

Public Engagement in the Nuclear Sector: A UK and EU Perspective

EU08051/06/10/01
Issue 3

A report prepared for and on behalf of
NUGENIA+

This project has received funding from the Euratom Seventh Framework Programme
under Grant Agreement No. 604965



Public Engagement in the Nuclear Sector: A UK and EU Perspective

EU08051/06/10/01
Issue 3

Reuben Holmes, Jonathan Scott and Colette Grundy
October 2016

	<u>Name</u>	<u>Signature</u>	<u>Date</u>
Checked by:	Dr Colette Grundy*	<i>Dr Colette Grundy</i>	27/10/2016
	Mr Reuben Holmest†	<i>R Holmest</i>	27/10/2016
Approved by:	Dr David Ritson	<i>David Ritson</i>	27/10/16
Work Order No.	08051.200		

* Checker for sections written by R. Holmes and J. Scott

† Checker for sections written by C. Grundy

KEYWORDS: public engagement, nuclear sector, public perception, good practice

EXECUTIVE SUMMARY

A report published by Euratom in 2012 set out recommendations for the current programme of research under Euratom Fission (Horizon 2020) over the period 2014-2020. The report 'Benefits and Limitations of Nuclear Fission for a Low Carbon Economy' identifies that the nuclear fission community need to provide reliable answers to the economic, social, and environmental issues linked with energy production. A specific recommendation was made in regard to public engagement (see section 2.2);

"Following Fukushima, nuclear fission for energy has become a sensitive political issue in some member states and the public at large expects its concerns to be properly addressed. Future fission research therefore needs to respond to those concerns, including new ways of engaging the public. This is the only way for European industry in the nuclear field to maintain its worldwide leading position."

In accordance with this, NUGENIA identified a need to establish a "joint political and civil society advisory group" to relay community needs and inform research and development focus and formalised this within the NUGENIA+ Deliverable 2.7. This report makes specific recommendations in regard to this aim, as well as identifying good practice in public engagement on nuclear energy issues. Research needs to respond to public and political concerns, which requires efficient, effective and informed ways of engaging the public. These activities are crucial in ensuring that the links between NUGENIA, the member states and the EU are strong and the views of the public are represented. Hence, a number of pan-EU, UK and other individual member state activities have been identified as being relevant to NUGENIA's goals.

The Euratom Fission Call in 2014, NFRP12 'Nuclear developments and interaction with society', identified that perception of, and engagement with, civil nuclear society is a challenging issue. The ultimate aim is to improve communication and interaction with civil society for the benefit of all the public and private stakeholders concerned, leveraging over half a century of historical nuclear development knowledge across the EU. The UK is currently participating in this Horizon2020 study (History of Nuclear Energy and Society, "HoNESt"), with the contribution being led by the University of Central Lancashire's (UCLan) Energy and Society research group, which brings social scientists and historians together to review the current status. The project began in 2015 and involves more than twenty partner organisations across the EU. The National Nuclear Laboratory (NNL) have formal links with the Energy and Society research group at UCLan and are able to leverage knowledge into this study. NNL play a key role in the UK and global nuclear sector. That means reducing the cost of clean-up and decommissioning, and maintaining critical skills. Since July 2008, we have been providing independent advice to the UK Government, and working with other national laboratories around the world. NNL deliver a full range of research and technology to support the nuclear fuel cycle.

At a Governmental level, the UK's nuclear industrial strategy, titled 'The UK's Nuclear Future', was published in 2013 as part of a series of industrial strategies co-created by UK Government and industry. The strategy set out the UK Government's clear expectation that nuclear power will play a significant role in the UK energy mix of the future, and outlines the key actions and approach needed to realise a vibrant, diverse and strategically cohesive nuclear sector that Government and industry wishes to see develop. A series of actions were recommended to enable this strategy to be realised, one of which was entitled, "public engagement and awareness", and the Nuclear Industry Council (NIC) was appointed the action owner.

In 2014, the NIC published a high-level strategy, "In the Public Eye: Nuclear Energy and Society" for Central and Welsh Government, industry, and other stakeholders. This set priorities for Government and industry to work together with other parties to enhance public engagement with nuclear energy, and proposed four main activities. The strategy states that Government, industry and other stakeholders must work together to ensure that public confidence in nuclear power's place as part of a low carbon energy mix is strengthened, and that the benefits of nuclear energy to society, in terms of electricity generation, jobs and the economy, are recognised.

The UK nuclear sector has made progress over recent years in engaging with the public in order to understand the important issues and concerns around proposed developments within the industry. The UK nuclear sector has only recently (in the past decade) experienced a change towards a more open and transparent approach to public engagement. For example, in 2006 with the generic design assessment programme for new nuclear build where there was open, transparent reporting of progress and a public involvement process.

The UK is set to embark on a new nuclear build programme that is expected to see around 16 GWe added to the electricity grid over the next 10 to 15 years, effectively replacing the ageing fleet of advanced gas-cooled reactors. The proposals for new nuclear power stations to be built, transforming the energy infrastructure, together with extended operational lifetimes for existing nuclear reactors and a legacy of waste for existing sites that needs to be managed mean that effective engagement with the public is very important. Initiating public discussions and entering a two-way conversation throughout projects such as the 2015 Generic Design Assessment (GDA) Public Dialogue Pilot for new nuclear reactors (see later herein) have been important in ensuring public views are reflected within key policy elements. Maintaining and strengthening this conversation with the public is essential for these developments at a national and local level. Without seeking to listen and understand the public's views and concerns, the industry will be unable to address them, and will find that neither the political mandate nor the industrial backing will be sufficiently robust to deliver the transformation in energy infrastructure over the extended timescales required. The underlying methodology of the UK's "Nuclear Future" strategy and the consequent "In the Public Eye" report have direct relevance and applicability to NUGENIA's role as a research and development co-ordinating body¹ and will underpin aspects of the joint political and civil society advisory group that is recommended for formation by NUGENIA+ Deliverable 2.7².

The relationship between the UK's nuclear sector and its stakeholders has experienced a shift in recent years, from one that has been described as "*the government control of society by an elite of technical experts*", to a deliberative engagement approach that has grown in popularity. The latter approach is being increasingly used as a method of developing public understanding of nuclear energy related matters; informing and enabling the public to make their own decision in regards to nuclear energy. It is this empowerment that allows the public to challenge and influence the direction of nuclear energy projects, which helps to build trust between stakeholders, and ultimately leads to a final outcome that is mutually beneficial to both industry and society. This approach

¹ Specifically relating to safety of Generation II and III nuclear reactors.

² Deliverable 2.7 is the formation of the Joint Political and Civil Society Advisory Group (JPCSAG). The JPCSAG is intended to inform NUGENIA of public and political concerns such that its research and development strategies can be aligned with these concerns.

has offered many benefits to the UK nuclear sector and may offer similar benefits for NUGENIA and the European community.

This report briefly sets out the history of the UK nuclear industry, with the role of various bodies including operators, regulators, NGOs and Government. It also considers at a high-level the developments in the UK nuclear sector over time and the engagements that have occurred. Overseas experience in European countries and wider experience is identified. The latest developments and UK position are set out including NNL current and proposed work on public engagement. Recommendations for the NUGENIA joint political and civil society advisory group's terms of reference, and supporting guidance materials, are made.

VERIFICATION STATEMENT

This document has been verified and is fit for purpose. An auditable record has been made of the verification process. The scope of the verification was to confirm that: -

- The document meets the requirements as defined in the task specification/scope statement
- The constraints are valid
- The assumptions are reasonable
- The document demonstrates that the project is using the latest company approved data
- The document is internally self-consistent

HISTORY SHEET

Issue Number	Date	Comments
Issue 1	18/02/2016	Initial issue to NUGENIA.
Issue 2	30/09/2016	Report updated with new information, further conclusions and recommendations drawn, and comments from NUGENIA+ WP2 members addressed.
Issue 3	28/10/2016	Corrected an error with the references

CONTENTS

	Page
1. INTRODUCTION AND OBJECTIVES.....	14
1.1. Structure of the UK nuclear industry	15
1.2. The importance of public engagement for the nuclear industry	17
1.3. The importance of public engagement for the wider nuclear sector	21
2. REVIEW AND SUMMARY OF THE UK'S AND EU'S POSITIONS ON ENGAGEMENT WITH NUCLEAR.....	24
2.1. History of UK nuclear public engagement.....	24
2.2. Roles of UK organisations	38
2.2.1. Role of UK Government	38
2.2.2. Role of NGO's	38
2.2.3. Role of industry	39
2.2.4. Role of NNL (In the UK and overseas)	39
2.3. Public engagement with nuclear across the EU	39
2.3.1. Sweden	41
2.3.2. Finland	42
2.3.3. France.....	43
2.3.4. Czech Republic	44
2.3.5. Summary.....	44
2.4. Public engagement with nuclear outside the EU and UK	45
2.4.1. Evaluating public consultation in nuclear energy: The importance of problem structuring and scales (2014)	45
2.4.2. Communicating Nuclear: Balancing risk with opportunity (2012).....	46
2.4.3. South Korea: The spent nuclear fuel storage dilemma (2015).....	46
2.4.4. International Learning	46
3. REVIEW AND SUMMARY OF NNL WORK IN 2016.....	47
3.1. Nuclear energy and society Concordat for public engagement and Public Dialogue Study	47
3.2. Extension of NUGENIA+ Deliverable D2.7 "Establishment of the joint political and civil society advisory group"	49
3.3. Radioactive waste management.....	50
3.4. Academic research.....	51
3.4.1. University of Central Lancashire – Dr John Whitton, Head of UCLan Energy	51
3.4.2. Liverpool University – Professor Bruno Merk, NNL Visiting Professor	52
3.4.3. Sheffield University – Dr Susan Molyneux-Hodgson, Senior Lecturer in Sociology	53

3.4.4.	Sheffield University – Professor Neil Hyatt, Professor of Nuclear Materials Chemistry, and Dr Claire Corkhill, Department of Materials Science and Engineering.....	53
3.4.5.	The National Co-ordinating Centre for Public Engagement (NCCPE)	53
4.	REVIEW OF PUBLIC ENGAGEMENT IN THE ENERGY INDUSTRY AND UK UNIVERSITIES	55
4.1.	UK nuclear sector	55
4.1.1.	Generic Design Assessment (GDA)	55
4.1.2.	Geological Disposal Facility (GDF)	57
4.1.3.	Strategic stakeholder dialogue and social sustainability indicator development for nuclear decision-making in Anglesey, North Wales	61
4.2.	UK energy industry examples	63
4.2.1.	Shale oil and gas	63
4.2.2.	Onshore/offshore wind	63
4.3.	EU energy engagement	64
4.3.1.	European Economic and Social Committee (EESC) Report	64
4.3.2.	Recent EU studies and good practice	65
4.3.2.1.	Danish future energy systems	68
4.3.2.2.	Engaging civil society in low-carbon scenarios (ENCI-Lowcarb) (Germany and France).....	69
4.3.2.3.	Energy cities IMAGINE initiative	70
4.3.2.4.	Public participation approaches in radioactive waste disposal: Implementation of the RISCUM model in Czech Republic.....	70
4.4.	European Nuclear Energy Forum (ENEF)	71
4.5.	UK and EU Academic studies	72
4.6.	Public engagement in UK universities	72
4.6.1.	The Beacons for Public Engagement (2008-2012)	72
4.6.2.	Public engagement strategy	75
4.6.3.	Survey: Factors affecting public engagement by researchers	76
4.7.	The public’s perceptions and predispositions to different energy sources.....	77
4.7.1.	UK public perceptions of shale gas, carbon capture & storage and other energy sources & technologies: Summary findings of a deliberative interview study and experimental survey	77
4.7.2.	Public perceptions of climate change and energy futures before and after the Fukushima accident: A comparison between Britain and Japan.....	78
4.7.3.	From nuclear to renewable: Energy system transformation and public attitudes	80
5.	FINDINGS FROM THE UK PERSPECTIVE	81
6.	FUTURE ENGAGEMENT IN THE UK	83
7.	RECOMMENDATIONS FOR FUTURE PUBLIC ENGAGEMENT	85

8. SUMMARY OF LEARNING AND RECOMMENDATIONS FOR THE JOINT POLITICAL AND CIVIL SOCIETY ADVISORY GROUP (JPCSAG)	86
8.1. Introduction	86
8.2. Vision	87
8.3. Form	90
8.4. Function	95
9. REFERENCES	97
APPENDIX 1: UK NUCLEAR INDUSTRY CASE STUDIES OF PUBLIC ENGAGEMENT	106
APPENDIX 2: UK AND EU ACADEMIC GROUPS (+ RELEVANT WORK) THAT NNL HAS STRATEGIC PARTNERSHIPS WITH OR IS FOLLOWING CLOSELY.....	108

LIST OF TABLES

	Page
Table 1: Timeline of example UK nuclear public engagement activities	26
Table 2: Activities proposed by the NIC high-level strategy in 2014.....	34
Table 3: Variety of approaches across the EU to improve public engagement with energy projects.....	66
Table 4: Summary of learning from Beacons for Public Engagement	73
Table 5: Key areas of consideration for the JPCSAG	87
Table 6: Suggested composition of the JPCSAG	93

LIST OF FIGURES

	Page
Figure 1: Structural history of the UK nuclear industry [2].....	15
Figure 2: UK nuclear energy timeline [3].....	16
Figure 3: Public attitudes to nuclear energy: to what extent would you support or oppose the building of new nuclear power stations in Britain to replace those that are being phased out?	19
Figure 4: Best qualified to explain the impact of science and technological developments on society	20
Figure 5: Screenshot of the joint ONR and EA's 'Get involved' web page	30
Figure 6: Screenshot of the joint ONR and EA's web page where the public can comment and ask questions on reactor designs.....	31
Figure 7: How Fukushima affected EU members' nuclear expansion plans	40
Figure 8: SKB's various interactions at local and national levels	41
Figure 9: "Pre-conditions for trust and co-operation" [115].....	71
Figure 10: How much those surveyed feel they know about particular energy types.....	77
Figure 11: The hazards that the public associate with nuclear power.....	78
Figure 12: Favourability towards different forms of energy for electricity production (x-axis is % of people who support the energy source).79	79

Figure 13: Results of public survey (percentage) when asked, “Which Statement most closely resembles your opinion of nuclear power?”79

Figure 14: Concerns about nuclear power, and perceived benefits/risks (2011 date after events at Fukushima)80

Figure 15: “Conceptual framework for the establishment and prioritization of sustainability criteria with various community-level social groups, and developing sustainable future pathways.” [136]84

Figure 16: Nuclear associations across Europe (members of Foratom)92

Figure 17: Current NUGENIA Organisation structure93

Figure 18: Simple example procedure for inclusion of JPCSAG input to proposal generation process94

Glossary

ABWR	Advanced Boiling Water Reactor	EA	Environment Agency
ACN	Aarhus Convention and Nuclear	EC	European Commission
AGR	Advanced Gas-Cooled Reactor	ECITB	Engineering Construction Industry Training Board
AWE	Atomic Weapons Establishment	EdF	Électricité de France
ANCLLI	Association Nationale des Comités et Commissions Locales d'Information	EESC	European Economic and Social Committee
AWRE	Atomic Weapons Research Establishment	EIA	Environmental Impact Assessment
BBC	British Broadcasting Corporation	ENEF	European Nuclear Energy Forum
BE	British Energy	E-TRACK	Energy – Transparency Centre of Knowledge
BEIS	Department for Business, Energy and Industrial Strategy	EU	European Union
BIS	Department for Business, Innovation and Skills	FSC	Forum on Stakeholder Confidence
BNFL	British Nuclear Fuels Limited	GDA	Generic Design Assessment
BNG	British Nuclear Group	GDF	Geological Disposal Facility
CCS	Carbon Capture and Storage	GE	General Electric
CEGB	Central Electricity Generating Board	GM	Genetically Modified
CNA	Canadian Nuclear Association	GWe	Gigawatt electricity
CoRWM	Committee on Radioactive Waste Management	HMG	Her Majesty's Government
CSR	Corporate Social Responsibility	HoNESt	History of Nuclear Energy and Society
CUE	Community University Engagement	IAEA	International Atomic Energy Agency
DAD	Decide-Announce-Defend	IOG	Independent Oversight Group
DBT	Danish Board of Technology	INPRO	International Project on Innovative Nuclear Reactors and Fuel Cycles
DECC	Department of Energy and Climate Change	JPCSAG	Joint Political and Civil Society Advisory Group
DSRP	Dounreay Site Restoration Plan	JRC	Joint Research Centre

LLWR	Low-Level Waste Repository	PWR	Pressurised Water Reactor
LP&S	Legacy Ponds & Silos	R&D	Research and Development
ME	Magnox Electric Limited	RAWRA	Radioactive Waste Repository Authority
MRWS	Managing Radioactive Waste Safely	RCUK	Research Councils United Kingdom
NCCPE	National Co-ordinating Centre for Public Engagement	RCF	Rock Characterisation Facility
NDA	Nuclear Decommissioning Authority	RWM	Radioactive Waste Management
NEA	Nuclear Energy Agency	RWMAC	Radioactive Waste Management Committee
NI	Nuclear Institute	RWMD	Radioactive Waste Management Directorate
NIA	Nuclear Industry Association	SEA	Strategic Environmental Assessments
NIC	Nuclear Industry Council	SGPBD	Social Group and Priority Based Dialogue
NIRAB	Nuclear Innovation Research Advisory Board	SLC	Site Licence Company
NIREX	Nuclear Industry Radioactive Waste Executive	SMR	Small Modular Reactor
NGO	Non-Governmental Organisation	SNETP	Sustainable Nuclear Energy Technology Platform
NNL	National Nuclear Laboratory	SSM	Swedish Radiation Safety Authority
NRW	Natural Resources Wales	THORP	Thermal Oxide Reprocessing Plant
NSAN	National Skills Academy for Nuclear	UCL	University College London
NUGENIA	Nuclear Generation II & III Association	UCLan	University of Central Lancashire
OECD	Organisation for Economic Co-operation and Development	UK	United Kingdom
OND	Office for Nuclear Development	UKAEA	United Kingdom Atomic Energy Authority
ONR	Office for Nuclear Regulation	UNECE	United Nations Economic Commission for Europe
OUGO	Office for Unconventional Gas and Oil	URL	Underground Research Laboratory

US	United States	WNN	World Nuclear News
UWE	University of the West of England	WSA	Welsh School of Architecture
WNA	World Nuclear Association	YGN	Young Generation Network

1. Introduction and Objectives

This report has three principal objectives:

1. To review and briefly summarise the history and the current position of engagement between the nuclear sector and the public in the UK, and to a lesser extent in the EU, and its applicability to NUGENIA and deliverable D2.7; the formation of a Joint Political and Civil Society Advisory Group;
2. To summarise the work that the UK's National Nuclear Laboratory (NNL) has been undertaking to develop its capability in public engagement, including a toolkit for NUGENIA on public engagement for nuclear, and to highlight learning that will benefit NUGENIA, the EU and member states;
3. To review examples of public engagement in other industries and research institutions; identifying learning for the nuclear sector and building on current understanding of what is considered to be good practice for public engagement, as this will inform NUGENIA's strategy for incorporating political and civil society's views into research and development priorities.

In order to meet these objectives, this report will draw from selected case studies and events in the UK's history regarding public engagement on nuclear issues. The EU's position will also be briefly discussed, highlighting a number of case studies that the UK and EU can use to build on current understanding of public engagement good practice and identify key guidance for the establishment of the NUGENIA joint political and civil society advisory group (JPCSAG). Key learning from public engagement experiences of research institutions and other energy industries will be extracted from the literature, and consideration will be given to how any successful and/or promising approaches could be incorporated within the JPCSAG and wider nuclear sector. Finally, using experience from the relevant work streams that NNL is involved in, opportunities for further work will be considered, and recommendations made for further work that would bring benefit to the EU member states, NUGENIA and the public.

The relationship between the UK's nuclear sector and its stakeholders has experienced a shift in recent years, from one that has been described as "*the government control of society by an elite of technical experts*", to a deliberative engagement approach that has grown in popularity [1]. The latter approach is being increasingly used as a method of developing public understanding of nuclear energy related matters; informing and enabling the public to make their own decision in regards to nuclear energy. It is this empowerment that allows the public to challenge and influence the direction of nuclear energy projects, which helps to build trust between stakeholders, and ultimately leads to a final outcome that is mutually beneficial to both industry and society. This approach has offered many benefits to the UK nuclear sector and may offer similar benefits for NUGENIA and the European community.

The first three sections of this report examine the history of the key organisations in the UK nuclear sector and how attitudes towards public engagement have changed over time. The benefits of public engagement to the nuclear sector and society are also discussed, in addition to a summary of the change in public attitudes and opinions towards nuclear energy and the impact that dialogue processes can have. Next, the UK and NNL's work programmes on public engagement are discussed in order to highlight the work that is currently on-going in the UK to develop a consistent approach to public engagement across the nuclear sector. Additionally, selected case studies from the UK and EU nuclear and energy sectors, and UK universities, are examined to extract learning

that can be used to further develop the current understanding of public engagement good practice; ensuring the sector gives the public the opportunity to become informed, and enabling them to make their own decisions in regards to nuclear energy. Finally, conclusions are drawn as to how best to implement best practice into the terms of reference for the JPCSAG.

1.1. Structure of the UK nuclear industry

The UK's nuclear strategy essentially started after World War Two, when a decision was made to develop a nuclear programme in 1946 (Figure 1) [2]. The Tube Alloys project was a short name used for the UK's atomic research and development programme undertaken in the 1940s as part of the Department of Scientific and Industrial Research. Activities and were transferred to the Ministry of Supply for the period of 1946 to 1954. In 1954, the United Kingdom Atomic Energy Authority (UKAEA) was formed and inherited all the early UK nuclear work principally achieved by the Ministry of Supply, which included all the sites, assets and the UK's Nuclear Fission/Physics research base. UKAEA managed a broad range of nuclear facilities in the early years and was organised as four specific business groups; Production, Reactor, Research and Weapons, before the next major change came.

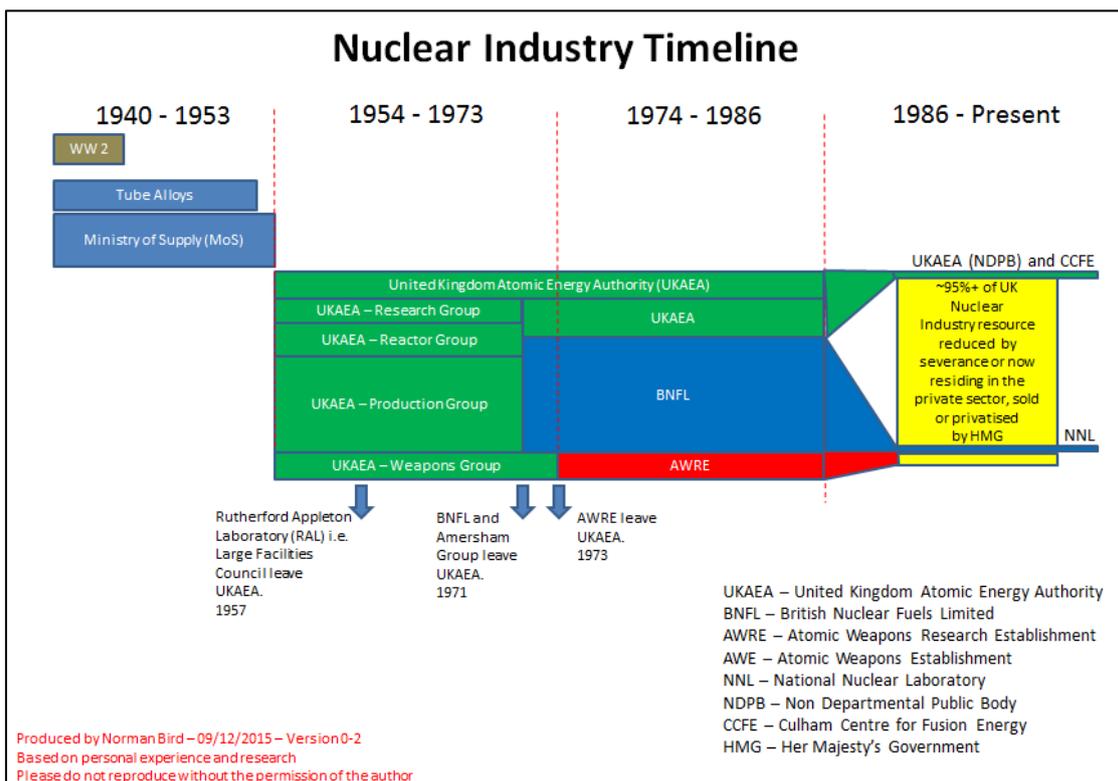


Figure 1: Structural history of the UK nuclear industry [2]

In 1971, British Nuclear Fuels Ltd (BNFL) was established from the Production group activities of the UKAEA. BNFL took over the major share of the UKAEA's assets that included enrichment, conversion, fuel manufacture and reprocessing facilities. Some assets remained with UKAEA, such as the UK's fast reactor programme located at Dounreay in Scotland. In 1973, the Atomic Weapons Research Establishment (AWRE) was formed from the Weapons group of the UKAEA. UKAEA, BNFL and AWRE (later AWE)

largely existed in this form until the early 2000s. Around this time BNFL formed British Nuclear Group (BNG), but this organisation was later changed and restructured in regard to the Nuclear Decommissioning Authority (NDA) model (see below).

The world's first nuclear reactor for commercial electricity generation was constructed at Calder Hall (Cumbria, England) and commenced operation in 1956 (Figure 2) [3]. A further three reactors were built at the same location shortly after, and a second sister reactor site was established at Chapelcross in 1959. Both these sites were under the control of the UKAEA until 1971, when they were transferred to BNFL. This early work by UKAEA led to the development of a considerably wider UK atomic energy programme under the control of the Central Electricity Generating Board (CEGB) and the Scottish Boards. In the late 1980s the CEGB and the other Boards were restructured into Nuclear Electric and Scottish Nuclear. In 1995, the UK nuclear energy industry was restructured again into British Energy (BE), which was privatised by the UK Government, and Magnox Electric Ltd (ME), which remained a state-owned company. In 1998, ME was merged into BNFL meaning for the first time since the start of the Magnox programme in 1956, all UK Magnox stations were under a single company's ownership/operation. BE suffered from various financial difficulties and was ultimately re-financed by the UK Government in 2004. BE's assets were subsequently restructured between 2004 and 2008, and BE's UK nuclear sites were sold to EdF (France) in 2008 for approximately £12 Billion. Centrica subsequently purchased a 20% stake in EdF in 2009. It has been speculated (early 2016) that EdF intend to dispose of part of their 80% shareholding in BE.

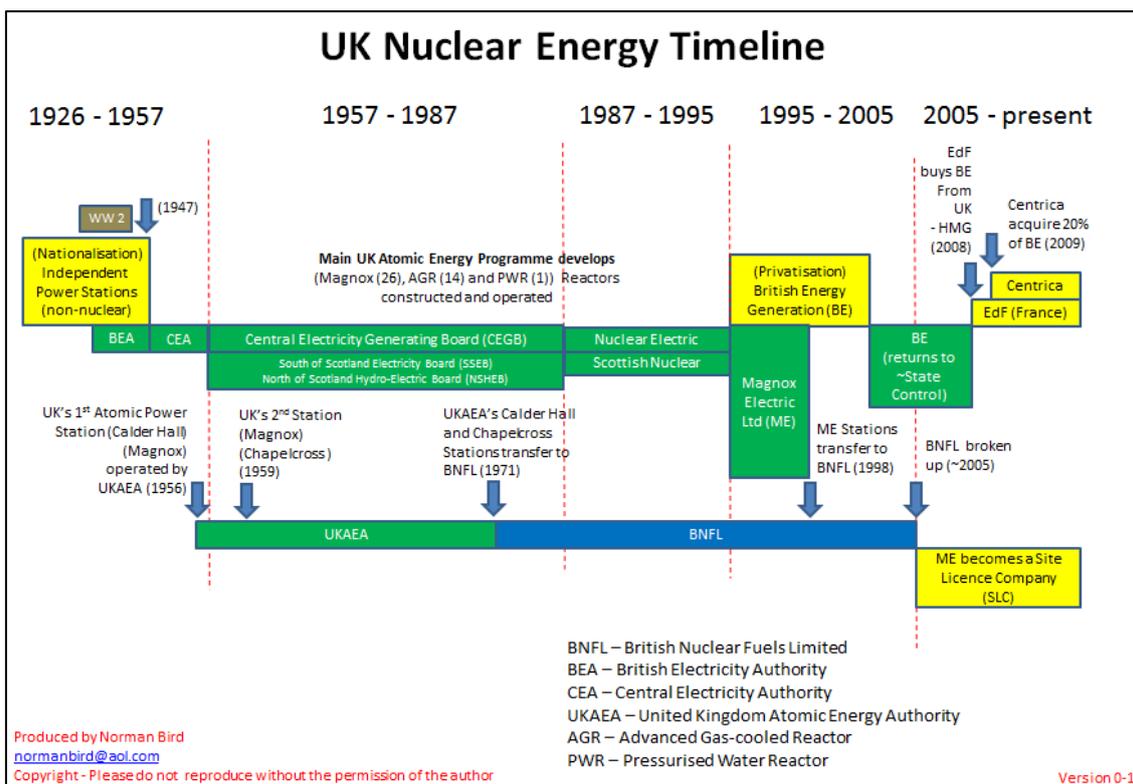


Figure 2: UK nuclear energy timeline [3]

The NDA, a UK Government Non-Departmental Public Body (NDPB), was established in 2005 to manage the UK's nuclear liabilities and the remaining parts of the BNFL group that were not privatised, sold or reorganised. From 2005 onwards, BNFL group and UKAEA went through significant restructuring, with the ownership of land, assets and

liabilities passed to the NDA. As part of the UK Government's restructuring of the industry BNFL was broken up with BNG assets forming the bulk of the NDA's Site Licence Companies (SLC). The SLCs established by the NDA were Sellafield Ltd, Magnox Ltd, Dounreay Site Restoration Ltd, Research Sites Restoration Ltd, Low Level Waste Repository Ltd, and Springfields Fuels Ltd. These SLCs also included Harwell, Dounreay and Winfrith sites from the UKAEA. Other businesses, such as AEA Technology and BNFL Westinghouse, were sold onto the open market. The research and technology subsidiary of BNFL was initially renamed as Nexia Solutions and later officially became the UK's National Nuclear Laboratory (NNL) in 2008. Today, NNL is Government owned and operated. Since 2008, Springfields Fuels Ltd has operated under Westinghouse Toshiba and has changed its contractual relationship with the NDA. Magnox Ltd and Research Sites Restoration Ltd have joined to form one SLC called Magnox Ltd. In April 2016, Sellafield Ltd ceased to be a contracted SLC and became a wholly owned subsidiary of the NDA.

National Nuclear Laboratory (NNL) plays a key role in the UK and global nuclear sector. That means reducing the cost of clean-up and decommissioning, and maintaining critical skills. Since July 2008, we have been providing independent advice to the UK Government, and working with other national laboratories around the world. NNL deliver a full range of research and technology to support the nuclear fuel cycle.

The UK has operated nineteen nuclear power plants of various types, many of which are ageing and moving towards shutdown. There is one operating Pressurised Water Reactor (PWR), located at Sizewell, which represents the most recent nuclear power plant built in the UK (came online in 1995). However, the UK is planning to build a generation of new nuclear power stations, and the Office for Nuclear Regulation (ONR) and Environment Agency (EA) have developed a pre-licencing process (Generic Design Assessment – GDA) to review the safety, security, environmental and waste management aspects of future reactors. The most recognised UK nuclear site is Sellafield in Cumbria, which hosted the Calder Hall Magnox reactors, the first civil nuclear power plant in the world, and the Thermal Oxide Reprocessing Plant (Thorp, which was built in the 1980s and at the time was the largest construction site in Europe). Sellafield site also stores legacy wastes and located close by is the Low Level Waste Repository (LLWR) site at Drigg.

1.2. The importance of public engagement for the nuclear industry

Currently, the UK nuclear industry supports over 60,000 jobs [4] and is distributed across various parts of the UK. In addition to delivering fuel cycle services (e.g. fuel manufacturing and developing new technologies), managing the UK's nuclear legacy (historic plants and waste), and extending the life of existing nuclear power plants, the UK is set to embark on a new nuclear build programme that is expected to see around 16 GWe added to the electricity grid over the next 10 to 15 years, effectively replacing the ageing fleet of advanced gas-cooled reactors. At the moment, ~20% of the UK's electricity needs is supplied by nuclear power plants, though it has been recognised that this has the potential to reach up to 50% by 2050 [5]. Nuclear energy is just one of a number of technologies being developed and deployed in the UK that will provide energy security and sustainability well into the twenty first century. Society's awareness, understanding and acceptance of developments in energy technologies is vital in achieving the UK's goals of ensuring secure, affordable and low carbon energy for decades to come. Effective public engagement will enable this future to be realised, as it provides a means of building trust and confidence between the public and the energy sector, and the nuclear industry must take this engagement seriously if it is to play a role in the UK's future energy mix. However, as with all infrastructure projects, society has a

voice and the successful delivery of both new power stations and a waste repository for the UK will be dependent upon broad acceptance from the public.

Engaging with the public is not a simple task, as the 'public' consists of a diverse mix of personalities from a variety of backgrounds. What may be considered as effective public engagement for one person, may not necessarily be appropriate for another, as people interact and respond in different ways depending on factors such as their age, their occupation, whether they have children or not, or whether they are male or female. A strategy to enhance public engagement with nuclear energy must ensure that suitable methods of communication are developed that allow engagement with the target audiences to be carried out effectively. The distinction between national, local and individual engagement is also key, as it is the local population that are most likely to experience the impact of government policy changes, meaning that greater emphasis should be placed on the need for dialogue and public consultation at the local level.

The UK nuclear sector has only recently (in the past decade) experienced a change towards a more open and transparent approach to public engagement. For example, in 2006 with the generic design assessment programme for new nuclear build where there was open, transparent reporting of progress and a public involvement process.

The past few decades have seen the division of the nuclear industry from a small number of larger organisations to an increasing number of separate organisations of various size and structure as described above and as shown in Figure 1. This division of the industry over time, into many smaller organisations with various approaches and commitments towards public engagement, has resulted in a nuclear industry that has fragmented styles and varying approaches towards public engagement. Ultimately this may prove detrimental to the development of public confidence in nuclear energy due to a lack of consistency in approach. If the UK nuclear industry is to succeed in becoming a key player in the low carbon energy mix of the future, it must build a trusting relationship with the public through clear and consistent two-way dialogue, and by listening intently to their views. Public support will be vital if the UK is to successfully tackle its current energy challenge of transforming its energy infrastructure into a system that maintains energy security, ensures energy prices are affordable, and reduces greenhouse gas emissions to help the global fight against the impacts of climate change. Sections 0 and 3.1 describe the recent developments of a UK Concordat for public engagement within the nuclear industry, which sets out principles for communication with the public as a first step.

An Ipsos MORI nuclear energy poll [6] has shown that while the public opinion of nuclear energy in the UK was largely unfavourable for the first part of the decade following 2000, the trend was increasingly growing towards favourability for new nuclear build, and has seen a complete reversal of opinion in the UK between 2001 and 2011 (Figure 3).

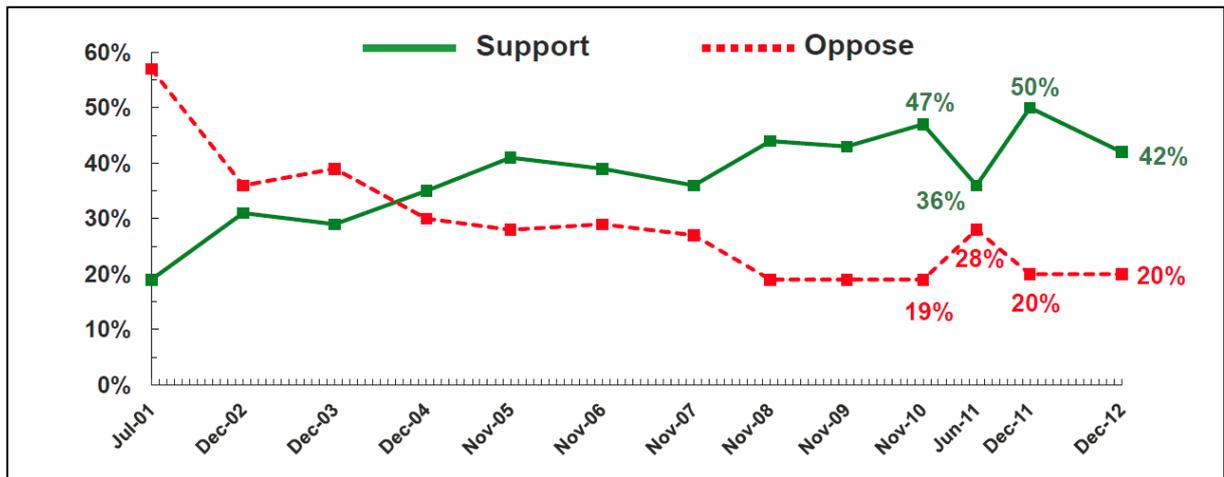


Figure 3: Public attitudes to nuclear energy: to what extent would you support or oppose the building of new nuclear power stations in Britain to replace those that are being phased out?

It is also clear from Figure 3 that the Fukushima incident in 2011 had a significant impact on public support for nuclear, which highlights the vulnerability of the nuclear sector, and reinforces the importance of not taking public support for granted. However, in the UK public support 'bounced back' within six months in part due to the unceasing commitment of independent academic experts to engage with the media and provide open and honest commentary.

There is a complex blend of factors that influence the public's attitude towards nuclear power, which includes trust in the Government and regulatory regime, the historical context of nuclear energy in the UK linking it with defence, and the media reporting of nuclear incidents. Therefore, there remain a number of underlying concerns among the UK public when nuclear power is considered, which contributes towards an attitude of 'reluctant acceptance' when taking nuclear power as part of a low carbon energy mix. "Waste, trustworthiness of Government, industrial secrecy and proliferation" were all cited as long standing public concerns during the early 2000s, with one study in 2006 identifying "the least trusted information sources were national government and the European Union" [7].

Focusing on the public's distrust of Government, the events surrounding Genetically Modified (GM) crops in the 1990s are a useful example of this attitude – what was effectively "political marginalisation" (political process making something seem insignificant) of public opinion led to an inquiry into the official processes for evaluating GM, which was then applied to other such matters. As a result, public engagement was centrally incorporated into UK policy on GM. It had been submitted that this approach should be applied to nuclear (and in retrospect, it has), as well as taking account of "social relations".

It also appears that a more favourable attitude towards nuclear was established when people began to consider nuclear as part of a mix of energy generation sources – not being forced to choose between renewables or nuclear. Further, evidence suggests that 63% of people in Europe believe that scientists working in universities or Government laboratories are best qualified to explain the impact of science and technological developments on society (Figure 4) [8].

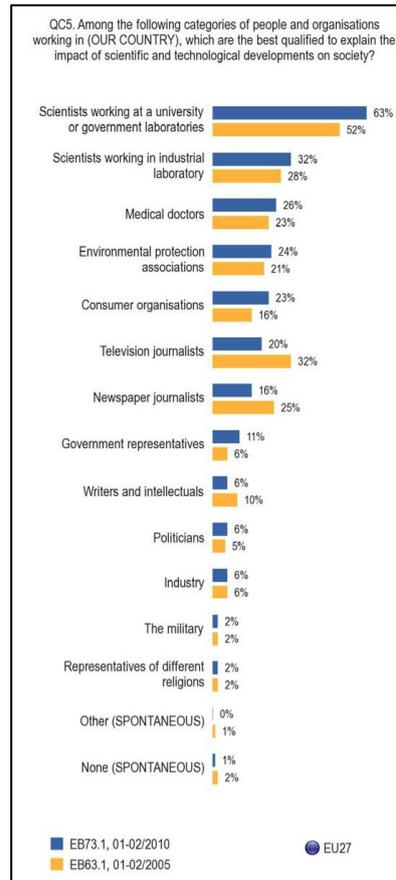


Figure 4: Best qualified to explain the impact of science and technological developments on society³

Even though research suggests that scientists in universities and Government laboratories are most qualified to engage with the public on technological matters, there must be an engaging, factually accurate, clear and consistent narrative that is agreed across the industry. This nuclear narrative should be used to articulate how nuclear energy provides energy security, jobs and clean energy, while contributing towards a growing economy. Additionally, it will demonstrate the steps that the nuclear industry takes to ensure it supplies electricity safely and at an affordable price to the public. Overall, the consistent communication of this narrative, together with the implementation of the UK nuclear industry's Concordat for public engagement (see Sections 2.1 and 3.1) will be key in securing the trust of the public, which is needed for the UK to embark upon its plans for building new nuclear capacity. Such a narrative has been developed in the UK with the Nuclear Industry Association (NIA) Factbook [9].

Industry currently plans to build 16GWe of new nuclear generating capacity; an investment of potentially around £60bn which will create opportunities for UK businesses and lead to new, long-term and high quality jobs (between 30,000 and 40,000) often in regions of the country where they are most needed.

³ Results based on a survey of all 27 EU member states (There are currently 28 EU member states, as Croatia joined the EU in 2013, after this survey).

With the public's support, the Government and industry will have the authority to deliver the energy infrastructure transformation that is required in the UK; an agenda in which new nuclear power stations play a key role. With such a large number of individual organisations in the UK's nuclear sector however, it is not a simple task to achieve the consistency and clarity that is necessary in the messages delivered by the industry. Therefore, a common understanding of the way the sector engages with the public is vital in realising the benefits that public engagement has to offer. The Concordat for public engagement with nuclear issues described in Sections 2.1 and 3.1 is the first step towards building public understanding.

If carried out in an open, transparent and respectful manner, public engagement can bring a host of benefits to the industry, its associated organisations, and the public, including [10] [11]:

1. Strengthening and enriching the sector's/organisation's brand and identity;
2. Helping to demonstrate accountability in a climate of increasing scrutiny;
3. Building trust and mutual understanding;
4. Forming new collaborations and partnerships;
5. Maximising the two-way flow of knowledge between industry and society;
6. Motivating the nuclear workforce and enhancing their skills and experience;
7. Stimulating creativity and innovation.

However, if engagement activities are not undertaken according to current good practice, it can often be ineffective, or even worse, detrimental, as it can lead to confusion, anxiety and distrust. Therefore it is essential that public engagement is taken seriously by organisations and commitments are made to effective engagement with the public.

1.3. The importance of public engagement for the wider nuclear sector

The nuclear sector is not purely defined as industry and Government; it includes a wide range of different organisations, as well as the public. Every member of the sector may be an ambassador for nuclear energy providing they have an interest to pursue engagement activities with the public, and the necessary interpersonal and communication skills required. Indeed, NUGENIA's role as a facilitator of R&D across the EU nuclear sector and its involvement in the key area of safety (a consistently important item on social agendas) affirms its suitability to co-ordinate and integrate industry, academic and public activities and efforts in key nuclear energy research areas.

Effective communication between the nuclear sector and the public is essential, and in the JPCSAG, NUGENIA has recognised the need for a central co-ordinating body for its own communication activities. Understanding and utilising the learning from the UK and other member states can inform the formation of the JPCSAG and ensure that it fulfils its desired role as a conduit to the expectations from civil and political groups for informing and developing research activity preferences. In particular, European Nuclear Policies such as the Europe 2020 strategy and the 2050 energy strategy can be better supported through engagement and understanding of political and civil issues (and are in fact required by the Aarhus⁴ [12] and Espoo conventions⁵ [13]), by extracting knowledge on individual member state progress to inform the potential levels of research required.

In addition to the above points, effective public engagement and representation of political and public opinion through the JPCSAG could offer many benefits to NUGENIA (see benefits listed in Section 1.2). Achieving the appropriate balance for engagement is crucial, as the impacts can be detrimental if the public feel their views are not being properly considered, or their inclusion in JPCSAG is a token gesture. Members of the JPCSAG need to be enthusiastic, passionate and committed to the objective and mandate of the group.

Much of the 'industry relevant' information outlined in Section 1.2 is relevant to the wider nuclear sector and is discussed below where appropriate, alongside more general commentary on the potential role for the JPCSAG in engagement activities.

The fragmentation of the UK nuclear industry could manifest at the sector and pan-EU level. This fragmentation could contribute to a more difficult position with an increase in the total number of organisations trying to engage and lead to inconsistency in approach and a lack of clarity in communications. As seen by the UK and recognised by the NIC, it is important to have a consistent approach to engagement, especially on complex topics such as nuclear energy and safety. The JPCSAG could co-ordinate engagement activities and act as a focal point for exchange of information and sharing of good practice, and learning from experience amongst NUGENIA members and mitigate the effect of fragmentation of the sector. Additionally, whilst the climate of UK opinion towards nuclear energy has changed positively over the years, there is no room to be complacent. Worldwide events and changing social priorities can quickly affect the opinion of the wider public. It is therefore important to continue dialogue and engagement with all interested stakeholders. The JPCSAG needs to meet regularly in order to be informed of developing and changing perceptions in civil society. Formal reporting to the NUGENIA ExCom will be carried out on a regular basis.

There is space for a voice within the sector that maintains independence from "industry", "Government" and the EC, and could serve as a valuable and trusted point of contact for public issues (see later discussion of SKB in Section 2.3.1) and a valuable forum to gain a

⁴ "The Aarhus Convention and its Protocol empower people with the rights to easily access information, participate effectively in decision-making in environmental matters and to seek justice if their rights were violated. They protect every person's right to live in an environment adequate to his or her health and well-being."

⁵ The UNECE Espoo Convention, named for the Finnish town in which it was signed in 1991, requires governments to provide an opportunity to the public in trans-boundary areas likely to be affected by a project to participate in the relevant Environmental Impact Assessment procedures regarding proposed activities. It must ensure that the opportunity provided to the public of potentially affected Parties is 'equivalent to that provided to the public of the Party of origin'.

true understanding of public opinion. The JPCSAG functioning in this role will contribute to avoiding the marginalisation of public opinion, especially if feed-in routes from more general public forums are well defined. Recommendations for how to achieve this are made in Section 8.

Building a relevant advisory group gathering political and civil society input requires:

- the identification of the expected contributions and the definition of the objectives of the group;
- the identification of relevant representatives;
- the identification of relevant activities and actions;
- definition and agreement of the terms of reference.

The composition of the JPCSAG may include scientists and engineers from national laboratories, industry organisations, academia, independent organisations and environmental protection groups; achieving the balance will be delicate as discussion should ensure all views are encouraged and debated openly. It is also suggested that there is a level of media presence (perhaps a group such as Nuclear Transparency Watch). Other members may include the SNETP, EESC, JRC, ANCLLI, Mutadis (French experience), academia and other NGOs. The Aarhus Convention and Nuclear (ACN) brought together parties very effectively and is perhaps something the JPCSAG should aim to replicate.

2. Review and Summary of the UK's and EU's Positions on Engagement with Nuclear

This section of the report describes the relationship between the UK public and the nuclear industry, and describes some of the changes in approach and attitudes to nuclear energy from the commencement of commercial nuclear power generation in 1956 to the present day plans for new nuclear build. The roles of key stakeholders and contributors in public engagement are considered and learning is highlighted to inform NUGENIA and the JPCSAG.

2.1. History of UK nuclear public engagement

The UK established the world's first civil nuclear programme by connecting eleven Magnox⁶ nuclear reactors to the grid between 1956 and 1971, starting with the Calder Hall reactor. A second fleet of nuclear reactors soon followed (1976 to 1989), comprising Advanced Gas-cooled Reactors⁷ (AGR's) at seven sites. Only one further reactor has been built in the UK since, a PWR located at Sizewell (connected to the grid in 1995). Despite the UK's worst nuclear accident (Windscale fire, 1957), civil nuclear power in the UK maintained its representation of prosperity and development [14] through the 1960s and into the 1970s. Attaining a job in the sector was highly regarded⁸. However, with worldwide incidents such as Three Mile Island (1979) and Chernobyl (1986), coupled with the association of nuclear weapons with the cold war [15], the popularity of nuclear power among the UK public gradually declined. The public raised concerns about the safety of UK nuclear facilities, the increasing amount of waste associated with nuclear activities, and about the technological challenges associated with managing the UK's growing nuclear legacy. The early days of nuclear development in the UK for the Manhattan project⁹ also contributed to a legacy of waste held at nuclear licensed sites. Through this period (1970s and 1980s), the UK continued to construct AGR's across the UK and the PWR at Sizewell, in addition to a host of other developments within the industry; including the construction of the Thermal Oxide Reprocessing Plant (Thorp) at Sellafield in Cumbria, where permission to build was granted in 1978.

The earlier relationship between the nuclear sector and the public is commonly described as 'technocratic' decision-making, and is also referred to as 'Decide-Announce-Defend' (DAD) [14]. This approach was based primarily around technical risk assessments rather than using other means such as public engagement, and was commonly used in the UK until recently. Communication with the public tended towards a 'need-to-know' approach, which over time, led to decreasing levels of trust between the sector and the public, with the industry said to operate with 'technical arrogance'⁸. This meant that the industry automatically entered into engagement with a defensive manner, making it more difficult to develop an open and trusting relationship with the public. The problems associated with the 'technocratic' DAD approach became evident in 1997 when the UK's deep repository programme for disposal of radioactive waste failed. A UK body, Nirex (Nuclear Industry Radioactive Waste Executive), was set up in 1982 to examine safe, environmental and economic aspects of deep geological disposal in the UK. In 1992,

⁶ Magnox reactors were the first generation of gas-cooled nuclear reactors designed and built in the UK. Eleven were constructed in the UK, one in Japan and one in Italy.

⁷ Second generation AGR technology was developed from the Magnox design and could be operated at a higher temperature in order to improve thermal efficiency. AGR's were built only in the UK.

⁸ Interview with A. Bull, NNL Head of External Relations, 27/11/2015.

⁹ The Manhattan Project (1942 to 1946) was a research and development project that produced the first nuclear weapons during World War II. It was led by the United States with the support of the United Kingdom and Canada.

Nirex announced plans to build a “Rock Characterisation Facility” (RCF) on the Sellafield site, and in 1997 submitted a proposal to build the RCF, which saw enough opposition for Nirex’s plans to be halted following a five-month local planning enquiry. This left no agreed strategy for the long-term management of radioactive wastes that were to arise from the UK’s ageing reactor fleet, as well as wastes from the decommissioning of other nuclear infrastructure that was due to follow and existing legacy wastes from former research programmes such as the Manhattan project.

The failure of the UK’s deep repository programme could be seen as the beginning of a series of studies around public engagement with radioactive waste management [1][16][17][18], and led to the formation of the Committee on Radioactive Waste Management (CoRWM). CoRWM is a group of 12 members, who are experts in different aspects of radioactive waste management, that was asked by Government in 2003 to make recommendations for the long-term management of the UK’s higher activity wastes that would both protect the public and the environment, and inspire public confidence. CoRWM is regarded as being successful in ascertaining public opinion on radioactive waste management and making consequent recommendations [19]. CoRWM provides independent scrutiny and advice to the UK government on the long-term management of higher activity radioactive wastes, and is an advisory non-departmental public body, originally sponsored by the Department of Energy & Climate Change (DECC), now the Department of Business, Energy and Industrial Strategy (BEIS). CoRWM used a process of framing, shortlisting, option assessment and integration in combination with four activities; public and stakeholder engagement, science and engineering input, ethics and social science input and learning from overseas experience. CoRWM members followed five principles:

1. To be open and transparent;
2. To uphold the public interest by taking full account of public and stakeholder views in their decision-making;
3. To achieve fairness with respect to procedures, communities, and future generations;
4. To aim for a safe and sustainable environment both now and in the future;
5. To ensure an efficient, cost-effective, and conclusive process.

A report undertaken by independent authors identified three further principles that might be considered in future public engagement on policy matters [19]:

6. To respect alternative points of view;
7. To participate as an individual, not as a member of an interest group;
8. To take personal responsibility for recommendations.

These eight principles are highly relevant to NUGENIA’s aspiration to create the JPCSAG.

In 2006, CoRWM presented a new approach for the UK Government to follow [20] for the siting of a deep repository, based on the first five principles above. Recommendations were made, with a significant number being directly related to public engagement:

‘Recommendation 9: There should be continuing public and stakeholder engagement, which will be essential to build trust and confidence in the proposed long-term management approach, including siting of facilities.’

'Recommendation 10: *Community involvement in any proposals for the siting of long-term radioactive waste facilities should be based on the principle of volunteerism, that is, an expressed willingness to participate.'*

'Recommendation 11: *Willingness to participate should be supported by the provision of community packages that are designed both to facilitate participation in the short-term and to ensure that a radioactive waste facility is acceptable to the host community in the long-term. Participation should be based on the expectation that the well-being of the community will be enhanced.'*

'Recommendation 12: *Community involvement should be achieved through the development of a partnership approach, based on an open and equal relationship between potential host communities and those responsible for implementation.'*

These recommendations demonstrate a clear move towards the public engagement approach in the nuclear sector that is more common today. The failure of the UK's initial approach to developing a deep repository programme appeared to initiate the process of a slow and reluctant transition from the 'technocratic' decision-making model to a more participatory model; a shift that is evidenced through the series of events detailed in Table 1.

The table below is a summary of events taken from Dr John Whitton's 2010 PhD thesis [14], titled 'Participant Perceptions on the Nature of Stakeholder Dialogue Carried Out by the UK Nuclear Decommissioning Authority (NDA)'. This PhD was sponsored by BNFL, and subsequently NNL, and was supervised by Dr Colette Grundy (co-author and checker of this report). It broadly summarises some of the key events in nuclear decision-making in the UK over the period from mid-1980s and includes both successful and unsuccessful approaches. It is not meant to provide a comprehensive picture rather a preview of selected developments. The table has been updated with post-2010 developments; and with developments since 2007, such as the GDA, which were not considered in the PhD.

Table 1: Timeline of example UK nuclear public engagement activities

Activity	Description
<p>1985 UKAEA Stand at the Ideal Home Exhibition</p>	<p>Evaluation of a UKAEA information stand revealed that those leaving the stand were more seriously concerned about nuclear power than they had been previously [14]. Reasons for this shift in opinion were a result of lack of contact with staff, lack of coherent layout and a concentration on technical issues. Simply communicating information via wallboards and a film was not enough to engage the public in a positive way, indicating the need to change the approach to two-way dialogue.</p>
<p>1988 - 2011 BNFL Sellafield Visitor Centre</p>	<p>To address concerns over adverse publicity, BNFL invested heavily in a communications campaign consisting of a visitor centre and free coach tours of the Sellafield¹⁰ site [14][21]. A study revealed that it</p>

¹⁰ Activities at the Sellafield site primarily support decommissioning of historic plants, and reprocessing fuel from UK and international nuclear reactors. The site also contains several nuclear waste stores.

	<p>was uncertain whether the visitor centre achieved its objective of establishing a positive change in attitude towards the nuclear industry. Similar to the 1985 UKAEA stand, this campaign was more focused on providing information rather than consultation with or engaging the public via two-way communication.</p>
<p>1998 - 2004 BNFL National Stakeholder Dialogue</p>	<p>BNFL recognised that it had a long history of poor engagement with stakeholders, which needed to change. A number of stakeholders were brought together with the aim of identifying areas of consensus via a deliberative process, which would help BNFL's decision-making regarding its operations [22]. At the time it was considered to be the longest, largest and most thorough public dialogue process ever undertaken in Europe. This extensive programme helped BNFL and stakeholders to focus research on areas of concern, build positive networks and build trust.</p>
<p>1999, 2000 Radioactive Waste Management Committee (RWMAC)</p>	<p>A report [23] concluded that the 'Decide, Announce, Defend' approach contributed towards the failure of the 1997 Nirex¹¹ programme for a deep geological store for nuclear waste. It was recommended that a consensus-building approach should be used in future to engender trust.</p>
<p>2000 International Atomic Energy Association (IAEA) Conference</p>	<p>Following the IAEA's International Conference on the Safety of Radioactive Waste Management in Cordoba, 2000, a proposal was put forward to establish a broad international stakeholder forum. This action came about as it was noted that the need for stakeholder engagement became a subject of discussion in almost all technical sessions [14], and subsequently, an action plan was approved by the General Conference that included seven actions, the final one being [24]:</p> <p>"Action 7 - Develop a step-by-step programme of work aimed at addressing the broader societal dimensions of radioactive waste management, including an appropriate mechanism to advise on such a programme and assess its suitability and progress."</p> <p>The International Project on Innovative Nuclear Reactors and Fuel Cycles (INPRO) was established in 2000 to help ensure that nuclear energy is available to help meet the energy needs of the 21st century in a sustainable manner, and the group has established the 'INPRO Dialogue Forum' [25]. A number of reports have since been published by the IAEA on stakeholder engagement [26][27][28].</p>

¹¹ Nirex was the UK body tasked with examining safe, environmental and economic aspects of deep geological disposal of intermediate-level and low-level radioactive waste.

<p>2002 Dounreay¹² Site Restoration Plan (DSRP)</p>	<p>In 2001, UKAEA publicly launched its detailed proposals for the environmental restoration of the Dounreay site. UKAEA initiated a public information campaign to raise awareness of and seek comment on the DSRP. Although it was later recognised by UKAEA that stakeholders were not involved early enough, new ground was broken with stakeholder engagement in this example, and it paved the way for a formal UKAEA Dounreay stakeholder strategy document, as well as a number of other improvements [29].</p>
<p>2002 Trawsfynydd Decommissioning</p>	<p>A public enquiry was held into the decommissioning method to be used for the Trawsfynydd Magnox reactor in Wales. This is an early example of a positive engagement process where the public participated from an early stage. The public's input had a clear impact on the final decision; the technical experts from industry presented a number of options to the public, stating which option was preferred, but as a result of the public's opinion, a different, more sustainable option was chosen as the most beneficial way to proceed [30].</p>
<p>2003 'Managing the Nuclear Legacy' and 'Energy' White Papers</p>	<p>The UK Government's 'Managing the Nuclear Legacy' white paper [31] was a further move towards a deliberative approach, with public participation and consultation recognised as key actions. White papers are policy documents produced by the UK Government that set out their proposals for future legislation, providing a basis for further consultation and discussion with interested or affected groups.</p> <p>Although the energy white paper [32], published in the same year, stated that nuclear new build was not an option being considered at the time, the following quote highlights the UK Government's commitment to public engagement:</p> <p><i>"Before any decision to proceed with the building of new nuclear power stations, there will need to be the fullest public consultation and the publication of a further white paper setting out our proposals."</i></p>
<p>2004, 2005 Nuclear Decommissioning Authority¹³ (NDA) Formed</p>	<p>A document was issued outlining the arrangements for NDA engagement with local and national stakeholders, with the National Stakeholder Group (NSG) established in 2005 to achieve the key engagement principles in the NDA Stakeholder Charter [14].</p>

¹² Since the 1950s, Dounreay has been the UK's site for the development of prototype fast breeder reactors and submarine reactor testing.

¹³ Formed in 2005, the NDA's purpose is to deliver the decommissioning and clean-up of the UK's civil nuclear legacy in a safe and cost-effective manner, as well as accelerating programmes of work that reduce hazard.

<p>2005 BNFL Legacy Ponds and Silos (LP&S) Public Dialogue</p>	<p>This was a strategic approach initiated after recognition that effective stakeholder dialogue would be crucial in developing socially-resilient technical options for decommissioning of LP&S located on the Sellafield site. Although the engagement framework promoted dialogue to inform decision-making, instances of engagement appeared sporadic and a clear direction was not apparent [33].</p>
<p>2006 - 2008 UK Government's Energy Challenge Report</p>	<p>The UK Government launched a public consultation on nuclear power in May 2007 in order to ensure that the public's views were taken into account, before the Government reached a final view on the future of nuclear power [34]. This consultation happened as a result of a U-turn in Government's views on nuclear power between the 2003 and 2006 white papers, which was successfully challenged by Greenpeace [35]. It was stated that the 2006 consultation had failed and was "<i>ill-conceived, carried out over too short a timescale, and did not involve the public in any meaningful way</i>". The 2006 consultation consisted of the release of a consultation document [36] that outlined the UK's policy framework for nuclear new build, providing an opportunity for the public to comment.</p> <p>As a result of Greenpeace's challenge, an extensive public consultation followed in 2007 that included a range of consultation methods: consultation document and stimulus materials, dedicated website, large-scale deliberative events, stakeholder meetings, engaging existing nuclear communities, advertising and awareness raising measures.</p> <p>Following the 2007 public consultation, the Government stated in a 2008 white paper on nuclear energy that [37]:</p> <p><i>"We set out our preliminary view that it is in the public interest to give energy companies the option of investing in new nuclear power stations. The purpose of the consultation was to subject this preliminary view, and the evidence and arguments for it set out in our consultation document, to a thorough and searching public scrutiny."</i></p> <p>and,</p> <p><i>"we have examined the specific concerns raised in the consultation and the extent to which they can be met by the existing regulatory framework, or could be met through further development of our policies."</i></p> <p>The 2008 white paper on nuclear energy concluded nuclear should have a role to play in the generation of electricity, alongside other low carbon technologies, and that the electricity industry should be allowed to build and operate new nuclear power stations, subject to meeting the normal planning and regulatory requirements.</p>

2007 - Present
Introduction of
Generic Design
Assessment¹⁴
(GDA) Process for
New Reactor
Designs

The GDA process was introduced in response to a request from the UK Government following the 2007 Energy Review white paper [38]. A joint regulators website was established in order to create a platform where the public could learn about and comment on the process, which included detailed reactor design information, and a place to express their views. One of the key benefits of the GDA process is considered to be that:

"It is open and transparent. Anyone can view detailed design information and comment on it."

This is another demonstration that the nuclear industry was becoming more committed to engaging the public in its decision-making processes, and attempting to build trust through operating in an open and visible manner. Screen shots of the joint Office for Nuclear Regulation (ONR) and Environment Agency (EA) website for public involvement are shown below [39].

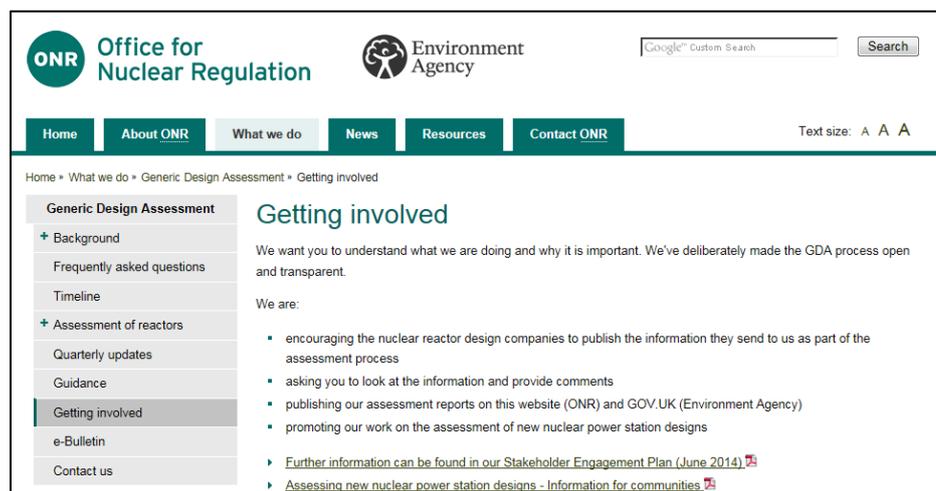


Figure 5: Screenshot of the joint ONR and EA's 'Get involved' web page

¹⁴ GDA is a UK regulatory process to ensure that any new nuclear power stations built in the UK meet high standards of safety, security, environmental protection and waste management.

	<p>Related content</p> <ul style="list-style-type: none"> ▪ Natural Resources Wales ▪ GOV.UK - Assessing new nuclear power station designs <p>Commenting on reactor designs</p> <p>GDA includes a comments process. The reactor design company is encouraged to publish detailed design information on its website and update it as new information becomes available.</p> <p>Anyone can view that information and comment on it. The design company is required to respond to questions and comments about their design. We are able to see both question and response so that we can consider them in our assessments.</p> <p>The comments process for Hitachi-GE's UK Advanced Boiling Water Reactor (ABWR) design</p> <p>You can make a comment about the UK ABWR design via Hitachi-GE's website. Hitachi-GE will respond to the comments and issues raised.</p> <ul style="list-style-type: none"> ▶ Make a comment - Hitachi-GE ▶ Cymraeg - Wneud sylw <p>We will see both the questions raised and the responses made and will use these, where relevant, to help inform our assessments of the UK ABWR.</p> <p>The comments process opened on 6 January 2014 and will continue throughout the GDA of the UK ABWR until a date to be advised. We expect this date will be during 2017, likely around four months before we make our decisions on the acceptability of the UK ABWR.</p> <p>Our comments process document describes the process in more detail.</p> <p>The comments process for Westinghouse's AP1000 reactor design</p> <p>You can make a comment about the AP1000 design via Westinghouse's website. Westinghouse will respond to the comments and issues raised.</p> <ul style="list-style-type: none"> ▶ Make a comment - Westinghouse <p>We will see both the questions raised and the responses made and will use these, where relevant, to help inform our assessments of the AP1000.</p> <p>The comments process will continue throughout the GDA of the AP1000 until a date to be advised. We expect this date will be during 2016, likely around four months before we make our decision on the acceptability of the AP1000.</p>
<p>2008 - 2013 'Managing Radioactive Waste Safely' (MRWS) White Paper and GDF Siting Process</p>	<p>In 2008, the MRWS white paper [40] outlined a framework for implementing geological disposal in the UK, which set out an approach based on voluntarism and partnership. The GDF siting process was undertaken between 2009 and 2013, with Cumbria being the only UK region to make it through to the latter stages of the process. Interest in hosting a GDF in Cumbria stalled in 2013 when the County Council voted against the plans, even though the two borough councils had voted to continue with the process.</p>
<p>2013 - 2015 Geological Disposal Facility (GDF) Siting Process</p>	<p>Following the decision in 2013 not to proceed with siting a GDF in Cumbria (see Section 4.1.2), the Department of Energy and Climate Change (DECC)¹⁵ published a revised GDF siting process, which was backed up by research and learning from a series of public dialogue workshops [41].</p> <p>An evaluation report issued in January 2015 [42], discusses the key learning points of the public and stakeholder engagement conducted on the siting process for a Geological Disposal Facility (GDF), for the UK's higher activity radioactive waste. The key learning from this exercise focused on:</p>

Figure 6: Screenshot of the joint ONR and EA's web page where the public can comment and ask questions on reactor designs

¹⁵ The Department of Energy & Climate Change (DECC) works to make sure the UK has secure, clean, affordable energy supplies and promote international action to mitigate climate change.

	<ul style="list-style-type: none"> - The importance of fully resourcing the workshops to obtain enough quality information; - The impact of dialogue workshops on ability to respond during consultation; - How the results tied up with Government consultation results; - How the dialogue results influenced the 2014 'Implementing Geological Disposal' White Paper [43]; - How the dialogue influenced the views of participants; - How DECC's confidence in public dialogue has been affected; - The impact on NGOs.
<p>2014 Implementing Geological Disposal</p>	<p>In 2014 UK Government published a renewed process for siting a Geological Disposal Facility in the form of a White Paper [44].</p> <p>Implementing Geological Disposal outlines an approach based on working with interested communities, beginning with two years of actions overseen by Government and intended to address issues that the public and stakeholders have told us are important to them.</p> <p>The UK Government remains committed to geological disposal as the right policy for the long-term, safe and secure management of higher activity radioactive waste.</p>
<p>2015 New Nuclear Power Stations – Public Dialogue Workshops</p>	<p>A public dialogue project was developed by the UK nuclear regulators to review and improve public involvement in design assessments of nuclear reactors for potential new power stations in the UK. This project plays a part in demonstrating that society's attitude to nuclear energy is being taken seriously, and that those organisations involved in the study (Environment Agency, Office for Nuclear Regulation and Natural Resources Wales) are placing public engagement high up their list of priorities.</p> <p>The key learning from this exercise focused on:</p> <ul style="list-style-type: none"> - What the public think they need to know; - Who to involve more closely from a geographical perspective; - Preferred methods of communication; - Difficulties with technical language; - Awareness of new nuclear power; - The effect on everyday lives; - Putting new nuclear in the context of existing nuclear facilities;

	<p>- How to build trust with the regulators; - How to reduce barriers to public engagement.</p> <p>The final report was published in August 2015 [45], and the independent evaluation report was published in October 2015 [46].The co-author of this report, Dr Colette Grundy was a member of the independent oversight group for this work.</p>
<p>2015 - 2016 'Nuclear Energy and Society Concordat for Public Engagement' and Public Dialogue Workshops</p>	<p>In December 2015, the NIC launched the 'Nuclear Energy and Society Concordat for Public Engagement' at the NIA's Annual Conference. This document set out public engagement principles that signatories agree to abide by and includes commitments towards the provision of leadership, engaging according to best practice, developing effective communicators and to making a difference.</p> <p>A series of public dialogue workshops were held in 2016 to test the Concordat principles with members of the public. The work was led by NNL working in partnership with Welsh Government and Sellafield Ltd. Workshops were held simultaneously in both non-nuclear and nuclear communities in England and Wales, and culminated in a number of recommendations being handed over to the UK nuclear industry that detailed how the public thought the Concordat could be improved. More information can be found in Section 3.1.</p>

In summary, Table 1 illustrates how the importance of public engagement on nuclear matters has been recognised in the UK over the past few decades, using examples from Government policy papers and case studies from UK nuclear organisations that have had both positive and negative outcomes. It is reasonable to expect that during such a transition in culture there will be barriers to overcome and lessons learned, and there were a number of initial problems associated with this shift in approach to public engagement and decision-making. For example, the DSRP issued in 2002 did not involve the public from an early stage, and a strategy had already been decided before the public were consulted. This resulted in the public's role being limited, as they had not been given the opportunity to contribute towards the objectives of the project from the start. Subsequent feedback from stakeholders and an independent evaluation led to recommendations for improvements on UKAEA's engagement process, including [14][29]:

- Wider and more frequent dialogue;
- Development of a more effective engagement process;
- Development of a mechanism for addressing issues with national significance.

Another example to learn from is BNFL's 2005 LP&S public dialogue, which appeared to start off with good intentions by developing a proposed engagement framework. However, with the nature of the dialogue unclear and engagement events becoming sporadic, there seemed to be little opportunity for a wide range of deliberation by stakeholders, and the initial enthusiasm and energy for the engagement process seemed to decrease. Therefore, it is clear that commitment is required from all parties/stakeholders in the longer term to ensure that engagement activities have the opportunity of being successful. This is certainly true for the JPCSAG, with the need for all members to be committed to achieving the aims of the group over the required timescales. The members of the group must also be conscious that their role as the

conduit between the wider political and public communities and NUGENIA can have a positive impact, but it can also have negative impacts if not carried out correctly. The suggested terms of reference presented later in this report have been developed to ensure that the JPCSAG take account of this learning. Recent activity in the UK

More recently, the Fukushima incident of 2011 has once again raised questions in the global arena around the safety of nuclear power, and as a result some countries have altered their nuclear energy strategies. An interdisciplinary study into the benefits and limitations of nuclear fission for a low-carbon economy in Europe highlighted the sensitivity of the industry to such events, and provided a series of ten recommendations, one of which recognised the importance of public engagement [47]:

"Following Fukushima, nuclear fission for energy has become a sensitive political issue in some member states and the public at large expects its concerns to be properly addressed. Future fission research therefore needs to respond to those concerns, including new ways of engaging the public. This is the only way for European industry in the nuclear field to maintain its worldwide leading position."

The interdisciplinary study noted above is one of the driving factors for NUGENIA's desire to establish the JPCSAG and the remainder of this section analyses the UK approach to satisfying the recommendation above.

Soon after this European study was released, the UK's nuclear industrial strategy, titled, 'The UK's Nuclear Future', was published in 2013 as part of a series of industrial strategies co-created by UK Government and industry [48]. The strategy set out the UK Government's clear expectation that nuclear will play a significant role in the UK energy mix of the future, and outlines the key actions and approach needed to realise a vibrant, diverse and strategically cohesive nuclear sector that Government and industry wishes to see develop. A series of actions were recommended to enable this strategy to be realised, one of which was entitled, "public engagement and awareness", and the Nuclear Industry Council (NIC) was appointed the action owner.

In 2014, the NIC published a high-level strategy, "In the Public Eye: Nuclear Energy and Society" for Central and Welsh Government, industry, and other stakeholders. This set priorities for Government and industry to work together with others to enhance public engagement with nuclear energy, and proposed four main activities (Table 2) [49]. The NIC is the leading engagement body between the UK nuclear industry and the Government, and provides a forum for dialogue between the different parts of the industry. The group is jointly chaired between government and industry, and has members comprising of senior representatives from the nuclear industry, developers, vendors, operators, key suppliers, contractors and unions.

Table 2: Activities proposed by the NIC high-level strategy in 2014

Proposed Activity	Current Status
1. Formation of a pan-nuclear senior communications group to share and coordinate public engagement activities and to deliver the strategy.	A "Senior Communications Group" was formed and meets quarterly. The group is made up of representatives from: Sellafield Ltd, National Nuclear Laboratory (NNL), Office for Nuclear Development (OND), Nuclear Decommissioning Authority (NDA), Radioactive Waste Management

	(RWM), Magnox Ltd, EdF Energy, Horizon, NuGen, URENCO, National Skills Academy for Nuclear (NSAN), University of Birmingham, Department for Business, Innovation and Skills (now the Department of Business, Energy and Industrial Strategy – BEIS), Prospect, Unite, and Nuclear Industry Association (NIA). Professor Andrew Sherry, Chief Scientist at NNL, chairs the group.
2. To establish a Concordat on public engagement with nuclear energy. This includes commitment to best practice, including building trust, clarity, dialogue and consultation.	The Nuclear Energy and Society Concordat for Public Engagement was signed by all members of the NIC and launched at the annual NIA conference in London on 3 rd December 2015 [50][51][52]. The Concordat was tested with members of the public through a series of public dialogue workshops led by NNL and its partners for the study, Welsh Government and Sellafield Ltd. The workshops were held in May and July 2016 (see Section 3.1).
3. To develop a nuclear narrative which sets out the industry's side of a conversation with the public, and helps those who work in the sector to discuss the nuclear industry in an open manner.	The nuclear narrative is currently being developed by members of the NIC. A good example of what the NIC is aiming to achieve with the nuclear narrative is the World Nuclear Association's (WNA) 'Hot Topics' brochure (and similarly, the NIA's Nuclear Factbook [9]); a collection of high-level nuclear industry positions backed up by facts [53].
4. To develop research to inform developments in this important area.	Recommendations have been made to UK Government through the Nuclear Innovation Research Advisory Board (NIRAB) ¹⁶ in this regard.

The high-level strategy also summarises some of the research that has been undertaken on public engagement, and highlights the results of an EC study which indicates that the public believe University and Government Laboratory scientists are the best qualified to explain the impact that science has on technological developments and society (Figure 4) [8]. It is therefore important that organisations like NNL, and research institutions and associations (such as NUGENIA), act on the recommendations and findings of this strategy by establishing their roles in leading the UK's development of public engagement with nuclear matters. NNL has closely followed and sponsored some activities in the development of public engagement research work on nuclear issues by UK universities (see Section 3.4), and is actively liaising with universities to share information and learning. Similarly, the JPCSAG might liaise with academia to ensure that an understanding of ongoing research activities and expected activities related to NUGENIA can be communicated.

¹⁶ NIRAB's mission is: "To ensure that public R&D programmes are aligned to support industrial and energy policy, and to maximise synergy across different aspects of the nuclear sector, including fusion and the NDA portfolio."

Around the time that the NIC were developing this high-level strategy in 2014, there was a survey conducted on behalf of the NIA to gather opinions on the nuclear industry [54]. Such opinion polls help the nuclear sector to recognise the areas of most concern to the public, which is a vital part of public engagement. This strategy report, along with other recent opinion polls [55][56], suggests that public support for nuclear in the UK remains relatively strong. Though, it does highlight that while the public feel very well informed about renewables and other energy sources, they do not feel well informed about nuclear energy. Another point to note from the 2014 NIA poll is that while favourability for nuclear power has remained steady since 2005 (apart from a brief drop in 2011 immediately after the Fukushima incident), opposition to nuclear has steadily declined. Could this shift from people opposing nuclear to being 'not sure' be partly due to the increasing commitment of the nuclear sector towards actively engaging with the public and seeking to use good practice? With a 2015 survey indicating that support for nuclear in the UK has fallen slightly [57], it is difficult to make any direct links between increased public acceptance and the change in approach towards public engagement. This also provides further evidence towards the argument that public opinion is finely balanced and easily impacted (discussed in Section 1.2). NUGENIA should ensure that the JPCSAG members understand the key areas of public and political concern and should be mindful of how those concerns align with NUGENIA's remit as an R&D organisation.

2014 and 2015 saw the publication of two reports detailing the following high-profile public dialogue projects:

1. Geological Disposal Facility (GDF) [41].

DECC commissioned research into the public dialogue process, to better understand the views on a revised GDF siting process (see Table 1). The research involved organising a public dialogue workshop, with three main objectives:

- Explore and understand the general public's awareness of geological disposal and the MRWS process;
- Obtain feedback on the proposals for improving the current MRWS site selection process for a GDF;
- Enable the public's views to be fed into the development of an improved GDF site election process.

This public dialogue project is discussed in more detail in Section 4.1.2.

2. Generic Design Assessment (GDA) [45].

A public dialogue project was developed to review and improve public involvement in design assessments of nuclear reactors for potential new power stations in the UK. This project plays a part in demonstrating that society's attitude to nuclear energy is being taken seriously, and that those organisations involved in commissioning and running the study (Environment Agency, Office for Nuclear Regulation and Natural Resources Wales) are placing public engagement high up their list of priorities. The final report published in August 2015, and the independent evaluation report published in October 2015, can be found on the Sciencewise website [58]. The key learning from this exercise is discussed in Section 4.1.1. Dr Colette Grundy, co-author to this report, was a member of the independent oversight group for this study.

The GDF and GDA public dialogue projects are important learning for engagement as it is likely that the previously failed GDF siting process will be attempted with new terms and conditions for the host community for the waste repository, and there are a number of reactor types currently going through the GDA process¹⁷, with the likelihood of more vendors commencing the process in future¹⁸. The public dialogue projects further demonstrate that the UK nuclear industry is taking public engagement seriously (other UK nuclear industry case studies are included in Appendix 1). Key learning from the very recent GDF and GDA public dialogue reports is covered in more detail in Section 4.1 of this report.

Nuclear Energy and Society Concordat for Public Engagement

It is the benefits of public engagement (Sections 1.2 and 1.3), in part, that have led to the development and launch of the UK's 'Nuclear Energy and Society Concordat for Public Engagement' in December 2015. The Concordat, signed by members of the NIC and other stakeholders, has been developed with the aim to improve public understanding of nuclear energy, and also acts as a demonstration of the sector's commitment to engaging with society on nuclear energy matters. The principles of the Concordat, outlined below, affirm the nuclear sector's resolve to show leadership, implement best practice, communicate effectively and make a difference:

1. **Leadership Commitment:** Companies working in the UK civil nuclear sector recognise the importance of public engagement;
2. **Best Practice:** Our engagement with the public will be characterised by two-way communication, trust building, clarity and consultation;
3. **Effective Communicators:** We recognise that our people are ambassadors for the sector and that independent experts as well as industry leaders have an important role to play in public communications;
4. **Making a Difference:** We recognise the importance of public attitudes to nuclear energy and regularly assess progress in fostering engagement with society.

A public dialogue project was led by NNL in 2016, which aimed to test and inform the further development of the Concordat through a series of public dialogue workshops. The project involved Welsh Government and Sellafield Ltd as project partners to NNL, who were involved in the design of the dialogue and throughout the workshops and reporting process. Details of this project are discussed in Section 3.1 of this report. To assist the nuclear industry in implementation of the Concordat principles, two guidance documents are due to be published in 2016, one for the 'Nuclear Workforce', and another for 'Communications Professionals'. These guidance documents will provide advice for nuclear organisations, with the aim of stimulating creativity in how the Concordat principles are implemented within organisations, and will help to ensure consistent implementation across the nuclear sector.

¹⁷ The ABWR (GE/Hitachi) and AP1000 (Westinghouse) reactor designs are currently going through the GDA process.

¹⁸ There has been interest in submitting other reactors designs through the GDA process from Russian and Chinese vendors.

2.2. Roles of UK organisations

As the UK's approach to public engagement has developed, so have the roles played by the stakeholders involved in the engagement process. The following sections briefly explain the transitions that have occurred, the drivers behind these transitions and how they contributed to the current engagement approach. The differences between the individual stakeholders also give perspective on how the JPCSAG should be comprised, and is intended to function and operate.

2.2.1. Role of UK Government

The role of the Government in public engagement has developed over time, as have the attitudes to public engagement held by stakeholders, both inside and outside of Government. Traditionally, Government adopted the "Decide, Announce, Defend" model to most, if not all, major infrastructure projects. There was a gradual shift away from this technocratic approach, where relevant experts had a dominant role in the decision-making process, through an introductory phase of public engagement that produced mixed results, to the current deliberative approach that involves the public in a meaningful way and is a model that has been referred to as "Engage, Deliberate, Decide" [59]. This transition occurred because Government recognised that by incorporating public opinion in the early stages (conception/design) of projects, the solution was usually a more rounded fit to the intended design. This allowed any issues to be identified and addressed before initiating the project - saving time and money, as well as avoiding adverse public reaction.

Consequently, impetus has been placed on developing public engagement in the UK across a range of sectors, which has translated into the aforementioned deliberative approach. There are still issues to address in public engagement and many organisations are seeking to address the different aspects of these problems. On this point, several studies have cited a widespread mistrust of UK Government policy by the British public, which has served to undermine attempts to progress various projects. Torsten Carlsson, the mayor of the Swedish town of Oskarshamn (which was a potential site for a geological repository) commented that the whole process of public engagement falls down where there is a lack of trust [60].

2.2.2. Role of NGO's

With the onset of "true" public engagement, the role of the NGO now typically falls into one of three areas; either the NGO performs the public engagement activities on behalf of Government, they participate in Government engagement activities, or they review a Government public engagement activity. This is not just the case in the nuclear sector, and is relevant for all sectors.

NGO's are seen as an impartial, independent and authoritative body capable of delivering an honest and thorough approach to public engagement and to counteract any mistrust of Government policy. The public tend to trust the results of an NGO study more than a Government study [61] as a Government study on a Government led project is often perceived as lacking independence from the original project. NGO's are often requested to be moderators or facilitators in public discussions and their view is usually requested

such that participants can be sure that all aspects of the issue under consideration are represented.

The UK Government has also taken the approach of creating NGO's to perform a variety of functions. One relevant example is the Science Media Centre [62], an independently governed and funded entity that provides information on science and technology issues currently at the forefront of public interest (i.e. in the media). Further, many NGO's are becoming increasingly active in public engagement, one example is Energy for Humanity [63], who are "seeking to inform public debate at all levels" by providing independent advice on energy and climate change.

As a side note, the Swedish approach was to involve NGO's on two levels in their repository siting process; national and local. Both groups received funding from the Nuclear Waste Fund for their continued attendance, with the stipulation that NGO management was democratic and voluntary. NGO's were able to raise questions about the license application and put their view to the Land and Environmental Courts. The NGO's were also able to conduct their own studies on a range of technical and non-technical topics [64].

2.2.3. Role of industry

The nuclear industry plays almost the same role it always has in the UK – it provides expertise and knowledge. Traditionally, this was directly to Government (who then chose from a set of options or were told by experts which one was the best choice). In the modern approach, industry provides experts and knowledge in an open and transparent way that informs discussion instead of dominating it. Increasingly there is a role for academics to provide independent and impartial advice in engagement approaches and studies. Industry is expected to fulfil a similar role in the JPCSAG.

2.2.4. Role of NNL (In the UK and overseas)

NNL plays a unique role in public engagement. As a Government owned, Government operated member of the nuclear sector with a remit to provide impartial and independent advice to Government, it spans the three previous categories. Whilst NNL could function in any of the three roles described above, its unique position enables it to undertake varied activities related to public engagement (see Section 3). As a scientific government laboratory organisation, there is an additional benefit that scientists and engineers are among the most trusted people in the eyes of the public [49][8]. Similarly, organisations such as NUGENIA and the Joint Research Centre (JRC) are also well placed to engage with the public.

2.3. Public engagement with nuclear across the EU

To summarise the status of nuclear public engagement in the EU as a whole would be a significant task and would require direct involvement of many stakeholders in order to be representative of the whole picture. In reality, the approach to public engagement varies widely on a country-by-country basis and varies over time. This variance in response/approach/attitude is highlighted by member states' reactions to the Fukushima

incident (Figure 7). The general trend however, is positive and moving away from previously posed questions around the legitimacy of how the EU communicates to its citizens [65]. NUGENIA and the JPCSAG can contribute to this positive movement. NNL have recently carried out work for NUGENIA to develop a toolkit for public engagement. NNL met with stakeholders in the UK, Finland and France to discuss approaches to engagement and to use feedback to develop the toolkit for NUGENIA members [66].

EU member states have split reactions on future of nuclear power after the Fukushima incident, affecting expansion plans

Country	Description	
Germany	<ul style="list-style-type: none"> 3 month closure of the country's nuclear power reactors that began operation in 1980 Government decision to decommission all nuclear power generation in the country by the end of 2022 	Changes vs. earlier position
Italy	<ul style="list-style-type: none"> After a referendum, new nuclear option is off the table for an undetermined period of time 	
Switzerland	<ul style="list-style-type: none"> Abandoned plans to build new nuclear reactors 	
Bulgaria	<ul style="list-style-type: none"> Plans to build unit at Kozloduy instead of Belene (current plans) because of low seismic activity 	Additional measures
Finland	<ul style="list-style-type: none"> Nuclear & radiation safety authority STUK to conduct review of nuclear facilities' emergency preparedness 	
Hungary	<ul style="list-style-type: none"> European nuclear stress tests for Paks (sole nuclear reactor) 	
Belgium	<ul style="list-style-type: none"> Lifetime extension for plants to be shut in 2015 being discussed. Existing plants undergoing stress tests 	No changes vs. earlier position
Czech Rep	<ul style="list-style-type: none"> Decision to continue with plans for nuclear new build 	
France	<ul style="list-style-type: none"> No change in policy; Construction work on the EPR at Flamanville continues 	
Lithuania	<ul style="list-style-type: none"> New tender proposals submitted for a replacement plant, Visaginas 	
Netherlands	<ul style="list-style-type: none"> Government has decided to carry on with plans for nuclear new build 	
Poland	<ul style="list-style-type: none"> No change in policy from the Polish government, referendum considered 	
Romania	<ul style="list-style-type: none"> No change in policy from the Romanian government 	
Slovakia	<ul style="list-style-type: none"> Commitment to nuclear power continues 	
Slovenia	<ul style="list-style-type: none"> No change in the nuclear policy of the Slovenian government 	
Spain	<ul style="list-style-type: none"> No change in policy from the Spanish government. First instance court confirmed closing of Garoña plant. 	
Sweden	<ul style="list-style-type: none"> No policy change, allow existing nuclear reactors to be replaced at the end of their lifetime 	
UK	<ul style="list-style-type: none"> The government is pushing ahead with plans for atomic power, confirming the 8 locations it has deemed suitable for new plants by 2025 in its first policy statement since Fukushima 	

EU stress tests will be performed on all plants during 2011

SOURCE: WNA; Team Analysis

Figure 7: How Fukushima affected EU members' nuclear expansion plans

The EU has solid foundations in its commitment to public engagement (participation) under the provision within the United Nations Economic Commission for Europe, UNECE Aarhus Convention on access to information, public participation in decision making and access to justice in environmental matters. The Aarhus convention which came into force in 2001 established a number of rights of the public (for individuals and their associations) with regard to the environment. For example, the right of everyone to receive environmental information that is held by public authorities, and the right to participate in environmental decision making. Further the right to review procedures to challenge public decisions that have been made without respecting the two rights listed in the previous sentence or environmental law in general (access to justice). As another example, the EU Directive on Strategic Environmental Assessment specifies the requirement "consultation with the public is a key feature of environmental assessment". Further, the Water Framework Directive [67] requires member states "to encourage the active involvement of interested parties".

The Power Perspectives 2030 report [68], a part of the EC's low carbon "Roadmap 2050" [69], takes note of public acceptance issues with nuclear new build, as well as Carbon Capture and Storage - CCS; in 2005 40% of the public supported nuclear new build (EU

Commission) [70]. The roadmap takes account of the requirement to involve interested parties specifically public participation with the intended outcome being that the most appropriate technological choice be that nuclear or otherwise will be selected through an open dialogue with the public; satisfying local environment requirements in the same gesture.

Multiple studies are currently underway by EU member states as well as several led by the EU council itself, confirming the EU commitment to participatory public engagement. Several countries in particular are making good on their commitments with regards to public consultation in the siting process for a geological disposal facility. The progress made relating to repositories is discussed below.

2.3.1. Sweden

The Swedish siting process lasted for over 20 years [71], following on from the 1977 implementation of a law requiring proof there was an “absolutely safe way” of managing the final disposal of nuclear waste. SKB, the Swedish Nuclear Fuel and Waste Management Company (privately owned by the Swedish nuclear utility companies), has a legal obligation to consult with the local populous, elected municipality officials, local and national NGO’s and other authorities involved at the local, regional and national level (see Figure 8). SKB was required to treat this obligation seriously as the municipality had the right to veto the implementation proposal¹⁹.

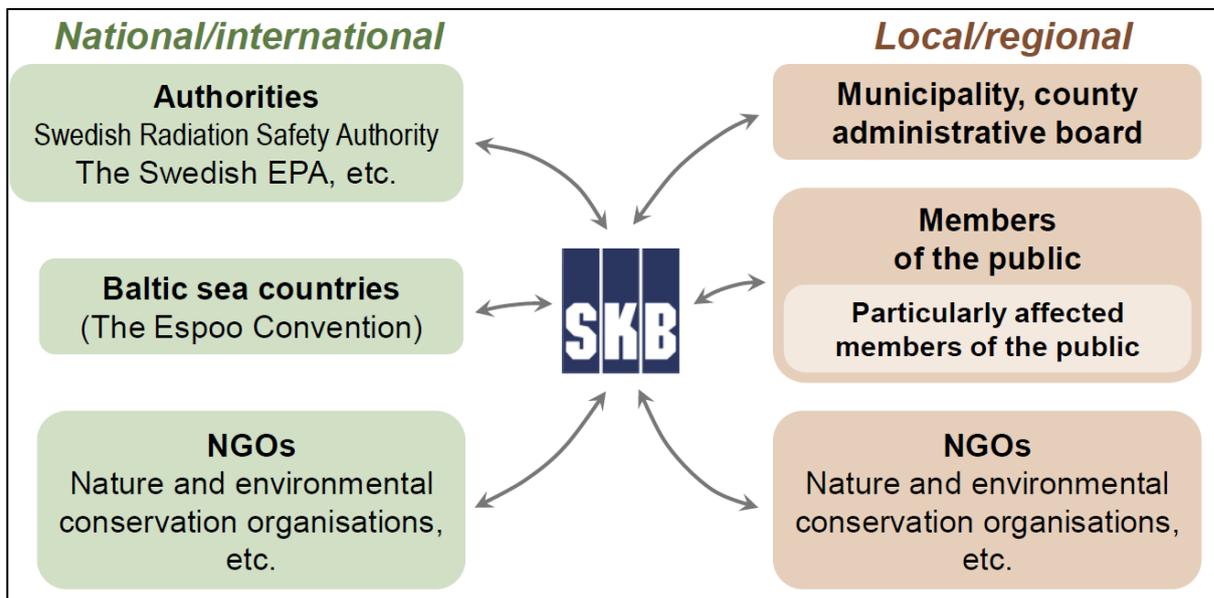


Figure 8: SKB's various interactions at local and national levels

In line with this requirement, SKB held a consistent consultation process that lasted about 10 years [72]. Based upon four public surveys undertaken during the process, there was a notable improvement in public attitude as the siting process progressed, in both public risk perception and policy attitudes, following the intense programme of information provision by SKB. Support in favour of implementation of a repository by the

¹⁹ See Footnote 5 for further information on the Espoo Convention.

end of the process (2009) was around 80%, from a 2003 position of 65% in favour. The increased support was believed to be due to the public being able to see that SKB were responsible and transparent, with trust following on from this. The Local Competence Building and Environmental Impact Assessment Project "LOK" was considered to have a large influence in this process, as were the seven associated principles proposed by the municipality [73], which SKB fully adopted [60]. Much of the approach was based on Slovic's *Perception of Risk* [74]²⁰, where the engagement process sought to understand what the balance of risk and benefits for that particular community was, prompting comparisons between the situation in the USA and Western Europe and the suitability of methods employed stateside to the situation in Europe. Key findings cited by SKB [72] were:

- The siting process shall be transparent and based on voluntary participation;
- Consistent and comprehensible dialogue are important;
- Division of responsibility is important – *"the implementing party cannot pretend to be a neutral player, and it is therefore important that another player adopts this role"*²¹;
- Afford the process enough time;
- Implement a step-wise and adaptive approach to implementation – including changes or improvements;
- Performance of operating facilities and of R&D work is of utmost importance to demonstrate that the issue at hand will be handled with appropriate skill (the public must have faith in the competence of the nuclear sector).

On 3 June 2009, SKB selected the Forsmark site (an existing NPP site) as the location for the repository [75]. The Swedish Radiation Safety Authority (SSM)²² gave its approval of SKB's application for the repository at Forsmark in June 2016 [76]. The Land and Environmental Court is due to send a Final Assessment to the Swedish Government in 2017 [77].

SKB presents an interesting case study for NUGENIA given how it presented its ownership by the Swedish utilities. The public would find it difficult to see SKB as independent (or indifferent) due to its ownership, but SKB's approach was to acknowledge that they had a vested interest in the success of the project and proceed on that basis. The division of responsibility was clear throughout the process, with local and national NGO's providing the neutral role (those with no pre-conceived interest in whether the project goes ahead or not). The JPCSAG needs to be aware of how its function and membership could be viewed by the public, especially if it were entirely populated with industry representatives, and should therefore include multiple NGO representatives to provide a level of neutrality, and in turn give the public confidence that their views are being fairly represented and given appropriate consideration.

2.3.2. Finland

The progress in implementation of a repository in Finland has been facilitated by a series of legislative acts. In 1983, a radioactive waste management strategy was clearly defined alongside a timetable for implementation. In 1994 the export of radioactive waste was forbidden and so deep geological disposal became the only real option to manage

²⁰ Slovic attempts to improve the "communication of risk information among lay people, technical experts, and decision makers" through assuring that those involved with health and safety disciplines have an understanding for how people interpret and respond to risk.

²¹ In SKB's case, local and national NGO's provided the "neutral" role.

²² In Swedish; Strålsäkerhetsmyndigheten.

radioactive waste. An Environmental Impact Assessment (EIA) was set as a mandatory condition for approval of the proposed disposal project. Between 1997 and 1999 a widespread participatory EIA was organised that aimed to develop public acceptance of the project based upon the Swedish model (described previously). Public support had originally been mostly negative in a number of municipalities; for example, in Eurajoki in 1992, 49% of local inhabitants were against the siting whilst 41% were in favour of siting of a disposal facility [78]. Simultaneous negotiations were occurring with the municipality on economic compensation. The Eurajoki municipal council approved the Onkalo repository project in 2000, with the completed repository anticipated to be operational in 2020. The process has evidently produced the outcome desired by Posiva (the Finnish company responsible for the disposal facility), however some independent academics that reviewed the process are concerned that there was an absence of “true debate” about the risks and drawbacks of the project [64][79].

The repository is currently on track to be implemented as planned, with final disposal beginning in 2020, but issues in Sweden around the longevity of the KBS-3 storage method [80], centring around the role of oxygen-free water in the corrosion rate of the copper waste housing, may threaten the current schedule.

2.3.3. France

When the proposed sites for a repository were revealed in the late 1980s, the French Government experienced intense local opposition at each site and were forced to declare a one-year moratorium in order to begin broad-spectrum consultations [64]. As a result of this, a law was introduced in 1991 that required a 15-year period of research on the three available disposal options; geological disposal, near surface disposal and, partitioning and transmutation. This law additionally introduced the concept of reversibility – that waste should be able to be retrieved from whatever disposal solution was selected, and the requirement for an Underground Research Laboratory (URL) was stipulated [81]. Achievements during the 15 years of research that followed include “organisation of the support to local development”²³ [82] and the arrangement of “information and evaluation”²⁴ at the national and local levels [83]. Despite this more public-oriented approach, the village of Bure became the only candidate in the search to find a site to host the new disposal facility.

In 2006 another law was passed that stated “reversible geological disposal” as the preferred option, combining the results of consultation that had come before with results from the Underground Research Laboratory (URL)²⁵. However, this was succeeded by a public debate that was subsequently described as a “difficult and arguably failed public consultation” [64] in 2013, where the outcome was to slow down timescales and plan to construct an industrial pilot in 2025 to test the technical solution. It is likely the project will go ahead, assuming technical success, despite some local and national resistance – noting the previously widespread public and political support. The “organisation of

²³ For example, Andra is contributing to local public-interest groups Objectif Meuse and GIP Haute-Marne. See [82] for more information.

²⁴ For example, a public information campaign was organised by local CLIS, and Andra has its own public information programme. See [83] for more information.

²⁵ The concept of reversibility – the idea that waste can be retrieved from a repository in case of emergency – was first included in the 1991 Waste Act, the URL was licensed in 1999 and tasked with studying the feasibility of reversible geological disposal (specifically in Collovo-Oxfordian clay). Part of the project plan for the deep geological repository included public consultations, which were held in 2012-13.

(economic) support to local development” has been a driving factor in discussion thus far, as the Bure region has been in economic decline since the 1970s.

2.3.4. Czech Republic

Following the breakup of Czechoslovakia and the cancellation of plans to dispose of spent nuclear fuels in the previously united territories (and ultimately to ship waste to the USSR), the Czech Government found itself in a position where it was required to seriously consider permanent domestic disposal options. In 1992, attempts to identify potential sites began; but with no nuclear law to govern waste siting procedures, existing mining legislation was used to justify site investigations under a “Council of Six” [60] arrangement²⁶. In 1997, the Czech Government passed the Atomic Act following pressure from the EU and IAEA, and created the Radioactive Waste Repository Authority (RAWRA) that was to be responsible for all nuclear waste in the Czech Republic. In creating RAWRA, there was no longer a need for the Council of Six to continue its oversight and responsibility fell solely to RAWRA.

RAWRA, having been created in June 1997, restarted the siting process from the beginning that same summer after deciding that the criteria used in previously narrowing down the potential disposal sites from 32 to 8 were not sufficiently robust. RAWRA attempted to complete the study in six years. During this time, the public began to question RAWRA’s commitment to finding a suitably safe solution and widely rejected the repository proposals. Consequently, the Czech Government imposed a five-year moratorium on the repository project.

The Czechs had tried to implement the Swedish method, but ultimately failed. Dawson and Darst, academics from Connecticut College and University of Massachusetts respectively, [60] attribute this to the developing nature of the institutions in the Czech Republic at the time, as well as a lack of “pre-existing and reciprocal trust” as a young democracy coming out of communist rule. The short timeframe in which RAWRA tried to narrow down the prospective number of sites also had a large impact, and the long-term nature of the build meant the economic benefit appeared to be a long way off for the municipalities.

2.3.5. Summary

In summary, the public was initially opposed to hosting a repository in each of the countries discussed as examples, which has confirmed the requirement for, and adoption of, dialogue and deliberative participatory processes. Openness in terms of both inputs and outputs was described as key for success (see Lehtonen [64]), and the favourability of concepts of reversibility or commitment depended upon the attitude of the public towards the Government. Notably, reversibility may be more about the possibility to retrieve waste in the event of an accident or similar, rather than being specifically about extracting the waste from the repository (commitment). Additionally, R&D and knowledge production require oversight to facilitate trust throughout the whole process. If the public are confident that the information they are given is accurate, it will better

²⁶ The Council of six was established to oversee preparations for the new facility. Key ministries from the Czech Government were included, as well as representatives from the State Office for Nuclear Safety (SUBJ), the Czech Power Company (CEZ) and the Nuclear Research Institute (NRI).

serve the process of reaching an informed decision. To that end, the public need to feel that they have sufficient information and briefings to feel competent to discuss various topics.

Whilst Finland has certainly made the most progress, the method adopted isn't necessarily the best, as a range of approaches to engagement and participation may be required, together with an understanding of communities and their values and local culture. France's engagement demanded a high level of transparency due to the mistrust held by the public; this was not the case in Finland as the Finns hold their authorities in high regard. Sweden appeared to have a high level of transparency in their process, though evidence of SKB "silencing" researchers that were critical of the KBS method has been raised by several authors (see section on Finland for reference to issues with the KBS-3 method). Essentially, there is a significant dependency on the locale; cultural issues dictate various aspects of the engagement strategy.

Public engagement is ultimately about providing sufficient information for the public to make their own judgement and decision, that is, "real engagement is about so much more than providing the correct answer" [84], which is a crucial distinction to make before any engagement occurs. Commitment and honesty are a precursor to trust. The picture in the UK reflects this statement, as does the picture in the EU, though some "newer" states are still finding their own political certainty.

It is important that NUGENIA is cognisant of the situation across Europe, and emerging local themes. The JPCSAG will need to represent the member states and to have a good appreciation of cultural and local issues within each state.

2.4. Public engagement with nuclear outside the EU and UK

This section of the report highlights a few worldwide activities that are relevant to the current situation in the UK and Europe. These recent examples highlight key learning for the JPCSAG.

2.4.1. Evaluating public consultation in nuclear energy: The importance of problem structuring and scales (2014)

University of Regina (Canada)

The academic authors submit that an engagement process based on "one process, one question and one time frame" is not suitable for nuclear public engagement [85]. A review was undertaken across the entire uranium value chain looking at previous public consultation activities in Saskatchewan which has a large Uranium mining industry. Deficiencies were found in the approaches to process, question and time frame; in particular, the importance of identifying what the public want to talk about (i.e. their concerns), and bottom up (fully inclusive) and interactive engagement were highlighted. Further, an "ideal model" of public participation of "iterative, longer term consultation" is proposed by the authors for future engagement activities.

2.4.2. *Communicating Nuclear: Balancing risk with opportunity (2012)*

University of Western Ontario (Canada)

The Canadian Nuclear Association (CNA) has a key strategic priority on stakeholder engagement and communications [86]. The CNA built its 2010-2015 strategic plan on "Dialogue for understanding and growth" and utilised a mental modelling approach²⁷ to understand the issues the industry is facing. Mental modelling is a method of explaining an individual's thought process on a particular topic, in this case nuclear energy. Mental modelling was described by Jay Wright Forrester as "the image of the world around us, which we carry in our head, is just a model. Nobody in his head imagines all the world, government or country. He has only selected concepts, and relationships between them, and uses those to represent the real system". CNA used several "waves" of mental model to understand what aspects of nuclear the Canadian public were concerned about. Mental modelling was seen as "pivotal in jump-starting the dialogue", enabling engagement with stakeholders to identify their priorities and preferences. Key messages from the engagement process identified the following values; transparency, respect, honesty, excellence, leadership, insight, continuity and accountability.

2.4.3. *South Korea: The spent nuclear fuel storage dilemma (2015)*

The authors (from the International Panel on Fissile Materials and Institute for Peace and Cooperation) conducted a telephone survey of 2000 residents in regions that were host to nuclear power plants, measuring the effect of education (through the distribution of "nonpartisan scientific information") on public opinion and found that those residents had significant concerns about safety of the plants, mainly relating to "corruption scandals" regarding replacement parts and operational safety problems, but little knowledge of nuclear power or radioactive waste [87]. The authors followed up with a series of lectures to selected focus groups that comprised of respondents from the initial survey. Whilst not statistically significant, the authors noted marked benefits in the support of expanding spent fuel stores. The authors concluded that the failure to implement a long-term storage solution for radioactive waste in South Korea has been due to a lack of consultation with local communities, along with a widespread belief that nuclear power plants and storage are not safe.

2.4.4. *International Learning*

The first example of Canadian experience suggests that approaches to public engagement need to be varied (aligning with European expectations of incorporating the local aspect) and also sufficiently long term consultation is required (reinforcing the findings in Sweden).

The second example of Canadian experience and the South Korean example, provide positive and negative examples of forward looking appreciation for public understanding, respectively. In the South Korean case, a failure to find a long-term solution for radioactive waste was seen to be due to a lack of consultation with local communities. In the Canadian case, the CNA was proactive in engaging with the public to address their concerns and engage in dialogue.

The JPCSAG should recognise the need for forward looking, long term, and stable engagement.

²⁷ Approach developed by Dr B Fischhoff and at Carnegie Mellon University.

3. Review and Summary of NNL Work in 2016

Section 3 of this report provides details of relevant work streams being carried out in 2016 by NNL, other UK nuclear organisations, and UK research institutions. NNL have formed a capability in public engagement on nuclear energy issues led by Dr Colette Grundy, NNL Laboratory Fellow and directed by Professor Andrew Sherry, NNL Chief Scientist who formerly led the Dalton Nuclear Institute at the University of Manchester. The capability builds on the work undertaken by Adrian Bull, NNL External Relations Director, and Professor Andrew Sherry, in leading the UK Nuclear Industry Council work stream on 'Public Understanding of Nuclear Energy'. It also builds on Dr Colette Grundy's experience as a member of the Independent Oversight Group (IOG) for the 2015 Generic Design Assessment Pilot Public Dialogue study led by the UK Nuclear Regulators (EA, ONR and NRW) for the Advanced Boiling Water Reactors (ABWR) proposed at Wylfa, on the Island of Anglesey in Wales and Oldbury in England [45]. A study on the GDA pilot dialogue was published in 2016 in a special edition of the Journal for Radiological Protection [88], written by Dr Grundy, Annabelle Lillycrop (Environment Agency), Dr John Whitton, and Post-Doctoral Research Associate, PDRA Ioan Parry.

Colette is leading an NNL funded strategic project on public engagement under the direction of Professor Andrew Sherry, which includes the work elements discussed in Sections 3.1, 3.2 and 3.4. The aim of this project is to carry out research to contribute to public understanding on nuclear energy issues. It includes a series of work streams based on implementation of the Nuclear Energy and Society Concordat for Public Engagement, the development of guidance documents and a nuclear narrative to accompany the Concordat, and a public dialogue study to inform the further development of the Concordat and its implementation.

3.1. Nuclear energy and society Concordat for public engagement and Public Dialogue Study

NNL has undertaken a study in partnership with the Welsh Government and Sellafield Ltd to carry out a public dialogue exercise for the Nuclear Energy and Society Concordat for Public Engagement. The overall aim was to test the principles in the Concordat with members of the public from both nuclear and non- nuclear communities. The principles in the Concordat were developed by members of the Nuclear Industry Council and this was an opportunity to ask the public for their feedback on the principles, and to ask if there should be any changes to the principles, and whether there is anything missing and that should be added to the principles.

The objectives of the dialogue study were:

1. To inform and if needed, update the Concordat through public dialogue;
2. To gain and use insights into public expectations of how public engagement might be demonstrated;
3. To identify, and where appropriate take account of, the implications of implementing the Concordat within the nuclear sector and test how such measures align with public expectations;
4. To understand and take account of what is regarded by members of the public as respectful methods of engagement;

5. To work with participants to determine how public views can best be accommodated within any public engagement learning and review process.

Two rounds of workshops took place in England and Wales, one at a location close to a nuclear site (Barrow-in Furness) and the other located in a non-nuclear community (Wrexham). The overall aim of the dialogue workshops was to engage with the public through two-way discussion to inform the further development of the Concordat and its implementation. The dialogue process tested the expectations created by, and practicability of the Concordat statements by identifying and taking into account the views and concerns of the public expressed in the workshops. The dialogue discussions will be used to inform and update the Concordat and supporting materials, as well as provide recommendations for the JPCSAG terms of reference.

The strategic project launched in 2015 and the dialogue study workshops were held in May and July 2016. Preliminary findings from the round 1 workshops indicate that the Concordat principles and supporting text aligns with a number of the factors considered by participants as 'impressive communication', such as being honest, transparent and using two-way communication [89]. The Concordat principles were purposely not specifically discussed in the first workshops. Instead, the public were asked what they believed were important values for the nuclear industry in its communications. These expectations aligned with the Concordat principles. The public's views also highlight challenges that the nuclear industry faces such as association with disaster, nuclear weapons and the low profile of nuclear power as an energy source. At the same time, the dialogue study provides insight into methods that members of the public believe the nuclear industry could use effectively to overcome these barriers. For example, empowering the nuclear workforce as effective communicators and providing trustworthy sources of information.

The round 2 workshops explored the individual Concordat principles in more depth in discussion with members of the public, and preliminary findings indicate the participants believe there is nothing "wrong" with the Concordat principles, and that they would be mutually beneficial to industry and the public. There were a number of recommendations made by the public that highlighted where the principles could be built upon and made more complete. These recommendations focused on the amount of public engagement that will be carried out, the importance of making industry messages personal, providing proof of industry improvements, independent regulation for enforcing the principles and rebranding the principles as 'commitments'. It is planned that the recommendations and learning from the dialogue study will be reviewed by NNL and its partners at a meeting in October 2016 in order to agree a forward plan. A report on the complete findings from the dialogue study is expected to be published in late 2016²⁸. The nuclear industry should act on the feedback from the public to demonstrate that the sector takes society's views on nuclear energy seriously. It is anticipated that the Concordat will be revised with feedback and recommendations from the public to create a document that reflects public expectations.

In addition to the Concordat dialogue study, NNL is also leading and/or involved in a series of Concordat implementation activities. Two Concordat guidance documents are currently under development: one for the nuclear industry communications professionals and another for the workforce, or 'Informal Engagers'. The guidance documents will provide advice and ideas to communications professionals who will be responsible to implement the Concordat principles across their organisation. Guidance for the informal engagers will provide individuals with advice on how to talk about their job and the

²⁸ These results are expected to be published on the NNL website; www.nnl.co.uk

nuclear sector with friends, family, colleagues and strangers, to ensure clear and consistent two-way dialogue is used. These guidance documents are being developed by NNL in collaboration with a working group of the NIA's External Relations Steering Group, in which NNL plays an active role.

NNL will also be leading on the development of Concordat communication materials and the current plan is for a website to be hosted by the NIA. The NIA website will also be a platform for press releases on news of the Concordat; it has already been the host of an article on the launch of the Concordat [50]. Additionally, NNL will host information on its website, and other platforms have been explored for dissemination and communications, such as the World Nuclear News (WNN) website, which has also hosted an article on the launch of the Concordat [51].

To complement the Concordat, a 'nuclear narrative' is currently being produced by NNL and the NIC member organisations, which will provide the nuclear workforce with a series of industry positions that can be used for both formal and informal discussion with the public. This narrative must be engaging and factually accurate, and will focus on the benefits of nuclear energy. Some sample messages for the narrative are contained in the NIC's high-level strategy for public engagement [49], and include topics such as energy security, clean energy, economic growth, affordability and safety. The nuclear narrative will be published with the Concordat guidance and will be available in a 'Public Engagement Pack' that also includes the Concordat, guidance documents, and any other materials that the NIC consider should be included. This may include the NIA's 'Nuclear Factbook' – a concise collection of facts and figures relevant to common lines of discussion of nuclear topics [9], or the WNA's Hot Topics [53].

As part of NNL's strategic project on public engagement on nuclear energy issues, there are other areas of research planned, which will be carried out together with NIC's Communications Group and NIA's External Relations Steering Group (also includes members from the nuclear industry's professional and trade unions, and academics). The engagement activities with NIA, NIC and academia will aim to share learning and develop good practice. This will be achieved through the links and collaborations that NNL has with the various academic research groups noted in Section 3.4 and Appendix 2 of this report.

3.2. *Extension of NUGENIA+ Deliverable D2.7 "Establishment of the joint political and civil society advisory group"*

In January 2016, NNL proposed a number of further work packages under the NUGENIA+ deliverable D2.7, which were accepted and are due for completion by September 2016. These work packages are:

- WP1: Testing the outworking of Concordat Principles in Europe;
- WP2: Development of a European Toolkit involving guidance material on the Concordat, and the Nuclear Narrative;
- WP3: Optioneering study into the hosting and dissemination of the European Toolkit.

Through this project, NNL have been working with a number of organisations in Finland, France and Germany to develop an 'EU Nuclear Public Engagement Toolkit' based on the UK's Concordat and supporting materials. The Toolkit [66] is designed for use by European nations and includes guidance on how to adapt the Concordat and supporting materials to their own country's context.

NNL believes that these work packages will be of benefit to the wider European community, as the work undertaken by the NIC and NNL on the Concordat for public engagement is understood to be a stepping-stone towards enhancing European harmonisation on nuclear matters, recognising the importance of public engagement and building trust (as included in the Aarhus Convention).

3.3. Radioactive waste management

It is UK government policy to dispose of the UK's higher activity radioactive waste in an underground Geological Disposal Facility (GDF). It was noted in Section 2.1 (Table 1) of this report that Nirex had a proposal for a GDF rejected in 1997. One of the recommendations following this failed proposal was that any future programmes should adopt a consensus-building approach, in order to build trust and enable the public to provide input into the project. In January 2013, the UK's second attempt at progressing the GDF programme came to a halt, as the plans to look for a site for the GDF were rejected by Cumbria County Council. Cumbria was the only region remaining at this stage of the new consensus-building approach, after volunteering as a GDF host region, and had been formally involved in the process for four years.

In July 2014, after almost eighteen months of consultation, the UK Government published a White Paper [43] setting out a revised process for the siting of a GDF for radioactive waste. In order to support the implementation of this policy, Radioactive Waste Management Ltd (RWM), whose mission is to deliver the GDF, were asked to conduct a screening exercise that will improve the information available to communities on the geological attributes that may influence the siting of a GDF in the UK. As part of this process, RWM will work with regulators, CoRWM, industrial and academic experts, and the public.

In April 2016, RWM published guidance [90] on how information on the geology of England, Wales and Northern Ireland should be assembled and presented to the public. The screening exercise will involve engaging with the public through open events, a regularly updated website, email updates and through public consultation. It is anticipated that application of the guidance will result in authoritative, national-scale narratives and supporting maps presented for thirteen regions of England, Wales and Northern Ireland. This approach of inclusivity and engagement may be appropriate for inclusion in the terms of reference for the JPCSAG.

In April 2016, RWM also published a review of literature on the societal aspects of geological disposal, and NNL's Chief Scientist, Professor Andrew Sherry, conducted a peer review of this study [91]. The findings of the report take into account aspects such as early engagement, open dialogue, utilising different methods of engagement with different groups within communities, acknowledging the importance of both intra-generational and inter-generational equity, and confidence and trust building based on transparency and greater honesty. These findings align with the understanding presented in this report, as well as from other sources cited herein.

RWM participate in the Forum on Stakeholder Confidence (FSC), which is an OECD body (Organisation for Economic Co-operation and Development) hosted by the Nuclear Energy Agency (NEA) website. The FSC was established in 2000 and is foremost an organisation for learning about radioactive waste management and decision-making. FSC aims to foster learning about stakeholder dialogue and ways to develop shared confidence, consent and approval of management solutions. Sixteen countries from around the world are represented on the forum, and together they explore means of ensuring effective dialogue with the public and consider ways to strengthen confidence in decision-making processes. There are a range of FSC studies and reports available on the NEA website [92].

The European Commission's Directorate General for Energy, DG-ENER, and the Joint Research Centre (JRC) jointly host a platform of knowledge and information to support public participation in the implementation of energy policies, The Energy – Transparency Centre of Knowledge, E-TRACK. The first project is in the area of radioactive waste management, E-TRACK RWM and this platform allows governments and stakeholders in radioactive waste management to learn from each other by exchanging experience and lessons learned to ease the challenges of public participation [93]²⁹.

3.4. Academic research

Historically, academic studies on engaging the public with nuclear issues have been disparate, with relatively few academic groups focusing on this and associated areas for a sustained period of time. NNL has formed strategic partnerships with a number of academic groups in the UK who are currently carrying out research on engaging the public with nuclear issues. NNL is in the process of building a partnership with the National Co-ordinating Centre for Public Engagement, which is co-hosted by the University of Bristol and the University of the West of England (UWE). This section will provide a short summary of relevant academic groups and projects where NNL already have, or are in the process of developing, strategic links.

3.4.1. University of Central Lancashire – Dr John Whitton, Head of UCLan Energy

Dr John Whitton is a former NNL employee who was previously supervised in his BNFL/NNL PhD "Stakeholder Engagement and Decision Making in the Nuclear Industry" at the University of Manchester by NNL's Dr Colette Grundy. Dr Whitton now leads the University of Central Lancashire, UCLan Energy and Society research group. Over the past 5 years, NNL have provided funding and Dr Colette Grundy has supervised two case award PhD students at UCLan Energy and Society. These include Ioan Parry whose PhD addressed the representation of social sustainability within decision-making frameworks. The work comprised of two parts, 1) Defining sustainability criteria for decision-making and 2) the measurement/representation of criteria within decision-making frameworks. Ioan's PhD was completed in March 2016 and focused on the proposed new build project on Anglesey at Wylfa and the development of sustainability criteria based on discussions with local stakeholders. John Riley is Dr Grundy's second PhD student in the UCLan Energy and Society research group and John's research is focused on the GDA and its novel aspects including public engagement. In her role as a member of the Independent

²⁹ Further information can be obtained by emailing JRC-IET-ETRACK@ec.europa.eu.

Oversight Group working with the nuclear regulators for the pilot public dialogue study for the ABWR, Dr Grundy proposed and received endorsement for the involvement of her academic students, Ioan Parry and John Riley at UCLan Energy and for the ABWR proposed at Wylfa in Wales and Oldbury in England. As a result of Colette's engagement both her students were actively engaged in this public dialogue project with support from the IOG and the nuclear regulators. This report for this dialogue study is referenced later in Section 4.1.1.

The NNL strategic project for public engagement has incorporated a 2 year post-doctoral research post for Ioan Parry of UCLan's Nuclear Energy and Society research group, which includes his participation in NNL's public dialogue workshops on the Concordat, and dissemination of his knowledge and learning from the HoNESt project to NNL. Ioan is supervised in this role by NNL's Dr Colette Grundy. Ioan has also recently taken part in the work undertaken to produce the NUGENIA toolkit report having participated in the stakeholder meetings in Finland for this project. Dr Whitton's group was recently successful in receiving a Horizon 2020 research grant to work on a multi-disciplinary project, "History of Nuclear Energy and Society - HoNESt", which involves collaborating with 23 academic partner institutions across the EU. The programme was launched on September 1st 2015 and will be the first ever comprehensive comparative and transnational analysis of nuclear developments and their relations with society to cover 20 countries, ultimately aiming to help improve communication and interaction with civil society for the benefit of all public and private stakeholders concerned [94]. Dr Whitton's group are leading the social science and engagement section of this extensive programme for the UK, and NNL will have access to the findings and learning to help inform UK nuclear organisations' public engagement strategy. NNL are engaging with the Science Museum in London³⁰, who are also collaborating on the HoNESt project, where NNL have been asked to provide information about the UK nuclear industry and NNL members of staff have been interviewed as part of the research..

3.4.2. Liverpool University – Professor Bruno Merk, NNL Visiting Professor

Professor Bruno Merk has extensive experience in nuclear systems and methods in physics for nuclear reactor operation design, analysis, and safety. One area of work that he has recently entered into is the communication of complex problems to the public³¹. He is a member of the academic editorial board of PLOS ONE [95] and has been a member of the scientific editorial board of the HZDR Research Magazine "Discovered" [96] to communicate scientific results to the public.

Petra Mlejnkova is an NNL PhD research student and her work focuses on the strategic risk communication of nuclear projects. The main focus of her PhD project is Small Modular Reactors (SMRs) and their replacement of coal-fired power plants. The risks for SMRs that differ from risks associated with large nuclear power plants will be examined and a way of effectively communicating the risks to the public needs to be established. Before a risk communication strategy can be determined, public opinion on SMRs needs to be examined. After possibilities of SMR deployment are established, public engagement issues associated with possible deployment will be outlined and investigated.

³⁰ The Science Museum's role in the HoNESt project is to analyse the British experience of nuclear power in the European perspective in the years 1945-2010, using archives and interviews..

³¹ This is not specific to nuclear topics.

3.4.3. Sheffield University – Dr Susan Molyneux-Hodgson, Senior Lecturer in Sociology

Susan co-founded and is director of the “Science and Technology in Society” group at the University of Sheffield. Her work is focused on three main areas, which includes the sociology of scientific communities, science and society relations, and interdisciplinary collaboration. Having started in January 2016, Susan is leading a ‘Nuclear Futures’ seminar series [97] which will span over two and a half years, and aims to bring social scientists, engineers, policy-makers and industrial representatives together to discuss key thinking around radioactive waste management in the UK. The seminar series will comprise of the following seven topics, which NNL have been invited to participate in, and are of direct relevance to public engagement practice:

1. Understanding the socio-technical dimensions of nuclear;
2. Socio-technical dimensions of the geological;
3. Publics and the practices of participation;
4. Making waste knowledge: building trust;
5. Disposal cultures;
6. Planning and siting infrastructure;
7. Nuclear imaginations and entanglements.

Output will include academic talks and papers; policy briefings; reports and designs for engagement activities.

3.4.4. Sheffield University – Professor Neil Hyatt, Professor of Nuclear Materials Chemistry, and Dr Claire Corkhill, Department of Materials Science and Engineering

Neil and Claire represent Sheffield University in a multi-million pound four-year research programme DISTINCTIVE [98], that combines the expertise of the nuclear industry with ten universities to focus on some of the key challenges of the industry, with NNL, the NDA and Sellafield Ltd involved as industrial collaborators. NNL met with a Neil and Claire in February 2016 to discuss public understanding of nuclear issues, and the research that both parties are carrying out in this area.

3.4.5. The National Co-ordinating Centre for Public Engagement (NCCPE)

The NCCPE was established as part of the Beacons for Public Engagement initiative in 2008 to work with universities across the UK to embed public engagement³². It also plays a key role in sharing experiences and learning of public engagement among higher education institutions. The NCCPE host an annual conference, ‘Engage’, which NNL attended in December 2015. Attendance at this conference allowed NNL to learn about the work that UK universities are undertaking to embed public engagement across their institution, and to understand further the role that the NCCPE plays. Following the conference, NNL have held further discussions with the NCCPE and NCCPE were invited by NNL and presented its work to a meeting of the Nuclear Industry Council in May 2016.

³² It is currently hosted between the University of Bristol and the University of West England in the Arnolfini Centre, Bristol and is funded by the four UK Funding Councils, Research Councils UK and the Wellcome Trust.

NNL and NCCPE held discussions to look at areas for collaboration, including: adaptation of the NCCPE EDGE Self-Assessment Tool³³ for use in the nuclear industry, opportunities to share public engagement experience and learning between industry and academia, and possible incorporation of the NCCPE public engagement watermark into the nuclear industry (see Section 4.6.2).

³³ The Embryonic, Developing, Gripping and Embedded (EDGE) Tool is intended as a method of self-assessment in public engagement support. Based upon the findings of the Beacons for Public Engagement initiative, the tool presents nine focal points for consideration, detailing the expected level of commitment at each of the EDGE levels. Institutions are able to use the tool to develop internal objectives and progress against the criteria. The tool is available for free at:
https://www.publicengagement.ac.uk/sites/default/files/publication/the_edge_tool.pdf

4. Review of Public Engagement in the Energy Industry and UK Universities

This section of the report describes the outcomes of several key UK and EU public engagement studies. It first discusses recent events in UK nuclear engagement, highlighting key learning, before comparing this with other forms of energy engagement. A brief summary of some of the work being undertaken in Europe is then presented, with specific analysis performed to inform terms of reference for the JPCSAG.

4.1. UK nuclear sector

4.1.1. Generic Design Assessment (GDA)

As a follow up to the 2006 Energy Report [38], the GDA process (introduced in Table 1) was developed in the UK as a new pre-licensing approach for the assessment of new nuclear reactor designs. This assessment covers a broad range of technical and safety aspects, as well as aspects of public engagement. John Riley, an NNL funded PhD student at UCLan, is researching the novel aspects of the GDA process, under the supervision of Dr Colette Grundy.

The GDA assessment process is being undertaken on the GE-Hitachi UK Advanced Boiling Water Reactor (UK ABWR) at present, which is due to be built at the Wylfa and Oldbury sites in Wales and England respectively. The GDA process for this reactor is expected to be completed by regulators during 2017. A pilot public dialogue study new nuclear power stations: Improving public involvement in reactor design assessments' took place between October 2014 and August 2015'.

The dialogue study was commissioned by the Environment Agency, Office for Nuclear Regulation and Natural Resources Wales, and was delivered by a dialogue specialist company, 3KQ [99]. The study focussed on five key objectives [45]:

1. Inform the Environment Agency (EA), Office for Nuclear Regulation (ONR) and Natural Resources Wales (NRW) on current and future public engagement, and EA and NRW's consultation approach to GDA;
2. Identify approaches that will address issues and barriers to sharing complex technical information on the GDA with members of the public;
3. Develop and pilot materials on the GDA that are accessible to the public;
4. Identify potential public engagement process options for the GDA;
5. Help the nuclear regulators to pilot an effective public engagement and assess the EA's and NRW's consultation approach, during the current assessment of Hitachi-GE's UK Advanced Boiling Water Reactor (UK ABWR).

The report discussed several concepts that were found to be key to achieving the above objectives and engendering a positive public engagement experience. These concepts are; why involve, who to involve, how to involve people, language barriers³⁴, the need

³⁴ This referred to the English/Welsh language barrier between English speaking workshop facilitators and Welsh speaking members of the public.

for context, desire for detail, engagement as a story (and not as an isolated chapter), trust and confidence in regulators and reduction of barriers to engagement. To further distil these concepts for the benefit of the JPCSAG;

- **aims** of engagement (context and intent), i.e. why engagement is happening, what the intended outcome of the engagement process is, and what follow up there will be
- **organisation** of the engagement in order to ensure proper representation of stakeholders and achievement of the above aims
- **communication** of concepts in terms of language and appropriate detail
- **trust** – familiarisation (knowledge and face-to-face interaction) was found to be an important factor in trust building

These points are relevant to the role of the JPCSAG and are discussed in Section 8.

An independent evaluation report [46] commissioned by Sciencewise [100] agreed with the above points, and also found that the GDA dialogue process was "largely successful" in achieving its objectives, though noted that progress with respect to objective 3 above was not as advanced. The report additionally found that:

"The language, tone and style of engagement need to be closely aligned with the needs of the public. There is a distinct difference between the style and language of internal organisational conversations to that which is needed when working with the public. For example the term 'generic' (the G in GDA) was freely used and yet was largely found to be confusing by the public."

"More and better use of infographics was widely supported."

"Face to face contact as part of the consultation is the best way to build trust and respect. Where this is not possible there needs to be consideration as to how communications and information can demonstrate the integrity of the process and the desire of regulators to respect the needs and opinions of the public."

"The consultation needs to provide clearly signposted opportunities for the public to ask questions and seek additional information and clarification."

"The careful design and management of information, considering how it is communicated, explaining the opportunities to comment and participate, how feedback will be used and how to see its influence on GDA will help to build trust in and manage the understanding of the parameters of influence."

"The consultation team must be committed to and enthusiastic about the benefits of public engagement and excellent communicators."

"There is a need for the public to be aware of the 'bigger picture', where GDA fits into this and the scope and opportunity for dialogue and consultation at key points."

The above conclusions from the Sciencewise commissioned report are relevant to how the JPCSAG will interpret and respond to public opinion and is discussed in Section 8.

4.1.2. Geological Disposal Facility (GDF)

The Geological Disposal Facility (GDF) is the UK's preferred method for high-level radioactive waste disposal. The concept is similar to those seen in other countries – including Sweden and Finland. The siting process for the GDF was laid out in the Government's 2008 Managing Radioactive Waste Safely (MRWS) White Paper [40] (and was later developed by the 2014 Implementing Geological Disposal White Paper [43]).

Following the MRWS White Paper, the West Cumbria Managing Radioactive Waste Safely Partnership (referred to hereafter as 'the Partnership')³⁵ began a discussion on the effects of hosting a GDF. The purpose of this discussion was to inform the county council (Cumbria County Council) and two borough councils (Allerdale and Copeland Borough Councils) of the opinion of the public and organisations of West Cumbria, who were required by the MRWS process to vote on the inclusion of the county in consideration for hosting the repository.

The Partnership produced a public consultation document titled 'Geological Disposal of Radioactive Waste in West Cumbria?' [101], designed to inform the public and then seek their judgement on the siting of a GDF. This information was discussed in the Partnership's final report [102]. This report considered the following aspects:

1. Inventory
2. Geology
3. Design and engineering
4. Safety, security, environment and planning
5. Impacts
6. Community benefits package
7. Stages 4 and 5 of the MRWS³⁶
8. Overarching views
9. Public and stakeholder views

Aspects 1 through 7 are site specific and, whilst being extremely important, are not generally applicable to the scope of the JPCSAG, beyond emphasising the importance of tailoring consultation to the locale and noting the breadth and depth of the issues present and functions as an informative example as to the complexity of issues that the JPCSAG may need to manage. Aspects 8 and 9, however, are generally applicable.

Aspect 9 was summarised in that "across Cumbria there are more people in favour of taking part in the search for a suitable site than people who oppose taking part". The

³⁵ The Partnership consists of representatives from 16 separate organisations with interests in developments in West Cumbria. These are primarily councils (borough and city), as well as unions. The county of Cumbria, in the North-West of England, is home to the Sellafield site.

³⁶ Stage 4 relates to desk-based studies in participating areas. Stage 5 relates to more detailed geological investigation on remaining candidates.

figures that were measured using an independently verified opinion survey were 53% in favour of searching for a suitable repository site against 33% who were not. The remainder were neutral or undecided³⁷.

Aspect 8 included views on the following overarching topics; Uncertainty, Trust and Strategic Environmental Assessments (SEA's). Uncertainty focussed on the fact that a "great many things" remained uncertain about the GDF siting specifics as the process was still in its early stages. Trust was a recurring theme throughout the report and was cited as being the "root of many key concerns raised by the public and stakeholders". It was suggested that the use of a legally-binding mechanism may be beneficial in reinforcing trust in Government (for example, by making the Right of Withdrawal from the process a legal right) and in particular, continuing transparent and extensive public and stakeholder engagement.

The MRWS report [102] was considered in the deliberations of the county council and two borough councils. Despite the approval of the two borough councils, the county council voted to withdraw from the process, resulting in an overall decision to withdraw (both the borough and county councils had to agree to progress). In a note to the County Council cabinet [103], 8 key reasons are specified for its decision to withdraw. Several of these reasons echo the results from the Partnership's final report, but it is especially noteworthy that the council lacked confidence in the results of the opinion survey, citing that 70% of those surveyed knew little about the GDF proposal or process. Therefore, the JPCSAG may need to have confidence in that the civil society (public) views being represented are from an appropriately and honestly informed public.

The following is an excerpt from the conclusion of the note and concerns the issue of trust:

*"A key element of the recommended response is that the differences between the proposed process, and the current, are minimal. The County Council's main comments relate to the changes proposed at the local government level. The County do not believe that the current process failed in West Cumbria simply because the decision-making power was shared at both the district and county level. By making the "representative authority" the district council, county councils are side-lined until the focusing phase and then, they would only be granted a seat on the "consultative group" which is subservient to a "steering group" where decisions are taken. **The proposed process is therefore divisive and does not address the key issue of trust.** Within the current process, it was evident that there was a lack of trust in the decision-making process from stakeholders."*

It is therefore apparent that the MRWS process failed due to a lack of trust and inclusivity. This learning is similar to the case in the Czech Republic, where public engagement relating to the siting of new Czech nuclear power stations at Temelin did not adequately include German citizens that may be affected³⁸ [104]. The County Council also noted that progress in Sweden followed from 16 years of "painstaking" public engagement. The UK Government paid attention to these events and issued a call for evidence.

³⁷ The sample size was 4,262 across Allerdale, Copeland and the rest of Cumbria. The total population of Cumbria is about 500,000 according to Allerdale Borough Council.

³⁸ The German argument was that the German public were not included in Czech engagement activities, even though the proposed project could be seen to affect those members of the German public that lived close to the Czech border.

The UK Government issued the call for evidence early in 2013, following the unsuccessful MRWS consultation in West Cumbria (see above and Table 1), requesting public opinion on how the siting process could be improved. The results were published in a report [105], which stated that the siting process could be improved in a number of ways. In short, these improvements related to awareness of the topic, availability of information, clear context and intent of the consultation, continuity, role and rights of communities participating in the consultation, and integration of learning.

Following on from the Review of the Siting Process report above [105], DECC commissioned further research into the dialogue process, to better understand the views on the revised GDF siting process. This research, undertaken by Ipsos MORI in the form of a further dialogue process, resulted in a paper; 'Public Attitudes to the revised Geological Disposal Facility (GDF) Siting Process' (2014) [41]. The three objectives of the dialogue process were:

- Explore and understand the general public's awareness of geological disposal and the MRWS process;
- Obtain feedback on the proposals for improving the current MRWS site selection process for a GDF;
- Enable the public's views to be fed into the development of an improved GDF site selection process.

The results of the dialogue are presented in full in the paper [41], and were summarised as:

- **Awareness and education** – This was a key requirement for nearly all participants; workshop participants felt they initially knew very little (if anything) about radioactive waste and the agreed policy of managing it. They felt that if voluntarism was to succeed then the wider public needed to understand the challenges of managing our radioactive waste, and what the impact of a GDF might be for a community.
- **Transparency and openness** – Participants felt that it was important that Government was open and transparent about the need for a GDF, including what the potential risks could be from implementing it (or not). They wanted the siting process to be run in a similar vein with community representatives sharing the information on the potential impacts of a GDF and taking any decisions in the open.
- **Local** – In all the discussions participants referred back to the importance of ensuring the views of the "local community" and "local people" were heard, even though they generally struggled to define community in relation to a GDF.
- **Fairness** – The participants frequently spoke of fairness and for most this meant ensuring that the process represented and involved everybody in the community. It was generally felt that the process should hear the views of those who opposed a GDF as well as those who supported the facility. Fairness also meant that the information that was presented to the community and its representatives needed to be balanced and impartial.
- **Efficiency** – There was a clear call from participants for the process to be run as efficiently as possible. They were keen to find efficiencies which could lead to cost savings. In particular this principle underpinned responses around the calls for screening and targeting resources on specific communities (if possible) as well as queries around the timeline.

Later in 2014, the UK Government published its 2014 White Paper, 'Implementing Geological Disposal' which set out Government's expectations for the operator (RWM) to continue engaging with the public and identified an ongoing program of work for developing engagement with communities over a period over two years (due to finish in 2016).

To review the above White Paper, and in addition to the 'Public Attitudes to the revised Geological Disposal Facility (GDF) Siting Process' report, the UK Government commissioned an additional study later in 2014 (in collaboration with Sciencewise) to assess how effective the previous dialogues had been, as well as how Government policy was impacted (with specific reference to the 2014 White Paper [43]). This paper, the 'Evaluation of the Engagement Events during the Geological Disposal Facility Siting Review Consultation' report [42], published in January 2015, found that the engagement process had been a "credible and effective piece of public and stakeholder engagement" whilst appropriately handling the management aspects of a broad engagement that was relevant to the GDF siting process. It found that the engagement process had provided a benefit to Government, in terms of educating Government officials, as well as further clarifying the effectiveness and usefulness of public dialogue and "confirming the efficacy" of a particular two-day workshop model. The model featured a pilot event, incentive payments, and a homework task and was delivered through "plain English inputs"³⁹. The report additionally identifies the benefits of affording adequate time for planning dialogue, collaborative approaches to dialogue design and the need for clear communication protocols from the early stages of a dialogue project. Designing any engagement for the purposes of the JPCSAG should be done collaboratively, and it is imperative that communication protocols of the JPCSAG are well established within its terms of reference.

As mentioned above, the 2014 White Paper, 'Implementing Geological Disposal' [43], set out a direction for further development of community engagement processes. Part of this 'direction' included how community engagement would feature in the national geological screening process. RWM commissioned a consultation on the screening process itself [106], such that various stakeholders could provide input⁴⁰.

This consultation took the format of inviting feedback, and then addressing that feedback by grouping it into 'Response Themes' that are "representative of a number of similar responses". RWM then provided a response to that theme in terms of an answer or explanation and also any actions or changes being taken as a result of that theme⁴¹. Providing feedback in this way directly addresses the concerns of stakeholders and provides a direct link to what changes are being made to reflect those concerns (if they are necessary). However, when summarising concerns into broader topics, care should be taken so that the original concern of the stakeholder is not diluted into something that they did not intend. This may be a relevant method for the JPCSAG to address public or political concern. It should be noted that more recent work has been undertaken in 2016 with a consultation on National Geological Screening by Radioactive Waste Management, RWM a government body charged with delivering a GDF for the UK working with communities.

³⁹ In the UK, the concept of "plain English" means communicating in a straightforward and direct way (that is understandable by a layperson); refraining from using acronyms and other unnecessary 'jargon' that may confuse or complicate the intended meaning.

⁴⁰ This included members of the public, but also included responses from learned societies, academics, local authority organisations, geoscience professionals and non-governmental organisations.

⁴¹ For example, Theme 1.8 ("Topics associated with climate change") raised concerns about sea levels rises (among other things). RWM responded with further information on how sea level changes would impact a GDF and indicated that a further paragraph of text would be included in the screening documentation to explain how this would be considered.

4.1.3. Strategic stakeholder dialogue and social sustainability indicator development for nuclear decision-making in Anglesey, North Wales

As new nuclear power developments are proposed for the UK for the coming decades, it is important that public engagement and decision-making processes for these developments are carried out as effectively and sustainably as possible to benefit both current and future generations and avoid undue negative social impact and conflict, particularly at the local level. A PhD undertaken by Parry at the University of Central Lancashire, sponsored by both NNL and the Engineering and Physical Sciences Research Council (EPSRC), sought to understand these potential social impacts from future nuclear power developments further, and explore opportunities to enhance engagement with local stakeholders and decision-making undertaken at the local level, so that community priorities could be more accurately understood and incorporated into decision-making processes. As a case study, the island of Anglesey in North Wales formed the focus of the research. Wylfa Nuclear Power Station, shut down in December 2015, had operated for over 40 years on Anglesey, and a new nuclear power station in the form of Wylfa Newydd is now proposed for development on an adjacent site. Therefore, Anglesey has a history of nuclear power generation, and the communities of Anglesey have experience of living with such energy infrastructure.

The research sought to engage with various social groups on Anglesey in order to understand their social priorities and how a new nuclear power development may impact upon them, from their own perspective. Upon understanding these priorities and areas of potential social impact, the research aimed to develop sets of indicators for each group which could enable social impacts to be measured over time, and inform engagement with these groups and local decision-making. Four social groups in Anglesey, including two sixth-form student groups, a teachers group and a farmers group, were engaged with in a series of group sessions, where both questionnaires and group-based dialogue were undertaken to gain knowledge of the experiences and priorities of each group. These groups were selected to reflect both the current and 'next' generation of Anglesey residents. As a result of these sessions, Priority Profiles were developed for each group to reflect their different priorities, representing tools which could be utilised to better tailor engagement with these groups in the future, and identify where future developments may impact specific groups most greatly. This has the potential to inform and enhance decision-making at the local level so as to address these potential impacts and also mitigate conflict.

Ioan Parry, a post-doctoral research associate sponsored by NNL and supervised by Dr Colette Grundy (co-author of this report), investigated the effects of stakeholder dialogue on social sustainability for nuclear decision making [107]. The research involved engaging with four different groups of public stakeholders in Anglesey, North Wales, to understand their social priorities in the context of nuclear power developments, develop group-specific sustainability indicators to enable the impact of these developments on these group priorities to be measured over time, and explore how stakeholder dialogue and decision-making at the local level could be enhanced. Anglesey is the location of a recently shut-down nuclear power station (Wylfa, shut-down December 2015) and a proposed nuclear power station (Wylfa Newydd, translated as 'New Wylfa') on an adjacent site. Engaged stakeholders reflected a range of ages and social experiences, including sixth-form students, and both employed and retired adults. Parry's thesis presents a variety of social aspects - for example, concerns over the loss of the Welsh Language as a result of an influx of non-Welsh contractors - and discusses these social aspects as indicators of social sustainability and consequently nuclear sustainability. Parry indicated that a targeted engagement with consideration of social groups through a "social group and priority based dialogue (SGPBD)" could be a much more effective method of satisfying social sustainability issues, underpinned by a detailed literature review.

An additional point made by Parry relates to Kassakian's [108] argument that further development of nuclear power is "primarily a social challenge, not a technical one". This was broadened by Sovacool [109] in a 2015 study to "a primary shortcoming in the energy research literature is the under-examination of social dimensions". Indeed, much of the stall (1990s to ~2005) and then push (2006 to the present) in development of nuclear power in the UK has been dictated by levels of public support⁴², in contrast to the technocratic approach taken in the 1970s and 1980s (as described in Section 2.1). This has been recognised by various stakeholders, notably the UK Government and is evident in the GDA process. Despite this, Parry submits that the scope of the GDA Public Dialogue Pilot process, of which he was involved as an observer, is not broad enough to capture priorities that were "more site-based and locally-focussed", and could not provide sufficient opportunities for issues of local importance to be discussed. Parry states that there may be some evidence of a "deliberative U-turn" occurring, following the 'deliberative turn' observed around the turn of the millennium by scholars such as Dryzek [110], whereby more dialogue-based and deliberative approaches to engagement and decision-making with the public were advocated and employed. More recently, greater decision-making powers are proposed to return to the Secretary of State for Energy, reducing opportunities for public stakeholders to participate in and influence significant planning-related decision-making in a meaningful way⁴³.

Further, Parry highlights that "traditional scientific approaches" do not lend themselves to the social sciences as "the world and those inhabiting it cannot simply be observed, tested and measured as would a subject in a laboratory" [111]. Engagement must be genuine, honest and relevant to the target audience.

Parry suggests that young people (under 18), who make up 1 in 5 of the UK population, should be included in engagement as an important stakeholder group as it presents a plethora of social benefits. Young people formed a significant part of the Parry's research, who engaged with student groups in different schools on Anglesey to understand their social priorities and perceptions of nuclear power developments on Anglesey. Given the timescales involved in the nuclear sector as a whole, it is certainly foreseeable that the youth of today may in fact be in the prime of adulthood in the nuclear landscape of tomorrow (that is, bearing witness to the fruition of nuclear new build proposed) and consequently should be involved in discussions despite any perceived incomplete social presence (partial citizenship).

A cornerstone of the overall challenge in public engagement and social acceptability has been trust. As previously discussed, the UK public have (or perhaps had) a general distrust of Government and other authorities, which served to undermine many of the engagement attempts that had previously been made⁴⁴. Without trust, there is no investment by the public in the messages disseminated by Government and other authorities, which serves to weaken any engagement processes in support of major infrastructure projects, such as nuclear new build. It is therefore crucial that the JPCSAG is structured and operates in such a way that engenders and reinforces trust between NUGENIA, its partner organisations and the wider public.

⁴² Political and financial factors have also been a consideration.

⁴³ Note that this refers to a position before the change in UK Government following the 2016 'Brexit' referendum.

⁴⁴ This may generally be true, but specifically refers to the nuclear context for the purposes of this report.

4.2. UK energy industry examples

This section highlights a select number of examples of public engagement from other areas of the UK energy industry for comparison against the position of nuclear engagement.

4.2.1. Shale oil and gas

TNS BMRB, a UK public affairs research agency, produced a report in 2014 [112] on how to engage the public with shale gas and oil and coal bed methane, to inform the Office of Unconventional Gas and Oil's (OUGO) public engagement policy.

The findings included:

- Participants found it difficult to assess shale oil and gas against their energy priorities;
- Awareness of the risks associated with shale oil and gas was low;
- Shale oil and gas exploration caused unease amongst the public as it was felt to be "an unknown";
- Those predisposed to negative views exhibited confirmation bias;
- Government's pre-existing commitment to shale development and existing licenses undermined confidence in the decision-making bodies' ability to make independent decisions (despite evidence to the contrary⁴⁵);
- The complex nature of the subject was seen to be a barrier for public engagement.

Clearly, there are similarities between this recent public engagement exercise and those of nuclear engagement exercises, but there are some contrasts. Such contrasts include: the lack of risk awareness – nuclear is in the opposite situation; the public generally think they know about the risks of nuclear (safety, waste, etc.). The underlying issue of trust is in direct alignment and may suggest distrust in Government process rather than individual industries or Government bodies.

4.2.2. Onshore/offshore wind

The Centre for Sustainable Energy produced a protocol in 2007 [113] on public engagement for wind developments. The tenets of the protocol are:

1. Access to information;
2. The opportunity to contribute ideas;
3. The opportunity to take an active part in developing proposals and options;

⁴⁵ The report discusses this in terms of participant's views that Government was already committed to shale oil and gas through its policy and that bodies such as the Environment Agency would have little ability to make independent and meaningful decisions. The facilitators of the workshops used a variety of methods (including graphics showing the practicalities of energy policy and "profile cards" in a card ranking game) to explain Government's policy (at the time) and the role of different groups within the permit application process, but had little success in removing the opinion that engagement was a "fait accompli" (decision which has already been made).

4. The opportunity to be consulted and make representations on formal proposals;
5. The opportunity to receive feedback and be informed about progress and outcomes.

This approach has some similarities to the principles outlined in the NIC Concordat for engaging with the public on nuclear energy issues [52] discussed earlier in the report.

A 2014 best practice guide [114] on Community Engagement for Onshore Wind Developments was compiled for the Department of Energy and Climate Change. The guide identified five types of engagement that are key to the success of onshore wind projects: Awareness, Building, Participatory, Wider and On-going. These types of engagement approach are equally important for nuclear issues.

4.3. EU energy engagement

Given the recent (2012) publication of a report [115] commissioned by the European Economic and Social Committee (EESC) on public engagement processes in the EU, it was a logical first step to draw on the learning contained within for the benefit of the JPCSAG. To that end, the report is discussed below.

4.3.1. European Economic and Social Committee (EESC) Report

The EU recognises the requirement for reduction of carbon emissions and notes the variance in public acceptance of different forms of energy generation and the management and use of that energy. The EU also recognises that the picture in any one member state is different to the picture in other states.

This report [115] performed an extensive review of "energy futures" literature and distilled several important concepts from what were identified by the authors as "better practice". Notably, the balance between expert and "every-day" knowledge was raised, highlighting the "important step... in distinguishing between what is technically and economically possible to what is feasible and acceptable to stakeholders". NUGENIA's role of co-ordinating R&D aligns with this aspect, and the JPCSAG should serve as a platform to understand what is feasible and acceptable to stakeholders and to inform R&D to facilitate what is technically and economically possible. It is important that the JPCSAG is clear in distinguishing between these two "categories" and communicating it to interested stakeholders (political sphere and general public).

Further consideration is given to the increasing importance of public (and wider stakeholder) engagement in energy futures as the scale and importance of decisions increases (of course referring to on-going climate change issues and perhaps the 2015 United Nations Climate Change Conference "COP21" commitments), with a requirement for a focussing of the currently "diffuse" strands of involvement – a statement supported by literature. Indeed, "involvement led innovation" is posed as the way forward in this regard. The benefits for "capacity building trust" in a "bottom up" approach to engagement between statutory and non-statutory bodies are strongly suggested.

The report notes that there is a series of EU centred drivers, such as the previously mentioned EC Energy Road Map 2050. The EU has recognised in the Lisbon Treaty this capacity-building of knowledge and trust via involvement and dialogue between statutory and non-statutory civil society actors at pan-EU, state, regional, and local levels. More recently, the EC Energy Road Map 2050 concludes that:

"The current trend, in which nearly every energy technology is disputed and its use or deployment delayed, raises serious problems for investors and puts energy system changes at risk. Energy cannot be supplied without technology and infrastructure. In addition, cleaner energy has a cost. New pricing mechanisms and incentives might be needed but measures should be taken to ensure pricing schemes remain transparent and understandable to final consumers. Citizens need to be informed and engaged in the decision-making process, while technological choices need to take account of the local environment."

The report succinctly concludes the status of public engagement in the EU in the following two paragraphs:

"There is a range of strongly EU centred drivers to this dynamic, based on a perceived crisis of legitimacy in 'top-down' decision-making models. As a result, throughout the EU, there are clear policy moves to integrate public and community knowledge into decision-making processes. This shift has seen moves toward a two-way dialogue between specialists and non-specialists as a means of forging a more lasting consensus by increasing social involvement and participation, thereby fostering a sense of community."

"The underlying social force that underpins this move is the drive for more accountable, transparent, and publicly acceptable decision-making, with participatory dialogue no longer seen as an optional 'add-on' to policy making. It is in this context that civil stakeholder involvement provides a way forward to ensure that future policy solutions meet the needs of the public, and that these solutions are socially, culturally and politically acceptable as well as technologically feasible."

In this sense, the role of the JPCSAG is clearly defined; it must function as a body capable of two-way dialogue in engaging with interested political and civil society stakeholders.

4.3.2. Recent EU studies and good practice

Table 3 captures a range of different energy engagement projects and is intended to raise awareness of and highlight the varied approaches that are being taken to improving public engagement in the EU. While time and budget limitations of this study would not allow for a comprehensive review of all projects contained within Table 3, several key examples of good practice (as determined in the EESC report [115]) have been extracted and are discussed below the table.

Table 3: Variety of approaches across the EU to improve public engagement with energy projects

Project Name	Country/Countries	Description
ARTEMIS (2006)	Sweden	Aimed at developing new scenario exploration tools to support public engagement discussions on abstract scenarios.
ARGONA	Pan-EU	The ARGONA Project (Arenas for Risk Governance) is a project looking at how transparency and deliberation relate to each other.
RISCOM	Pan-EU	RISCOM (RISK COMMunication) aimed to improved stakeholder communication, particularly with regards to nuclear waste management.
Danish Future Energy System (2007)	Denmark	Brought together a broad range of individuals to review the Danish Energy system.
Public Acceptance of Renewable Energies at the Regional Level (2007)	Germany	Local and regional debates with various representatives to identify and investigate renewable energy and policy.
Plan N (2010)	Germany	Multi-stakeholder discussion on future of energy and emissions.
German Council for Sustainable Development (2001 - present)	Germany	Multi-stakeholder body that advises the German Government.
Engaging Civil Society in Low Carbon Scenarios (2012)	Germany and France	Developed scenarios for Germany and France with multiple stakeholders on low carbon options.
Spanish Energy Mix Forum (2012)	Spain	Structured national discussion on low carbon energy sources.
Transition Network (2012)	UK	Encouraged groups to apply the energy usage 'Transition Network Model' to their own locality.
Community Energy Challenge (2012)	UK	Looked at informing communities to enable initiation of co-operative renewable energy projects.
2050 Public Energy Dialogue (2011)	UK	UK Government developed various online tools to engage the stakeholders in low carbon energy choices supported by deliberative

		dialogue workshops.
Low Carbon Communities Challenge (2009)	UK	Provided financial and advisory support to communities to enable policy development.
Big Energy Shift (2009)	UK	Designed to encourage people to discuss energy generation and conservation.
Big Green Challenge (2010)	UK	Challenged communities to develop and implement sustainable CO ₂ reduction ideas.
Future of Nuclear Power: The Role of Nuclear Power in a Low Carbon UK Economy (2007)	UK	Thorough consultation on private sector nuclear new build. Featured deliberative regional meetings.
Submarine Dismantling Project (2011)	UK	Multi-stakeholder consultation (public and various other bodies) initiated by the Ministry of Defence.
Sustainable NOW (2012)	Pan-EU (Bulgaria, Hungary, Italy, Germany, UK)	Diverse programme to arrive at sustainable energy solutions at the community level.
EUROCITIES (2012)	Pan-EU	Network of European cities to share knowledge and reinforce role of local stakeholders in governance.
Energy Cities (2012)	Pan-EU	Association of local authorities concerned with energy futures.
PEPESEC (2010)	Pan-EU	Supports sustainable energy communities.
ENGAGE (2012)	Pan-EU	A communications initiative aimed at engaging citizens and stakeholders in building a sustainable energy future.
Covenant of Mayors (2012)	Pan-EU	Involves multiple regional authorities that have voluntarily committed to increasing energy efficiency and renewable usage.
ISLENET (2012)	Pan-EU	Network of island authorities looking to implement renewable energy through participation of citizens.
Covenant capaCITY (2011)	Pan-EU	Multi-stakeholder capacity building of local governments and sustainable energy communities.
Regions for Sustainable	Pan-EU	Promotes shift to climate-

Change (2012)		friendly economies through multi-stakeholder engagement and learning.
European Nuclear Energy Forum (2012)	Pan-EU	Attempts to involve stakeholders in the nuclear field with structured dialogues.
Implementing Public Participation Approaches in Radioactive Waste Disposal (2012)	Pan-EU	Attempts to enhance the decision-making process through awareness, fairness and trust.

Key learning from all of these projects was captured by the EESC authors in their 'Lessons learned' analysis. The most beneficial examples are discussed below.

4.3.2.1. Danish future energy systems

In 2004, the Danish Board of Technology (DBT) established a programme of engagement to assess Denmark's future energy needs and the systems that might deliver those needs⁴⁶. The project combined a steering group, a future panel, public hearings, scenarios and modelling and attempted to create policy instruments. The outputs of the project impacted on the Danish Government's energy policy and were also included in the EU Commission's 2006 'Green Paper' hearing. The following conclusions were made:

- For a dialogue between experts and politicians to be successful, there needs to be two-way communication. During the course of the process it is important to have frequent dialogue with all participants;
- Scenarios and energy modelling must be robust, but be made simple and easy to understand. They also need a flexible interface. The tool used in this process was able to conduct 'on the spot' analyses, which was useful at meetings;
- In general, there is a growing understanding among politicians and actors in the energy sector about the need for debate about long-term energy needs, political guidance about future directions, and for long-term energy planning. This project demonstrated that policy and decision makers benefit from dialogue with other stakeholders in the energy sector.

The DBT brought together multiple stakeholders from a variety of backgrounds to form the panel over a period of 2-3 years. These included; member of parliament, energy sector representatives, researchers, NGOs and the wider Danish Government (energy, transport, environment, business and development). The panel was involved in four public hearings.

The timescales of the project were sufficiently long for a meaningful dialogue to occur. Building trust takes time, which is why brief and sporadic dialogues can fail. Stability within the JPCSAG is recommended such that trust building and meaningful dialogue can be facilitated. Participants felt the forum was a "safe" space as all who attended were searching for common ground in order to make progress. This may be a usable format for the JPCSAG. Usage of scenarios and modelling is also a possibility for the JPCSAG, but should be done to supplement engagement and provide real value.

⁴⁶ Further information can be found at http://www.ea-energianalyse.dk/projects-english/638_the_future_danish_energy_system.html

4.3.2.2. Engaging civil society in low-carbon scenarios (ENCI-Lowcarb) (Germany and France)

The ENCI-Lowcarb project was executed by a partnership of NGO's and Research Institutes. The core of the project focussed on integrating engagement and stakeholder input into scenarios. The output scenarios that were developed were not considered as being as important as the process of developing the scenarios itself. This process had various steps and looked closely at the role of NGO's in collaboration with researchers and other stakeholders.

Further references are available⁴⁷, however key learning can be summarised as:

- The iterative process and the 'set-up' of the meetings were considered effective by all participants. It was important to end the project with a workshop designed to communicate the scenarios to policy makers, stakeholders and the wider public;
- The type of model used will impact on the extent to which stakeholders can engage and this in turn will impact on what can be achieved. In any case, sufficient time should be allocated to explain the functioning of the modelling tools to all the participants;
- It was helpful to differentiate between technological and political frameworks. This supported co-working between experts who defined the technological conditions, and Civil Society Organisation representatives who defined the social and political context;
- To account for the fact that collaboration partners come from significantly different and potentially conflicting professional backgrounds, the emphasis on intra-group development was important. Certain barriers needed to be overcome before the multi-disciplinary stakeholders could benefit from mutual learning and understanding. It is therefore important to plan in time for this;
- The project aimed to develop socially acceptable scenarios, which meant it was necessary to find a compromise in relation to different stakeholder opinions. One important lesson is that the range of stakeholders invited automatically limits the range of opinions possible. Therefore it is important to be aware of stakeholder and process design bias;
- The most useful element of the project was the translation process, which first ensured the incorporation of stakeholder narratives and stories into a quantitative model, and then allowed for further secondary review of the modelled outputs;
- For future projects to have legitimacy beyond a European research project, and for them to have an impact on decision-making processes, it would be beneficial to have government officials involved.

The main point of learning relevant to the JPCSAG is the formation of the group and the associated team-building exercises undertaken (such as a "wish list"). Scenario modelling may be a useful context approach to present the possible outcomes of a given line of research and development to political and civil society groups.

⁴⁷ See, for example; Olesen, G., Fink, M, et al (2012) 'Engaging Civil Society and Stakeholders in Low-carbon Scenarios, Synthesis report of the ENCI-LowCarb Project'. Also see; Schmid, E., Knopf, B., La Branche, S. and Fink, M. (2012) 'Social Acceptance in Quantitative Low Carbon Societies'.

4.3.2.3. Energy cities *IMAGINE* initiative

IMAGINE is a long-term initiative of Energy Cities. This initiative seeks to address the need for the way our cities work to adapt to combat climate change. The overall aim is to produce inventive plans to address this challenge; this was achieved in a variety of ways, but all relied on the close interaction of various stakeholder groups from both the consumption and supply backgrounds. A diverse array of engagement, responsibility sharing and collaborative working has emerged, enhancing governance from sectorial to distributive.

IMAGINE principally focusses on bringing stakeholders from different technical, social and cultural backgrounds together to discuss individual initiatives for mutual benefit. The JPCSAG will be aiming to replicate this success and account for local aspects in a similar way.

4.3.2.4. Public participation approaches in radioactive waste disposal: *Implementation of the RISCOM model in Czech Republic*

The RISCOM (Risk Communication) method was designed to facilitate decision-making for long-term, complex and hazardous projects. This project, part of the ARGONA EU Commission programme, was intended as a "safe space" for stakeholders to discuss complex radioactive waste management solutions and looked at truth, authenticity and legitimacy of communication. The RISCOM method contained two phases: Introductory, and Learning. The Learning phase makes use of the concept of "stretching" to validate claims and test authenticity and truth. The project was well received following the moratorium described in Section 2.3.4⁴⁸, with a key learning point on the "local aspect" of engagement processes.

In attempting to clarify the process of complex decision making, the RISCOM model looks at truth of information, legitimacy of the process and authenticity of the actors as a method to build trust through honesty and transparency. These three aspects may be key to the success of the JPCSAG.

The EESC highlight ten key points of learning for successful engagement through promoting the fundamental requirements of mutual trust and constructive cooperation among stakeholders (Figure 9).

⁴⁸ The Czech Government put a moratorium in place following public dissatisfaction with a siting engagement process.

Straightforward and ongoing open negotiation between all those involved.
Good mechanisms for transparency and accountability.
Clarity about purpose, objectives and scope.
Inclusion of the diverse stakeholders.
Mutual respect for differing views and knowledge.
Good communication between participants.
Independent expertise.
Appropriate oversight and evaluation.
Accurate and balanced information and knowledge sharing.
Genuine open discussion.

Figure 9: "Pre-conditions for trust and co-operation" [115]

The report also makes findings relating to the methods and tools used as part of the engagement or involvement. These involvement methods may be appropriate for the JPCSAG and include formats such as; stakeholder dialogues, public meetings, citizens' panels, events, forums, workshops, peer exchange, interactive web-sites and external communication through press and media. The use of decision-support tools was identified as positive, especially scenario-building.

It was also recognised that "mobilising people" and promoting building of networks and partnerships between stakeholders was necessary for inspiring stakeholder confidence. This involved a broad range of stakeholders from groups such as; "policymakers, government departments, devolved administrations, local government and local authorities, energy regulators, transmission system operators, industrial corporations and businesses, trade associations, non-governmental organisations (NGOs), local community based organisations (CBOs), independent energy sector experts and academic institutions".

The importance of a coherent process for progressing findings of any engagement activities, as well as any on-going involvement, was cited as a potential cause of difficulties. It is therefore crucial that the JPCSAG has a clear strategy for taking the input, findings and recommendations from engagement processes forward to appropriate bodies. Stakeholders should be provided with information on NUGENIA's role, scope and the limitations it may have in implementing any such decision or finding that comes about as a result of the JPCSAG.

4.4. European Nuclear Energy Forum (ENEF)

The European Nuclear Energy Forum was set up to act as an environment for broad discussion among all relevant stakeholders on the opportunities and risks of nuclear energy. At its first meeting, three working groups were established; the opportunities of

nuclear, the risks of nuclear and transparency. ENEF has been successful thus far and has provided advice to European policy-makers on a breadth of nuclear issues.

The approach of using working groups may be beneficial to the JPCSAG in helping to distil particular strands of NUGENIA activities into a format more suitable for wider discussion.

4.5. UK and EU Academic studies

Over the past decade, areas of academic activity relevant to public engagement with nuclear and the social aspects of nuclear have surfaced in both the UK and EU. This section is not meant to provide an exhaustive list of pertinent academic studies and research groups, but more a collection of works that NNL is aware of, is closely following, and/or has directly influenced. The academic studies are listed in Appendix 2.

4.6. Public engagement in UK universities

This section summarises some key public engagement initiatives and milestones that have been achieved across UK higher education institutions within the past ten years. NNL undertakes research with universities for the nuclear sector, and has strategic links in place as described in Section 3.4. Learning from the UK universities in regards to their approaches to public engagement has been assessed below.

4.6.1. The Beacons for Public Engagement (2008-2012)

The Beacons for Public Engagement was an initiative that aimed to inspire a culture change in how universities engage with the public, and involved six beacon partnerships across the UK, along with the National Co-ordinating Centre for Public Engagement (see Section 3.4.5 for more information on NCCPE). Each beacon was made up of a mixture of universities and local institutions (e.g. museums) as follows:

- CUE East Beacon (Community University Engagement East – led by the University of East Anglia);
- Manchester Beacon (University of Manchester, Manchester Metropolitan University, University of Salford, Museum of Science and Industry, Manchester: Knowledge Capital);
- UCL Beacon;
- North East Beacon (Newcastle University, Durham University, The Centre for Life);
- Edinburgh Beltane Beacon (University of Edinburgh, Heriot-Watt University, Edinburgh Napier University, Queen Margaret University, University of Highlands and Islands, nine non-university partners);
- Wales Beacon (Cardiff University, University of Glamorgan, Techniquist, National Museum of Wales, BBC Cymru Wales).

Each beacon was provided with funding over four years and was at the forefront of efforts to change the culture in universities, assisting staff and students to engage with the public. Key learning was summarised in individual evaluation reports [116], and has

been further condensed to provide some areas for consideration within the nuclear industry (Table 4).

Table 4: Summary of learning from Beacons for Public Engagement

Area	Key Learning <i>(Nuclear industry considerations)</i>
Timing	<ul style="list-style-type: none"> • Substantial time is required to develop projects; • Culture change takes time and appears random; the pace of change must be right for the institution and not dictated by external timescales. <p><i>(The nuclear industry should ensure that the process for enhancing public engagement is not rushed, and that the strategy is flexible to allow for variation in timescales and speed of development across the sector.)</i></p>
Location and Presence	<ul style="list-style-type: none"> • Consider where it is best to locate an organisational-wide infrastructure for public engagement; • Ensure clear benefits for the delivery of partners' own mission and services can be seen; • Culture change is only effective with senior level buy-in and workforce support; • Coordination and promotion: Central hub of activity is necessary; • Make approach visible and promote heavily, create a brand. <p><i>(The nuclear industry should ensure that buy-in is obtained from all senior figures, and that the public engagement strategy and process is visible across all levels of the individual organisations and industry as a whole.)</i></p>
Funding	<ul style="list-style-type: none"> • Small Resource: A small amount of focused resource goes a long way; • Investment in training staff and networks is key. <p><i>(The nuclear industry should invest in training its workforce in public engagement good practice, and support its workforce with focused funding.)</i></p>
Network	<ul style="list-style-type: none"> • Develop an expansive network of individuals, groups and organisations; • Build partnerships and networks across strategic, operational and practitioner levels. <p><i>(The nuclear industry should identify existing networks that can be used to carry the message about the importance of public engagement, and to disseminate ideas and learning.)</i></p>
Strategy	<ul style="list-style-type: none"> • Develop a clear communication strategy, which is subjected to continual enhancement; • Vision, clarity, purpose: A strong, commonly agreed strategic approach to public engagement is required, but also local flexibility needs to be retained; • Sustainability: Consistent support and encouragement is required to

	<p>ensure sustainable public engagement;</p> <ul style="list-style-type: none"> • Need to consider the internal and external drivers that support a culture of engagement within your organisation. <p><i>(The nuclear industry should ensure each organisation has a strategy for public engagement, which is clear, consistent, and sustainable and is tailored to fit each organisation's needs.)</i></p>
People	<ul style="list-style-type: none"> • Appoint staff early, with a mix of skills, a good calibre champion, and strong commitment at senior level; • There is significant added value in meeting directly with engagers; • Champions: Create champions and pockets of good practice; • Partnerships and audiences: Roles and responsibilities of partners need to be clearly defined, stakeholders need to be relevant and may change over time or be involved at different stages; • 'Public Engagement' is understood differently by different people and departments. <p><i>(The nuclear industry should ensure public engagement champions are placed at various levels throughout organisations. The nuclear workforce should be aware of the need for and benefits of public engagement.)</i></p>
Barriers	<ul style="list-style-type: none"> • Negotiating institutional bureaucracy and politics can be major barriers. <p><i>(Nuclear organisations should ensure it is as easy as possible for its workforce to engage confidently with the public for example via resource provision and training.)</i></p>
Evaluation	<ul style="list-style-type: none"> • Evaluation and learning: Include time for reflection for all involved, evaluate at a number of levels; • Sharing good practice: formal participation and informal engagement, regular communication between all levels, more flexibility for UCL as it was the only institution in its beacon - whereas other beacons had multiple organisations involved; • Celebrating success kept the community energetic and positive; • Encourage people to reflect on their journey so they can celebrate and evaluate; • Recognition: Financial gain not necessarily a motivator for public engagement – a system of reward structures. <p><i>(The nuclear industry should ensure methods are in place to evaluate and also to reward public engagement activities.)</i></p>

The success of the Beacons initiative and the momentum it has gathered led to further funding for higher education institutions through 'Catalyst' funding [117] (three year programmes) for eight UK universities, as well as 'Catalyst Seed' funding [118] (one year programme) for ten UK universities, with the aim of embedding a culture of public engagement within these organisations.

The beacons approach involving the use of steering boards as a positive forum of senior partner organisations representatives to "maintain commitment and momentum" may be employed by JPCSAG [119]. Establishing working groups also served to ensure particular strands of activity were taken forward and afforded proper attention. The table above

repeats learning from other activities in terms of affording the process of engagement proper time and commitment and bringing together key individuals in an appropriate way.

4.6.2. Public engagement strategy

A number of UK universities now have strategies in place for public engagement. For example, UCL [120], Bristol [121], Newcastle [122], Bath [123], and Manchester Metropolitan [124] have strategies which set out the reasons for engaging, the benefits of public engagement, and details the support available within the university for researchers to engage with the public in discussions about their work. Universities often have dedicated web-pages that provide information to staff, students and the public; detailing available resources, guidance on good practice, timetables of events and benefits of public engagement.

UK higher education institutions are able to sign up to a Concordat for engaging the public with research that was launched by Research Councils UK (RCUK) and the National Co-ordinating Centre for Public Engagement (NCCPE) in November 2013 [125]. This Concordat is intended to provide guidance that will allow the fostering of public engagement through a single, unambiguous statement of expectations and responsibilities, and is based on the following four principles:

1. UK research organisations have a strategic commitment to public engagement;
2. Researchers are recognised and valued for their involvement with public engagement activities;
3. Researchers are enabled to participate in public engagement activities through appropriate training, support and opportunities;
4. The signatories and supporters of this Concordat will undertake regular reviews of their and the wider research sector's progress in fostering public engagement across the UK.

Such principles are relevant to the mission of the JPCSAG as an underpinning requirement and should be implemented through its terms of reference.

The principles above were the basis for the development of principles in the nuclear industry's Concordat for public engagement, which was described in Sections 0 and 3.1 of this report. Since the RCUK and NCCPE launched their Concordat about two years before the nuclear industry, it will be important to track the developments of the RCUK, NCCPE Concordat and to learn from their experiences of implementation and evaluation, and to apply any relevant learning to the nuclear industry concordat. NCCPE provides the platform on which higher education institutions can learn more about public engagement and share their experiences of activities they have undertaken. It will be important for the nuclear industry to form a link with the NCCPE in order to share learning and experience while public engagement is still developing in both research institutions and in industry. NNL held initial discussions with NCCPE in January 2016, and identified a number of areas with potential for collaboration. Following this, NCCPE presented to the NIC in May 2016 and it is anticipated that NNL will develop a formal working partnership with NCCPE for implementation activities associated with the UK's Concordat.

One useful tool on the NCCPE website is the 'EDGE' self-assessment tool [126], which can be used to assess an organisation's support and position and progress with regard to public engagement. This tool provides an overarching framework of nine focal points that need to be addressed when creating a culture that is supportive of public engagement. These focal points are; Mission, Leadership, Communication, Support, Learning, Recognition, Staff, Students and Public.

Once the assessment has been completed, the areas of strength and weakness in a team/organisation become clear, and the tool can be used to create a plan to develop an environment where public engagement can thrive. It is proposed that this EDGE tool, or an appropriate adaptation, is trialled in the nuclear industry, along with the Concordat, Concordat guidance documents and nuclear narrative. It is suggested that the adapted tool can be used to ensure organisations are aware of their current public engagement status and have the necessary tools to align their attitudes and practice to be consistent with the rest of the nuclear industry. Once the adapted EDGE tool has been trialled by selected organisations, feedback will be collected from participating organisations and amendments may need to be made following feedback. The plan is then to launch the tool more widely across the industry. This adapted tool may also be applied to measuring the success of the JPCSAG and its activities if agreed by the NUGENIA ExCom and serve as an external review.

4.6.3. Survey: Factors affecting public engagement by researchers

In 2015, a national survey [127] into the factors that affect public engagement by researchers was funded by a consortium of organisations to understand if there had been a shift in participation in, and attitude towards public engagement, since a Royal Society survey in 2006 [128]. Although the survey is specifically focused on public engagement within higher education institutions, there are key findings that could have significant benefits for public engagement in the nuclear sector, if incorporated correctly. A summary of findings from the survey is as follows:

- 82% of researchers have done at least one form of public engagement within the past 12 months (this could act as a benchmark for the nuclear industry to aim for);
- 61% of respondents say that competing pressures on time is a major barrier for carrying out public engagement (could the nuclear industry make it easier for the workforce to carry out public engagement by allowing time for activities, or even making it part of role/job descriptions?);
- 38% of respondents stated that they would take part if invited to take part (could the nuclear industry ensure the workforce are made more aware of opportunities?);
- 33% of public engagement enablers thought that there was a lack of effective internal coordination across the institution (what is the state of internal coordination within the nuclear industry organisations?);
- The shift in attitude between 2006 and 2015 is positive, with increases in the number of respondents who believe it is important to engage with the public (49% → 58%) and who would like to spend more time engaging with the public (45% → 53%).

It is vital that the nuclear sector continues to keep abreast of developments in public engagement practice, and surveys across UK universities, as there is likely to be a great

deal of learning that can be taken and incorporated into the way the nuclear industry carries out public engagement. NNL is planning to develop a strategic partnership with NCCPE so learning can be shared and reviewed on a regular basis. The JPCSAG members should ensure appropriate communication amongst themselves and with NUGENIA member organisations in addition to wider political and public audiences. The reporting structure to the NUGENIA ExCom must be clearly defined.

4.7. The public's perceptions and predispositions to different energy sources

It is important to consider the predisposition the general public has towards different types of energy (nuclear in particular) as this may influence the proposal for communication, as well as determining the course of discussions; groups that feel negatively about nuclear power will wish to discuss their concerns and issues, whilst other groups may be willing to listen to more general facts and information. A selection of reports is discussed in this section.

4.7.1. UK public perceptions of shale gas, carbon capture & storage and other energy sources & technologies: Summary findings of a deliberative interview study and experimental survey

A study [129] by Cardiff University and the University of Leeds attempted to understand public attitudes to different types of energy, especially shale gas. The study employed various metrics of perception, but most notably on how much those surveyed felt they knew about a particular energy type (Figure 10) and how severe they felt certain hazards were (Figure 11).

	Natural gas	Coal	Shale gas	UCG	CCS	Nuclear	Offshore wind	Solar	Bio-energy
A lot	10%	23.3%	6.7%	0%	3.3%	10%	6.7%	3.3%	10%
A little	86.7%	70%	73.3%	20%	46.7%	83.3%	83.3%	90%	40%
Only the name	3.3%	6.7%	16.7%	46.7%	26.7%	6.7%	6.7%	6.7%	46.7%
Nothing	0%	0%	3.3%	33.3%	23.3%	0%	3.3%	0%	3.3%

Figure 10: How much those surveyed feel they know about particular energy types

A large proportion of those surveyed believe they knew "a little" about nuclear power, with a low percentage citing they only knew the name and no respondents saying they knew "nothing" about nuclear power.

Mean rank	Risk	Mean rank value	Modal rank	Highest rank	Lowest rank
1 (most severe)	Radiation leak	4.23	1	1	14
2	Radioactive waste	5.93	3	1	17
3	Explosion of flammable gas	6.51	1	1	18
4	Pollution of water sources	6.79	6	1	16
5	Hazardous conditions for workers	7.43	1	1	17
6	Airborne pollution	7.9	5	1	19
7	Hazardous solid waste	8.0	4	3	17
8	Slow to shut down	9.0	3	2	19
9	CO2 escapes into atmosphere	9.2	11	1	19
10	Depletion of natural resources	9.6	2	1	18
11	Loss of species	11.10	9	3	18
12	Food shortages	11.55	15	2	19
13	Minor earthquake	11.86	14	1	19
14	High noise levels	12.06	14	1	19
15	CO2 leaks near people's homes	12.13	18	3	19
16	High financial costs	12.26	17	2	19
17	Loss of local businesses	13.0	10	1	19
18	Variable energy generation	13.7	19	1	19
19 (least severe)	Disruption to landscape	13.27	19	1	19

Figure 11: The hazards that the public associate with nuclear power

Figure 11 shows that hazards associated with nuclear power are seen as the most severe forms of risk associated with energy generation. This, in combination with the above designation that the general public only know "a little" about nuclear power, suggests that further development of awareness and understanding of nuclear is important as part of public engagement processes. Also of interest are the high modal ranks for "hazardous conditions for workers", "explosion of flammable gas" and "depletion of natural resources", suggesting serious concerns exist in sectors outside of nuclear. An online survey also showed a trend of "reluctant acceptance" towards nuclear power, which supports the idea that the public are recognising the severity of issues outside of nuclear and are perhaps beginning to understand more about the risks of nuclear itself. The JPCSAG should be conscious of the role that perception can play in public and political opinion.

4.7.2. Public perceptions of climate change and energy futures before and after the Fukushima accident: A comparison between Britain and Japan

A study [130] by the Welsh School of Architecture (WSA) reviewed public opinion (n= ~1500) of nuclear energy before and after the Fukushima incident. The results indicated that the general attitude recognised climate change as a legitimate threat. Nuclear power remained one of the least supported types of energy, being held in close position to oil and coal (see – Figure 12 note that the GB2011 study occurred in November 2011, after events at Fukushima).

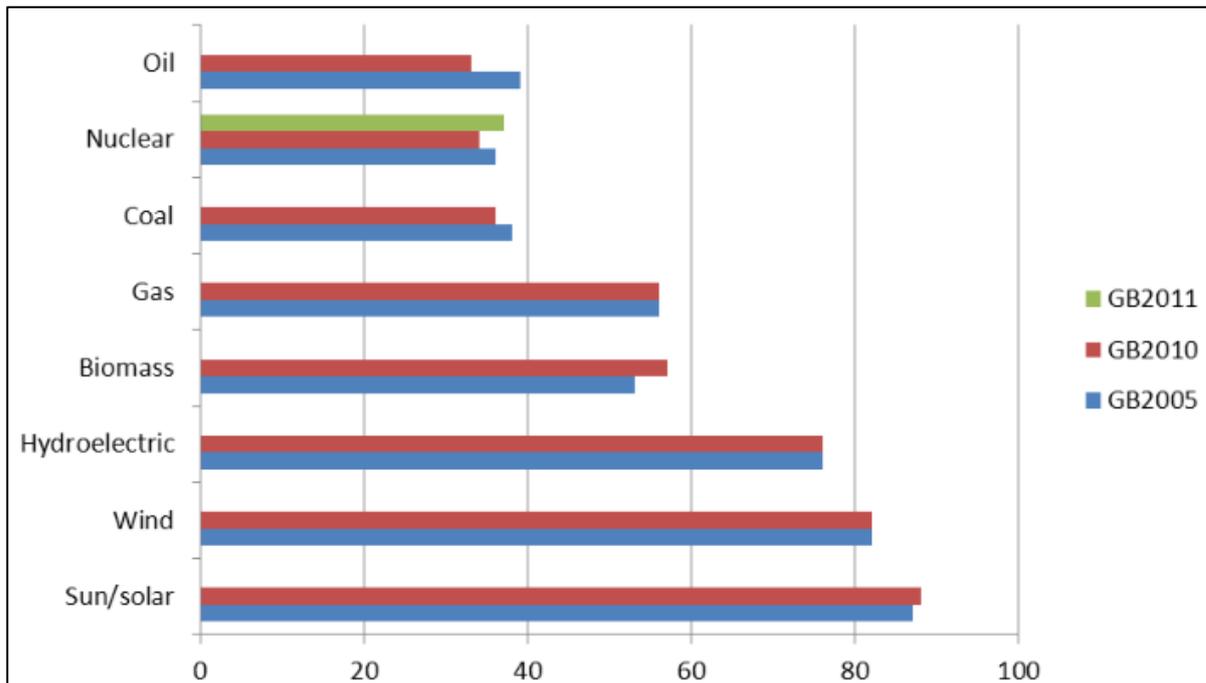


Figure 12: Favourability towards different forms of energy for electricity production (x-axis is % of people who support the energy source)

Despite this, nuclear was increasingly being considered as an option (see Figure 13 and Figure 14), especially with regards to addressing energy security, and there is certainly an upward trend in public support.

	GB2005	GB2010	GB2011
We should increase the number of power stations	9	17	23
We should continue using the existing NP stations and replace them with new ones when they reach the end of their life	34	29	21
We should continue using the existing NP stations but <u>not</u> replace them with new ones when they reach the end of their life	34	33	21
We should shut down all existing NP stations now and not replace them with new ones	15	13	11
Don't know/none of these	7	7	14

Figure 13: Results of public survey (percentage) when asked, "Which Statement most closely resembles your opinion of nuclear power?"

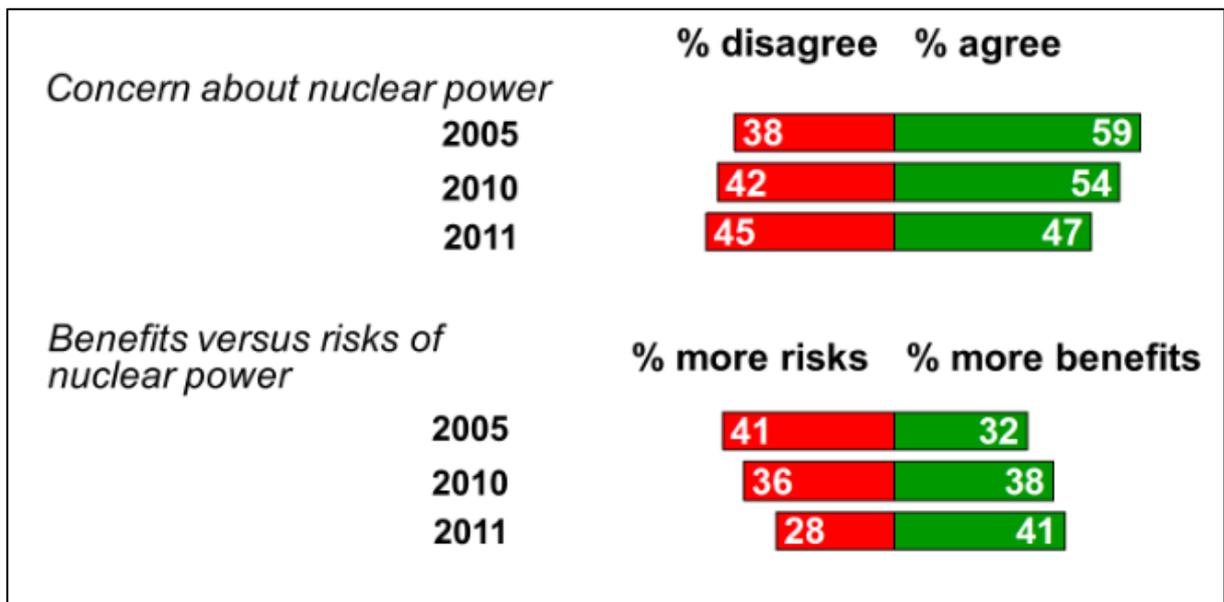


Figure 14: Concerns about nuclear power, and perceived benefits/risks (2011 date after events at Fukushima)

This upward trend is perhaps a reflection of the aforementioned “reluctant acceptance” of nuclear power; an acceptance that perhaps comes from the acknowledgement that despite the preferences of the public, energy sources such as solar, wind and hydro are not appropriate forms of secure energy generation at our current technology levels. Nuclear appears to be becoming increasingly attractive as a form of supplementary base load electricity. Understanding such trends within nuclear power on a national, European and international level will serve to solidify the JPCSAG’s role as a conduit for political and civil society concern to NUGENIA and the role that issues such as safety may have in the bigger picture.

4.7.3. From nuclear to renewable: Energy system transformation and public attitudes

A useful overview of the development of public attitudes towards nuclear power is presented by Pidgeon and Demski [131]. This paper discusses the public reluctance towards hosting large-scale renewables projects despite generally positive national studies. Pidgeon, Demski and Wouter later stated that surveys are constructed and consequently interpreting them must involve a degree of caution due to the influences of question framing and other factors [132].

Pidgeon and Demski also discuss the development of public attitude towards nuclear power. Introducing the distrust in authorities due to “secrecy” fostered by the overlapping civil and military nuclear activities in the mid-20th century, the general attitude towards nuclear power in the UK was negative from the 1970’s through to the approximately 1990⁴⁹. Early attempts to improve this relationship included the “deficit model”; a model that assumed a deficit of knowledge by the public and suggested a programme of education to eliminate this deficit. This model was subsequently disproved when it was found that assuming a deficit of knowledge can be patronising and having preconceived ideas of what the public wants to discuss can discourage conversations on actual topics of interest [133].

⁴⁹ Pidgeon and Demski describe public attitude as becoming “more positive” between 1990 and 2010.

5. Findings from the UK perspective

Drawing from various case studies and academic works it is clear that the position of public engagement within the UK's nuclear sector has experienced a gradual shift from the 1970s to the present. This transition period has seen the UK nuclear sector realise the importance of public engagement, and through a number of both successful and failed attempts at conducting public engagement according to good practice, the UK now appears to be in a position to align efforts across the nuclear sector, ensuring public engagement is consistently carried out according to current understanding of good practice. The UK may be regarded as being in the "leading group" of nations with respect to public engagement with nuclear matters, particularly with the launch of the Nuclear Energy and Society Concordat for Public Engagement in December 2015. However, it is recognised that the development of good engagement practice is at an early stage based on recent work. In the EU's case, approaches to public engagement vary widely on a country-by-country basis and have been undertaken with mixed success. The general trend however, is positive, with multiple studies currently underway by EU member states as well as several led by the EU council itself. The Swedish model⁵⁰ for public engagement has been implemented by several countries; some have had success (Finland) and others have not (Czech Republic). The findings of the Horizon 2020 HoNEST project will need to be evaluated in future to assess the learning that may be applied to future engagement practice on nuclear energy matters.

A review of public engagement programmes and studies across the UK nuclear sector, other UK energy industries, UK research institutions, and in the EU, has provided a myriad of useful learning that can be incorporated across the nuclear sector and for the JPCSAG. It is proposed that the success of an engagement project depends upon several key intricacies, including:

- **Trust** is essential and is fostered through continuous and consistent processes – it is not won overnight, and can be easily lost;
- Being conscious of the "**local aspect**" is crucial in relating the proposed engagement plan to the intended audience;
- Being willing to "**listen before you speak**" and not pre-empting the issues.

It is recommended that the learning extracted from the engagement programmes covered in Section 4 of this report be considered for the JPCSAG, especially when analysing the findings of public engagement exercises, when developing research strategies, and in developing understanding of good practice.

Additionally, this report has highlighted a number of opportunities that NNL and NUGENIA members could pursue to bring further benefit to their organisations, the industry, across Europe and with the public.

Early progress has been made in 2016, with NNL's public engagement work programme having delivered a series of public dialogue workshops based on the Nuclear Energy and Society Concordat for Public Engagement. The next steps are to review the feedback and learning and for NNL to work with its partners Welsh Government and Sellafield Ltd to

⁵⁰ The "Swedish Model" is referred to in a number of literature sources, such as Chilvers, J., Kearnes, M., (Eds.), (Routledge, 2015) 'Remaking Participation: Science, Environment and Emergent Publics', 157. This is most likely because Swedish engagement processes apparently began in 1977, whereas Finnish processes apparently started in 1983.

agree a forward plan of action, including how the feedback may be incorporated in further development of the Concordat. There are also plans for a widespread public engagement programme to be undertaken by Radioactive Waste Management Ltd as part of the UK's GDF siting process where RWM will be working closely with communities.

Governments, Regulators and agencies are working together on nuclear and radioactive waste management programmes in the EU with both Global and European platforms (available for sharing learning among member states who are at various stages of GDF siting processes). As an example, the Forum on Stakeholder Confidence (FSC) [134] facilitates the sharing of experience in addressing the societal dimension of radioactive waste management. It explores means of ensuring an effective dialogue with the public with a view to developing confidence in the decision making process. The FSC has produced a number of studies and reports on issues including stakeholder engagement and siting approaches for repository sites. The work being done by E-TRACK [135] was mentioned earlier herein. The knowledge being developed from E-TRACK such as on the radioactive waste project will be of value to other forms of energy engagement such as for wind and shale gas etc., in addressing public concern through an increasing level of confidence among stakeholders. It is therefore also essential in informing the citizen and supporting their role at the centre of a successful European Energy Union. Additionally, there are a number of relevant, in-depth academic studies on-going that will contribute to the nuclear sector's understanding of public engagement good practice.

6. Future Engagement in the UK

The Concordat for public engagement is the first step in developing the dialogue between the nuclear sector and the public, with the aim to develop public understanding and to build a trusting relationship. The focus can now gradually shift towards evaluating engagement events and refining the underlying principles behind the term 'good practice'. It has already been suggested by Whitton [136] that a deliberative U-turn (a move away from deliberative dialogue) in the UK's approach to public engagement has commenced, evidenced by amendments to UK planning and infrastructural law detailed in the 2014/15 Infrastructure Bill. More decision-making powers are being transferred to the Secretary of State, which will enable some 'barriers and delays' to large-scale energy infrastructure developments to be mitigated. It is important that the nuclear sector takes into account any policy changes when considering its public engagement strategy.

Along with the general shift towards more deliberative public engagement, the subject has attracted the attention of academics. Various studies have been carried out which complement the learning from recent and historical dialogue projects, and it is important that the nuclear sector draws on this experience and knowledge when informing what it considers as 'good practice' [137][138][139][140]. For example, Whitton [136] proposes that dialogue is not only a 'two-way' process, but is actually multi-directional and dimensional, involving numerous stakeholders. Learning from relevant studies must be considered when reviewing the term 'good practice', and incorporated where necessary to allow evolution of what we understand to be 'good practice'. It is recognised that there is a need for further research into "understanding the perceptions, priorities, involvement and support of local residents regarding large-scale energy infrastructure", therefore it is anticipated that further research will emerge, and the learning from these studies must be tracked and used to inform public engagement practices. Whitton [136] has presented a conceptual framework for social sustainability (see Figure 15), which allows various stakeholder groups to agree priorities that contribute to energy decision-making through deliberation and community visioning, leading to strong and sustainable communities. It will be interesting to see how this framework is tested, and if it can be used by the nuclear sector to further develop its public engagement strategy.

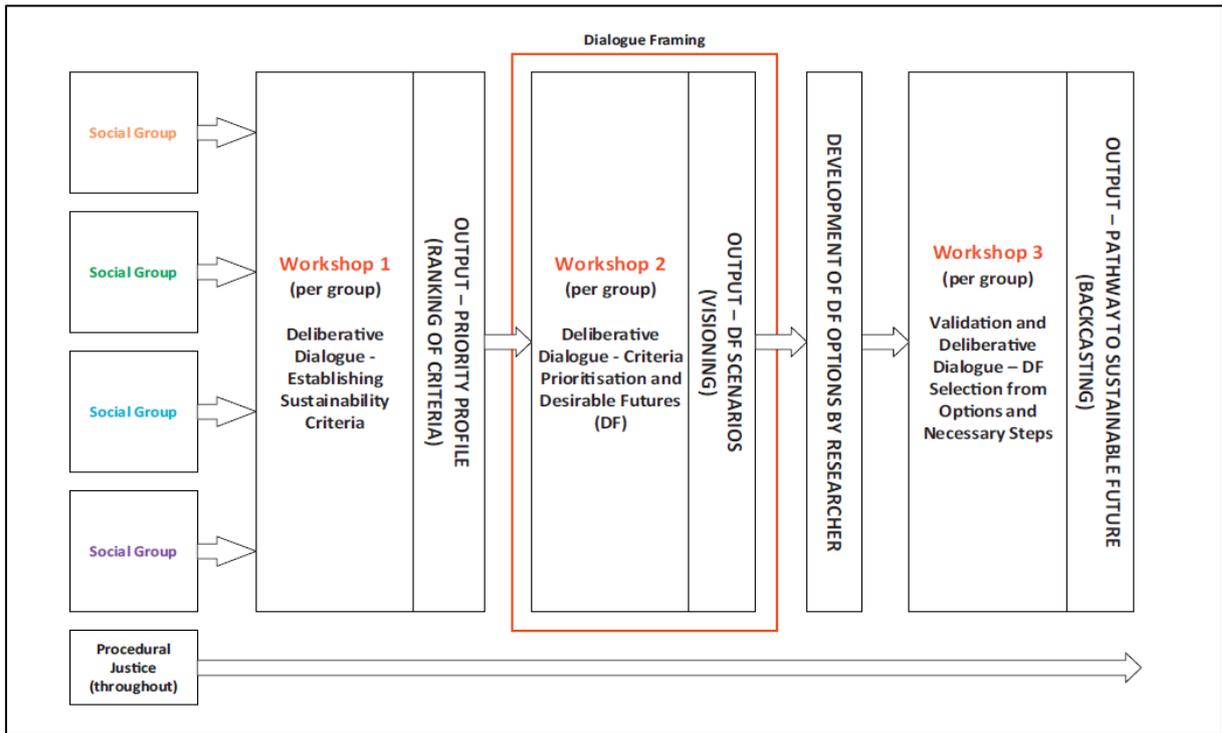


Figure 15: “Conceptual framework for the establishment and prioritization of sustainability criteria with various community-level social groups, and developing sustainable future pathways.” [136]

7. Recommendations for Future Public Engagement

NNL should consider adopting the recommendations below:

- Build and act upon the research that indicates the public believe University and Government Laboratory scientists are the best qualified to explain the impact that science has on technological developments and society by developing a network of ambassadors to support public engagement work and events;
- Continue to work with and build partnerships with universities and academic experts in supporting public engagement;
- The nuclear sector must draw from the experience and knowledge of academics and current research on both a national and international basis when informing what is considered as 'good practice' in public engagement;
- Consider how the learning from UK higher education institution's 'Beacons for public engagement' initiative could be relevant to the nuclear sector, and how it could be incorporated into policies and strategies;
- Consider incorporating the NCCPE's 'EDGE self-assessment' tool into the nuclear sector as a means of providing a clear and consistent method for evaluating public engagement;
- Consider the role of the laboratory in liaising with international organisations such as NUGENIA, and possibly the JPCSAG;

The learning from the recent NUGENIA toolkit public engagement report [66] should also be evaluated as part of any future work. NNL proposed three further work packages under the NUGENIA+ deliverable D2.7 to be completed in 2016:

- Testing the outworking of Concordat Principles in Europe;
- Development of a European Toolkit involving guidance material on the Concordat, and the Nuclear Narrative;
- Optioneering study into the hosting and dissemination of the European Toolkit.

The work package activities have been completed and the results are available in a separate report.

8. Summary of Learning and Recommendations for the Joint Political and Civil Society Advisory Group (JPCSAG)

8.1. Introduction

NUGENIA has recognised the need for a Joint Political and Civil Society Advisory Group (JPCSAG), in order to align future research and development with the concerns of political and public stakeholders. This requirement is expressed explicitly within the EC Synthesis Report; "Benefits and Limitations of Nuclear Fission for a Low-Carbon Economy: Defining Priorities for Euratom Fission Research & Training)" [141], which states;

"Following Fukushima, nuclear fission for energy has become a sensitive political issue in some member states and the public at large expects its concerns to be properly addressed. Future fission research therefore needs to respond to those concerns, including new ways of engaging the public. This is the only way for European industry in the nuclear field to maintain its worldwide leading position."

Generally, the questions previously posed around the legitimacy of how the EU communicates to its citizens are starting to fade through initiatives introduced in the Aarhus and Espoo Conventions⁵¹. NUGENIA and the JPCSAG have the opportunity to become part of this positive movement within the nuclear sector and further establish the EU in its "worldwide leading position". NUGENIA's role of co-ordinating safety Research and Development (R&D) for Generation II and III reactors presents an excellent opportunity for the formation of the JPCSAG, which should serve as a platform to understand what is feasible and desirable to stakeholders; and to inform R&D to facilitate what is technically and economically possible. This report has presented a high-level analysis of the progress made and recent development informing good practice public engagement in the UK, as well as case studies from a selection of European countries. This learning has been analysed to inform the proposed formation of the JPCSAG, in terms of its role, composition and terms of reference.

Developing and informing good practice engagement is not a simple task; the effects of engagement can be detrimental if the public believe their views are not being treated seriously, or the existence of the JPCSAG is a token gesture. Raising issues in the wrong way may exacerbate concerns among stakeholders, which is of particular relevance to safety – a high priority issue for many social groups.

Table 5 presents three key areas; 'Vision', 'Form' and 'Function', as well as high-level points that should be addressed to ensure smooth function of the JPCSAG. The following sections address each area specifically and present a concise representation of the learning discussed throughout the report.

⁵¹ See Section 1.3 for more information on the Aarhus and Espoo Conventions.

Table 5: Key areas of consideration for the JPCSAG

Vision – the context and intent of the JPCSAG	What is NUGENIA?
	What is Horizon 2020?
	What is the goal of WP2?
	What is the goal of the Joint Political and Civil Society Advisory Group?
Form – the structure of the JPCSAG	Organisational structure including terms of reference
	Timescales and timings
	How does the JPCSAG work to inform the ExCom ⁵² ?
	What is the membership of the JPCSAG?
	What are the formal reporting arrangements?
	Is any additional infrastructure needed to support the JPCSAG?
Function – the operation of the JPCSAG	Internal communications protocols
	External communications protocols
	Linking with member states
	Information provision (listening/reporting)
	Event organisation

8.2. Vision

The vision, or the context and intent of the JPCSAG, provides the detail required such that all stakeholders understand the purpose of the JPCSAG itself, and also how it fits with NUGENIA, Horizon 2020 and Work Package 2⁵³. Defining the context and intent in this way sets the expectations of stakeholders, internally and externally, in terms of what level of involvement is expected from them, and what outcomes they can expect as a result of their involvement. This ensures that the JPCSAG functions as NUGENIA intends it to, and it therefore achieves the goals relevant to NUGENIA, but also that it functions as the public and political groups expect it to.

The role of the JPCSAG needs to be carefully specified to ensure that its members, and the political and wider public spheres it affects, are clear on how the group will function and how their input will be taken forward. It is therefore recommended that a short, clear description of the JPCSAG is recorded as a “statement of purpose” and serves as the core of the terms of reference. An example statement of purpose is as follows:

“The Joint Political and Civil Society Advisory Group is a Forum/Working Party/Sub-Group of the Nuclear Generation II & III Association – “NUGENIA”. The group engages and works in collaboration with a range of political and public stakeholders to understand concerns about nuclear power in order to develop and inform NUGENIA’s programme of nuclear research and development activities in Europe.”

⁵² Executive Committee.

⁵³ Deliverable 2.7 is discussed in Footnote 2 (page 4).

Having the core statement set out in a positive manner is important to demonstrate the benefits the advisory group is expected to realise. However, it is important that the mission and scope of activities carried out by JPCSAG is properly communicated and understood by all parties, and using statements that define the limits of its function can be equally important. For example:

"It is not a voice of industry, Governments or the European Commission. It is a neutral, independent forum to inform nuclear safety research and development."

To support the above statements, it is important to ensure that all parties understand the function of NUGENIA, and by extension, the intentions of Horizon 2020 and Work Package 2. Such a statement for the function of NUGENIA is outlined on the NUGENIA website, under the purpose and scope section. The statement reads as follows;

"NUGENIA is set up to be the starting point of a more ambitious and united community to advance the safe, reliable and efficient operation of nuclear power plants. NUGENIA shall provide, in a transparent and visible way, a scientific and technical basis by initiating and supporting international R&D projects and programmes. NUGENIA will contribute to innovation and facilitate implementation and dissemination of R&D results." [142]

Further, the high-level scope of activities may be useful to inform JPCSAG members of the type of activities that NUGENIA considers within its remit. The high-level scope is;

"NUGENIA scope of activities covers 8 main technical areas:

- 1. Plant safety and risk assessment*
- 2. Severe accidents*
- 3. Improved Reactor Operation*
- 4. Integrity assessment of Systems, Structures and Components*
- 5. Fuel Development, Waste and Spent Fuel Management and Decommissioning*
- 6. Innovative LWR design & technology*
- 7. Harmonisation*
- 8. In-service Inspection and Non Destructive Examination" [142]*

Likewise, the Horizon 2020 website contains the following statement;

"Horizon 2020 is the financial instrument implementing the Innovation Union, a Europe 2020 flagship initiative aimed at securing Europe's global competitiveness.

Seen as a means to drive economic growth and create jobs, Horizon 2020 has the political backing of Europe's leaders and the Members of the European Parliament, who have agreed that research is an investment in our future and have therefore put it at the heart of the EU's blueprint for smart, sustainable and inclusive growth and jobs. By coupling research and innovation, Horizon 2020 is helping to achieve this with its emphasis on excellent science, industrial leadership and tackling societal challenges. The goal is to ensure Europe produces world-class science, removes barriers to innovation and makes it easier for the public and private sectors to work together in delivering innovation.

Horizon 2020 is open to everyone, with a simple structure that reduces red tape and time so participants can focus on what is really important. This approach makes sure new projects get off the ground quickly and achieve results faster.

The EU Framework Programme for Research and Innovation will be complemented by further measures to complete and further develop the European Research Area. These measures will aim at breaking down barriers to create a genuine single market for knowledge, research and innovation.” [143]

To complete the picture, a short explanation of Work Package 2 should be offered to explain the link between the JPCSAG, NUGENIA and Horizon 2020 completely. An example statement is:

“NUGENIA has identified the opportunity to build a foundation of strong synergy between NUGENIA itself and Horizon 2020, and ensure long-term beneficial impact. Currently, Member State R&D programmes are typically based upon the research strategy of that Member State. For R&D relating to NUGENIA’s technical areas, there is an opportunity to align member state research, NUGENIA’s R&D strategy and wider EU (Horizon 2020) research funding. The Joint Political and Civil Society Advisory Group is expected to be part of this alignment that ensures political and public concerns are properly reflected within research and development priorities.”

Further factors are recommended for inclusion into the Terms of Reference (ToR). The RISCUM⁵⁴ model looks at truth of information, legitimacy of the process and authenticity of the actors as a method to build trust through honesty and transparency [115]. These three aspects are key in the success of the JPCSAG and it is recommended that these should be implemented as part of the terms of reference. Also under the terms of reference, it should be specified as a membership requirement that JPCSAG members are expected to be enthusiastic, passionate and committed to the mission of the group.

It is important that NUGENIA is cognisant of the situation across Europe, with strong local and cultural themes emerging. The JPCSAG will need to appropriately represent the Member States and be conscious of, but not dominated by, local and cultural issues. In this situation, the role of the JPCSAG would be similar to that of a steering group⁵⁵.

The approach of using working groups may be beneficial to the JPCSAG in helping to distil particular strands of NUGENIA activities into a format more suitable for wider discussion. The Beacons for Public Engagement project is a good example of the use of steering boards as a positive forum of representatives from senior partner organisations to “maintain commitment and momentum” [119].

NUGENIA should ensure that the JPCSAG members develop an appreciation and understanding of the key areas of public and political concern, and should be mindful of how those concerns align with NUGENIA’s remit as an R&D organisation.

⁵⁴ ‘RISK COMMunication’ (RISCUM). See Section 4.3.2.4 for more detail.

⁵⁵ See Sections 3.1 and 4.3.2.1.

The JPCSAG members must also be aware of appropriate communication amongst themselves in addition to wider political and public audiences and conscious of the role that perception can play in public and political opinion. A method of measuring the success of the JPCSAG's may be through the NCCPE's EDGE tool⁵⁶ and its use could be sanctioned by the NUGENIA ExCom and function as an external review of the effectiveness of engagement activities with stakeholders.

The principles extracted from the CoRWM report [20] and independent evaluation report [19], align well with the learning presented above and could be included in the JPCSAG ToR directly. The principles are;

1. To be open and transparent;
2. To uphold the public interest by taking full account of public and stakeholder views in our decision-making;
3. To achieve fairness with respect to procedures, communities, and future generations;
4. To aim for a safe and sustainable environment both now and in the future;
5. To ensure an efficient, cost-effective, and conclusive process.
6. To respect alternative points of view;
7. To participate as an individual, not as a member of an interest group;
8. To take personal responsibility for recommendations.

Similarly, the findings from the GDF Siting Process report by Ipsos MORI [41], found that key principles expected by the public included;

- Awareness and education
- Transparency and openness
- Local
- Fairness
- Efficiency

Offering a complete picture of the roles and expectations of each body and JPCSAG member completes the 'Vision' section.

8.3. Form

The 'Form', or organisation of the JPCSAG, explains how the JPCSAG will be structured in order to achieve its aims.

Studies presented earlier in this report⁵⁷ indicate there is space for a body within the sector that maintains independence from "industry" and "Government" (and by extension, the EC), providing a valuable and trusted point of contact for engaging with public and political stakeholders to review a range of issues.

⁵⁶ See Section 3.4.5.

⁵⁷ See Sections 1.3 and 2.2.2 in particular.

In 'traditional' decision-making processes (such as Decide, Announce, Defend)⁵⁸, industry experts would make decisions on the direction of strategy without any further input or engagement with the public. Whilst the role of industry experts has been maintained, this has been supplemented through the presence of other stakeholders to support two way dialogue with stakeholders. Increasingly there is a role for academics to provide independent and impartial advice in engagement approaches and studies.

Some members may have concerns over how realistic it is that the JPCSAG would be seen as truly independent given its composition of, primarily, sector professionals. However, the experience of SKB in this regard should be noted⁵⁹. SKB acknowledged their interest in the outcome of the repository siting project, openly identifying themselves as non-neutral. They were still able to provide information and partake in discussions, but the role of the neutral assessor (oversight function) was fulfilled by local and national NGOs.

Scientists and engineers from government and research laboratories are regularly cited as the most trusted sources of information for the public [8]. Additionally, the IMAGINE Cities project⁶⁰ has already demonstrated the benefits of bringing stakeholders from different technical, social and cultural backgrounds together to discuss individual initiatives for mutual benefit.

The membership of the JPCSAG should therefore be a mixture of representatives from key bodies, such as the NUGENIA ExCom, the JRC and the EC (or an appropriate sub-body, such as DG-ENER or Horizon 2020), as well as representatives of every Member State that participates in NUGENIA⁶¹ that ideally represent a diverse combination of technical, social and cultural backgrounds. A selection of NGO's and other groups should be present to act as the neutral parties and provide a level of assurance that the topics being discussed receive proper consideration. JPCSAG members that are thought of as "neutral" could be given an 'objection' vote that shows they are not content with the process by which a decision was made (but not simply because they disagree with the outcome) and raises that particular point for consideration by the NUGENIA ExCom. Depending upon the numerical balance of the JPCSAG, a quota for consideration could be required. For example, if 3 'objection' votes are raised, then the issue is discussed by the ExCom.

The invitation process for member state representatives needs to be considered on a country by country basis to ensure that an appropriate amount of reach can be achieved within that Member State. NNL have separately developed a toolkit to promote good public engagement practice in nuclear [66] and this should be used to develop insight into the prevalence of engagement within individual Member States and may help identify the best organisation for participating in the JPCSAG. The representatives could be from Member State Government or national organisations, academia, NUGENIA technical areas, industry, professional organisations, or they could be from the individual

⁵⁸ See Section 2.2.1.

⁵⁹ See Section 2.3.1.

⁶⁰ See Section 4.3.1.

⁶¹ 20 countries are represented as "full members" of NUGENIA, with an additional 4 represented as "honorary members" [142].

state industry association. Figure 16 shows nuclear associations in a number of European countries⁶² [144].

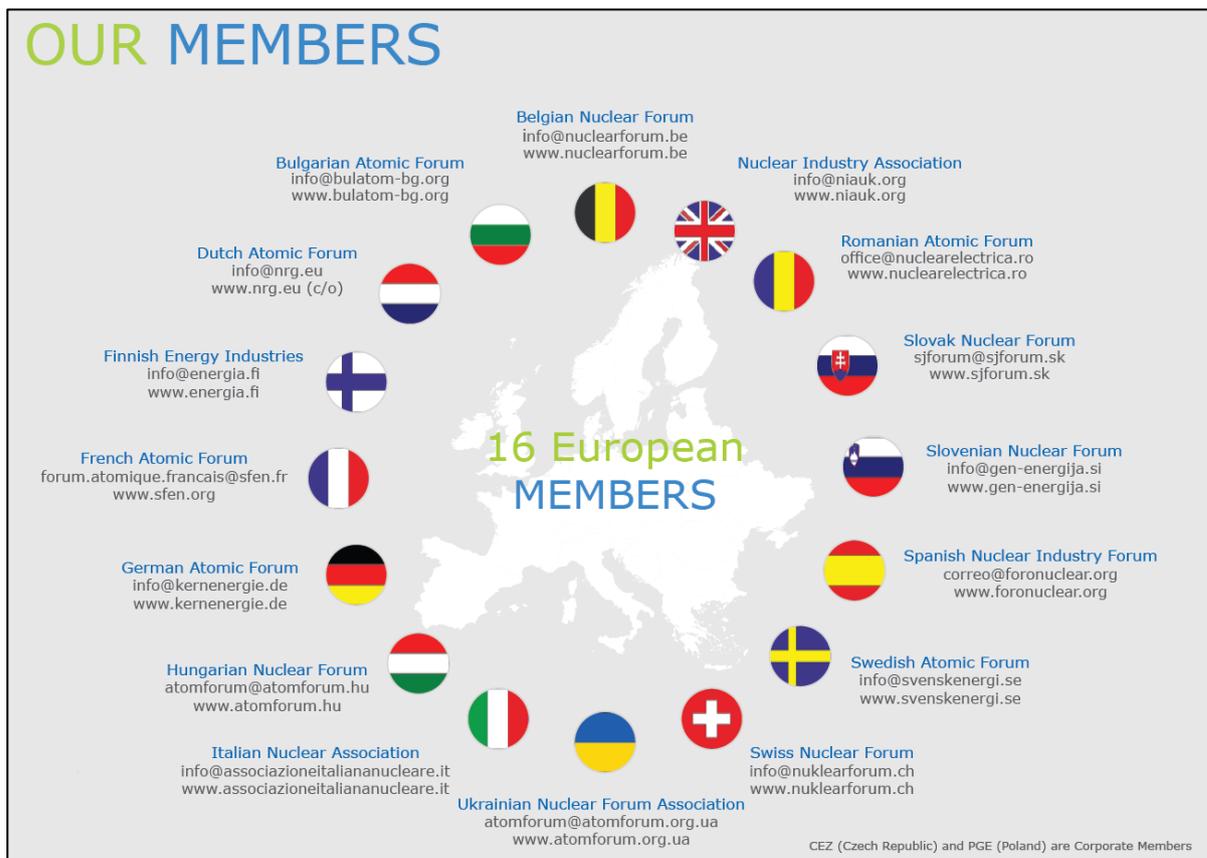


Figure 16: Nuclear associations across Europe (members of Foratom)

NGO representatives could be from pan-European or member state organisations. A range of representatives is suggested. Groups for consideration could include Nuclear Transparency Watch, ANCLLI, Mutadis, Greenpeace, and Aarhus Convention and Nuclear (ACN).

⁶² From Foratom, the European industry association, which may be considered for a place on the JPCSAG.

The suggested composition of the JPCSAG can be found in Table 6.

Table 6: Suggested composition of the JPCSAG

Group	Number of Members
NUGENIA Executive Committee	1
European Commission, or nominated deputy organisation	1
Joint Research Centre	1
Neutral parties, such as Academia and Non-Governmental Organisations	5 or 6 representatives for both Academia and NGOs
Member States	One per member state represented within NUGENIA (currently 20 + 4) ⁶³
Additional members; SNETP ⁶⁴ , Foratom, Euratom, IAEA ⁶⁵ Safety division, news agencies, and other ad-hoc attendees (e.g. technical area members could be invited to present at meetings)	Variable
Nominated permanent secretary from NUGENIA	1

It is recognised that this may be a large group and rules should be established to set minimum attendance such that the meeting is quorate for decisions to be agreed. Having formed the JPCSAG, its position should be clearly defined within the structure of NUGENIA. The current NUGENIA structure is [145] in Figure 17.

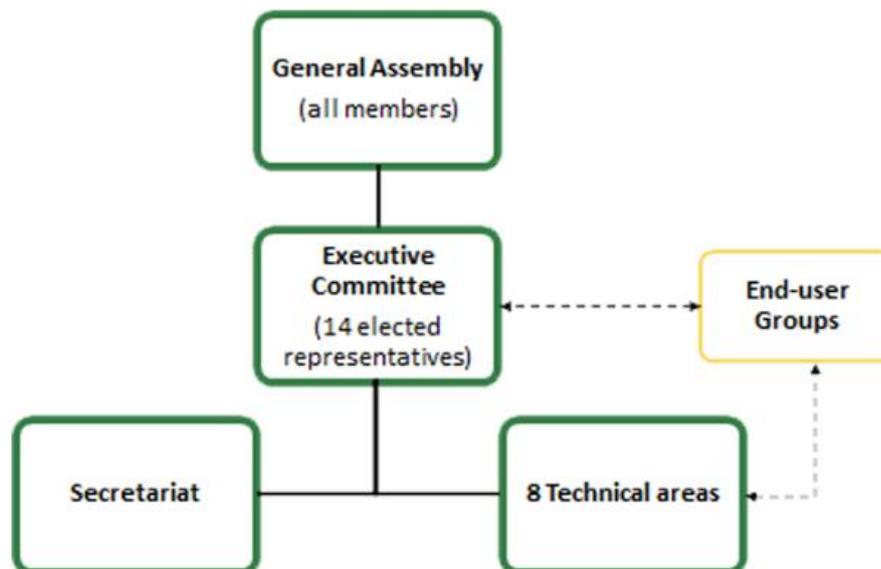


Figure 17: Current NUGENIA Organisation structure

⁶³ See Footnote 61.

⁶⁴ Sustainable Nuclear Energy Technology Platform.

⁶⁵ International Atomic Energy Agency.

THE JPCSAG should sit separately to the Secretariat and 8 technical areas but should report to, and be under the supervision of, the Executive Committee (ExCom). This arrangement should provide a strong basis for formal reporting arrangements to the ExCom, as well as liaison with the technical areas. Formal reporting arrangements should be well defined within the JPCSAG ToR. Consideration should be given to how reporting could align with the R&D strategy development process. This is discussed further in Section 8.4.

The timescales of successful projects are sufficiently long for a meaningful dialogue to occur. Building trust takes time, which is why brief and sporadic dialogues often fail. Stability within the JPCSAG is recommended such that trust building and meaningful dialogue can be facilitated. Participants should feel assured that the group is a neutral and “safe” space to raise and resolve issues.

Whilst the timescales need to be sufficiently long, it is also important that the JPCSAG meets regularly enough to stay informed of changing and developing situations. However, formal reporting to the NUGENIA ExCom may not need to be as regular.

The expected timescales of operation should be clearly defined. For example, is the JPCSAG expected to continue to function beyond Horizon 2020? Similarly, the timings of JPCSAG meetings should be complementary to the Horizon 2020 funding cycle and internal NUGENIA processes. A formal procedure for input of JPCSAG output should be developed. A simple example procedure is included in Figure 18.

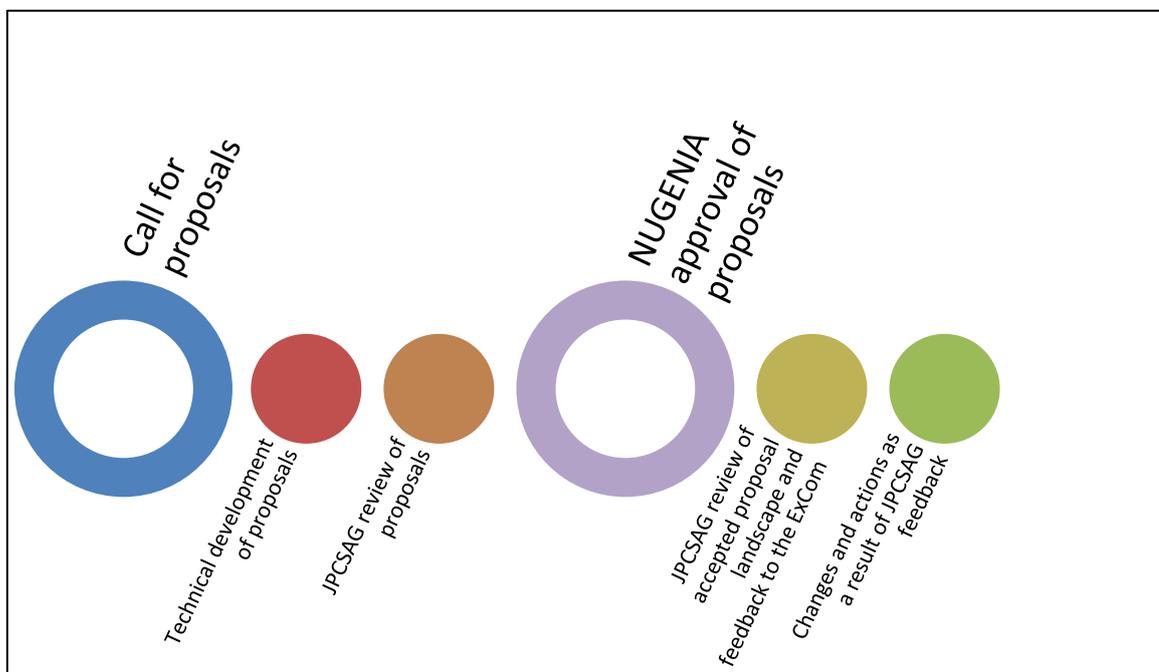


Figure 18: Simple example procedure for inclusion of JPCSAG input to proposal generation process

Finally, a level of infrastructure is required for the JPCSAG to perform its function appropriately. Such infrastructure includes a website (or web page), email inbox, secretarial functions, educational materials, and detailed terms of reference that include financing arrangements for attendance⁶⁶.

8.4. Function

The 'Function', or operation of the JPCSAG, explains how the JPCSAG will achieve its aims.

The principal method of the JPCSAG achieving its aim is through the meeting of its members to discuss engagement with the individual Member States. The process for collecting information at the Member State level is twofold. The first part involves the JPCSAG representative collecting information from their home country. The second part involves that same representative disseminating that same information at a meeting of the JPCSAG.

To ensure that the representative is properly informed of the situation in their home country, it is recommended that a thorough review is made of the individual bodies within each member state in order to identify which body is most suited to act as the focal point of public and political concern in that Member State, as well as to establish the current status of public engagement activity within that Member State. As part of this assessment, it is recommended that the European toolkit developed by NNL for NUGENIA should be used [66].

As an additional layer, the Permanent Secretary should be responsible for checking other sources of information that may be relevant to the JPCSAG's mission. This may include sources of information such as the Eurobarometer⁶⁷, or other pan-EU surveys.

Once the information on public and political opinion has been obtained, the dissemination to the wider JPCSAG, and NUGENIA itself, can occur. It is expected that the JPCSAG will hold events to discuss key findings, and will have regular meetings for its members to discuss updates.

Organising networking events, or engagement activities, appropriate to the above will be an important factor in maintaining an understanding of trends (whether positive or negative) in public opinion. The choice of event or activity will depend upon the desired goal. For example, if the event is intended to bring partners from industry together to discuss a particular issue, a specific workshop may be most appropriate. Events such as this have benefits specific to the purpose they fulfil, with the above example possibly contributing to mitigating fragmentation of the sector by ensuring that current practice and thinking is shared between all participants. These involvement methods are appropriate for the JPCSAG and include formats such as; stakeholder dialogues, public

⁶⁶ Face to face meetings are generally considered more effective for engagement and discussion, particularly for first time meetings. See Section 4.1.1, and particularly [46], for more information.

⁶⁷ The European Commission monitors public opinion and publishes the results as a 'Eurobarometer'. The website is: <http://ec.europa.eu/COMMFrontOffice/publicopinion/index.cfm>

meetings, citizens' panels, events, forums, workshops, peer exchange, interactive websites and external communication through press and media. As a minimum, it's expected that the JPCSAG will meet quarterly.

The conclusions from the independent evaluation of the Sciencewise dialogue study [46] (see following quote) are relevant to how the JPCSAG will be informed of public opinion, and implementation of this learning is key in ensuring that an accurate representation of public opinion can be attained and incorporated into decision-making processes.

"Face to face contact as part of the consultation is the best way to build trust and respect. Where this is not possible there needs to be consideration as to how communications and information can demonstrate the integrity of the process and the desire of regulators to respect the needs and opinions of the public."

Having loosely defined the benefits that can be gained from the JPCSAG operating effectively, it is important to consider the process for progressing findings of any engagement activities, as well as any on-going involvement. This has been cited as a potential cause of difficulties.

Dissemination may involve engaging with the public through open events, a regularly updated website, email updates and/or through public meetings and consultation. This approach of inclusivity and engagement is expected to be an appropriate mechanism for the JPCSAG to effectively communicate. The use of decision-support tools has been identified as positive, especially scenario-building, and may be suitable for cascade from the JPCSAG to the political and public areas via defined routes.

Ensuring that public and political opinion is shared with the JPCSAG, and then with the ExCom as appropriate, requires a formal communication protocol for dissemination within NUGENIA and its partner organisations. A basic process has been suggested in Figure 18, but the formal mechanism should be well defined within the Terms of Reference. It may be that the Permanent Secretary takes notes during any meeting of the JPCSAG and prepares minutes and actions to be disseminated to the group, and additionally produces reports on a periodic basis to capture key learning. The minutes should be published.

Further, formalising the route in which any key findings will be returned to the member states for dissemination by the nominated JPCSAG representative in that particular Member State will engender trust and confidence in the individuals that had made their concerns known for discussion at the JPCSAG. It is recommended that the reporting function uses the format from the RWM's 'Response to Consultation' [106], where the issue is presented in the report, along with a technical response (as appropriate) and a record of any action or change associated with that issue. This ensures that there is a direct link to the concern or issue raised, with an explanation and an outcome if necessary.

Defining the communications, Member State links, event organisation and the reporting arrangements for the JPCSAG concludes the 'Function' section.

This concludes the Summary of Learning and Recommendations for the JPCSAG.

9. References

- [1] Elam, M. and Sundqvist, G. (2007) 'Six Domains of Decision for Stakeholder Involvement in Nuclear Waste Management', *CARL Thematic Report No. 4*.
- [2] Bird, N. (2016) *Re: Diagram of History of BNFL UKAEA*, email to R. Holmes (reuben.m.holmes@nnl.co.uk), 20 Jan. [20 Jan 2016], EU08051/06/09/01.
- [3] Bird, N. (2016) *Re: Timeline – UK Atomic Energy*, email to R. Holmes (reuben.m.holmes@nnl.co.uk), 31 Jan. [01 Feb 2016], EU08051/06/09/02.
- [4] Nuclear Industry Association, *Industry Maps*, [Online], Available: www.niauk.org/nia-industry-maps [15 Feb 2016], EU08051/06/48/01.
- [5] Department of Energy & Climate Change (DECC), (2011) *The Carbon Plan: Delivering Our Low Carbon Future*, UK Government Publication.
- [6] Ipsos MORI (2013) *British Public Split on Nuclear Power*, [Online], Available: <https://www.ipsos-mori.com/researchpublications/researcharchive/3284/British-public-split-on-nuclear-power.aspx> [15 Feb 2016], EU08051/06/48/02.
- [7] Grove-White, R., Kearnes, M., MacNaghten, P. and Wynne, B. (2006) 'Nuclear Futures: Assessing Public Attitudes to New Nuclear Power', *The Political Quarterly*, vol. 77, no. 2, April-June, pp. 238-246.
- [8] European Commission (EC), (2010) *Science and Technology Report*, Special Eurobarometer 340/Wave 73.1 – TNS Opinion & Social, EC Publication.
- [9] Nuclear Industry Association, *Nuclear Energy Factbook*, [Online], Accessed: https://issuu.com/nuclear_industry_association/docs/nia_facts_book_for_web/1?e=6190736/34699528 [15 Sep 2016].
- [10] Research Councils UK (RCUK), *What's in it for me? The Benefits of Public Engagement for Researchers*, RCUK Publications.
- [11] National Coordinating Centre for Public Engagement, *Benefits of Engagement*, [Online], Available: <http://www.publicengagement.ac.uk/explore-it/why-it-important/benefits-engagement> [15 Feb 2016], EU08051/06/48/03.
- [12] United Nations Economic Commission for Europe, *Public Participation*, [Online], Accessed at <http://www.unece.org/env/pp/welcome.html> [29 Sep 16]. EU/08051/06/48/136.
- [13] United Nations Economic Commission for Europe, *Text of the Convention*, [Online], Accessed at http://www.unece.org/env/eia/about/eia_text.html [29 Sep 16]. EU/08051/06/48/137.
- [14] Whitton, J. (2010) 'Participant Perceptions on the Nature of Stakeholder Dialogue Carried Out by the UK Nuclear Decommissioning Authority (NDA)', *PhD Thesis submitted to the University Of Manchester*.
- [15] Pidgeon, N. F. and Demski, C. (2012) 'From Nuclear to Renewables: Energy System Transformation and Public Attitudes', *Bulletin of the Atomic Scientists*, vol. 68, no. 4, pp. 41-51.
- [16] Kos, D., Polic, M. and Zeleznik, N. (2008) 'The Framing of Radioactive Waste Risk: A Comparative Analysis', *CARL Thematic Report No. 1*.
- [17] Bergmans, A. (2008) 'Stakeholders in Radioactive Waste Management and their Networks', *CARL Thematic Report No. 3*.
- [18] Elam, M. and Sundqvist, G. (2007) 'Fission or Fusion? Reconciling Technical and Social Aspects of Radioactive Waste Management', *CARL Thematic Report No. 5*.

-
- [19] Morton, A., Airoidi, M. and Phillips, L. D. (2009) 'Nuclear Risk Management on Stage: A Decision Analysis Perspective on the UK's Committee on Radioactive Waste Management', *Risk Analysis*, vol. 29, no. 5, pp. 764-779.
- [20] Committee on Radioactive Waste Management (CoRWM), (2006) *Managing our Radioactive Waste Safely: CoRWM's Recommendations to Government*, CoRWM Publications.
- [21] Irving, A. (2012) *The £16M Cost of Sellafield Visitor Centre – and Today it Stands Idle*, [Online], Available: <http://test.cnmedia.co.uk/the-16m-cost-of-sellafield-visitor-centre-and-today-it-stands-idle-1.955030> [15 Feb 2016], EU08051/06/48/04.
- [22] Perret, A. (2006) 'BNFL National Stakeholder Dialogue: A Case Study in Public Affairs', *Journal of Public Affairs*, vol. 3, no. 4, November, pp. 383-391.
- [23] Radioactive Waste Management Committee (RWMAC), (2000) *Twentieth Annual Report, Chapter 3: Building Consensus on Future Radioactive Waste Management Policy*. RWMAC Publications.
- [24] International Atomic Energy Agency, *International Conference on the Safety of Radioactive Waste Management*, [Online], Available: <http://www-ns.iaea.org/meetings/rw-summaries/cordoba-2000.asp?s=10&l=80> [15 Feb 2016], EU08051/06/48/05.
- [25] International Atomic Energy Agency, *INPRO Dialogue Forum*, [Online], Available: <https://www.iaea.org/INPRO/DFs/index.html> [15 Feb 2016], EU08051/06/48/06.
- [26] International Atomic Energy Agency (IAEA), (2006) *Stakeholder Involvement in Nuclear Issues*, International Nuclear Safety Group Publications.
- [27] International Atomic Energy Agency (IAEA), (2009) *An Overview of Stakeholder Involvement in Decommissioning*, IAEA Nuclear Energy Series No. NW-T-2.5.
- [28] International Atomic Energy Agency (IAEA), (2011) *Stakeholder Involvement Throughout the Life Cycle of Nuclear Facilities*, IAEA Nuclear Energy Series No. NG-T-1.4.
- [29] Faulkland Associates, (2004) *Evaluation of the Dounreay BPEO Stakeholder Programme: A Summary Report for UKAEA*, Faulkland Associates Publications.
- [30] Bond, A., Palerm, J. and Haigh, P. (2004) 'Public Participation in EIA of Nuclear Power Plant Decommissioning Projects: A Case Study Analysis', *Environmental Impact Assessment Review*, vol. 24, no. 6, pp. 617-641.
- [31] Department of Trade and Industry (DTI), (2002) *Managing the Nuclear Legacy: A Strategy for Action*, UK Government White Paper.
- [32] Department of Trade and Industry (DTI), (2003) *Our Energy Future - Creating a Low Carbon Economy*, UK Government Energy White Paper.
- [33] Whitton, J. (2009) 'Stakeholder Participation for the Legacy Ponds and Legacy Silos (LP&LS) Facility at Sellafield, Cumbria, UK: The Nature and Effectiveness of the Dialogue', *Conference Proceedings*, 12th International Conference on Environmental Radiation & Radioactive Waste Management/Nuclear Decommissioning, Liverpool.
- [34] Department for Business Enterprise & Regulatory Reform (BERR), (2008) *Meeting the Energy Challenge - The Future of Nuclear Power: Analysis of Consultation Responses*, UK Government Publication.
- [35] Summers, D. (2007) *Government Loses Nuclear Power Case*, [Online], Available: <http://www.theguardian.com/uk/2007/feb/15/nuclear.greenpolitics1> [15 Feb 2016], EU08051/06/48/07.

-
- [36] Department of Trade and Industry (DTI), (2006) *Policy Framework for New Nuclear Build: Consultation Document*, UK Government Publication.
- [37] Department for Business Enterprise & Regulatory Reform (BERR), (2008) *Meeting the Energy Challenge - A White Paper on Nuclear Power*, UK Government White Paper.
- [38] Department of Trade and Industry (DTI), (2007) *Meeting the Energy Challenge - A White Paper on Energy*, UK Government White Paper.
- [39] Office for Nuclear Regulation, *Getting Involved*, [Online], Available: <http://www.onr.org.uk/new-reactors/public-involvement.htm> [15 Feb 2016], EU08051/06/48/08.
- [40] Department for Environment, Food and Rural Affairs (DEFRA), (2008) *Managing Radioactive Waste Safely: A Framework for Implementing Geological Disposal*, UK Government Publication.
- [41] Department of Energy & Climate Change (DECC), (2014) *Public Attitudes to the Revised Geological Disposal Facility (GDF) Siting Process*, Final Report, Ipsos MORI Publication.
- [42] Blowers, A. B, Kemp, S. and Haslam, P. (2015) *Evaluation of the Engagement Events During the Geological Disposal Facility Siting Review Consultation*, Icarus Publication.
- [43] Department of Energy & Climate Change (DECC), (2014) *Implementing Geological Disposal*, UK Government White Paper.
- [44] Department of Energy & Climate Change (DECC), (2014) *Implementing Geological Disposal*, UK Government White Paper.
- [45] Three Key Questions (3KQ), (2015) *New Nuclear Power Stations: Improving Public Involvement in Reactor Design Assessments*, 3KQ Publications.
- [46] Smith, S. (2015) *Improving Public Involvement in Reactor Design Assessments for New Nuclear Power Stations – Public Dialogue: Project Evaluation – Final Report*, Icarus Publication.
- [47] European Commission (EC), (2012) *Benefits and Limitations of Nuclear Fission for a Low-Carbon Economy: Defining Priorities for Euratom Fission Research & Training (Horizon 2020)*, Synthesis Report, EC Publication.
- [48] Department for Business, Innovation and Skills (BIS), (2013) *Industrial Strategy: Government and Industry in Partnership – The UK's Nuclear Future*, UK Government Publication.
- [49] Nuclear Industry Council (NIC), (2014) *In the Public Eye: Nuclear Energy and Society*, NIC Publication.
- [50] Nuclear Industry Association (2015) *Nuclear Industry Commits to Public Engagement*, [Online], Available: <http://www.niauk.org/news/2284-nuclear-industry-commits-to-public-engagement> [15 Feb 2016], EU08051/06/48/09.
- [51] Sherry, A. (2015) *In the Public Eye: Nuclear Energy and Society*, [Online], Available: <http://www.world-nuclear-news.org/V-In-the-public-eye-nuclear-energy-and-society-0312151.html> [15 Feb 2016], EU08051/06/48/10.
- [52] Nuclear Industry Council (NIC), (2015) *Nuclear Energy and Society: A Concordat for Public Engagement*, NIC Publication.
- [53] WORLD NUCLEAR ASSOCIATION, 2015, *Hot Topics 2015 edition*, Unpublished internal document, World Nuclear Association.

-
- [54] Nuclear Industry Association (NIA), (2014) *Public Opinion Polling November 2014*, YouGov Publication.
- [55] World Nuclear News (2015) *In Other News*, [Online], Available: <http://us1.campaign-archive2.com/?u=140c559a3b34d23ff7c6b48b9&id=94e9cbbcce&e=ee27113e11> [15 Feb 2016], EU08051/06/48/11.
- [56] Department of Energy and Climate Change, *DECC Public Attitudes Tracking Survey*, [Online], Available: <https://www.gov.uk/government/collections/public-attitudes-tracking-survey> [15 Feb 2016], EU08051/06/48/12.
- [57] Vaughan, A. (2015) *Public Support for UK Nuclear and Shale Gas Falls to New Low*, [Online], Available: <http://www.theguardian.com/environment/2015/aug/04/public-support-for-uk-nuclear-shale-gas-falls-new-low> [15 Feb 2016], EU08051/06/48/13.
- [58] Sciencewise Expert Resource Centre, *New Nuclear Power Stations – Reviewing How to Engage with Members of the Public in Reactor Design Assessments (Known as the Generic Design Assessment of GDA)*, [Online], Available: <http://www.sciencewise-erc.org.uk/cms/new-nuclear-power-stations-reviewing-how-to-engage-with-members-of-the-public-in-reactor-design-assessments-known-as-the-generic-design-assessment-or-gda> [15 Feb 2016], EU08051/06/48/14.
- [59] Richardson, P. (2012) 'A brief history of stakeholder engagement in relation to radioactive waste disposal programmes' Galson Sciences Ltd. Available: https://www.iaea.org/OurWork/ST/NE/NEFW/WTS-Networks/DISPONET/disponetfiles/TCStakeholderDialogue_Poland2012/TC-StakeholderDialogue_Poland2012-BriefHistory_Richardson.pdf [14 Sep 2016], EU/08051/06/48/139.
- [60] Dawson, J. and Darst, R. G. (2006) 'Meeting the Challenge of Permanent Nuclear Waste Disposal in an Expanding Europe', *Environmental Politics*, vol. 15, no. 4, pp. 610-627.
- [61] Edelman (2015) *Trust and Innovation*, [Online], Available: <http://www.edelman.com/insights/intellectual-property/2015-edelman-trust-barometer/trust-and-innovation-edelman-trust-barometer/> [15 Feb 2016], EU08051/06/48/15.
- [62] Science Media Centre, [Online], Available: <http://www.sciencemediacentre.org/tag/nuclear-energy/> [15 Feb 2016], EU08051/06/48/16.
- [63] Energy for Humanity, *Energy for Humanity is a New Voice for the Environmental Movement*, [Online], Available: <http://energyforhumanity.org/about-efh/> [15 Feb 2016], EU08051/06/48/17.
- [64] Lehtonen, M. (2015) Finland, France and Sweden: Models for Successful Radioactive Waste Management Policy? Presentation in Hannover on 27th April 2015.
- [65] Power, A. (2010) 'EU Legitimacy and New Forms of Citizen Engagement', *Electronic Journal of e-Government*, vol. 8, no. 1, pp. 45-54.
- [66] Bull, A., Cormack, M., Grundy, C., Holmes, C., Holmes, R., Kayani, S., Scott, J., Taylor, O. (2016) 'NUGENIA: Developing an "EU Nuclear Public Engagement Toolkit"'. National Nuclear Laboratory. EU08051/06/10/02.
- [67] European Parliament (2000), 'Directive 2000/06/EC of the European Parliament and of the Council', *Official Journal of the European Council*, vol. 327.

-
- [68] Hewicker, C., Hogan, M. and Mogren, A. (2011), European Climate Foundation Report, Power Perspectives 2030: On the Road to a Decarbonised Power Sector, Synthesis Report.
- [69] Roadmap 2050, *Roadmap 2050*, [Online], Available: <http://www.roadmap2050.eu/project/roadmap-2050> [15 Feb 2016], EU08051/06/48/18.
- [70] European Commission (EC), (2005) *Radioactive Waste*, Special Eurobarometer 227/Wave 63.2 – TNS Opinion & Social, EC Publication.
- [71] Sjoberg, L. (2004) 'Local Acceptance of a High-Level Nuclear Waste Repository', *Risk Analysis*, vol. 24, no. 3, pp. 737-749.
- [72] Thegerstrom, C. and Engstrom, S. L. (2012) 'Deep Geological Disposal of Nuclear Waste in the Swedish Crystalline Bedrock', *International Journal for Nuclear Power*, vol. 59, no. 6.
- [73] Ahagen, H. (1999), The Oskarshamn Model for Public Involvement in the Siting of Nuclear Facilities, IAEA NCL Collection Store, SE0000124.
- [74] Slovic, P. (2000), 'The Perception of Risk', *Earthscan Publications*, vol. 37, pp. 473.
- [75] ENS News (2009) *The Forsmark NPP, in Sweden, Will be First to House a Deep Geological Repository for its High-Level Radioactive Waste (HLW)*, [Online], Available: <https://www.euronuclear.org/e-news/e-news-25/forsmark.htm> [15 Feb 2016], EU08051/06/48/19.
- [76] SKB (2016) Swedish Radiation Safety Authority endorses SKB's application, [Online], Available: <http://www.skb.com/news/swedish-radiation-safety-authority-endorses-skbs-application/> [14 Sep 2016], EU08051/06/48/140.
- [77] Swedish Radiation Safety Authority (2015) *Preliminary Outcome: Forsmark is a Suitable Site for a Geological Repository for Spent Nuclear Fuel*, [Online], Available: <https://www.stralsakerhetsmyndigheten.se/In-English/About-the-Swedish-Radiation-Safety-Authority1/News1/Preliminary-outcome-Forsmark-is-a-suitable-site-for-a-geological-repository-for-spent-nuclear-fuel/> [15 Feb 2016], EU08051/06/48/21.
- [78] Kojo, M. (2005) 'Approach Change in Stakeholder Involvement: The Case of the Site Selection Process of the Final Disposal Facility for High-Level Nuclear Waste in Finland', *Conference Proceedings*, Technology: Between Enthusiasm and Resistance International Conference, 10-11 May, Jyvaskyla.
- [79] Strauss, H. (2010), 'Involving Finnish Public in Nuclear Facility Licensing: Participatory Democracy and Industrial Bias', *Journal of Integrative Environmental Sciences*, vol. 7, no. 3, pp. 211-228.
- [80] Szakálos, P. and Seetharaman, S. (2012), Corrosion of Copper Canister, Technical Note 2012:17, Swedish Radiation Safety Authority Publication.
- [81] Tison, J. M. (2009) 'Update on French Deep Geological Program for High Level Waste', *IAEA CEG Workshop*, Bommersvik, 24-26 Feb.
- [82] Andra (2009) 'The presence of Andra in the Meuse and Haute-Marne districts', [Online], Available: <https://www.andra.fr/download/andra-international-en/document/355VA-B.pdf> [15 Sep 2016]. EU08051/06/48/140.
- [83] OECD (2010) 'Radioactive Waste Repositories and Host Regions: Envisaging the Future Together', Synthesis of the FSC National Workshop and Community Visit, Bar-le-Duc, France, 7-9 April 2009.
- [84] Foster, R. (2015) *Go Forth and Mingle*, [Online], Available: <https://www.timeshighereducation.com/features/public-engagement-go-forth-and-mingle> [15 Feb 2016], EU08051/06/48/22.

-
- [85] Hurlbert, M. (2014), 'Evaluating Public Consultation in Nuclear Energy: The Importance of Problem Structuring and Scales', *International Journal of Energy Sector Management*, vol. 8, no. 1, pp. 56-75.
- [86] Olson, K., Reddin, C. and Thorne, S. (2012) *Communicating Nuclear: Balancing Risk with Opportunity*, [Online], Available: <http://iveybusinessjournal.com/publication/communicating-nuclear-balancing-risk-with-opportunity> [15 Feb 2016], EU08051/06/48/23.
- [87] Kang, J., Kim, S-W. and Lee, B-C. (2015), 'Hot Potato in South Korea: The Spent Nuclear Fuel Storage Dilemma', *Bulletin of the Atomic Scientists*, Vol. 71, No. 3, pp. 76-83.
- [88] Whitton, J., Parry, I., Grundy, C., Lillycrop, A., and Ross, D., 'A review of the Generic Design Assessment (GDA) Public Dialogue Pilot (2015) for new nuclear build in the UK: lessons for engagement theory and practice' *J. Radiol. Prot.* 36 (2016) S23–S44.
- [89] Grundy, C., Bull, A., Holmes, C., Cormack, M., Scott, J., Holmes, R., (forthcoming 2016), 'Engaging with Society on Nuclear Energy Matters – A Public Dialogue on the UK's "Nuclear Energy and Society: A Concordat for Public Engagement"', Paper for oral presentation at European Nuclear Conference, October 2016.
- [90] Radioactive Waste Management, *National Geological Screening Guidance*, [Online], Available: https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/510678/ngs-guidance.pdf [20 Sep 2016], EU08051/06/48/141
- [91] Radioactive Waste Management, Societal aspects of geological disposal, [Online], Available: <https://rwm.nda.gov.uk/publication/societal-aspects-of-geological-disposal/> [20 Sep 2016], EU08051/06/48/142
- [92] Nuclear Energy Agency, *Forum on Stakeholder Confidence (FSC)*, [Online], Available: <http://www.oecd-nea.org/rwm/fsc/reports.html> [15 Feb 2016], EU08051/06/48/24.
- [93] European Commission (2015) *E-TRACK Open Seminar & Official Launch*, [Online], Available: <https://ec.europa.eu/jrc/en/event/other-event/e-track-2nd-open-seminar-rwm-official-launch> [15 Feb 2016], EU08051/06/48/25.
- [94] European Commission (2015) *NFRP-12-2015 – Nuclear Developments and Interaction with Society*, [Online], Available: http://cordis.europa.eu/programme/rcn/664950_en.html [15 Feb 2016], EU08051/06/48/26.
- [95] PLOS One, *Journal Information*, [Online], Available: <http://journals.plos.org/plosone/s/journal-information> [15 Feb 2016], EU08051/06/48/27.
- [96] Helmholtz Zentrum Dresden Rossendorf, *HZDR Research Magazine "discovered"*, [Online], Available: <https://www.hzdr.de/db/Cms?pNid=2931> [15 Feb 2016], EU08051/06/48/28.
- [97] University of Sheffield Department of Sociological Studies, *ESRC Nuclear Futures Seminar Series*, [Online], Available: <https://www.sheffield.ac.uk/socstudies/research/research-seminars/esrc-nuclear-futures> [15 Feb 2016], EU08051/06/48/29.
- [98] Nuclear Decommissioning Authority (2014), *Collaborative Research Takes DISTINCTIVE Approach*, [Online], Available: <https://www.nda.gov.uk/2014/01/collaborative-research-takes-distinctive-approach/> [15 Feb 2016], EU08051/06/48/30.

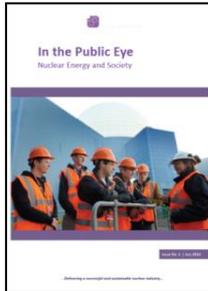
-
- [99] 3KQ, *Home Page*, [Online], Available: <http://www.3kq.co.uk/> [15 Feb 2016], EU08051/06/48/31.
- [100] Sciencewise Expert Resource Centre, *About Us*, [Online], Available: <http://www.sciencewise-erc.org.uk/cms/about-us/> [15 Feb 2016], EU08051/06/48/32.
- [101] West Cumbria MRWS, (2011) *Geological Disposal of Radioactive Waste in West Cumbria? The West Cumbria Managing Radioactive Waste Safely (MRWS) Partnership's Initial Opinions*, Public Consultation Document, West Cumbria MRWS Publication.
- [102] West Cumbria MRWS, (2012) *The Final Report of the West Cumbria Managing Radioactive Waste Safely Partnership*, West Cumbria MRWS Publication.
- [103] Savege, J. (2013) *Managing Radioactive Waste Safely: The Siting Process for a Geological Disposal Facility Consultation Response*, Note to Cabinet, 21 Nov 2013.
- [104] Philip Kearney, "Practical implementation of Aarhus Convention in the context of nuclear safety – what should be a way forward?", Chair of the Aarhus Convention's Task Force on Access to Information Report, Public Participation in Decision-making and Access to Justice in Environmental Matters. 4th ACN Roundtable, Brussels, 5 December 2012.
- [105] Department of Energy and Climate Change (DECC), (2013) *Consultation: Review of the Siting Process for a Geological Disposal Facility*, UK Government Publication.
- [106] Radioactive Waste Management (RWM), (2016) *National Geological Screening: Response to consultation*, UK Government Publication.
- [107] Parry, I. (2016) 'Strategic Stakeholder Dialogue and Social Sustainability Indicator Development for Nuclear Decision Making in Anglesey, North Wales', *Draft PhD Thesis submitted to the University of Central Lancashire*.
- [108] Kassakian. (2000), In: Assefa, G. and Frostell, B. (2007) 'Social Sustainability and Social Acceptance in Technology Assessment: A Case Study of Energy Technologies', *Technology in Society*, vol. 29, no. 1, pp. 63-78.
- [109] Sovacool, B. K. et al. (2014) 'Integrating Social Science in Energy Research', *Energy Research & Social Science*, vol. 6, pp. 95-99.
- [110] Dryzek, J.S. (2000) *Deliberative Democracy and Beyond: Liberals, Critics, Contestations*. New York: Oxford University Press.
- [111] Parry, I. (2016) 'Strategic Stakeholder Dialogue and Social Sustainability Indicator Development for Nuclear Decision Making in Anglesey, North Wales', *Draft PhD Thesis submitted to the University of Central Lancashire*. 33
- [112] TNS BMRB, (2014) *Public Engagement with Shale Gas and Oil: A Report on Findings from Public Dialogue Workshops*, TNS BMRB Publication.
- [113] Centre for Sustainable Energy (2007), *The Protocol for Public Engagement with Proposed Wind Energy Developments in England: A Report for the Renewables Advisory Board and DTI*, Centre for Sustainable Energy Publication.
- [114] Department of Energy and Climate Change (DECC), (2014) *Community Engagement for Onshore Wind Developments: Best Practice Guidance for England*, UK Government Publication.
- [115] Dorfman, P., Prikken, I. and Burall, S. (2012) *Future National Energy Mix Scenarios: Public Engagement Processes in the EU and Elsewhere*, European Economic and Social Committee (EESC) Report.

-
- [116] National Co-ordinating Centre for Public Engagement, *Beacons*, [Online], Available: <http://publicengagement.ac.uk/work-with-us/completed-projects/beacons> [15 Feb 2016], EU08051/06/48/34.
- [117] National Co-ordinating Centre for Public Engagement, *Catalysts Project*, [Online], Available: <http://publicengagement.ac.uk/work-with-us/current-projects/catalysts-project> [15 Feb 2016], EU08051/06/48/35.
- [118] National Co-ordinating Centre for Public Engagement, *Catalyst Seed Fund*, [Online], Available: <http://publicengagement.ac.uk/work-with-us/current-projects/catalyst-seed-fund> [15 Feb 2016], EU08051/06/48/36.
- [119] Manchester Beacon Partners, (2012) *Final Report of the Manchester Beacon for Public Engagement*, [Online], Available: https://www.publicengagement.ac.uk/sites/default/files/publication/manchester_beacon_final_report.pdf [26 Sep 16], EU08051/06/48/143.
- [120] University College London, *The UCL Public Engagement Strategy*, [Online], Available: <https://www.ucl.ac.uk/public-engagement/documents/uclpublicengagementstrategy> [15 Feb 2016], EU08051/06/48/37.
- [121] University of Bristol, (2014) *Engaged University Strategy*, University of Bristol Publication.
- [122] Younger, P. L. (2009), *Engagement Strategy 2010-2013*, Newcastle University Publication.
- [123] University of Bath, *Public Engagement at Bath: Supporting Researchers to Engage*, University of Bath Publication.
- [124] Manchester Metropolitan University, *Public Engagement Strategy: "Bridging the Gap Between MMU and the Public"*, Manchester Metropolitan University Publication.
- [125] Research Councils UK (RCUK), *Concordat for Engaging the Public with Research*, RCUK Publications.
- [126] National Co-ordinating Centre for Public Engagement, *Self Assess with the EDGE Tool*, [Online], Available: <http://www.publicengagement.ac.uk/support-it/self-assess-with-edge-tool> [15 Feb 2016}, EU08051/06/48/38.
- [127] TNS BMRB, (2015) *Factors Affecting Public Engagement by Researchers: A Study on Behalf of a Consortium of UK Public Research Funders*, TNS BMRM Publication.
- [128] The Royal Society, (2006) *Science Communication: Survey of Factors Affecting Science Communication by Scientist and Engineers*, Royal Society Publication.
- [129] Whitmarsh, L., Nash, N., Lloyd, A. and Upham, P. (2014) *UK Public Perceptions of Shale Gas, Carbon Capture & Storage and Other Energy Sources & Technologies: Summary Findings of a Deliberative Interview Study and Experimental Survey*, Understanding Risk Research Group Working Paper 14-02, Cardiff University Publication.
- [130] Poortinga, W. and Aoyagi, M. (2013) *Public Perceptions of Climate Change and Energy Futures Before and After the Fukushima Accident: A Comparison between Britain and Japan*, WSA Working Paper Series ISSN 2050-8522.
- [131] Pidgeon, N. F. and Dmeski, C. (2012) 'From Nuclear to Renewable: Energy System Transformation and Public Attitudes', *Bulletin of the Atomic Scientists*, vol. 68, no. 4, pp. 41-51.
- [132] Demski, C., Poortinga, W. and Pidgeon, N. F. (2014) 'Exploring Public Perceptions of Energy Security Risks in the UK', *Energy Policy*, vol.66, pp. 369-378.

-
- [133] Pidgeon, N. F., Hood, C., Jones, D., Turner, B. and Gibson, R. (1992) *Risk Perception - Risk Analysis, Perception and Management*, Royal Society Study Group Publication.
- [134] Nuclear Energy Agency, (2000) 'Stakeholder Confidence and Radioactive Waste Disposal, Inauguration', First Workshop and Meeting of the NEA Forum on Stakeholder Confidence in the Area of Radioactive Waste Management, [Online], Accessed at: <https://www.oecd-nea.org/rwm/reports/2000/nea2829.pdf> [26 Sep 16], EU08051/06/48/144.
- [135] European Commission Joint Research Centre, (2015) *Energy - Transparency Centre of Knowledge (E-TRACK)*, [Online], Accessed at: <https://ec.europa.eu/jrc/en/research-topic/energy-policies-and-public-participation> [26 Sep 16], EU08051/06/48/145.
- [136] Whitton, J., Parry, I. M., Akiyoshi, M. and Lawless, W. (2015) 'Conceptualizing a Social Sustainability Framework for Energy Infrastructure Decisions', *Energy Research & Social Science*, vol. 8, pp. 127-138.
- [137] Shapiro, L. (1999) *Enough of Deliberation: Politics is About Interest and Power*, In: S. Macedo (Ed.), *Deliberative Politics: Essays on Democracy and Disagreement* (pp. 28-38), New York: Oxford University Press.
- [138] Gutman, A. and Thomson, D. (1996) *Democracy and Disagreement*, Cambridge MA: Harvard University Press.
- [139] Mendelberg, T. (2002) 'The Deliberative Citizen: Theory and Evidence', *Political Decision Making, Deliberation and Participation*, vol. 6, pp. 151-193.
- [140] Rossi, J. (1997) 'Participation Run Amok: The Costs of Mass Participation for Deliberative Agency Decision-making', *Northwestern University Law Review*, vol. 92, No. 1.
- [141] EU Commission and European Economic and Social Committee (EESC), (2013) *2012 Benefits and Limitation of Nuclear Fission for a Low-Carbon Economy: Interdisciplinary Study Synthesis Report*.
- [142] NUGENIA, *Purpose and Scope*, [Online], Accessed at: <http://www.nugenia.org/> [28 Sep 16]. EU08051/06/48/146.
- [143] European Commission, *Horizon 2020: What is Horizon 2020?*, [Online], Accessed at: <https://ec.europa.eu/programmes/horizon2020/en/what-horizon-2020> [28 Sep 16]. EU08051/06/48/147.
- [144] Foratom, (2016) *Info Graphics*, [Online], Accessed at: <http://www.foratom.org/public/topical-publications/8662-infographics-flyer/file.html> [29 Sep 16]. EU08051/06/48/148.
- [145] NUGENIA, *Organisation*, [Online], Accessed at: <http://www.nugenia.org/> [28 Sep 16]. EU08051/06/48/149.

Appendix 1: UK Nuclear Industry Case Studies of Public Engagement

Case Study 1: Nuclear Industry Council – “In The Public Eye”: Nuclear Energy and Society, High-Level Strategy



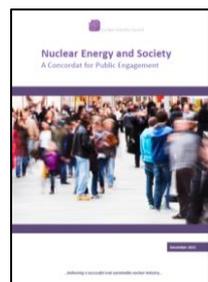
In July 2014, the NIC published its strategy, which aims to develop a consistent nuclear narrative for communication by nuclear industry professionals. This highlights the beneficial contribution nuclear energy makes to society, for example, providing long term and high skilled jobs, and a reliable source of low carbon energy to homes and industry, at prices that are affordable to society. It adopts best practice principles to ensure clarity on nuclear matters; to build trust through mutual respect; to enable dialogue that provides opportunities to address the concerns of the public; and to facilitate consultation with local stakeholders.

Case Study 2: The National Nuclear Laboratory – Corporate Social Responsibility (CSR) report



In October 2015, NNL launched its first CSR report, which reflected NNL's implementation of a more structured approach and strategy to CSR activities and events. Publication of the report on NNL's website is an example of NNL communicating its public engagement values to the nuclear sector and the public, while demonstrating that it provides support and opportunities for its workforce to take part in public engagement activities. For example, the report mentions NNL's work with The Smallpeice Trust, which involves delivering a nuclear engineering course for high school students. These types of activities allow NNL to provide development opportunities to all its employees, while enabling more of the public to be involved in finding out about NNL's work and available career opportunities. The report is available on NNL's website.

Case Study 3: Nuclear Energy and Society: A Concordat for Public Engagement



In December 2015 the Nuclear Energy and Society Concordat for Public Engagement was launched by the NIC, in response to the recommendations stated in the NIC's high-level strategy (see Case Study 1 above). The Concordat provides four principles that the nuclear industry organisations should implement in order to earn and sustain the trust and understanding of people whose livelihoods and interests are affected by the nuclear industry. It recommends that the industry must listen to its critics as well as to its friends, and above all it must ensure that all its communications and engagement with the public are underpinned by a dedication to clarity, factual accuracy and honesty.

Case Study 4: Nuclear Concordat – Implementation Group Workshop

The nuclear Concordat implementation group held a workshop in July 2015 to discuss a variety of details around completion and implementation of the Concordat. A number of organisations participated in this workshop, including: Sellafield Ltd, Office for Nuclear Development (OND), National Nuclear Laboratory (NNL), Nuclear Decommissioning Authority (NDA), Nuclear Institute (NI), Young Generation Network (YGN), Radioactive Waste Management (RWM), Magnox Ltd, Cavendish Nuclear, EDF Energy, National Skills Academy for Nuclear (NSAN), University of Liverpool, Department for Business, Innovation and Skills (BIS), Engineering Construction Industry Training Board (ECITB),

Prospect, Nuclear Industry Association (NIA) and Sciencewise. With such a large number of organisations involved, this is an example of acting collectively to build understanding and awareness of the positive impact of the nuclear sector on society.

Case Study 5: Public Dialogue for Nuclear Energy and Society: A Concordat for Public Engagement



The dialogue project aimed to engage with the public in order to build a two-way discussion, which in turn will be used to inform the further development of the Concordat text and its implementation (see Case Study 3). Public dialogue workshops were used to test the expectations created by, and practicability of the Concordat statements and supporting stimulus materials, such as a nuclear narrative and this guidance document, by identifying and

taking into account the views and concerns of the public. Workshops were held in parallel in areas both with, and without, a history of nuclear development. Preliminary findings of the workshop are discussed in Section 3.1.

Case Study 6: Public Dialogue Project for New Reactor Study



A public dialogue project was developed to review and improve public involvement in design assessments of nuclear reactors for potential new power stations in the UK. This project plays a part in demonstrating that society's attitude to nuclear energy is being taken seriously, and that those organisations involved in the study (Environment Agency, Office for Nuclear Regulation and Natural Resources Wales) are placing public engagement high up their list of priorities. The dialogue process focussed on five key objectives:

1. Inform the EA, ONR and NRW on current and future public engagement, and EA and NRW's consultation approach to GDA;
2. Identify approaches that will address issues and barriers to sharing complex technical information on the GDA with members of the public;
3. Develop and pilot materials on the GDA that are accessible to the public;
4. Identify potential public engagement process options for the GDA;
5. Help the nuclear regulators to pilot an effective public engagement and assess the EA's and NRW's consultation approach, during the current assessment of Hitachi-GE's UK Advanced Boiling Water Reactor (UK ABWR).

Appendix 2: UK and EU Academic Groups (+ relevant work) that NNL has Strategic Partnerships with or is Following Closely

UCLan: Dr John Whitton

- (2015) Conceptualizing a Social Sustainability Framework for Energy Infrastructure Decisions;
- (2014) Social Sustainability: Participant-led Dialogue as a Basis for the Development of a Conceptual Framework for Energy Infrastructure Decisions;
- (2014) Public Consent for the Geological Disposal of Highly Radioactive Waste and Spent Nuclear Fuel;
- (2011) Stakeholder Participation in the Environmental Clean Up of Radioactive Wastes in the United Kingdom, Japan and United States;
- (2011) Emergent Themes in Nuclear Decommissioning Dialogue: A Systems Perspective;
- (2010) Participant Perceptions on the Nature of Stakeholder Dialogue Carried Out by the UK Nuclear Decommissioning Authority;
- (2008) Case Studies from the United Kingdom and the United States of America Stakeholder Decision Making on Radioactive Waste Management.

Cardiff University: Professor Nick Pidgeon

- (2015) Public values for energy futures: Framing, indeterminacy and policy making;
- (2015) Public engagement with energy system change;
- (2015) Gender, ethical voices and UK energy policy in the post-Fukushima Era;
- (2014) Exploring public perceptions of energy security risks in the UK;
- (2014) Creating a national citizen engagement process for energy policy;
- (2013) Nuclear power after 3/11: Looking back and thinking ahead;
- (2013) Transforming the UK Energy System: Public Values, Attitudes and Acceptability - Deliberating energy system transitions in the UK;
- (2013) Public perceptions of climate change and energy futures before and after the Fukushima accident: A comparison between Britain and Japan;
- (2012) From nuclear to renewable: Energy system transformation and public attitudes;
- (2012) Living with nuclear power: Sense of place, proximity, and risk perceptions in local host communities;
- (2011) From the material to the imagined: public engagement with low carbon technologies in a nuclear community;
- (2011) Nuclear Power After Japan: The Social Dimensions;
- (2011) Nuclear power, climate change and energy security: Exploring British public attitudes;
- (2010) From the familiar to the extraordinary: local residents' perceptions of risk when living with nuclear power in the UK;
- (2009) Living with nuclear power: a Q-Method study of local community perceptions;
- (2008) Reframing nuclear power in the UK energy debate: nuclear power, climate change mitigation and radioactive waste;
- (2008) Climate change or nuclear power - No thanks! A quantitative study of public perceptions and risk framing in Britain.

University of Manchester (now Rolls-Royce): Dr Martin Goodfellow

- (2015) Public Perceptions of Design Options for New Nuclear Plants in the UK;
- (2014) A system design framework for the integration of public preferences into the design of large infrastructure projects;
- (2013) A Participatory Design Framework: Incorporating Public Views into the Design of Nuclear Power Plants;
- (2012) Research into the Public Perception of Nuclear Design;
- (2011) Nuclear renaissance, public perception and design criteria: An exploratory review.

University of East Anglia: Mr Peter Simmons

- (2015) The participatory turn in radioactive waste management: Deliberation and the social-technical divide;
- (2014) Monitoring and the Risk Governance of Repository Development and Staged Closure: Exploratory Engagement Activity in Three European Countries;
- (2014) Addressing the Long-Term Management of High-level and Long-lived Nuclear Wastes as a Socio-Technical Problem;
- (2013) Nuclear power and climate change: just energy or conflicting justice claims?;
- (2012) Monitoring the Safe Disposal of Radioactive Waste: a Combined Technical and Socio-Political Activity;
- (2012) Perspective on radioactive waste monitoring: confirmation, compliance, confidence building, and societal vigilance;
- (2012) A socio-technical perspective on repository monitoring;
- (2012) Living with nuclear power: Sense of place, proximity, and risk perceptions in local host communities;
- (2012) International Socio-Technical Challenges for Geological Disposal.

London Imperial: Mr Malcolm Grimston

- (2014) The siting of UK nuclear reactors;
- (2007) Risk and rationality: Packaging Transport, Storage and Security of Radioactive Material.

University of Antwerp: Dr Anne Bergmans

- (2015) Long-term repository governance: a socio-technical challenge;
- (2012) Guaranteeing transparency in nuclear waste management: monitoring as social innovation: introduction to the thematic focus.

University of Stuttgart: Professor Ortwin Renn

- (2015) Stakeholder and public involvement in risk governance.

University of Groningen: Dr Henk Mulder

- (2015) Engaging the public in R&I: why, when, & how;
- (2015) Maximizing the Policy Impacts of Public Engagement: A European Study;
- (2014) PERARES: Public Engagement with Research and Research Engagement with Society.

DISTRIBUTION

Name	Email Address	Location
Ertugrul Karabaki	Ertugrul.Karabaki@eon.com	E.ON, Hannover
Bruno Autrusson	bruno.autrusson@irsn.fr	IRSN, France
Abdou Al-mazouzi	abderrahim.al-mazouzi@edf.fr	EDF, France
Eija-Karita Puska	Eija-Karita.Puska@vtt.fi	VTT, Finland
Steve Napier	steve.t.napier@nnl.co.uk	NNL, UK
David Ritson	david.r.ritson@nnl.co.uk	NNL, UK
Colette Grundy	colette.grundy@nnl.co.uk	NNL, UK
Reuben Holmes	reuben.m.holmes@nnl.co.uk	NNL, UK
Jonathan Scott	jonathan.scott@nnl.co.uk	NNL, UK
NNL Document Controller		