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THE ENERGY CHALLENGE AND THE FUTURE OF THE HEC

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1. Management Summary

In the coming decades various European regions will increasingly be facing a challenge to make the energy system more sustainable, while keeping energy affordable, available and accessible (triple A conditions). This requires the large-scale development and integration of big and small renewable energy options within the existing energy system.

Energy of different geographical origin, reversed flow and different production-supply patterns will be inserted into an increasingly interconnected system. Cost-effective balancing of this complex integrated energy system will, therefore, not only be a key instrument to maintain network integrity but it will also serve as facilitator for the development and deployment of renewables (e.g. wind, solar-pv, bio-gas, and solar- and geothermal options) that have differing balancing needs. The current HEC region has a very strong position as far as several renewable (primarily gas-based) options deriving from a flexible energy system are concerned ,– which, relatively – speaking, is highly cost-effective and competitive in terms of system balancing.

The required strategies to tackle this energy system challenge effectively (triple A conditions) goes far beyond the scope of one single country or sub-set of provinces. In fact, intensified cross-border cooperation, coordination and collaboration can be seen as necessary basic ingredients of effective energy system strategies.

The current Hansa Energy Corridor (HEC) intiative, in terms of organization and structure, successfully integrates the triple-helix stakeholders via a strong bottom-up oriented approach. However, the HEC initiative will run up to the end of 2012, which requires careful consideration of the need for (why?) and structure of (how?) a possible successor of the HEC in light of the formidable energy challenge.

WHY?

1. Increasing share of renewables, with strong focus on biomass, (offshore) wind and hydro in North Sea region,
2. Ongoing interconnection and integration of national energy systems,
3. The need for cost-effective (gas-based) balancing to keep energy 'triple A',
4. Cross border triple helix collaboration creates critical mass for R&D, innovation, employment and technology/service export to other regions,
5. Scope for synergies and complementarity with other North Sea countries in trying to tackle the energy challenge,
6. Cost-effective energy system balancing services provide ideal ground for early development and deployment of renewable energy.

HOW?

1. By extending the HEC in order to cover the entire Energy Valley and Niedersachsen-Bremen region in the short-term, while also taking the initial steps to scale-up to the North Sea energy region on specific R&D themes or specific private sector stakeholder groups, all for the sake of a full-scale extension over the North Sea region in the medium-term, aiming at improving the chances of European recognition,
2. Via a more structured and joint lobby in Brussels on behalf of the HEC stakeholders,

3. Through an R&D and education structure and program, which is better aligned with the 'quadruple helix' within the HEC region (e.g. embed the HEC strategic priorities Energy Academy Europe program),
4. By assuming a continuation of the prime focus on energy in order not to dilute the efforts, and within the energy theme focus HEC efforts only on those key strategic issues that are not sufficiently addressed within the scope of other (inter)national platforms (e.g. address system barriers for specific renewable energies, and/or finance, policy and competitiveness issues),
5. By taking a position that would not rule out that the HEC concept acts as a precursor of serious international political collaboration and actual joint institutions with decision making powers on various energy issues,
6. With the help of an organizational structure that intelligently combines the current bottom-up strength of the HEC with a more strategy oriented, top-down executive board,
7. By creating a situation in which the HEC organization not only focuses on research and training at various levels and forms, but also seeks a coordinating role for joint commercial energy activities,
8. By developing a structure in which the HEC grows into a legal entity capable of independently contracting various project activities conducive of joint energy activity.

In order to seriously strengthen HEC governance, the SER NN advises that the HEC Advisory Committee (HEC-AC) carefully assesses its current tasks and responsibilities within the future of HEC (as sketched in this report). In this respect, the SER NN stimulates the HEC-AC to claim a role and position as an executive rather than advisory body that governs and stimulates cross-border quadruple helix initiatives. Such an executive board – in the view of the SER Noord-Nederland – would need to be able to initiate new activities and carry a number of executive responsibilities (e.g. decision power), should be supported by a professional international secretariat, and should be able to initiate and delegate specific tasks to specialist thematic groups active within the extended HEC region.

2. Introduction

In the scope of the EU's 20/20/20 targets, the European energy and climate issue has become a challenge for the affordability, availability and accessibility to more sustainable forms of energy and energy systems. With increasing network interconnection and cross-boundary energy production initiatives, the various energy systems within Europe become more and more intertwined.

Aside from the fact that these system integrations create clear benefits to society as a whole in terms of economic effectiveness, integrating formerly disconnected national energy systems does confront the triple helix with some serious technical, economical and institutional challenges. The common denominator for all triple helix stakeholders is how to effectively, efficiently and intelligently facilitate, speed up and commercialize this ongoing integration process (for research institutes, public authorities and private sector stakeholders) that provides both opportunities and threats not only in economic , but also increasingly so in social and environmental terms.

In 2008 the SER Noord Nederland (SER NN) already underlined the growing need for cross-border cooperation in its advice on the 'Noordelijke ontwikkelingsas' (Northern economic development corridor). In this advice the argument was developed to further intensify the economic links between Northern Netherlands and regions in North-eastern direction, ranging from Germany to Poland, the Baltic region and Scandinavia. Since the release of that advisory report, a number of initiatives has been developed to substantiate the Northern corridor concept. One of those initiatives relates to energy cooperation on a triple-helix basis between Northern Netherlands, (hereafter referred to as the Energy Valley (EV) region) and Lower Saxony and Bremen. This collaboration has led to the establishment of the Hansa Energy Corridor (HEC) organization in 2009. Due to a subsidy of the Interreg Program, the HEC organization has gradually grown into a network of research institutes, energy companies and public bodies on both sides of the border.

The current structure has typically grown bottom-up, with a clear focus on innovative research-driven activity based on public-private, German-Netherlands partnerships focusing on joint energy action within the region itself. At the same time the HEC initiative receives clear support top-down from the political leaders of the region. Given the progress so far, however, it looks like the stage has been reached to seriously consider the future target and scope of the HEC, and address the issue if the current scope and structure are sufficiently robust to tackle the enormous energy challenges ahead. This becomes even more urgent due to the fact that the current HEC organization is based on an INTERREG project which will be finished at the end of 2012. Therefore, in this advisory report the SER Noord-Nederland elaborates on the question whether the HEC initiative should continue. If that is the case, to what extend the continuation should take place and how it should be organized?

In this advice, the SER Noord-Nederland first seeks to explore what the true synergetic basis of the HEC collaboration is and can be within a regional and European context, and how and to what extent the regions can benefit from cross-border energy partnership collaboration. In other words: 'Why HEC? (section 1).' Second, the advice concerns the possible future scope of the HEC collaboration and some related design questions (see section 2). Third, given the preferred scope, the advice concentrates on how a future HEC initiative could be structured to reach the economic, social and environmental energy and climate targets set: 'How HEC? (section 3).' Finally, the three above elements are consolidated in an overall advice on the future of the HEC (section 4).

With this advisory report, the SER Noord-Netherlands offers its input to the discussion whether or not to continue with the HEC initiative. Moreover, SER Noord-Nederland hopes this report helps to bring some insights into the HEC organization for discussion within the HEC Advisory Council.

Given the German–Netherlands scope of the current HEC initiative, the committee preparing this report included the following experts:

- Catrinus Jepma (chair)
- Thomas Klencke (University of Oldenburg)
- Gerard van Pijkeren (Gasunie – Vertogas)
- Robert Wittmaekers (BAM)
- Hans Peter Beck (EFZN)
- Jutta Geldermann (University Göttingen)
- Bob Bergsma (SER Noord-Nederland)
- Lambert Zwiers (SER Noord-Nederland)

The committee met three times in the period between November 2011 – March 2012.

3. Why HEC?

3.1. The European Energy challenge

In March 2007, the EU's leaders endorsed an integrated approach to climate and energy policy that aims at combating climate change and increasing the EU's energy security while strengthening its competitiveness. They committed Europe to transforming itself into a highly energy-efficient, low- carbon economy. This package involves ambitious quantitative targets in terms of:

- achieving a 20% reduction of GHG emissions below 1990 levels,
- a 20% share of renewable energy in final energy consumption, and
- a 20% reduction in primary energy use compared with projected consumption levels.

Achieving all these goals by the year 2020 is not only a significant, but also a highly complex challenge. As far as energy is concerned, the EU goal is to make energy is affordable, accessible and acceptable. The complexity of the challenge is to combine these 'triple A' criteria, i.e. to make sure that EU citizens and industries will pay a fair price for their energy, that energy supply is reliable and uninterrupted, and that the energy production satisfies environmental criteria especially in the framework of climate policy.

3.2. The Energy challenge in and around the HEC region

Within the HEC region and in the surrounding North Sea countries, a relatively high level of energy system integration can be achieved. The former predominantly national energy systems are, as a result of the construction and operation of additional interconnector capacity, increasingly physically integrated. This means that larger volumes of energy can flow freely from one country to another. An open, integrated and liberalized market provides many advantages in terms of affordability, accessibility and availability (triple A principles) of energy. However, there are still also cross-boundary challenges to keep the integrated energy system operating properly.

Any EU regional energy system has to deal with a certain level of change. Increasing volumes of renewable energy are being supplied to the energy grids, while leaving important questions with respect to balancing, system optimization and cross-border cooperation and coordination. These system challenges do not only translate into a series of technical engineering challenges, but also focus on institutional harmonization, financial, economic and legal issues. It would be unrealistic to assume that one single country can tackle such challenges on its own by not abandoning the 'triple A principles'.

Within the North Sea region, the production of energy (both fossil and renewable) is increasingly concentrated on-, near- and/or offshore[i]. This explains why during the last decade quite considerable energy production investment has developed in the North Sea coastal region, particularly near harbors,[ii] and especially at those harbors that still have considerable growth potential and are not located in the industrial hearts of the area.

The increase in power production capacity in, for instance, the regions Energy Valley in the Netherlands (the provinces Groningen, Fryslân, Drenthe and the northern part of North-Holland), Lower Saxony and Bremen has been much more prominent than in virtually any other EU region[iii]. Another trend explaining why the coastal zones of Europe typically tend to develop into energy regions is the drive towards renewable energy based on the formally accepted renewable energy targets, e.g. in the framework of the EU Renewable Energy Directive (2009/28/CE).

3.3. Energy system challenges & advantages within the HEC region

WIND: Driven by the climate change debate and associated policies, (on- and offshore) wind energy has strongly benefitted from various incentive schemes. This type of energy source employment is growing rapidly and is foreseen to expand much further during the next decades. So far considerable wind production capacity has been installed onshore. Increasingly, however, one recognizes that there are limits to onshore wind for reasons of public acceptance, so that most of the additional expected future wind capacity additions will probably be located near- or offshore. The North Sea basin is geophysically well-suited to attract near- and offshore wind investments[iv] (see Annex B for background data on wind).

Offshore wind power will need to be transported to its onshore destination via a grid connection system. This offshore grid will typically land at or near harbors with industrial complexes. Also power grid interconnections with renewable power from Scandinavia towards Northwestern Europe (will) get onshore in various North Sea region harbors. Examples are the undersea high-voltage cables NorNed (Norwegian hydropower), and the planned Cobra cable[v] (Danish wind power) landing in the Eemshaven area.

To illustrate the potential impact of such wind capacity expansions on the power system, Figure 1 below contains a simulation of the balancing impact on the power system due to a tenfold extension of U.K. wind capacity as compared to the current level. Similar energy system impacts can be considered as fairly representative for the entire North Sea region given the above-mentioned expectations on wind capacity growth. Figure 1 reflects the annual demand and supply pattern and distinguishes between the various sources of power supply.

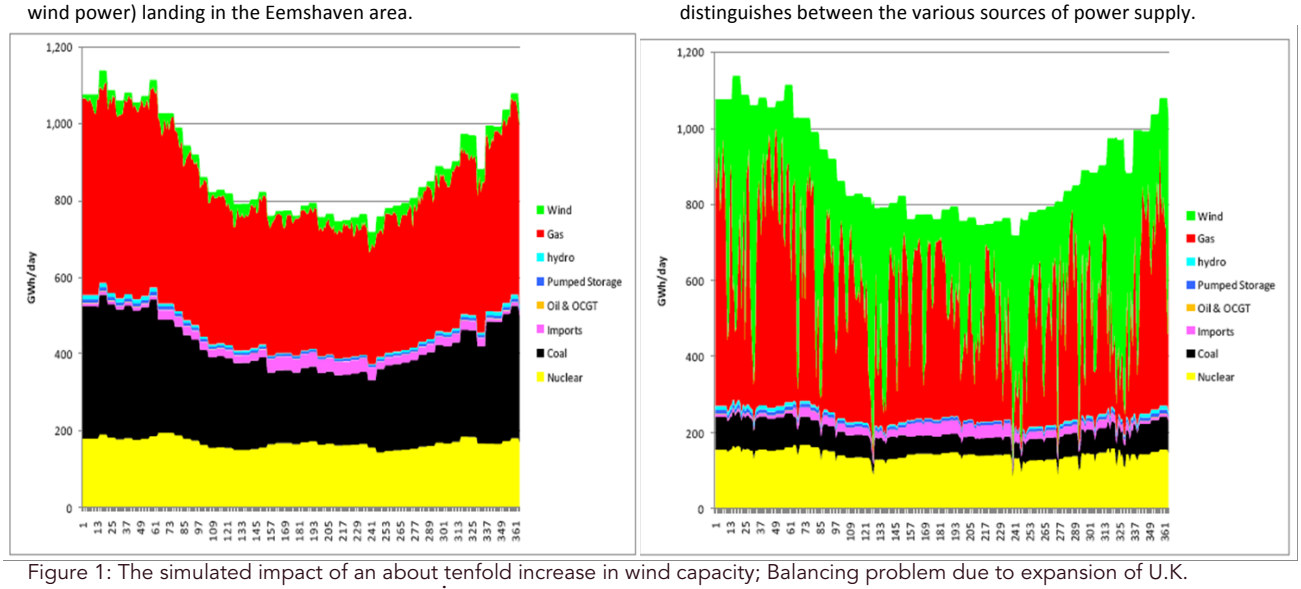

Figure 1: The simulated impact of an about tenfold increase in wind capacity; Balancing problem due to expansion of U.K. wind capacity (left 3.8 GW; right 43.2 GW) [vi]

Based on Figure 1, one can conclude that under the assumption that wind-based power will have priority access due to its low marginal costs as compared to other sources of power production, increasing wind capacity will pose considerable challenges to the back-up and flexibility potential of specifically gas-fired power production. Figure 1 also illustrates that the introduction of intermittent wind will only be possible if there is sufficient flexibility within the energy system with respect to production, storability and transportability of energy (notably gas) and other conventional energy sources. In fact, similar simulations reflecting the patterns during the day suggest that on average in a number of days per year wind power can potentially crowd out all other power supply sources up to a level where the absorption of power rather than its supply will have a positive price. The challenge (the renewable energy source) that wind power therefore poses to the energy system is formidable indeed. To put it boldly one could argue: *"No climate targets without the use of renewables, but no 'triple A' renewables without fossil back-up."*
The combination of bringing onshore massive offshore wind-based intermittent power on the one hand, and rapidly increasing onshore fossil and renewable-based power production on the other hand, is not only typical for the region comprising Energy Valley, Niedersachsen and Bremen (i.e. the current Hansa Energy Corridor region), but also for the wider North Sea region.

BIO-ENERGY: Another characteristic of the HEC region is its relatively large scope for biomass-to-energy activities, particularly biogas production from agricultural resources (see Annex B for some data on bio-energy). There is a strong historical agricultural background within the HEC region; agriculture has long been the dominant industry sector. Also today a large number of leading agricultural industries have significant industrial operations within, or are sourcing biomass from, the HEC-region, such as Avebe, Friesland Campina, Cosun, Suiker Unie, Omrin, van der Wiel, Biogas Weser Ems GmbH, EnviTec Biogas AG, MT- Energie GmbH & Co. KG, WELtec BioPower GmbH, EWE A.G, and others. In Lower Saxony for instance, after the car industry, the agricultural and food industry is the second largest sector, employing some 100,000 persons.[vii] To illustrate this further, one in every two potatoes produced in Germany comes from Lower Saxony, as do half of all the poultry, more than a third of the eggs, a third of all the pork and around one-fourth of the commodity for sugar. What the strong agricultural sector has in common is its production and use of biomass, directly or indirectly, and its search for enhancing the value to be derived from it.

Precisely because the renewable energy and climate targets have made people realize that biomass is a renewable fuel, agriculturally based industries increasingly line up with energy industries in order to optimize the biomass value chain. This also establishes a scope for

strong coalitions between the agricultural and the energy industry in the HEC region, and the associated knowledge sector.

UNDERGROUND: The characteristics of the underground are another distinguishing feature of the HEC region. First, the region has shown the production of considerable fossil energy volumes. The HEC region represents the largest production region within the EU-27 in term of gas production with The production levels of Germany and the Netherlands combined making up for over 40% of the total EU-27 gas production (168 Mtoe in 2007). Moreover, the underground in the area is relatively well endowed with empty or almost empty gas fields, salt domes, and aquifers, which can be used for storage purposes, notably of gas but possibly in the future also of CO_2 (see Annex B for background data).

3.4. Balancing: Linking renewables like wind and bio-energy with flexible gas

The energy challenge is typically enhanced by the fact that most of the renewable energy produced is difficult and or expensive to store, whereas the fossil fuels, like natural gas can on the whole be stored cost-effectively and with relative ease. The problems to store (renewable) power, for instance, and the problem to steer wind and solar power supply patterns and bring them in line with energy demand patterns can create serious difficulties in balancing the power market (see Figure 1, above), which can only be resolved if combined with storable and flexible energies that can be introduced into the changing energy system. This 'balancing-dilemma' can take various shapes and sizes depending on the energy production portfolio within the region.

As an example, in those regions where fairly massive wind-based energy production is concentrated, such as in the coastal areas near the North Sea, this dilemma could have been observed in actual practice (on 4 November 2006) when a power system black-out started in Northern Germany as a result of peak wind-energy production in the area. This system fall-out had a profound impact on the electricity supply throughout Europe. The fall-out resulted in, among others, some five million French customers being disconnected from power.

The above example illustrates why wind-energy regions, such as the North Sea coastal region, are good candidates for initiatives that try to tackle the energy balancing issue via, for instance, joint R&D, joint experiments, and joint ventures. The example also shows that the energy system issues are already crossing multiple borders and that local solutions should always be seen within a cross-boundary or energy system context. However, the balancing challenge is not only related to wind-energy fluctuations and it can have different dimensions. Other new renewable options, such as geothermal energy, bio-gas and bio-methane applications also face balancing challenges that either have a technical of economic nature. In most cases, the solutions to the energy balancing challenge require a regional tailor-made approach. This is due to the fact that regional energy systems throughout the EU have a different size, structure and diversity (even despite many initiatives to integrate the EUs energy markets). This is also why the EU policy for the period 2013 -2020 increasingly focuses on establishing regional excellence centers that can interact on a European level.

The above information and insights on the regional energy system explain why the HEC-region is typically well-suited for addressing the energy balancing issues in relation to an increasing share of renewables in the energy portfolio. This is not only a challenge to expand the development and deployment of renewable energies, but also a challenge to intelligently integrate renewable into the existing energy system so that it remains affordable, accessible and acceptable. In the meantime, other energy market developments, such as the recently announced nuclear phase-out in Germany[viii], only add to the sense of urgency for enhanced cross border cooperation in the field of implementation of renewable energies and integration within the existing energy system.

The HEC-region is perfectly suited to provide a fertile ground for early development and deployment of renewable energies due to its strong gas-based balancing opportunities. Although natural gas remains a fossil fuel, intermittent renewables like wind and solar, and/or inflexible base-load renewables like, biogas and geothermal, can benefit strongly in economic terms from the availability of gas-based balancing.

3.5. Organizational challenges & advantages within the HEC region

CURRENT HEC ORGANIZATION

As already indicated in the introduction, a structure of the HEC organization has evolved since 2009 (for more background information on the current HEC structure and its history see Annex C). The current structure has typically grown bottom-up, with a clear focus on innovative research driven activity based on public-private, German-Netherlands partnerships focusing on joint energy action within the region itself. At the same time, the HEC initiative gained clear support top-down from the political leaders of the region. Given the progress so far, however, it looks like the stage has been reached to seriously consider the future target and scope of the HEC, and address the issue if the current scope and structure are

sufficiently robust to tackle the enormous energy challenges ahead.

The time of smaller national energy systems operating in full isolation has passed, simply in order to keep energy affordable, accessible and acceptable. Energy system integration provides many socio-economic benefits to the EU population. However, it also provides the various EU regions with a series of specific challenges which can only be addressed by massive cooperative and coordinated cross-border efforts carried out by strong coalitions of various triple helix stakeholders. These coalitions not only include large stakeholders, but also the medium-sized and smaller ones. The HEC initiative is a good example for such cross border regional initiatives to tackle a common challenge.

With the end of the current HEC initiative in sight, the various HEC stakeholders have asked themselves the question if and to what extend there is the scope for continued collaboration on the various energy challenges within the HEC-region. A number of reasons why such continued cross-border cooperation could make sense is listed below.

SYNERGIES ON JOINT CROSS BORDER ACTIVITIES

One good candidate to start such collaboration, first and foremost, is the area of information exchange, research, and joint execution of pilot and demonstration activities that will precede commercial roll out initiatives by private sector stakeholders. Frontrunner in cross-border and the regional HEC initiatives is, for instance, the German gas infrastructure, partly operated and administered by Gasunie Deutschland, which is a subsidiary of Gasunie in the Netherlands. Moreover, as of January 2010, the German Transpower Stromubertragungs GmbH has been taken over by the Netherlands state-owned TSO for power TenneT, creating the first European cross-border TSO. On the research and development side, the upcoming INTERREG IVa green gas/biogas program will further strengthen cross border corporation within the region. Various other private sector stakeholders in the field of renewable energy (e.g. BioMCN, Sunoil Biodiesel, WELTEC Biopower, E-Invest, Envitec Biogas) also increasingly operate across borders in search for:

1. developing renewable energy projects,
2. testing and demonstrating renewable energies,
3. exporting renewable energy technologies, or
4. supplying renewable energy.

SYNERGIES ON CROSS-BORDER R&D AND TRAINING

An additional example of synergy relates to research and development (R&D). High quality innovative research often requires sufficient critical mass, especially when it comes to carrying out experiment through pilots and demos. As long as research facilities remain scattered and isolated, such critical mass will be very hard to develop. If, however, research institutes in a larger area, e.g. the various universities of academic and applied science in the HEC-region, would closely work together on energy and sustainability and at the same time work together with relevant industries, a research conglomerate of sufficient size would grow to effectively tackle the energy research challenges. The same applies for that matter for energy training and education.

At the national or regional level, the traditional ways of organizing and working could eventually become a potential obstacle for high-quality and effective energy system development. Intelligent cross-border collaboration for R&D players, will create a scope for the creation of international/ European centers of excellence of academic and post-academic training that are needed, given the challenges we are facing, and to create a new generation of young energy professionals who understand that one has to move from a focus on individual energy carriers towards energy systems. Two important developments in this regard are:

- the set-up of the Energie-Forschungszentrum Niedersachsen (EFZNix) in Goslar by 2007 combining resources for research of the technical university Clausthal and with those of universities of Braunschweig, Göttingen, Hannover and Oldenburg. In the Energy Valley region, there is a strong movement trying to set up an Energy Academy in Groningen in the coming years based on collaboration between the various research and training institutes and the energy industry in the regionx;
- the set-up of the Energy Valley foundation in 2003 in the Northern part of the Netherlands. Energy Valley has historically played a strong role in economic development in relation to the energy sector by bringing together the relevant triple-helix stakeholders, thereby stimulating energy R&D and training and energy investments in the region. In light of the energy challenge developments, the various stakeholders within the Energy Valley region are increasingly looking across borders for good internationalization opportunities on R&D, private sector activities and governance in terms of market expansion, economies of scale and establishing sufficient critical mass.

Both the EFZN and Energy Valley initiatives, united within the current HEC, are important frontrunner initiatives that in the near future, together with other public and private stakeholders, can benefit strongly from continued and well-structured cross-border cooperation in order to effectively address or bank on today's and tomorrow's threats and opportunities of the energy challenge of integrating the various energy systems (e.g. linking renewable with flexible gas).

4. Possible target and scope of the HEC

As far as the HEC target is concerned, the prime focus so far has been on joint public-private innovative activity to promote greening the economy. The underlying idea also was by joining forces to create, among others, better success chances in acquiring EU funding for the energy innovation activities. However, no clear targets have been set with respect to contribution to the overall economy and competitiveness, employment, or social indicators, such as contributions to health and safety. Besides, no clear environmental or energy targets have been set under the current HEC, or targets related to social acceptance, security of supply, access to affordable energy, etc.

In order to improve the monitoring and accountability of any future HEC (or any other cross-border initiative), it could be considered if and to what extent more explicit sustainability targets (economic, social and environmental indicators) could be used to evaluate and guide cross-border initiatives. As far as the HEC scope is concerned, a number of scope issues present themselves as described below.

4.1. Geographical Scope

Given the current HEC coalition, should the prime focus be on innovative energy joint activity in the Energy Valley/Ems-Achse region, or instead in the much wider region covering Energy Valley region, Lower Saxony and Bremen? This point is not trivial insofar as the 'founding' INTERREG subsidy to set up the HEC was provided to the coalition of EV and Ems-Achse/Landkreis Aurich, which made it complex to broaden the scope of beneficiaries. In fact, the region covering the Ems-Achse/Landkreis Aurich does not even formally include Oldenburg and therefore the Carl von Ossietzky University. Moreover, should the HEC primarily focus on the Energy Valley and Lower Saxony and Bremen region energy collaboration with occasional extensions towards other countries/regions, or instead strive for a permanent wider alliance structure including the bulk of the energy research and development community (both public and private) around the North Sea, and perhaps even a wider area?
Good consideration of the geographical scope is important for structuring any future HEC-like initiative. A crucial question in this respect is if and to what extent will there be a perfect overlap (in terms of geographical scope) given the needs of the triple helix stakeholders.

Traditionally, R&D stakeholders have been frontrunners in setting-up cross-border cooperation and developing joint research activities. However, also within the international arena, competition on intelligently organized and structured R&D activities is on the rise. The EU region classically has been a leading R&D region, with well-organized institutes. However, due to this increased internationalization, a sufficiently robust base (crititcal mass) and high quality interdisciplinary profile of R&D institutes are paramount.

As far as the private sector is concerned, these stakeholders generally tend to operate on various geographical regions varying from activities at the local, regional or national level up to activities at the North Sea region, European, but also international level.

Intergovernmental cooperation and collaboration by public bodies also tend to differ in geographic scope as they try to address specific themes or issues. Such cross-border public cooperation is often organized via conventions, treaties, executive bodies or structured negotiation processes.

4.2. R&D scope

Given the focus of the HEC, i.e. future oriented energy-based research activities, the question arises what defines the scope of this focus: in other words, is the HEC focusing on fundamental research, applied research, demo's and pilots and pre-competitive test projects, or should the HEC also deal with coordinating (joint) commercial energy activity? Additionally, is the HEC solely focusing on research or also on training, public acceptance and human resource issues related to energy? Alternatively, will the HEC focus be on issues directly or indirectly linked to renewables, or could also more classical fossil energy issues be covered?

Although it may be wise to keep various options open depending on future developments, some clear focus may increase chances of broader recognition. The above questions also illustrate that when developing and designing a post-2012 HEC framework, it is important to consider what the specific needs of the various R&D

parties will be and what they expect from the HEC-operational body. In this case the EFZN structure could function as a good example, where, in order to participate in EU research calls for proposals, the EFZN organization is a legal entity that can solely engage in EU contracts on behalf of its network partner universities. Such organizational structures increase the flexibility for selecting the research staff with proper expertise.

4.3. Private scope

Private sector stakeholders, albeit small and medium-sized enterprises (SMEs) or multinational companies (MNCs), can operate at different geographical levels. Besides, much can be gained by setting up a facilitating body that enables and facilitates cross-border activities, not only to expand the 'home-market', but also expand the opportunities for technology export and transfer. Designing a future HEC meeting the specific needs of this diverse group of renewable energy and energy network stakeholders requires careful consideration of which cross-border projects and initiatives are already existing and what value they add to the relevant stakeholders. A future HEC organization should be aware not to repeat things that have already been covered, but to aim at further building upon and reinforce these initiatives by developing a more programmatic approach for various subgroups of stakeholders.

PUBLIC SCOPE

Should the HEC be considered as a possible precursor towards political collaboration between the relevant regions, e.g. leading to joint cross-border bodies with delegated responsibilities towards public decision making on, for instance, licenses, subsidies, spatial planning, etc., or should the HEC remain restricted primarily to public-private collaboration with a clear focus on future oriented energy research? This question is highly relevant in the light of the ongoing energy system integration activities. The underlying idea of this question is that public decision making and other processes should not frustrate but preferably speed-up the introduction and integration of renewables within the energy system. Good step to be considered in this area is aligning permitting procedures and spatial planning processes with relevance for energy system developments.

Another, often ignored, but crucial, aspect that is part of the public scope is related to public participation and social acceptance. Given the growing number of renewable energy and energy infrastructure projects, the general public increasingly will be faced with all sorts of activities that take place "in or under their backyard". The recent years have shown that in many countries the top-down structures of investment decision making and technocratic permitting procedures do not sufficiently interact with the general public, which in many cases has only one possibility of being heard, namely via lawsuits and other forms of legal procedures.

A future HEC organization could also consider steps on how to improve this kind of implementation processes. In this case, one could consider involving the local public stakeholders more actively already at the planning and design stage in order to look for project configurations that provide mutual beneficial outcomes. Improving public participation in the transition process is likely to improve the social acceptance of alternative energy systems. By adding public participation and social acceptance to the triple-helix, one could now speak of the '*quadruple-helix*'.

THEMATIC SCOPE

So far the key goal of the HEC is energy system integration, or more explicitly exploring how the emerging intermittent renewable energy sources can be combined technically, economically and socially with feasible back-up systems capable of balancing the overall energy system (see also Figure 4 in Annex 2 for the current thematic scope of the HEC). This scope implies the need for combining a huge variety of perspectives and disciplines. One could discuss whether the theme should be narrowed down to smaller proportions in order to be able to make the activities more manageable, or alternatively expand the scope to include other energy themes.

ORGANIZATIONAL SCOPE

Should the HEC eventually develop into a rather slim organization with a prime focus on acquisition support 'bringing the relevant people together', bringing the relevant topics under their attention, and 'supporting new energy research initiatives', or should the HEC instead take their own project responsibility and therefore grow into a potentially significant organization in terms of management and responsibility?

In relation to the question above, should the HEC get a formal legal status as a cross-boundary organization and thereby the ability to contract under its own name, or should the HEC rather remain a more loose association of a number of interested partners that collectively provide some budget to coordinate their joint interests?

5. How the HEC?

Given that the targets, scope, structure and organization of the current HEC initiative thus far have not been explicitly determined and discussed in public, it is advised to determine those points for any future HEC initiative. As a result, the picture of what the current HEC truly stands for can differ between various stakeholders involved in the process, depending on their point of view. In order to structure the discussion and to provide clarity on the scope and activities of a future HEC, four stylized blueprints will be presented, each describing a specific interpretation of a future HEC.

BLUEPRINT 1: A TEMPORARY JOINT RESEARCH FACILITATION PROJECT

The HEC is a project, funded by INTERREG during 2010-12 to set up a structure of triple-helix research collaboration (including pilots and demos) between the interested EV region and Lower Saxony and Bremen energy stakeholders. Its main target is to set up structures of collaboration that, once initiated, will need to evolve on their own. The focus, therefore, is on organizing and bringing the experts together. As the current subsidy period ends by the end of 2012, it is still open to discussion if and how the HEC will continue thereafter.

BLUEPRINT 2: A CONTINUED REGIONAL DEVELOPMENT PROGRAM

The HEC is a program stimulating the local economic development of the energy sector activities, both large-scale and small-scale, at both ends of the German-Dutch border. Prime concern is to involve small-scale industrial players active within that area, and link them to the local knowledge networks, and more generally involve them in the regional energy triple helix. Key targets are to enhance implementation of energy transition pilots and demos, to increase investment activity in the energy sector, and thereby to improve the competitiveness of the local industry, to add to the innovative base and to create local employment.

BLUEPRINT 3: DEVELOPING NORTH SEA ENERGY ALLIANCE

The HEC is a concept of triple-helix innovative energy collaboration of Northern Netherlands-German origin. The prime focus of the HEC is to deal with one of the biggest energy challenges that Europe is facing, namely to enable the large scale introduction of renewables in the Northwestern Europe, and in doing that to try to resolve the system integration challenge: to provide back-up, to guarantee balancing, and to enhance storage. This challenge requires considerable research and testing. The coastal areas around the North Sea are typical areas well-suited to take a leading intellectual role in this energy transition process. The HEC, being a German-Dutch initiative by its origin, should therefore be expanded to also include in its structure the key triple-helix stakeholders from other North Sea countries. Therefore, the original HEC structure has to be abandoned.

BLUEPRINT 4: SCALING UP AND STRENGTHENING THE CURRENT HEC STRUCTURE

The HEC in its current structure, scope and functioning is too small-scale to be able to deal with the greater energy challenge (see also Blueprint 3). Therefore, it is important to broaden the geographical scope, but also the organizational setting and possibly the thematic scope. A logical next step in that case is to start from the current HEC structure and network, and extend it from there to include triple-helix stakeholders from Scotland, Norway, and possibly other interested North Sea parties. Another logical next step is to considerably strengthen the governance structure in order to give the HEC a firm societal cloud, and to strengthen the scope of the professional organization. Contrary to Blueprint 3, the current HEC structure and activity is included in the new wider structure. The HEC focuses on system integration and presents itself clearly to the EU authorities.

The four blueprints are just stylized representations but they can be further developed and linked to the various scope and target factors as outlined in the example table below. The table can be used as a basic framework to structure ideas on a future HEC design.

Scope	1	2	3	4
Geographical	EV region, Lower Saxony and Bremen	EV region, Lower Saxony and Bremen	North Sea region	North Sea region
Public	No cross-border governance	No cross-border governance	Cross-border governance (for discussion)	Cross-border governance (for discussion)
Private / R&D	Pre-competitive	Pre-competitive	Up to commercial roll-out?	Up to commercial roll-out?
Thematic	System integration of Solar Wind Balancing Smart grids Legal and European issues Clean mobility Bio-energy Underground	System integration of Solar Wind Balancing Smart grids Legal and European issues Clean mobility Bio-energy Underground	System integration of Solar Wind Balancing Smart grids Legal and European issues Clean mobility Bio-energy Underground Hydro Power-to-Gas	System integration of Solar Wind Balancing Smart grids Legal and European issues Clean mobility Bio-energy Underground Hydro Power-to-Gas
Organizational	Facilitating project	Facilitating program	Flexible set of interacting autonomous legal entities (triple helix)	Clearly formalized and structured set of autonomous legal entities (triple helix)
Time	Until beginning 2013	X-year program	No time limit	No time limit

Targets*		1	2	3	4
Economic	1 Increase investments in region	x	x	x	x
	2 Improve employment in region	x	x	x	x
	3 Increase innovative R&D initiatives	x	x	x	x
	4 Improve access to public R&D funding	x	x	x	x
	5 improve international competitiveness of region			x	x
	6 Increase technology export			x	x
	7 Etc.				
Social	1 Improve labor conditions for energy workers	x	x	x	x
	2 Improve safety standards	x	x	x	x
	3 Increase public participation	x	x	x	x
	4 Improve labor mobility throughout extended region			x	x
	5 Etc.				
Environmental	1 Improve local air quality	x	x	x	x
	2 Minimise local ecosystem impact	x	x	x	x
	3 Reduce water/resource use	x	x	x	x
	4 Reduce GHG emissions				x

* These are indicative 'targets' one could think of when setting the level of ambition for a possible follow-up HEC initiative

6. Advice on the future of the HEC

Based on the above-mentioned description and assessment of the HEC and the alternative HEC futures, the SER NN notes the following:

We believe that the HEC initiative could benefit from further organizational strengthening and broadening in order to continue to play a key role as a European Region of Excellence in the area energy and sustainability.

We confirm the relevance and importance of the thematic approach of the HEC, namely to join forces and to create synergies in order to establish more critical mass that is needed to tackle a number of EU energy challenges.

We assess that there is significant scope for synergy and complementarity with respect to the energy challenge across the North Sea region.

We note that the current success of meaningful and effective cross-border collaboration is largely based on a consistent triple-helix approach, but we find that public participation and social acceptance forms a crucial fourth element that completes the '*quadruple helix*', where the general public via local stakeholders (environmental NGO's, local residents, etc.) can interact with industry, the research community, and public authorities in the planning and design stage. A follow-up HEC could embrace this quadruple-helix approach by facilitating and structuring systematic cooperation and collaboration between these four groups of stakeholders.

We consider that the bottom-up approach with on-the-ground expert collaboration within the current HEC initiative can serve as a good blueprint model for cross-border collaboration initiatives.

We acknowledge that the current HEC initiative could also benefit and improve from a top-down strategic approach and top-down political support, which further are vital elements to their success.

Therefore, we believe that by expanding the regional scope of the HEC, and thus by joining triple-helix forces with partners from other complementary coastal regions along the North Sea (and possibly also the East Sea), the extended HEC region will be able to better cope with the energy challenge today and in the near future. As such, the region can not only develop into a European region of knowledge in the field of energy, but also into a formally recognized European region of energy excellence.

As far as the HEC structure is concerned, from the EU perspective, the current structure remains relatively modest in terms of regional coverage, legal status, content and critical mass of triple helix collaborations. It seems that the existing HEC structure has now reached a crossroad, at which it has to decide if it broadly wants to remain as it is right now, or instead should broaden its horizon to include a wider region, a wider coverage and a stronger institutional structure.

The SER Noord-Nederland concludes that there are sufficient arguments to further strengthen the HEC resulting in:

1. An extension of the HEC to cover the entire Energy Valley and Niedersachsen-Bremen region in the short-term, while also taking the initial steps to scale-up to the North Sea energy region on specific R&D themes or specific private sector stakeholder groupsxi, all in order to achieve a full-scale extension to the North Sea region in the medium-term and so to improve the chances of European recognition,
2. A more structured and joint lobby in Brussels on behalf of the HEC stakeholders,
3. An R&D and education structure and program, which is better aligned with the quadruple helix within the HEC region (e.g. embed the HEC strategic priorities Energy Academy Europe program),
4. A continuation of the prime focus on energy in order not to dilute the efforts, and within the energy theme focus the HEC efforts only on those key strategic issues that are not sufficiently addressed within other (inter)national platforms (e.g. address system barriers for specific renewable energies, and/or finance, policy and competitiveness issues),

5. A position that would not rule out that the HEC concept acts as a precursor of serious international political collaboration and in fact joint institution with decision making powers on various energy issues,
6. An organizational structure that intelligently combines the current bottom-up strength of the HEC with a more strategy oriented, top-down executive board,
7. A situation, in which the HEC organization not only focuses on research and training at various levels and forms, but also seeks a coordinating role for joint commercial energy activities,
8. A structure, in which the HEC grows into a legal entity on its own capable of contracting all kinds of project activities conducive of joint energy activity. To put it in a slightly provocative way: "The HEC could grow into the joint Energy Valley of the North Sea region."

Finally, in order to seriously strengthen the HEC governance, the SER NN advises that the HEC Advisory Committee (HEC-AC) carefully assesses its current tasks and responsibilities within the future of the HEC (as sketched in this report). In this respect, the SER NN stimulates the HEC-AC to claim a role and position as an executive rather than advisory body that governs and stimulates cross-border quadruple-helix initiatives. Such an executive board, in the view of the SER Noord-Nederland, would need to be able to initiate new activities and carry a number of executive responsibilities (e.g. decision power), should be supported by a professional international secretariat, and should be able to initiate and delegate specific tasks to specialist thematic groups active within the extended HEC region.

Annex A: Some relevant developments in the NS-region

Within the North Sea region, the production of energy (both conventional fossil and renewable) is increasingly concentrated on-, near- and/or offshore. There are, among others, a number of reasons for this trend: First, increasingly strict rules with regard to cooling water make it consistently less attractive to position conventional fossil fueled power plants inland at the riverside.

- Second, in order to optimize economic return, modern power plants increasingly focus on multisource engineering designs, i.e., capable of absorbing various primary energy sources (coal, gas, biomass, etc.) in various mixes. This requires easy access to such sources. Near (sea)harbor siting of such multisource plants currently is the preferred option in order to be able to attract various sources of primary energy.
- Third, energy plants are increasingly included in co-siting initiatives, where various production facilities are, or can be properly organized, linked together in order to optimize, among others, energy (re-)use. Such co-siting requires the presence of industrial production conglomerates, or (eco)industry parks, which can often be found close to harbors. Fourth, the traditional offshore gas sector in the North Sea basin provides an interesting stepping stone for other offshore activities, such as offshore wind. Considering that the North Sea area is a so-called 'mature' gas production area, offshore wind can be an interesting renewable option to retain a strong offshore sector.
- Finally, increasingly strict environmental standards drive the power production facilities (both fossil and renewable) away from population centers towards e.g. coastal areas, especially those which are still not overly densely populated.

Annex B: Key energy system features in and around the HEC-region

The increase in power production capacity in, for instance, the regions Energy Valley in the Netherlands (the provinces Groningen, Fryslân, Drenthe and the northern part of North-Holland), Lower Saxony and Bremen has been much more prominent than in virtually any other EU region.

To further illustrate this, in the Energy Valley region about 400 companies are active in the conventional and renewable energy sector, some 350 projects are under development, and the joint number of jobs in energy/sustainability activity is estimated at 25,000. In Lower Saxony, according to 2009 data, 186 companies with some 40,000 employees, about 8% of the total German employment in the energy sector, were active in the energy field.[xii]

WIND: Driven by the climate change debate and associated policies, (on- and offshore) wind energy has strongly benefitted from various incentive schemes, it is growing rapidly and is foreseen to much further expand during the next decades. So far, considerable wind production capacity has been installed onshore.

Increasingly, however, one recognizes that there are limits to onshore wind for reasons of public acceptance, so that most of the additional expected future wind capacity additions will be located near- or offshore. The North Sea basin is geophysically well-suited to attract near- and offshore wind investments.

The current (2010) installed on- and offshore wind capacity in North Sea countries is about 40,000 MW (see Table 1 below), which is about 47% of total installed capacity within the EU-27 (excluding Norway data). Current scenario estimates suggest this capacity to increase towards approximately 100,000 MW of installed capacity by the year 2020, of which roughly 40% will be expected onshore. With respect to offshore wind, the North Sea region is expected to remain a leading offshore wind energy region with roughly about 75% of the projected offshore wind market in 2020 (see Table 1).

Country	MW installed end 2010			MW installed end 2020 EWEA 'baseline' scenario			MW installed end 2020 EWEA 'high' scenario		
	Onshore	Offshore	Total	Onshore	Offshore	Total	Onshore	Offshore	Total
Belgium	716	195	911	2,100	1,800	3,900	2,500	2,000	4,500
Denmark	2,944	854	3,798	3,700	2,300	6,000	4,000	2,500	6,500
Germany	27,122	92	27,214	41,000	8,000	49,000	42,000	10,000	52,000
Netherlands	1,998	247	2,245	5,000	4,500	9,500	5,400	6,000	11,400
United Kingdom	3,863	1,341	5,204	13,000	13,000	26,000	14,000	20,000	34,000
EU-27	81,380	2,944	84,324	190,000	40,000	230,000	210,000	55,000	265,000
HEC-region % of total	36	12	35	24	31	25	23	29	24
North Sea countries %-share of total	45	93	47	34	74	41	32	74	41

Table 1: Wind power capacity in the EU-27[xiii]

BIO-ENERGY: Another somewhat more specific characteristic of the HEC region is its relatively large scope for biomass-to-energy activities and biogas from agricultural resources in particular. Data (2006) from the European Biomass Association shows biogas production levels in the EU-27 from three types of sources (see Table 2).

Country	Landfill gas	Sewage sludge gas	Other biogas (agriculture)	Total
Germany	383.2	270.2	1,011.7	1,665.3
United Kingdom	1,318.5	180.0	-	1,498.5
Netherlands	46.0	48.0	47.1	141.1
Denmark	14.3	21.0	57.6	92.9
Belgium	51.0	17.6	9.1	77.6
EU-25	2,007.3	867.8	1,330.8	4,898.9
HEC region % of total	21	37	80	37
North Sea countries % of total	90	62	85	71

Table 2: Biogas production in the EU-25[xiv]

The data shows that there is a strong agricultural historical background within the HEC region, where agriculture has long been the dominant industry sector. Also today a large number of leading agricultural industries have significant industrial operations within or are sourcing biomass from the HEC-region, such as Avebe, Friesland Campina, Cosun, Suiker Unie, Omrin, van der Wiel, Biogas Weser Ems GmbH, EnviTec Biogas AG, MT- Energie GmbH & Co. KG, WELtec BioPower GmbH, EWE A.G, and others. In Lower Saxony, for instance, after the car industry, the agricultural and food industry is the second largest sector, employing some 100,000 persons.[xv] Moreover, to give another example, one in every two potatoes produced in Germany comes from Lower Saxony, as do half of all the poultry, more than a third of the eggs, a third of all the pork and some 25% of sugar. What such industries have in common is their production and use of biomass, directly or indirectly, and their search for enhancing the value to be derived from it.

THE UNDERGROUND IN THE REGION: The characteristics of the underground are another distinguishing feature of the HEC region. First, the region has shown the production of considerable fossil energy volumes. The annual production of natural gas from the Groningen field and the Netherlands' small fields is about 55 Mtoe in 2007, and production in Germany (mainly concentrated in Lower Saxony), some 13 Mtoe in 2007 (EU, energy statistics). In terms of gas production, the HEC region represents the largest production region within the EU-27 (within Europe only Norway produces a higher level, 78 Mtoe in 2007), currently about equal but soon significantly larger than the rapidly declining UK production level at about 65 Mtoe in 2007, where a peak production level of 97 Mtoe was reached in 2000 (data source: EU energy statistics, 2010). The production levels of Germany and the Netherlands combined make up for over 40% of the total EU-27 gas production (168 Mtoe in 2007). Moreover, the underground in the area is relatively well endowed with empty or almost empty gas fields, salt domes, and aquifers, which can be used for storage purposes, notably of gas but possibly in the future also of CO_2.

Country	Installed	Projected	Total
Austria	4,744	5,035	9,779
Belgium	709	50	759
Bulgaria	350		350
Czech Rep.	3,127	620	3,747
Denmark	980	30	1,010
Estonia			0
Finland			0
France	12,645	2,020	14,665
Germany	20,404	11,685	32,089
Greece			0
Hungary	6,130		6,130
Ireland	218	2.5	220.5
Italy	14,937	11,555	26,492
Latvia		1,000	1,000
Lithuania			0
Luxemburg			0
Malta			0
The Netherlands	5,078	4,400	9,478
Poland	1,630	1,870	3,500
Portugal	181	120	301
Romania	2,694	2,150	4,844
Slovakia	2,750		2,750
Slovenia			0
Sweden	10		10
Spain	4,140	5,590	9,730
United Kingdom	4,371	19,075	23,446
EU 27 total	85,098	65,203	150,301
HEC region % of Total	30	25	28
North Sea countries % of total	37	54	44

Table 3: Installed and projected gas storage capacities in EU-27 (in million m^3)[xvi]

With respect to natural gas storage, Table 3 shows the EU-27 technical storage capacities for natural gas that can be used for seasonal, weekly and daily energy system balancing purposes in the electricity and heating markets in the EU. The data for the Netherlands excludes the Groningen gas field, which in itself is a significant source of energy system balancing.

Regarding CO_2-storage possibilities, just to illustrate this, the theoretical on- and offshore CO_2 storage capacity on the Dutch Continental Shelf (DCS) is estimated at some 1,566 Mt, of which 85% will become available in 2020, 94% in 2025 and 100% in 2030 (source: NOGEPA, Ministry of Economic Affairs, 2008. Note: data excludes Groningen field).

Annex C: The current HEC Organization

The Hansa Energy Corridor (HEC) initiative started in 2009, based on an initiative taken by a number of energy players from the region and the FC Groningen football club. The HEC can be described as a bottom-up informal platform initiative, where various triple helix stakeholders (science, private and public representatives) interact and exchange ideas and information in order to give a boost to the various energy developments within the region. The founding HEC partners decided that the time was right to seek further collaboration with partners from both sides of the Dutch-German border in order to see if joint green initiatives could be set up.

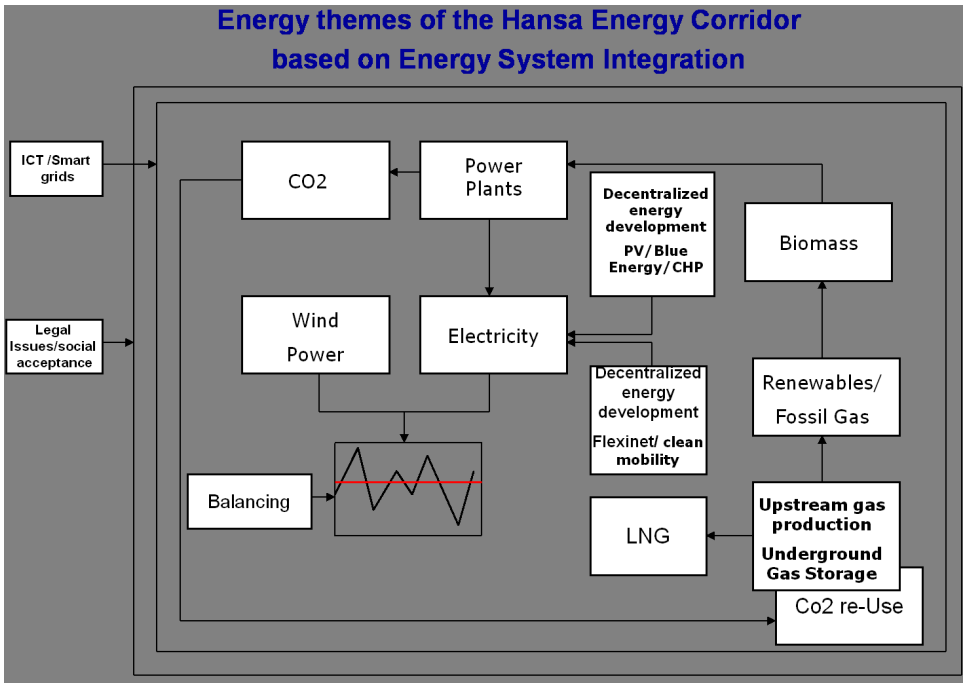

Figure 3: How the HEC energy components fit together.[xvii]

The series of discussion and meetings that followed created a collaborative atmosphere, and eventually resulted in a formal platform initiative. The formalization of the HEC to date has been made possible by an about €1.1 million INTERREG subsidy for the 2010-2012 period (via the cross-border energy clusters, EMS-Achse, OLEC and Energy Valley) to further give shape and operative power to the organization. The initiative was named after the historical Hansa partnership. The basic idea was to establish strong cross-border triple-helix cooperation and coordination on energy system integration within the target region, spanning across the Energy Valley region, Lower Saxony and Bremen. The HEC-initiative tries to deal with various aspects (or themes) of the energy challenge in order to establish a robust energy system for the future. Figure 3 describes how the various selected HEC energy themes fit together.

In the course of 2010, it increasingly became clear that the HEC initiative was met with considerable political enthusiasm, including the explicit support from the prime minister of Lower Saxony, Mr. David McAllister, and from the Commissioners to the Queen (e.g. Mr. Max van den Berg of the Province of Groningen) and other officials from the Energy Valley (EV) Region, and from Land Freie Hansestadt Bremen officials. This political support was

also explicitly expressed during a public event presenting the Northern Netherlands region in Brussels on 24 March 2010 by Dr. Josef Lange (state secretary of the Ministry of Science and Culture, Lower Saxony).

At the same time, the bottom-up process proceeded by a continuous range of meetings (mainly at the Eems-Dollard Region office in Nieuweschans) to further give shape to the structure, which was eventually decided upon in the course of 2010 (see Figure 4). Also the goal of the HEC was formulated more clearly (see also the HEC website):

"HEC […] strives to develop […] a European Region of Excellence on Energy Transition."

"Industry, science and governments cooperatively shape projects to achieve the »20-20-20« climate change and energy targets under the HEC umbrella. These efforts are not solely aimed to increase relative usage of renewable energy, but also strive for stable and secure energy delivery by balancing the flows of renewable energy that is being produced on both sides of the Dutch-German border."

"Additionally, the HEC will make a significant contribution to developing employment possibilities. In the Northern Netherlands over 10,000 employees are currently involved in existing renewable energy projects. In Germany, this figure is even higher with an estimated 300,000 employees. Forecasts indicate that these amounts will double within the next twenty years and the HEC aims to make a significant contribution to this process."

As far as the HEC organizational structure is concerned, the heart of the organization is clearly within the competence groups in which public and private parties collaborate on specific energy research and development themes, themes which are all crucial elements of the energy system of the future. Each theme is chaired by a combination of a German/Dutch public/private expert, and seeks to set up collaborative research driven projects and/or to look for funding for supporting such activities. The prime body responsible for the management of the project is the HEC steering committee (they meet about 10 times per annum, and are chaired by the formal coordinator, University of Groningen, represented by Prof. Jepma), supported by a HEC financial committee and a HEC working group, primarily dealing with the HEC daily matters. The HEC Advisory Committee,installed as per November 2011, is a high-level body meeting a few times per year and providing overall advice to the HEC operations.[xviii]

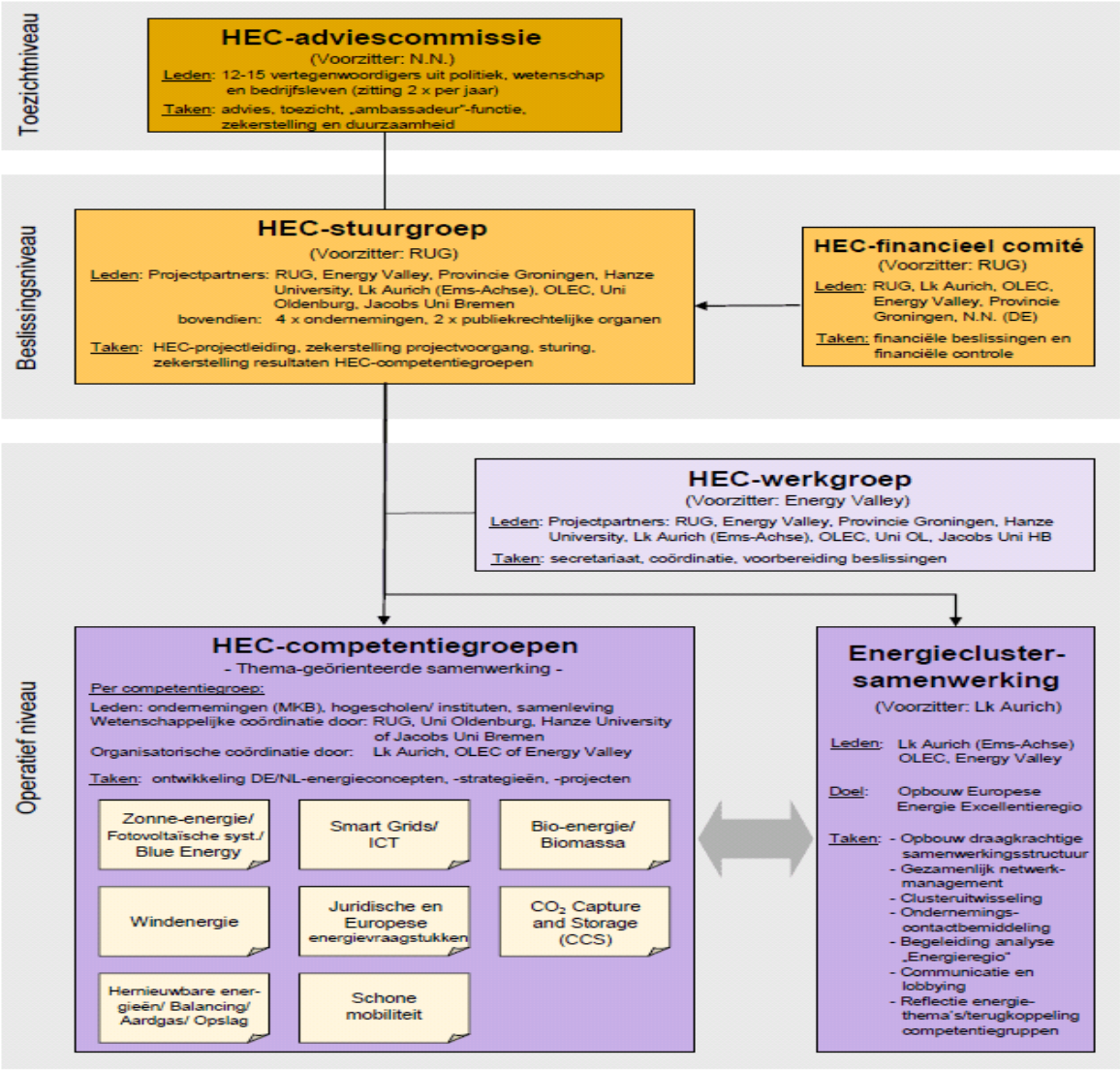

Figure 4: The HEC organizational structure (figure to be translated)[xix]

Within the HEC-framework (above), a number of activities was set up during 2010-2011:

- A range of workshops, joint sessions, etc. took place within and between the various HEC competence groups.
  A number of competence groups submitted joint research proposals for funding support via various research calls for proposals; results are expected in 2012 (early 2012 an about €10 million INTERREG IVa project on green gas/biogas was formally committed, also a Jacobs University of Bremen led Smart Grid proposal was pre-selected under the EU's 7th Framework Program.
- A number of PR-activities were initiated, including a presentation in Brussels on 21 June 2011. A HEC website was set up, see http://www.hansaenergycorridor.eu/.
- A data gathering project was launched both in Lower Saxony and Northern Netherlands to generate a better overview of energy data on investment levels, economic activity, employment, etc.

Notes

[i] There are a.o. a number of reasons for this trend, which will be explained in Annex A.

[ii] In the EV region, there are currently five large scale conventional power plants with a total capacity of about 3,760 MW including the largest national power plant, the 2,442 MW Eemscentrale of Electrabel. In addition, three new power plants are planned or under construction, jointly representing another about 4,000 MW (Essent 1,600 MW; Nuon 1,200 MW; Advanced Power 1,200 MW). Source: Background study Hansa Energy Corridor, March 2010.

[iii] In the EV region about 400 companies are active in the conventional and renewable energy sector, some 350 projects are under development, and the joint number of jobs in energy/sustainability activity is estimated at 25,000. In Lower Saxony, according to 2009 data, 186 companies with some 40,000 employees, about 8% of the total German employment in the energy sector, were active in the energy field. Also, Lower Saxony now already ranks fifth among Bundesländer in terms of energy sector turnover with this position being likely to grow further as well. Nowadays over a quarter of the German wind energy and bio-energy production comes from Lower Saxony. Sources: Background study Hansa Energy Corridor, March 2010; and report from NorddeutschenWirtschaft e.V. "Energieland Niedersachsen: Struktur, Entwicklung und Innovation in der Niedersächsischen Energiewirtschaft", December 2010.

[iv] The current (2010) installed on- and offshore wind capacity in North Sea countries is about 40.000 MW, which is about 47% of total installed wind capacity within the EU-27 (excluding Norway). Recent scenario estimates suggest this capacity to increase towards approximately 100,000 MW of installed capacity by the year 2020 of which roughly 40% will be onshore. With respect to offshore wind, the North Sea region is expected to remain a leading region with about 75% of the projected offshore wind capacity by 2020.

[v] This initiative received considerable funding support from the European Commission because it fits in with the EU ambitions to create a stronger inter-connected European power transmission grid.

[vi] Source: H.V. Rogers – The impact of import dependency and wind generation on UK gas demand and security of supply to 2025 – The Oxford institute for energy studies (p.67 and p.71).

[vii] Sources: Background study Hansa Energy Corridor, March 2010; Norddeutschen Wirtschaft e.V. "Energieland Niedersachsen: Struktur, Entwicklung und Innovation in der Niedersächsischen Energiewirtschaft", December 2010.

[viii] To illustrate this, the phase out represents (in 2007 data) little over 36 Mtoe of energy production, which is equivalent to 15% of total EU-27 nuclear production or 4.2% of total EU-27 energy production. In order for renewable to fill this upcoming 'energy gap', the 2007 total EU-27 renewable energy production (139 Mtoe) would need to grow by 26% alone, while expectations for renewable energy are that also other conventional energies are increasingly phased out!

[ix] EFZN is a research centre of Clausthal University of Technology, in cooperation with the NTH member universities of Braunschweig and Hanover, as well as with the universities of Oldenburg and Göttingen. At EFZN, scholars of the natural and engineering sciences, law, social studies and economics study interdisciplinary energy-related issues ranging from raw material sources to the disposal of waste products from energy production. EFZN aims to cover the entire energy chain by finding ways of reducing the dependency on finite fossil energy sources, as well as new ways of sustainable energy use while ensuring constant supply of power.

[x] To that end, Dr.Noe van Hulst (former secretary-general of IEF and former director strategy IEA) has been appointed per 5 January 2012 as a founding director of such an Energy Academy.

[xi] Other geographical constellations could be considered based upon the specific needs of the various stakeholder groups (e.g. if SME industry stakeholders are interested in exporting renewable energy technologies and services to the Baltic and/or Balkan region, the HEC, together with existing platforms, could facilitate trade missions and conference meetings).

[xii] Sources: Background study Hansa Energy Corridor, March 2010; and report from Norddeutschen Wirtschaft e.V. "Energieland Niedersachsen: Struktur, Entwicklung und Innovation in der niedersächsischen Energiewirtschaft" December 2010.

[xiii] Source: Adapted from EWEA, 2011.

xiv Source: AEBIOM, 2010

[xv] Sources: Background study Hansa Energy Corridor, March 2010; and report from Norddeutschen Wirtschaft e.V. "Energieland Niedersachsen: Struktur, Entwicklung und Innovation in der niedersächsischen Energiewirtschaft" December 2010.

[xvi] Source: GSE Storage Map Dataset, 2010.

[xvii] Source: W.L. Kling. Intelligence in Power Networks (adjusted by author Dr. Koos Lok Eur.Ing MBA). Inaugural address at Eindhoven University of Technology, the Netherlands (in Dutch), 2002.

[xviii] Prof. Dr. Ing. H.P. Beck (EFZN), Prof. Dr. H.C. Appelrath (Uni Oldenburg), Dr. W. Brinker (EWE), H.D. Kettwig (Enercon), Ing. M. Wendt (Ems-Achse), Mr. F.J. Sickelmann (Regierungsvertretung Oldenburg), Dr. H. Heseler (Min. of Economic Affairs), Prof. Dr. G. Schwandner (Stadt Oldenburg), R. Hentschel (OLEC), Prof. Dr. S. Poppema (Groningen University), Mr. H. Coenen (Gasunie Deutschland), Drs. G. van Werven (Energy Valley), Dr. J.P. Rehwinkel (Municipality of Groningen), Mr. B.C. Eijgendaal (Min. of Economic Affairs, Agriculture and Innovation), Ms. W.J. Mansveld (Province of Groningen), Prof. Dr. C.J. Jepma (Groningen University).

[xix] For more detailed information on the HEC structure see: http://www.hansaenergycorridor.eu/index.php/index.php