THE ROLE OF REGIONS IN PROMOTING SUSTAINABLE ENERGY WITH SMART SPECIALISATION STRATEGIES

CenSES working paper 6/2016

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ISBN: 978-82-93198-18-5

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Abstract

The transition to a low-carbon economy is a grand challenge confronting policy makers on all government levels. In the European Union, ambitious targets of carbon emission reduction are linked to aspirations of fostering 'green growth' at national and regional levels. These aspirations become manifest in a recent radical policy change in the EU through the introduction of the 'smart specialization' (RIS3) research and innovation strategy for national and regional development. This article addresses the potential to promote sustainable energy with RIS3. As such we contribute to the literature on policy strategies for realizing EU targets linked to a more sustainable energy system, as well as the RIS3 ambition of fostering competitive advantage. We do so by exploring, first, the extent and nature of energy related priority settings in RIS3 strategies across Europe, second, by conducting in-depth analyses of three regional cases from different European countries, and third, by discussing the potential of RIS3 to contribute to the realisation of EU energy policy targets. Rather than provide clear-cut answers, the aim of this article is to initiate a debate about the potentials and contribution of RIS3 to the technological development and deployment of sustainable energy. Core findings are that energy-related priority settings substantially varies within RIS3, and that regional innovation policy ambitions may be hindered by lacking or unsupportive policy frameworks at national levels. The role of path-dependency and vested interests in priority setting processes is identified as a key topic for further research.

Keywords: smart specialization, regional development, sustainable energy, Europe

INTRODUCTION

Decarbonisation of the energy sector is one of the 'grand challenges' confronting policy makers on all scales (Coenen et al., 2015). The European Union (EU) aims to reduce greenhouse gas (GHG) emissions by 40% by 2030 compared to 1990, and to achieve at least 27% share of renewable energy (RE) in its energy mix (EC, 2014b). These supra-level policy targets 'trickle down' to national government levels, where specific targets largely mirror different countries' potential for expanding the deployment of RE technologies. In turn, national level policies and processes are coupled with regional and local level policies (Essletzbichler, 2012). This transcendence of government scales is important for the discovery and usage of localized energy sources, for capitalizing on geographically localized innovation and technology development processes, and finally for the mobilization of heterogeneous actor networks around 'regional energy visions' to facilitate deployment of RE.

In addition to these energy and GHG related policy targets, the EU has since 2014 introduced a new and highly ambitious research and innovation strategy for national and regional development. This regional smart specialisation (RIS3) strategy aims to support the more general aims of 'smart, inclusive and sustainable growth' across Europe. RIS3 has key features in considering knowledge and innovation as main drivers of regional development, and in acknowledging public policy as crucial for promoting knowledge assets and innovation processes (Boschma, 2013). RIS3 is a place-based approach in the sense that prioritized economic activities should be based on region-specific assets (Grillitsch, 2016, Morgan, 2016b). At the core of this paradigmatic change in regional innovation policy is the so-called 'entrepreneurial discovery process' which aims at including a wide range of socio-economic actors in the process of regional priority definition (Capello and Kroll, 2016).

As stated in a recent EU report on energy and RIS3 strategies, energy "plays a main role as a cross-cutting issue that affects many other sectors as well as their productivity" (Navarro and Uihlein, 2016: 3). If successful, RIS3 strategies may contribute to innovation and technological development necessary for more sustainable ways of producing, distributing and consuming energy. Energy is the most popular priority area in RIS3 strategies across Europe, with more than two thirds of all EU regions choosing at least one energy-related priority.[1] This may reflect that regions across Europe aim to take part in the new value-creating industrial and entrepreneurial

[1] http://eusew.eu/smart-specialisation-energy-%E2%80%93-how-europe%E2%80%99s-regions-are-implementing-their-priorities Accessed 31 October 2016

opportunities that are part-and-parcel of the 'green turn' (Cooke, 2010). Regions themselves may be the loci of initiatives and attempts to transform energy systems, through fostering (new) economic activities, R&D or technology trials, or through active lobbying to higher political scales to create more conducive framework conditions for RE and innovation in energy infrastructure. However, the popularity of energy as a target area in RIS3 strategies could also be the result of the necessity to transform the energy system in compliance with national and EU level policy targets – also at regional levels.

Against this background the main aim of this article is to initiate a debate about the potential of RIS3 to foster technological development and deployment of RE, thereby supporting the achievement of the EU's energy targets. As such, the article has three more specific objectives:

- First, to explore the extent and nature of energy-related priority settings in RIS3 strategies. This extensive mapping exercise is based on data from the EYE@RIS3 Smart Specialisation platform and a recent descriptive report by the European Commission's Joint Research Centre (Navarro and Uihlein, 2016).
- Second, to explore how particular energy-linked target areas in RIS3 strategies relate to RIS3 priority setting rationales. Analyses of three sub-national case regions from Norway (Nordland), Spain (Galicia), and Germany (Schleswig-Holstein) shed light on the multiple ways in which energy-related RIS3 priorities are rationalized and strategically sought developed.
- Third, to discuss if and how 'energy RIS3' can contribute to meeting EU energy policy targets, both as innovation policy and as policy supporting the deployment of RE technologies.

The complexity and immense variety of this empirical field implies that our analysis is cast at a relatively general level. Rather than go into details, our ambition is to illuminate how a grand challenge is dealt with in a multi-dimensional policy context.

The article proceeds as follows. In section 2 we briefly trace the history of the RIS3 framework and review the burgeoning literature addressing its merits and weaknesses. We also provide an account of key EU energy policy targets and discuss their relationship with RIS3 strategies, and review the literature on the role of regions in promoting sustainable energy. We present our findings from the extensive mapping exercise and case studies in section 3. We discuss our findings, conclude and reflect on issues that deserve closer attention in section 4.

BACKGROUND

SMART SPECIALIZATION – A POLICY STRATEGY IN THE MAKING

RIS3 strategies are now being developed across Europe at both country and regional levels, not least because it constitutes an ex-ante conditionality for receiving European Structural and Investment Funds (Valdaliso et al., 2014). The notion of 'smart specialisation' can be traced back to the end of the 2000s and discussions in the EU Knowledge for Growth Expert Group (Foray, 2014). The governing idea behind smart specialisation is that in our era of globalization, regions – and less advanced and transitions regions in particular – need to develop both generic and specific capabilities (linked to particular technologies and industries) that will enable them to achieve competitive advantages in certain market niches. According to Foray (2014: 492) "the idea is neither to narrow down the development path of a region nor to produce some sort of technological monoculture, [but rather to] generate new options or new specialities in order to diversify the structures of the regional economy." Thus, smart specialisation entails a fundamental shift in regional development policy (Cooke, 2016, Morgan, 2016b) from focusing on a particular industry or knowledge domain towards nurturing (re)combinatory innovations at the intersections of related sectors with complementary capabilities (McCann and Ortega-Argilés, 2013, Hansen and Coenen, 2015). Consequently, prioritized areas for R&D and upgrading strategies should be based on existing regional assets in order to reap the benefits of cross-fertilization of ideas between technological domains (Iacobucci and Guzzini, 2016a). This emphasis on place-based innovation policy strategies (Morgan, 2016b) also

reflects how the intention of RIS3 is to avoid (European) regions competing head-on or duplicating their (sector-based) strategies, and rather focus on their pre-existing competences and potentials for further development (Piirainen et al., in press). Finally, RIS3 emphasises trans-national and trans-regional learning through data and tools for peer-review processes, and arenas for sharing experiences and cross-regional collaboration for further strategy development.

The strategy development should ideally follow a six-step guideline (Foray et al., 2012):

1. Diagnosis: analysis of the regional context and potential for innovation
2. Governance: set up a sound and inclusive governance structure
3. Vision: production of a shared vision about the future of the region
4. Objectives: selection of a limited number of priorities for regional development
5. Instruments: establishment of suitable policy mixes
6. Evaluation: integration of monitoring and evaluation mechanisms

The core principle of priority-setting on the basis of regional assets (place-based approach) is clearly visible in the RIS3 strategy development process. A crucial element is the policy facilitated process of 'entrepreneurial discovery' (ED) that is supposed to draw together a varied set of actors who mutually identify potential development activities based upon a broad understanding of innovation "at the cross-roads between a new technology and a traditional sector – and structural changes (modernisation and diversification)" (Foray, 2014: 494). However, as noted by Valdaliso et al. (2014), the process of ED is both positively and negatively prone to path-dependent regional institutional contexts. RIS3 strategies may as such be in conflict with other (long-standing) regional policy objectives. Path-dependence may also constrain transformation processes in governance structures that are necessary for RIS3 development and implementation (Morgan, 2016b, Capello and Kroll, 2016).

The rationale behind the ED process is that government actors are not blessed with perfect foresight, and should therefore involve stakeholders from policy, business and academia in policy development. Another aspect is to avoid 'old industries' triumphing on behalf of industries with potentially greater future potential. Hence, the ED process builds on existing industries with the goal to transform them (modernisation, diversification or transition) (Foray, 2014). Several studies highlight the crucial role of pre-existing regional capacities (competences and potentials) both for renewal of established industrial development paths as well as for the creation of new ones (Frenken et al., 2007, Tanner, 2014). For both these (stylized) industrial development processes, vested interests of industry and political actors may have impacts on direction and momentum. However, the more specialised a region is the more likely it is that powerful regional actors influence development processes (Boschma and Frenken, 2011, Moodysson et al., 2015). This also highlights differing adaptive capacities of actors for developing strategic responses or reacting to new initiatives with an openness to change and novelty, such as RIS3, due to "political habits, practices and routines" (Kroll, 2015: 5) that might either foster or counteract path creation and renewal. For example, Pugh (2014: 152) found that the Welsh RIS3 strategy largely follows a past policy approach based on cluster-rationales, even omitting "the important entrepreneurial discovery process to identify the real strengths of the region."

RIS3 strategy development and implementation is likely to be influenced by national institutional frameworks, the centrality of government, levels of regional autonomy and regional endowments (e.g. in terms of resource allocation). Variety along these dimensions imply that the conditions for RIS3 are highly heterogeneous and likely to be strongly shaped by institutional context and the quality of governance (McCann and Ortega-Argilés, 2014, Rodríguez-Pose, 2013, Grillitsch, 2016). Challenges in RIS3 governance also occur between political levels and various operational bodies in the implementation phase (Morgan, 2016a). Together this hints at a certain likelihood of path-dependent policy making in RIS3.

EUROPEAN ENERGY POLICY – A BRIEF OVERVIEW

In 2007 EU leaders identified security of supply, competitive markets and sustainability as three pillars for European energy policy. Enacted in 2009, the following targets were set for 2020: min. 20% reduction of CO_2 emissions compared to 1990 levels, 20% increase in energy efficiency, and 20% of energy (consumed) from renewable energy sources (EC, 2010). Referred to as the 'EU 20-20-20 targets', an important element of this energy policy strategy was that it should be accompanied by fostering 'green growth' through innovation and technological and industrial development. Figure 1 illustrates that the share of RE in the European energy mix grew from 8.5% in 2004 to 16% in 2014, and that both Germany and Spain have seen substantial growth in this period while Norway has always been a leader in RE deployment – the three countries are cases of our later in-depth analysis.

For the 2020-2030 period, the EU recently set new targets: GHG emissions shall be reduced by 40 % in 2030 compared with 1990, and the share of RE in total energy production shall amount to min. 27% (EC, 2014b). The strategic approach of the 'EU Energy Union' comprises five non-hierarchical dimensions, which are seen as "closely related and mutually reinforcing" (EC, undated-a): (1) security of supply, (2) a fully-integrated energy market, (3) energy efficiency, (4) emission reduction, and (5) research and innovation (supporting low-carbon technologies). The role of RIS3 vis-a-vis these goals is to support the 5th dimension of the energy union (also labelled the 'Strategic Energy Technology Plan (SET-Plan)) "to help governments in their decision-making processes concerning long term innovation strategies and smart allocation of resources" (Navarro and Uihlein, 2016: 3).

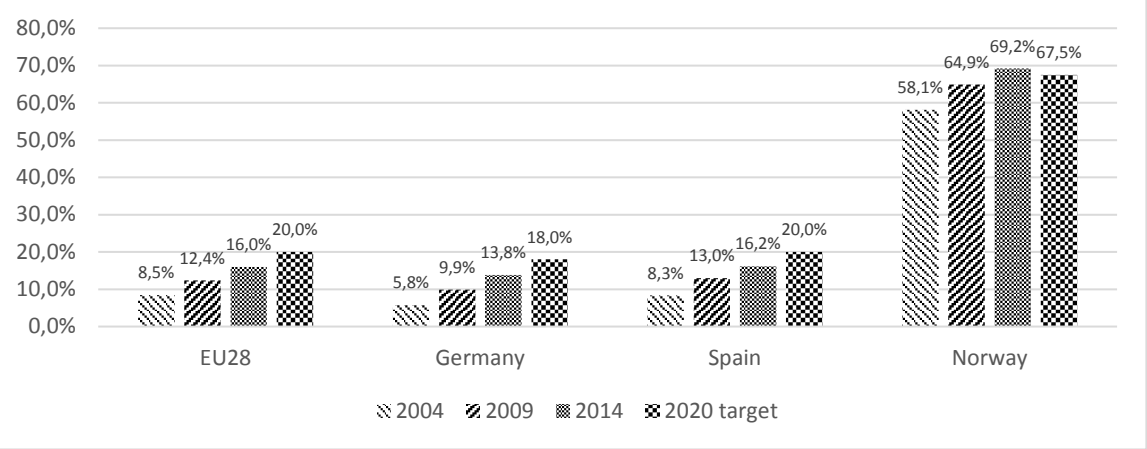

FIGURE 1: OVERALL SHARE OF ENERGY FROM RENEWABLE ENERGY SOURCES IN EU28, GERMANY, SPAIN AND NORWAY (IN % OF GROSS FINAL ENERGY CONSUMPTION). SOURCE: EUROSTAT (UNDATED)

In order to support energy related RIS3 activities, the S3P Energy platform was launched in 2011, based at the Institute for Prospective Technological Studies (IPTS) in Seville within the European Commission's (EC) Joint Research Centre. The S3P Energy platform is intended as "an enabling tool for regions to coordinate, rationalise and plan their respective energy strategies, develop a shared vision on knowledge-based energy policy development, and set up a strategic agenda of collaborative work" (EC, undated-c). One of their services is the provision of the EYE@RIS3 tool, which we use for the extensive part of our empirical analysis. In combination with other services such as funding and facilitating partnerships, S3P Energy aims to foster alignment of local, regional and national policy priorities in order to achieve EU energy targets, for which regions are seen as crucial drivers by the EC.

THE ROLE OF REGIONS IN PROMOTING SUSTAINABLE ENERGY

In the academic literature, regions are seen as important for promoting renewable energy (RE) in at least three fundamental ways: deployment, technological development, and influence on national and supra-national

energy policy (Essletzbichler, 2012, Martin and Coenen, 2014, Mattes et al., 2015, Dewald and Fromhold-Eisebith, 2015).

First, regions as administrative-political units can promote the deployment of RE technologies (RET) through setting targets for the local or regional market or by creating demand for RE fuels or sources (market formation). Regions differ considerably in their opportunities for deploying RETs, most obviously due to considerable differences in natural resource endowments (Hansen and Coenen, 2015). Empirical research shows how specific local or regional networks/actor constellations are critical to early niche market formation and for subsequent 'scaling up' in deployment to national or even international scales (Dewald and Fromhold-Eisebith, 2015). Additionally, it is important to point out that "regional governance structures help to pave the way for a decentralized energy supply structures. In a multi-level and networked framework of energy policy, spatial politics have to be realigned to meet the specific regional challenges" (Faller, 2014: 904). However, regional aspirations of RE deployment will in most countries critically depend on national level support policies (e.g. subsidy schemes). Moreover, it is primarily at the regional and local scale where new forms of organisation and ownership (Moss et al., 2015) and opposition (NIMBY) to the deployment of energy deployment (van der Horst, 2007) is noticeable.

Second, regions, or more specifically region-specific clusters or innovations systems, are important for the development of RE technology and industrial capacity (e.g. Simmie et al., 2014 for wind energy). However, regional level attempts to develop new R&D and innovation capacities related to RE (or any other technology or sector for that matter) may be vulnerable to rescaling and re-scoping of policy interventions at other governance levels (Dawley, 2014). Thus, whilst economic activities must be seen as place-specific, it is important to avoid regional fetishism and falling into the trap of considering innovation and new path creation as a locally emergent phenomenon (Martin and Sunley, 2006). Rather, it is crucial to account for the place-specificities of economic activities and their embeddedness in multi-scalar innovation and production networks (Binz et al., 2014, Coe, 2011).

Third, regions understood as such regionally embedded networks of actors, can influence national or even EU levels of policy to provide more favourable framework conditions for REs. It is beyond the scope of this article to address this issue, but several studies (e.g. Faller, 2016) suggest that actors on various scales exert influence on RE development, and that their influence changes during the course of a transformation process. This particularly applies to political scales, where the ability and capacity of regional actors to promote RE will be contingent on the level and extent of regional policy autonomy, particularly vis-a-vis the national level (Dawley et al., 2015).

To summarize thus far, there is considerable variety in modes of deploying as well as (strategically) facilitating and steering innovation and industrial development related to RE at the regional level. The remainder of the paper serves to explore this variety in the context of RIS3.

ENERGY IN EUROPEAN RIS3 STRATEGIES

METHODS AND ANALYTICAL APPROACH

In the following section we first provide a brief and mainly descriptive account of the extent and variety of energy related priorities in RIS3 strategies across Europe. This mapping exercise is based on the EYE@RIS3 online database, and complemented with a content analysis of a recent descriptive report by the European Commission's Joint Research Centre (Navarro and Uihlein, 2016). The EYE@RIS database is not a source of statistical data, but "intended as a tool to help strategy development" (EC, undated-b). It shall support regions in identifying 1) priority areas vis-a-vis other regions (suggesting a regional division of economic specialization) and 2) regions for collaboration. The database contains information on regions' research and innovation (R&I) capabilities, business areas and target markets, and their link to 'top down' EU wide policy objectives (referred to as 'EU Priorities'), all of which have sub-categories. For instance, 'energy distribution' and 'power

generation/renewable sources' are subcategories under the R&I capability of 'energy production and distribution'. The EU policy objectives in the EYE@RIS database (11 in total, each with subcategories) have been developed by the S3 Platform on the basis of the 'Societal Grand Challenges' identified in Horizon 2020 as well as the 'headline policies' in the 'Innovation Union Flagship' initiative.

Second, we conduct an in-depth qualitative content analysis of RIS3 strategy documents for three sub-national regions: Nordland (Norway), Galicia (Spain) and Schleswig-Holstein (Germany). The case study regions were chosen because they are leading RE deployment regions in their national contexts, already had energy-related (innovation) policies in place prior to RIS3, and because they strongly emphasise RE in their RIS3. Including a non-EU region (Nordland) additionally enriches our case comparison which aims to shed light on how RIS3 can contribute to regional development linked to more sustainable ways of producing, distributing and consuming energy. For each of these cases we analyse the implementation of the place-based approach (diagnosis, governance, vision, objectives, instruments, evaluation) and the role of regional capacities (competences, potentials) during the process of entrepreneurial discovery. We also reflect on the (potential) influence of supra-regional policies on regional energy related RIS3 strategies. In order to substantiate findings and obtain preliminary insights into the role of vested interests and openness towards change (novelty) we also draw on secondary data sources in the form of RE related policy documents, reports, websites and media. This second approach answers Navarro and Uihlein (2016, 32) call for more detailed assessment of RIS3 strategies in order to better understand RE development processes.

THE ROLE OF ENERGY IN RIS3 – AN EXTENSIVE MAPPING OF RE TARGETS IN THE EU

Following the logic of RIS3 regions shall foster R&I capabilities for promoting RE, also by combining regional R&I capabilities with capabilities implemented or adopted from elsewhere. This reflects the basic idea of RIS3 that strategies and priorities should be rooted in established activities in a region and particular advantages vis-a-vis other regions. In the following we will descriptively show that energy is a core issue of RIS3 strategies with respect to both research and innovative capacities, and business and market targets, as well as their connections with EU policy priorities (Sustainable Innovation, Blue Growth, Digital Agenda, and Key Enabling Technologies).

According to Navarro and Uihlein (2016: 19), 162 RIS3 strategies (of 1,167 in total at NUTS 1-3 levels distributed amongst 198 regions) are linked to energy. They find that the five 'top' (energy-related) prioritized R&I capabilities are linked to energy efficiency, smart grids, e-mobility, bioenergy and wind energy. Out of 11 possible EU priorities, energy related RIS3 strategies are (with a few exceptions) connected to four main EU priority areas: Digital Agenda, Sustainable Innovation, Key Enabling Technologies, and Blue Growth. Our mappings (Figures 2-6), then, focus on linkages between energy-related RIS3 strategies and these four EU priority areas. It should be noted that whilst some regions do not indicate an energy-related R&I capability, 'energy production and distribution' may still be a target market. For instance Cantabria (Spain) links its R&I capability in maritime engineering ('manufacturing & industry' R&I capability) to both fossil and renewable offshore energy production. Whilst our primary interest is identifying RIS3 strategies that are based on R&I capabilities linked to energy production and distribution (with 'energy distribution' and 'power generation/renewable resources' as sub-categories), we therefore also include energy-related RIS3 priorities based upon 'Business Areas & Target Market'. Note also that due to our focus on the regional dimension of energy-related RIS3 strategies, we have excluded 'EU country' and 'Non-EU country' entries in EYE@RIS from our mapping. Figure 2 illustrates the extent of RIS3 strategies across Europe in which 'energy' is explicitly prioritised, as R&I capability and/or as business area/target market.

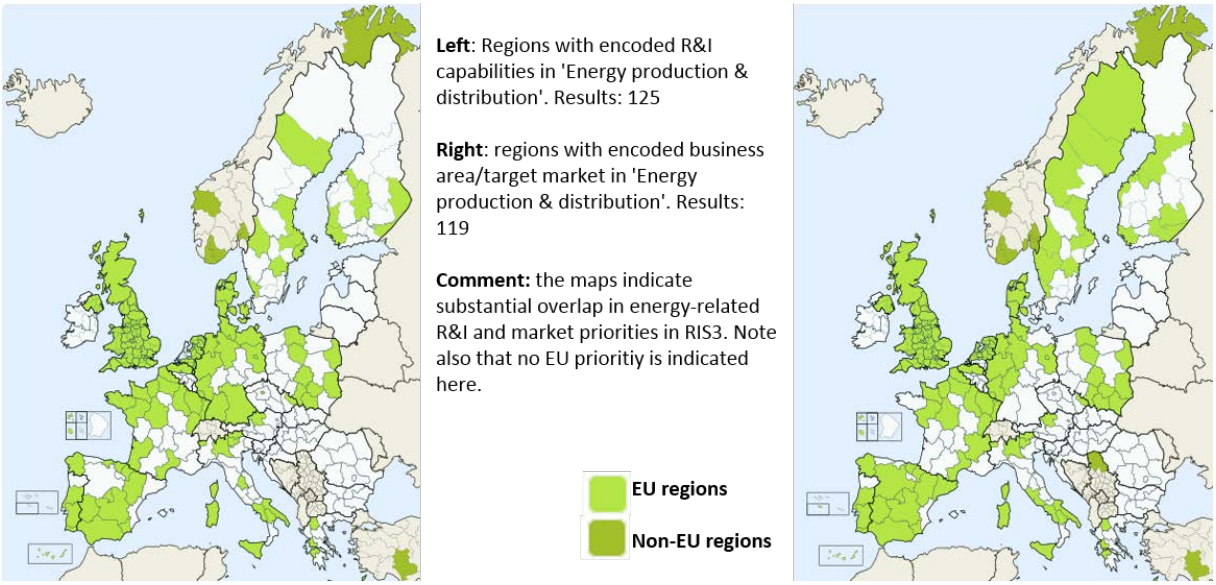

FIGURE 2 OVERVIEW OF ENERGY-RELATED RIS3 STRATEGIES BASED UPON R&I CAPABILITIES OR BUSINESS AREA/TARGET MARKET. SOURCE: EYE@RIS

The most used EU Priority area for addressing energy is Sustainable Innovation (Figure 3), which refers to innovation that can contribute to the "de-coupling of growth from environmental degradation and resource consumption" (Doranova et al., 2012: 16). Two of our case studies (Galicia and Schleswig-Holstein) are part of this group of regions. Description entries in EYE@RIS suggest that these strategies comprise a rather wide variety of specific topics, ranging from particular REs (wind energy, bioenergy etc.) to the use of 'sustainable energy' solutions in construction or waste treatment.

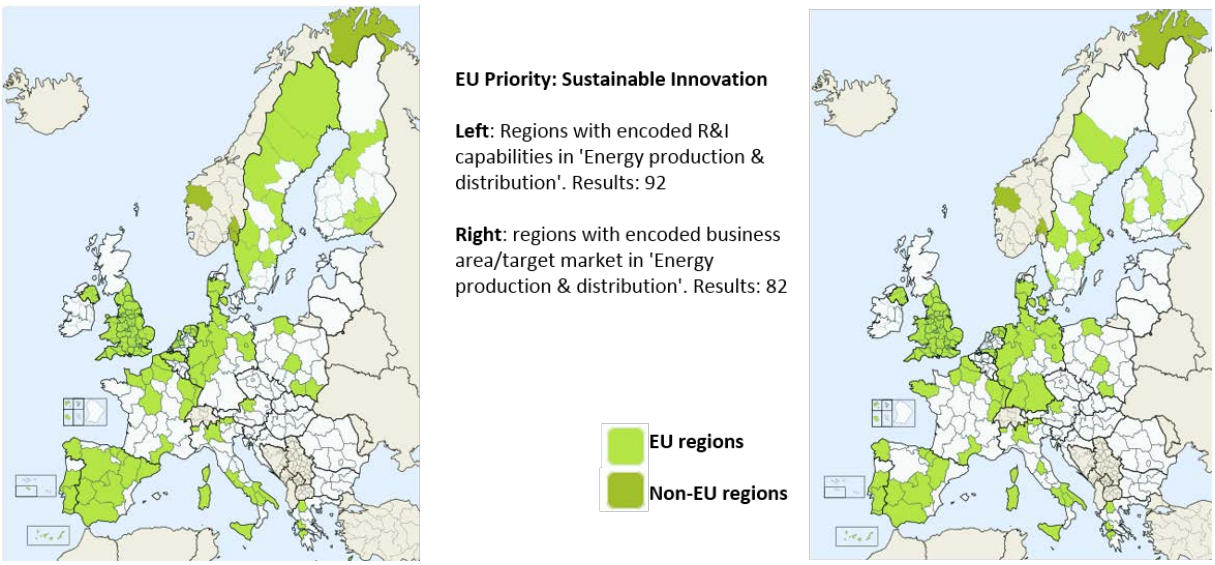

FIGURE 3 ENERGY IN RIS3 STRATEGIES (REGIONS) WITH EU PRIORITY 'SUSTAINABLE INNOVATION'

Energy is one of eight sub-categories in Blue Growth, which the EU defined as the long term strategy to support sustainable growth in marine and maritime sectors (de Vet et al., 2016), with RE as one of eight sub-categories under this EU priority area. Figure 4 illustrates that RE/Blue Growth is mainly a focus in Western Europe, notably in the United Kingdom where maritime RE (offshore wind and tidal power) is a focus area in the national RIS3 strategies of England and Scotland. Compared with Sustainable Innovation, energy-related RIS3 strategies with this EU Priority link to much fewer technologies and business areas.

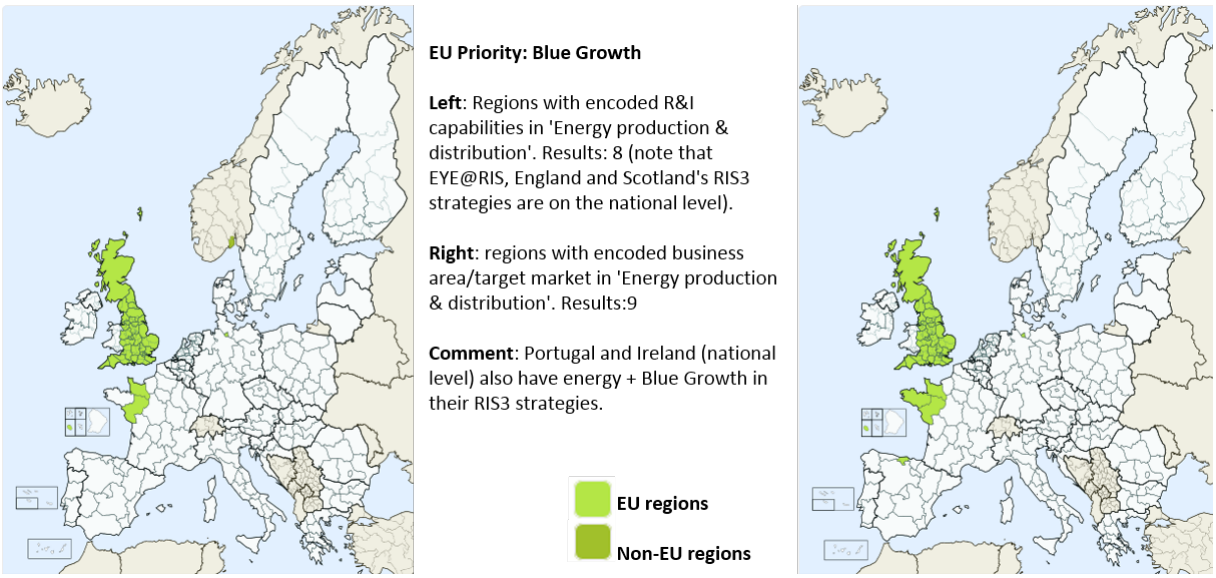

FIGURE 4 ENERGY IN RIS3 STRATEGIES (REGIONS) WITH EU PRIORITY 'BLUE GROWTH'

Digital Agenda is seen as important to RIS3 strategies because "information and communication technologies are a powerful driver for economic growth, innovation and increased productivity" (Foray et al., 2012: 82). The typical energy R&I capabilities linked to Digital Agenda' as a RIS3 EU priority relate to more efficient energy infrastructure and smart grid technologies.

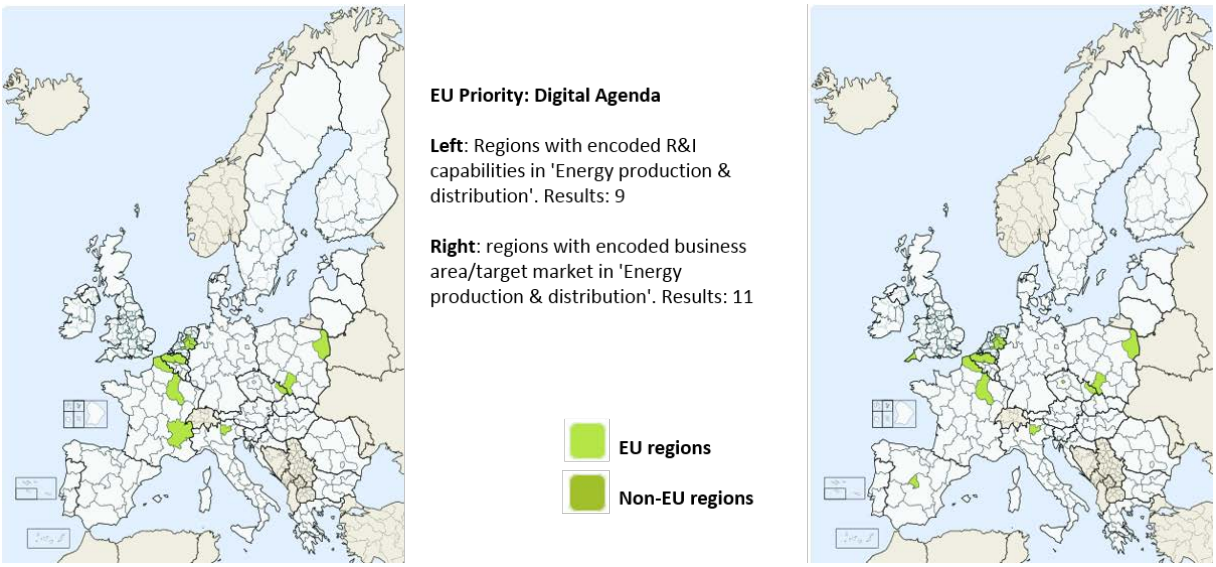

FIGURE 5 ENERGY IN RIS3 STRATEGIES (REGIONS) WITH EU PRIORITY 'DIGITAL AGENDA'

Key enabling technologies (KETs) in RIS3 comprises micro- and nano-electronics, photonics, nanotechnology, industrial biotechnology, advanced materials and advanced manufacturing (Foray et al., 2012). More generally, KETs are seen as crucial to 'smart growth' by contributing to the modernisation and upgrading of existing industries, as well as for forming the basis for entirely new areas of economic activity. Given their multi-industry nature, these technologies are relevant for energy production and distribution in many ways. Amongst our case study regions, Nordland links its energy-related RIS3 strategy to KETs, however this is not apparent from the map in Figure 6, and will be elaborated upon in the case study section.

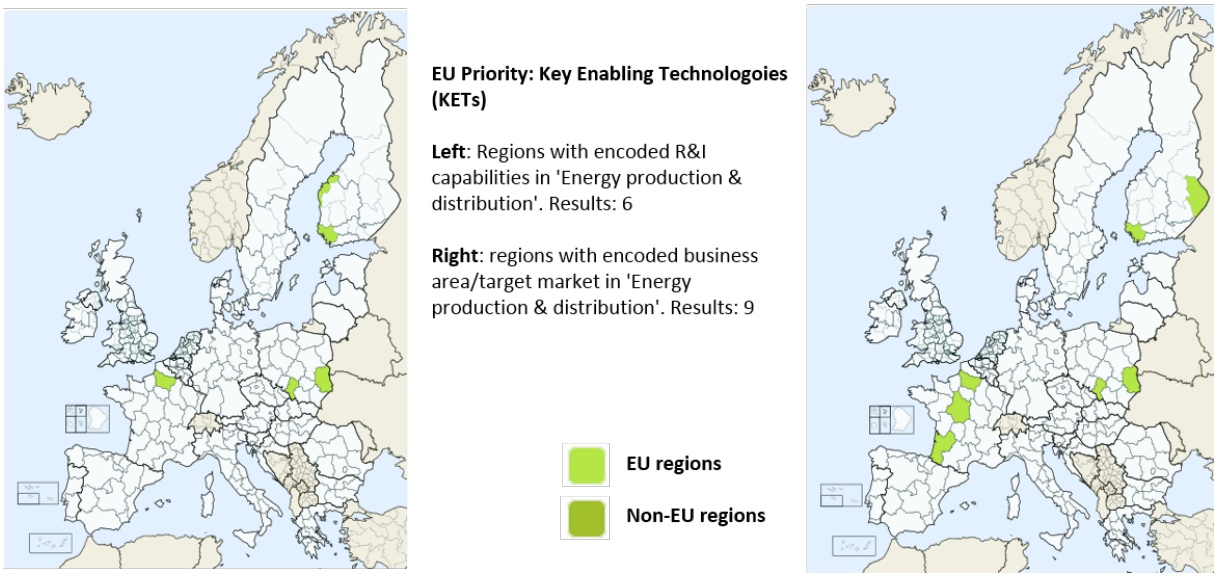

FIGURE 6 ENERGY IN RIS3 STRATEGIES (REGIONS) WITH EU PRIORITY 'KEY ENABLING TECHNOLOGIES'

In sum, the above mappings reflect the significance of energy-related priority areas in RIS3 strategies. Whilst RIS3 strategies related to the EU Priority 'Sustainable Innovation' by far outnumber the other EU priority areas, a closer inspection of actual 'contents' of these RIS3 strategies show that they are highly diverse, ranging from novel use of 'traditional' natural resources such as biomass from forestry or agriculture to energy-efficiency in manufacturing or construction sectors. This suggests that these energy-related strategies are based on endogenous assets and capabilities and as such are in line with RIS3 priority setting rationales. These mappings also reflect that in most cases R&I capabilities and business areas/target markets are overlapping, however, there are numerous exceptions to this. In addition, case-by-case investigation of entries in EYE@RIS revealed that many regions have 'energy' in their description without linking this specifically to either capabilities or markets and therefore do not show up in the above maps (this includes our case study region Nordland). For instance, Castilla y Leon (Spain) links its R&I capabilities in 'agriculture, forestry and fishing' to the 'manufacturing and industry' market and 'sustainable innovation' as EU priority. In its description in EYE@RIS, emphasis is on 'agro-food and sustainable use of natural resources', with bio-energy as one topic listed. Moreover, such qualitative descriptions of RIS3 priorities strengthen our impression that there is considerable variety in energy-related RIS3 strategies at the regional level. As such, a complete mapping of energy related priorities in RIS3 based upon EYE@RIS would require a comprehensive content analysis of all entries, however this is beyond the scope of our analysis. Instead, we explore the contents and strategy process of RIS3 in three regions.

Case studies

Our in-depth analysis of three regional case studies sheds light on the role of energy in RIS3 strategy processes, how they relate to RIS3 rationales and key European energy policy targets. We consider the regions Nordland, Galicia and Schleswig-Holstein as exemplars of differentiated RE related RIS3 development strategies.

Nordland

Being a major exporter of oil and gas and having a national electricity system based almost entirely on hydropower, Norway is relatively unique. Besides hydropower, onshore wind power and bioenergy are important sources of renewable energy (MoPE, 2015). Furthermore, the government committed to a 67.5% share of renewable energies by 2020. This represents more than two-thirds of Norway's energy consumption, and is a higher ratio than in any other European country.

Nordland County in Northern Norway is rich in natural resources and has considerable power production. Energy intensive industries (e.g. the metallurgical process industries) consume more than 60% of total primary energy

production. Future regional energy demand is to large extent contingent on the future development of these industries as well as potentials for power export, for which a further developed grid infrastructure connecting Nordland to larger energy market areas would be a key requisite. Nordland has considerable untapped potential in energy sources such as hydropower and wind energy (Sweco, 2014), and ambitious goals to expand deployment with 5,7 TWh by 2025 (50% wind energy, 25% hydropower, 25% energy efficiency). This is in order to meet its (regional) target of a 20% reduction in GHG emissions compared to 1991 (NF, 2013). However, although several RE projects have received concessions, few new energy projects have been developed in recent years. This is largely due to low prices in the Norwegian electricity market and (corresponding) limited investment capacity in the power industry (Weaver and Steen, 2013).

Whilst Norway is not a member of the EU, a few Norwegian county-municipalities have chosen to follow a RIS3 approach in their innovation strategies for regional development. As the first region in Norway to join the S3P platform, Nordland launched its RIS3 strategy entitled "Innovative Nordland" in 2014, which was based on a regional innovation strategy and strategies for regional economic sectors. A main reason for joining S3P was the recognition that “knowledge/market development and research funding, to a growing extent takes place internationally” (NFK, 2014). The 32-page RIS3 strategy document addresses in particular how Nordland can use its competitive advantage in natural resources including energy and raw materials. In EYE@RIS, Nordland has three entries, namely 'experience economy', 'industry processes, services and products', and 'suppliers to seafood'. It is the second one of these that relates to energy, and it is based upon R&I capabilities in 'manufacturing & industry' and linked to the KETs 'EU Priority'.

In 2013 the Nordland Research Institute (NRI) conducted an analysis (diagnosis) of the region’s strengths in line with the RIS3 principles (Mariussen et al., 2013). Together with more than 600 stakeholders in the region, NRI participated in the preparations and development of the strategy (governance). During this entrepreneurial discovery process, actors in Nordland identified (vision) the need to develop firm networks in order to exploit the potential for more 'green' energy production (objective). The key instrument for achieving this is the so-called green energy cluster (Figure 7), for which the metallurgical process industry and its electro-technical supplier base is considered key driver. Consequently, choosing KETs as priority area for the cluster appears to be a somewhat logical step, given the regional resource endowments, industrial competences and strategic objectives (regional potentials). Altogether, Nordland’s process fully accounted for the place-based approach.

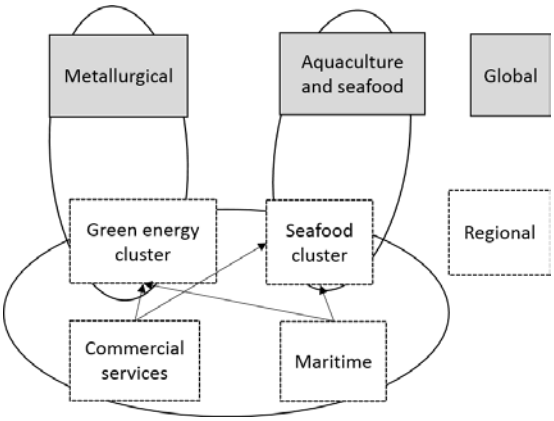

FIGURE 7: THE GREEN ENERGY CLUSTER IN NORDLAND’S RIS3 NETWORK (NFK 2014, 11).

Nordland’s industry strategy, which forms one of the pillars for the RIS3 strategy, emphasises entrepreneurial opportunities associated with RE. This is supported by a supplementary analysis by NRI of regional core strengths in RE, which also presents recommendations for how RIS3 can contribute to increasing RE deployment in the region. Nordland has limited endogenous R&I capabilities in RE. In addition to highlighting the need for further developing Nordland's knowledge base in energy technology, this analysis suggests that the current strategic

planning process as well as the national incentive scheme for RE projects hampers deployment of RE technologies in the region (Mariussen et al., 2014).

GALICIA

Spain was a pioneer in introducing support schemes to spur investments into the deployment of RE, as feed-in-premiums were introduced already in 1998. Generous financial support led to rapid growth in RE deployment in the 2000s (e.g. almost 9% increase between 2005 and 2006). The economic downturn following the 2007-2008 financial crisis with decreasing economic output was accompanied by an approximate 10% reduced electricity demand from 2008 to 2012 (EC, 2014a). Additionally, (energy) tariff deficit summed up to EUR 25.5 billion by 2013.[2] As a consequence, the 'energy transition' in Spain has come under increasing stress. In February 2013, all incentives for RE deployment were abolished, leading to a collapse in the domestic market. Whilst 16.2% of Spain's energy need (and 44% of domestic electricity demand) was supplied by RE by the end of 2014, it is uncertain whether Spain reaches its target of 20% RE of gross final energy consumption by 2020 (set in 2009). In 2013, Galicia was the leading Spanish region in hydropower production and second to Castile and León in installed wind energy production. Galicia produces 103% of total renewable regional electricity demand, implying that it is a net exporter of RE. The region is also home to many pioneers in Spain's wind energy industry (Matti et al., 2016), making the region both a strong innovator and (historically) a site of RE deployment.

The development of Galicia's RIS3 strategy was led and administered by the Galician Innovation Agency (GAIN) which was purposefully set up in 2012 to function "as a fundamental element for establishing an open and plural Governance framework" (Xunta de Galicia, 2014: 11) for the regional innovation system. The 168 pages RIS3 strategy was passed in May 2013 and implemented in 2015 (Xunta de Galicia, 2014). In EYE@RIS Galicia has 11 entries. These span from introducing KETs (especially ICT) in public administration via modernization of traditional primary sectors to diversification of key industrial sectors such as automotive. Key strategies are to enhance the use of new technology, and many strategies are linked to the EU priorities of KETs and Sustainable Innovation.

The step-wise RIS3-approach was closely followed in the strategy development process. The diagnosis of Galicia's regional context and specialization potential was conducted by GAIN and regional government departments together with the three regional universities, support from the affiliated Galician Innovation Observatory (responsible for evaluation and monitoring of public innovation policy) and with data from the Galician Innovation Platform. It was explicitly based on an innovation systems approach (Tödtling and Trippl, 2005) that distinguished between a knowledge generation and dissemination (R&D, education etc.) and a knowledge application and exploitation (firms) subsystem, with regional policy potentially playing a powerful role in shaping regional innovation processes.

Following a series of workshops (2 general and 5 thematic), broader forums and citizen consultation (governance), 30 'future potential niches' (vision) were identified in a process of entrepreneurial discovery (Figure 8). On this basis, 10 priorities were chosen, and these were in turn linked to 3 main challenges: 1) new model for innovative management of natural and cultural resources based on innovation, 2) new industrial model based on competiveness and knowledge, and 3) new healthy lifestyle model based on active ageing of population. Energy related issues are fundamental elements of challenges 1 and 2. The mapping of potential areas of regional specialisation was additionally based on analysis of gross added value (GAV) and relative productive specialisation index for Galicia-Spain, as well as a mapping of technological entrepreneurship dynamics, together revealing the regional competitive advantages. In terms of relative specialization within Spain and its influence on specific instruments, Galicia's primary sector stands out in its economic structure. Regarding challenge 1, Galicia aims to develop energy generation from renewable resources, particularly biomass from the agriculture and livestock sub-sectors. A second prioritization is marine RE (wave energy, offshore wind power, algae for biofuels). These are considered as opportunities for RE deployment as well as technological and

[2] http://energytransition.de/2015/06/energy-transition-in-spain/ Accessed 21 June 2016

industrial development. Regarding the latter, a key argument is that Galicia's industrial infrastructure linked to naval technologies "could find a path towards diversification in this field aimed at a new niche in the market" (Xunta de Galicia, 2014: 82). This then overlaps with challenge 2, where the regions shipbuilding sector (the largest in Spain) can potentially diversify towards marine RE and supply ships, platforms and components.

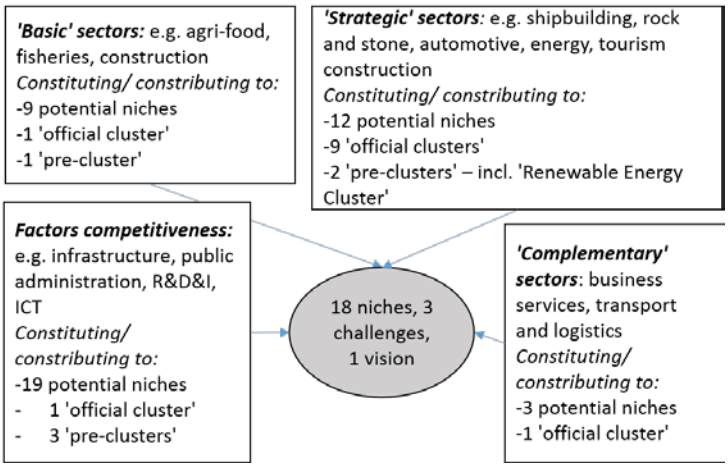

FIGURE 8 GALICIA'S RIS3 STRATEGY PROCESS AND OUTCOME. SOURCE: XUNTA DE GALICIA 2014

SCHLESWIG-HOLSTEIN

In 2011, the German government officially announced the energy transition as a key priority for the future national development. The official goal is to have 35% of electricity and 14% of heat produced by RE in 2025, and 80% of RE electricity by 2050. Decisive political decisions in that direction were the nuclear power phase-out until 2022, the end of coal subventions by 2018, and various measures for promoting RE (e.g. feed-in tariffs) and energy efficiency (e.g. National Action Plan on Energy Efficiency). The occurring changes are exemplarily mirrored in the electricity mix, where the RE sources wind, biomass, water, and photovoltaics (PV) increased in total share to 30%. A recently discussed amendment of the Renewable Energy Sources Act (2017) will change the future direction of national RE support, though–what cannot be substantiated by evidence up to date.

Schleswig-Holstein (SH) is one of Germany's leading regions regarding RE. Several firms produce technical components, large project developers are based in the state, and various universities offer study programmes. In total, over 16,000 people are (in)directly employed in the RE industry. In 2015, 43% of the state's electricity production and 13.5% of heat production were covered by regionally produced RE (Schleswig-Holsteinischer Landtag 2015). The bulk of deployment has been in on- and offshore wind energy, but also PV and biomass contribute to the RE mix that covered 75% of regional gross electricity consumption in 2015 and is set to expand. Besides industrial activities, various educational programmes and political agenda setting emerged in SH from 2005 onwards, together forming a RE cluster in SH (Fornahl et al., 2012). Diekmann et al. (2014) identify SH as the leading German Bundesland regarding the output of RE strategy documents and statistics and also political engagement for the RE sector. Together, the region deploys and develops RE technology and also influences national RE policy.

The status of RE is mirrored in Schleswig-Holstein's RIS3 strategy (WiMi.SH, 2014), which was passed in December 2013 and finally amended in July 2014. The extensive 178-page document has 9 chapters, 6 with a thematic focus out of which two directly address energy related aspects, especially RE–other energy sources are addressed in the document. It follows the guiding vision: "Schleswig-Holstein addresses the global challenges of climate change, energy transition and demographic change with innovative solutions and will be an important European driver of innovation by 2020. This will ensure economic growth, attractive career opportunities and sustainable development of the state" (WiMi.SH 2014: 91; author's translation).

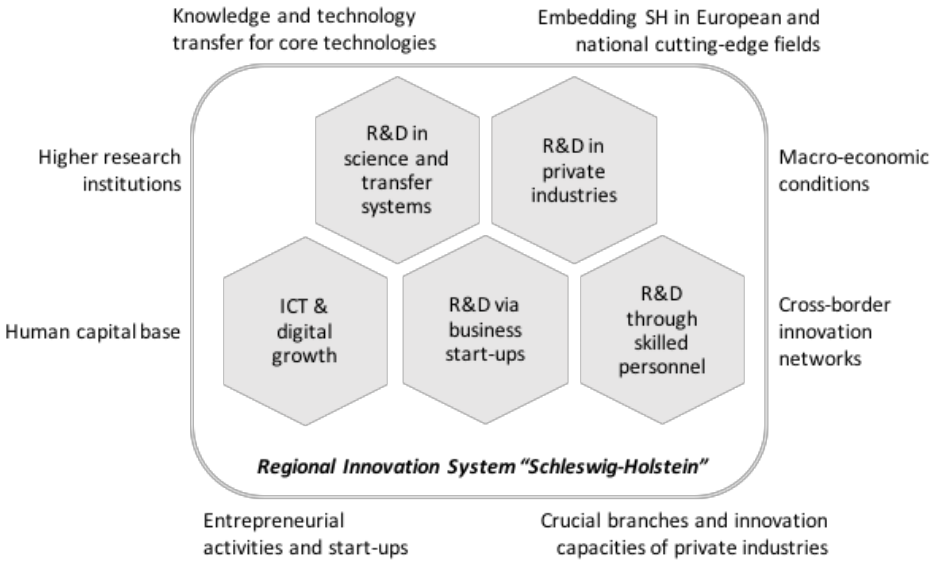

FIGURE 9: THE REGIONAL INNOVATION SYSTEM IN SCHLESWIG-HOLSTEIN AND ITS MOST INFLUENTIAL FORCES, OWN ILLUSTRATION BASED ON WIMI.SH 2014, 14-49.

For developing RIS3-SH, the place-based approach and entrepreneurial discovery processes were crucial. A region-specific SWOT-analysis was conducted (diagnosis). Starting point was the definition of a Regional Innovation System comprising five elements and eight influencing forces (see Figure 9), as well as a consideration of past regional development paths, regional assets, and global market developments. For all five system elements, RE is seen as strength with potential for future regional development. A 6-step consultation process with multiple stakeholders from SH's administration, policy and industry (governance) followed the SWOT-analysis. This led to the identification of 20 potential priority areas (objectives) and approximately 100 action recommendations (instruments). For the first two steps the results from the SWOT-analysis were important. In step three and four, workshops and consultation with selected participants from SH deepened the understanding of regional potentials and led to a prioritization of areas and actions. Thereby, relevant actors could provide valuable insights and knowledge for the final decision by internal governmental bodies. Finally, state leaders defined five priority areas, out of which one is RE.[3]

Each priority area features 3 to 5 specific innovation potentials; in the RE area these are energy/drive technologies, environmental technologies, and RE software. Besides priority areas, SH also set nine strategic action fields for smart specialization, putting knowledge and innovation at core to the strategy. Energy is an important aspect, embedded in most categories and seen as a field in which various actors in the region share interest and knowledge (regional capacities), which builds on existing competences and offers the potential to develop a regional competitive advantage.

DISCUSSION AND CONCLUSIONS

Our preceding empirical section aimed to shed light on 1) the extent and role of energy in RIS3 strategies, and 2) how particular energy-linked target areas in RIS3 strategies relate to RIS3 priority setting rationales. In this section we discuss our findings from both the extensive mapping and case study exercises, and also reflect on the potentials of RIS3 strategies to foster sustainable energy, thereby contributing to reaching broader EU energy policy targets. Based upon this discussion we conclude and point out five key topics that deserve further scrutiny.

The extensive mapping exercise revealed that energy is the most widely used target area in RIS3 strategies in Europe, with more than 2/3 of all regions having energy integrated in their RIS3 strategy in one way or another.

[3] The other four priority areas in SH are maritime economy, life science, food industry, and information technologies.

Based on the EYE@RIS database, we found that the majority of these strategies are linked to the EU Priority 'Sustainable Innovation'. A closer inspection of entries into the database revealed that there is considerable variety in the particular research and innovation (R&I) capabilities that underlie energy-related RIS3 strategies, especially under this most widely used EU Priority. This suggests that energy-related priorities in RIS3 have been chosen on the basis of place-based resources and assets, rather than different regional strategies converging around a few technologies. Our examination of EYE@RIS data furthermore suggests that (in line with RIS3 guidelines) a broad understanding of innovation underlies energy-related RIS3 priorities, with some regions aiming to upgrade and modernize existing sectors, whilst others are targeting more niche-type segments in the energy system and associated value chains.

This finding is further supported by the analysis of our case study regions, which dispelled substantial differences in their energy-related priorities as well as the rationales for choosing those. The defined energy-related priority areas explicitly relate to the pre-existing industrial structures and natural resources available in these regions, suggesting that the key RIS3 idea of 'place-based' priority settings have been followed. In sum, alignment with broad EU energy related policy targets, a strong focus on pre-existing activities, and inclusion of many different stakeholder groups are core characteristics of RIS3 in the three regions. We also note that in these RIS3 strategies, development ambitions are sought and realized with cluster-type approaches. In the energy-related sphere it appears, however, that these cluster strategies are multi-sectorial in the sense that they aim to either diversify existing clusters or develop new ones based on capabilities in different sector. This, we suggest, is indicative of increasing attention being paid to 'relatedness' between sectors and scope for knowledge spillovers between different industrial domains (Iacobucci and Guzzini, 2016b) in regional development strategies such as RIS3.

The most fundamental change accompanying the introduction of RIS3 is the process of entrepreneurial discovery (ED) (Foray et al., 2012), whereby a variety of experts and stakeholders are enrolled into the strategy making process through workshops and consultations. In line with RIS3 guidelines, as argued by Asheim and Grillitsch (2015, 23), entrepreneurs “are found not only among firms and individuals engaging in start-up activities but also in the local research environment, educational facilities, cluster organisations, and public administration.” Hence, the underlying idea of ED is that a heterogeneous stakeholder group will arrive at priority settings based on a broader understanding of the potential for innovation and development in a region. This approach appears to have been followed in the three case regions. Future research on RIS3 strategy making should seek to shed further light on how particular priorities are made, and the underlying assumptions amongst regional authorities and other stakeholders concerning particular regional strengths or comparative advantages vis-a-vis other regions. In the context of rigid sectors such as energy (Lovio et al., 2011), where there are often strong vested interests tied to sunk costs in extant production and distribution infrastructure, institutional entrepreneurs (Sotarauta and Pulkkinen, 2011) who strive to change or modify 'the rules of the game' may play particularly important roles.

Whether vested interests of strong regional actors have triumphed over the interests of more marginal actors in energy-related strategy making processes is another key topic for further research. The prevalence of priority areas based upon already existing clusters in the cases scrutinized in this paper may as such be due to vested interest of selected participants (with sunk investments in infrastructure and technologies), or to path-dependent political decision-making. It is often assumed that energy sector incumbents are fierce defenders of status quo, that they can block the rise of entrants with new technologies, or influence policy making in ways advantageous to them. This is also debated in the sustainability transitions literature, where regimes encompassing incumbents and vested interests are set in a multi-level-relation to niches (incubation spaces for innovation), and broader macro-trend landscapes (e.g. global greenhouse gas emission agreements). That literature also identifies the need to better understand the role of smart specialisation in supporting the growth of new clean-tech 'niche' sectors which is crucial for the transition to more sustainable energy systems (Hansen and Coenen, 2015). A clearer understanding of the role of vested interests in RIS3 strategy making will in our view require qualitative research that carefully disentangles the institutional work (in particular) of powerful

actors such as the incumbent firms in energy sectors. Focusing on individual agents, e.g. in place-based leadership, and taking their stakeholder's salience (power, legitimacy and urgency) (Neville et al., 2011) into account might additionally account for potentially harmful as well as supportive elements of vested interest.

Our empirical investigation moreover suggests that there is a close inter-relation between RIS3 strategies and broader EU energy policy targets on energy efficiency and increasing the share of RE in the energy mix. This will require substantial technological progress and investments in new or upgraded infrastructure (in many sectors). Regions that for instance aim to develop capabilities in more energy efficient construction or waste management, or reduce energy consumption in agriculture, manufacturing or process industries may thus make important contributions to overall EU targets, alongside those regions that have RIS3 strategies more directly linked to energy production technologies (e.g. wind or solar energy). Moreover, we see that many regions have aspirations of developing technology and solutions for smart grid infrastructure, which is a prerequisite for a well-functioning energy market with substantial levels of intermittent energy production from RE sources. Furthermore, as our case studies show, regions like Nordland can use RIS3 as an upgrading strategy for their innovative capacities and thus move beyond being a site of energy deployment to fostering technological innovation. For leading regions like Galicia or Schleswig-Holstein, RIS3 can contribute to further strengthening their position in a technology field. A concern here is therefore that these innovation and development strategies need to be matched by energy policy instruments that stimulate market demand and formation. The fate of Galicia and Nordland's energy-related priorities will largely depend on national energy policy frameworks that are currently not very favourable to expanding RE deployment. Upcoming regulatory changes on the (German) national level regarding tendering procedures for RE project development will similarly have potentially negative influence on energy-related developments in Schleswig-Holstein. Whilst RIS3 can contribute positively to EU energy targets by fostering sustainable energy innovation and deployment at regional levels, this potential may therefore be undermined by the lack of conducive framework conditions that are largely a result of national level policies.

ACKNOWLEDGEMENTS

The authors gratefully acknowledge support from The Research Council of Norway grant no. 209697 (FME CenSES). Earlier versions of the article were presented at the EU-SPRI conference in Lund and the RGS conference in London (both 2016). We thank commentators at these conferences for their helpful recommendations. Finally, we thank Robert Hassink for valuable comments and suggestions.

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