

International Engagement of Energy – Update Paper

The following paper provides an update for the project which has 2-3 months of work remaining. It is not intended to be a final paper, but much of this is likely to be incorporated in the final document.

1. Background

Currently there is no international engagement strategy set for the UK's energy interests that can be referenced by public sector organisations or the private sector. There are localised strategies within government departments and other public organisations but these have not been strategically coordinated and tend to deal with just one aspect, for example maximising Horizon 2020 income or selling UK products and services.

Therefore, some of the UK's engagement activities have been done on an ad hoc basis, reacting to opportunities rather than strategically for the benefit of the UK. This paper is not proposing that these impromptu opportunities aren't taken, but recommends that activities are sought pro-actively and opportunities that arise are assessed against the objectives of an overall strategy. An open strategy would also help the private sector understand the opportunities in the UK for their activities and for collaborative R&D. ERP's *International Engagement of Energy* project seeks to address this with two main aspects, building on previous work undertaken by ERP in 2012/13:

1. Firstly, a mapping of the UK's current international engagement activities and how they interrelate has been undertaken.
2. Secondly, a methodology and format for composing a strategy has been proposed and two case studies have been selected to provide examples of potential engagement strategies. Offshore wind is mostly complete and is reported here, with energy storage currently underway.

During this work some further examples have been found where international engagement arguably been conducted more strategically. The Scottish government and its agencies work to a common plan for engagement activities and this is reported in Section 6. Denmark is renowned for its clear strategy and work is underway to investigate this with a summary of findings so far also in Section 6. Finally, a more specific example - the UKTI Life Sciences Organisation - is thought to provide a useful case study for the co-ordination of International Engagement activities and this will be examined for good practice that can be transferred across to the energy sector. [Interview on 12th October].

2. Objectives

ERP's work has the following objectives:

1. **Mapping of current activity:** The aim is to identify where elements of an engagement strategy exist and the organisations involved - gaps can then be identified.
2. **Case Studies:** The two technical examples will present what an engagement strategy might look like and will help determine the resource/effort required to pull together the relevant material. The wider examples are to learn from good practice seen elsewhere.
3. **Recommendations:** High level guidance of how to compose an international engagement strategy, however at this stage, ERP will not make recommendations on who should own this. This leads onto:
 - Who the strategy could be used by
 - What it should seek to do

Working with the LCICG, the overall aim of the work is to identify and bring together the different steams of current activity to provide a framework and longevity to an engagement strategy.

3. Mapping of current International Engagement Activity in the UK

A number of organisations are involved with International Engagement of Energy, and the following diagram highlights the UK’s main current activities. The LCICG has also recognised that there is an issue with co-ordinating international engagement and has written a paper and set up a working group for many of the organisations involved to share their activities. The following is drawn mostly from discussions with the organisations themselves but is supplemented by public information and analysis in the LCICG paper.

Figure 1 below shows the positioning of most of the organisations reviewed on the innovation chain, and also illustrates ongoing initiatives across the globe.

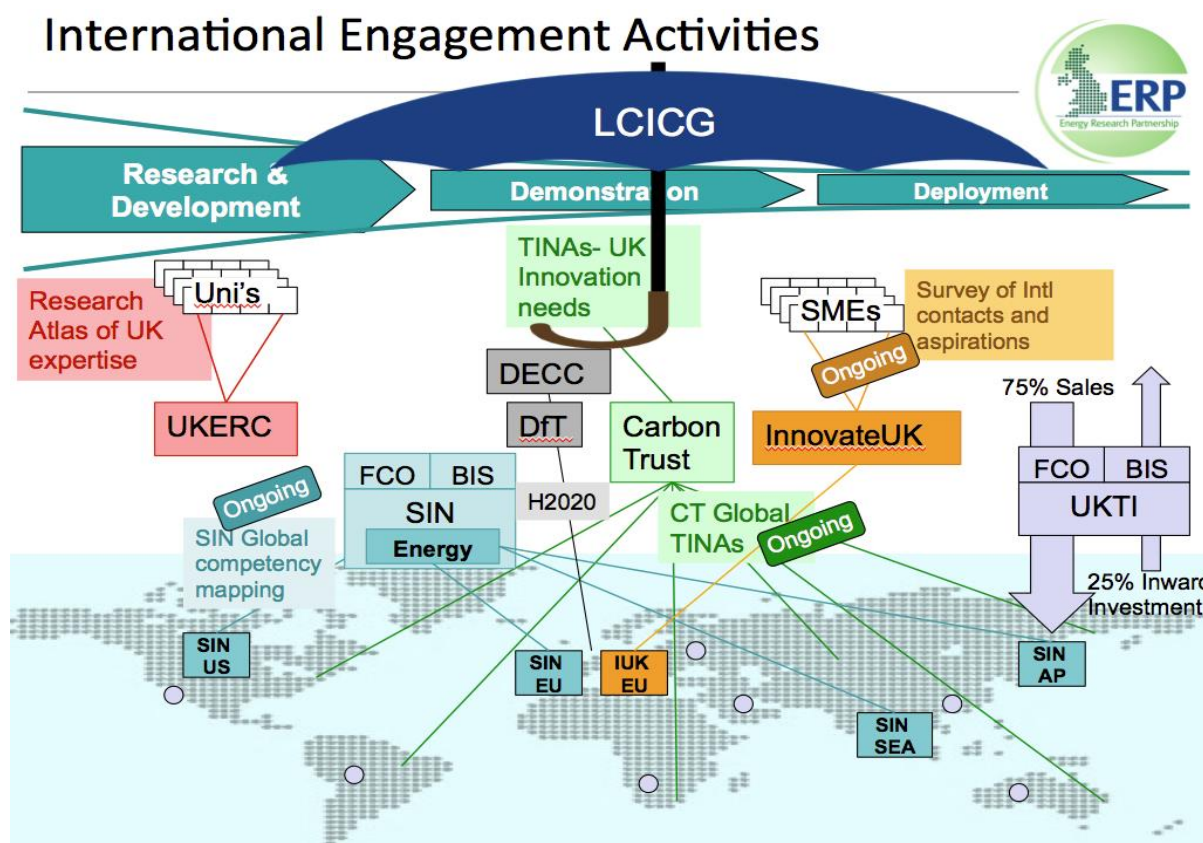


Figure 1: Mapping international engagement activities of key organisations

The Low Carbon Innovation & Coordination Group (LCICG)

As noted, in September 2015, LCICG **launched a working group on international collaboration opportunities**. Many interviewees expect that the group will develop a strategy and a co-ordination approach to the international engagement arena and also saw LCICG as the natural umbrella body for doing this.

The LCICG have also produced a discussion paper on the topic. The focus initially is to help members work together and share information to identify and access funding from EU and other international sources as opportunities arise. It sees the Horizon 2020 funding calls as an “attractive option for joint activity” with the aim of “attracting additional funding to the UK”. Suggested objectives are to:

- Attract inward investment
- Develop centres of excellence
- Develop industrial or research clusters
- Develop supply chains addressing UK innovation needs

- Support export opportunities

The work being undertaken by LCICG covers many of the ERPs objectives and is an important part of formulating an engagement strategy.

- **LCICG intend to review all technology areas and develop recommendations for any new international engagement** activities, plus identify opportunities that fit with the focus of UK National Programmes.

However,

- **LCICG is driven more by capturing opportunities than progressing developments in technology areas deemed as essential to the UK and**
- **Mainly focuses on Low Carbon Technologies, with the exception of Oil & Gas and Shale Gas, where it is interested in cost reduction and efficiency improvements.**
- **LCICG is more of a think-tank than an implementation group.**

The LCICG's activities will therefore be a crucial input for an International Engagement of Energy strategy, and will make use of ERP's project output, but at this stage the organisation are not coordinating a high-level UK approach to engagement or acting as an owner for a strategy document.

BIS

BIS provide indirect support for innovation via its funding for Innovate UK, ETI and the Research Councils, who then engage with international partners directly. BIS provides some co-ordination in the EU by being the policy lead for Horizon 2020. They also manage the Newton Fund – which aims to build science and innovation capacity in 15 developing countries.

DECC

At a European level, DECC has been a strong supporter of the EU's Strategic Energy Technology (SET) Plan. DECC provides the UK's input to the SET Plan's Steering Group and chairs a 21 Member State Joint Actions Working group which develops collaboration opportunities between Member State National Programmes.

DECC is also the **focus of engagement with the EU's Horizon 2020** Energy Work Programme, providing the UK input to its Energy Programme Committee and Work Programme development. This engagement in key committees, in consultation with UK stakeholders has helped to shape the agenda towards UK interests and has been successful in securing an average of around 9% of the available budget for UK institutions over the last 9 years, rising to at least 15% (€77m) in 2015. DECC has UK Stakeholder Groups for bioenergy, solar, wind, CCS, smart cities, smart grids, ocean and a group on energy efficiency is in the process of being set-up to help encourage future successful engagement with EU energy related programmes and funding.

DECC Co-Chairs the LCICG's International Working Group with Innovate UK looking at EU and wider international low carbon energy innovation collaboration opportunities. In addition, DECC provides the current Chair to the International Energy Agency's Governing Board and one of the Vice-Chairs to its Committee on Energy Research and Technologies, which oversees the IEA's Energy Technology Network and its energy innovation and policy development activities.

Science and Innovation Network (SIN)

SIN has about 90 people in 47 cities. Energy is the primary focus of 4 officers working out of the US, Sweden, South Korea and India. It falls under BIS and Foreign Commonwealth Office (FCO) but works across Whitehall. It works most closely with the Research Councils, UKERC, DECC and Innovate UK. In

theory, SIN works across the innovation chain from research to policy; in practice its focus is on science and research with UKTI picking up the more market focussed end.

SIN's **Global Energy Programme** originally had a bottom-up approach but now increasingly has more of a top down approach. SIN is hosting a series of events on Energy Storage (France-Germany-Mexico), Bioenergy (Nordics) and Smart Grids (US). However others have said this demonstrates the need for a strategy as events were not necessarily held in the best places for the subject areas.

The organisation is also working with LCICG / Innovate UK and is using its regional experts to **map competencies** across the globe. It doesn't get much steer on what the UK's priorities are, but is hoping LCICG will provide even more of a top down focus. It would **welcome a document that laid out the strategy**, but wouldn't want restrictions as also want to continue working opportunistically.

SIN's most serious **concern is the longevity of funding**, e.g. the GEP programme only has funding for FY 2014/15.

UKTI

UKTI has 108 people in many offices across the world - large countries have several offices (8 in US, 6 in China). Like SIN they are supported jointly by BIS and FCO, but unlike SIN their focus is on the market. 75% of their effort is on selling UK expertise, products and services, 25% on attracting inward investment. Their main recent areas of activity in energy have been in oil and gas, offshore wind, nuclear and waste. They help SMEs make contact and have a prioritised list of multinationals to engage with, including "account holders" and ministerial contact for most important.

They recognise need for better co-ordination and **would welcome a living strategy** but their most immediate need is for better handover between Innovate UK and UKTI. The former are helping innovators across the '*valley of death*', the latter could link to markets overseas if insufficiently developed in the UK.

Innovate UK

Innovate UK aims to help companies across the *valley of death* prior to commercialisation. It has an office in Brussels to help with EU engagement and is co-funding some activity within Europe and North America.

The organisation has been at the forefront of the aforementioned LCICG initiative, in partnership with DECC, to coordinate international engagement activities and is currently working to create more of a profile for these activities. It has recently led and undertaken a **survey focusing on SMEs**, asking what their current international engagement activities are and what useful contacts they would like to make. The survey covered the high value high growth countries and the Newton countries but still provided an opportunity to gather interest on EU countries.

Innovate UK also **worked with SIN to create a survey focussed on all SIN territories**. The survey offered the chance for respondents to name other areas of interest, or set up contact with UKTI to discuss their requirements. ERP and UKTI have had some involvement in setting the survey questions, and both questionnaire outputs will report back through the LCICG-DECC network.

Carbon Trust

Carbon Trust collaborates with a range of partners on Horizon 2020 bids across a range of technology areas, as well as working on Offshore Wind and Marine Energy in China and Japan. It also is involved in activities in Brazil, Chile and Mexico.

Carbon Trust, as part of the LCICG undertook the original Technology Innovation Needs Assessments (TINAs). They have now embarked upon a **Global TINA programme (soon to be renamed)** for the FCO, covering similar ground to the SIN competency mapping exercise but based on public databases of R&D spending. It will deliver an index rating of countries, for 20 technology groups x 4 segments of the value chain and the results will be presented at COP 21. A more theoretical piece will also seek to understand the role of collaboration and will produce broad recommendations.

The Research Councils

The **UKERC Research Atlas** provides an up-to-date understanding of the UK energy research landscape, particularly in terms of activities, their location, inter-relationships, major achievements, and outputs. This will be a key input into an engagement strategy. The research councils help UK researchers participate in EU funding programmes and also have strong links with China India and the US, with emerging links to South Korea and Japan.

Devolved Governments

Anecdotally although the UK doesn't have a coherent energy strategy, one OEM said the devolved administrations, especially Scotland, had a "clearer picture" which sometimes offered a better route to engage with the UK. Scotland's strategy is dealt with as a case study in section 6.

Wales focuses its smaller resource on a few key links, often with multinationals associated with its priorities (e.g. links with Hitachi/Japan which are important for nuclear and rail electrification, and EU funds important for tidal development). The Wales European Funding Office (WEFO) works to coordinate activities in Europe, attract investment and shape Welsh institutions to have a better impact. In many areas it works closely with DECC and through other UK institutions.

Others

The activities of other organisations and departments (such as the Catapults and DfT) has yet to be captured here. This will come from the final phase of research and interviews.

Summary

In summary, the LCICG are providing a good basis for the development of an IE Strategy, this will need to be developed further to address engagement on a more specific per-technology level and a long-term home is required to ensure its kept up to date. **Many interviewees noted that a strategy would be useful** for them so it could provide a backdrop to their own activities and help with co-ordination with other organisations. There was also a key message that the UK needed an overall "sense of what it was trying to achieve" with international engagement and where priorities lay between technologies and within each technology area. A clear domestic strategy is a prerequisite to develop an international strategy and some organisations felt this was currently lacking.

4. Developing an Engagement Strategy

The following are two processes that help to develop an overarching International Engagement strategy for energy.

The first process looks at where the UK needs technology to meet its overall objectives. The second looks at where the UK has expertise that could be used to help others meet their objectives, or be developed further through collaboration.

The former is not well developed, the latter is being tackled by LCICG. A complete strategy will combine the two, to inform planned activity and messages when engaging internationally or when prioritising which countries, companies and institutions to proactively engage with.

Process 1 (to meet UK energy objectives)

1. Identify Energy priorities for the UK (for example maximising hydrocarbon recovery from the UKCS, minimising carbon emissions from generation or decarbonising heat)
2. Identify the key technologies and processes needed to achieve 1 (e.g. enhanced oil recovery [EOR], offshore wind [OSW], or small modular reactors [SMR])
3. For undeveloped technologies identify where progress needs to be made (e.g. handling CO₂ on rigs for EOR, reducing cost of OSW foundations or safety systems for SMR)
4. For these sticking points identify centres of expertise in the UK
5. Also identify which countries, institutions or companies have expertise that UK needs to solve the problem.
6. Develop a programme of collaboration between 4 and 5.

Process 2 (to take advantage of UK expertise)

1. Identify areas where UK is leading innovation (for example in fusion research or internal combustion engine development)
2. Identify which countries, institutions and companies could collaborate with or need that UK expertise
3. Identify sources of funding
4. Develop a programme of engagement to bid for funding, attract inward investment or form collaborative partnerships.

5. Case Studies

To assess the resource needed to shape a strategy and also to provide an example for discussion, ERP carried out a non-exhaustive pilot example using Offshore Wind, to present what an International Engagement Strategy document on a *per technology* basis could look like. **A pilot example relating to Energy Storage will also be provided post-October 2015.** For the sake of these pilot studies it is assumed that steps 1 and 2 in the first process of section 4 have already identified these as key technologies for the UK. The studies show what steps 3-5 might look like but do not go on to the final step of developing an engagement programme.

Following interviews with key organisations (including multinationals), it was felt that the pilot study should consider Offshore Wind at a fairly detailed *component level* to really capture the types of engagement opportunities available.

Table 1 below highlights (at a global level):

- Countries (and companies where known) with expertise in a certain component or sub-area
- The type of expertise they offer i.e. at which level of the innovation chain
- The status of engagement opportunities for the UK/Devolved Administrations e.g. **Learning Opportunities, Collaboration Opportunities**, or where the UK already has **Leadership status**.

It has been noted that the work of the [LCICG Offshore Wind TINA](#) provides an analysis of UK opportunities in terms of *value in business creation* and *benefit of UK public sector activity/investment* at a component level also. It would therefore be valuable for the TINA work to feed into any final versions of International Engagement Strategies.

At present however, ERP's work differs from the TINAs in two ways: i) the pilot example here highlights opportunities at a more detailed component level and ii) (as stated above) the work identifies specific countries that are considered leaders in those areas. It is important to note that ERP's analysis is not

exhaustive but aims to provide a respectable example / overview of how engagement opportunities can be assessed at a technology level.

Pilot Example 1: Offshore Wind

Background

More than 91% of the world's offshore wind power is currently installed off northern Europe, in the North, Baltic and Irish Seas, and the English Channel. Most of the rest is in two "demonstration" projects off China's east coast¹. Offshore Wind is a component-heavy technology, which presents multiple opportunities for UK market and supply chain development. The UK currently has the world's greatest levels of offshore wind installation but as a growing industry, there are many more benefits to capture.

Example International Engagement of Energy Strategy – Offshore Wind, Summary

Areas to sell UK expertise elsewhere:

- Electrical equipment – system integration, power converters, controls systems, cables, substations.
- O&M, logistics
- Engineering Consultancy and certification services
- Drivetrain and Blade testing (via OEMs)
- Adhesives, lubricating oils (UK is world leading)

Areas to attract inward investment:

- Foundation and tower manufacture (from Bladt, Denmark)
- Carbon fibre raw materials – to reduce cost base, may need to collaborate with aerospace.

Areas to collaborate on Innovation:

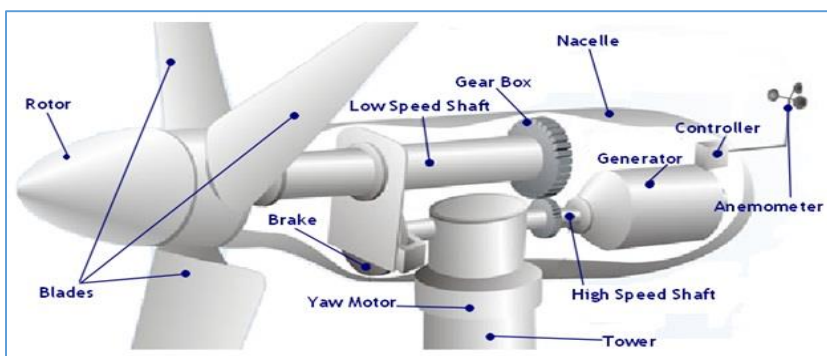
- Avoiding rare earths – alternative magnet materials, generators without permanent magnets, superconducting machines (maybe spill over from medical research)
- Meteorology – UK world leading but so much to gain from better forecasting – perhaps in conjunction with space technology
- Floating platforms (to access deeper water if UK strategy requires a lot of offshore wind)

Analysis by components

The diagram below identifies some key offshore wind turbine components and is supported by Table 1 which additionally highlights the level of expertise of countries that are considered leaders within each area. [Some elements of the table remain to be completed but the table so far helps to present what would be a key part of the proposed engagement strategy.]

¹ <http://www.gwec.net/global-figures/global-offshore/>

Figure 2: Major components of a wind turbine (plus turbine foundation, not pictured)



Offshore Wind Component*	Countries / Companies with Expertise	Type of Expertise**	Type of Engagement Opportunity	Notes
Rotor				
Magnets	UK	Research / Development	Leadership Op	Sheffield – eliminating permanent magnet materials
	Germany – Enercon			
	China	Deployment		China is responsible for roughly 97 percent of global production
Blades				
	UK – Blade Dynamics	Demonstration		Test centre in Blythe, UK (Blade Dynamics) – collaboration with US
	US – Blade Dynamics		Collaborative Op	
Nacelle				
Gearbox	Germany – Siemens	Deployment	Learning Op	Gearless Direct-drive technology
	US – GE	Deployment		Gearless Direct-drive technology
	Germany – Enercon	Deployment		Made gearless Direct-drive technology famous – and DOES NOT use neodymium http://www.renewablesinternational.net/neodymium-a-bone-of-contention-in-wind-turbines/150/435/31015/
Power Converters / Transformers	UK – Leeko University	Research / Development		e.g. Nottingham, Leeko, Sheffield and Southampton Universities – 90% of Siemens turbines in Denmark have Power Converters made in the UK
Foundations				

Fixed Foundations		Denmark – Bladt			
		Netherlands – Sif			
Floating Foundations		Netherlands			1 st developed floating foundation
		France		Collaborative Op	Ideol
		Norway/ Hywind			
Adhesives / Resins		US/ Dow			Co-owners of Blade Dynamics
		UK			Experience from boat building applications
Transformer Oils		UK – MIDEL / Manchester University		Leadership Op	Liquid dielectric for machine insulation and cooling. Very safe and non-toxic
Carbon Fibre		US			E.g. Blade Dynamics Test centre, Blyth – UK couldn't get close to US cost-base for carbon fibre
Electrical		UK			Keele, Sheffield, Nottingham, Warwick, Newcastle and Southampton
Cabling					
Export cables		UK – Prysmian Group		Leadership potential	Currently low market involvement but high potential
Inter-array cables		UK/ JDR Cables			
Substation Manufacturing		UK			
Controllers					
Generator		India – GE			
Tower					

Other relevant considerations:					
Meteorology		UK – Reading University	Research / Development	Leadership Op	Space – Leicester and Guildford (Sussex)
		US			NOAA
O&M		UK			Offshore experience from Oil & Gas Industry
Aerodynamics					

Table 1: Analysis of Offshore Wind International Engagement Opportunities at a component level: Leading Countries, type of expertise and type of engagement opportunity.

6. International Engagement - Case Studies

Case Study 1: Scotland, UK

Scotland is an example of a country with an organised and strategic approach to International Engagement for energy. Whilst interviewing OEMs as part of this work, one respondent offered the comment that although the UK lacked clarity, it was often easier to deal with the devolved administrations (especially Scotland), who have clearer energy priorities.

Decisions relating to overseas engagement are informed at a high level and are managed and led by: [Scottish Development International](#), [Scottish Enterprise](#), [Scottish Government](#) and [The Highlands and Islands Enterprise](#). Scotland engages at an EU level, with its own representative in Brussels (part of [Scotland Europa](#)); has representatives co-located across 26 international offices and resources International Engagement energy activities with 30+ dedicated members of staff situated within Scotland itself.

The Scottish Government has produced an economic strategy which highlights the sectors that will have clear advantages for Scotland. The above organisations then work together to:

- consider what it takes to fulfil these advantages and how they can be supported;
- identify which markets are important to companies within each energy sector;
- identify priority areas of collaborative R&D for Scottish institutions
- consider how both inward investment and export opportunities can be encouraged within these identified markets

This information is strategically filtered down and international engagement activities appropriate to each energy sector / sub-sector take place with these in mind.

Scottish Development International's (SDI) Trade and Investment Strategy was published in 2011 (is currently being updated) and although isn't sector specific, does map 'Key Sectors and 'Top 5' Priority Geographic Markets' and provides a sense of SDI's operating approach overall.

Further down the innovation chain and in relation to deployment, Offshore Wind is an important technology focus for Scotland. The above organisations work closely with the [Offshore Wind Investment Organisation](#) (part of UK Trade & Investment - UKTI) to promote investment opportunities in the UK's offshore wind supply chain internationally.

In relation to R&D, Wave Energy has been identified at a high level as a key area of focus that could gain momentum through collaboration. The [Wave Energy Scotland Initiative](#) was set up to provide funding packages for the development of innovative technologies to produce low cost, efficient and reliable components and subsystems, to help form the basis of cost effective generation of wave energy in Scotland. This attracted many responses internationally.

Universities across the country are also used as vehicles for International Engagement within particular sectors of work.

Finally, Scotland's [Low Carbon Infrastructure Transition Programme](#) provides a range of support mechanisms including project development, expert advice and funding to support the development of substantive private, public and community low-carbon projects across Scotland.

Case Study 2: Denmark – Danish International Engagement Activities

Denmark is renowned for its well-coordinated international engagement activities, particularly relating to energy. The country is known for setting its sights on particular energy technologies, or meeting specific targets and setting about to achieve them.

In relation to International Engagement, of particular note is a central organisation called [State of Green](#) that ‘gathers all leading players in the fields of energy, climate, water and environment and fosters relations with international stakeholders interested in learning from the Danish experience’. State of Green is an initial point of contact for those wishing to engage with Denmark and a gateway for discussing and viewing Denmark’s green policies and solutions.

Denmark’s energy priorities and the international engagement activities it seeks, stem from guidance, mutual government party agreement and clarity at a top-level regarding what aspects of energy are key for the country to achieve its low carbon targets (for example). Although wider engagement is always encouraged, one of Denmark’s current key energy strategy documents places importance on three countries and technologies in particular:

1. Engagement with **China** – a focus on **Wind Power**
2. Engagement with the **UK** – a focus on **District Heating**
3. Engagement with **Germany** – a focus on both **District Heating and Energy Efficiency**

There are also Growth Plans for wider markets, some of which include energy (or aspects of energy) as key specific areas for growth.

Denmark’s relationship with China additionally includes other forms of collaboration, e.g. the National Renewable Energy Center, where Denmark is involved in helping China analyse how they can increase the share of Renewables in the grid. The US is also involved in this partnership.

Finally, the Danish Technological University is a key institution where much of the energy research in Denmark takes place. The University helps to seek and initiate R,D&D collaborations with universities in other countries that will help continue innovation but keep aligned with and deliver Denmark’s key areas of focus.

7. Key Findings

1. There are many positive international engagement activities taking place, although better coordination and an understanding of the bigger picture is required.
2. There are ongoing initiatives that will deliver steps on the road towards the development of an international engagement strategy, but generally these are funded on a short-term basis (to April 2016).
3. On the whole, feedback shows that a UK-wide International Engagement Strategy would be a welcome tool for the public organisations involved and for multinationals.
4. However, clarity regarding the UK’s domestic energy priorities is key for uncovering International Engagement opportunities. The devolved administrations are seen to be (at least by OEMs/multinationals) easier to engage with as they currently have a clearer focus regarding their energy priorities.
5. Multinationals with their built-in international relationships and understandings should be involved (alongside SMEs, Government depts. etc.) in the formation of an international engagement strategy.
6. An international engagement strategy for energy needs to cover the entire innovation chain

from R&D through to deployment in a well-coordinated manner.

7. Denmark is often cited as a positive case study for International Engagement, however closer to home, Scotland has a well-thought out strategy of engagement which is informed and supported from a top-down perspective.

8. Recommendations

At this stage, it is too early to be definitive about final recommendations for a UK International Engagement Strategy for Energy. However, the following lists provide immediate recommendations for how ERP's current project should be completed, and some of the likely final recommendations upon project completion in early 2016. These may be modified or others added during the final phase of this project (October 2015 – January 2016).

For this project:

- Use energy storage as a second example for a technology-specific strategy
- Look for more examples of how international strategy has been done well e.g. The UKTI Life Sciences Organisation
- Estimate the resource required to deliver an engagement strategy and to keep it a 'live document'
- Propose how a strategy could be implemented and state how the strategy may be used (e.g. for Ministerial visits, to inform private investment, by civil servants etc.)
- Continue to work with and support the LCICIG and its member organisations, and be a participant on the LCICIG's International Engagement Working Group
- Deliver final recommendations for approval at the January 2016 plenary

The ownership of the strategy is unclear at present, although it is unlikely the ERP will have the resources to manage this long term. The objective of ERP's work is to identify the needs for an International Engagement Strategy for Energy and demonstrate how they can be met.

Possible final recommendations for ERP to propose for others:

- A living document should be produced and maintained (using ERP's examples as guidance) that identifies the level and type of engagement priorities *per technology* at component level and where in the world expertise lies. This will include combined inputs from the LCICIG TINAs and other existing work.
- This document should also use the same data to identify countries that should be a priority for engagement / relationship-development (either to deliver the innovation needed or to sell UK expertise)
- The document may in fact be an interactive website tool or online database (the exact format is unclear at this stage, but further work should help determine the overall structure.)
- A structure and a funding source should be identified to ensure the longevity of this document.