Forward Visions on the European Research Area

VERA WP 3 (to Consortium and Commission Services only)

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1. Introduction

This report is an extension to VERA scenario report (Teufel et al. 2013). Four scenarios of the VERA project are *Private Knowledge – Global Markets*, *Societal Challenges – Joint Action*, *Solutions apart – Local is beautiful*, and *Times of Crises – Experts at the Wheel* (ibid.). This report analyses sector-specific aspects of these scenarios. The objective of the analysis is to illustrate whether it is feasible to bring together VERA scenarios with existing sector-specific FLAs and whether we can get some additional European Research Area (ERA) policy-related insights to VERA scenarios of the sector-specific analysis.

The sectoral analysis of VERA scenarios was aligned with analytical parts of the VERA project, and accordingly this report examines arising impacts of sectoral aspects to discussions on the consequences of VERA scenarios for the capability of ERA to make Europe more innovative and capable of solving the challenges ahead related to the task of Workpackage 4 of the VERA project. Moreover the report analyses arising insights of sectoral aspects on the debate of implications of VERA scenarios for EU level research and innovation policy strategic related to the task of Workpackage 5 of the VERA project.

The structure of the report is as follows. Chapter 2 presents the structure of the sectoral analysis of VERA scenarios and the arguments in making a choice of sector-specific FLA area for the analysis. Chapter 3 analyses VERA scenarios vis-à-vis selected sectoral FLAs, and Chapter 4 draws arising conclusions and policy implications.

2. Framework and methodology

Figure 2.1 presents the outline of the sectoral analysis of VERA scenarios: In the FLA inventory in the stocktaking part of the VERA project we analysed five types of FLA documents, listed in left box of Figure 2.1 (Amanatidou et al. 2012). In this report we analyse VERA scenarios vis-à-vis selected FLA documents of the FLA inventory.

FLA inventory in stocktaking of VERA project

Five types of FLA documents:

1. ERA-governance related policy and strategy documents
2. European FLAs addressing the future of EU and ERA (directly or indirectly)
3. FLAs on national R&I priorities (not necessarily ERA related at first glance)
4. FLAs on important sectors for Europe
5. International scope

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VERA scenarios

1. Private knowledge – Global markets
2. Societal Challenges – Joint Action
3. Solutions apart – Local is beautiful
4. Times of crises – Experts at the Wheel

Figure 2.1 The outline of the analysis of sectoral aspects of VERA scenarios.

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Energy and climate change are among most serious sectors of global grand challenges and these challenges are widely represented in the strategic agenda of the EU. Moreover, also various deliverables and events of the VERA project have addressed climate change as one of the major global challenges. For these reasons we selected from the FLA inventory to the sectoral analysis of VERA scenarios related four EU documents: *Energy Roadmap 2050* (2011), *A Roadmap for moving to a competitive low carbon economy in 2050* (2011), *Energy Efficiency Plan* (2011), and *Adapting to climate change (2009)*. Due to numerous FLA publications both in energy and climate change sectors and also in other grand challenge (GC) areas the following analysis must be considered only as an illustrative example of analysing analysis sector-specific aspects or VERA scenarios.

3. Sectoral analysis of VERA scenarios

The analysis of VERA scenarios vis-à-vis sectoral Forward Looking Activities (FLAs) below gives detailed descriptions what kind of links and impacts sectoral aspects have to VERA scenarios. The analysis builds in general on long versions of VERA scenarios and in particular the scenario overview in Table on page 11-13 of the final scenario report (Teufel et al. 2013).

VERA scenario 1 "Private knowledge – global markets" assumed that a small share of public research is horizontally coordinated by clubs of EU Member States (MSs). Private actors like big corporations and lobby organizations, are assumed to be risk averse, and they have significant agenda setting power to align public RTDI activity to market interests. In the energy field this may lead to fragmented and ineffective governance of energy RTDI in MSs. As public intervention in general and the coordination by EU bodies are weak, private actors may pay attention to short-run competitiveness aspects of energy technologies and not to long-term needs of sustainable energy production and consumption system, resulting in possible tensions between assumption of short-term perspective made by Scenario 1 and EU´s long-term energy and climate change action plans. The public good and externality aspects of climate change, usually strongly among key arguments of public policy, may also be undervalued by actors in power in this scenario. In the worst case, in addition to tensions above, all these issues together may jeopardize attainment of EU´s strategic energy and decarbonisation goals.

According to Scenario 1 worldwide RTDI is coordinated by non-state actors in vertical networks and value chains without hands-off coordination of vertical networks and value chains, which may lead to hard price competition among vertical chains and networks. Success and sustainability of RTDI of renewable energy (RE) depends on global customers, and for example the power of China as big customer may have significant influence on vertical chains RE RTDI and production. Moreover, the assumption of Scenario 1 according to which research directions are justified by the promise of successful commercial exploitation mainly by private actors, does not necessarily guarantee European or global public long-term interests and welfare aspects, accentuated in several FLAs in energy and climate change sectors. Short-sighted and risk-averse business logic may lead primarily to incremental solutions while sustainable energy technologies require radical long-term RTDI strategy and high investments to produce radical innovations.

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Diversified research organization, as assumed in Scenario 1, may lead to excellent specialized individual RE-RTDI providers, but the arising threat is the insufficient coordination between individual providers, Joint Ventures, and public-private consortia, and finally fragmentation and competition between providers. Short-sided commercial expectations affect also the selection of researchers accepting such mind-set, and researchers with ethical and responsible mind-set will be laid aside. These issues have been raised in many EU documents and for example in recent responsible research initiatives by the EU. In the EU growth and job creation rationales are still valid, but the economic and other means for effective policies and for sustainable energy RTDI contribution remain limited. On the global level limited resources of Europe give room for expanding economies such as China and Brazil in energy related RTDI and in Europe growing inequalities lead to form "cliques" among economically stronger MSs also in R&D energy investments.

In conclusion, as the key assumptions of Scenario 1 are strong power and role of big corporation and private sector, and weak role of EU and lack of public coordination, consequences to the future development in energy and climate change become even predictable: Actions and evidently also RTDI in energy, climate change, energy efficiency, and related fields become more short-sighted. The short time horizon affects RTDI and, leads, for example, to incremental rather than radical eco-innovations which however the transition to sustainable energy future requires. The limited resources of the EU and fragmented European landscape due to "cliques" of MSs may make future oriented policies towards sustainable energy structure even impossible. On the global level Scenario 1 gives room for expanding economies such as China and Brazil also in energy technologies and related RTDI.

VERA scenario 2 "Societal Challenges – Joint Action" is in many ways positive for sustainable energy RTDI development and this scenario creates conditions for a positive future for energy and climate change strategy of the EU. On condition regional and EU level governance is able to collaborate closely in searching of RTDI driven solutions for GCs, Scenario 2 may well promote the attainment of EU´s strategic energy and de-carbonisation goals. As the major part of decisions about policy priorities and programming takes place between the EC, the Council, and the Parliament, the public conditions for the solving of energy and other GCs seem positive. The challenge remaining in this scenario, based on strong role of public sector activities, is how to engage private sector to plan and implement in concrete terms required publicly driven actions and, especially, to develop required globally competitive sustainable energy eco-innovations on a basis of publicly supported research.

Scenario 2 also recognizes the importance of solving GCs on a global level. This scenario assumes that government-driven transnational joint actions and programmes, European and global, are working together towards building new international alliances where GCs need to be addressed at global level. Growth and job driver, as well as GC strategies give a strong legitimacy for policy and for public RTDI funding as well, and Joint European action creates good conditions for RTDI driven solutions for energy and climate change issues. As European integration has remained a "leitmotif" for European governments, this creates good conditions for RTDI driven solutions also in energy and climate change issues.

In conclusion, Scenario 2 favours in many also sustainable energy RTDI development and related actions presented in EU´s future oriented energy and climate change documents. The question how

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to engage private sector to EU´s strategy and required actions, needed especially in development of required energy eco-innovations, seem to remain unclear in this scenario. Accordingly, this is seems to be a particular issue which would need a careful analysis of the needs of policy intervention and actions in Scenario 2 in the future.

VERA scenario 3 "Solutions apart – Local is beautiful" is based on citizen driven bottom-up approach in which the European RTDI governance is framed at a regional and micro-level by single citizens and at meso-level by social intermediaries, and at the macro-level by two high-level ERA forums. As citizens have essential influence on RTDI governance and as they recognize the need of creation of a sustainable future of energy production and consumption, in general Scenario 3 creates positive conditions for RTDI driven renewal of energy production and consumption system, energy efficiency and solving GC of climate change. The assumed relatively weak role of EC institutions and even smaller role of private sector however will weaken the realisation of concrete actions for RDTI driven sustainable energy production and consumption, eco-innovations and mitigation of impacts of climate change. The role of RTDI is weak also for the sake of the assumed insignificant role of scientific knowledge among other sources of knowledge.

Citizen level influence and even regional and national governments level influence on research agendas, both as such sympathetic, may remain "too selfish" and insufficient to see the real challenges of urgency to change the energy system towards sustainable development path solving GC due to climate change. In this scenario (as in Scenario 1) the role of EC institutions is small, meaning weak coordination in order to reach the European level optimal RTDI programmes and consequent required implementation of industrial eco-innovation activities. The justification of RTDI activities, relying in Europe mainly on "relevance" for health, quality of life and happiness, may prove to be insufficient due to harmful consequences of the use of fossil energy sources causing health and other welfare effects for citizens.

Citizens can however participate increasingly in opening innovation processes by firms which leads to more private-public, transdisciplinary and transnational research networks, contributing towards more sustainable energy structures and mitigation of climate change impacts, importantly encouraging citizens to innovate also close to local "grass root" level. The direct influence of citizens makes research career for many researchers also very attractive. As in Europe the immediate rationale of human well-being is replacing purely economic indicators of wealth, the longer term possibilities to shift towards more sustainable energy structure may however suffer. As after-effects of the global economic crisis remain still deep at least till the 2020s, Europe will differ from other continents where, for example, in North America the RTDI regime still remains successful and in Africa and expanding countries a shift takes place towards knowledge-intensive innovations also in energy sector. In European societies however the transformation towards common beliefs and new values is gradually beginning as is the progress towards more intensive European integration in different policy areas.

In conclusion, on the one hand citizen driven Scenario 3 may create certain positive conditions for a long-term renewal of energy production and consumption system, energy efficiency and solving GC of climate change, as pursued in related EU strategy documents. The strengths are related to strong

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impact of grass root citizens of RTDI and the trust that they have understanding of real needs to change energy structures for the sake of health and other human welfare aspects. On the other hand relatively weak coordination of EC institutions, insignificant RTDI, weak role of private sector and private-public partnerships, and after effects of global crisis in Europe however may deteriorate these conditions. In these conditions the European economy may furthermore lack behind other competing continents. The low role of industry weakens also concrete actions for eco-innovations in energy technologies alike in Scenario 2.

VERA scenario 4: Times of Crises – Experts at the Wheel creates in many ways promising points of departure for the sustainable energy future and climate change mitigation. In this scenario European level institutions have a strong role in prioritisation of RTDI and consultation of sustainability experts and stakeholders play an important role. In this scenario RTDI governance stretches across all governance levels and societal domains and applies federal and deliberative principles. The science-in-society contract binds RTDI to deliver value with regard to sustainability, and the commitment to overall RTDI governance to sustainability creates strong basis for knowledge and innovation driven long term changes in the European energy structures. These characteristics of Scenario 4 create good starting points for the creation of sustainable, renewable driven energy and climate change strategies. Moreover, this development is contributed by the EC´s DG on research and innovation which strongly cooperates with all other DGs (e.g. energy, transport, agriculture) to align missions and implement RTDI as a part of coordinated and sustainable transition activities. Also the global perspective of sustainable innovation systems is well integrated in this approach: governance, architectures and processes are globally interconnected.

In Scenario 4 Europe shows relatively high investments in RTD compared to most other regions worldwide and, moreover, European research is funded by a wide range of actors – all defining RTDI tasks for sustainability, also towards renewables and reduction of GHG emissions. In this scenario private and public sector research around the globe is complemented by citizen science and the maker movement, enforcing also conditions for a more sustainable energy future. The science in society contract and citizen science will tie research and innovation also in energy and related climate change fields as well as related private and public actors and other stakeholders closer to each other. Energy and climate change issues are strongly in most agendas, as sustainability is the most important rationale for the organization of social, political and economic life. This scenario assumes also that sustainable innovations will pave the way for relatively stable GDPs and labour markets in Europe. In spite of the facts that “Next Eleven” countries emerged as the “next tigers” in the world economy and there is a power shift to Asia, Scenario 4 assumes that the polycentric world is democratizing. This may lead towards more intensive and constructive global collaboration also in the fields of more sustainable energy technologies in production and consumption as well as towards consequent mitigation of impacts of climate change.

In conclusion, in general Scenario 4 seems to give promising future perspectives for RTDI driven sustainable energy technology development and mitigation of climate change, given support to long-term strategies and programs of the EU. In many ways Scenario 4 gives most promising future perspective of all four VERA scenarios both on European as well as on global level.

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4. Key features of VERA scenarios from sectoral perspectives

This report examines whether it is feasible to bring together VERA scenarios with existing sector-specific FLAs and whether we can get some additional ERA policy-related insights to VERA scenarios of their sector-specific analysis. The analysis is carried out by considering VERA scenarios vis-à-vis selected sector-specific FLA documents from the FLA inventory of the VERA project. FLA documents represent energy and climate change sectors because these particular sectors are among most serious global challenges and also widely represented in the strategic agenda of the EU.

The sectoral analysis raises the following additional ERA policy-related insights and aspects to VERA scenarios. Scenario 4 (Times of Crises – Experts at the Wheel) gives most promising future perspective in energy and climate changes sector of all four VERA scenarios on European and on global level. Furthermore, Scenario 4 gives support to long-term strategies and programs of the EU. Scenario 2 (Societal Challenges – Joint Action) also favours in many ways also sustainable energy RTDI development and related actions presented in EU´s future oriented energy and climate change documents. The engagement of private sector to EU strategy and required industrial actions in the development of required energy eco-innovations remain however unclear in this scenario. Accordingly, in Scenario 2 sector-specific analysis raises a need for a careful analysis of ERA and Member State RTDI policy intervention and instruments.

According to the sectoral analysis, the citizen driven Scenario 3 (Solutions apart – Local is beautiful) contains some positive and some negative conditions for a long-term renewal of efficient energy system and solving of climate change challenge. In spite of strong role of citizens, the assumed weak EU coordination, insignificant RTDI, and weak role of private sector deteriorate these conditions. Moreover insignificant role of industry may weaken concrete actions to generate eco-innovations in energy sector. Scenario 1 (Private knowledge – global markets) reveals significant tensions as big corporations and other key actors in power have short-sighted attitudes in business making, while solutions to energy and climate change challenges require strong future oriented long-term strategy, RTDI and action plan. Among others the short time horizon leads to incremental innovations instead of radical eco-innovations, required by sustainable energy future. Significant policy challenge arising from Scenario 1 is how to activate private sector into sustainable energy and climate change actions. Moreover, on the global level the sector-specific analysis of Scenario 1 seems to give a lot room in global markets for expanding economies such as China and Brazil also in energy technologies and related RTDI.

In conclusion, this exercise revealed interesting policy-related insights to VERA scenarios. However, due to numerous FLA publications both in energy and climate change sectors and in other grand challenge (GC) areas, this analysis should be considered only as an illustrative example of analysing sector-specific aspects or VERA scenarios.

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