic Thinking (Spain), University of Oslo (Norway).

internet, while less than 150 years ago, bicycles were considered a controversial technology and several different models competed for social approval (Pinch and Bijker, 1989). Conversely, technologies disappear (e.g. steam engines, cassette recorders, VCRs, or the Concorde airplane), and this for a host of different reasons. For geological disposal, although commonly presented by the expert community as the best available technology today to deal with the long term management of high-level waste and spent nuclear fuel, such stability is clearly not present. In fact, deep geological disposal remains today in many respects a hypothesis, of which the functionality has not been empirically demonstrated for actual long term safety.

ON SOCIO-TECHNICAL CHALLENGES FOR GEOLOGICAL DISPOSAL

Geological disposal is a particular technical concept to deal with the problem of radioactive waste; a technology that is considered by the expert community as the best available: *"The prevailing view of technical experts, as well as of many members of the general public that have been familiar with the work relating to geological disposal, is that geological disposal is a safe and technically achievable solution."* (NEA, 2008a: 14). In 2011, the European Council adopted a new Directive "Establishing a Community framework for the responsible and safe management of spent fuel and radioactive waste" [2], which takes this technical consensus as a basis: *"It is broadly accepted at the technical level that, at this time, deep geological disposal represents the safest and most sustainable option as the end point of the management of high-level waste and spend fuel considered as waste"* (consideration (23) framing the Directive). As a consequence it urges Member States to develop and implement national programmes for the management of all spent fuel and radioactive waste under their jurisdiction, including disposal as the final stage in the management of radioactive materials (article 11 - §1). This suggests that today also a political consensus exists at the European level that GD is the technology of the future, where high level waste and spent fuel are concerned.

However, this does not mean that this technical concept is no longer controversial. Many of the general public, as well as many environmental groups and scientists from other disciplinary backgrounds, are still not convinced. The last Eurobarometer survey on attitudes towards radioactive waste for example showed that despite 43% of the Europeans polled thinking deep underground disposal to be the most appropriate solution for the long term management of high-level radioactive waste, still more than 70% of all respondents did not believe that there actually is a safe way of getting rid of it (TNS, 2008: 23-24). This may or may not have to do with the fact that few people are familiar with the concept of GD and the potential attributed to it by the research done so far in that field, as the above quote from the NEA - RWMC statement suggests. Still doubt remains even among those more familiar with the work on GD. In a review of scientific papers on the subject, commissioned by Greenpeace, Wallace (2010)

[2] Council Directive 2009/71/Euratom of 25 June 2009 establishing a Community framework for the nuclear safety of nuclear installations [OJ L 172, 02/07/2009, p. 18–22].

stresses the remaining uncertainties and gaps in knowledge, for example on corrosion and chemical effects. While the RWM community acknowledges the existence of these uncertainties, they are not considered problematic. It is argued that they are treated in the so called 'safety cases'[3], focussing on the question of long-term safety (i.e. after closure of a GD facility), and thus taken into account. However, a safety case is a very technical concept, based on modelling, mathematical analyses and performance calculation. It is a complex given that is not widely known outside the RWM community, and controversy does remain concerning methodology, as critics such as Wallace (2010) have expressed concerns regarding the reliability of models predicting long term repository safety.

What is also clear, is that the concept of GD has developed, and will continue to do so, not only because of evolutions in scientific knowledge, but also as a consequence of debates on how to integrate this technology into society. A clear example of this, is the introduction, by legal obligation, of the seemingly contradictory notion of retrievability into the concept of GD in Switzerland[4] and that of reversibility in France[5]. The adapted concept of GD that is being developed in these and other countries today (see for example the NEA's R&R project: NEA, 2011; NEA 2012) still has to prove its capacity for resolving competing values with regard to the safe disposal of radioactive waste. But it does show that we need to think about GD (or more generally any technique to provide in the long term management of high level waste or spent fuel) not as a technology designed by scientists and experts, but as a socio-technical concept of which the meaning and characteristics are negotiated and value laden.

InSOTEC METHODOLOGY AND STRUCTURE

InSOTEC focuses on situations and issues where the relationship between the technical and social components of RWM and GD in particular is still unstable, ambiguous and controversial, and where negotiations are taking place in terms of problem definitions and preferred solutions. Such negotiations can vary from relatively minor contestations, over mild commotion, to strong and open conflicts. Some concrete examples of socio-technical challenges are the question of siting and, as already suggested, of introducing the notion of reversibility and retrievability (R&R) or long term repository monitoring into the concept of GD. These examples show that the concept of GD develops over time, not only because of evolutions in scientific knowledge, but also as a consequence of debates on how to integrate this technology into society.

[3] A safety case in the context of geological disposal can be described as "a synthesis of evidence, analyses and arguments to quantify and substantiate that a repository will be safe after closure and beyond the time when active control of the facility can be relied upon" (NEA, 2008b).
[4] Kernergiegesetz, vom 21. März 2003 (*Nuclear Energy Act* - 21 March 2003)
[5] Loi n°2006-739 du 28 juin 2006 de programme relative à la gestion durable de matières et déchets radioactifs (*Radioactive Materials and Waste Planing Act* - 28 June 2006). On the notion of reversibility In France, see also Aparicio (2010).

Whether in a pre-siting, siting or more advanced stage of the implementation of GD, implementers all over the world are looking for ways of addressing stakeholder concerns regarding how to integrate societal 'boundary conditions' (including concerns about safety, but also for example political and economic constraints) with the environmental, technical and regulatory 'boundary conditions' for disposal facility design. Such integration and attuning is needed to determine the social feasibility of technology, at a certain point in time. It is also needed to sound the technical viability of specific socio-political expectations and demands (think for example about the issue of R&R). InSOTEC aims to provide a valuable contribution to this challenge by developing a fine-grained understanding of how the technical and the social influence, shape and build upon each other in the case of RWM and the design and implementation of GD. How are socio-technical combinations in this field translated and materialized into the solutions finally adopted? With what kinds of tools and instruments are they being integrated? A better understanding of RWM in terms of socio-technical challenges and combinations allows the concept of GD to be seen not merely as a technical artefact to be introduced in a not necessarily receptive social environment, but as part of that social environment and therefore partially shaping it and being partially shaped by it. GD is in this respect viewed as a possible means to attain a long term management of radioactive waste, rather than as a goal in itself. The socio-technical challenges for implementing GD will therefore be looked at within the broader context of how RWM strategies are defined (by 'technical' and 'social' stakeholders) and how GD fits into these strategies.

The work in the InSOTEC project is structured into seven work packages (WPs). Three of those are supportive WPs dedicated to communication and dissemination activity, the organisation of seminars, and project management. The four research oriented WPs are organised as follows:

WP1 provides a review of national and international RWM focusing on the correlation of socio-political and techno-scientific challenges and whether or not they are acknowledged and dealt with as such.

WP2 consists of an assessment of mechanisms regarding the interaction of social and technical challenges through a number of case studies. These are: siting; technology transfer and transfer of socio-technical innovations; the issue of R&R; and the demonstration of safety.

WP3 looks at arenas where socio-technical combinations on RWM are formed through the co-production of knowledge between different actors. For this reason, networks or spaces are explored where people and organisations from various backgrounds interact with each other and create knowledge through a process of dialogue. A particular case study is the Implementing Geological Disposal Technology Platform (IGD-TP)[6].

WP4 links the research activity to the practice of RWM and GD by offering concluding reflections and recommendations.

The InSOTEC Stakeholder Reflection Group is an advisory committee composed of nine individuals representing different groups interested in the subject (social scientists, implementers, local communities involved in RWM issues, national oversight bodies, the IGD-TP and the NEA). It is set up to ensure that different perspectives from potential end users are taken into account and that the results are useful to the 'practitioners' in the field.

InSOTEC AIMS

With this project, the InSOTEC partners hope to create greater awareness among the technical community of the social implications of their work, as well as of the underlying social assumptions that directly and indirectly colour the solutions they are developing. At the same time the partners hope the project will also provide other parties concerned (such as political decision makers or involved communities) with a better insight into the origins of certain technical concepts, which may help them to be better equipped when dealing with these issues in their own context.

Complementary to providing better theoretical insight in the complexities of RWM, and GD in particular, by describing them as socio-technical challenges, InSOTEC aims to provide concrete suggestions on how to address the actual socio-technical challenges identified within national and international contexts. We expect to offer insights (e.g. with regard to technology transfer and transfer of socio-technical innovations, the issue of reversibility, the inclusion of social aspects in the safety case model, …) to scientists and technical experts that could help them to communicate in a two way process about their work and to engage with stakeholders on technical and safety issues. With regard to the IGD-TP, InSOTEC will also investigate whether and how stakeholders representing different parts of concerned society with different backgrounds could be linked to the platform on a structured basis. In addition, advice will be

[6] This technology platform was established in 2009 on the initiative of a number of European waste management agencies. European Technology Platforms (ETP) are a specific tool supported by the European Commission (EC) to bring together R&D-relevant stakeholders with various backgrounds, led by industry, to set a strategic research agenda and to develop a long-term R&D strategy and action plans in technological areas of interest to Europe (http://cordis.europa.eu/technology-platforms/home_en). Although most ETPs in one way or another seek connection to a broader range of stakeholders beyond the technical community in their particular field, there is no standardized approach to involve diverse stakeholder groups, nor are there specific instructions or expectations formulated by the EC in this regard (IDEA Consult, 2008). The IGD-TP has a dedicated Exchange Forum (EF) through which it wants to interact with stakeholders. Up until now this Exchange Forum has mainly been able to attract specialized stakeholders from the technical research community.

provided on how to set priorities for a multidisciplinary research agenda which incorporates social sciences and which will address socio-technical challenges in a coherent and integrated way.

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Introduction

This report was prepared in the context of Work Package 3 of the InSOTEC project. The overall objective of this work package (WP) is to take a closer look at arenas where socio-technical combinations on radioactive waste management (RWM) are formed. The attempt is to illustrate the interconnections between the sources of different types of information and knowledge development with the various stakeholders having access to that information. This will enable us to better understand the ways in which the field of communication is structured, and therefore the lessons that can be learned from already established information exchange practices in the field of geological disposal. For this reason, networks or spaces where heterogeneous actors interact with each other and create knowledge within this process will be explored. A particular case study is the Implementing Geological Disposal Technology Platform (IGD-TP), which is the focus of this report. At this stage, organisational issues are mapped out, whilst at a later stage, this report will be reviewed and complemented to assess how such networks contribute to constitute socio-technical knowledge.

The present report starts by reviewing the literature on models of networks in social science theories and co-production of knowledge. This field of literature does not have an overarching framework for integrating conceptual, theoretical and empirical work. Rather, we have chosen an eclectic approach, integrating elements of diverse theories to increase the explanatory power of research efforts. The notion of "networks" has different meaning throughout different field of research. Here we position ourselves in the tradition of policy studies (see section 2), where the notion of network refers to a complex system composed of a variety of components, of actors, who themselves have specific attributes, and these actors might be interconnected in different ways. Understanding networks in their entirety is an intricate task. They are situated in a specific space and at a specific point in time, but they are also dynamic and will therefore, evolve. Their composition, focus and structure can thus change over time. Hence, a broad analytical context seems pertinent to situate the exploration on networks around socio-technical issues. In this report, we introduce ideas pertaining to the field of socio-technical and governance studies, such as policy networks, participatory technology assessment, interdisciplinary studies, science-policy studies and science and technology studies.

The second part of the report provides an overview of European Technology Platforms (ETPs), as mechanisms for creating knowledge and advising on research and development (R&D) policy in a specific domain. The IGD-TP is set up as an ETP and therefore, we show how other ETPs have been formed, how they involve their members, how different categories of members interact and to what extent 'outsiders' are being involved.

The third part presents our view on the IGD-TP as a complex network which includes actors, knowledge and practices across different countries, focusing on a very specific topic (i.e. implementing geological disposal). How the IGD-TP is viewed by its members and by outsiders

to the platform was explored through different methods, including an illustrative survey and semi-structured interviews.

The fourth section uses a framework of different degrees of interaction between science and society to discuss a continuum of scenarios for improving stakeholder involvement in the IGD-TP. The focus is here on the interactions between science, society and policy in view of defining R&D priorities, and how these interactions could be conceptualised and interpreted for the IGD-TP. We apply Callon's framework (1999) for structuring different modes of participation in the creation of knowledge to interpret how the IGD-TP can interact with stakeholders and to explore different scenarios of potential stakeholder involvement within the platform.

Finally, some concluding reflections and remarks are offered to help the IGD-TP to reflect on its current way of working, and on consequences of decisions on future paths.

1. Framing knowledge networks and co-production of knowledge

This section provides a general introduction and overview of stakeholder involvement in relation to scientific activity and research and development, as it embodies the main rationale of ETPs (i.e. to develop structured and inclusive approaches for developing R&D policy with a wide range of stakeholders). For this, two main threads of research are considered. Firstly, a brief review of the state of the art of the study of networks and its application to social science studies is provided. In this context, we focus on knowledge networks, as we are particularly interested in the ways that networks can influence knowledge creation and transfer. We are also interested in the way 'non-specialists' are involved in networks and can influence research, policy and practice. However, we do not attempt to present a detailed analysis of the literature relating to networks and knowledge networks, rather to identify key characteristics of networks and the key role they can play in generating knowledge and some of the reasons they are successful.

The second strand of research deals more directly with knowledge assessment and knowledge production. In the past twenty years, there has been an evolution from the so-called 'public understanding of science' model to more direct forms of public participation and engagement in science and technology. Most participatory models, evaluations of participatory settings and analytical framings of 'the lay-expert divide', still tend to fall back on the more conventional understanding of lay input and social aspects, which represent first and foremost interests and values. Whenever the issue of 'raising knowledge' is addressed, it focuses primarily on the accessibility of reliable scientific knowledge to policy makers. In addition, while it appears generally accepted that such scientific knowledge should be supplemented with knowledge on social and policy aspects, it seldom leads to the interpretation of 'extending the peer community' for other purposes than the incorporation of public and stakeholder value judgements in the decision-making process. Most prescriptive literature focussing on issues such as process design and deliberation techniques to optimize decision-making, pays abundant attention to interest representation and representativeness of participants in terms of interests and values, but tends to touch only marginally upon the cognitive dimension of participation. The concept of co-production of knowledge rejects the idea that science (or technology) rules society, but equally dismisses the claim that society fully governs science (and technology):

> *"… it presumes that knowledge and its material embodiments are products of social work, and at the same time, constitutive of forms of social life. It acknowledges that lived 'reality' is made up of complex linkages among the cognitive, the material, the normative and the social …" (Jasanoff, 2006: 274).*

1.1 Framing knowledge networks

This part deals with network concepts and presents a multi-theoretical, multi-level framework which permits an organised investigation of a wide variety of 'knowledge networks'. Networks are present in the literature around governance, social capital, organisational or knowledge management, even information and communication technologies. In the context of this research, networks can also be described or conceptualised as forums for interactive information exchange, platforms, coalitions, partnerships, alliances or collaborative arrangements. As such, network is a widely used term which is inherently difficult to define but can provide a helpful approach to complexity and pluralism.

Chilvers and Evans (2009) review different perspectives on how networks are understood in the field of 'science-policy studies' and acknowledge that the proliferation of the notion of networks "has generated considerable conceptual complexity". They review the notion of networks in policy studies (i.e. policy networks, epistemic communities, advocacy coalitions); networks in science studies (i.e. actor network theory). They note that "*a corollary of this theoretical confusion is the current deficit of basic methodological clarity in environmental science-policy studies, which tend to provide detailed explications of theory without always outlining its exact implications in terms of the methodological approach adopted*" (Chilvers and Evans, 2009: 359). Hence, researchers face challenges trying to get to grips with how best to approach the study of networks in the environmental field. Empirical research demonstrates how "boundaries and demarcations – of science/policy, insider/outsider, expert/lay and so on – are continually made and remade in these assemblages". Chilvers and Evans end up noting that there is a need for even more "complex theoretical registers that fuse notions of networks, actors and space with concepts of discourse, knowledge and power" (Chilvers and Evans, 2009: 360).

As part of the governance realm, there is a large body of literature on the emergence of governance structures, such as networks. On the one hand, a vast amount of research has focused on public private partnership arrangements, for instance between civil society (e.g. NGOs) and the market (Van Huijstee et al., 2011) or the so-called multi-stakeholder partnerships or cross-sector partnerships (Morsink et al., 2011). Partnering spans a continuum of relationships from transactional ones to very strong collaboration and at different levels, from international to local. In the field of nuclear waste, for instance, a typical case of partnership would be the one formed between the radioactive waste management agency and the local community in which a facility would be sited (NDA, 2007; NEA/FSC, 2009; Hooft et al., 2002) and which can be conceptualised as a policy network (Bergmans et al., 2008). Policy networks can be understood as "clusters of actors with an interest in or relevant knowledge on a particular policy sector or domain, that each have the capacity to contribute to the success or failure of policy" (Peterson, 2003: 1, as in Bergmans et al., 2008). As a starting point, a network can be considered from the policy network perspective as a stable pattern of social relations between interdependent actors, which take shape around policy problems and/or policy programmes (Rhodes, 1996: 652). The CARL project classifies two types of networks

around radioactive waste management: networks focusing on the siting of repository facilities and networks on general management issues, overall strategy and policy programmes (Bergmans et al., 2008).

Another growing body of research is found in the field of knowledge networks. Empirical research on this topic spans multiple disciplines, such as psychology, sociology, management and economics, and different levels of analysis. A systematic review of empirical research on knowledge networks is provided by Phelps et al. (2012). The paper identifies points of coherence and conflict in theoretical arguments and empirical results within and across levels and across knowledge-related outcomes. A knowledge network is defined in the paper as "a set of nodes – which can represent knowledge elements, distributed repositories of knowledge and/or agents that search for, transmit and create knowledge – that are interconnected by relationships that enable and constrain the acquisition, transfer and creation of knowledge" (Phelps et al., 2012: 1117). The authors suggest that knowledge network research in general only considers one type of relationship and as a result, only one type of network, whereas actors are involved in multiple, different types of ties and networks. They point out to different dimensions which may have been overlooked in many studies and should be worth considering, such as network composition, observing the volume and content of actual information flows between actors, depth and diversity of network member knowledge stocks and knowledge creation, among other issues. According to Stone and Maxwell (2004: 11) "knowledge networks incorporate professional bodies, academic research groups and scientific communities that organise around a special subject matter or issue". Perkin and Court (2005) identify how networks can influence policy in international development. For this, they review the most emerging terms surrounding networks and suggest that "if the knowledge network includes a number of influential individuals, it may be a vital tool in bridging research and policy" (Perkin and Court, 2005: 9). They also point out the difficulties of knowledge networks due to the inefficient use of resources or conflicts arising between politically heterogeneous actors.

Thus, the literature reviewed provides bits and pieces which can be used as building blocks for a more integrative perspective. The scope of interest for this study has been limited to networks with a key emphasis on creating and promoting knowledge or influencing policies and research on a pan-European level. Therefore, they have qualities of policy and knowledge networks.

Based on the definitions above, we define **networks as formal and informal structures that link actors (individuals or organisations) who share a common interest on a specific issue**. Therefore, the definition adopted in this report claims no more than practicability within the context of InSOTEC's goals. Given the purposes of this study, this is intended to be a very broad definition which can be applied to both an informal group and a rigid structure which show links between actors, allowing them to communicate better and share information. Attention is focused on how networks are created and who initiates them, what conditions are placed on its creation, how they operate, who takes part and which is the role of the different

members, what can affect its design, why organisations collaborate with partners to exchange knowledge, who or what can influence its dynamics and what determines their functioning. Obviously, networks do not take place in a vacuum but rather in interplay between different organisations, institutional framework, power and trust relations. Networks also evolve under changing conditions.

1.2 Co-production of knowledge

Literature identifies different objectives of participation in decision-making. Pellizzoni (2001), for instance, suggests three types of virtues of public deliberation which are closely intertwined. The first type is the *'governance virtue'*, which refers to the fact that participation can contribute to the legitimacy of the policy and the decisions made. Participants that have a say in the decision-making procedure, are more likely to support the actual implementation of the decision. Participation is therefore presumed to foster increased levels of acceptation (Hage et al., 2005). The second or *'civic virtue'* points to the role of participation in helping to produce 'better' citizens who are more informed, responsible, fair, open to the arguments of others, etc.; what consequently leads to a more democratic society. The third and last would be the *'cognitive virtue'*, which indicates that participation contributes to better informed decisions, by bringing in lay and local knowledge. Since nobody in normal situations possesses all the information required to take a collectively advantageous decision, the strength of participatory decision-making lies in the fact that open dialogue can give rise to new and more articulate points of view and can deepen the knowledge about a problem (Pellizzoni, 2001). The cognitive virtue is probably of most relevance here, as it clearly implicates that within participatory settings (and ETPs surely are to be understood as participatory settings) different knowledge is being generated, as compared to knowledge generated in closed expert circles.

Concerning more integrative approaches to scientific activity and R&D, Funtowicz and Ravetz (1993, 1999) developed the concept of "post-normal science". This characterises the changing relationship between science and society as a situation in which there is no longer a single description and connection of the facts, or a shared vision among scientists of the meanings of concepts and principles. Post-normal science is meant to be applied whenever high uncertainty, urgency, high stakes and/or risks are involved in a policy-relevant issue. Funtowicz and Ravetz furthermore introduced the notion of "extended peer community" consisting of stakeholders with various perspectives on the issues, who are brought into the dialogue to assess the input from science to decision-making. By extending the notion of peers, other facts (referred to as "extended facts") and which may otherwise have been neglected, are introduced into the dialogue (Funtowicz and Ravetz, 1993). Thus, open negotiation on complex issues helps ensure that various stakeholders can debate their perspectives and fosters new forms of understanding and engagement with science and technology (Funtowicz and Ravetz, 1993). Funtowicz states that knowledge assessment is a form of an extended peer community, including not merely people with an institutional accreditation, but also others who have a desire to participate in the resolution of the issue (Funtowicz, 2006: 143). However, the theory

of post-normal science does not yet offer clear operational criteria to assess certain scientific activities and practices (Van de Kerkhof and Leroy, 2000).

Hoppe (2009) developed a typology of science-policy interactions based on two dimensions: whether the primacy lies with science or politics, and whether science and politics are seen to converge or diverge in their essential social functions. Hoppe conceives six models of boundary arrangements: enlightenment model, advocacy model, technocracy model, bureaucracy model, policy-oriented learning model and engineering model. He studied how Dutch policy workers themselves conceive the division of labour between science and politics. As an ETP can be considered a boundary organisation in itself, linking science and policy, Hoppe's work on dealing with the science-policy interface merits some attention, for example with regard to how other types of knowledge (such as experience-based knowledge or citizen knowledge) are integrated with scientific knowledge in arriving at policy decisions. This can be illustrated by the following passage, which echoes a number of the challenges the IGD-TP is facing in its role as a boundary organisation:

> *"the knowledge and assessment agencies employing boundary workers are faced with a changing, more pluralistic political landscape. They now generally work in alliance with national government. But they face an expanding number of increasingly vociferous civil society organizations and stakeholders, like non-governmental organizations. Also, they need to position themselves vis-à-vis supranational levels of government (e.g. the European Commission's Bureau of European Policy Advisers, BEPA) and the knowledge institutes and think tanks operating at the international level (like the OECD, IMF, World Bank, Eurostat, etcetera). Ambiguities among boundary workers' beliefs on allowing lay or practitioners' knowledge standing at the policy tables, and on dealing with supranational levels of government, suggest they are aware of the problems. Yet, it will take quite some ingenuity to find satisfactory strategies between not antagonizing traditional governmental clients and coping with the value and knowledge pluralism of the new multi-actor and multi-level governance structures" (Hoppe, 2009: 256).*

Others have referred to this scientific knowledge production system as "Mode-2 science", emphasising that knowledge is increasingly generated in "the context of application". Therefore, science can no longer be considered an autonomous space clearly demarcated from economy, society and culture (Gibbons et al., 1994). We consider this thinking of particular relevance for the implementation driven R&D work that is at the core of the IGD-TP's mission. Gibbons and his colleagues later further developed the concept of "Mode-2 science" to that of a "Mode-2 society", with a 'contextualisation' of science and the production of 'socially robust knowledge'. With "socially robust knowledge", the authors refer to knowledge that is open-ended, and more reliable because it remains valid "outside these 'sterile' spaces created by experimental and theoretical science" (Nowotny et al., 2001: 168).

Because of its robustness, Nowotny et al. consider "contextualized knowledge" to be not only inevitable and relevant (addressing more directly social, political and economic agenda's), but also scientifically beneficial, allowing scientific problems to be addressed by a wider range of perspectives and techniques (Nowotny et al., 2001). From a normative 'contextualized knowledge perspective', the quality assessment of scientific knowledge would have to be

performed with the involvement of non-scientists. Nowotny, Gibbons and others stress the ”organisational aspects of knowledge generation”, with a particular emphasis on the need for ”co-production of knowledge” by all relevant stakeholders, ”though they do not provide operational procedures either” (Hage et al., 2005).

Along the ideas of Mode-2, the concept of transdisciplinarity refers to a joint effort by specialists from the scientific community and from business, politics and society, to jointly identify problems, develop common theoretical structures, research methods, etc. (Van de Kerkhof and Leroy, 2000). ‘Transdisciplinary research’ in this interpretation therefore refers to research activity that aims to integrate “knowledge that is segmented into different scientific fields and fields of practice” (Bergmann et al., 2005: 9) and that is “characterised by a process of collaboration between scientists and non-scientists on a specific real-world problem” (Walter et al., 2007: 325).

In our field of research, Technology Assessment (TA) is a more specific form of knowledge assessment. Based on the final report of the European project ‘Technology Assessment in Europe: between Method and Impact’ (TAMI), Technology Assessment can be defined as “a scientific, interactive and communicative process which aims to contribute to the formation of public and political opinion on societal aspects of science and technology” (TAMI, 2004; 17). TA can be applied on a large variety of technologies, but amongst them the most important are biotechnology & medicine, nanotechnologies and information & communication technologies. TA can appear in different forms. Although scientific literature divides TA in many different categories, one can roughly distinguish three important types. A first important category of TA is Parliamentary Technology Assessment (PTA)[7]. The aim of PTA is to provide the parliament with accounts and reports of developments in emerging technologies. This is seen as an aid to the democratic control of technological innovations, and was pioneered in the 1970s by the Office of Technology Assessment (OTA) of the US Congress (EPTA, 2012: 1). In Europe, the European Parliamentary Technology Assessment network (EPTA) consists of 14 members and 3 associates (EPTA, 2012). Two of these technology assessment bodies operate at the level of the European Parliament (i.e. Scientific Assessment Technology Policy Options for the European Parliament, STOA) and the Council of Europe (i.e. Committee on Culture, Science and Education, COE). A second form of a TA is participatory Technology Assessment (pTA) (Bellucci & Joss, 2000: 35; Joss & Bellucci, 2002). The aim of this category of TA is to involve various kinds of social actors as assessors and discussants. Those actors may be expert-stakeholders, such as technical experts or sociologists, but also a broader public including lay persons (Van Eijndhoven, 1997: 272). A final TA category is Constructive Technology Assessment (CTA), particularly developed in the Netherlands and Denmark. This category tries to broaden the design of new technology by interacting with new actors early on. The results

[7] The four year EU financed project under FP7 PACITA (Parliaments and Civil Society in Technology Assessment) aims at increasing the capacity and enhancing the institutional foundation for knowledge-based policy-making on issues involving science, technology and innovation, mainly based upon the diversity of practices in PTA. See www.pacitaproject.eu for further references.

of such dialogues can feed into the construction of new technology. The main difference with other forms of TA however, is that CTA does not want to influence regulatory practices, but tries to address social issues by influencing the technology design itself (Schot and Rip, 1997: 252). Case studies of those three forms of TA can be found in Annex 2.

Since complexity of technology has increased during the last decades, both deeper levels of specialization and greater levels of collaboration between different scientific disciplines are required (Beam et al., 2003: 123). Also, real-world problems do not come in disciplinary-shaped boxes (Jeffrey, 2003: 539). Therefore, interdisciplinary programs were developed in the second half of the twentieth century to overcome gaps and inadequacies in the disciplinary structure of the academic world. Areas such as gender studies and environmental studies are common examples. Scholarly literature on interdisciplinarity was first written by Klein in 1990. Klein mentions that there is no unambiguous definition of interdisciplinarity, but in any case it involves combining two or more academic fields into a single discipline (Klein, 1990: 11-12). Some authors mention there are important barriers for interdisciplinary programs, of which the differing of perspectives and methods between different scientific disciplines and a lack of sufficient autonomy are the most important (Augsburg, 2006: 53-55).

Science, technology and society (STS), also referred to as science and technology studies, is a perfect example of such interdisciplinary research. During the so-called ”turn to technology” (Woolgar, 1991: 14), social scientists stated that society influences technological development and vice versa, and social construction of technology is therefore a better term than technological development itself (MacKenzie and Wajcman, 1985: 23; Bijker et al., 1987: 54). During the following decades, STS has been carried out in many sectors, such as nanotechnology, computer science and sustainable development. In this context, “upstream engagement” is now claimed as a means to involve the public early on, before significant R&D has taken place and before established public discourse has developed, to encompass co-production of knowledge (Rogers-Hayden and Pidgeon, 2008). ’Upstream‘ public engagement[8] allows opening up differences in visions and bringing them into the public arena. This may overcome one of the common problems with public engagement activities: narrowly framed debates (Rogers-Hayden & Pidgeon, 2008). Rogers-Hayden and Pidgeon develop a definition of upstream engagement as follows:

> *“Dialogue and deliberation, that includes the publics and related interest groups, relevant science communities and policy makers, about potentially disruptive/controversial technologies at an early stage of the research and development process and in advance of significant applications, or widespread public knowledge, in a way that has the potential to influence the technology trajectories” (Rogers-Hayden and Pidgeon, 2008: 1011).*

Examples of different levels of upstream engagement processes have taken place in the field of nanotechnology, mainly in the UK (Rogers-Hayden and Pidgeon, 2008; Chilvers, 2006; Joly

[8] Public participation and public engagement are often used interchangeably. Delgado et al. (2011) argue that public engagement “could be taken to refer to both a need to generate early interest, and a more inclusive form of participation”.

and Kaufmann, 2008) and at the level of the European Union and other countries (Bava Laffite and Joly, 2008). According to Tait (2009) "upstream engagement has brought some new voices to decision-making" (such as NGOs) but has declined others (like industry and other professional groups). Tait claims that:

> *"upstream engagement seems likely merely to substitute one set of dominant opinions for another set that is no more universal, and if anything, is less based on scientific evidence than the previous one" (Tait, 2009: S21).*

Additionally, Todt (2011) questions if improvements in public access to information or opening up decision-making processes to previously excluded stakeholders and the introduction of participatory mechanisms, do effectively improve acceptance and social robustness of science and technology. In view of the dangers of upstream engagement efforts, Tait suggests in that respect to engage in a "wider dialogue across a wider range of social science disciplines and professionals functions" in order to bring in "expertise in innovation systems, regulation, governance and economics" (Tait, 2009: S21).

Rogers-Hayden and Pidgeon (2008) furthermore argue that in upstream engagement, new questions need to be asked about visions for society, about agendas and practices of science, and how the new technologies may interact with these new visions. Nevertheless, Joly and Kaufmann (2008) show that the 'upstream engagement' concept pursued by some science and technology studies (STS) scholars is still embedded in a linear model of innovation and is not very useful for pursuing the co-production of innovations. Based on an experience of a public debate on nanotechnologies by a group of social scientists in Grenoble, the authors analysed the local configuration of nanotechnology projects, presented options for participatory exercises and made recommendations about the road to follow to move towards a more participatory culture. At the local level, it was found that public participation can be a way for local elites to overcome local contestation whilst at the same time stick to technocratic governance. Policy makers believed that it was necessary to educate the public in order to promote a scientific culture and to create a context in favour of nanotechnology. This perspective does not allow discussion of local choices and how local public might be involved either. On the other hand, local activists did not want to engage in participatory exercises initiated by the local government. As cited by Joly and Kaufmann (2008: 19), Marris et al. (2008) already claimed that "the lack of analysis of the interactions between the microcosm of public participation and the wider world is one of the major shortcomings of studies of public participation".

On the other hand, Delgado et al. (2011) also explore public engagement in nanotechnology from an STS perspective. They highlight the tensions in STS discourse on public engagement[9] and how these entangled tensions are translated into practice. They conclude that putting

[9] They identify five top topics of tension related to the general questions of: "why should we do public engagement?", "who should be involved?", "how should it be organised?", "when should it be done?" and "where should it be grounded?".

theory into practice demands choices and compromises between competing theoretical ideals, and that their reflection can enrich STS scholars.

2 Methodology

As indicated in the introduction, the focus of this report is on organisational arrangements for structuring knowledge networks, how these affect the scope and inclusiveness/exclusiveness of the network, and how this applies to the IGD-TP as an international knowledge network on RWM. Therefore, attention will primarily be paid to characterise the interactions between members in networks, rather than to identify the (socio-technical) knowledge discussed or derived from these arrangements. The latter question will be treated in a follow up report at a later stage in the InSOTEC research.

As a first step, interactions between members are identified through the members' participation in the organisational structures, meetings and conferences. For this, data was collected from public reports, documents, web pages, minutes of meetings, press releases as well as participatory observation in the IGD-TP Exchange Forums. A systematic analysis has been developed of European Technology Platforms (ETPs), which has enabled the InSOTEC consortium to draw conclusions on different forms of interaction (and integration) between the social and the technical spheres in knowledge-making. Furthermore, a critical reflection is made on the inclusiveness/exclusiveness of the knowledge generated through such networks or platforms and on how dissident voices are treated.

Two types of illustrative surveys were carried out as part of the InSOTEC project: a survey for IGD-TP members who have endorsed the vision (with the exception of the radioactive waste management organisations who founded the TP) [10], and a survey for organisations currently outside the IGD-TP, but who are known to have an interest in or knowledge on geological disposal or radioactive waste[11]. The former survey was aimed at those organisations who had been invited to join the IGD-TP once the platform had already been established and the vision was already set up. In order to be efficient in collecting responses and analysing results, the following principles were applied to both surveys: most of the questions had predominantly a "closed" character, the number of questions was limited to less than 25, giving an average survey completion time of about 10 minutes, some open questions were included to leave the possibility to give suggestions. The survey for the members endorsing the vision was structured around the following main themes: identification, awareness of the IGD-TP, involvement with IGD-TP, and the role of the Exchange Forum (EF). The survey for non-members was structured around similar themes: identification, awareness of the IGD-TP, awareness of the Strategic Research Agenda, awareness of the role of IGD-TP, and interest to engage with the IGD-TP.

[10] *Survey on the functioning of the IGD-TP*, issued in October 2011.
[11] *Survey on awareness and interest in the IGD-TP*, issued in August 2011.

For the survey for members of the IGD-TP an email was sent by the IGD-TP secretariat to its members (with the exception of the RWM agencies) inviting them to answer the questions of the InSOTEC survey.[12] Out of the total of responses received that completed the survey (34 responses), 50% of them (i.e. 17) have been analysed, corresponding to those participants affirming that their organisations had endorsed the vision. For the survey for outsiders, an email invitation was sent via the InSOTEC administration to pre-identified non-members of the IGD-TP. The list of non-members was compiled from a database of contact addresses of interested persons and organisations who had attended at some point a conference, seminar or meeting on radioactive waste management over the last four years. This list was complemented with contact addresses from the InSOTEC consortium members. The email sent out to non-members contained a hyperlink so that the respondents only needed to click on the address of the page in order to fill out the questionnaire online. Once the questionnaire was filled out, the data were automatically sent to a database for processing. In addition the survey was linked to the InSOTEC website so that it could be accessed by anyone visiting the web. Additionally, the survey was printed and distributed in a seminar organised by the Group of European Municipalities with Nuclear Facilities (GMF) to seek the input of local representatives. Therefore, a third of respondents (34%) out of the total of 72 completed responses, represent local communities and the best represented countries are Sweden and Spain. It should thus be emphasised that the results from both surveys are indicative and that their small sample size and the heterogeneity of the respondents do not allow for a statistical analysis in terms of representative or generalizable results. This however, has never been the intention of these surveys, they merely served to point us to potential issues and reasons why some stakeholder (type)s would be interested, or not, to engage with the IGD-TP.

These illustrative surveys were further complemented with the conduction of a number of semi-structured interviews with key stakeholders to clarify information, uncover assumptions and contrast the information from the surveys. Some interviews have been conducted by phone or skype. The interviewees were encouraged to talk about their view on the IGD-TP, its purpose, their expectations, the fact that organisations have to endorse the vision to become members and the role of the EF. The interviews were conducted in a qualitative manner. Ten people were interviewed, each representing a different type of stakeholder regarding RWM.

One brainstorming exercise was also undertaken as part of the methodology to explore the InSOTEC's researchers perception of the IGD-TP and ways to improve stakeholders' involvement. The InSOTEC researchers group was at the same time broken up into four smaller groups of around 4 to 5 people to discuss a set of open questions regarding the IGD-TP and stakeholder involvement. This brainstorming exercise was particularly appropriate to explore issues of importance for social scientists and above all, to generate their own questions and

[12] The responses to this survey however showed that the invitation reached a wider population than the one expected. 50% of the respondents said they had not endorsed the vision, while the survey was addressed only to those organisations registered as members of the IGD-TP, at a point in time when endorsing the vision was mandatory to become a member.

develop different perspectives on the IGD-TP. This brainstorming exercise contributed to focusing on issues that are central in the IGD-TP strategy for stakeholder involvement.

Finally, InSOTEC researchers have had the opportunity to become involved in a working group discussion as part of one of the working groups set up at the second EF, in particular, the EF Interfaces Working Group (IWG). The role of the EF, the way working groups were set up, and the aims of these WGs will be explained later on in this report.

3 European Technology Platforms

This section provides an overview of European Technology Platforms (ETPs). The IGD-TP is set up as a ETP and therefore, we review here how ETPs are formed, how they involve their members, how different categories of members interact and to what extent 'outsiders' are involved in the ETP.

The European Commission encouraged the development of ETPs in December 2002 in the EC Communication "Industrial Policy in an enlarged Europe". The ambition was to provide a framework for all RD&D stakeholders, led by industry, to define research priorities and action plans on a number of technological areas. Thus, the prerequisite for European Technology Platforms is that they are industry-lead to ensure the implementation of RD&D results. The platforms had a mandate in helping to further mobilise private and public RD&D investments. The Platforms are meant to be set up in a "bottom-up manner", meaning that mainly industrial stakeholders take the initiative and the European Commission evaluates and guides the process, but does not own or manage platforms. Therefore, ETPs are considered independent organisations from the EC. The European Commission does, however, support their creation and remains engaged with them in structural dialogue on research issues. There are currently around 36 ETPs on a diversity of sectors: energy, information and communication technologies, bio-based economy, production and processes and transport (EC, 2011a).

ETPs generally follow a three-stage process of development:

1) Stage 1: Emergence and Setting up: Stakeholders, led by industry, come together to agree a common vision for the technology. At this stage, the main principles for the governance of the platform are established;
2) Stage 2: Definition of a Strategic Research Agenda: Stakeholders define a Strategic Research Agenda (SRA) and set out the necessary medium-to long-term objectives and priorities for the technology. The definition of a SRA is commonly coordinated by an advisory council that includes representation from a wide range of stakeholders (EC, 2005a). In parallel with the definition of the SRA, ETPs start the design of a deployment strategy with the key elements required to implement the SRA effectively;
3) Stage 3: Implementation of the SRA: Stakeholders implement the Strategic Research Agenda with the mobilization of significant human and financial resources.

ETPs are understood as mechanisms able to foster public-private partnerships and contribute to achieving EU growth, competitiveness and sustainability. Public-private partnerships, it is argued, can address technological challenges that could be key for sustainable development, for the improved delivery of public services and for the restructuring of traditional industrial sectors (EC, 2011). According to the EC (2012), key stakeholders in ETPs typically include: industry, public authorities (given their role of policy-makers, funding agencies as well as promoters and consumers of technologies), research institutes and the academic community, financial community and civil society, including users and consumers. Furthermore, some ETPs, namely the Water Supply and Sanitation Technology Platform (WssTP) distinguish between

members and contributors, whilst the Zero Emissions Fuel Power Plants Platform (ZEP) has an Advisory Council and experts contributing to its activities.

Almost all constituted ETPs take the same form with small variations. Whilst some ETPs are loose networks that come together in annual meetings, others are establishing legal structures with membership fees. Most ETPs have developed internal structures, like stakeholder forums, governance boards, task forces, advisory groups and numerous working and support groups. Formal agreements have often been signed by the main stakeholders with varying degrees of commitment. In few cases, ETPs have been established as companies, like the Forest-Based Sector Technology Platform (FTP) which is a limited company under Belgium law run by the European Confederation of Woodworking Industries (CEI-Bois), the Confederation of European Forest Owners (CEPF), the Confederation of European Paper Industries (CEPI) and later joined by the European State Forest Association (EUSTAFOR). The FTP is open to the entire forest-based sector and to get involved one should contact the National Support group or FTP management. Other ETPs, like the WssTP, is a non-profit organisation under the Belgian Law.

ETPs work on developing and updating agendas of research priorities for their particular sector. These agendas constitute important input to define European research funding schemes. Since they should be developed through dialogue among industrial and public researchers and national government representatives, they are also expected to contribute to create consensus and to improve alignment of investment efforts. Avoiding duplication and making the most of poles of excellence and best practices is one of the great challenges of European research, and ETPs are seen by different actors as a very good vehicle to improve synergies (EC, 2012a).

Some critical reflection is in place as to the centrality of the role of these industry led initiatives and how this affects the setting of the research agenda. Different reports by the EC capture the dominant role of the industry leaders and the need to ensure sufficient involvement of civil society organisations in ETPs. The EC recognises that there are negative effects associated with ETPs where members are typically only from companies and become “clubs” or “closed shops” (EC, 2005c). The report from Idea (2008) points to the need to be aware of the potential negative effects of ETPs becoming ’clubs‘ where members (typically from companies) seek to use the ETPs to generate funding for their firms. For this reason, openness, transparency and clear-cut rules of membership, participation and governance are seen as essential for the success of ETPs, apart from strong leadership and credibility to mobilise stakeholders, among other features (EC, 2005a; EC, 2005b). According to the EC, the three key principles for an open and transparent platform are openness, accountability and transparency (EC, 2006a). Openness refers to the degree to which an ETP encourages and allows the participation of a broad range of stakeholders in its activities. It also relates to the level of cooperation with national and regional public authorities, as well as with other platforms. Accountability refers to the existence and clarity of rules and procedures within the ETP structure, as well as to the process for monitoring and adapting platform’s activities according to changing priorities and circumstances. Finally, transparency refers to the measures taken by ETPs to communicate

openly with their target audiences, including the general public, and to provide full and up-to-date information about their current status and activities. The EC considers that "a strong commitment to openness and transparency is key to the success of technology platforms. The involvement of a broad range of stakeholders increases efficiency and effectiveness" (EC, 2005b: 4).

To ensure a broad stakeholder base, it is recognised that "targeted actions may be necessary to reach specific audiences, such as small and medium-sized enterprises, end-users and civil society" (EC, 2006a: 3). At a seminar in December 2004, the industrial leaders of ETPs signed up to a voluntary code of good practice on openness and transparency vis-à-vis all relevant stakeholders, and notably small and medium sized enterprises as well as groups representing wider societal interests (EC, 2005c). However, each platform is free to decide how to implement the principles of openness and transparency, and which kind of initiatives they take in this respect. One way to involve stakeholders, apart from directly inviting different organisations to become involved, organising workshops or publishing a call for expressions of interest, would be to involve existing networks (e.g. federations, associations, groups) within the ETP's structure in order to facilitate broad-ranging participation (EC, 2006a). The EC also recognises that the structure of an ETP does not have to be permanent over time and that it can change, engaging the right stakeholders at the right time (EC, 2010a: vii). In fact, the latest report of the ETP Expert Group adopts the view that ETPs should evolve in the near future. They could join forces in temporary activity clusters and these new arrangements called European Technology and Innovation Platforms (ETIPs) will be linked to a specific Societal Grand Challenge (EC, 2010: 29). The intention of the EC is that these ETIPs should address societal engagement, in principle, in a broader and deeper manner, as they would involve not only researchers and funding institutions, but policy makers at EU and national level, business communities and organisations representing the interests of the citizen from the beginning and at strategic moments. The new concept of ETIPs should also address some of the weaknesses that could be attributed to ETPs, like the fact that civil society groups "may need special consideration regarding their access to finance and expertise" (EC, 2010b: 13). Thus, the report recommends taking into consideration several elements to appropriately engage societal actors (EC, 2010b: 31):

- inclusiveness: need to select carefully representatives of civil society to be inclusive enough but achieving the right balance between inclusiveness and efficiency;
- clear division of tasks between societal actors and members of ETIPs, respecting and acknowledging their limited involvement in the more detailed aspects of research and innovation strategies;
- respect for the need to involve their associative structures before expressing their views, which may extend the timelines for consultation;
- availability of resources to help societal actors participate in the work of the ETIPs/ETPs;
- representatives from civil society groups are required to have rights, but also obligations, like committing to their role in advising ETIPs when initiating and finalising

research plans and delivering constructively on the tasks they have been entrusted with.

It remains to be seen if and how ETPs will evolve into ETIPs and whether these new network structures will take into account all these recommendations and focus efforts more directly on societal demands and societal challenges. In some sectors, like for example, nanotechnology, an integration and innovation platform called NANOfutures is set up as a long-lasting nanotechnology hub, to coordinate on-going initiatives and projects on nanotechnology and connect all relevant stakeholders, including universities, research institutions, industries, investors, ETPs, consumer associations, regional and national clusters, etc. Similarly, the European Aquaculture Technology and Innovation Platform is an international non-profit association designed to include all members of the European aquaculture value chain to develop, support and promote aquaculture in Europe.

Apart from civil society groups and given the importance of the committed involvement of national authorities, some ETPs have set up Member State "Mirror Groups" composed of experts nominated by the Member States. Mirror Groups aim to facilitate coordination and provide an effective two-way interface between platforms and complementary activities at a national level (ETP, 2006). However, "not all Member States are represented in all ETPs and not all ETPs are represented at the national level in all Member States" and cooperation between European and national levels is not organised in a systematic way, nor are research priorities at both levels synchronised (EC, 2010b: 55).

In the section below, we identify some of the main features of ETPs in the field of environment and energy. In particular, to gain insight into the activities and results of the ETPs with regards to stakeholder engagement and to identify potential good practices, four ETPs have been analysed more in depth. The key elements we seek out for these ETPs are: their concept and the main mechanisms in place for stakeholder involvement, their organisational structure and the main communication channels in place. The four ETPs considered are: European Biofuels Technology Platform (EBTP), Zero Emissions Fossil Fuels Plants (ZEP), Sustainable Nuclear Energy Technology Platform (SNETP), European Wind Energy Technology Platform (TPWind). As a final section of this chapter, some commonalities and differences are pointed out. Here we also include features from some other ETPs we consider relevant. Unless otherwise indicated, the descriptive data on the ETPs considered, has been drawn from their dedicated websites. The following chapter of the report devotes specific attention to the IGD-TP.

3.1 European Biofuels Technology Platform (EBTP)

The European Biofuels TP was launched in June 2006 with the aim to contribute to the development of cost-competitive world-class biofuels value chains and the creation of a healthy biofuels industry, and to accelerate the deployment of biofuels in the European Union, through a process of guidance, prioritisation and promotion of Research Development and Demonstration (RD&D). It brings together stakeholders from industry, biomass resources providers, research and technology development organisations and NGOs. The EBTP defines

the concept of stakeholder in the context of the TP in an open manner: "*any organisation whose commercial or business activities affects or can be affected directly by, the actions taken or recommendations of the EBTP. Hence, stakeholders can include: businesses, corporations and other organisations involved in supplying any components of the overall chain from biomass production, through utilisation, conversion, distribution and end use. […] also include research institutes and university departments actively engaged in biofuels research. A wide range of support organisations or common interest groups are also stakeholders […] From the financial world, investors, shareholders and others […]. From the legal and decision-making sector stakeholders will include Government regulatory agencies as well as both national and local governmental bodies […]. Finally, since everyone will be affected by a growth in use of biofuels – the public at large, not only in Europe but world-wide as these policies impact on the global community*".[13] The EBTP does not accept individuals but only designated representatives of organisations as stakeholders. Stakeholders can complete their registration form online via the EBTP website. Their involvement is defined by the Terms of Reference (ToR) which allows representation of all relevant stakeholders in the Steering Group and the various sectorial working groups. Members, this is nominated individuals able to contribute to the EBTP through work, advice and influence, are appointed for a 2-year period.

The vision of this platform, as stated in the vision document 'Biofuels in the European Union. A vision for 2030 and beyond' (EC, 2006b), is that by 2030, the European Union should cover as much as one quarter of its road transport fuel needs by clean and CO_2 efficient biofuels. Thus, the EBTP will "provide scenarios and strategic guidance for decision makers to set up the proper policy framework, and to help define and implement the strategic research needed to achieve the vision" (EC, 2006b: 5).

The Stakeholder Plenary is the mechanism for direct stakeholder participation in the activities of the EBTP. The main communication channels are the website and the once-a-year Plenary meeting which aims to facilitate information dissemination to stakeholders concerning the platform's activities and to promote cooperation in RD&D projects. In addition, there are six working groups covering biomass resources, conversion, end use, sustainability, markets/regulation and the European Industrial Bioenergy Initiative (EIBI). The Platform's website includes possible searches or filtering the information on stakeholders. It contains a Stakeholders Database which allows searches by country, sector, organisation or keyword. To access certain information (such as RD&D mapping, pilot plants and biofuels debates databases) stakeholders should register first. This section allows direct interaction with the Platform through an on-line forum. The NGOs involved in this platform are the European Environmental Bureau and PANOS. The former is a federation of environmental citizens organisations providing expert insight on a vast amount of environmental issues[14]. PANOS is a

[13] http://www.biofuelstp.eu/stakeholders.html
[14] from www.eeb.org

network of eight institutes that foster public debate around development issues and ensures that the voice of the poor and marginalised are included in the decision-making process[15].

At national level, there are some National Biofuels Technology Platforms which have no direct link to the EBTP but may address similar topics.

3.2 European Zero Emissions Fuel Power Plants (ZEP)

The ZEP was launched in December 2005 as a unique coalition of stakeholders to support CO_2 capture and storage (CCS) as a key technology for combating climate change. ZEP had the support of the EC to be launched as part of the FENCO (Clean Fossil Energy) Co-ordination Action.

The vision of this platform is to enable European fossil fuel power plants to have zero emission of CO_2 by 2020. The structure of the ZEP is based on an Advisory Council, a Government Group (previously named as Mirror Group), a Coordination Group, a Secretariat and 4 Taskforces (previously named Working Groups). The Government Group advises the Advisory Council of the Member State Government's views and policies with regard to proposals and recommendations emerging from the work of the ZEP platform. Thus, their objectives, which are described in the Terms of Reference on the website, include facilitating dialogue between Member States or promoting public private partnerships, among others. The Taskforces focus on: Demonstration and implementation, Technology, Policy and regulation, and Public communications. ZEP Taskforces present their work plans to the Advisory Council, who accepts them or adjusts some of the activities. The ZEP Advisory Council consists of a maximum of 40 different companies and organisations, although 300 experts in 19 different countries contribute actively to ZEP's activity, according to the information on its website. ZEP defines its role as "CCS advisor and facilitator, CCS technology contributor and a respected communicator" (ZEP, 2010, 8). However, according to the newsletter of January 2012, the CCS landscape is changing and ZEP is starting a process of strategic reorientation in order to align itself well on these changes (ZEP newsletter Nr. 8; January 2012). A working group on strategic reorientation of the Platform has been created for this purpose.

ZEP identifies four categories of stakeholders who are members of the platform: 2 government representatives, 27 companies – utilities or generators, equipment suppliers, petroleum companies or oil and gas companies -, 2 NGOs and 7 representatives of academia and research. The two NGOs currently taking part in the ZEP are the Bellona Foundation and E3G. The Bellona Foundation is an international NGO based in Norway, whose aim is to identify and implement solutions to the global environmental problems, particularly climate change[16]. The other NGO, E3G, works in the field of climate and energy, among others, to reframe the climate change debate around how to deliver the scale and pace of investment needed to

[15] from http://www.panos.org.uk
[16] From www.bellona.org

preserve climate security, and to animate new coalitions and propositions to help achieve this outcome[17].

The ZEP website allows searches based on the category of stakeholders (i.e., government, companies and sponsors, NGOs, academia and research). Most documents regarding agendas of meetings, minutes, assemblies, lists of members, newsletters, are accessible through their website.

3.3 European Wind Energy Technology Platform (TPWind)

TPWind is composed of stakeholders from industry, government, civil society, R&D institutions, finance organisations and the wider power sector, at both Member State and EU level. According to its own definition, TPWind is "the only body with sufficient representation or 'critical mass' of wind-specific knowledge and experience to be able to fully understand and map realistic and prioritised pathways for policy and technology R&D, taking into account the full range of sector needs" (www.windplatform.eu). The vision or the aim of the platform is that Europe continues to be the global technological leader in wind energy. Thus, the platform will contribute to these goals by being a permanent EU wind energy R&D forum and a wind energy advisor for EU and national authorities (TPWind, 2011). The first TPWind members (active over the period 2007 - 2010) were selected by the Platform's Steering Committee through an open 'call for expression of interest' launched in 2007. Current TPWind members, who will compose the Platform over the period 2010 - 2013, were selected by the Steering Committee through a new 'call for expression of interest' open from July to October 2010. There are currently no NGOs involved in the TPWind (personal communication, 2012).

The structure of TPWind is based on an Executive Committee, a Steering Committee, a Member States Mirror Group, Working groups, an Advisory Board, and a Secretariat. Working groups are the following: wind conditions, wind power systems, grid integration, offshore and environment and deployment. Additional stakeholders may be invited to attend Steering Committee meetings as observers, if properly justified. The Advisory Board is composed of external stakeholders (i.e. non-Platform members) helping TPWind to enhance its network and effectiveness by providing advice and contacts. Members of the Advisory Board include representatives of organisations like the European Academy of Wind Energy, the Alliance for Offshore Renewables, Global Wind Energy Council, Intelligent Energy Agency, European Energy Research Alliance, EUROGAS, amongst others[18]. It has a consultative role and is considered to represent an important link between the platform and other relevant sectors and stakeholders. The Steering Committee invites the relevant candidates to join the Advisory Board. Advisory Board members are selected because of the stakeholder they represent, not because of their individual expertise. Advisory Board meetings take place at least once a year (TPWind, 2011). General Assemblies are also organised in which only TPWind members are invited. Apart from the plenary session, working group meetings are also held to discuss future

[17] From www.e3g.org
[18] http://www.windplatform.eu/123.0.html

projects and activities of the platform. The working groups of the platform have decided to hire professional facilitators to avoid working groups' chairs and secretaries to invest most resources in ensuring proper participation, rather than contributing to the discussions and brainstorming exercises with their unique experience and insight.

The TPWind releases newsletters monthly covering funding opportunities, news regarding the Secretariat, the members and events.

3.4 Sustainable Nuclear Energy Technology Platform (SNE-TP)

The SNE-TP was launched on 21 September 2007, by Commissioners Potocknik (Research) and Piebalgs (Energy) to promote and coordinate research activities in the field of nuclear fission. Over 180 researchers, scientists and engineers contributed to the development of the SRA. Currently the SNE-TP counts approximately 100 members. The SNE-TP defines the following stakeholder groups: industry, research, academia, technical safety organisations, non-governmental organisations and national representatives (SNE-TP, 2011).Although this Platform does not have such a specific vision like the others, its objectives are defined in the SRA and fall under three main areas: maintaining and improving the safe and efficient operation of the current Generation II and III nuclear reactors; developing Generation IV fast neutron reactors with closed fuel cycle whilst reducing the amount of radioactive waste and nuclear cogeneration (i.e. supply carbon free electricity and process heat to large industrial installation). The SNE-TP is in line with the Strategic Energy Technology Plan (SET-Plan) to achieve the following goals: for 2020 maintain safety and competitiveness in fission technology and provide long-term waste management solutions; for 2050 act now to complete the demonstration of a new generation of fission reactors with increased sustainability and enlarge nuclear fission applications beyond electricity production.

The general assembly of the SNE-TP every second year is a means to facilitate the widest involvement of interested stakeholders, providing feedback, interaction, networking and building commitment towards attaining the goals of the Platform. An organisation wishing to become a member of the Platform and to participate in its operations has to send a formal letter (template provided on the website) to the Chair of the Platform's Governing Board explaining its motivation and how it intends to contribute to the objectives of the SNE-TP. The Chair will submit the application letter to the Executive Committee for advice, and the Governing Board will make a decision based on consensus via a tacit approval procedure (SNE-TP, 2008). Apart from the governing board, the executive committee and the secretariat, there are four working groups on the following issues: strategic research agenda; deployment plan; education, training and knowledge management and a task force of the European Sustainable Nuclear Industrial Initiative. In addition, National Platforms or Member States' Mirror Groups are foreseen as a means to influence the agenda for nuclear energy research and development at national level.

At present, the SNETP has 5 NGOs as members: Environmentalists for Nuclear Energy (AEPN), Sauvons le Climat and Confrontations Europe from France, Cogent Sector Skills Council from

the UK and the European Committee for Electrotechnical Standardization (CENELEC). Environmentalists for Nuclear Energy aims at providing complete information to the public on energy and environment and promoting the benefits of nuclear energy[19]. Sauvons le Climat is an association of retired members of the French Society of Physics and the Group of Studies on Energy and Environment in the 21st century. They defend the need to reduce energy consumption and develop nuclear power and renewable energy sources[20]. Confrontations Europe is an association of members of the civil society, politicians, students, unionists, etc. committed to the idea of an active participation of civil society for building Europe[21]. Cogent is the Sector Skills Council for the Chemicals, Pharmaceuticals, Nuclear, Oil and Gas, Petroleum and Polymer Industries. Cogent is licensed by Government to help employers in these science-using industries to address their workforce development needs so that they can compete successfully. Finally, CENELEC is a non-profit technical organisation set up under Belgian law which is responsible for standardisation in the electrotechnical engineering field. CENELEC prepares voluntary standards which help facilitate trade between countries, creates new markets, cut compliance costs and support the development of a Single European Market.

3.5 Overview of Technology Platforms

The overview of the different technology platforms (see Annex1) shows that they share a number of features:

- The background work for all technology platforms was prepared by an advisory council established by the European Commission or by a research project funded by the European Commission. These advisory councils or projects were represented, in most cases, by the industry sector and research institutes in the specific field.
- Technology platforms are forums for developing or influencing policy and research as well as for carrying out technology research and development in collaboration among Member States.
- TPs are dynamic and new members can sign up, while others may withdraw. In addition, new working groups can be established focusing on different topics but also on the strategic reorientation of the platform (as is the case for the ZEP platform).
- Some platforms offer the possibility to sponsor the platform with sponsorship contracts (e.g. TPWind) and offer them different benefits depending on the type of contract (e.g. platinum, gold, silver).
- Most ETPs have established 'Mirror Groups' to link the European activity with national level priorities.
- Despite the fact that the ETP concept was originally developed to tackle socio-economic challenges, most ETPs are mostly industry-driven. In a lesser extent, the research community is also strongly involved (Idea, 2008).

[19] From www.ecolo.org
[20] From http://www.sauvonsleclimat.org/qui-sommes-nous/373-manifesto-save-the-climate.html
[21] From www.confrontations.org

- In general, NGOs and end-users (meaning consumers and often, NGOs) seem to be missing or are at least under-represented in most of the ETPs, taking into account the societal dimension of the ETPs and compared to the strong involvement of other stakeholders. It remains a challenge to explain to society why large investments in RD&D are needed and what the potential benefits might be (Idea, 2008). For this reason, Idea also suggests that in the process of developing the SRA and the Implementation Plan, ETPs should emphasise the societal impact and implications of the underlying technologies in order to mobilise stakeholders, such as end-users and consumers. ETPs need to look for the common issues that can bring together diverse groups of stakeholders: often, this will be an underlying societal aspect or common interest.

In addition to these findings, regular evaluations carried out by the EC through the consultancy Idea (2008) raise a number of other interesting issues with regards to organisational structure, stakeholder engagement and communication of ETPs. Firstly, participation of stakeholders is stronger in the development of the SRA and participation in organised ETP events. Less participation is seen, for example, in the development of the strategic vision, the implementation strategy, the organisation of events, and education and training initiatives. The latter, in particular, is in general underdeveloped at the moment. It is recommended that ETPs should address the needs of all stakeholders (Idea, 2008: 105). Secondly, in some cases, general meetings between ETP stakeholders are being replaced by or complemented with small thematic workshops or meetings on specific topics (Idea, 2008: 12). Finally, although ETPs facilitate communication between stakeholders and make more and better information available to members and stakeholders on the challenges in the technology sectors, communication can still be improved. The communication tools used are not interactive enough to involve all stakeholders in an engaging manner (Idea, 2008: 70).

Some of these characteristics are also revealed in the case of the IGD-TP, except for the fact Mirror Groups have not yet been established and that so far the platform does not seem to offer sponsorship possibilities. One of the main characteristics that is worth noting and will be discussed later on, is the fact that the IGD-TP has been set up as a mechanism to develop and influence research policy in such a way that they contribute to future research Framework Programmes. The Commissioner Potočnık noted that the expectation should be that technology platforms are “champions of knowledge for growth” because they contribute to ensuring that EU research responds to industry’s needs (Potočnık, 2005: 5,6). He argued that “technology platforms can cover the whole economic value chain – from knowledge production to transforming that knowledge into successful technologies and processes, products and services” and continues “openness and transparency are important in ensuring the participation of regulators and other stakeholders” (Potočnık, 2005: 5,6).

ETPs also show some differences. ETPs have undertaken different types of initiatives to broaden the range of actors involved in the network and facilitate participation of relevant

stakeholders. Some ETPs[22] have drawn up a list of organisations that they consider have a role to play in their network and have invited them to participate in open meetings or to be integrated within their structure. The European Technology Platform on Sustainable Mineral Resources identifies the key players in the following categories: industries, geological surveys, associations and academia and research. Similarly, the European Water Platform has different categories of members, which are classified depending on the membership fee they pay. Thus, there are three categories: college A which corresponds to industry partners, college B for academics and research centres and college C for public utilities and water users. The membership fee is related to the organisation's turnover in the water sector in Europe.

In some cases, general meetings between ETP stakeholders are being replaced by or complemented with small thematic workshops or meetings on specific topics. The outcome of these activities can be recommendations that can be further discussed in more general meetings where broader groups of stakeholders are present (Idea, 2008). Another possible recommendation, as set out following the evaluation of ETPs, is to create vertical focus areas that concentrate on particular segments of industry or particular groups of stakeholders in order to provide focused thematic priority topics in relation to the specific needs of the industrial segment or stakeholder group concerned (Idea, 2008). For instance, the structure of the European Construction Technology Platform foresees Advisory Groups to provide specific strategic advice in well-identified fields to the platform. There are currently two Advisory groups, one representing clients and users and another one representing SMEs.

Generally, platforms are open and flexible and integrate additional members upon their request. In most cases, membership is bound to institutions rather than individuals. In the case of the NanoMedicine ETP, initial members are the parties that endorse the vision document. Nevertheless, additional members can join upon invitation or submission of an Expression of Interest, subject to approval by the Platform. In some Platforms the role of these actors is mainly consultative whilst in others they become part of the structure or they participate in working groups. For instance, the Climate Action Network and WWF International are members of the Advisory Council of the European Technology Platform Zero Emission Fossil Fuel Power Plants (EC, 2006a).

ETPs use a wide range of tools for disseminating information on their activities, but they do not seem to use very interactive tools. Most ETPs have a dedicated website which provides up-to-date information on events, developments and reports. According to Idea (2008) ETPs websites should be made more interactive. In some cases they use press releases, newsletters, targeted mailings and articles in scientific journals. The CORDIS and BBC websites have been used to disseminate the European Robotics TP more widely. Public consultations and discussion forums on the Strategic Research Agenda (SRA) are usually fostered via events or through the website, allowing stakeholders to contribute to the report and to be updated on new developments. The European Technology Platform for Water (WssTP) organised specific

[22] ETP for Global Animal Health, ETP for Advanced Engineering Materials and Technologies

Stakeholder Events to gather key representatives and stakeholders to discuss and provide recommendations for a competitive water sector in Europe. In some cases, like the Water Supply and Sanitation Technology Platform, the Vision document and SRA are considered as working documents which should be continuously updated to include new development and new input from stakeholders and the public at large. Stakeholders are sometimes encouraged to disseminate the activities of an ETP to other parties that may be interested in participation or feedback. Idea (2008) suggests that ETPs should organise more interactive events with a broader range of stakeholders.

Some platforms have launched European and national campaigns. The Plants for the Future ETP even organised consultations with the European Parliament and at the national level. National consultations involved meetings, on-line surveys and dedicated sessions at conferences. The Technology Platform for Waterborne Transport and Operations in Europe launched an awareness and participation campaign using national clusters and stakeholders associations. Another TP[23] has organised a contest for schools and universities to increase interest and awareness about its vision. National platforms help to disseminate information, overcome language barriers and in some cases, to coordinate national programmes of research with pan-European initiatives (EC, 2006a).

[23] Embedded Systems European Technology Platform

4 Implementing Geological Disposal of Radioactive Waste Technology Platform (IGD-TP)

As expressed in the Seventh Framework Programme of the European Atomic Energy Community (EURATOM) for nuclear research and training activities (2007-2011), the IGD-TP is expected to contribute to "*a sound scientific and technical basis for demonstrating the technologies and safety of disposal of spent fuel and long-lived radioactive wastes in geological formations*" and "*underpin the development of a common European view on the main issues related to the management and disposal of waste*" (EC, 2009: 13). The ambition, according to the Vision Report is "*to bring together research and development-relevant stakeholders with various backgrounds (e.g. regulatory bodies at various geo-political levels, industry, public authorities, research institutes and the academic community, the financial world and civil society) who would develop a research and development strategy in areas of research needed in Europe*" (EC, 2009: 13).

The IGD-TP is driven by waste management organisations with the common vision that "*by 2025, the first geological disposal facilities for spent fuel, high level waste, and other long-lived radioactive waste will be operating safely in Europe*" (EC, 2009: 9). The three commitments listed by the Platform are to (EC, 2009: 9):

- *build confidence in the safety of geological disposal solutions among European citizens and decision-makers;*
- *encourage the establishment of waste management programmes that integrate geological disposal as the accepted option for the safe long-term management of long-lived and/or high-level waste;*
- *facilitate access to expertise and technology and maintain competences in the field of geological disposal for the benefit of Member States*.

In March 2012, the IGD-TP had in its core (i.e. Executive Group) 11 waste management organisations. The members of the Executive Group (EG) are organisations responsible for implementing a nuclear waste programme or being formally responsible for RD&D programmes needed for implementation. This way, it is argued that the "*TP has the power and capacity needed for carrying out the mission*" (IGD-TP, 2011a: 2). The Chairperson of the Executive Group, responsible for the overall development of the IGD-TP work is rotating every two years. The Chairperson is assisted by a Core Group consisting of two persons, one of whom being the past Chairperson of the EG (IGD-TP, 2011a: 3). So far, Andra and Ondraf/Niras have been selected for this role.

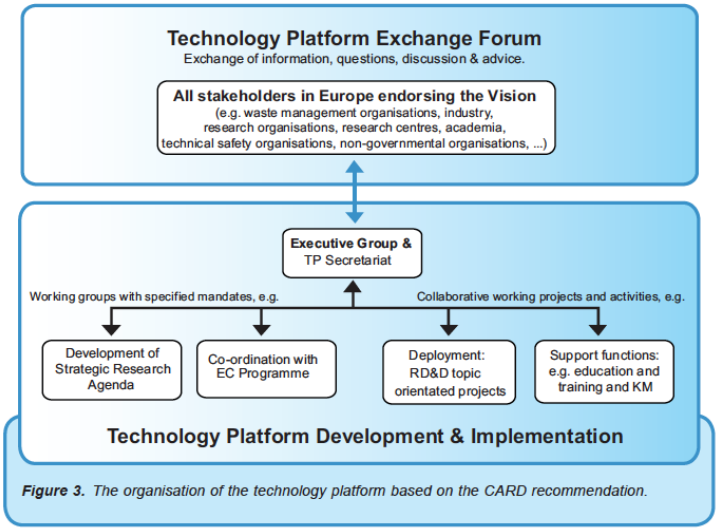
The other members of the platform include 71 organisations representing governmental bodies, industrial organisations, universities and research organisations. Thus, in July 2011, the IGD-TP had over 80 participating organisations with a wide range of backgrounds e.g. waste management organisations, industry, research institutes, research centres and the academic community (IGD-TP, 2011c: 6).

In principle, network membership seems to be open, but under certain conditions. If an organisation is interested to join the IGD-TP, it has to endorse the IGD-TP Vision by filling in an application form, on which the contribution that the organisation is ready to make (to the activities of the platform and more generally in RD&D regarding implementing geological disposal) should be also defined (www.igdtp.eu). In principle, those organisations are invited to take part in the TP's Exchange Forum, and in smaller working groups dedicated to particular topics. Applications for membership are to be approved by the EG. On the other hand, the EG can invite research organisations (with significant autonomous budgets and/or available funding) to have an advisory role at EG Meetings. Representatives from the European Commission (DG RTD and DG ENER) are invited as observers to the EG meetings (IGDTP, 2011a: 3). It is the EG who decides to set up particular working groups.

According to the IGD-TP, the Exchange Forum (EF) is meant to include all interested stakeholders who are potential contributors on information exchange, potential resources providers and potential support providers, such as waste management organisations, industry, research organisations, research centres, academia, technical safety organisations, non-governmental organisations, etc. (www.igdtp.eu). At the beginning, the EF was only open to those organisations endorsing the vision. However, some exceptions were made for both EFs so far, which does not contribute to a clear reading of the platform's structure. As we will argue later, in the assessment of the IGD-TP, there are certain predefined conditions set by technology platforms in general and this platform particularly, that contribute to limiting participation, openness and transparency. The IGD-TP changed the pre-requisites for taking part in the EF and it was recently decided that the EF would be open to any organisation. Nevertheless, if organisations want to take part in the activities of the Technology Platform, they need to endorse the vision (www.igdtp.eu).

The overall organisation of the IGD-TP is shown in Figure 1 below. As we can see in the structure of the IGD-TP, the decisions are taken by the EG and the Secretariat, who can set up working groups with specific mandates and collaborative working projects and activities. The EF is seen as a platform consisting of "all stakeholders endorsing the Vision" to exchange information, ask questions, discuss and advice the EG and the Secretariat.

Figure 1 Organisation of the IGD-TP[24]



Source: EC (2009: 21)

As for concrete outputs, the three main documents published by the IGD-TP so far are:

- The Vision Report (November 2009)
- The Strategic Research Agenda (July 2011)
- The Draft Deployment Plan (draft version available since December 2011).

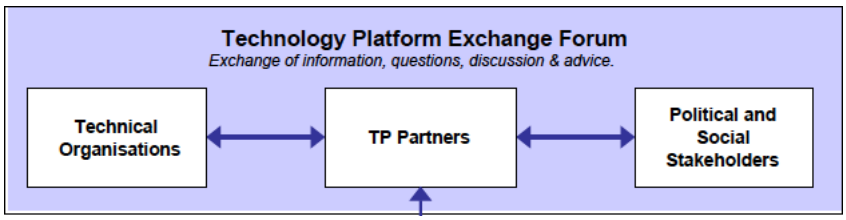
4.1 Origin and institutionalisation

The origin of the IGD-TP goes back to the European projects Net.Excel and CARD. In particular, the EC CARD project was led and carried out by implementers and supported by the European Commission. Its main aim was to assess the feasibility of creating a technology platform for networking and co-operation in the field of RD&D for geological disposal of radioactive waste in the EU. The CARD project prepared a preliminary vision for the TP, its objectives, structure and working methods. According to the CARD project, input was sought from stakeholders through a questionnaire sent to 82 national organisations, research providers, regulatory bodies, safety authorities and other stakeholders, of which 76 responded from 14 countries. Based on the results of the questionnaire and feedback in an open workshop, the final report of the CARD project pointed out "the high level of support to and interest with regards a European TP in the field of RD&D for geological disposal of radioactive waste". It also noted that while support for a TP was high in waste management organisations, technical support organisations and research providers, other stakeholders (mainly ministry departments, regulators and social stakeholders) may be less interested (CARD, 2008: 3).

[24] The Working Groups are indicative only. The types and number of working groups is decided separately based on needs.

At this point, it is worth noting that in the CARD survey, the term "*social stakeholders*" was used to designate local community representatives mostly (e.g. the MONA and STORA partnerships in Belgium, the municipalities of Oskarshamn and Östhammar in Sweden, the Centre for Nordic Studies (CeNS) in Finland, and the Nuclear Legacy Advisory Forum (NuLEAF) in the United Kingdom).[25] In the open workshop, "*the interests of social stakeholders were represented by participants in national and international initiatives concerning, for example, waste governance and education and training*" (CARD, 2008: 4). This term of social stakeholders is then widened up and the category "p*olitical and social stakeholders*" is used to indicate the possible structure of the Technology Platform (as shown in the Figure below).

Figure 2 Concept of the EF as conceived in the CARD project



Source: from CARD (2008, p.28)

The EF would consist of the TP partners as part of the formal structure, in which an executive body would control a working programme supported by a secretariat. Other potential participants with technical interests and concerns would include "(Technical Organisations), for example, regulatory bodies, research institutes and universities and public authorities including municipalities, i.e. with an interest in gaining information from, and influencing research programmes" (CARD, 2008: 28). The CARD report acknowledges that for regulators, resources and independence are the main limitations for supporting the TP. It is particularly interesting to note that the role of political and social stakeholders is not explicitly defined anywhere else in the report, but only addressed as such in the Figure shown above. One of the reasons for this lack of definition of "political and social stakeholders" in the structure is the unclear role of this category of stakeholders in the Technology Platform. The CARD report recognises that "*other stakeholders*[26] *are supportive but their direct participation may be limited*" (CARD, 2008: 5) because it is primarily a technical forum and lacks the social dimension. It is nevertheless considered that the TP can be seen as positive for confidence building.

[25] The organisations responding to the CARD questionnaire were classified as formal national appointees (i.e. implementers or technical support organisations), stakeholders (other waste management organisations, ministry departments, regulators and social stakeholders) and research providers (university departments, other nuclear research institutes or commercial contractors).

[26] Meaning apart from waste management organisations, technical support organisations and other research providers.

Thus, the basic structure of the TP envisages "*a broad forum for exchange of information and discussion of RD&D needs in relation to implementation of geological disposal*" (CARD, 2008: 27). The EF is foreseen as a mechanism for promoting dialogue, actively seeking views and responding to views from stakeholders and informing them on the activities and outcomes of the Technology Platform (CARD, 2008: 29). However, there is no clear focus on the role that social and political stakeholders can play in the Platform. As we argue later on in the report, this lack of clarity on the horizontal structure of the network contributes to having an inevitable highly formalised and hierarchical structure. It is evident that the way the TP was conceptualised in the CARD project and the lack of stakeholder involvement from the beginning has implications on the resulting structure.

Based on discussions following the results of the CARD project, the waste management organisations of Sweden and Finland took the lead to set up the technology platform as a tool to facilitate the implementation process of deep geological repositories in Europe. An Interim Executive Group (IEG) consisting of representatives of SKB, Posiva, Andra and the BMWi prepared the Vision Report with the active support in the preparations and endorsement from Ondraf/Niras, Enresa, Nagra and the NDA. In addition, a "consultation process" was carried out during the summer of 2009, according to the IGD-TP. Nevertheless, the extent to which this consultation has been effective in reaching some stakeholder groups is unknown by the authors of this report.

Thus, the CARD project expanded its membership and activity, and developed from a formal gathering of interested waste management agencies in R&D on geological disposal into a highly institutionalised platform of implementers and R&D stakeholders leading the implementation of geological repositories in Europe. The platform is supported mainly by radioactive waste management agencies and the EC. As is indicated below, it has expanded its membership without being all-inclusive and totally open, since it is dominated by a few members, all sharing a very specific vision on geological disposal.

4.2 The Exchange Forum of the IGD-TP

The IGD-TP was launched on 12 November 2009, and at the same time the Vision Report was published. At the launch event, the origin and the benefits of the TP were presented as well as the views and perspective from different actors. About 120 persons from 18 countries attended the meeting. According to presentations from the EG at the launching event, the starting point for participating in the IGD-TP and becoming a member is to endorse the vision, commit to the statements of the vision and contribute with various resources to make the vision happen.[27] According to the Terms of Reference "*IGD-TP participants endorsing the vision and thereby showing their willingness to contribute positively and constructively to the objectives and goals of the platform shall be invited to an annual Exchange Forum meeting, have access to a restricted intranet for information and discussion, shall be invited to seminars*

[27] From the presentation at the launching event: "IGD-TP: from vision to implementation" (http://www.igdtp.eu).

where they can give early input to documents under development and shall be consulted to comment on important documents before finalisation. IGD-TP participants not endorsing the vision shall be invited to the annual EF meeting" (IGDTP, 2011). The Vision document also details the responsibilities of the participants in the EF, including information exchange, providing written contribution and participation in the consultation of the SRA and DP, but it goes as far as to say that "they are also asked to identify and provide resources for the working groups" (EC, 2009: 21). However, the type of resources is not specified. In the objectives section of the Vision report, resources often refer to "competent human resources that can handle all aspects of geological disposal" as well as to "public and private funds from the platform members and from other funding sources" (EC, 2009: 18). As we will argue later, the type of resources expected to be exchanged in a network will definitely influence its structure.

At the launching event, three round tables were organised to present the views and perspectives from 1) governmental and safety authority bodies and international bodies; 2) R&D actors and technology suppliers and 3) implementing organisations. The presentations pointed at the benefits of the IGD-TP from the different stakeholder group representatives. The representative of the safety authority bodies, particularly, Marie-Pierre Comets from the French Safety Authority ASN, highlighted the importance of implementation as well as the existence of a European framework to allow resource optimisation, sharing knowledge and harmonising nuclear safety. Later on the representative of RD&D actors, Eric van Walle from SCK.CEN, remarked the need for clear goals in order to undertake well focused RD&D projects and the necessary links of the IGD-TP with the Sustainable Nuclear Energy Technology Platform (SNETP). It was also mentioned in another presentation from RD&D sector by Bernd Grambow from Subatech / Université de Nantes, that the mission of building confidence in disposal, included in the vision report, suggests that social sciences need to become more strongly involved. As it will be argued later on, some of these views and suggestions still hold true today. At present, the way the IGD-TP is structured and operating seems strongly influenced by a few advanced waste management organisations. These organisations consider that they have demonstrated already that "it is possible to site facilities for geological disposal through a process involving broad societal participation" (EC, 2009: 12). Thus, according to them, time has come now for implementation and less emphasis seems to be put on public involvement in this phase. Sundqvist and Elam (2010: 221) argue that the IGD-TP places a lot of emphasis on confidence building and the way the IGD-TP conceptualises public participation is too focused on "procedures for participation and on how to reconfigure public perceptions, and most important, the underlying issue of concern seems to be already decided upon as well as the best ways of addressing it". The new structure of the EF with the creation of different working groups may change the current situation.

Up to now, the IGD-TP has organised two EFs, the first in Paris on 8 February 2011, where the SRA was presented. InSOTEC researchers participated in this meeting as observers. The aim of the first annual EF was to "*solicit advice for the deployment of the SRA and to engage the participants of the EF in the deployment process of the IGD-TP. Another aim was that participants of the EF could find Key Topics and Topics that are of interest to their*

organisations. […] they can contribute in achieving the Vision 2025" (IGD-TP, 2010). One of the questions raised by the Executive Group for discussion in the EF addressed participation issues. This was "how can we in the best way give opportunities to all participants to express their views?". Among the questions raised by the participants were some on "who the IGD-TP considers as stakeholders?". Finally, in the conclusions, the questions which were addressed again included: how to improve the involvement of the "circles" of stakeholders and how to involve those who are not endorsing the vision.[28] In this first EF, around 70 participants attended from 13 different countries.

The second EF was held in Helsinki on 29 November 2011. The progress made by a dedicated working group on the Deployment Plan was presented as well as two pilot projects selected by the Executive Group and led by Posiva/SKB and NDA respectively. The pilot projects would serve as test cases for models for future cooperation based on the selection of Topics. In the afternoon, participants were divided into working groups on different topics related either to the technical/scientific themes of the DP or to the organisational schemes. The following Working groups were established by the EG and the TP Secretariat:

- WG1. Organising Peer Reviews
- WG2. Establishing an Environmental Reference State
- WG3: Competence Maintenance, Education and Training
- WG4. Interfaces
- WG5. Setting Information Exchange Platforms
- WG6. Safety Case Benchmarking

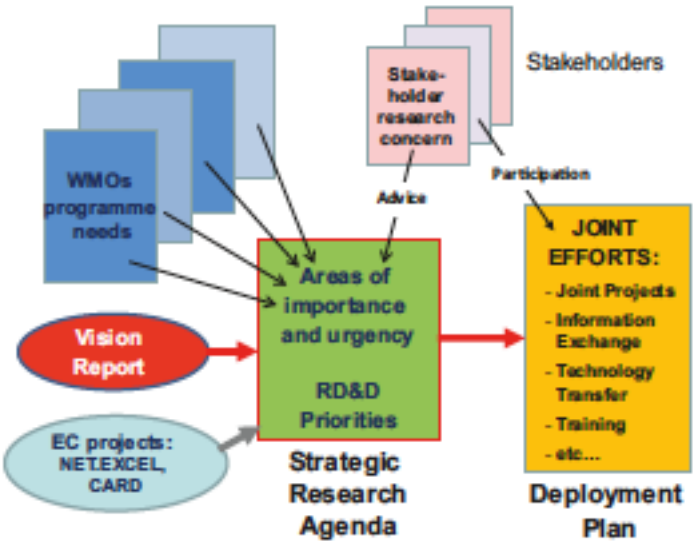
The objective of the working groups was to produce a detailed Topic vision and define a strategy for the topic as well as to ask participants about their interest in participating in the working groups. These working groups were presented by the secretariat as Organisational Woking Groups or Technical/Scientific Working Groups, and "first experiments to carry out one of the Deployment Plan's joint activities" (www.igdtp.eu). In this second EF, 62 participants attended from 14 different countries. At the time of breaking into different groups, the number of participants per working group varied. Two InSOTEC researchers were invited to participate in the Interfaces Working Group, where there were a total of nine people. Apart from defining a vision of the Interfaces WG, the aim of this WG was also to explore which would be the different types of stakeholders that the IGD-TP should address and why, and explore ways to incorporate their concerns. Thus, one could claim that this working group was set up as an exploratory approach to gain knowledge from the participants' interpretation of stakeholders' involvement with regards to the IGD-TP.

[28] Presentation from Patrick Landais (http://igdtp.eu/Documents/Paris20110208/15_Patrick%20Landais_Conclusions.pdf)

4.3 The Strategic Research Agenda

The IGD-TP has adopted a common vision 2025 and has prepared the SRA which outlines the remaining research, development and demonstration activities needed to reach the vision. According to the IGD-TP "The SRA is a document for communicating the implementation of the oriented research needs and opportunities to stakeholders in the waste management community, and it is also an instrument for creating synergies, co-operation and co-ordination with activities taking place in other technology platforms and within other international co-operation forums" (IGD-TP, 2011b: 12). The input for the SRA's content was initially derived from the RD&D priorities of organisations responsible for implementing waste management programmes or organisations formally responsible for the RD&D programme needed for implementation. This SRA has been followed by a Deployment Plan for the activities and joint work to be carried out by the IGD-TP and its members and participants. Figure 3 illustrates how the IGD-TP has developed the SRA and the DP and the main interactions and involvement of stakeholders.

Figure 3 Process defined by the IGD-TP to develop the SRA and the DP



Source: IGD-TP (2011b, p.12)

Consequently, throughout the development of the SRA, the IGD-TP argues that consultation was held and stakeholder input provided at different stages of the process (IGD-TP, 2011b: 13, 17, 23, 56, 59). The way the SRA was developed, according to the IGD-TP SRA document, is as follows:

- A SRA working group with representatives from the IGD-TP's member waste management organisations produced a first draft;

- A SRA seminar was held on 16 June 2010 in Brussels with the IGD-TP participants who provided information and input for the framing of the potential Topics of the SRA. Participation in the SRA seminar held in June 2010 was on invitation only to IGD-TP members endorsing the vision. About 55 persons attended the meeting, representing organisations in 13 different countries;
- During November 2010, there was a consultation on the preview version of the SRA Key Topics to members of the IGD-TP (endorsing or not endorsing the Vision);
- On 23 December 2010, the draft SRA document was published on the IGD-TP website for public consultation. Comments on the SRA draft document had to be sent to the Secretariat before January 28, 2011. The comments received were integrated into a document summarising main comments and answers from the IGD-TP;
- The SRA document was discussed at the first open IGD-TP EF meeting held on February 8, 2011.

According to information provided by the EG, a total of sixteen organisations from 8 different countries (Belgium, Finland, France, Germany, Greece, Romania, Sweden and United Kingdom) provided comments to the SRA, mostly universities and research centres. Among the sixteen organisations, two NGOs also provided comments, an international NGO and a national NGO. From February to July 2011, the IGD-TP worked on finalising the SRA and a document replying to the comments received during the public consultation. All 108 comments are enumerated and classified according to key words and to the section, paragraph and page of the SRA they refer to. Each of the comments or questions has a response statement or correction measure to indicate how the review comment has been handled. Both SRA and the 'response' document are available on the IGD-TP website.

The SRA provides a list of remaining RD&D priorities for fostering disposal implementation. The strategy is organised in 7 Key Topics, comprising a total of 37 individual Topics, "*aimed mainly at scientific and technical aspects*" (IGD-TP, 2011b: 24). The majority of the Topics focus on the Technical feasibility and long-term performance of repository components (Topic number 3). Each of the Topics is classified according to its relative importance and level of urgency to meet the Vision 2025. The last topic in the list is Topic number 7, which refers to "Governance and Stakeholder involvement". Its purpose is to "*develop guidance for communicating to decision makers and stakeholders the results of research that underpin the development of safety cases and environmental assessments. It considers tools and approaches for communicating current information relating to geological disposal*" (IGD-TP, 2011b: 42). Within this Key Topic, there are 3 topics defined. Topic 1 refers to "governance of decision-making processes" and points out that "it is necessary to develop improved methods for the integration of technical, social and economic information in an open and transparent decision-making framework". This topic is classified of high importance and urgency for receiving a license and should be carried out between 2010 and 2014. Topics 2 and 3 are of medium importance and involve respectively, the use of RD&D results for open and transparent dialogue with stakeholders and the involvement of stakeholders during the license application and when construction and operations begin as well as the influence on the work of the

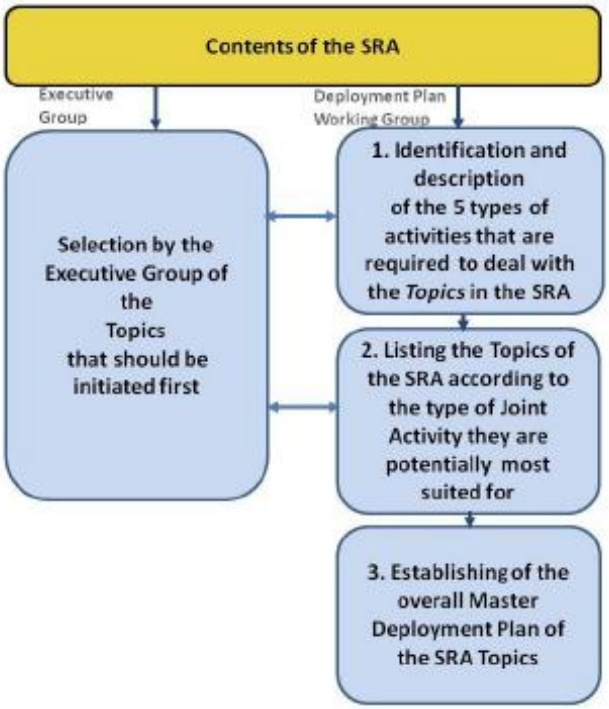
researchers and decision-makers. These latter topics should be carried out between 2016 and 2025. According to the document, "*the SRA is expected to have an impact on overarching issues such as confidence building and acceptance of geological disposal among stakeholders*" (IGD-TP, 2011b: 24). Apart from the Key Topics, Cross-Cutting Activities were also identified including Dialogue with regulators, Competence maintenance, Education and training, Knowledge management and Communication.

4.4 The Deployment Plan

The Deployment Plan (DP) defines and organises the RD&D activities that could be implemented for the deployment of the SRA topics over the timescale 2011-2025, even if the DP is limited to a 5-year term. The process to define the Deployment Plan consisted of three steps (IGD-TP, 2011d: 25), as shown in Figure 4:

1) The contents of the SRA were examined to identify the types of activities that could be used to cover the Topics listed and this led to the identification of five types of activities;
2) The Topics from the SRA were listed according to the potential type of activity they would be most appropriately suited for;
3) Using the results of the previous steps, the Master Deployment plan for this initial deployment was identified.

Figure 4 Approach undertaken by the EG for defining the Master Deployment Plan



Source: IGD-TP (2011d)

The types of Joint Activities defined by the EG and identified in the DP are the following: Organizational Working Group; Technical / Scientific Working Group; Information Exchange Platform; Technical Project and Technological Transfer. The Topics from the SRA are listed according to the potential type of activity. The Organizational Working Group can be installed in case of development of methodologies or to organise peer review. The Technical and Scientific Working Group would prepare a detailed roadmap before the launch of a RD&D programme for a Topic that needs to be worked out. Once the roadmap is ready, the programme would be launched as a Technical Project. According to the Draft Deployment Plan report, "the Information Exchange Platform is defined to share and exchange information among the programmes" and "plays an important role as a vehicle for fostering discussion, information exchange and further cooperation" (IGD-TP, 2011d: 37). Finally, Technology Transfer type of activity would be mostly suited for value exchange, including on a commercial basis.

The general methodology for the deployment, as put forward by the Draft Deployment Plan (IGD-TP, 2011d) involves:

- for each Joint activity, an activity outline was developed based on the standard template. This work is done by the interested members of the EG with the assistance of the Secretariat.
- The activity outlines are presented at EG meetings. The EG members decide on their respective participations. A leading organisation for a Joint Activity is designated and

will carry out scoping in a form that can be communicated to call for volunteers from the IGD-TO to the Joint Activity. Along with this communication the call for volunteers, decision on announcement dates and decision on the type of activity are announced on the IGD-TP's intranet.

- After the Joint Activity a team of participants is formed, the initial activity outline is discussed and detailed (and can be modified at this stage) and further discussions on the financing, on specific planning and schedule can take place among the participants under a leading organisation (in most cases an EG member).
- The schedule is included into the Master Deployment Plan and the progress activity is monitored along with all the other elements listed in the master plan.

The draft DP document was available for public consultation at the open website of the IGD-TP from December until 13 February 2012. At the moment of writing this section of the report (March 2012), the IGD-TP Secretariat is analysing the comments received in order to publish a final version of the DP[29]. The basic Master DP will be updated continuously by the EG and the Secretariat and will take into account the evolutions of the SRA.

[29] Update: as of August 15, 2012. The final Deployment Plan is not yet published at the time of writing.

5 The IGD-TP as a knowledge network

In this section, we analyse the IGD-TP through the lens of knowledge networks, but focusing above all on the organisational characteristics of the network, rather than on the outcomes, which will be the focus of another InSOTEC report. We examine the IGD-TP, identifying its members, principles and expectations, the resources involved, the network structure, the scope of activities, and how knowledge is exchanged. Results from the two different illustrative surveys, the interviews, the working group discussions and (participatory) observation have been employed to draw up this section.

5.1 Members, principles and expectations

IGD-TP includes mainly implementers, research organisations, industrial organisations and academia. This knowledge network benefits from the strong support of the EC, who plays a key role in encouraging the emergence of the ETP and supports its implementation. In fact, the majority of organisations and individuals outside this network who replied to the survey mentioned in section 3 of this report, are aware that the waste management organisations are the lead organisations promoting the IGD-TP (75,56% of respondents) as well as the EC (51,11%).

According to the SRA (IGD-TP, 2011b: 3), the IGD-TP's work is driven by ten waste management organisations and one governmental body, that share a common vision. However, the fact that SKB and Posiva, with two of the most advanced programmes in Europe regarding the implementation of the repository took the lead in the CARD project to prepare for implementing the technology platform, might suggest that they are leading the IGD-TP in terms of deciding the time frame of 2025 in the Vision. Sundqvist and Elam (2010) go as far as to argue that one could say that the ambition of the platform is to export the Nordic success to other programmes in the EU. The IGD-TP secretariat indeed refers to cooperation being seen as, "beneficial for the timely and safe implementation of the first geological disposal facilities" (Palmu and Ouzounian, 2011). The Draft Deployment Plan furthermore states that "the three countries closest to licensing i.e. Finland, France and Sweden, plan to commission their respective geological disposal repositories at latest by 2025" and that other countries will benefit from the experience gained by these programmes (IGD-TP, 2011d: 4). Therefore, it would seem that the most advanced programmes play a key role which is backed up by the rest of the waste management organisations. Interestingly, the country represented with the highest number of organisations in the IGD-TP is Germany.

At the time of stock taking for this report (March 2012), five international organisations (European Repository Development Organization Working Group (ERDO), EuroGeoSurveys, European Nuclear Society (ENS), Foratom, Joint Research Centre Institute for Transuranium) are also members of the IGD-TP. Their attendance has varied during the two EF meetings. It is interesting to point out that the way they see themselves in the IGD-TP might be different from the way the EG might see them. One of the interviewees representing an international organisation mentioned that they "*want to be involved but only to a certain degree, not on the*

forefront, but in a second line, as observers. In my opinion there are two layers of involvement in the IGD-TP: a first layer with direct participation of organisations having the necessary experience and developing projects, and a second layer of observers, relaying information".

Greenpeace was mentioned on the IGD-TP website as a member of the Platform until 23 February 2012, when Greenpeace sent a letter to the IGD-TP Chairman and Secretary General to withdraw from the platform. The argumentation given for this withdrawal, was the following: "Greenpeace has been excluded from the activities of the platform, including the advice that the latter gave to the European Commission on the draft Radioactive Waste Directive. […] the IGD-TP only marginally reflected in the final SRA paper the ideas we brought forward and did not organise any further exchanges on the points raised. […] In this document [Draft Deployment Plan] we observe that even the marginal points that originated from the Greenpeace input have been removed". Their main conclusion is that the "IGD-TP is not a platform for open and scientifically sound discourse on the issue of radioactive waste management" and therefore Greenpeace "sees no basis for further cooperation and withdraws from the platform" (Greenpeace, 2012). It remains to be seen whether the IGD-TP will take any actions to try to bring Greenpeace back into the EF, or will use this withdrawal to reflect on its general approach to stakeholder involvement and consultation. The latter would be more interesting. As put forward by a representative of a waste management organisation in an interview: "*it is also important to have contacts with others who do not endorse the vision or who have troubles or doubts. Because those troubles and doubts can help the WMO's to come to solutions that are more acceptable. If there are doubts, and those doubts and questions can be picked up and addressed in your research, that can lead to a better solution*".

Greenpeace completed the membership form of the TP on 6 January 2010, where they explained their reasons for not be willing to formally endorse the IGD-TP vision (Greenpeace, 2010) as follows:

1. The Vision is not a scientific approach to the nuclear waste problem, but a political one. For that reason a critical reflection is absolutely required to address the interests of the European citizens.
2. Even though no proposed option of nuclear waste processing can be called a real sustainable solution, the Vision does not include a clear move to the phase-out of the production of nuclear waste – something that does happen with other forms of toxic waste.
3. Currently too little research is done to alternative options to deep geological storage, so that deep geological storage is getting the label of 'best solution' by default, not because there are sufficient scientific data to back up such a position.
4. Deep geological storage faces still important scientific challenges that first need to be clarified before it can be accepted as an option – the IGD-TP Vision is running ahead of the findings of this research, which is partly still on going without final conclusions and partly not even started. The Vision is therefore not based on science.

5. By positioning deep geological storage as 'the technically proven' solution, the IGD-TP does not make clear that deep geological storage is in its most optimum form nothing more than a tool for risk reduction, not a solution.
6. The IGD-TP is used as a vehicle to promote the expansion of nuclear energy, in spite of the fact it cannot provide a solution for high radioactive waste, and irrespective of the other problems that the use of nuclear energy is posing, like the risk on a large accident, proliferation, diversion of capital and capacity from more effective ways to tackle climate change and meet energy demand, etc.

The IGD-TP argues that the EFs "are open to all stakeholders. Despite the fact Greenpeace has not endorsed the IGD-TP's vision, the IGD-TP secretariat has invited them to the EF and will continue to do so" (IGD-TP, 2011b: 10). Thus far, only two EFs have been organised. Only the first was attended by (few) people other than representatives from implementing organisations, related R&D actors and technology suppliers. This could be coincidental, but is more likely to be symptomatic for the way the IGD-TP (and TPs in general, for that matter) operates and is perceived by "outsiders". A Greenpeace representative, present at the first EF, was interviewed for this project and gave a number of reasons for not attending the second EF: "*the original invitation never reached Greenpeace; it was too late when they received the invitation; the issue is not of high priority for Greenpeace because they have not seen an active role of the IGD-TP nor steps to more inclusiveness and stress tests are now the priority*" and adds "*we are a member organisation but have the impression we only have a token voice. This makes us weary and suspicious of being used as greenwash*" (interview Greenpeace, 2011). Already when making comments to the SRA, Greenpeace: "demand[ed]s either to be treated […] as a participant of the IGD-TP or [..] will retreat its participation and publish the way it has been treated by the IGD-TP" as they argue that they have "neither been invited to the seminar nor […] to deliver comment on the draft version of the SRA document before this public consultation" (IGDTP, 2011: 10). This resonates very much with the statements made by Monique Goyens (2010) from the European Consumer Organisation, when talking of ETPs in general. She considers that for most TPs, the participation of some NGOs is just cosmetic and they have no possibility to make a difference. From her point of view, "EU institutions speak a lot about civil society, because it is a factor of legitimacy", but they struggle with the concept and with its practical implementation.

In fact, in general, NGOs are missing or not well represented in ETPs compared with the large representation of industry and the strong involvement of the research community (Idea, 2008: 65). In the outsiders' survey undertaken as part of the InSOTEC research, international NGOs (4 respondents) are unclear about their role in the IGD-TP. They would like to receive information, but do not think the IGD-TP is useful enough or are unsure of its usefulness. In addition, only one of them would be prepared to endorse the vision. One of the international NGOs mentioned that the reason for not endorsing the vision is that "*it is focused only on 2 or 3 most advanced programmes. It should be at least accompanied by a vision that all Member States have a clear path leading to geological disposal at the appropriate time*". The same pattern follows for national NGOs, as most of these respondents do not know if they would

like to be involved in the development of the DP or future versions of the SRA, and none of them know if they would like to participate in the IGD-TP. Some of them would be willing to endorse the vision, whilst some of them would not.

Another type of stakeholders whose involvement in the IGD-TP seems uncertain at best is regulatory bodies and TSOs. According to IGD-TP documents and CARD report cited above, regulators could form a Mirror Group by themselves. According to the Terms of Reference, regulators and technical safety organisations "*shall be invited to join the technology platform for example by forming mirror group(s) as decided by them*" (IGD-TP, 2011b: 3). The results of the overview of ETPs indicate that Mirror Groups are usually associated with national platforms developed in Member States of the EU. In the survey for outsiders, five regulatory bodies participated and indicated different opinions on their involvement in the development of the deployment plan and future versions of the SRA (2 would like to be involved, 1 would not and 2 don't know). Even if we need to be careful about interpreting the results of the survey, it is interesting to note that most of them (4 out of 5) agreed that the platform should be a tool to support confidence-building in the safety and implementation of deep geological disposal. They would mainly be interested in the IGD-TP relating to the exchange of information and networking, but would not endorse the vision to preserve their independence. Some of them also highlight that there are many groups and platforms. In this regard, one of the opinions from a regulatory body representative is that "*the IGD-TP should avoid duplication of work performed by other international organisations. [..] the work should really focus on R&D and methodologies for safety assessment including in-depth education and training of specialists dealing with this matter*".

As explained above, the InSOTEC survey for outsiders also addressed local communities, particularly those which are members of the GMF. It should be noted that the 25 respondents represented Sweden (8), Spain (13), United Kingdom (2), Finland (1), Hungary (1). 88% indicated that they would like to have more information on the IGD-TP and that they would be prepared to endorse the vision. We must stress that these results are merely indicative and cannot be considered representative for local communities in general. First because of diversities in national contexts, and second because most respondents representing local communities were GMF members, that means municipalities hosting nuclear facilities, but not necessarily (potential) host communities for disposal facilities for radioactive waste. Nevertheless, an in-depth interview with the General Secretary of GMF provided useful insights into the expectations of local communities in the IGD-TP. According to the GMF General Secretary: "*the perception of mayors, in general, is that industry or radioactive waste management agencies feel uncomfortable when they have to meet mayors. […] Thus, they only interact with the local level when it is absolutely necessary. For instance, in the siting phase, they do not have any other option because they need the local level. But when constructing a facility, they think they are already offering jobs and it is not necessary to interact. The technical world has not yet accepted that the local level is an important actor in this field. The result is that they usually seek the validation of a proposal. This allows them to say that they have taken stakeholders into account*". A representative of academia from Sweden, in the

survey, observed that "*municipalities should be active and allocate resources to review independently, some issues related to the long-term safety of repositories, for the sake of local confidence*".

The lack of a clear process for public involvement in the IGD-TP can be found in one of the comments made to the draft SRA: "*the drivers for research seem to come from within the WM community (WMO, regulators, research organisations) only, the 'end-user' (the public at large) does not really appear in the equation. This is the more strange as public acceptance is the single most important obstacle to implementation encountered so far. In other words, I miss a process and procedure by which the overall socio-political context can have a bearing on the development of SRAs*" (IGD-TP, 2011b: 1). The response statement made by the IGD-TP to this comment reads as follows: "*organisations involved with siting have strong interactions with the local communities and the issues of the SRA come from the waste management programmes*" (IGD-TP, 2011b: 1).

For local communities, their potential role in a European Technology Platform such as the IGD-TP is not clear. For them to be interested, the GMF General Secretary argues the "*IGD-TP should talk about issues which are of interest to them, but before that, they should know what they want from the others*". The interest of local community representatives, in his opinion, is to have a European platform for the local level to exchange experience, and maybe the IGD-TP should seek to contact the Committee of the Regions to consult the opinion of the local level. Overall, the role of municipalities is unclear in the framework of the IGD-TP.

5.2 Network structure

An important factor contributing to the current network structure is that the network was initiated top-down, by the EC and the most advanced waste management organisations in Europe. The participants in the core of the network share a common language and a common set of values and objectives. The way the TP was conceptualised and framed from the very beginning in the CARD project has mostly remained. Thus, some of the limitations foreseen in the CARD project regarding the potential lack of interest from some stakeholder groups still remain. In addition, the fact that the CARD project did not address governance issues from the very beginning has resulted in an ambiguous strategy regarding communication and stakeholder involvement. Whilst stakeholder involvement, openness and transparency seem to be actively sought, the network arrangements operate in such a way that there are few opportunities for outsider groups to become involved in the IGD-TP.

The patterns of interaction among individual members in the EG are strong, particularly among some radioactive waste management agencies in the most advanced stages of implementing a geological disposal facility and, therefore, sharing a high level of related (technical) knowledge. Contrary, the interested actors who are not members, and participated in one or two EF events, or are otherwise connected to the platform, show weak to medium patterns of interaction. They form a loose network of fifty people or so interested in undertaking RD&D projects on geological disposal. In fact, many network relations already existed prior to the

development of the IGD-TP as part of consortia undertaking EURATOM funded research projects. Overall, the structure of the network is rather hierarchical, reflecting the positions of the few implementers who are at the core.

The fact that this network or platform is 'technology oriented' influences the range and number of stakeholder to be involved. Furthermore, in fulfilling its role as a facilitator of RD&D sharing and co-ordination on geological disposal, the IGD-TP prioritises one concrete solution for managing spent fuel and high-level radioactive waste and leaves out other management options. The Vision Document clearly states that "deep geological disposal is the most appropriate solution for long-term management of spent fuel, high-level waste, and other long-lived radioactive wastes" and that "This consensus is based on work over several decades, comprising extensive Research, Development and Demonstration (RD&D) programmes to develop the technical solutions for deep geological repositories […]" (EC, 2009: 10). This statement ignores a fundamental tension remains between voices that argue for other management options, and those following the path towards geological disposal in the near future. The dual mechanism of formal membership and participation in the EF aims at integrating different views and bodies of knowledge. However, the inclusion of some stakeholders, particularly regulatory agencies and technical safety organisations and NGOs is uncertain. Furthermore, an unclear boundary exists between the roles of formal members and participants in the EF. There is a precarious balance between trust, openness and cooperation within the platform members on the one hand and transparency and openness towards non-members on the other hand. The EF is, above all, a means for networking among the relevant research community.

Within the IGD-TP, some projects are already being undertaken, resulting in new constellations of networks among members. An example is the joint IGD-TP project on the demonstration of plugging and sealing techniques, which involves Andra, Rawra, BMWi, SKB and Posiva. But there are also other forums or networks where actors from the IGD-TP engage in R&D activities or exchange experiences. There are clear examples of bilateral or multilateral relationships between waste management organisations for undertaking R&D or sharing experiences and information on the management of radioactive waste. For instance, Posiva and SKB have been cooperating for several years on R&D of the final disposal of nuclear fuel and both are currently proceeding to the construction stage of the final disposal facilities. Other bilateral agreements have been undertaken between radioactive waste management agencies (for instance, the French agency Andra with Ondraf/Niras, Posiva, Enresa, Nagra or SKB; or the Belgium Ondraf/Niras with Andra and Nagra; the Spanish Enresa with the Hungarian Puram; etc.). Beyond the European context, some of the organisations in IGD-TP[30] take part in international organisations and are also members of EDRAM, the International Association for Environmentally Safe Disposal of Radioactive Material and OECD/NEA Radioactive Waste Management Committee (RWMC). EDRAM has the objective to promote the exchange of knowledge, experience and information among its members. However, it is

[30] Namely: SKB, Posiva, Ondraf/Niras, NDA, Nagra, Enresa, Andra, BfS and DBE (www.edram.info).

not the same individuals taking part in both networks. In the case of EDRAM, the Heads of Agencies (presidents or CEOs) are the members, whereas in the IGD-TP the members are the responsible persons in R&D. Another international forum comprising senior representatives of implementers, regulatory authorities, policy-making bodies and research and development institutions is the OECD/NEA RWMC. This Committee aims to foster international co-operation in the management of material from nuclear facilities, including facility decommissioning and long-term waste management. The result of the interaction between the different affiliations in the RWMC is consensus documents and / or shared research results. The RWMC addresses both the technical and societal requirements for sustainable waste management and decommissioning solutions[31]. The RWMC is assisted by three working parties to carry out the programme of work: the Forum on Stakeholder Confidence (FSC), the Integration Group for the Safety Case (IGSC) and the Working Party on Management of Materials from Decommissioning and Dismantling (WPDD).

Another example to illustrate interactions among the actors of the IGD-TP at European level is the development of EURATOM research projects. Waste management organisations collaborate with universities, research centres and consultancies on European funded projects on the management of radioactive waste. One of the interviewees from a research centre states in that regard: "I *know all the agencies. I know most of the research organisations. We work together with at least half of the universities involved in the IGD-TP. The 'club' is not very large and has not changed much over time*". In addition, as part of the FP7, some of the current scientific and technical projects where collaboration between different organisations can be found are Recosy, Forge, Carbowaste and MoDeRn. In many cases, the organisation of conferences, seminars or meetings (whether related to these European projects or not) brings together implementers with academic and scientific partners, forging synergies and collaboration between organisations. In some cases, different organisations forge a network and compete with others for European funding. On-line communication is often supported by face-to-face interaction, which involves close ties of relationships between them.

At national level, the radioactive waste management agencies often collaborate with the universities and research centres, which are also members of the IGD-TP, to carry out research projects. Most of the current members of the IGD-TP learnt of the platform through personal and professional contacts either at European (35% of respondents) or national level (21% of respondents).

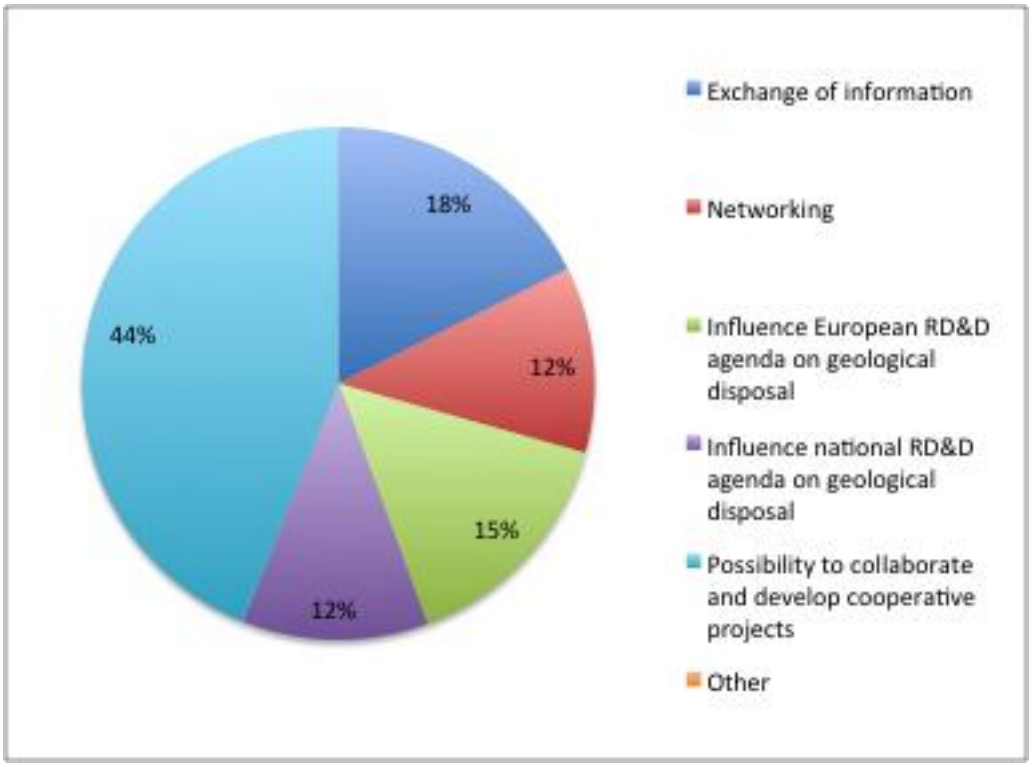
5.3 Scope of activities

The motivation of the principal actors –members- in joining a network is wide ranging. Some may be more interested in receiving information, others in establishing relationships with other actors or networking, having potential access to funds for carrying out projects to advance in the implementation of the geological repository or perhaps the motivation is to

[31] More information on www.oecd-nea.org/rwm

achieve political objectives. According to the survey sent to members of the IGD-TP, their main interest for becoming involved is the possibility to collaborate and develop cooperative project and secondly, the exchange of information. This opinion was supported by a representative of a research centre interviewed for this project who argued that "*the main purpose of the IGD-TP from my point of view is the exchange of information and scientific knowledge / findings within the expert scene (which comprises a limited number of institutions and people in Europe). This exchange should foster the identification of synergies that support the work of the organisations involved*".

Figure 5 Main interest of members in the IGD-TP



Indeed, the IGD-TP offers opportunities "to take part in the planning of research, development and demonstration (RD&D) activities, to efficiently participate in focused implementation work, and to participate in important information exchange and knowledge transfer", if your organisation is committed to the IGD-TP vision (IGD-TP, 2010: 11). Therefore, it can be said that the activities undertaken by the Platform are not appealing to those organisations not endorsing the vision. The arguments for transparency and openness could thus be questioned then. At this point, it is interesting to extract from the surveys some of the main reasons pointed out by outsiders' groups for not wanting to endorse the vision:

- *I think it is difficult, might even be dangerous to set a date because you cannot force a process which involves common people and society in a so difficult and emotional question if you shall succeed. On the other hand, if no dates are set you can go on and on for ever in research for example and the process, because it is difficult to maintain interest and knowledge within the population for too long time. I also believe that you*

should hold the doors open for new technology that might not include geological disposal (from a local community representative);

- *Delays to be expected on technical, organisational, social and political grounds* (from a licencing authority representative – at national or regional level);
- *Scottish Government is not endorsing the UK NDA policy of deep geological disposal therefore it is pointless for Dounreay Stakeholder Group to endorse a position /vision that is not possible in Scotland at this time* (from a local community representative);
- *We are independent regulator* (from a regulator representative);
- *We have no connection and contacts with IGD-TP developers* (from an industry representative);
- *A vision by short term objectives based on a technical approach has always failed, short of genuine public involvement in the objectives of research and in the design of technical options* (from a private research organisation representative);
- *2025 seems to be too optimistic* (from an industry representative);
- *Just because people would not understand why it could be possible to dispose of spent fuel in one country and why not everywhere. Moreover, is direct disposal of spent fuel as soon as possible the best way to manage the future energy needs?* (from a waste management organisation representative).
- *It is an industry effort without possibility for critical input or analysis of fundamental issues* (from a national NGO representative).

Whilst the IGD-TP argues the necessity of continuous interaction with stakeholders, the way public acceptance and public confidence is understood in the documents of the TPs related to nuclear (i.e. SNE-TP and IGD-TP) is seen by some as misleading. Sundqvist and Elam, for example, regard the way the IGD-TP understands participation as an "… orchestrated dialogue that implies one-way communication", where "demonstrating technical achievements is a strong argument to convince the public that it is possible to proceed in a direction already decided" (Sundqvist and Elam, 2010: 219). Their critique is aimed at passages in the Vision report arguing that it is now time to go ahead on the basis of what has already been achieved, e.g.: "The waste management organisations agree that it is time to proceed to licence the construction of deep geological repositories. Despite public and political debate related to the siting of such facilities, a number of examples show that it is possible to site facilities for deep geological disposal through a process that involves broad societal participation" (EC, 2009: 10).

In the conference on ETPs "ETP 2010: Working Together on Societal Challenges" held in Brussels in May 2010, the IGD-TP was presented among other energy-related ETPs. The report on this conference states that the IGD-TP "is working to build confidence in geological disposal as the most appropriate solution for long term management of spent radioactive fuel.[...] It is critical to feed the public and political debate related to the safety of deep geological repositories with factual scientific data. In two successful siting case studies in Finland and Sweden, social and political challenges were addressed by prioritizing the dialogue with local communities to share the extensive scientific and engineering work underpinning the conclusion that geological disposal is technically feasible and safe" (EC, 2010: 17). The panel on

energy-related ETPs considered that "[…] the implementation of a technology is part of a socio-technical system that interacts with the local community, the local environment, the key stakeholders and the project developers." (EC, 2010: 19).

A number of WGs were set up by the EG during the second Exchange Forum. It does appear that the way decisions on the creation of working groups and the setting up of joint projects are basically taken in the close circle of the EG. This makes that the rationale behind these decisions is not always clear to other TP members. As raised in an interview with a representative from a research institute: "*For me it is absolutely unclear, how these working groups are being managed: who is going to implement and run the working groups? What are the expectations from 'outsiders': should they become active addressing their topics and interests or should they wait until they are asked to participate?*".

5.4 Resources

We argued above that the IGD-TP documents, and particularly, the Vision document, refer to "resources" on several occasions (e.g. as competent human resources and public and private funds) but are not clear about the type of resources that participants in the EF are expected to provide to the working groups. The SRA document goes a step further and mentions resources related to research infrastructures and training. It is interesting to highlight here that the IGD-TP recognises that its RD&D programme is biased towards some of the countries which are closest to licensing, but states that "all European waste management programmes are foreseen to use similar stages in their programme development and therefore the IGD-TP offers all participants reasonable incentives for participation and sharing of resources" (IGD-TP, 2011c: 59). Thus, resources – knowledge, human competence, research infrastructure, financially – seem to come from a variety of organisations being involved in the network. Clearly, so far, the EC and the most advanced radioactive waste management organisations have provided most of the resources for the foundation of the IGD-TP and the main outcomes. The EC has provided financial support to the secretariat since its inception. However, support for stakeholder involvement as such is not conceived and if this continues to be the case, some organisations might not be able to continue financing their involvement. For instance, one interviewee from an international association suggested that "*if they ask us to pay a fee, probably we would have to withdraw given the current economic situation*". In fact, in the survey for IGD-TP members, most of the respondents mentioned that the main disadvantage for their organisations' involvement in the EF was financial resources (35%, 6 respondents) whilst the second reason was the different levels or types of knowledge between participants (24%, 4 participants). When asked about what kind of contribution would they expect from members of the Exchange Forum, the majority of respondents answered expertise and knowledge (76,5%, 13 respondents), technology (11,5%, 2 respondents) and others. According to the ETP Expert Group "financial resources must be provided to ensure the engagement of societal and academic actors when these do not have sufficient financial resources or provision of such funding from industry is not an option, due to the need for an independent contribution" (EC, 2010b: 52). A researcher interviewed for this project mentioned that

indeed, "*Waste management organisations pay for this [the IGD-TP] but count on the knowledge of others. However, others will not be able to bring in money. Consultancies will try to make business out of this. Universities only have knowledge. So, waste management organisations give the following argument: 'We pay, so why should we give someone else the power of control?*"".

5.5 Networking activities

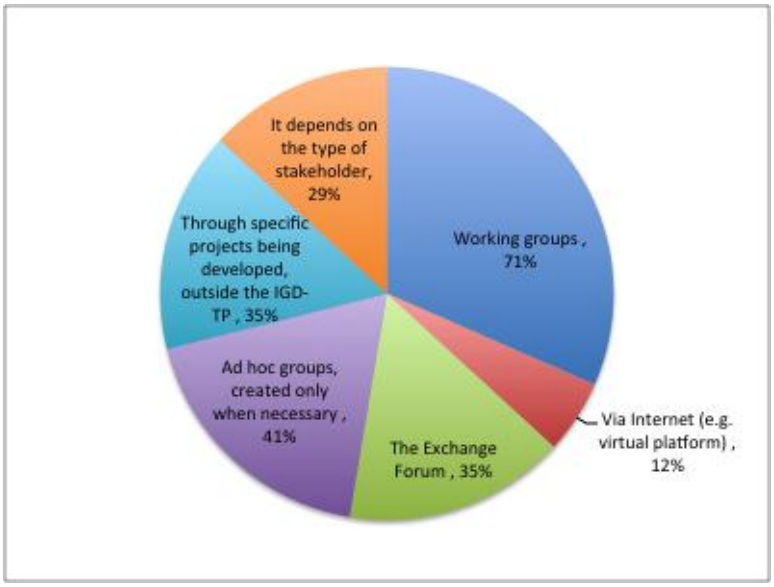
Already in the CARD proposal, knowledge management was seen as a "highly prioritised activity for the TP, involving the commissioning of books and reports on the state of the art of relevant topics, effectively handbooks for radioactive waste management. […] the involvement of a wide range of stakeholders including social stakeholders will enhance the value of knowledge management initiatives and inform their objectives" (CARD, 2008: 4).

So far, the IGD-TP has been focusing its main activities on developing the SRA and the DP and has achieved this in relatively short time compared to other ETPs. Thus, whilst some management decisions are clearly structured and reported in the Terms of Reference, other arrangements seem to be aside or not given enough priority. As one interviewee from a radioactive waste management organisation declared in an interview "*the contact with society is still to be defined. The EF, as it is set up, is not a tool to communicate. It is open but the way it is designed is not prepared for the participation of everybody*". Another interviewee from an international organisation raised questions regarding the need to involve more people in the EF: "*It is not important if there are 60 or a 100 participants, but rather if the people who have to take decisions are there and the quality of their contributions. Maybe there are 300 participants, but, do they contribute? The question is if it is necessary to involve more people. There is a need to involve people if they have to contribute to research, cooperation and collaboration, but if it is only lip service, it is not going to have any results".* Another comment from a representative of a research organisation and member of the IGD_TP, supports this view: "*The EF only works in one direction. The steering committee wants to show that all has not been settled yet, and to give others the impression that they could exert some influence. But this influence is limited to ventilating ideas, and you do not have any influence over how these ideas are incorporated in the next steps*".

Involving stakeholders in the EF, for instance, is one of the issues where the opinion of IGD-TP members seems to be more diverse. When asked "how do you see the main role of the EF?" one option had to be chosen among: 'adviser', 'tool for stakeholder participation', 'dissemination of the IGD-TP', 'confidence building', 'don't see a role for the EF', 'other'. Some of the IGD-TP members responding to the survey chose 'dissemination of the IGD-TP' (35%, 6 respondents), whilst others chose an advisory role (23,5%, 4 respondents). In fact, the role of the EF up to now does not seem to be clear for some members of the IGD-TP, neither for some of the organisations having attended the EF. There seem to be a wide range of possibilities for the Forum or other mechanisms to address public concerns. For instance, one interviewee mentioned the possibility to have some portal function where the IGD-TP could react or answer to questions in a supranational way. When the IGD-TP members were asked which are

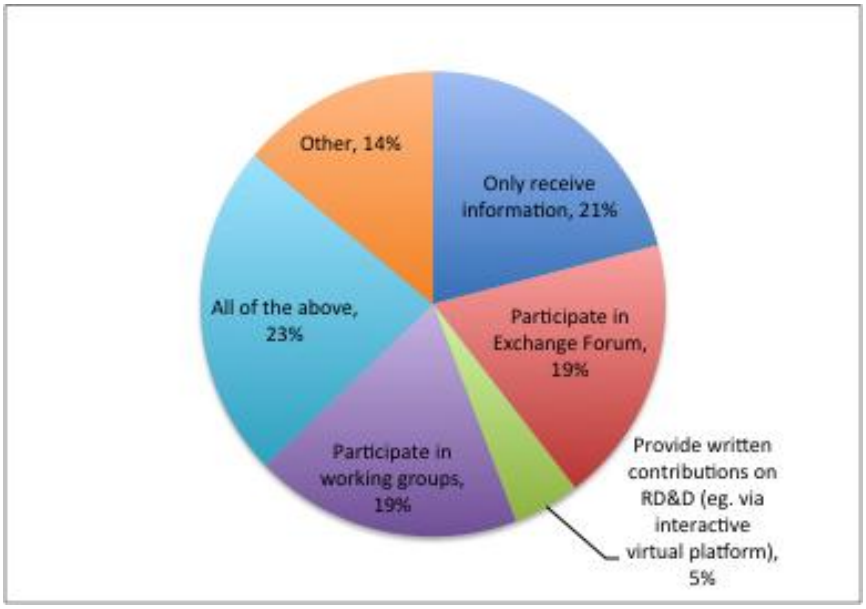
the best mechanisms for stakeholder involvement, most of them answered that working groups (71%, 12 respondents) and ad hoc groups (41%, 7 respondents) created only when necessary, would be the best, as shown in the Figure below.

Figure 6 Best mechanisms for stakeholder involvement according to IGD-TP members (17 respondents)



However, when outsiders of the IGD-TP were asked in the survey if they would like to be participate in the IGD-TP, more than half of the participants (61%, 44 out of 72) responded affirmatively whilst 31% did not know. Out of the 44 who responded favourably about becoming involved in the IGD-TP, their preferred option of involvement was to only receive information (21%, 9 respondents out of 43 who answered this question) and their least preferred option was to provide written contributions through for instance an interactive virtual platform (5%, 2 respondents out of 43), as shown in the Figure below. It is worth noting here that one of the respondents indicated that at present their preferred way to be involved is just to receive information, but should the Scottish Government change policy on geological disposal, a mechanism allowing further participation would be preferred at that stage.

Figure 7 Ways outsiders prefer to be involved in the IGD-TP



Monique Goyens, from the European Consumer Organisation, reviews the role of civil society and in particular, consumers groups, in research and development and also in ETPs in general (EC, 2010b: 74). She sees two dangers of the trend to refer to civil society: cosmetic legitimacy and the need to build into the decision-making system the specificities of civil society participation. Thus, "it is important that research planning is not led unilaterally by scientists, researchers and technical experts. Planning has to pass the civil society test and must not overlook societal aspects and respect of our fundamental values" (EC, 2010b: 77). She suggests some recommendations for involving civil society in ETPs:

- involve from the start, not just at the end;
- provision of funding for participation, expertise must be upheld;
- provide for some balance in the decision making process. For this, it would be necessary to diversify participation of civil society organisations in a given structure, providing sufficient timing for the works and consultation within the organisation, provide possibilities for dissenting opinions to be recorded, cluster ETPs meetings, and organise meeting agendas that allow civil society organisations to participate only in those meetings that are strategic for them and where they can bring added value.

In a similar vein, the Forum of Stakeholder Confidence of the OECD/NEA (FSC) presents principles and components of an inclusive decision-making approach specific to radioactive waste management (NEA/FSC, 2008). For instance, the FSC supports early involvement and in particular, the stepwise approach. The FSC observes that this approach is largely considered by decision makers to facilitate involvement, manage the complexity of long-term radioactive waste management and take decisions that are viewed as legitimate and can be more easily sustained (NEA/FSC, 2004). Partnerships are also regarded as mechanisms to achieve a balance between sometimes competing requirements of fair representation and competent participation (NEA/FSC, 2010).

6 A framework for considering stakeholder involvement in the IGD-TP

In this section, we present a method for thinking about possible scenarios for improving stakeholder involvement in the IGD-TP, along a continuum of various degrees of interaction, from relatively weak to quite strong. Therefore, the focus is on the interactions between science, society and policy in view of defining R&D priorities, and how these interactions could be conceptualised and interpreted for the IGD-TP. It is challenging to develop scenarios for stakeholder involvement taking into account the complexity involved in knowledge creation in an area like geological disposal, where there is high uncertainty, long time scales and multiple interests. Hence, the different levels in the continuum are conceptualised based on a broad understanding of stakeholder involvement in fostering the co-production of knowledge.

We use in this report the three models of production of knowledge suggested by Callon (1999): deficit model, public debate model and co-production of knowledge model. For Callon, there is no need for one of these models to replace any of the others. Whether the organisation and production of knowledge should follow the first model of strict segregation between science and society, or the third, which actively involves lay people in the creation of knowledge that concerns them, is a matter of context, of the nature of the problem or question at hand (Callon, 1999). Even if they do not yet offer a full framework for systematic empirical analysis of knowledge co-production, as argued by Hegger et al. (2011), Callon's three models of co-production of knowledge, provide a simple and comprehensive framework to consider the range of possible modes of representation by non-experts in science and technology debates. In what follows, we will use Callon's taxonomy to interpret three different configurations of relationships between experts and stakeholders and subsequently provide three different scenarios through which the IGD-TP could communicate and interact with various stakeholder groups.

Following Callon's typology, the scenarios suggested in this report, range from the '*deficit*' model of public engagement, through more collaborative platforms of co-production of knowledge. Rather than conceptualising the scenarios as unique single possibilities for stakeholder involvement, they are presented here as a means to stimulate further discussion within the IGD-TP on the possibilities to explore stakeholder involvement. Therefore, the scenarios should be regarded as part of a spectrum of stakeholder involvement in which the intensity of engagement is higher as we move along the spectrum. There are no sharp boundaries between the different levels. At one end of the continuum, stakeholders are not involved in R&D, whilst at the other end, experts and stakeholders are becoming more closely entangled with each other and mutually interdependent for engaging in a collective research initiative. In between these extremes, there is an intermediate model of debate or consultation. It should be noted that there is no "best place" to be along this continuum and one model is not better than the other. The position depends on what is appropriate for a particular phase of a particular process, depending on the contextual circumstances. These scenarios could thus be used to enrich the understanding of the nature and role of stakeholder

involvement in the context of the IGD-TP. Probably there is no one scenario which fully reflects the views of radioactive waste management agencies nor of all possible stakeholders. In addition, a combination of features of the different scenarios may be more appropriate than selecting one scenario, depending on the objectives, the circumstances at each point of time, or the decisions to be made. Furthermore, it is important to bear in mind that to be effective, ETPs must be driven by actors from the problem end of the innovation process (EURAB, 2004).

Although most of the approaches of knowledge production do not offer clear-cut criteria for assessing stakeholder involvement in the context of the IGD-TP, Callon's basic model allows us to identify some criteria to help conceptualise the different scenarios. These elements have been grouped under the following headings:

- Nature and level of interaction between experts and stakeholders;
- Types of stakeholders involved;
- Aimed for degree of co-production;
- Use of instruments and tools to generate information and knowledge;
- Legitimacy of decisions.

The elements identified above are by no means exhaustive. They have been distilled from Callon's paper (Table 1) and then applied to the case of the IGD-TP (Table 2). In addition, advantages and disadvantages of each of the models are spelled out in Table 2.

Table 1 Different scenarios for involvement (based on: Callon, 1999)

	'Deficit' or 'public education' model	*'Public Debate' model*	*'Co-production of knowledge' model*
Nature and level of interaction experts-stakeholders	Minor or absent: scientific knowledge is considered the opposite to lay knowledge.	Muddled boundaries between specialists and non-specialists. Stakeholders have knowledge competencies which enhance and complete that of scientists and specialists.	Constant interactions between stakeholders and experts. The relationship between experts and stakeholders is based on an equal footing.
Type of stakeholders involved	Narrow conception of stakeholder. Involvement restricted to professionalised networks leading the process.	Moderate level of involvement, depending on the issues to be addressed, but the circle of stakeholders is broadened up. Differentiates between stakeholders with different points of view and competencies.	High involvement and engagement of stakeholders as "hybrid collectives" or "heterogeneous collectives" (Callon, 1994)
Degree of joint co-production of knowledge	Limited or absent: stakeholders do not participate in knowledge production. Generally, one way statements to assist participants understand the problem.	Knowledge is generated through comparison of opinions, knowledge and judgements which are mutually enriching.	Process of collective learning to attain a shared understanding which is mutually reinforcing throughout the process. Stakeholders and scientists jointly define a new vision in which they can recognise themselves.
Instruments and methods for co-production of knowledge	Unidirectional communication. Generally, educational and informative actions are carried out by experts and specialists.	There are forums for discussion, consultation and deliberation to address certain issues, that may take different forms. The actors are in a position to negotiate the co-production of knowledge, but asymmetric distribution of power between scientists and stakeholders.	Stakeholders may play a leading role in the production, orientation and evaluation of knowledge as part of the heterogeneous networks
Legitimacy of decisions	Legitimacy is conferred by the scientific, objective and universal knowledge.	Legitimacy relies on the existence of consultation and open debate.	Legitimacy relies on the ability of stakeholders to gain recognition for their actions.

Table 2 Different scenarios for involvement in the IGD-TP

	'Deficit' or 'public education' model	*'Public Debate' model*	*'Co-production of knowledge' model*
Nature and level of interaction experts-stakeholders	The IGD-TP has no intention to interact with stakeholders to create a common knowledge base, since there is too much disagreement and/or mutual misapprehension. Obligation to endorse the vision to become a member fits this approach. The interaction is based on keeping participants informed and aware of technical programmes, R&D results, new R&D projects …	The IGD-TP offers a number of opportunities for interaction, mainly focused upon consultation (e.g. SRA and DP consultation processes). These consultation processes are mainly oriented on convincing stakeholders of own assumptions and values. Some opportunities lead to processes of harmonising and combining knowledge (i.e. working groups as part of the EF).	The IGD-TP displays an open and communicative attitude and actively exchanges information and knowledge with stakeholders, and is receptive to other insights and sources of knowledge. Stakeholder involvement is continual and seen as a routine (meetings on a regular and organised basis). Interaction is organised to contribute to building a relationship of trust.
Type of stakeholders involved	Decision-making restricted to radioactive waste management organisations. Active and direct communication with certain stakeholders, such as academic professionals and science providers. Indirect and passive communication towards other stakeholders (such as NGOs, local communities, regulators, media, etc.).	Some "selected" stakeholders (industry, governments, consultancies, academia) are more actively involved in the consultation processes to provide comments to SRA and DP. This results in a strong need to clarify the policy for membership in the IGD-TP.	Accessible to all interested parties by open invitation. No barriers to participation. Secretariat seeks proactively stakeholder participation. Apart from stakeholders in the public debate model, associations of local communities are key actors in the mobilisation of knowledge and are both the objects and the subjects of research. Resources are available for some organisations to become involved in the meetings. Cooperation between technical researchers and researchers in human and social sciences is common. Potential for ICT to play a role in this model. Interaction with other ETPs (e.g. the SNETP) would be advisable.

	'Deficit' or 'public education' model	*'Public Debate' model*	*'Co-production of knowledge' model*
Degree of joint co-production of knowledge	No real joint knowledge production activities are developed. Knowledge is developed and dominated by the IGD-TP, who is granted the role of defining what counts as a problem, determines research agenda and produces and disseminates scientific knowledge. No intention to include other values and perspectives. Stakeholders are recipients of the scientific information. The Vision, SRA and DP of the IGD-TP are not discussed in depth.	Joint activities are developed strategically or symbolically with no real intention to create a common knowledge base. Discussion is seen as complicated by the technical complexity involved in RD&D issues dealing with geological disposal. There is much difference between knowledge assumptions and values between actors. The IGD-TP mainly interacts with those sharing its assumptions and values. Towards other groups, the IGD-TP displays these assumptions in one-way communication.	Joint activities are developed to prepare for or actually develop a common knowledge base. Knowledge differences are displayed through a process of communication, negotiation and mutual adjustment. Vision, SRA, DP, … are negotiated with other stakeholders. Local communities may become involved in defining research orientations, producing practice-oriented knowledge and actively disseminating results. Mediators or facilitators can help in the co-production of knowledge. A broader conceptualisation of issue formation and concerns than those presently guiding the IGD-TP is allowed: e.g. discussing the relationship between geological disposal and nuclear new build.
Instruments and methods for co-production of knowledge	IGD-TP is in control, accountable and responsible. The Vision, SRA and DP are communicated one-way. The website is seen as the main mechanism of interaction between the IGD-TP and its stakeholders.	Consultation limited to (1) posting a draft document on the website for a certain period of time and ask for comments and (2) the Exchange Forum. Some do not feel their input is taken into account, or feel discussion is not free and really open. Some key points are kept out of the discussion and debate is not structured to allow for different perspectives. The EF often presents ready-made solutions to predefined problems. However, some degree of learning and debate is possible.	Different engagement instruments are used as negotiation and learning processes (ICT, forums, working groups, etc.) and allow the opening up for a process towards new issue formation. Need for clear commitment and choice of instruments and methods as part of the strategic choices. A dedicated WG is a good way to start, but would merit to seek advice from professionals in this field, to guard over the soundness of the instruments and coherence of the methods used.

	'Deficit' or 'public education' model	*'Public Debate' model*	*'Co-production of knowledge' model*
Legitimacy of decisions	Given the complexity of the problem, it is unlikely that legitimacy can be found in broad agreement on the existence of universal knowledge and the absence of scientific disagreement.	Legitimacy relies on the existence of consultation and open debate.	Legitimacy is enhanced through including formally excluded groups. Extending the responsibility to a wider group can also help to achieve greater accountability of decisions taken by stakeholders.
Advantages	Little time and effort spent by the IGD-TP compared to the other scenarios. Priority is on information provided to stakeholders.	Can bring in new perspectives and useful viewpoints.	Optimal use of participants' competencies and knowledge. Stakeholders are accountable and responsible. Empowers stakeholders. The outcome is more representative of a wider group, and the feeling of ownership will be extended.
Disadvantages	Dissatisfaction and distrust among stakeholders in the IGD-TP (their concerns are different from those of the IGD-TP). No opportunity to make contributions, some of their assumptions could be relevant, but are rejected from the beginning and there is no possibility to question the IGD-TP's assumptions.	Stakeholders may lose interest if their aims and concerns are not sufficiently addressed. Some critical groups (i.e. Greenpeace) decide to withdraw from the IGD-TP. The EG may not acknowledge the need for reflection on values and expectations, posing a threat to successful knowledge co-production.	Stakeholders discuss issues which are of interest to them and this would mean that the IGD-TP would remain open to discuss other technologies. Stakeholder involvement can frustrate a process, can be cost and time intensive. It is unrealistic and too complex to let all stakeholders participate in every phase of the knowledge co-production process. Roles and responsibilities get blurred and it may be more difficult to manage oversight and review.

Using the three models above (deficit model, public debate model and co-production of knowledge model) to interpret how the IGD-TP can interact with stakeholders makes it possible to explore different scenarios of stakeholder involvement within the platform. The models take into account the relationships between stakeholders and scientists with respect to the modalities of cooperation, the conditions of legitimacy of the decisions taken and the roles of scientists and citizens in the production and dissemination of knowledge. As stated above, a certain type of model might not be appropriate in all situations, but following certain patterns can be effective at certain points in time. The three categories in the tables above are not to be understood as absolute or directive. They are meant to be indicative and illustrative for different ways to organise 'outreach' and integrate views in a decision-making process on prioritizing R(D)&D needs. They should help the IGD-TP to reflect on its current way of working, as wells as to decide on future paths.

The current approach of the IGD-TP seems to fall mostly into a model between the public education and public debate models. Firstly, the experts involved in the IGD-TP seem to come from similar disciplinary backgrounds, which make it easier for them to communicate and interact but probably more difficult to acknowledge that other stakeholder's knowledge has the potential to improve the identification of problems and the search for feasible acceptable solutions. Secondly, the actions currently undertaken to involve stakeholders in deliberation and discussion seem more in line with the first model and are not fully consistent with the IGD-TP's discourse. Stakeholders, such as NGOs, local communities, regulators, are either not involved in the platform or are only involved on a very limited scale. This limited involvement may be attributed to the lack of a clear strategy on stakeholder involvement, and some perceived resistance within the EG towards change. At the same time, some representatives of the EG indicate the need for more input in terms of quantity and representation from some groups (like NGOs). Finally, the role and nature of the Exchange Forum (EF) is not yet clear as its objectives are not well-defined. It is unclear if it should be a dissemination mechanism, a consultation tool, a forum for exchanging and sharing R&D results among agencies and research organisations, for proposing R&D projects or a mixed approach to information dissemination and consultation. Under the knowledge co-production model, one could assume more opportunities to allow and enable stakeholders to, as Sundqvist and Elam suggest, "legitimately raise and articulate their concerns, leading to a process of issue transformation capable of engaging and animating all involved parties" (Sundqvist and Elam, 2010: 222). The recent decision to no longer demand people and organisations to endorse the vision in order to participate in EF meetings creates a new form in uncertainty, as the difference between members and non-members becomes blurred.

7 Concluding remarks and reflections on the IGD-TP

This report has discussed mainly the organisational aspects and issues of practical inclusiveness/exclusiveness associated with the IGD-TP. Technology Platforms can be understood as knowledge networks, deliberately set up to influence (research) policy in a specific domain. We therefore used knowledge networks as a conceptual approach to better understand the IGD-TP. The way knowledge is generated and shared and the extent to which this can be considered 'socio-technical' knowledge will be subject to further investigation in the following months.

The effects of the core members in the IGD-TP will be studied further in following phases of the InSOTEC project. So far, it is perceived that the RD&D activities of the IGD-TP are heavily influenced by the most advanced programmes on geological disposal in Europe, most notably Sweden, Finland and France. This is predictable since this network emerged precisely from the interface between these advanced radioactive waste management agencies and the EC. From the analysis in this report, it is possible to highlight the following observations as concluding remarks. Firstly, the IGD-TP shows concerns regarding the involvement of different stakeholders in the platform, but has no clear position with regards to how to involve stakeholders. The main question for the IGD-TP core members remains: they need to elucidate why stakeholders should be involved, what the IGD-TP can offer to them and what stakeholders can offer to the platform, in order to understand clearly the benefits and drawbacks of participation. In this regard, it is important to recognise that as long as geological disposal, with the exemption of the question of siting, is regarded as mainly a technical challenge, as seems to be the case now, participation will have a minor role in the IGD-TP. So far, the Exchange Forum is the existing participatory instrument for the IGD-TP to involve stakeholders with the objective to exchange information on the SRA and the DP. It has probably served as a valuable vehicle to enable the IGD-TP to disseminate information and involve mainly radioactive waste management agencies and R&D institutions in providing comments to key documents of the IGD-TP. However, if the aim of the EF is to serve as a venue for engaging with different stakeholders in RD&D for the implementation of geological disposal, other mechanisms may be more appropriate. Obviously, the choice of participatory methods will depend on the objective, the context and the type of stakeholders to engage. Therefore, some of the questions for the IGD-TP to reflect on before taking decisions on changing or choosing a participatory model or another could be: Why is the IGD-TP interested in inviting stakeholders? What can the IGD-TP offer to them and what can they bring to the IGD-TP? Or even: is the European level the right level to agree on a vision when implementation is taking place at national level?

Additionally, it is worthwhile noting that the extent to which social scientists are currently involved in the IGD-TP is minor to none, apart from the participatory observations of InSOTEC researchers and a few social scientists working for waste management organisations involved in the platform. A possible avenue for reflection would be for the IGD-TP to consider the involvement of social scientists as part of the discussion on RD&D, together with technical scientists. Despite the fact that

there is a Key Topic in the SRA on governance and stakeholder involvement, this seems often to be regarded as a last issue to be addressed, after the scientific and technical topics. On the other hand, there is the "interfaces working group" set up in the last Exchange Forum held in Helsinki in November 2011. Its main objectives are to propose an organisational framework for interfacing with and better involving various types of stakeholders (including regulators and TSOs) and incorporate their concerns and to explore ways forward to stimulate review of IGD-TP material by non-technical stakeholders[32].

However, as mentioned above, with regard to technology platforms in general, the European Commission did recognise that "[…] the implementation of a technology is part of a socio-technical system that interacts with the local community, the local environment, the key stakeholders and the project developers." (EC, 2010: 19). Therefore, involving key stakeholders from the social sphere is of primary importance if one is considering the implementation of a geological disposal repository. One aspect of that could for example be a broader reflection on the notion of 'demonstration', demonstration to whom, and for what purpose.

Secondly, the way the IGD-TP designs and implements consultation processes is of particular interest when assessing stakeholder involvement. Almost all consultation processes launched by the IGD-TP have been concerned with posting a report on the IGD-TP website (www.igdtp.eu) and asking for comments or consultation has been understood as comments made at a specific seminar. During the SRA consultation, a document on comments and replies was prepared to show the extent to which each review comment was handled by the IGD-TP. Nevertheless, this type of consultation rarely results in meaningful stakeholder engagement and in building constructive working relationships. Generally, participation involves a more in-depth exchange of views and information, with the aim to generate a sense of ownership in the process and its outcomes. At present, this does not seem to be the case for most stakeholders not belonging to the technical research community.

Thirdly, the vision of the IGD-TP is very concrete. Setting such an explicit target was a deliberate choice by the initiating waste management agencies. While it has to some extent the advantage of clarity, it also limits the extent to which a wide range of stakeholders can be involved or integrated in the platform, since there are no opportunities to broaden the scope of the vision, or the IGD-TP's activities. Rather, implementation of a geological disposal repository by 2025 is the one and only concern and opening this issue to alternative visions for discussion does not seem to be possible at present.

Finally, the overall approach of the technology platform might restrict the scope of stakeholder involvement, as it seems to narrow participation down to uniquely technology experts, hindering socio-technical manifestations. As already suggested by the European Research Advisory Board

[32] See presentations from the 2nd EF in www.igdtp.eu.

(EURAB), the focus on technology may be highly misleading and may hamper some initiatives of stakeholder involvement. EURAB (2004) suggests emphasising more the mission or the problem solving aspects rather than the more limited technological issues. Additionally, the new European Technology and Innovation Platforms (ETIP) concept promoted by the EC seems to go a step forward in establishing stronger relationships between industry leaders and other organisations having an interest in the issue, and ensuring a more balanced representation of different interests in the platform's scope and activities. So far, the IGD-TP seems to give limited opportunities for stakeholders to broadly discuss scientific research and demonstration, which might seem a too complex arena for stakeholders to be involved. Involving stakeholders in exploring societal and ethical questions could be a way to work on the co-evolution of research and scientific activities with societal visions. Because the way Technology Platforms approach stakeholder involvement differs and can also change over time, it is never too late to begin designing and implementing a new communication and stakeholder involvement plan, which may change some of the traditional ways to communicate and engage with different interest groups

It should also be noted that networks in general are not static institutions, but rather dynamic structures, which may change as new knowledge can be gained. Therefore, there is room for engaging with stakeholders in the field of radioactive waste management, if this is the intention of the IGD-TP. The mechanisms for engagement with stakeholders may be various, and not solely the EF. However, it is important to identify "if stakeholders come to the table with non-negotiable positions, for example due to the statutory obligations of some organisations that prevent them from compromising with others on certain issues […] In that case, limitations need to be identified and flagged up at the start, to avoid frustration and potential conflict" (Reed, 2008). At present, the underlying issue of concern is already decided upon as well as the best ways of addressing it (Sundqvist and Elam, 2010). On the other hand, the new structure of the EF with the creation of different working groups may facilitate the identification of common goals and a sense of a more horizontal structure. In fact, the IGD-TP may need different representative and participation structures at different levels over time. Flexibility towards new actors and new concerns may prove advantageous. Similarly, the number of stakeholders may increase over time or even stakeholders can change. Given the fact that the IGD-TP is a European platform, one of the options for involving representative stakeholders could be to invite institutions or organisations at the European level, such as the Committee of Regions or the European Economic and Social Committee. Others that could be taken into consideration might be: the Group of European Municipalities with Nuclear Facilities, the European Network of Environmental Professionals, the European Nuclear Young Generation, the Association of European Journalists, the European Environmental Bureau, the Climate Action Network Europe, etc.

8 Further research

The IGD-TP currently lacks clarity concerning membership, particularly regarding the conditions to become a member or to participate in some of the IGD-TP activities, and regarding the roles attributed to members or participants. Some of the questions that need to be clarified are:

1) Which 'external' stakeholders are expected to participate in the activities of the IGD-TP or in the discussions of the issues addressed by the IGD-TP?;
2) At what stage should they become involved? (e.g. identifying research topics, deployment plan, dissemination, etc.);
3) How and to what purpose 'external' stakeholders should be involved in the IGD-TP? What is the role of members endorsing the vision, and in what way is that expected to be different from that members of interested parties not endorsing the vision?

Overall, more analysis should be done on the different stakeholders' groups, concerns and expectations regarding the IGD-TP to target communication and participatory actions.

This report has not touched upon methods of interaction used for realising co-production of knowledge (e.g. participatory technology assessment, multi-criteria analysis, consensus conferences, scenarios workshops, etc). For instance, the analysis of stakeholder involvement scenarios developed in this paper could also be undertaken as an interactive exercise in which the IGD-TP launches a process engaging a group of stakeholders to identify key issues, to create and explore scenarios to reflect on the different possibilities. This discussion would provide an opportunity for participants to frame and re-frame the problem according to the specific issues, arguments and assumptions. This exercise could become a possibility to learn directly from stakeholders' concerns and expectations on the IGD-TP. Rather than being passive recipients of information as up to today, the exercise would reach those audiences who might be interested in the IGD-TP but have so far remained unaware, or are critical about the way stakeholder involvement has been conceived so far. For the purpose of a long-term structure, this interactive and deliberative approach can provide a basis for framing a common understanding of future opportunities for involvement and an opportunity for social learning and greater mutual understanding. It is interesting to bear in mind that "the way in which methods of knowledge production are used and the intention of the involved actors to combine and harmonize knowledge is more decisive for realising co-produced knowledge than the methods themselves" (Edelenbos et al., 2011: 683). In fact, no participation is better than bad participation that is not well managed and in which voiced preferences are neglected (Edelenbos and Klijn, 2005).

The report has not yet touched upon the knowledge produced by the co-production processes, but rather on the interactions between actors. This has obviously limitations and will be the focus of further research in the next phase of the InSOTEC project. In this regard, an analytical framework to assess knowledge co-production which may be useful is suggested by Hegger et al. (2011) in the field of climate change. They identify six levers for action in knowledge co-production projects, where

knowledge is perceived as salient, credible and legitimate from the perspective of both science and public policy actors. Their six leverage points are followed by six propositions that could provide an additional basis for the IGD-TP to reflect upon (Table 3).

Table 3 Levers for action in knowledge co-production projects

Levers for action in knowledge co-production projects	**Propositions for successful knowledge co-production**
Actors involved in knowledge co-production need to choose which stakeholders to involve and how.	*Although broad involvement of stakeholders in knowledge co-production projects, maximising legitimacy as perceived by the actors involved, is hard to achieve, it is necessary to arrive at successful knowledge co-production across borders of science and action.*
Manage expectations on goals and problem definitions.	*The chance that knowledge co-production is successful is enhanced in cases in which participating actors develop a shared understanding of the nature and denomination of the policy problem and the type of outcomes (ideas, closure on problem definition, concepts, arguments or solutions) to be expected.*
Manage expectations and values regarding what to expect from researchers.	*Actors in knowledge co-production projects can be expected to have diverging and implicit normative expectations regarding the role of scientific knowledge in policy-making, necessitating reflexivity and discussion to enable mutual adjustment, revision of and refinement of these expectations.*
Choose for degrees and forms of cooperation.	*The chance that knowledge co-production is successful is enhanced in cases in which actors involved make conscious and reflexive choices about degrees and forms of co-operation, to make sure that the possibilities for action, to the extent available, are used.*
Develop a common language through boundary-work and objects and through interfacing and sharing of tacit knowledge.	*The chance that knowledge co-production is successful is enhanced in cases in which actors are brought together around boundary objects and tools as well as through intensive forms of science-policy cooperation (face-to-face interaction, spending time together, exchanging co-workers) enabling interfacing and sharing of tacit knowledge.*
Set up arrangements for broadening reward structures.	*The chance that knowledge co-production is successful could be enhanced through novel forms of social accountability and quality control, but more experience with such examples is needed.*

Source: from Hegger et al. (2011)

This analytical tool could be applied to the IGD-TP in the next phase of InSOTEC project to evaluate co-production of knowledge.

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Annex 1. Energy related European Technology Platforms

Platform	Biofuels[33]	SmartGrids	TPWind	Photovoltaics
Vision	By 2030, the EU covers as much as one quarter of its road transport fuel needs by clean and CO2-efficient biofuels.	Europe's electricity networks in 2020 and beyond will be flexible, accessible, reliable and economic.	To spread wind energy in Europe, supplying 23% of European electricity by 2030, taking into account that consumption is expected to increase by half from 2005 to 2030.	Large scale deployment of photovoltaics as renewable electricity generation technology by the year 2020 and beyond, leading to reduced carbon emissions and improved security of supply.
Year of establishment	2006	2006	2006	2005
Precursor to the ETP	Biofuels Research Advisory Council (BIOFRAC) to define the vision	Advisory Council to develop a joint Vision and put together a SRA (Executive Group)	Advisory Council (Member States Ministries are the core of this Advisory Council) – call for EoI – Upwind FP6 project	Photovoltaic Research Advisory Council
Structure for defining SRA	5 WG restricted to 25 members each, supported by Secretariat. Members of WG were selected from individuals representing companies or organisations who responded to a call for EoI issued by the EC following acceptance of the BIOFRAC report.	4 WGs representing a wide range of European industrial and academic expertise. Member State government through the Mirror Group.	Wind Energy Thematic Network Project (6 strategy workshops and 4 groups)	Prepared by the Science, Technology and Applications working Group of the EU PV-TP

[33] The EBTP and ZEP joined forces under the joint taskforce on Bio-CCS base don common acknowledgedgement that biomass production and use and CCS present potential synergies worth exploring (http://www.zeroemissionsplatform.eu/extranet-library.html).

Platform	Biofuels	SmartGrids	TPWind	Photovoltaics
Specifically identified categories of stakeholders	Business, corporations and other organisations involved in supplying any components of the overall chain. Support organisations or common interest groups (learned societies, farm of forest unions, professional associations, industry trade groups, NGOs, lobbying groups or other special interest advocacy groups). Financial world investors, shareholders. From legal and decision making sectors (government regulatory agencies, national and local governmental bodies). Public at large.	Users; electricity network companies; energy service companies; technology providers; researchers; traders; generators; regulators; governmental agencies; advanced electricity service and solution providers;	Private and public industry and research, Member States and EU throughout the wind energy sector.	
Current Structure of the TP	Steering Committee, 5 WG and 2 Task Forces on specific topics	WG; Group of Associations (enable participation of association of stakeholders)	Executive Committee; Steering Committee[34], 5 Working Groups: Policy/Market Development Research WGs; Technology R&D Working Groups, Finance Working Group; Advisory Board.	Steering Committee, secretariat and 4 Working Groups (policy and instruments, market deployment, science, technology and applications and developing countries)

[34] Additional observers may be invited to attend SC meetings as observers, if properly justified.

Platform	Biofuels	SmartGrids	TPWind	Photovoltaics
Participation of stakeholders in the TP	Defined in the ToR (representation in Steering Committee and WG). Registration, get access to key contacts (Stakeholders Database), internal and external reports, events, opinions and expertise on biofuels R&D. Stakeholder Plenary meetings (once a year) and website (stakeholder section).	Participate in General Assembly (Bi-annual TP Forum). Subscription to newsletter. Join a working group. Partner of platform initiatives. Participate in consultations	Subscription to Newsletter. Participate in Advisory board (non-Platform members) to help TP Wind to enhance its network and effectiveness by providing advice and contacts. They act as quick access point to the expertise and know how developed by other sectors. Consultative role. Members selected by Steering Committee.	Participate in the General Assembly
Inclusiveness and communication	"The TP "Biofuels" is open to all interested stakeholders that support, in a non-dogmatic manner and on the basis of consensus, the aim of strengthening research, development and innovation efforts in Europe in the biofuels sector" (ToR)	Communications strategy included in the Deployment Plan for the key messages about SmartGrids deployment and its benefits	The SC invites relevant candidates to join the Advisory Board. They will remain members as long as considered appropriate by the SC. AB members are selected because of the stakeholder they represent, not because of their individual expertise. For this reason, AB member who move to different organisations have to be replaced by the SC.	
Member State representation	EC Steering Group for Strategic Energy Technologies	Mirror Group	Mirror Group	Mirror Group

Platform	Biofuels	SmartGrids	TPWind	Photovoltaics
Deliverables of the Platform[35]	European Industrial Bioenergy Initiative (EIBI)	Project GRID + (involvement of major stakeholders in the platform).	European Wind Initiative: long-term, large scale programme for improving and increasing funding to EU wind energy R&D	Solar European Industry Initiative
website	www.biofuelstp.eu	www.smartgrids.eu	http://www.windplatform.eu	http://www.eupvplatform.org

[35] Deliverables apart from the Strategic Research Agenda and the Deployment Plan.

Platform	ZEP	SNETP	Renewable Heating and Cooling (RHC)
Vision	To enable European fossil fuel power plants to have zero emission of CO2 by 2020.	Achieving a sustainable production of nuclear energy in Europe's low-carbon energy system. Elements of the vision are: development of nuclear energy in the world relying on generation III light water reactors; development of generation IV fast neutron reactor with closed fuel cycle which require technological breakthroughs; generation IV systems with closed fuel cycles; development of new applications of nuclear energy in Europe.	In 2020, over 25% of heat consumed in the EU could be generated with renewable energy technologies. By 2030, renewable heating and cooling technologies could supply over half of the heat used in Europe. By 2050, fully carbon neutral energy solutions through regional, integrated networks.
Year of establishment	2005	2007 (launched on September, 21)	2005
Precursor to the ETP	ZEP Advisory Council and Coordination Group	FP6 projects (Networks of Excellence and Integrated Projects)	European Solar Thermal Platform evolved into the RHD TP and four major European organisations (EUREC, AEBIOM, EGEC, ESTIF) are leading the process.
Structure for defining SRA	ZEP Advisory Council and Coordination Group – along with 4 WGs and a Mirror Group	Working Group drawing from more than 150 persons and feedback obtained from an open public consultation.	SRA of the European Solar Thermal Technology Platform
Specifically identified categories of stakeholders	European utilities, petroleum companies, equipment suppliers, scientists, academics and environmental NGOs. Advisory Council members (2 representing government, 27 companies, 2 NGOs and 7 academia / research).	Industry, research, academia, technical safety organisations, non-governmental organisations and national representatives.	

Platform	ZEP	SNETP	Renewable Heating and Cooling (RHC)
Current structure of the TP	Coordination Group; ZEP Advisory Council; Government Group, General Assembly, 4 Taskforce (demo & implementation, technology, policy & regulation, public communication).	Governing Board, Executive Committee, 4 Working Groups (SRA; deployment strategy; education, training and knowledge management and a task force of the ESNII); General Assembly	3 Technology Panels (Solar Thermal, Biomass, Geothermal); Cross Cutting Technology Panel, RHC Board, 3 Horizontal Working Groups (on Common Vision, Shared SRA and Policy Issues)
Participation of stakeholders in the TP	ZEP General Assembly, Newsletter, ZEP Advisory Council members (300 experts in 19 different countries contribute actively to ZEP's activities while a maximum of 40 different companies and organisation are represented on its Advisory Council or board).	General Assembly	Updated on activities, receive newsletter, influence definition of priority areas for EU policy and research, participate in focus and working groups; may be elected on steering committee of one of the 4 technology panels; attend annual conference; personalised access to members' area.
Inclusiveness and communication	Very active webpage, not only with the information on the TP but on a wide range of projects and demonstration programmes, policy and regulation, demonstration videos, events, news, etc.	Virtual events and internet based collaborative activities could be used to supplement the regular physical events (Organisation and structure document. July 2008).	By signing the application form, applicant declares to be in agreement with the objective of developing and promoting renewable energy technologies for heating and cooling. The applicant declares to support the activities of the ETP on RHC and will participate in its activities as outlined in the EU publications "ETPs – ensuring openness and transparency" (2006)

Platform	ZEP	SNETP	Renewable Heating and Cooling (RHC)
Procedures to become a member	Apply to the Advisory Council.	Send a formal letter (template on website) to the Chair of the Governing Board explaining motivation and how it intends to contribute to the objectives of the Platform. The Governing Board will make a decision based on consensus via tacit approval procedure.	
Member State representation	Mirror Group	Mirror Group	-
Deliverables of the Platform	CCS demonstration projects. Educator and source of information on CCS. Expert advice on all technical, policy, commercial issues.	European Sustainable Nuclear Industrial Initiative (ESNII) which will address the need for demonstration Gen IV Fast Neutron Reactor Technologies, together with the supporting research infrastructures, fuel facilities and R&D work.	
Website	http://www.zeroemissionsplatform.eu	http://www.snetp.eu	http://www.rhc-platform.org

Annex 2. Case studies

PTA Case – Parliamentary Office of Science and Technology (POST)

The Parliamentary Office of Science and Technology was founded by the Parliament of the United Kingdom in 1989. It promotes the formation of political and public opinion on science and technology. By writing briefings, organizing events and assisting Select Committees, POST tries to help parliamentarians examine emerging technologies effectively (POST, 2012: 1). Their projects include biological sciences and health, environment and energy, and physical sciences and ICT.

POST's most important working tools are so called POSTnotes, short briefing notes, focusing on current science and technology issues. The organization publishes 20-30 of such notes per year, along with occasional longer reports. The POST staff consists of six highly educated scientific advisers. They all have a PhD in their respective field of work and can thus be called technical experts themselves, although they work independently from the different technology sectors. Since they are supposed to forecast possible societal impact of new technologies, it is remarkable that they do not have any background in ethics or sociology.

pTA case – Danish Consensus Conference

A perfect example of a participatory technology assessment method is the Danish-style consensus conference, organized once or twice a year by the Danish Board of Technology (DBT). The DBT selects a topic that is of social concern – for example electronic surveillance in 2000 or genetically modified crops in 2005 – and then seeks 15 volunteer lay participants to discuss about that topic (Sclove, 2010: 7). During three weekends, the lay group first gets informed through an expert background paper, thereafter discusses about the topic and finally prepares a report, identifying issues on which the group could reach an agreement and remaining points of disagreement. Afterwards, the DBT encourages further informed public discussion by publicizing them actively.

Although the intention of such consensus conferences is not to have a direct impact on public policy or public opinion, they do have in some cases. For instance conferences in the late '80s influenced the parliament to adopt legislation limiting the use of genetic screening. After consensus conferences about biotechnology in the '90s, a study found that more Danes understood and supported their national biotechnology policies (Sclove, 2010: 8).

CTA case – NanoNed Technology Assessment

NanoNed is a Dutch nanotechnology Research and Development initiative, supported by the Dutch government. It is a consortium of seven universities, Philips and the Netherlands Organisation for Applied Scientific Research (TNO). Apart from eleven research projects ('flagships'), it consists of a

valorization platform and a section taking care of technology assessment (NANONED, 2009a: 1). This TA section exists of sociologists and philosophers from different universities. The TA research project is based on the vision that research activities, scientific fields and societal visions are interdependent and shaping each other. The aim of the TA program therefore is further reflection on this notion of co-evolution.

Although some tools for anticipatory coordination have been worked out by the TA program, such as bibliometrics, foresight and scenario building (Propp & Rip, 2006: 21), the actual impact of TA on the R&D program has yet to be defined. Nevertheless, some projects have been defined already. For example early-stage studies of new nanotechnologies will be used in strategy building workshops in which relevant stakeholders can participate. Next to that, dialogues will be held between researchers and NGO's, exploring societal and ethical questions (NANONED, 2009b: 1).

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