



# Low-carbon energy study

## Final report

March 2017

**Job number:** 353300084

**Submitted to:**

**UK Foreign & Commonwealth Office (FCO)**

**Submitted by:**

**ICF**



*This page is intentionally blank*



A report submitted by [ICF Consulting Services](#)

Date:

Job Number 353300084

[ICF Consulting Services Limited](#)

Watling House  
33 Cannon Street  
London  
EC4M 5SB

T +44 (0)20 3096 4800

F +44 (0)20 3368 6960

[www.icfi.com](http://www.icfi.com)

---

## Document Control

<b>Document Title</b>	Low-carbon energy scoping study
<b>Job No.</b>	353300084
<b>Prepared by</b>	Neal Mehta
<b>Team</b>	Ravi Kantamaneni, Mark Allington, Colin Moody, Melisande Couespel, Jonathan Lonsdale; Zorica Trkulja, Angela Francis (Green Alliance), David Hodgson and Gary Felgate.
<b>Checked by</b>	Ravi Kantamaneni, Mark Allington
<b>Date</b>	March 2017

ICF is a global consulting and technology services provider with more than 5,000 professionals focused on making big things possible for our clients. We are business analysts, policy specialists, technologists, researchers, digital strategists, social scientists and creatives. Since 1969, government and commercial clients have worked with ICF to overcome their toughest challenges on issues that matter profoundly to their success.

This report is the copyright of the UK Foreign & Commonwealth Office (FCO) and has been prepared by ICF Consulting Services Ltd under contract to FCO. The contents of this report may not be reproduced in whole or in part, nor passed to any other organisation or person without the specific prior written permission of FCO.

ICF has used reasonable skill and care in checking the accuracy and completeness of information supplied by the client or third parties in the course of this project under which the report was produced. ICF is however unable to warrant either the accuracy or completeness of such information supplied by the client or third parties, nor that it is fit for any purpose. ICF does not accept responsibility for any legal, commercial or other consequences that may arise directly or indirectly as a result of the use by ICF of inaccurate or incomplete information supplied by the client or third parties in the course of this project or its inclusion in this project or its inclusion in this report.

## Contents

<b>Executive summary</b> .....	<b>1</b>
<b>1 Introduction</b> .....	<b>3</b>
1.1 UK experience.....	3
1.2 Objectives .....	3
<b>2 Methodology</b> .....	<b>4</b>
2.1 Data collection.....	4
2.2 Identifying UK capabilities .....	4
2.3 Quantifying market access.....	4
2.4 Country case studies.....	5
2.5 Interventions.....	5
<b>3 UK’s low-carbon and energy capabilities</b> .....	<b>6</b>
3.1 Key UK sectoral strengths.....	6
3.2 Key capabilities and market opportunities .....	7
3.3 Green finance.....	7
3.4 Professional and technical services across clean energy sectors and sustainable infrastructure .....	9
3.5 Smart Energy .....	12
3.6 Other sectors that the UK has strong capabilities in .....	15
<b>4 Sizing the market opportunity</b> .....	<b>18</b>
4.1 Focus on low-carbon and energy-related services .....	18
4.2 Total market size .....	19
4.3 UK market access for services .....	20
<b>5 Country case studies</b> .....	<b>22</b>
5.2 Opportunities in South Africa, Turkey and Colombia .....	23
<b>6 Recommended interventions</b> .....	<b>26</b>
6.1 Intervention focus.....	26
6.2 Green finance.....	27
6.3 Professional and technical services .....	28
6.4 Smart Energy .....	29
<b>7 Impact of interventions</b> .....	<b>30</b>
<b>8 Conclusion</b> .....	<b>33</b>
<b>Annex 1 References</b> .....	<b>35</b>
<b>Annex 2 Identification of key emerging countries</b> .....	<b>39</b>
<b>Annex 3 Limitations to the market sizing approach</b> .....	<b>40</b>

## Executive summary

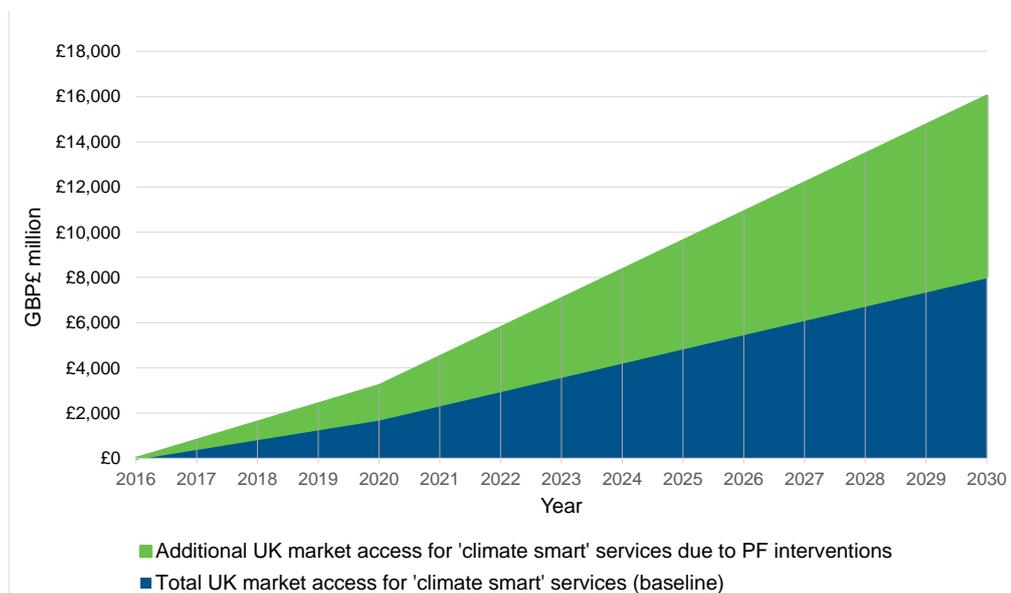
The UK is well-placed to support a low-carbon transition in emerging countries. UK companies have **leading capabilities in green finance, technical and business services** to help develop low-carbon markets and support clean energy and sustainable infrastructure projects. The rapid growth in **smart energy** is also identified as an important sector in the short-medium term.

**Figure ES1.1 Summary of key capabilities and market opportunities**

	Green finance	Professional and technical services	Smart Energy
Key capabilities	<ul style="list-style-type: none"> <li>Long-lasting track record in financial services</li> <li>London is recognised as a centre for green finance</li> <li>Support services and legal system</li> </ul>	<ul style="list-style-type: none"> <li>Export lessons in energy market reform</li> <li>Expertise in end-to-end solutions</li> <li>Trusted, high-quality advice</li> </ul>	<ul style="list-style-type: none"> <li>Innovation is giving the UK an advantage</li> <li>Leadership of Ofgem as a progressive regulator</li> <li>Hands-on experience through demonstration projects</li> </ul>
Market opportunities	<ul style="list-style-type: none"> <li>Emerging markets, becoming more important to the UK</li> <li>China and India are key countries</li> <li>Other countries in South America and South East Asia</li> </ul>	<ul style="list-style-type: none"> <li>Related to green finance (“follow the money”)</li> <li>Challenging in India, China and Brazil, given local competition</li> <li>Focus on existing relationships</li> </ul>	<ul style="list-style-type: none"> <li>Focus on India with Smart Cities ambition</li> <li>Countries that can leap-frog to smart infrastructure</li> <li>Interest in China, but concerns over intellectual property</li> </ul>

**UK market access can be worth £2.5-£3.2 billion by 2020 and possibly £12.5-£16 billion by 2030** across key emerging markets. This assumes modest increases in the market size and the UK market share of climate-related services in nine of the largest emerging markets, as a result of Prosperity Fund (PF) and other related interventions.

**Figure ES1.2 UK market access for climate-related services to 2030**

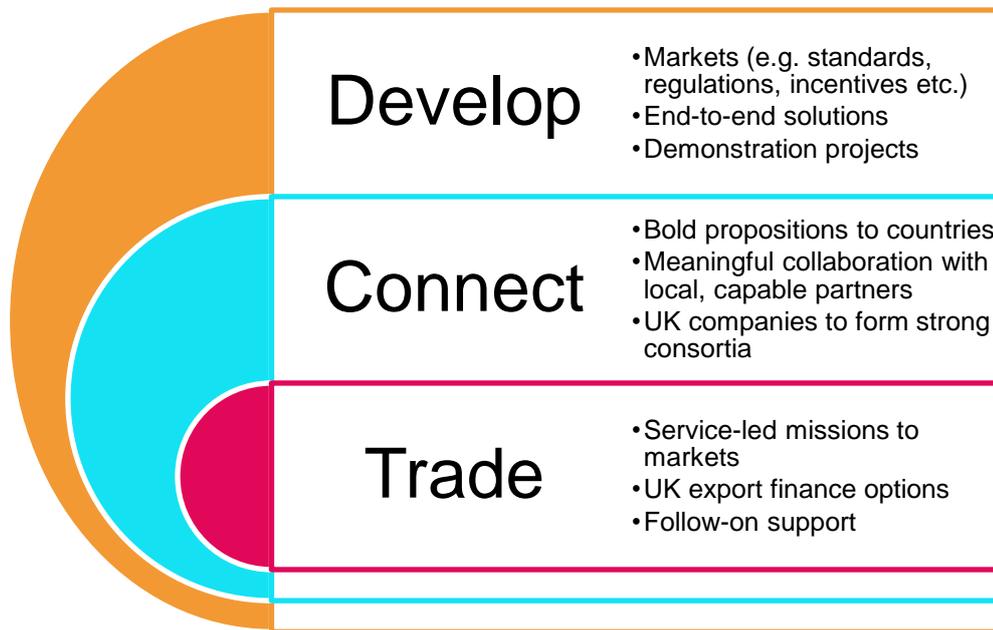


Focussing on just Colombia, Turkey and South Africa,<sup>i</sup> the market access potential for the UK is estimated to be £670-£715 million by 2020.

Interventions can overcome key barriers to help UK companies support low-carbon and energy development in emerging markets. These interventions will help:

- **Develop** the conditions for clean energy and sustainable infrastructure
- **Connect** with the right actors for bold propositions and meaningful collaboration
- Secure **trade** deals through practical steps and government support

Figure ES1.3 Interventions focus



<sup>i</sup> Focus on three large countries that are underrepresented in terms of Cross Government Prosperity Fund energy-related investment.

## 1 Introduction

This report is the final deliverable of the study under contract “CPG/1362/2016: Scoping study to help develop UK programmes to support the low-carbon transition in targeted developing countries and deliver commercial benefits.”

The scoping study was launched by FCO on 17 October, 2016, and this report summarises the main findings from the study.

### 1.1 UK experience

The UK is one of the world leaders in delivering solutions to energy security and climate change. It is ranked behind just France and Sweden in the recent Climate Change Performance Index by Germanwatch, which reviews the performance of 58 top emitting countries.<sup>1</sup> The pioneering UK Climate Change Act established a target to reduce emissions by 80% from 1990 levels by 2050. The UK is currently on track to outperform its second carbon budget (2013-17). Meeting its fifth (2028-32) will require that emissions be reduced by 57% on 1990 levels in 2030.<sup>2</sup>

The UK is a front-runner in the transition to a low-carbon economy due to the first mover advantage offered by the structural economic changes, such as electricity and gas market privatisation and reform, and ambitious climate policies and targets that have been implemented over the last three decades. Coupled with significant research and development in new technologies, such as smart energy applications, the UK has strong capabilities in many low-carbon and resource efficient services, technologies and processes, which presents a significant potential opportunity.

### 1.2 Objectives

The objective of the scoping study was to assist in the development and successful delivery of Prosperity Fund (PF) programmes to support the low-carbon transition and to facilitate economic growth of host countries and opportunities for business, including UK business, with relevant capabilities.

The study helped to identify relevant UK low-carbon capabilities, match these with target countries' needs, and identify mechanisms to remove barriers to growth, creating new market opportunities, including for British business.

Chapter 2 provides a summary of the methodology for the study.

Chapter 3 highlights the UK's low-carbon and energy capabilities, and their potential to meet the needs of emerging countries.

Chapter 4 presents the analysis and the market access opportunity for the UK in emerging countries for low-carbon and energy related services.

Chapter 5 summarises country-specific opportunities for the UK that may be important to the central Prosperity Fund bid: Turkey, Colombia and South Africa.

Chapter 6 provides a summary of the key interventions that are required to overcome barriers and increase the UK's involvement in low-carbon and energy market development in emerging countries.

Chapter 7 provides a summary of the impact of interventions that can help increase the market size and UK market share for low-carbon and energy related services.

## 2 Methodology

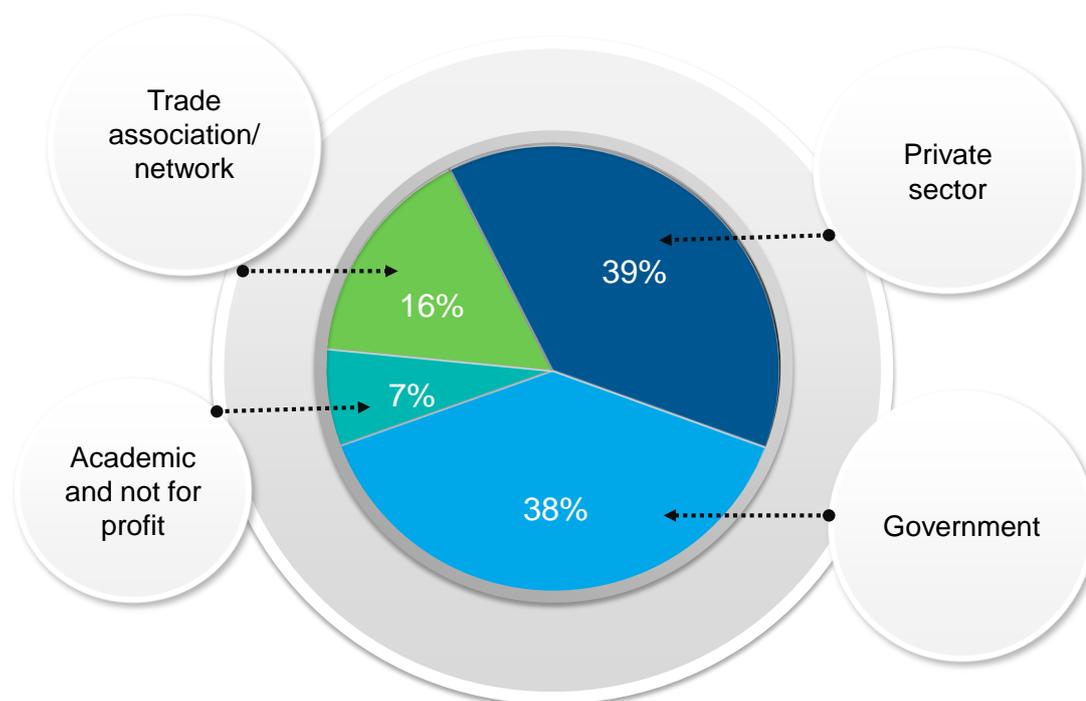
This section describes the methodology and instruments (i.e., market access model, case studies) used to assess UK low-carbon capabilities, market access potential, and associated interventions.

### 2.1 Data collection

The study drew on primary sources of information and uses qualitative and quantitative methods to address the study objectives. Data collection included a desk review, and interviews with the private sector, government, trade associations and academia in the UK, and stakeholders from a select number of countries, Turkey, Columbia and South Africa. In the private sector, both manufacturers and service providers were consulted. In the public sector, officials involved with domestic and international energy, climate, business, industrial, trade and aid policy were consulted.

Over 70 stakeholders were consulted for this study (Figure 2.1). We have reflected some of the key insights from the stakeholders in quotations throughout the report. To respect the privacy of those who have kindly shared their views for this study, we have not named them directly.

**Figure 2.1 All key stakeholder groups were consulted**



### 2.2 Identifying UK capabilities

The study team compared and analysed information on the services and technologies in which UK companies have leading expertise and capabilities or potential to export to emerging markets. The findings, which categorise UK capabilities for relevant sectors, are presented in section 3: UK’s low-carbon and energy capabilities.

### 2.3 Quantifying market access

The study team developed a simple Excel-based model to map the short-term market access (within five years) for UK energy and low-carbon development services in nine ODA-

eligible countries. Priority was given to countries that have the most ambitious climate investment objectives, the highest value of UK exports, and are strategically important, based on prior engagement with the FCO. Further information on the selection of key emerging countries is provided in Annex 2.

The calculation of UK market access is based upon estimates of the total size of the low-carbon market (section 4.2) and the UK's market share (section 4.3).

## **2.4 Country case studies**

To illustrate country-specific low-carbon and energy issues and the associated opportunities for the UK, additional research and interviews were undertaken in three large countries that are underrepresented in terms of Cross Government Prosperity Fund energy-related investment: Turkey, Colombia and South Africa. This is summarised in section 5.

## **2.5 Interventions**

Information was triangulated across all sources to synthesise and identify interventions that are required to overcome barriers and increase the UK's involvement in low-carbon and energy market development in emerging countries. This is presented in section 6.

### 3 UK’s low-carbon and energy capabilities

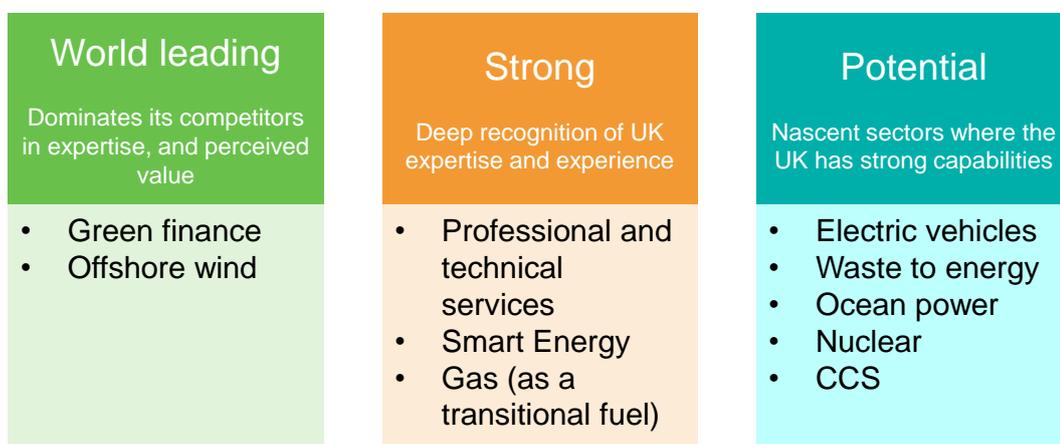
This section highlights the UK’s low-carbon and energy capabilities, and their potential to meet the needs of emerging countries.

#### 3.1 Key UK sectoral strengths

This study has applied an inclusive definition of ‘low-carbon’, based on activities that can help with a cleaner and more resilient energy transition. This includes clean energy, low-carbon transport and buildings, energy efficiency and climate resilience.

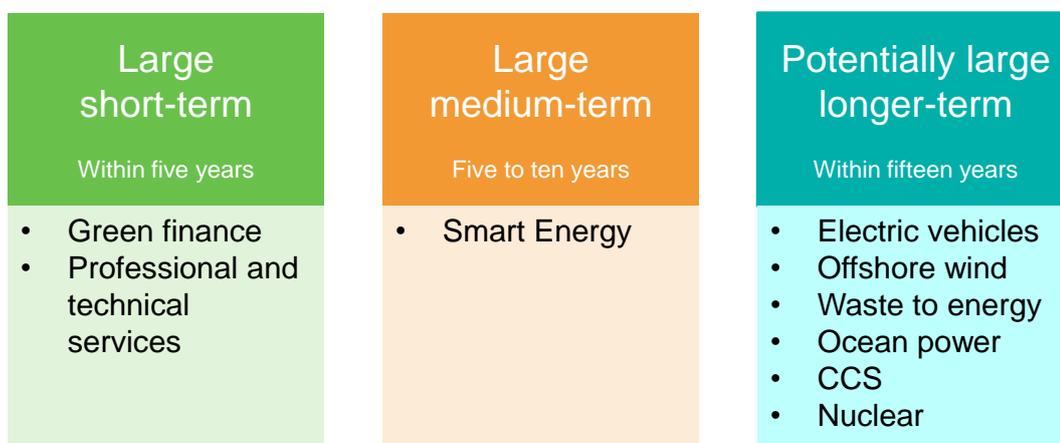
The analysis on key UK sectoral strengths is based on the market research (desk-based research and interviews, using qualitative and quantitative data). The analysis has identified ten key UK sectoral capabilities, which are classified as ‘World Leading,’ ‘Strong,’ and ‘Potential’ based on the depth of expertise, perceived value, and image of UK market players.

**Figure 3.1 UK capabilities in the energy and climate sectors**



Within the context of emerging economies (i.e. a country that has some characteristics of a developed market, but does not meet standards to be a developed market and is still eligible for official development assistance), these capabilities have been reclassified based on the size of the opportunity and the timescale of their needs.

**Figure 3.2 UK capabilities that are relevant for emerging markets**



The gas sector is being reviewed in more detail by other studies.

The following sections outline the UK’s key capabilities to address the needs of emerging economies in the short to medium-term: green finance, professional and technical services, and smart energy.

### 3.2 Key capabilities and market opportunities

UK strength in core sectors and the market opportunities in emerging countries (in the short-medium term) are summarised in Figure 3.3.

Figure 3.3 Key UK capabilities and market opportunities

	Green finance	Professional and technical services	Smart Energy
Key capabilities	<ul style="list-style-type: none"> <li>• Long-lasting track record in financial services</li> <li>• London is recognised as a centre for green finance</li> <li>• Support services and legal system</li> </ul>	<ul style="list-style-type: none"> <li>• Export lessons in energy market reform</li> <li>• Expertise in end-to-end solutions</li> <li>• Trusted, high-quality advice</li> </ul>	<ul style="list-style-type: none"> <li>• Innovation is giving the UK an advantage</li> <li>• Leadership of Ofgem as a progressive regulator</li> <li>• Hands-on experience through demonstration projects</li> </ul>
Market opportunities	<ul style="list-style-type: none"> <li>• Emerging markets, becoming more important to the UK</li> <li>• China and India are key countries</li> <li>• Other countries in South America and South East Asia</li> </ul>	<ul style="list-style-type: none"> <li>• Related to green finance (“follow the money”)</li> <li>• Challenging in India, China and Brazil, given local competition</li> <li>• Focus on existing relationships</li> </ul>	<ul style="list-style-type: none"> <li>• Focus on India with Smart Cities ambition</li> <li>• Countries that can leap-frog to smart infrastructure</li> <li>• Interest in China, but concerns over intellectual property</li> </ul>

Source: ICF, 2017

The following sections provide more detail for these sectors.

### 3.3 Green finance

Green finance is finance that supports sustainable and low-carbon developments. The UK has a clear comparative advantage in financial services. In 2014, the UK exported £49 billion worth of financial services, which makes up 22% of total UK exports in services. The UK only imported £10 billion in financial services, providing a net surplus of £39 billion.<sup>3</sup> The strengths in financial services have been applied to pioneering green financing mechanisms.

#### 3.3.1 London is the green financial hub

The UK has market-leading expertise in green finance, and especially activity in London. This is recognised internationally. A UNEP study stated how the City of London helps to develop “sustainable finance initiatives that are **setting the agenda both domestically and internationally.**”<sup>4</sup>

*“London is a financial centre and the base for major infrastructure funds is the main reason for its dominance of green finance”<sup>5</sup>*

There are various reasons why London is leading on green finance. The most important relate to London’s long-standing expertise in financial services and being an established

base for a concentrated cluster of international financial institutions and investment funds around the London Stock Exchange. **London is the top ranked financial centre**, according to the Z/Yen Global Financial Centres Index.<sup>6</sup>

London has an array of related services that support the city as a top financial centre. Support services include rating agencies, accountancy and tax companies, law firms, insurance companies as well as financial services companies.

*“The UK has a good cluster of the support pieces of the puzzle necessary to make green finance flourish”<sup>7</sup>*

The legal system in the UK has been highlighted as a key strength.

*“People recognise the UK has the best legal structure in the world, which attracts finance – with the rule of law and independence of the judiciary”<sup>8</sup>*

English contract law has been widely adopted in international finance.

*“The biggest banks in this field are British, Swedish and American, but they are also based in London and that says something about London’s role”<sup>9</sup>*

London is a hub for international banks. Its ability to attract people for financial development means thought leadership is developed in London. A key differentiator is that **London is considered more outward looking than other international financial hubs**. New York may focus on the USA, and Hong Kong on China and Asia, but London focuses on international markets.

Banks based in the UK have deep expertise in green bonds. There have been **40 green bonds listed on the London Stock Exchange (LSE)** that have raised approximately USD\$10.5 billion in seven different currencies, as of December 2016.<sup>10</sup> Both India and China have issued green bonds on the London Stock Exchange in recent years. There are various benefits of issuing a bond in London. As reported by the managing director of India’s Axis bank after the listing a USD\$500 million Certified Climate Bond in London, “the **ease of the listing process and breadth of investors** seen in this bond issuance demonstrates the role London Stock Exchange can play in supporting India’s financing needs.”<sup>11</sup> Issuing a bond in London also provides credibility to financial institutions operating in this space, and their ability to attract finance from global investors.

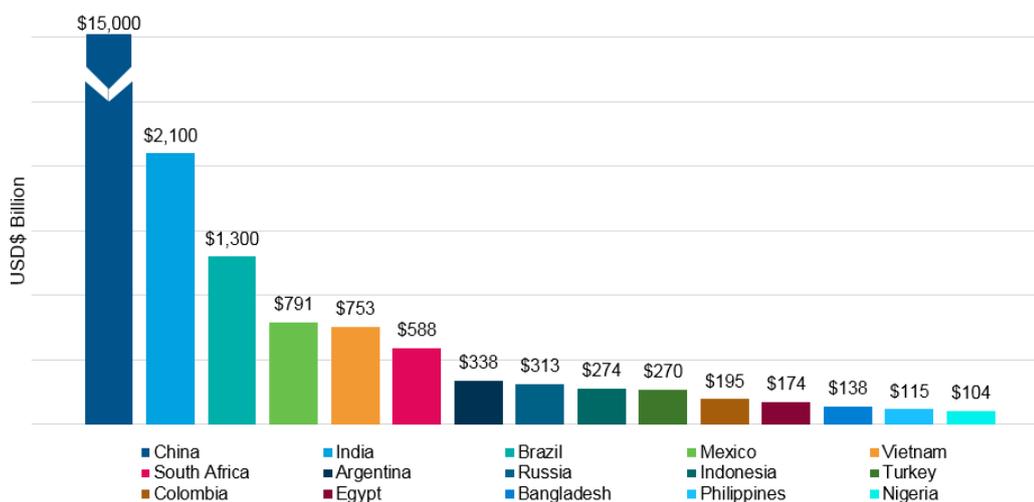
Banks based in London have expertise in clean energy and green infrastructure project finance, private equity and promoting third-party verification, as well as relevant insurance mechanisms needed in the sector. For example, Lloyd’s of London is a leading player in this sector. Lloyd’s is a founding member of ClimateWise, which is an insurance initiative focused on reducing the risk of climate change. Through this initiative, Lloyd’s is engaged in various activities, including promoting risk-based pricing so insurance does not de-incentivise adaptation efforts.<sup>12</sup>

### 3.3.2 Emerging markets becoming increasingly important

Green finance is essential to meet climate and sustainable development goals. Current levels of climate finance are falling short of what is needed. Between 2011 to 2014, USD\$1.2 trillion of climate finance has been invested.<sup>13</sup> The level of investment required to meet nationally determined contributions (NDCs) from 2015 to 2030 is USD\$13.5 trillion, while to limit the global temperature increase to 2°C an additional USD\$3 trillion will be required over the same period.<sup>14</sup> The leveraging of private finance is critical for the funding gap. Private sector investors including individual investors, private equity or institutional investors (e.g. pension funds, insurance companies, sovereign wealth funds etc.) have assets under management representing several trillions of dollars globally. Out of the total USD\$392 billion of climate finance in 2014, **61% was from private sources**.<sup>15</sup>

Recent analysis by the International Finance Corporation (IFC)<sup>ii</sup> (2016) indicates that there is **USD\$23 trillion worth of opportunities for climate-smart<sup>iii</sup> investments in emerging markets between 2016 and 2030**. Considering the rapid growth in emerging markets, and their increasing focus on sustainable growth, these are important targets for UK organisations, especially in a post-Brexit world.<sup>16</sup> The following graphic (Figure 3.4) illustrates the top 15 emerging countries based on the level of ‘climate-smart’ investment to 2030, as identified in the recent IFC (2016) analysis.

**Figure 3.4 Climate-smart investment for emerging countries by 2030**



Source: ICF 2017, based on data from IFC, 2016

The key markets highlighted by financial experts include China and India. **China has the largest investment potential to 2030 (USD\$15 trillion)**.<sup>17</sup> It is significantly more than other emerging markets, and seven times more than the next largest market of India (USD\$2.1 trillion).<sup>18</sup>

Many other emerging markets are looking at developing green finance initiatives to scale-up the financing of clean energy and sustainable development projects. Other countries mentioned by financial experts include Brazil, Chile, Colombia, Mexico, South Africa and Turkey. South East Asia is of importance, given that the UK has large financial institutions that have a significant amount of business there; e.g., Standard Chartered, HSBC etc.<sup>19</sup>

Green bonds are important in emerging markets but can be challenging to develop. The development of green loans is particularly important for emerging countries, because there may not be credit-worthy entities to issue green bonds in sufficient size.<sup>20</sup> It is important for the UK to focus on markets that are willing and open to innovative green finance mechanisms too, given the difficulty of developing expertise in new products and in new markets.<sup>21</sup>

### 3.4 Professional and technical services across clean energy sectors and sustainable infrastructure

The service sector has been growing in recent years and now accounts for almost 80% of the UK economy.<sup>22</sup> In 2014, the UK exported £57 billion worth of professional and technical services (which are distinct from financial services), and imported £35.5 billion, providing a

<sup>ii</sup> IFC is a member of the World Bank Group.

<sup>iii</sup> Climate-smart investment includes investment in low-carbon technologies and sectors that help mitigate and adapt to climate change. This includes investment in the following sectors: renewables, transport, buildings, waste and industry. The figures are likely to be underestimates, given data gaps. The figures in the IFC analysis are considered conservative estimates, and just focus on the priority sectors for each country (IFC, 2016).

balance of £21.5 billion.<sup>23</sup> The UK has expertise in applying business and technical expertise to develop clean energy markets and support specific sustainable development projects that can achieve ambitious climate goals.

### 3.4.1 The UK has the technical and commercial know-how to design and deliver low-carbon transitions

The UK has the expertise to provide services necessary for low-carbon transitions in emerging markets (Figure 3.5).

**Figure 3.5 UK service expertise addresses aspects of the low-carbon value chain**



Source: ICF, 2017

UK service sector companies are well placed to provide end-to-end solutions to address low-carbon challenges. This includes project management and management consulting services to assess, design and implement sustainable policies and projects. Specific examples of UK services being used in emerging markets include:

- Assisting governments to assess if their low-carbon programmes are viable and bankable;
- Supporting the drafting of smart-energy regulations;
- Master-planning of sustainable cities, and supporting the design of cost-effective energy systems; and
- Legal advice in reviewing clean energy project documents, and engaging with regulators.

UK companies can export technical and business services across the project lifecycle on clean energy and sustainable infrastructure projects. This is important when dealing with multidisciplinary, interconnected challenges in emerging markets, such as designing sustainable urban systems. For these challenges, different stakeholders need to come together, from government, business and local communities.

*“The UK is extremely well placed on how to join things up and deliver an overarching solution”<sup>24</sup>*

The UK is considered a trusted partner with high-quality offerings based on market experience and innovative approaches.

*“The UK is respected because they do not favour any one technology. We are independent and high-quality advisors”<sup>25</sup>*

The UK has the technical and commercial know-how to support the development of the enabling environment for clean energy markets (i.e. developing the policy, standards, regulations, incentives). The UK has key expertise in energy market reform, which is important for many emerging markets. UK firms have been identified as **valuable partners for markets that are liberalising energy markets and seeking to design and implement market solutions**.<sup>26</sup> This is supported by the fact that the UK is considered to have energy regulations that are considered the most sophisticated and complicated in the world.<sup>27</sup>

*“Market design, regulation, unbundling, reform of energy sectors is definitely expertise that UK has which is exportable”<sup>29</sup>*

*“In all corners of the world, governments want to drive down cost, introduce competition into the distribution and retail markets and the UK is leading the way”<sup>28</sup>*

It is important to note that the UK’s historic expertise in energy policy is within the context of being part of the European Union. The UK will have to work to maintain this expertise in changing circumstances.

*“Need to build a level of trust and credibility within a dramatically shifting context”<sup>30</sup>*

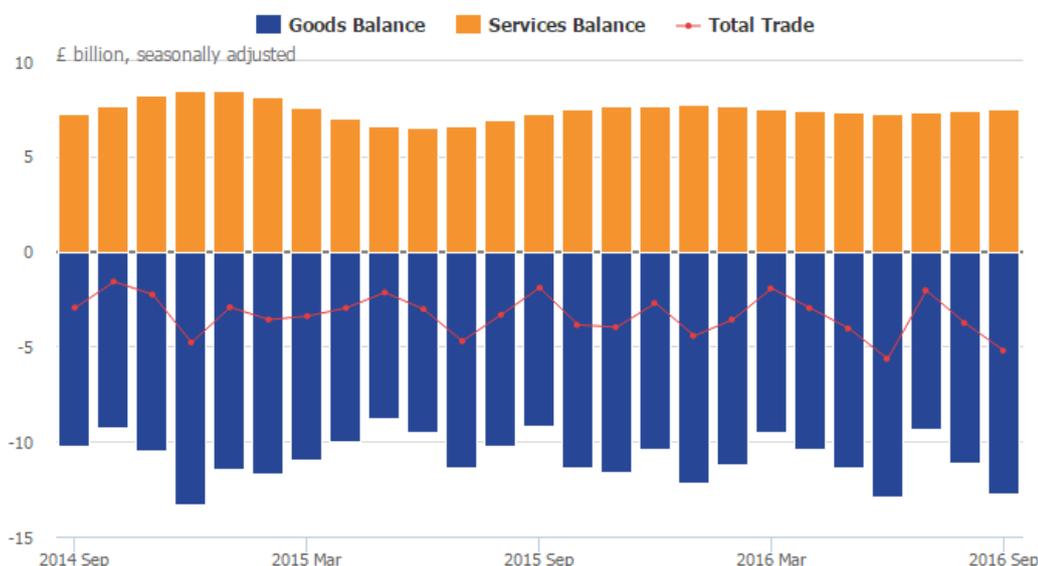
The experience of UK companies in designing and implementing policies that support a balanced approach to meeting low-carbon objectives can be beneficial to emerging economies. The UK has expertise in designing and implementing policies for emissions trading schemes, carbon pricing and pollution permits. The UK also has deep knowledge internationally of how to blend and align market mechanisms with fiscal approaches. For example, the UK has shared lessons with China on its own experience with the design and implementation of the UK carbon floor price and participation in the EU Emissions Trading Scheme (EU ETS).<sup>31</sup> These valuable lessons are relevant for many emerging countries that are interested in achieving ambitious low-carbon targets, in the most cost-effective manner possible.

Many experts agreed that the UK is better placed at exporting expertise and services rather than goods and technologies. There is a focus on the UK exporting its ability to develop ideas and its knowledge rather than manufacturing capability.

*“Lot of expertise in delivery mechanisms and services rather than in technologies”<sup>32</sup>*

This is supported by UK trade data, demonstrating a sustained trade deficit in goods, contrasting to a surplus in services in recent years (see Figure 3.6).

Figure 3.6 Balance of UK trade, September 2014 to September 2016



Source: ONS, 2016.<sup>33</sup>

### 3.4.2 Technical and business services need to ‘follow the money’

The focus for technical and business services in emerging markets is related to green finance. There is a need to ‘follow the money’. India and China have been regarded as important countries. However, it is important to also focus on markets based on historic relationships. Furthermore, local competition and restrictions can make it difficult to export to high growth emerging countries such as India, China and Brazil.<sup>34</sup>

Low-carbon advice is still considered a specialist market. Experts highlighted how more mature markets (such as various Asian economies) are more willing to pay for advice. Africa is considered a significant emerging market but tends to procure low-cost offerings and contracts that require in-country expertise. Local-partner models reduce the margins for UK companies and developing foreign affiliate models can be risky.<sup>35</sup>

## 3.5 Smart Energy

Smart energy is a broad term and encompasses activities to create a sustainable, secure and responsive energy system that improves infrastructure productivity.

### 3.5.1 UK SMEs leading in Smart Energy solutions

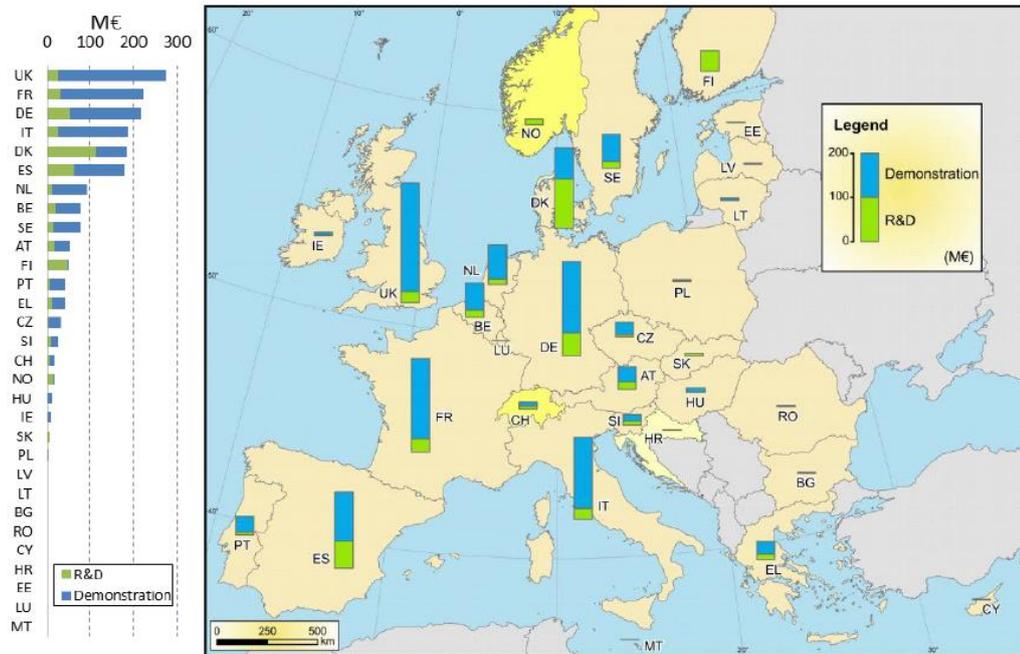
UK companies have developed expertise across the supply chain for smart energy. This includes smart grid products, asset management software, low voltage equipment, storage and the communications infrastructure that sits behind smart metering. This recent growth has been led by small to medium-sized enterprises (SMEs).

The UK’s capability in smart energy can be attributed to **increased investment in research and demonstration projects in the UK**. The Innovation Funding Incentive, Registered Power Zone in 2005 and the Low-carbon Network Fund in 2010, have been important in accelerating innovation in the UK.<sup>37</sup>

*“A lot of innovation gives UK the advantage”<sup>36</sup>*

This funding has helped the UK to stand out in the sector. The following graphic demonstrates how the UK has spent more on demonstration projects than other European Union members (Figure 3.7).

**Figure 3.7 Investment in research and development (R&D) and demonstration projects in Smart Grid projects across Europe**



Source: European Commission, 2013.<sup>38</sup>

The growth of new research and commercial companies entering this sector has contributed to the UK's leading capabilities in smart energy. The knowledge from the investment in demonstration projects (at network-scale level) can be highly exportable, given the value of hands-on experience to overcome challenges in designing and implementing smart energy systems.<sup>39</sup>

The role of Ofgem has been highlighted as a key strength for the UK. The transparent RIIO framework (Revenue = Incentives + Innovation + Outputs), that helps to set price controls by Ofgem is an important element of this. The RIIO model is designed to encourage network companies to meet various objectives, including: Involving stakeholders in the decision-making process; investing efficiently to ensure continued safe and reliable services; Innovating to reduce network costs; Delivering a low-carbon economy and wider environmental objectives.<sup>41</sup>

*“The regulator in the UK is seen internationally to be the most progressive in the world”<sup>40</sup>*

The structure of the UK smart metering system, with its independent Data Communications Company and controlled access to data for third party Service Users, as well as the utilities is of interest to countries seeking operational models and protocols for smart energy. The British system will enable both existing and new market participants to improve services for energy users as well as improving electricity network utilisation, bringing structured and innovative competition to energy supply and demand management. Many emerging markets look to the UK and the lessons from Ofgem for their own smart energy plans. **The adoption of UK-like smart energy policies and systems in emerging markets will provide a platform for UK service providers.**

Research by the Department for International Trade (DIT) has highlighted **approximately 60 UK companies that have the capacity to export expertise to foreign markets for smart energy development**. This ranges from companies that are able to model smart energy systems to provide cost-effective solutions (EA Technology) to the remote terminal units (these enable utilities to monitor and control switchgear) (Lucy Electric).

The UK's comparative strength in smart energy is in services, which is in line with the evidence supporting the UK's capability in professional and technical services. Whilst there may be companies that sell hardware, they may make most of their money from services.<sup>42</sup>

*“Some of the software development, management systems, the consulting around it, that's where we are stepping in - the periphery around it that holds it together”<sup>43</sup>*

The UK is leading in the provision of innovative services at the edge of the market, which comprises of trading, peak shifting, asset management and that are all associated with novel finance mechanisms too.<sup>44</sup>

### 3.5.2 Focus on countries with Smart Energy demonstrations

Many of the UK SMEs that have strong capabilities in smart energy goods and services are focussing on mature international markets. For example, EA Technology is focussed on international opportunities in the USA, Australia and New Zealand.

For country focus in emerging markets, India has been highlighted as a priority country with its ambition of creating Smart Cities at a rapid rate. There is already evidence of decision makers in India interested in learning from the UK in how to design smart metering programmes and smart infrastructure plans.<sup>45</sup>

Several companies and experts cited the importance of energy security and reduction of energy theft/non-payment as being important drivers for smart energy applications in emerging markets.

There is interest from UK companies in exporting to African countries, especially given that many may be able to leap-frog into Smart energy infrastructure in the future.

Whilst several companies and experts highlighted the growth and investment in China, there are concerns amongst some companies over the strength of local competition. There is also concern over the robustness of intellectual property protections. However, we understand the UK Government already has support and guidance in place for exporters to manage this.

### 3.6 Other sectors that the UK has strong capabilities in

The following table summarises the capabilities in other sectors that the UK has a potential competitive edge. However, there are various hurdles to realising opportunities in the short-term. For the majority of these sectors, respondents highlighted the need for stronger domestic support, which is critical for the success of exports.

**Table 3.1 Sectors that the UK has capabilities in (longer-term opportunities)**

Sector	Capabilities	Challenges
<b>Offshore wind</b>	<ul style="list-style-type: none"> <li>■ The UK is considered a global market leader in offshore wind. According to Renewable UK, UK companies have won 115 contracts to help build and service 50 offshore wind projects abroad.<sup>46</sup></li> <li>■ The UK has experience of installing large turbines in very deep water and harsh conditions.<sup>47</sup></li> <li>■ There are several UK companies with capabilities for certain components, such as undersea cables (e.g. JDR Cables).</li> <li>■ The UK has companies with very strong capabilities in various services in this sector, such as site surveys, designing vessels, operating and maintenance, and installation.</li> <li>■ A UK wind expert estimated for foreign projects, UK content may be approximately 25-30% maximum, and this includes all the services related to the projects.<sup>48</sup></li> </ul>	<ul style="list-style-type: none"> <li>■ The UK offshore wind market is being developed through investment from international companies (e.g. Siemens, DONG, MHI Vestas).</li> <li>■ High-value manufacturing for wind energy is more prevalent in other countries, such as Denmark and Germany.</li> <li>■ In emerging markets, there is limited progress in offshore wind development, apart from China and Taiwan.</li> <li>■ Offshore wind is still relatively more expensive than solar and onshore wind energy.</li> <li>■ There is uncertainty over how rapidly this market will develop over the next five years.</li> </ul>
<b>Low-carbon and electric vehicles</b>	<ul style="list-style-type: none"> <li>■ The UK is a leading producer of low-carbon and electric vehicles. Based on recent ONS estimates, exports in the low emission vehicles accounted for an estimated 66% of total low-carbon and renewable exports in 2015, equivalent to £2.5 billion.<sup>49</sup> This includes “low emission vehicles and infrastructure” and “fuel cells and energy storage” sectors.<sup>50</sup></li> <li>■ The UK has strong capabilities in automotive engineering, innovation and storage (i.e., batteries) in this sector. For example, Motorsport Valley (companies around Midlands and Oxfordshire) is a leader in electric motor design.</li> <li>■ There is also strong manufacturing capability in the UK, with the Nissan LEAF plant based in Sunderland.</li> </ul>	<ul style="list-style-type: none"> <li>■ The supply chain for low-carbon vehicles relies on international companies and foreign components.</li> <li>■ The UK lacks tier one suppliers, i.e. the businesses that combine technologies into packages that the manufacturers can incorporate into their products.<sup>51</sup></li> <li>■ Whilst European and USA markets for electric vehicles are growing, there is limited growth in many emerging economies. This is due to the significant investments in the infrastructure required for electric vehicles.</li> <li>■ Emerging economies that have expressed ambitious targets for electric vehicles (such as China) are keen to build local manufacturing capabilities and expertise.</li> </ul>

Sector	Capabilities	Challenges
<p><b>Energy from waste</b></p>	<ul style="list-style-type: none"> <li>■ The UK is relatively strong in the biomass and anaerobic digestion sectors. For these sectors, the UK's main real strength is <i>“the front end: consultancy, data crunching, governance, enforcement, regulation – understanding how investment works, financing and putting money in the system”</i>.<sup>52</sup></li> <li>■ There are few UK companies that manufacture the components needed in this sector, but there are UK designers for good quality waste management systems.<sup>53</sup></li> </ul>	<ul style="list-style-type: none"> <li>■ Challenging domestic market circumstances with cuts in the Renewable Heat Incentive scheme in the UK are making it difficult for companies to grow domestically.</li> <li>■ There is a need for many emerging markets to develop energy from waste (especially from biomass and anaerobic digestion), given that waste management is a very serious issue. UK companies in this sector are interested in smaller foreign markets, where they are seeing some traction: Small islands, Malta, Caribbean Islands and Indonesia. However, there are difficulties in exporting to these markets.<sup>54</sup></li> <li>■ There is also strong competition from companies from Germany (very active in China) and Spanish companies across Latin America.<sup>55</sup></li> </ul>
<p><b>Gas as a transitional fuel</b></p>	<ul style="list-style-type: none"> <li>■ The UK gas industry is a rich source of best practices for the gas value chain. This expertise can be valuable to emerging markets.</li> <li>■ The UK has provided signals to the relevant players along the entire value chain, through appropriate policies, regulations and contractual environment, beginning from the liberalisation of UK gas market in the mid-1990s.</li> <li>■ Experts stated that this sector may not need direct support to UK gas companies, but there is value in the UK using its influence to help create markets, i.e. focus on sharing expertise to support market liberalisation.</li> </ul>	<ul style="list-style-type: none"> <li>■ Gas is less carbon-intensive than other fossil fuels, such as oil and coal. However, there needs to be further work to understand the future value of investing in a gas infrastructure in emerging markets, and how this is consistent with countries own INDCs and ambitious climate targets.</li> <li>■ The future development of lower carbon fuels, such as hydrogen is unknown, yet the UK does possess capabilities to develop this in the future.</li> </ul>
<p><b>Ocean power</b></p>	<ul style="list-style-type: none"> <li>■ The UK has a strong capability in ocean power, with research and development in the sector over several decades. The UK is regarded as a leader in this field.</li> <li>■ Tidal stream and wave energy use British technology, with examples of demonstration projects (e.g. Atlantis Resources' MeyGen tidal stream project in Scotland)</li> <li>■ The recent positive backing of a £1.3 billion tidal lagoon in Swansea means it may contribute to low-carbon energy in the future. The independent review stated: <i>“tidal lagoons can play a cost-effective role in the UK's energy mix”</i>. It also said that <i>“there is some overseas potential for tidal lagoons...however, it would require an additional leap of faith to believe that the UK would be the main industrial beneficiary of such a global programme”</i>.<sup>56</sup></li> </ul>	<ul style="list-style-type: none"> <li>■ The turbine intellectual property for tidal lagoon technology is primarily German</li> <li>■ This sector remains in its early stages of development, and there are limited opportunities in emerging markets looking to deploy this technology in the near future.</li> </ul>

Sector	Capabilities	Challenges
	<ul style="list-style-type: none"> <li>■ In the long term, tidal stream and wave energy can potentially be important low-carbon technologies for many emerging markets, especially small island states with ambitious renewable plans and appropriate resource.</li> </ul>	
<b>Carbon capture and storage (CCS)</b>	<ul style="list-style-type: none"> <li>■ The UK has demonstrated expertise in CCS with research and development and demonstration projects.</li> <li>■ If ambitious global climate targets are to be met, CCS has an important role to play in future energy mixes for emerging markets, especially those that are currently reliant on coal.</li> </ul>	<ul style="list-style-type: none"> <li>■ The CCS sector has been challenged by the high level of uncertainty around possible government funding support.</li> <li>■ CCS projects require much longer timeframes for commercial applications and need significant public financial support to be viable in emerging markets.</li> </ul>
<b>Nuclear energy</b>	<ul style="list-style-type: none"> <li>■ The UK has a strong historic capability in nuclear power and can offer operations, fuel reprocessing and radioactive waste handling, and decommissioning expertise.</li> <li>■ Recent innovations in small modular reactors.</li> </ul>	<ul style="list-style-type: none"> <li>■ The UK's comparative advantage in this nuclear has been weakened by competition from countries advancing their nuclear capabilities, such as France.</li> <li>■ Similar to CCS projects, nuclear projects also require much longer timeframes for commercial applications and need significant public financial support to be viable in emerging markets.</li> </ul>

## 4 Sizing the market opportunity

This section presents the analysis and the market access opportunity for the UK in emerging countries for low-carbon and energy related services.

### 4.1 Focus on low-carbon and energy-related services

Low-carbon energy is a key component of any sustainable development strategy. Ensuring reliable and affordable access to energy is essential to improve the welfare of the poor, and address national development strategies for health, education, rural development and gender equality. As such, identifying opportunities that promote economic development and welfare, while at the same time maximise the commercial benefit to the UK, is a key focus of the study.

As discussed in Section 3, green finance and professional and technical services, which are relevant across different clean energy and sustainable infrastructure sectors, represent key strengths for the UK. As such, the quantification of market opportunities focuses on the service sector, rather than the UK's manufacturing capability. This does not mean that the UK does not have potential to sell goods to emerging markets in low-carbon and energy sectors, but the comparative advantage to deliver a commercial return, lies with services in the short-term (up to 2020), at least.

Please refer to the Annex for more detailed information about the selection of the nine key emerging countries for the market sizing, and the limitations of the approach.

## 4.2 Total market size

For key emerging economies, Table 4.1 presents the anticipated market opportunity for ‘climate-smart’<sup>iv</sup> investment per sector by 2020.

**Table 4.1 Value of ‘climate-smart’ investment to 2020 by key sectors (GBP£ billion)**

Country/ sector	Solar	Wind	Biomass	Small Hydro	Geothermal	Buildings	Transport	Waste	Industrial energy efficiency	Smart Grid	Total	Key (GBP£ billion)
China	£157	£89	£7.8	£3.2	-	£1,297	£141	£7.8	£23	£158	£1,883	Over 1,000
India	£64	£25	£3.2	-	-	£58	£49	£1.9	£18	£16	£234	500 to 1000
Brazil	£5.2	£21	£7.8	£1.3	-	£32	£136	£3.2	£4	£8	£219	250 to 500
Vietnam	£1.3	£1.3	£0.3	£5.2	-	£5.2	£111	£0.2	-	-	£124	100 to 250
Mexico	£3.9	£7.1	-	£1.3	£0.6	£21	£86	£0.0	£0.3	£3.7	£124	50 to 100
South Africa	£3.2	£5.2	£0.2	-	-	£4.5	£89	£0.6	£1.1	£6.3	£110	10 to 50
Turkey	£4.5	£10	-	£0.6	£1.9	£12	£4.5	£0.6	£1.9	£19	£56	Under 10
Colombia	£0.1	£1.3	-	-	-	£5.2	£22	£0.6	-	£0.2	£29	
Indonesia	-	-	£1.9	£0.6	£2.6	£15	£3.9	£0.6	-	-	£25	
<b>Total</b>	<b>£239</b>	<b>£159</b>	<b>£21</b>	<b>£12.3</b>	<b>£5.2</b>	<b>£1,450</b>	<b>£641</b>	<b>£16</b>	<b>£48</b>	<b>£211</b>	<b>£2,804</b>	

Source: Multiple sources that are listed in references

<sup>iv</sup> Climate-smart investment includes investment in low-carbon technologies and sectors that help mitigate and adapt to climate change. This includes investment in the following sectors: renewables, transport, buildings, waste and industry. The figures are likely to be underestimates, given data gaps. The figures in the IFC analysis are considered conservative estimates, and just focus on the priority sectors for each country (IFC, 2016).

As noted, over £2.8 trillion in climate investment will be required by these emerging economies by 2020. Notably, the largest investment opportunity relates to buildings and transport. China is the largest market for investment, with nearly 50% of the total from these nine countries.

### 4.3 UK market access for services

The following graphic highlights the approach utilised to quantify the ‘service-related’ UK market opportunity.

Figure 4.1 Calculation of value of climate-related services exported by the UK

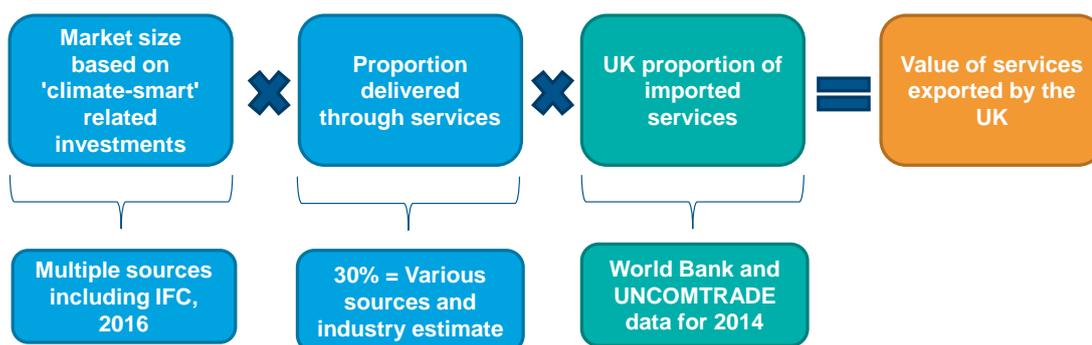


Table 4.2 illustrates the potential UK commercial benefit from ‘climate-related’ services in the priority countries by 2020, assuming that existing market access remains constant.

Table 4.2 UK market access for ‘climate-smart’ related services by 2020 (GBP£ million) baseline

Country	Total market for 'climate smart' services (GBP£ million)	Proportion of services imported in 2014 (%)	Proportion of services imported from the UK in 2014 (%)	Total value for 'climate smart' services from the UK (GBP£ million)	UK proportion of services (%)
China	£564,873	8%	1%	£594	0.1%
South Africa	£33,011	8%	19%	£511	1.5%
India	£70,215	8%	5%	£262	0.4%
Vietnam	£37,286	21%	2%	£121	0.3%
Brazil	£65,586	6%	3%	£102	0.2%
Turkey	£16,786	5%	8%	£77	0.5%
Mexico	£37,163	4%	3%	£43	0.1%
Colombia	£8,848	6%	2%	£11	0.1%
Indonesia	£7,391	9%	2%	£10	0.1%
<b>Total</b>	<b>£841,159</b>			<b>£1,732</b>	<b>0.2%</b>

Source: Multiple sources that are listed in references

Assuming that existing trade relationships between the UK and the priority countries do not decline and that the percentage contribution of UK service-related exports to overall services imported by the countries remains constant, the UK commercial benefit from climate-related services is estimated to be worth £1.7 billion by 2020. China contributes nearly £600 million worth of this. Whilst India has a larger potential market than South Africa, given the strong UK trade relationship with South Africa, the potential market access is approximately £510 million, nearly double of India. Despite Vietnam being a smaller market, the reliance on international imports for services means the UK's estimated market access is over £120 million.

Table 4.3 presents the total value of climate-related services split between green finance, technical and professional services.

**Table 4.3 UK market access for 'climate-smart' related services by 2020 (GBB£ million) baseline**

Country	Green finance	Energy and climate professional services	Energy and climate technical services	Total	Key (GBP£ million)
China	£291	£142	£162	£594	Over 1,000
South Africa	£250	£122	£139	£511	500 to 1000
India	£128	£62	£71	£262	250 to 500
Vietnam	£59	£29	£33	£121	100 to 250
Brazil	£50	£24	£28	£102	50 to 100
Turkey	£37	£18	£21	£77	10 to 50
Mexico	£21	£10	£12	£43	Under 10
Colombia	£5.6	£2.7	£3.1	£11	
Indonesia	£5.0	£2.5	£2.8	£10	
<b>Total</b>	<b>£847</b>	<b>£413</b>	<b>£472</b>	<b>£1,732</b>	

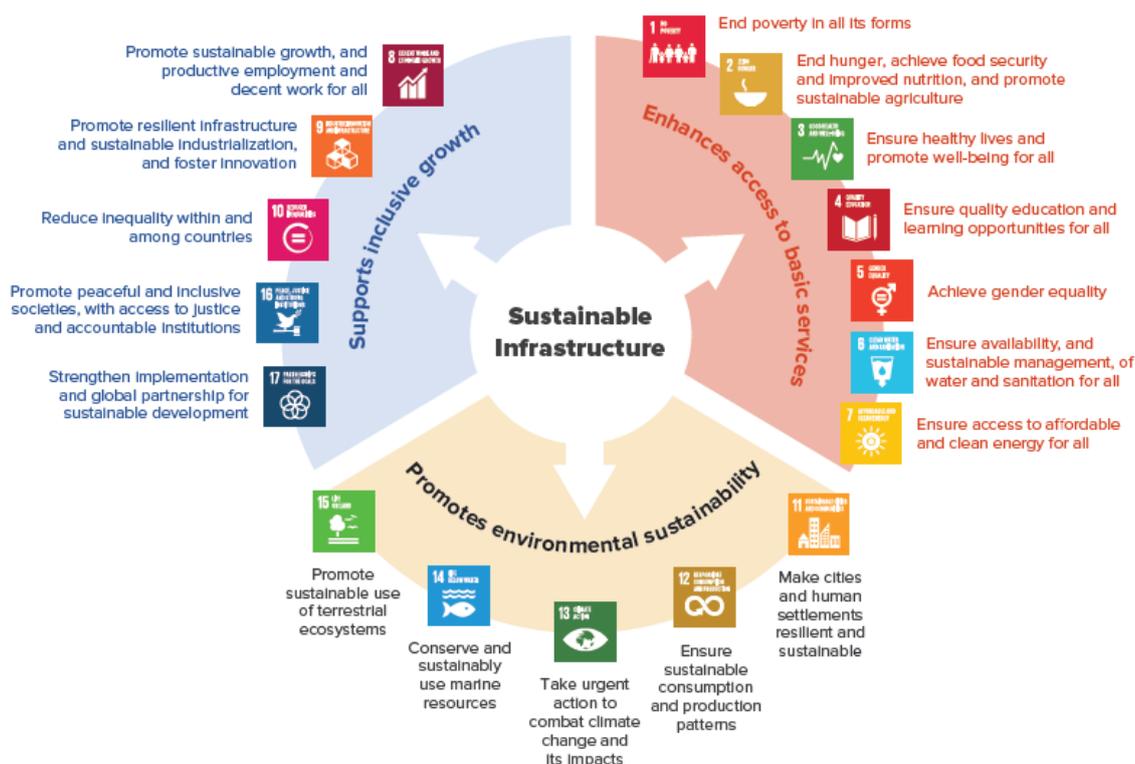
Source: Multiple sources that are listed in references

As illustrated, given the UK's comparative advantage in the financial sector, nearly half of the total value (~£850 million) relates to green finance opportunities by 2020.

## 5 Country case studies

Inclusive economic growth is key to achieving sustainable development, and most economic activity would not be possible without energy. The 2030 Agenda for Sustainable Development established seventeen Sustainable Development Goals (SDGs), which aims to end poverty, protect the planet, and ensure prosperity for all. SDG 7 focuses on access to affordable, reliable, sustainable and modern energy for all. Energy has a direct influence on other SDGs, including 1 (End poverty in all its forms everywhere); 8 (Promote sustained, inclusive and sustainable economic growth, full and productive employment and decent work for all); and 13 (Take urgent action to combat climate change and its impacts). Figure 5.1 illustrates how sustainable energy and infrastructure plays an important role in the attainment of all relevant SDSs.

Figure 5.1 Sustainable infrastructure meeting sustainable development goals



Source: *The New Climate Economy, 2016, based on Bhattacharya et al, 2016.*<sup>57</sup>

In the climate change arena, the Paris Agreement negotiated at the 21st Conference of the Parties to the United Nations Framework Convention on Climate Change, sets a long-term vision for a low-carbon and sustainable future. It called on countries to reduce their greenhouse gas emissions, and submit intended nationally determined contributions (INDCs) that detail plans to mitigate emissions. Financial resources will be needed to implement these INDCs, of which investment in the sustainable energy sector, will be critical for establishing, prioritising, and meeting emission reduction commitments.

To illustrate the country-specific issues in meeting these targets and the associated opportunities for the UK, this section discusses three countries that may be important to the Cross Government Prosperity Fund Energy Transformation Programme bid: Turkey, Columbia, South Africa.

## 5.2 Opportunities in South Africa, Turkey and Colombia

Table 5.1 Summary of opportunities in South Africa, Turkey and Colombia

	South Africa	Turkey	Colombia
<b>Green finance</b>	<ul style="list-style-type: none"> <li>■ The new energy plan targets 37.4 GW of wind capacity and 17.6 GW of solar photovoltaic capacity between 2020 and 2050.<sup>58</sup> UK companies can help support in financing these projects in the future.</li> <li>■ There is also a significant investment requirement for sustainable infrastructure – primarily for transport and buildings (USD\$138 billion by 2020).<sup>59</sup></li> <li>■ UK finance companies have a strong track record in South Africa, with UK companies and their subsidiaries participating in 49% of the deals for the Renewable Energy Independent Power Producer Procurement Programme (REIPPP).<sup>60</sup></li> </ul>	<ul style="list-style-type: none"> <li>■ Turkey is import dependent; with over 70% of energy used coming from foreign sources (i.e., 20% of coal, &gt;90% of oil and natural gas).<sup>61</sup> This has contributed to energy security and balance of payment concerns, with the current account deficit topping USD\$60 billion in 2013.<sup>62</sup></li> <li>■ Non-recourse project finance<sup>v</sup> is almost non-existent in Turkey and the country needs support to create the appropriate financing conditions and institutions.</li> <li>■ UK finance companies can provide support with Green Bonds, which is needed in Turkey, especially for large infrastructure projects. The promotion of public-private partnership (PPPs) can be a useful point of entry for UK companies.<sup>63</sup></li> </ul>	<ul style="list-style-type: none"> <li>■ Colombia has plans to increase investment in renewable energy and sustainable infrastructure, with the largest investments in the transport and building sector (USD\$42 billion by 2020).<sup>64</sup></li> <li>■ Large banks are interested in investing more in low-carbon projects, but lack the capacity and need support for renewables and sustainable infrastructure projects.<sup>65</sup></li> <li>■ Financing energy efficiency at scale is challenging. The UK can offer innovative financing approaches for energy efficiency and help develop an ESCO market.</li> </ul>
<b>Professional and technical services</b>	<ul style="list-style-type: none"> <li>■ The UK can continue to offer support on SA’s clean energy plans with continued policy support across various aspects: the carbon tax, mapping energy solutions and market reform, especially with recent new energy plan being announced and a greater focus on low-carbon forms of energy. UK companies have expertise across these relevant areas to support effective energy policy.</li> </ul>	<ul style="list-style-type: none"> <li>■ Lack of policy certainty and enforcement is limiting the renewable sector. The UK can provide support in strengthening policies, such as Feed-in-Tariffs (FITs) for renewables.</li> <li>■ Support for emissions trading scheme and cost-effective emission reductions policies (The UK and European companies are already supporting research studies into this).</li> </ul>	<ul style="list-style-type: none"> <li>■ There are opportunities for UK companies to support various clean energy projects, and specifically transport and buildings.</li> <li>■ There is a pressing need for a more effective transport system for freight, which is currently transported primarily by trucks. There has also been a significant</li> </ul>

<sup>v</sup> Non-recourse finance is a loan where the lender is only entitled to repayment from the profits of the project the loan is funding, not from other assets of the borrower (Investopedia, 2016).

	South Africa	Turkey	Colombia
	<ul style="list-style-type: none"> <li>SA has ambitious plans for sustainable cities, with high levels of investment across the major cities in the country. Key opportunities where UK companies have expertise include: integrated transport planning systems (especially in Pretoria and Durban); sustainable building design and urban climate resilience – particularly dealing with water and waste management.</li> </ul>	<ul style="list-style-type: none"> <li>This is the right time to enter the market. Privatisation of the electricity market is still relatively new. Important lessons from the UK can be exported to Turkey to ensure a cost-effective smart energy plan is implemented.</li> </ul>	<p>expansion of cars and motorcycles in recent years, with limited environmental regulations.<sup>47</sup> UK services in logistics and transportation systems and the lessons in developing and applying emission standards for vehicles will be useful for Colombia.</p>
<b>Smart energy</b>	<ul style="list-style-type: none"> <li>Smart grid management is in demand in SA, with its energy security challenges and power shortages that are putting a strain on Eskom. There has been some progress with pilot roll outs for smart meters, but much more is needed.</li> <li>The UK can help design and implement smart energy demonstration projects that go beyond just installing smart meters. In an efficient power sector scenario for South Africa, USD\$7 billion of investment is required in the transmission network and USD\$28 billion in the distribution network from 2013-2030.<sup>66</sup></li> </ul>	<ul style="list-style-type: none"> <li>The Turkish government is convinced about the importance of smart energy in the country, primarily because of energy security issues. Turkey plans to invest USD\$5 billion a year in the electricity sector through 2020, and utilities are expected to invest USD\$9.3 billion in smart grid investments from 2016 to 2020.<sup>67</sup></li> <li>One of the main constraints for the electricity grid in Turkey is the uptake of renewable energy technologies, which are similar to the challenges that have been faced by the UK.<sup>68</sup> Private companies in Turkey are eager to improve networks.<sup>69</sup></li> <li>There is potential for UK companies to support distribution companies and municipalities with potential demonstration projects.</li> </ul>	<ul style="list-style-type: none"> <li>From 2015 to 2029, Colombia aims to invest in transmission works of USD\$167 million and energy infrastructure of USD\$700 million, primarily to interconnect wind power.<sup>70</sup></li> <li>Colombia has a Smart Grid plan in place (“Smart Grids Colombia Vision 2030”), but has made little progress in developing the market.</li> <li>Lessons on creating the market will be important in the short-term, especially taking on board lessons from Ofgem in setting regulations and the framework to allow the market to develop in the most cost-effective way possible.</li> </ul>



	South Africa	Turkey	Colombia
<b>Barriers and risks</b>	<ul style="list-style-type: none"> <li>■ The new integrated energy plan is in consultation and there is already some backlash from industry and Eskom, especially over proposed delays in developing nuclear energy. This is creating uncertainty over SA's future energy mix.</li> <li>■ Capacity challenges, especially at the local government level, which makes decision making difficult and procuring foreign companies challenging.</li> </ul>	<ul style="list-style-type: none"> <li>■ There are signals that the government wants to slow down renewable energy investment and focus on coal expansion.</li> <li>■ There is a lot of bureaucracy for renewable energy development in Turkey, with investors complaining that the progress is chaotic and unknown.<sup>71</sup></li> <li>■ The uncertainty and risk of investing in Turkey are compounded by recent social and political unrest and terrorism.</li> </ul>	<ul style="list-style-type: none"> <li>■ There is a lot of competition from Spanish services companies in Colombia.</li> <li>■ The size of the low-carbon market is much smaller than other Latin American countries such as Brazil and Mexico.</li> </ul>

## 6 Recommended interventions

This section provides a summary of the key interventions that are required to overcome barriers and increase the UK’s involvement in low-carbon and energy market development in emerging countries.

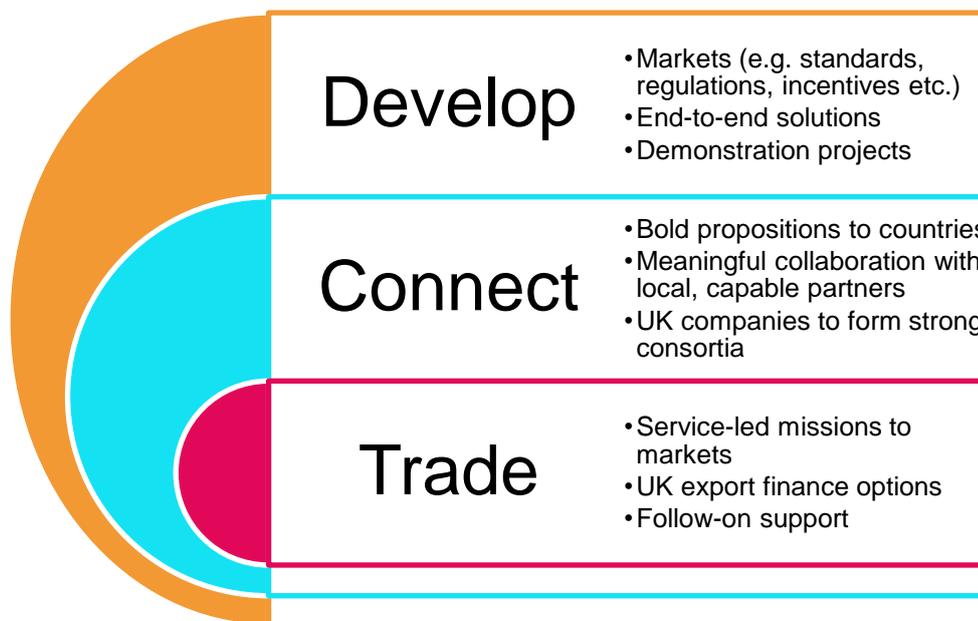
### 6.1 Intervention focus

A package of interventions are required to ensure mutual benefits can be realised from UK activities in emerging markets. Interventions that help develop low-carbon and energy markets can primarily be supported by ODA-eligible programmes, such as the Prosperity Fund. However, there needs to be a coordinated effort with other interventions by the trade network to help secure commercial opportunities for UK companies. These interventions include connecting stakeholders and supporting trade efforts. These should be undertaken in coordination with the Prosperity Fund, but are likely to be delivered through other institutions and mechanisms, such as through the Department for International Trade (DIT).

Key barriers have been identified and reviewed that have prevented UK companies supporting low-carbon and sustainable work in emerging countries. There are a number of interventions that can overcome these key barriers to help UK companies support low-carbon and energy development in emerging markets. As illustrated in Figure 6.1, these interventions can overcome barriers to help:

- **Develop** the conditions for clean energy and sustainable infrastructure (interventions primarily delivered through ODA-eligible programmes, such as the Prosperity Fund).
- **Connect** with the right actors for bold propositions and meaningful collaboration (delivered through the trade network, with some support from local FCO posts).
- Secure **trade** deals through practical steps and government support (delivered primarily through the trade network and institutions such as DIT).

Figure 6.1 Intervention focus



Source: ICF, 2017

The following sections summarise the main interventions recommended for each of the key sectors.

## 6.2 Green finance

Name	Focus	Description	Cost <sup>vi</sup>	Risk and management
Maintain credibility in green finance	Develop	There is a risk over the credibility of green finance investments, with concerns over so called 'green finance' supporting projects where the sustainable development benefits are not verified or realised. There is a need to help maintain the quality of green finance by promoting effective innovative financing mechanisms (e.g. lessons in non-recourse project finance) and best practice principles (e.g. Promote the use of the ICMA Green Bond Principles). This intervention can provide case studies and best practice examples demonstrating how best to develop Green Bonds and the benefits of listing on credible stock exchanges.	£	Difficult to demonstrate the tangible short-term value of maintaining credibility in an unregulated green finance market.  = Demonstrate the financial and also non-financial benefits of maintaining the credibility in this market. Also show how non-recourse project finance has helped scale up finance in clean energy project internationally.
Pathfinder for green finance	Develop Connect	Put together a strategy package and assist UK Government local posts and companies to identify and secure opportunities related to green finance.  Provide ongoing support to help identify and develop a pipeline of projects that UK companies can help finance.	££	Hard to find and secure deals on the ground in emerging markets.  = Ensure local experts and partners who can help to identify and secure deals are supported in order to engage effectively.
Capacity building across the supply chain	Connect	Support local banks in emerging markets with understanding the benefits of investing in clean energy projects.  Capacity building with British infrastructure companies and support them in accessing green finance. Engage with UK firms to help structure projects fit for sustainable construction and then green finance. <sup>72</sup>	££	Hard to convince UK companies of the value of green projects if it is not demanded by international clients.  = Focus on countries, sectors and firms that are likely to succeed to help build a successful track record in this area.

<sup>vi</sup> It is difficult to estimate the actual costs of the interventions, because they will depend on the extent of the activity across markets and countries. The cost symbols refer to the possible relative costs for these interventions based on the likely scale of intervention required between the different activities.

### 6.3 Professional and technical services

Name	Focus	Description	Cost	Risk and management
Export UK policy lessons and implement	Develop	<p>Help emerging countries design and then implement the regulatory frameworks needed to facilitate affordable investment in low-carbon infrastructure.<sup>73</sup></p> <p>Export the lessons in energy market reform to develop the relevant standards and incentives. Support in the implementation of these policies, which will allow UK companies to benefit from operating in familiar environments in the future.</p> <p>Present end-to-end solutions that respond to other government priorities (e.g. poverty alleviation, economic growth etc.)</p>	£££	<p>Local politics and bureaucracy can hamper desired policy changes.</p> <p>= Requires continual support and advocacy – perhaps through secondments or subsidised projects.</p>
Meaningful partnerships	Connect	<p>Identifying partners, incubating relationships to turn them into something mutually productive is a challenge and requires lots of effort in terms of money and time.<sup>74</sup></p> <p>Develop relationships with leading local providers who want to strengthen their offer with UK expertise. Local providers are best source of local intelligence on opportunities</p> <p>A database can be developed of local firms and specialists that are credible to help initiate meaningful partnerships.</p> <p>This can be linked with liability insurance to protect companies.</p>	££	<p>To build meaningful partnership can be costly and time-consuming.</p> <p>= Offer ongoing support to strengthen partnerships</p>
Service missions	Trade	<p>It can be harder to support selling services rather than goods. Individually the deals may be small, even if in aggregate the potential is large.<sup>75</sup></p> <p>There is a need to provide support to service companies and not just UK companies trying to sell kit.<sup>76</sup> These should be designed with specific opportunities in mind, and follow on support needs to be provided.</p>	££	<p>Uptake of trade missions has been limited in the past for low-carbon and energy sectors.</p> <p>= Need to make trade missions attractive for service companies and provide support beyond introductions to decision makers.</p>
Procurement support	Trade	<p>Support procurement process to ensure companies are selected on the basis of quality and lifetime cost rather than limiting selection to lowest initial cost or local suppliers i.e. moving decisions from capital expenditure to total expenditure over asset life.</p>	£	<p>Difficult to change local content regulations or deal with budget constraints for decision makers, especially in the public sector</p> <p>= Provide compelling cases for lifetime costs. Also Export Finance options to buyers of UK services.</p>

## 6.4 Smart Energy

Name	Focus	Description	Cost	Risk and management
Develop Smart Energy system	Develop	Export the UK approach on Smart Energy systems. I.e. Share Ofgem’s experience and UK expertise with smart metering standards, communication protocols, active grid management, demand side management, data collection and market governance etc. If foreign markets follow UK standards, UK firms would have an advantage.	££	Many of the lessons from Ofgem are publically available. = Tailor lessons from the UK to local circumstances. Different markets are at different stages of smart energy maturity. Present hands-on experience with responding to challenges.
Bold propositions	Connect	Arrange country-country agreements and strike a deal with bold propositions to secure high-value contracts: E.g. Make proposals directed to foreign governments stating “We can do 15 of your Smart Cities”. <sup>77</sup> UK Government can help coordinate demand from Tier 1 and 2 players in overseas markets to allow UK companies to access the market. Connect UK SMEs to form turnkey solutions across the Smart Energy system. Ensure this is a UK Government endorsed consortium to help connect with the senior decision-makers.	£££	Difficult to bring UK Smart Energy SMEs together as they may have different desires to enter foreign markets = Ensure that SMEs are supported and understand value of joining with other companies to present an end-to-end solution to emerging markets
UK Export Finance options	Trade	Few companies involved in this sector are aware of export finance options. This agency can guarantee loans to overseas buyers of UK goods and services where the private market needs support, or offer its own loans to buyers directly. Lowering the thresholds may allow SMEs in the Smart Energy sector to take advantage of these options.	££	Contract values may be too small initially to warrant Export Finance support for the buyers. = Need to present a packages approach rather than a few deployments. This will require SMEs coming together to deliver larger projects.

## 7 Impact of interventions

This section illustrates the impact of interventions that can help increase the market size and UK market share for climate-related services.

As part of this study, changes to the baseline calculation can be analysed through changes in the market size and market share. The interventions outlined in the previous section can help increase the market size and UK share of that market for low-carbon services. It is difficult to analyse the impact of interventions on particular markets, given the interplay of so many other factors that may contribute to desired and undesired impacts. It is also difficult to measure the impacts of these interventions separately, so an approach has been developed to quantify their potential aggregate benefit.

Table 7.1 presents a sensitivity analysis of different scenarios of the potential impact of interventions on market size and UK market share and the corollary market access benefit to the UK. Given the recognition that climate finance needs to be scaled up from its current levels, it is assumed that PF interventions will play a role in the mobilisation of investment from other sources, such as private and public sectors, which will increase the market size. However, considering that many emerging markets are subject to one or more factors (e.g., policy, institutional, and/or macroeconomic issues) that are slowing down, or limiting the achievement of sustainable energy solutions for poverty reduction and economic growth, Table 7.1 presents the benefit to the UK assuming an increase in market size ranging from 0% to 10%.

The range of values for UK market share (0-4%), presented in Table 7.1, reflects the limits of UK experience over the last five years in key emerging economies. For example, in Brazil, China, India, Indonesia, and Mexico, UK market share (for imported services) fluctuations between 2010 and 2014 were on the order of 1 percentage point; while in Turkey and South Africa, it was 2 and 5 percentage points, respectively.

**Table 7.1 Interventions can help potentially increase UK market access by over £3 billion**

Total value of services for the UK (GBP£ million)		Uplift in market size due to PF interventions				
		0%	2.5%	5.0%	7.5%	10.0%
Increase in UK market share due to PF interventions (% point increase)	0%	<b>£1,732</b>	£1,775	£1,818	£1,862	£1,905
	1%	£2,400	£2,460	£2,520	£2,580	£2,640
	2%	£3,068	£3,145	<b>£3,221</b>	£3,298	£3,375
	3%	£3,736	£3,829	£3,923	£4,016	£4,110
	4%	£4,404	£4,514	£4,624	£4,734	£4,845

The scenarios demonstrate that percentage point increases in UK market share have a large impact on the UK market access benefit. This ranges from £1.7 billion, in the baseline case (0%), to £4.4 billion assuming a 4 percentage point increase in UK market share across all relevant countries. Alternately, if interventions increased the market size only (from 0% to 10%), the UK market access benefit would increase by less than £200 million.

The model used to calculate the impact of the interventions can be used to develop bespoke scenarios for different types of interventions by country, but for the purpose of this study, the aggregated impact has been estimated. For this study, it has been assumed that Prosperity Fund interventions, over a five year period, will lead to an increase in market size of 5% and **a 1 to 2 percentage (%) point increase in UK market share of exports**. The latter assumption reflects a modest increase in UK market share, as it is within the bounds of

historic (i.e., baseline) UK market share fluctuations (i.e., 1 to 5 percentage points) in key emerging economies. This leads an **increase in UK market access to £2.5-£3.2 billion**.

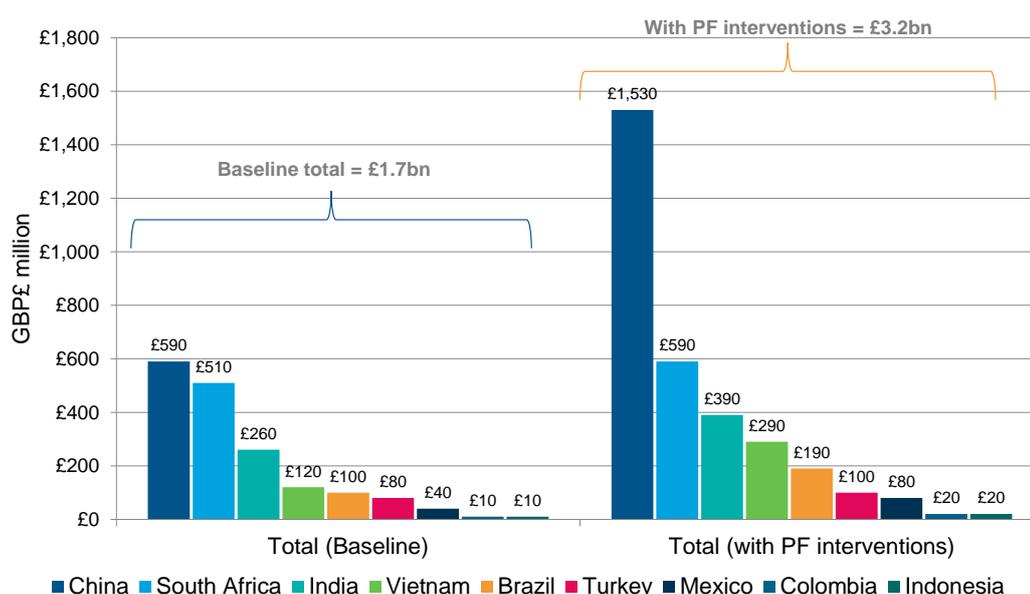
The following table (Table 7.2) and graphic (Figure 7.2) highlight how the increase in market size of 5% and increase in UK market share to 2% points across all countries can increase the UK commercial benefit from £1.7 billion to £3.2 billion in 2020 (over 80% increase from the baseline scenario). This correlates to an increase in the UK proportion of the total low-carbon service market from 0.2% to 0.4%.

**Table 7.2 UK market access for ‘climate-smart’ related services by 2020 (GBP£ million) with PF interventions**

Country	Total market for ‘climate smart’ services due to PF interventions	Proportion of services imported in 2014 (%)	Proportion of services imported from the UK in 2014 (%)	Total value for ‘climate smart’ services from the UK	UK proportion of services (%)
China	£593,117	8%	3%	<b>£1,530</b>	0.3%
South Africa	£34,662	8%	21%	<b>£592</b>	1.7%
India	£73,726	8%	7%	<b>£394</b>	0.5%
Vietnam	£39,150	21%	4%	<b>£289</b>	0.7%
Brazil	£68,865	6%	5%	<b>£190</b>	0.3%
Turkey	£17,625	5%	10%	<b>£100</b>	0.6%
Mexico	£39,022	4%	5%	<b>£79</b>	0.2%
Colombia	£9,290	6%	4%	<b>£24</b>	0.3%
Indonesia	£7,761	9%	4%	<b>£24</b>	0.3%
<b>Total</b>	<b>£883,217</b>			<b>£3,221</b>	<b>0.4%</b>

Source: ICF, 2017 using multiple sources that are listed in references

**Figure 7.2 UK market access for ‘climate-smart’ related services by 2020**



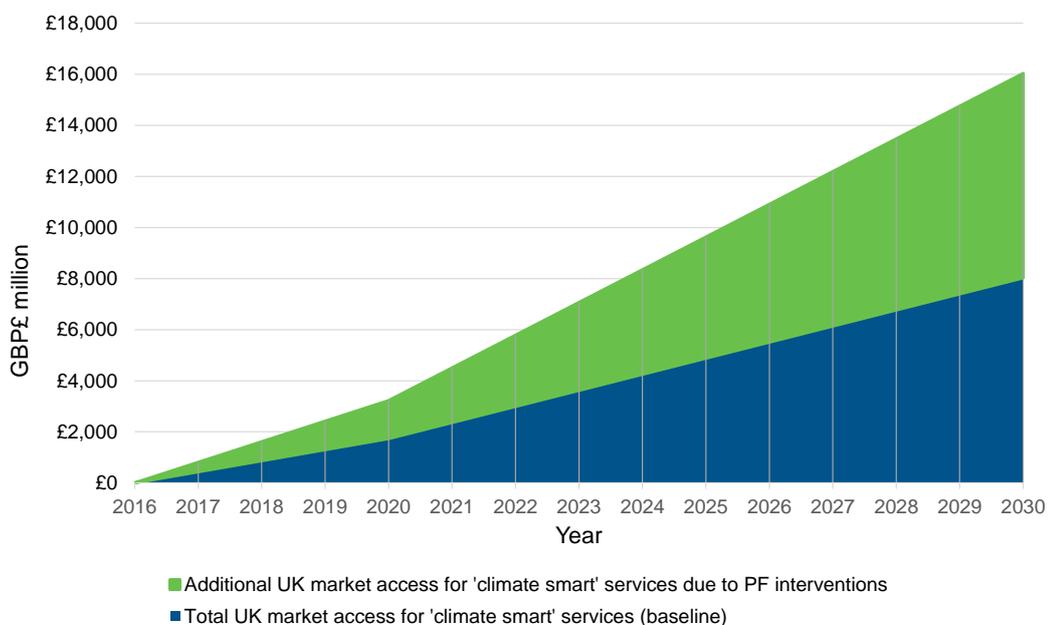
Source: ICF, 2017 using multiple sources that are listed in references

The impact of increasing market share has a smaller impact on countries that the UK already has a strong trading relationship with, such as South Africa, with an increase of only £80 million. The largest increase is from China, where the potential benefit is £1 billion. The modelling shows strong potential returns from interventions in China, due to the market size and its stage of development. However, the Prosperity Fund and ODA-eligible programmes will want to take a sensible, balanced portfolio approach, which takes advantage of growth in all emerging economies.

If the programme just targeted **Colombia, South Africa and Turkey** (the countries that are underrepresented in terms of Cross Government Prosperity Fund energy related investment), then the UK commercial benefit could increase from a baseline of approximately £600 million to **£670-£715 million UK market share by 2020**.

By 2030, the market size is expected to increase in the emerging markets. Assuming the same impact from interventions, the **UK 'climate-smart' services can possibly be worth £12.5-£16 billion**, meaning that interventions in the low-carbon and energy space could realise £4.5-£8 billion in additional commercial benefit to the UK. The following graphic demonstrates the impact of interventions if the timeframe is from 2016 to 2030, assuming a 5% increase in market share and 2% point increase in market access.

**Figure 7.3 UK market access for 'climate-smart' related services to 2030**



*Source: ICF, 2017 using multiple sources that are listed in references*

This assumes the market size increases significantly from 2020 to 2030, and is in line with the data provided by IFC (2016) analysis and other data sources provided in the Annex.

If the programme just targeted Colombia, South Africa and Turkey, then the UK commercial access can potentially be £3.3-£3.6 billion, meaning that interventions can help to realise £550-£750 million in additional commercial benefit to the UK, by 2030.

## 8 Conclusion

This scoping study was commissioned to support the development of the central Energy Transformation Programme bid to the Cross-Government Prosperity Fund. Using the most up to date data we examined where the UK was best placed to contribute to and to benefit from the global low-carbon transition.

Over the past 25 years, the UK has accumulated a large amount of experience at the policy level, the technical level, and in terms of commercial strengths and capabilities. In many ways, the UK has operated as a testbed for the kinds of approaches, which countries will need to adopt if they are to fulfil the ambition of their energy system reforms. Countries may be at different stages in the development process, but there are common energy system challenges that the UK has navigated. For example, how best to use policy and regulation to drive through the upgrading of an energy system? How fast can new technologies be combined to make an energy system smarter and more efficient? What can be done in terms of business models and financial innovation to bring about new projects and new company structures? In all of these areas, the UK has demonstrated its expertise, which it now has the opportunity to use to good effect.

This scoping study found clear options for action by the British Government through ODA-funded investments in energy system reform, supporting the development of low-carbon markets. In this way, new energy service markets can be established and developed. Aligned with these developments, Britain's trade promotion network has the opportunity to help secure trade deals and expand the share of the markets won by well-positioned British companies. The model developed for this scoping study paints a clear picture on the size of the opportunity, using plausible and up to date information.

If the UK is able to play its role in global energy transformation, it may be able to achieve a step change in the way that the world produces, transmits and utilises energy. In this way, the UK can contribute to the objectives set out in the internationally-endorsed Sustainable Development Goals and the Paris Climate Agreement. The energy system can play its part in boosting prosperity and human development.



# ANNEXES

## Annex 1 References

- Advanced Propulsion Centre, 2016. Low-carbon vehicles: The road to a cleaner future. [Online] Available from: <http://www.apcuk.co.uk/wp-content/uploads/2015/09/Low-Carbon-Vehicles-The-Road-To-A-Cleaner-Future.pdf> [Accessed 17/01/2017]
- Blanco, 2008. The economics of wind energy. Elsevier. Figure 4: Estimate of capital cost breakdown for an offshore wind farm. [Online] Available from: <http://anakena.dcc.uchile.cl/~mnmonsal/sdarticle03.pdf> [Accessed 23/11/2016]
- British Columbia, Ministry of Transportation and Infrastructure, 2013. Project cost estimating guidelines. Appendix 1: Cost elements for Transportation Projects (p28). [Online] Available from: [http://www.th.gov.bc.ca/publications/planning/guidelines/cost\\_estimating\\_guidance.pdf](http://www.th.gov.bc.ca/publications/planning/guidelines/cost_estimating_guidance.pdf) [Accessed 23/11/2016]
- Climate Action Tracker, 2015. Climate Action Tracker – Turkey. [Online] Available from: <http://climateactiontracker.org/countries/turkey.html> [Accessed 18/01/2017]
- Deloitte Access Economics, 2014. Major Infrastructure projects: costs and productivity issues. Chart 3.5: Cost shares for public infrastructure projects (%) (p15) and Table 3.1: Cost shares for public infrastructure projects (%) (p16). [Online] Available from: <https://www2.deloitte.com/au/en/pages/economics/articles/major-infrastructure-projects.html> [Accessed 23/11/2016]
- Department of Energy and Climate Change (DECC), 2014. Smart Grid Vision and Routemap. [Online] Available from: [https://www.gov.uk/government/uploads/system/uploads/attachment\\_data/file/285417/Smart\\_Grid\\_Vision\\_and\\_RoutemapFINAL.pdf](https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/285417/Smart_Grid_Vision_and_RoutemapFINAL.pdf) [Accessed 17/01/2017]
- Department of Energy South Africa, 2016. IRP Update Assumptions & Base Case. [Online] Available from: <http://www.energy.gov.za/files/media/presentations/2016/IRP-Update-Presentation-22-Nov-2016.pdf> [Accessed 23/01/2017]
- European Commission, 2013. Smart Grid projects in Europe: Lessons learned and current developments. [Online] Available from: [http://ses.jrc.ec.europa.eu/sites/ses.jrc.ec.europa.eu/files/documents/ld-na-25815-en-n\\_final\\_online\\_version\\_april\\_15\\_smart\\_grid\\_projects\\_in\\_europe\\_-\\_lessons\\_learned\\_and\\_current\\_developments\\_-2012\\_update.pdf](http://ses.jrc.ec.europa.eu/sites/ses.jrc.ec.europa.eu/files/documents/ld-na-25815-en-n_final_online_version_april_15_smart_grid_projects_in_europe_-_lessons_learned_and_current_developments_-2012_update.pdf) [Accessed 17/01/2017]
- Green Finance Initiative (GFI), 2013. Globalising Green Finance. The UK as an international hub. [Online] Available from: [http://greenfinanceinitiative.org/wp-content/uploads/2016/11/Globalising-green-finance\\_AA3.pdf](http://greenfinanceinitiative.org/wp-content/uploads/2016/11/Globalising-green-finance_AA3.pdf) [Accessed 10/12/2016]
- Hendry Review, 2017. Independent Review of Tidal Lagoons. [Online] Available from: <https://hendryreview.wordpress.com/> [Accessed: 17/01/2017]
- IEA, 2015. Energy Efficiency Outlook for South Africa - Sizing up the opportunity. [Online] Available from: [https://www.iea.org/media/topics/energyefficiency/EnergyEfficiencyPotentialinSouthAfrica\\_FINAL.pdf](https://www.iea.org/media/topics/energyefficiency/EnergyEfficiencyPotentialinSouthAfrica_FINAL.pdf) [Accessed: 02/12/2016]
- International Finance Corporation (IFC), 2016. Climate Investment Opportunities in Emerging Markets. [Online]. Available from: [http://www.ifc.org/wps/wcm/connect/51183b2d-c82e-443e-bb9b-68d9572dd48d/3503-IFC-Climate\\_Investment\\_Opportunity-Report-FINAL-11\\_6\\_16.pdf?MOD=AJPERES](http://www.ifc.org/wps/wcm/connect/51183b2d-c82e-443e-bb9b-68d9572dd48d/3503-IFC-Climate_Investment_Opportunity-Report-FINAL-11_6_16.pdf?MOD=AJPERES) [Accessed 11/01/2017]
- International Trade Administration (ITA), 2016. Smart Grid Top Markets Report 2016. [Online]. Available

from:[http://trade.gov/topmarkets/pdf/Smart\\_Grid\\_Top\\_Markets\\_Report.pdf](http://trade.gov/topmarkets/pdf/Smart_Grid_Top_Markets_Report.pdf) [Accessed 15/11/2016]

- Investopedia, 2016. Non-recourse finance. [Online] Available from: <http://www.investopedia.com/terms/n/non-recoursefinance.asp>. [Accessed 23/01/2017]
- London Stock Exchange Group (LSEG), 2016. Factsheet December 2016. Green Bonds. [Online] Available from: <http://www.lseg.com/sites/default/files/content/documents/20161201%20Green%20Bond%20Factsheet.pdf>. [Accessed 23/01/2017]
- Office for National Statistics (ONS), 2016a. UK index of services: August 2016. [Online] Available from: <https://www.ons.gov.uk/economy/economicoutputandproductivity/output/bulletins/indexofservices/august2016>. [Accessed 17/01/2017]
- Office for National Statistics (ONS), 2016b. The Pink Book 2015. Trade in Services. [Online] Available from: <http://www.ons.gov.uk/economy/nationalaccounts/balanceofpayments/compendium/unitedkingdombalanceofpaymentsthepinkbook/2015-10-30/unitedkingdombalanceofpaymentsthepinkbook>. [Accessed 16/11/2016]
- Office for National Statistics (ONS), 2016c. UK Environmental Accounts: Low-carbon and Renewable Energy Economy Survey, first estimates of direct activity: 2015. [Online] Available from: <https://www.ons.gov.uk/economy/environmentalaccounts/bulletins/finalestimates/2015> [Accessed 17/01/2016]
- Office for National Statistics (ONS), 2016d. UK Trade, Sept 2016. [Online] Available from: <https://www.ons.gov.uk/economy/nationalaccounts/balanceofpayments/bulletins/uktrade/sept2016>. [Accessed 23/01/2016]
- Ofgem, 2017. Network regulation – the RIIO model. [Online] Available from: <https://www.ofgem.gov.uk/network-regulation-riio-model>. [Accessed 30/01/2017]
- Renewable UK, 2016. Exporting offshore wind. [Online] Available from: [http://c.yimcdn.com/sites/www.renewableuk.com/resource/resmgr/Exporting\\_Offshore\\_Wind.pdf](http://c.yimcdn.com/sites/www.renewableuk.com/resource/resmgr/Exporting_Offshore_Wind.pdf) [Accessed 17/01/2017]
- The Smart Grid Observer, 2016. Smart Grid Infrastructure Investment in South America: \$38.1bn by 2025. [Online] Available from: [http://www.smartgridobserver.com/n8-11-15-South-America-smart-grid.htm?utm\\_source=August+14%2C+2015&utm\\_campaign=SGO+8-14-15&utm\\_medium=email](http://www.smartgridobserver.com/n8-11-15-South-America-smart-grid.htm?utm_source=August+14%2C+2015&utm_campaign=SGO+8-14-15&utm_medium=email) [Accessed 03/01/2017]
- UNFCCC, 2015. Republic of Turkey – Intended Nationally Determined Contribution. [Online] Available from: [http://www4.unfccc.int/submissions/INDC/Published%20Documents/Turkey/1/The\\_INDC\\_of\\_TURKEY\\_v.15.19.30.pdf](http://www4.unfccc.int/submissions/INDC/Published%20Documents/Turkey/1/The_INDC_of_TURKEY_v.15.19.30.pdf) [Accessed: 18/01/2016]
- UKFOREX, 2016a. Historical Exchange rates. Yearly Average Rates. Selection: Compare = British pound, Against = US Dollar, Year = 2014. [Online] Available from: <http://www.ukforex.co.uk/forex-tools/historical-rate-tools/yearly-average-rates> [Accessed: 16/11/2016]
- UKFOREX, 2016b. Historical Exchange rates. Selection: 1 Unit of = British Pound, = X Units of = US Dollar, Period = Last 5 Years. [Online] Available from: <http://www.ukforex.co.uk/forex-tools/historical-rate-tools/historical-exchange-rates> [Accessed: 23/11/2016]

- UN COMTRADE, 2016a. UN COMTRADE Database. Selection: Services, Period = 2014, Reporter = United Kingdom, Partner = World. Total Export. [Online] Available from: <https://comtrade.un.org/data/> [Accessed 16/11/2016]
- UN COMTRADE, 2016b. UN COMTRADE Database. Selection: Services, Period = 2014, Reporter = United Kingdom, Partner = South Africa. Total Export. [Online] Available from: <https://comtrade.un.org/data/> [Accessed 16/11/2016]
- UN COMTRADE, 2016c. UN COMTRADE Database. Selection: Services, Period = 2014, Reporter = South Africa, Partner = World, Total Import. [Online] Available from: <https://comtrade.un.org/data/> [Accessed 16/11/2016]
- UN COMTRADE, 2016d. UN COMTRADE Database. Selection: Services, Period = 2014, Reporters = Turkey, Colombia, China, India, Brazil, Partner = World, Total Import. [Online] Available from: <https://comtrade.un.org/data/> [Accessed 18/11/2016]
- UN COMTRADE, 2016e. UN COMTRADE Database. Selection: Services, Period = 2014, Reporters = United Kingdom, Partner = Turkey, Colombia, China, India, Brazil, Total Export. [Online] Available from: <https://comtrade.un.org/data/> [Accessed 21/11/2016]
- UN COMTRADE, 2016f. UN COMTRADE Database. Selection: Services, Period = 2014, Reporter = Indonesia, Mexico, Partner = World, Total Import. [Online] Available from: <https://comtrade.un.org/data/> [Accessed 16/11/2016]
- UN COMTRADE, 2016g. UN COMTRADE Database. Selection: Services, Period = 2014, Reporters = United Kingdom, Partner = Indonesia, Mexico, Total Export. [Online] Available from: <https://comtrade.un.org/data/> [Accessed 23/11/2016]
- UN COMTRADE, 2016h. UN COMTRADE Database. Selection: Services, Period = 2014, Reporters = United Kingdom, Partner = Colombia, Total Export. [Online] Available from: <https://comtrade.un.org/data/> [Accessed 28/10/2016]
- UN COMTRADE, 2016i. UN COMTRADE Database. Selection: Services, Period = 2014, Reporter = Vietnam, Partner = World, Total Import. [Online] Available from: <https://comtrade.un.org/data/> [Accessed 06/01/2017]
- UN COMTRADE, 2016j. UN COMTRADE Database. Selection: Services, Period = 2014, Reporters = United Kingdom, Partner = Vietnam, Total Export. [Online] Available from: <https://comtrade.un.org/data/> [Accessed 16/11/2016]
- UNEP, 2016. The United Kingdom: Global Hub, Local Dynamics. [Online] Available from: <http://web.unep.org/inquiry/publications> [Accessed 23/01/2017]
- UPME, 2016. Expansion Plan 2015 - 2029. [Online] Available from: <http://www1.upme.gov.co/sala-de-prensa/fotonoticias/plan-de-expansion-2015-2029>. [Accessed 03/01/2017]
- World Bank, 2016a. World Development Indicators. World Databank. Selection: country = South Africa, Brazil, China, Colombia, India, Turkey, Series = Services, etc., value added (current US\$), Time = 2014. [Online] Available from: <http://databank.worldbank.org/data/reports.aspx?source=world-development-indicators&preview=on> [Accessed 19/12/2016]
- World Bank, 2016b. World Development Indicators. World Databank. Selection: country = Indonesia, Mexico, Series = Services, etc., value added (current US\$), Time = 2014. [Online] Available from: <http://databank.worldbank.org/data/reports.aspx?source=world-development-indicators&preview=on> [Accessed 19/12/2016]
- World Bank, 2016c. World Development Indicators. World Databank. Selection: country = Vietnam, Series = Services, etc., value added (current US\$), Time = 2014. [Online] Available from: <http://databank.worldbank.org/data/reports.aspx?source=world-development-indicators&preview=on> [Accessed 06/01/2016]



- Z/Yen Group, 2016. The Global Financial Centres Index 20. [Online] Available from: [http://www.longfinance.net/images/gfci/20/GFCI20\\_26Sep2016.pdf](http://www.longfinance.net/images/gfci/20/GFCI20_26Sep2016.pdf) [Accessed 23/01/2017]

## Annex 2 Identification of key emerging countries

The following table illustrates the ranking of official development assistance (ODA) eligible countries based on the level of “climate-smart”<sup>vii</sup> investment required by 2030. The table also summaries the value of UK ‘service-related’ exports to the countries in 2014.

**Table A2.1 Ranking of ODA eligible countries based on level of climate investment**

Rank	ODA-eligible countries	Level of "Climate-smart" investment to 2030 (USD\$ billion)	Value of UK service imports (USD\$) 2014
1	China	\$15,000	\$5,276,934,850
2	India	\$2,100	\$3,680,077,850
3	Brazil	\$1,300	\$2,285,817,100
4	Mexico	\$791	\$889,962,150
5	Vietnam	\$753	\$235,675,900
6	South Africa	\$588	\$3,309,160,650
7	Indonesia	\$274	\$524,093,250
8	Turkey	\$270	\$2,104,476,850
9	Colombia	\$195	\$258,791,800
10	Egypt	\$174	\$940,976,550
11	Nigeria	\$104	\$1,746,844,650
12	Kenya	\$81	\$416,883,300
13	Morocco	\$68	\$622,933,650

Source: (IFC, 2016 and UN COMTRADE, 2016).

The size of UK exports is used as a proxy to prioritise countries that the UK has a strong trading relationship with, and also where the commercial opportunity for future low-carbon and energy work is the greatest.

To prioritise the most important countries, the study focuses on countries that have “climate-smart” investment objectives in 2030 of over USD\$250 billion and where the value of UK ‘service-related’ exports is over USD\$500 million. In addition to the countries that meet this criteria, Vietnam and Colombia have been added given the large market size for Vietnam and prior work undertaken in Colombia by FCO.

<sup>vii</sup> Climate-smart investment includes investment in low-carbon technologies and sectors that help mitigate and adapt to climate change. This includes investment in the following sectors: renewables, transport, buildings, waste and industry. The figures are likely to be underestimates, given data gaps. The figures in the IFC analysis are considered conservative estimates, and just focus on the priority sectors for each country (IFC, 2016).

## Annex 3 Limitations to the market sizing approach

### A3.1 Limitations

The approach to estimate the UK market access in emerging markets relies on a number of assumptions and caveats.

#### A3.1.1 Analysis

- The estimation for many sectors is based on recent analysis by the IFC, 2016 which like any market forecast is dependent on various factors, including public policy, public finance, and macroeconomic stability.
- The assumption of 30% of the total market is attributed to services is based on an average benchmark, but can be very different depending on various factors such as country, sector and market maturity and the novelty of the clean energy or sustainable infrastructure project being undertaken. The sensitivity analysis on this figure reveals that a 1% change in this variable leads a change of approximately 3.3% in the UK market access for services.
- The estimation assumes UK market access for the baseline calculation is in line with total UK service exports to relevant countries as a proportion of total services that are imported. The proportion may be different for various low-carbon and energy related services.
- The data to quantify UK service-related exports is based on the most recent trade and service statistics available, which is from 2014.
- Where applicable, a five-year average exchange rate between USD\$ and GBP£ is used to lessen the impact of recent currency fluctuations.
- Assume trade in services is constant over time. Assume some markets become less reliant on importing services, but the UK can counter this by constantly innovating and increasing productivity.

#### A3.1.2 Data

- Many experts have noted the difficulty in gathering data on actual sales and exports to emerging markets for specific low-carbon and energy products. This information is not currently collected in publically available portals for trade data.
- Trade associations have tried to gather data through surveys, but have suffered from low response rates, since many companies are not willing to divulge sensitive commercial information and sales figures.
- The recent ONS surveys (Low-carbon and renewable energy economy surveys) have good coverage, but do not consider the direction of the exports. Furthermore, the sub-sectoral data is not robust, with no breakdown provided for service exports
- DIT has information on its trade activities, but only a small portion of quantitative data on trade deals in renewable and energy sector
- There are various estimates for size of total markets in emerging countries, with no consistent way to compare many of these estimates
- Many reports over the past five years have referenced K-Matrix methodology, which does not provide transparent references and has been challenged in the past for its validity
- Due to the nascent nature of some technologies, robust and transparent data is limited.

---

## Endnotes

- <sup>1</sup> Germanwatch, 2016. Climate change performance index. Results, 2017. [Online] Available from: <https://germanwatch.org/en/download/16484.pdf>. [Accessed 14/02/2017], p.4.
- <sup>2</sup> Committee on climate change, 2016. Carbon budgets and targets. [Online] Available from: <https://www.theccc.org.uk/tackling-climate-change/reducing-carbon-emissions/carbon-budgets-and-targets/> [Accessed 10/02/2017]
- <sup>3</sup> Office for National Statistics (ONS), 2016a. UK index of services: August 2016. [Online] Available from: <https://www.ons.gov.uk/economy/economicoutputandproductivity/output/bulletins/indexofservices/august2016>. [Accessed 17/01/2017]
- <sup>4</sup> UNEP, 2016. The United Kingdom: Global Hub, Local Dynamics. [Online] Available from: <http://web.unep.org/inquiry/publications> [Accessed 23/01/2017], p.4.
- <sup>5</sup> Interview with energy finance expert working for a leading professional service company. 09/12/2016.
- <sup>6</sup> Z/Yen Group, 2016. The Global Financial Centres Index 20. [Online] Available from: [http://www.longfinance.net/images/gfci/20/GFCI20\\_26Sep2016.pdf](http://www.longfinance.net/images/gfci/20/GFCI20_26Sep2016.pdf) [Accessed 23/01/2017], p.4.
- <sup>7</sup> Interview with climate finance expert working for a leading financial institution. 21/11/2016.
- <sup>8</sup> Interview with green finance expert working for a leading financial institution and supporting a green finance campaign. 02/11/2016.
- <sup>9</sup> Interview with green finance expert working for a leading financial institution and supporting a green finance campaign. 02/11/2016.
- <sup>10</sup> London Stock Exchange Group (LSEG), 2016. Factsheet December 2016. Green Bonds. [Online] Available from: <http://www.lseg.com/sites/default/files/content/documents/20161201%20Green%20Bonds%20Factsheet.pdf> [Accessed 23/01/2017], p.1.
- <sup>11</sup> London Stock Exchange Group (LSEG), 2016. London Stock Exchange welcomes India's first internationally listed certified green bond. [Online] Available from: <http://www.lseg.com/resources/media-centre/press-releases/london-stock-exchange-welcomes-india%E2%80%99s-first-internationally-listed-certified-green-bond>. [Accessed 14/02/2017]
- <sup>12</sup> London Climate Change Partnership, 2016. Lloyd's. [Online]. Available from: <http://climatelondon.org.uk/partners/lloyds/>. [Accessed 14/02/2017]
- <sup>13</sup> Climate Policy Initiative, 2016. The Landscape of Climate Finance. [Online]. Available from: <http://www.climatefinancelandscape.org/> [Accessed 13/02/2017]
- <sup>14</sup> Climate Policy Initiative, 2016. The Landscape of Climate Finance. [Online]. Available from: <http://www.climatefinancelandscape.org/> [Accessed 13/02/2017]
- <sup>15</sup> Climate Policy Initiative, 2016. The Landscape of Climate Finance. [Online]. Available from: <http://www.climatefinancelandscape.org/> [Accessed 13/02/2017]
- <sup>16</sup> Interview with sustainability expert working for a sustainable economy alliance. 23/11/2016.
- <sup>17</sup> IFC, 2016. Climate Investment Opportunities in Emerging Markets. [Online]. Available from: [http://www.ifc.org/wps/wcm/connect/51183b2d-c82e-443e-bb9b-68d9572dd48d/3503-IFC-Climate\\_Investment\\_Opportunity-Report-FINAL-11\\_6\\_16.pdf?MOD=AJPERES](http://www.ifc.org/wps/wcm/connect/51183b2d-c82e-443e-bb9b-68d9572dd48d/3503-IFC-Climate_Investment_Opportunity-Report-FINAL-11_6_16.pdf?MOD=AJPERES) [Accessed 11/01/2017], p.20.
- <sup>18</sup> IFC, 2016. Climate Investment Opportunities in Emerging Markets. [Online]. Available from: [http://www.ifc.org/wps/wcm/connect/51183b2d-c82e-443e-bb9b-68d9572dd48d/3503-IFC-Climate\\_Investment\\_Opportunity-Report-FINAL-11\\_6\\_16.pdf?MOD=AJPERES](http://www.ifc.org/wps/wcm/connect/51183b2d-c82e-443e-bb9b-68d9572dd48d/3503-IFC-Climate_Investment_Opportunity-Report-FINAL-11_6_16.pdf?MOD=AJPERES) [Accessed 11/01/2017], p.56.
- <sup>19</sup> Interview with sustainable finance expert working for a leading academic institution. 28/11/2016.
- <sup>20</sup> Interview with green finance expert working for a leading financial institution and supporting a green finance campaign. 02/11/2016.

- 
- <sup>21</sup> Interview with energy and environmental finance expert working for a leading professional service company. 22/11/2016.
- <sup>22</sup> Office for National Statistics (ONS), 2016a. UK index of services: August 2016. [Online] Available from: <https://www.ons.gov.uk/economy/economicoutputandproductivity/output/bulletins/indexofservices/august2016>. [Accessed 17/01/2017]
- <sup>23</sup> Office for National Statistics (ONS), 2016b. The Pink Book 2015. Trade in Services. [Online] Available from: <http://www.ons.gov.uk/economy/nationalaccounts/balanceofpayments/compendium/unitedkingdombalanceofpaymentsthepinkbook/2015-10-30/unitedkingdombalanceofpaymentsthepinkbook>. [Accessed 16/11/2016]
- <sup>24</sup> Interview with clean energy expert working at a UK trade association. 30/11/2016.
- <sup>25</sup> Interview with energy from waste specialist. 21/11/2016.
- <sup>26</sup> Interview with energy finance expert working for a leading professional service company. 09/12/2016.
- <sup>27</sup> Interview with clean energy legal expert working for a leading legal firm. 10/11/2016.
- <sup>28</sup> Interview with energy and environmental finance expert working for a leading professional service company. 22/11/2016.
- <sup>29</sup> Interview with smart energy expert working for a leading engineering and development company. 04/11/2016.
- <sup>30</sup> Interview with sustainability expert working for a leading academic institution. 08/11/2016.
- <sup>31</sup> Discussion with energy and climate change expert working for the UK Government. 09/02/2016.
- <sup>32</sup> Interview with energy efficiency expert working at a UK trade association. 09/11/2016.
- <sup>33</sup> Office for National Statistics (ONS), 2016d. UK Trade, Sept 2016. [Online] Available from: <https://www.ons.gov.uk/economy/nationalaccounts/balanceofpayments/bulletins/uktrade/sept2016>. [Accessed 23/01/2016]
- <sup>34</sup> Interview with clean energy legal expert working for a leading legal firm. 10/11/2016.
- <sup>35</sup> Interview with energy finance expert working for a leading professional service company. 09/12/2016.
- <sup>36</sup> Interview with smart energy expert working at a UK trade association. 04/11/2016.
- <sup>37</sup> Department of Energy and Climate Change (DECC), 2014. Smart Grid Vision and Routemap. [Online] Available from: [https://www.gov.uk/government/uploads/system/uploads/attachment\\_data/file/285417/Smart\\_Grid\\_Vision\\_and\\_RoutemapFINAL.pdf](https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/285417/Smart_Grid_Vision_and_RoutemapFINAL.pdf) [Accessed 17/01/2017]
- <sup>38</sup> European Commission, 2013. Smart Grid projects in Europe: Lessons learned and current developments. [Online] Available from: [http://ses.jrc.ec.europa.eu/sites/ses.jrc.ec.europa.eu/files/documents/ld-na-25815-en-n\\_final\\_online\\_version\\_april\\_15\\_smart\\_grid\\_projects\\_in\\_europe\\_-\\_lessons\\_learned\\_and\\_current\\_developments\\_-2012\\_update.pdf](http://ses.jrc.ec.europa.eu/sites/ses.jrc.ec.europa.eu/files/documents/ld-na-25815-en-n_final_online_version_april_15_smart_grid_projects_in_europe_-_lessons_learned_and_current_developments_-2012_update.pdf) [Accessed 17/01/2017], p.24.
- <sup>39</sup> Interview with Smart Energy specialist working for a leading electrical asset management company. 10/11/2016.
- <sup>40</sup> Interview with Smart Energy specialist working for a leading electrical asset management company. 10/11/2016.
- <sup>41</sup> Ofgem, 2017. Network regulation – the RIIO model. [Online] Available from: <https://www.ofgem.gov.uk/network-regulation-riio-model> [Accessed 30/01/2017]
- <sup>42</sup> Interview with Smart Energy expert working at a UK trade association. 04/11/2016.
- <sup>43</sup> Interview with energy network expert supporting innovation in the transmission and distribution network. 08/11/2016.
- <sup>44</sup> Interview with energy and environmental finance expert working for a leading professional service company. 22/11/2016.
- <sup>45</sup> Interview with Smart Energy expert working at a UK trade association. 04/11/2016.
- <sup>46</sup> Renewable UK, 2016. Exporting offshore wind. [Online] Available from: [http://c.yimcdn.com/sites/www.renewableuk.com/resource/resmgr/Exporting\\_Offshore\\_Wind.pdf](http://c.yimcdn.com/sites/www.renewableuk.com/resource/resmgr/Exporting_Offshore_Wind.pdf) [Accessed 17/01/2017], p.2.

- <sup>47</sup> Interview with offshore wind expert working for a leading offshore wind energy company. 06/12/2016.
- <sup>48</sup> Interview with offshore wind energy specialist. 25/11/2016.
- <sup>49</sup> Office for National Statistics (ONS), 2016c. UK Environmental Accounts: Low-carbon and Renewable Energy Economy Survey, first estimates of direct activity: 2015. [Online] Available from: <https://www.ons.gov.uk/economy/environmentalaccounts/bulletins/finalestimates/2015> [Accessed 17/01/2016]
- <sup>50</sup> Office for National Statistics (ONS), 2016c. UK Environmental Accounts: Low-carbon and Renewable Energy Economy Survey, first estimates of direct activity: 2015. [Online] Available from: <https://www.ons.gov.uk/economy/environmentalaccounts/bulletins/finalestimates/2015> [Accessed 17/01/2016]
- <sup>51</sup> Advanced Propulsion Centre, 2016. Low-carbon vehicles: The road to a cleaner future. [Online] Available from: <http://www.apcuk.co.uk/wp-content/uploads/2015/09/Low-Carbon-Vehicles-The-Road-To-A-Cleaner-Future.pdf> [Accessed 17/01/2017], p.6.
- <sup>52</sup> Interview with energy from waste specialist. 21/11/2016.
- <sup>53</sup> Interview with energy from waste specialist. 21/11/2016.
- <sup>54</sup> Interview with energy from waste specialist. 21/11/2016.
- <sup>55</sup> Interview with energy from waste specialist. 21/11/2016.
- <sup>56</sup> Hendry Review, 2017. Independent Review of Tidal Lagoons. [Online] Available from: <https://hendryreview.wordpress.com/> [Accessed: 17/01/2017]
- <sup>57</sup> The New Climate Economy, 2016. The Sustainable Infrastructure Imperative. P.21. Based on, Bhattacharya et al., 2016. Delivering on Sustainable Infrastructure for Better Development and Better Climate.
- <sup>58</sup> Department of Energy South Africa, 2016. IRP Update Assumptions & Base Case. [Online] Available from: <http://www.energy.gov.za/files/media/presentations/2016/IRP-Update-Presentation-22-Nov-2016.pdf>. [Accessed 23/01/2017], p.18.
- <sup>59</sup> IFC, 2016. Climate Investment Opportunities in Emerging Markets. [Online]. Available from: [http://www.ifc.org/wps/wcm/connect/51183b2d-c82e-443e-bb9b-68d9572dd48d/3503-IFC-Climate\\_Investment\\_Opportunity-Report-FINAL-11\\_6\\_16.pdf?MOD=AJPERES](http://www.ifc.org/wps/wcm/connect/51183b2d-c82e-443e-bb9b-68d9572dd48d/3503-IFC-Climate_Investment_Opportunity-Report-FINAL-11_6_16.pdf?MOD=AJPERES) [Accessed 11/01/2017], p.73.
- <sup>60</sup> Based on UK Government commissioned study for South Africa, 2016.
- <sup>61</sup> Yazar, Y., 2012. Renewable Energy in Turkey. General Directorate of Renewable Energy. [Online]. Available from: <http://www.ewea.org/events/workshops/wp-content/uploads/2013/03/EWEA-TUREB-Workshop-27-3-2013-Yusuf-Yazar-YEGM.pdf> [Accessed 05/01/2017], p.2.
- <sup>62</sup> Institutional investor, 2015. Turkey: Long-term strengths, short-term uncertainties. [Online]. Available from: <http://www.institutionalinvestor.com/images/416/Special%20Reports/4-15%20Turkey.pdf> [Accessed 05/01/2017], p.4.
- <sup>63</sup> Interview with low-carbon expert in Turkey working for a local sustainability consultancy. 09/12/2016.
- <sup>64</sup> IFC, 2016. Climate Investment Opportunities in Emerging Markets. [Online]. Available from: [http://www.ifc.org/wps/wcm/connect/51183b2d-c82e-443e-bb9b-68d9572dd48d/3503-IFC-Climate\\_Investment\\_Opportunity-Report-FINAL-11\\_6\\_16.pdf?MOD=AJPERES](http://www.ifc.org/wps/wcm/connect/51183b2d-c82e-443e-bb9b-68d9572dd48d/3503-IFC-Climate_Investment_Opportunity-Report-FINAL-11_6_16.pdf?MOD=AJPERES) [Accessed 11/01/2017], p.43.
- <sup>65</sup> Interview with low-carbon energy expert in Colombia working for the National Planning Department. 16/01/2017
- <sup>66</sup> IEA, 2015. Energy Efficiency Outlook for South Africa - Sizing up the opportunity. [Online] Available from: [https://www.iea.org/media/topics/energyefficiency/EnergyEfficiencyPotentialinSouthAfrica\\_FINAL.pdf](https://www.iea.org/media/topics/energyefficiency/EnergyEfficiencyPotentialinSouthAfrica_FINAL.pdf) [Accessed: 02/12/2016], p.31.
- <sup>67</sup> International Trade Administration (ITA), 2016. Smart Grid Top Markets Report 2016. [Online]. Available from: [http://trade.gov/topmarkets/pdf/Smart\\_Grid\\_Top\\_Markets\\_Report.pdf](http://trade.gov/topmarkets/pdf/Smart_Grid_Top_Markets_Report.pdf) [Accessed 15/11/2016], pp.62-63.
- <sup>68</sup> Based on information shared by a UK low-carbon expert working for a leading consultancy. 2016
- <sup>69</sup> Interview with low-carbon expert in Turkey working for a local sustainability consultancy. 09/12/2016.

- 
- <sup>70</sup> UPME, 2016. Expansion Plan 2015 - 2029. [Online] Available from: <http://www1.upme.gov.co/sala-de-prensa/fotonoticias/plan-de-expansion-2015-2029>. [Accessed 03/01/2017].
- <sup>71</sup> Interview with clean energy expert in Turkey working for a local green finance consultancy. 06/12/2016
- <sup>72</sup> Interview with green finance expert working for a leading financial institution and supporting a green finance campaign. 02/11/2016.
- <sup>73</sup> Interview with sustainability expert working for a sustainable economy alliance. 23/11/2016.
- <sup>74</sup> Interview with low-carbon innovation expert working for a leading academic institution. 03/11/2016.
- <sup>75</sup> Email exchange with senior UK Government low-carbon and energy expert, 2017.
- <sup>76</sup> Interview with energy finance expert working for a leading professional service company. 09/12/2016.
- <sup>77</sup> Interview with smart energy expert working for a leading engineering and development company. 04/11/2016.