

## Impact case study (REF3)

<b>Institution:</b> University of Aberdeen		
<b>Unit of Assessment:</b> UOA17 (Business and Management Studies)		
<b>Title of case study:</b> Economics of Decommissioning in the UK		
<b>Period when the underpinning research was undertaken:</b> 2005-2019		
<b>Details of staff conducting the underpinning research from the submitting unit:</b>		
<b>Name(s):</b>	<b>Role(s) (e.g., job title):</b>	<b>Period(s) employed by submitting HEI:</b>
Alex Kemp	Professor	1966 - present
Sola Kasim	Research Fellow/Lecturer	1999 - present
Linda Stephen	Research Fellow	1994 – May 2020
<b>Period when the claimed impact occurred:</b> 2014-2020		
<b>Is this case study continued from a case study submitted in 2014?</b> N		
<b>1. Summary of the impact</b> (indicative maximum 100 words)		
<p>Pioneering research by Professor Alex Kemp and colleagues Linda Stephen and Sola Kasim at the University of Aberdeen has analysed the economic aspects of decommissioning activity in the UK continental shelf (UKCS) and the related issues of change of use of oil assets and the prospects for carbon capture and storage. This work has been used by Government and industry to inform decision-making and financial planning to introduce financial security for decommissioning. In particular, the research has highlighted the potential size and timing of decommissioning including the sensitivity of the economic limit (COP date) to oil price behaviour and the implications of complex tax issues on the viability of the process.</p> <p>Professor Kemp and his team's research also demonstrated how change of use of oil assets such as pipelines could make a major contribution to enhancing the possibility that CO<sub>2</sub> carbon capture and storage could become economically viable. Kemp's research has informed recent initiatives made by oil company operators and the Oil and Gas Authority (OGA) and has provided key guidance relating to the cost advantages from the reuse of oil-related infrastructure facilities to meet Net Zero emissions goals.</p>		
<b>2. Underpinning research</b> (indicative maximum 500 words)		
<p>Decommissioning cost (also known as asset retirement obligation) is the cost incurred by companies in reversing the modifications made to the installation site. In the UK, decommissioning costs were estimated to be GBP48,000,000,000 (August 2020) by the Oil and Gas Authority (OGA). Since 2004, supported by numerous grants from both industry and government, Professor Kemp has led a pioneering body of research (initiated in 1992), which analysed the significant decisions taken in determining the economic limit to a field's production [P1-8]. The rationale for mothballing (that is the deactivation and preservation of equipment or production facilities for future use or sale) was articulated for both industry and policymakers [1-5].</p> <p>The methodology involved financial simulation modelling, including the use of the Monte Carlo technique (computational algorithms that deploy random sampling to analyse probability) to assess the various risks. He has demonstrated that the moment to initiate decommissioning is not necessarily the time when persistent operating losses emerge. Instead, the research unveiled a variegated picture that incorporated the size and phasing of the decommissioning market, included the variabilities of price fluctuation and availed of the reuse of capital assets, while remaining mindful of the geographical distribution of activity across the various regions of the UKCS. In this work, Kemp and his team have been instrumental in outlining key mechanisms for (1) ensuring economic adaptability during decommissioning of new fields and (2) identifying new and late life assets, which support carbon capture.</p>		

**(1) Procuring financial security for decommissioning**

The complex effects of the interaction of field production decline rates along with oil price volatility and the complex tax system are difficult to measure. To address this challenge, Professor Kemp and colleagues developed a sophisticated model capable of incorporating a very comprehensive field database. This model facilitated an in-depth analysis and future prediction of how the market in the UKCS could feasibly develop over the long run to 2050 [2, 3]. The size of the market and its sensitivity to different assumptions (such as relating to oil prices and operating costs) were highlighted, given their interest to both industry and government.

Professor Kemp and his team have also provided an in-depth analysis of the economic effects of various instruments, which can be deployed to procure financial security for decommissioning, seen from the viewpoints of both investors and Government [3]. Complex tax issues were included in the modelling (using the Monte Carlo technique) allowing analysis of the effects of policy changes on both investors and UK Government revenue. This research has been the first to clarify the comparative effects of the use of instruments such as:

- Letters of Credit (an irreversible standby letter of credit acceptable in form and substance to the Decommissioning Issuing Bank)
- Surety Bonds (this bond makes any decommissioning costs the financial responsibility of the utility company, rather than the taxpayer)
- Decommissioning Trust Funds (an external and irrevocable trust created for the purpose of funding decommissioning obligations).

**(2) Carbon (CO<sub>2</sub>) capture and decommissioning**

Carbon capture and storage (CCS) is the process of storing harmful carbon (CO<sub>2</sub>) emissions. The use of extant assets (old platforms) to store carbon emissions underground is predicted to be significantly cheaper than decommissioning the platforms and would help to meet the UK's CO<sub>2</sub> emissions targets (2050 net-zero target). Reacting to the growing interest in CO<sub>2</sub> capture and storage from industry, and the realisation that the related economics was very challenging to both investors and Government, Kemp produced a detailed study [4], demonstrating how reuse of oil-related assets plus adoption of the cluster concept (accumulation of assets in a geographic area) could substantially reduce the costs. The in-depth study was based on a hub area at St. Fergus terminal followed by reuse of redundant trunk oil pipelines, and sequestration of the CO<sub>2</sub> in depleted oil and gas fields in the Central North Sea/ Outer Moray Firth regions.

Professor Kemp and his team further highlighted the need for the economic analysis to incorporate the relationship between the three main phases of capture, transportation and storage. If any one part of the chain is not viable, the whole activity stalls [5]. Optimising the linked activities would be needed for industry to take this initiative forward; it would also require the UK Government to introduce appropriate regulations and incentive schemes.

**3. References to the research** (indicative maximum of six references)

- [1] Kemp, A. with Stephen, L., "Economic Aspects of Prospective Decommissioning Activity in the UKCS to 2030", University of Aberdeen, Department of Economics, North Sea Study Occasional Paper, No.97, December 2004, pp.1-61.
- [2] Kemp, A. with Stephen, L., "Economic and Tax Issues Relating to Decommissioning in the UKCS: the 2016 Perspective", University of Aberdeen, Department of Economics, North Sea Study Occasional Paper, No.137, July 2016, pp.1-63. DOI: <https://www.abdn.ac.uk/business/documents/nsp-137.pdf>
- [3] Kemp, A. with Stephen, L., "Financial Liability for Decommissioning in the UKCS: the Comparative Effects of LOCs, Surety Bonds and Trust Funds", University of Aberdeen, Department of Economics, North Sea Study Occasional Paper, No.103, October 2006, pp.1-150. DOI: <https://www.abdn.ac.uk/business/documents/NSO-Paper-No103.pdf>

- [4] Kemp, A. with Kasim, A. S., "The Economics of CO<sub>2</sub> EOR Cluster Developments in the UK Central North Sea", *Energy Policy*, 2013, Vol.62, pp.1344-1355. DOI: <https://doi.org/10.1016/j.enpol.2013.07.047>
- [5] Kemp, A. with Kasim, A. S., "An Optimised Investment Model of the Economics of Integrated Returns from CCS Development in the UK/UKCS", University of Aberdeen, Department of Economics, North Sea Study Occasional Paper, No.126, May 2013, pp.1-33. DOI: <https://www.abdn.ac.uk/business/documents/nsp-126.pdf>

## GRANTS

- [P1] By group of oil companies and Scottish Enterprise, 2000. Subject: North Sea Oil and Gas Economics, 2000. Amount: GBP76,000.
- [P2] By group of oil companies and Scottish Enterprise, 2001. Subject: North Sea Oil and Gas Economics, from 2001 – 2014 (GBP536,950)
- [P3] By group of oil companies, Scottish Enterprise and Office of Chief Economic Advisor, Scottish Government, 2015: Subject: North Sea Oil and Gas Economics, 2015, Amount: GBP120,000
- [P4] By group of oil companies, Scottish Enterprise and Office of Chief Economic Advisor, Scottish Government, 2016: Subject: North Sea Oil and Gas Economics, 2016, Amount: GBP120,000
- [P5] By group of oil companies, Scottish Enterprise and Office of Chief Economic Advisor, Scottish Government, 2017: Subject: North Sea Oil and Gas Economics, 2017, Amount: GBP95,000
- [P6] By group of oil companies, Scottish Enterprise, Office of Chief Economic Advisor, Scottish Government, and Oil and Gas Authority, 2018: Subject: North Sea Oil and Gas Economics, 2018, Amount: GBP110,000
- [P7] By group of oil companies and Scottish Enterprise, Office of Chief Economic Advisor, Scottish Government, and Oil and Gas Authority, 2019: Subject: North Sea Oil and Gas Economics, 2019, Amount: GBP115,000
- [P8] By National Decommissioning Centre, 2020: Subject: Economics Aspects of Different Instruments for Procuring Financial Security Relating to Decommissioning in the UKCS, Amount: GBP114,000

The quality of the research and its impact are reflected in the fact that the grants are peer-reviewed and, while only given on an annual basis, have been renewed repeatedly over the years (starting in 1975) by sponsors, some of whom have renewed ever since. The sponsors are from both industry and Government bodies, reflecting the perceived benefits to both.

## 4. Details of the impact (indicative maximum 750 words)

Professor Kemp is a widely recognised authority on the economics of the oil and gas sector with particular emphasis on the UKCS. In recognition of his expertise, Kemp was appointed in 2011 to the Scottish Energy Advisory Board by the First Minister; in 2015 he was named as a member of its Petroleum Resource Allocation Advisory Group by the New Zealand Government. In recognition of his contribution to industry, Professor Kemp became the first person to be inducted into the North Sea Hall of Fame at the Aberdeen Press and Journal Gold Award ceremony in 2015. The *Press and Journal* energy editor stated, "*Prof Kemp has witnessed the entire North Sea Oil saga so far. This extraordinary individual has played an important role influencing the course of that great story as a linchpin advisor to a succession of governments and petroleum companies*" [S1].

Professor Kemp and his team's research has attracted the interest of several organisations and led to invitations to speak at various events, including a presentation by Professor Kemp to a Work Group entitled "Prospects for Activity in the UKCS with Emphasis on Decommissioning" in May 2015 [S2]. Professor Kemp delivered a further presentation entitled "Economics of Decommissioning in Global Oil and Gas Sectors" to the world's leading decommissioning community at the TOTAL DECOM conference, at Manchester on 28<sup>th</sup> March, 2017 [S2]. The

annual conference series brings together policy makers, regulatory bodies, agencies, operating companies and Tier 1 and 2 suppliers, encouraging the cross-referencing of skills and innovations within the Nuclear, Oil and Gas, Renewables, Process and Defence industries.

Moreover, Professor Kemp's research findings have (1) informed practice within the financial management of the oil industry; (2) underpinned feasibility studies by both industry operators and regulators; and (3) informed UK Government strategy on carbon capture and storage.

### **(1) Establishing best practice through training for oil and gas professionals**

Professor Kemp and his team's research on financial security issues relating to decommissioning led to an invitation to give a presentation to the Chartered Institute of Management Accountants (CIMA) entitled "Economic, Financial Security and Tax Issues Relating to Decommissioning" in May 2018. This was followed by another invited presentation on the same subject to the Decom Offshore Conference in March 2018. As a result of his work on this aspect of the subject, Professor Kemp was awarded a research grant from the National Decommissioning Centre (NDC) in 2020 [P8] to pursue further work on the topic through a PhD training programme. This is now available as an Engineering Construction Industry Training Board-approved Continuing Professional Development (CPD) course, delivered by the NDC for delegates, including oil and gas professionals, engineers, managers, finance and procurement personnel and regulatory bodies wishing to develop their understanding of the issues and activities associated with offshore decommissioning. Professor Kemp produced the section on economics [S3]. In November 2020, Professor Kemp's expertise on taxation and decommissioning has been recognised by Oil & Gas UK (OGUK) who asked him in 2020 to explain associated complexities in a video production, scheduled for wide release in 2021 as part of wider a social media programme by OGUK to 'demystify' decommissioning [S4].

### **(2) Informing feasibility studies by industry and regulators in the UKCS**

Research by Professor Kemp and his team has demonstrated the cost advantages of developing a cluster of CO<sub>2</sub> capture and transportation developments utilising existing oil-related infrastructure. Use of the concept is currently being examined by a consortium of major companies including Pale Blue Dot/TOTAL/Shell, with feasibility studies being undertaken since 2019 [S5]. The team have also produced innovative comparative research on the effects and thus comparative costs and benefits of various instruments for procuring financial security for decommissioning. These include bank Letters of Credit, Surety Bonds and Trust Funds. This issue has attracted increasing attention from the Offshore Petroleum Regulator for Environment and Decommissioning (OPRED), the relevant section of the UK Department of Business, Energy and Industrial Strategy (BEIS) [S5, S6, S7].

### **(3) Informing UK Government strategy on CCS implementation**

The research undertaken by Professor Kemp and Dr Kasim on the economics of carbon capture and storage emphasised the benefits from reuse of oil-related assets, the concept of cluster developments and the need of Government policies to incorporate regulations and incentives for the whole chain of capture, transportation and storage. In August 2020, the Oil and Gas Authority (OGA) jointly with the Department for Business, Energy and Industrial Strategy (BEIS), The Crown Estate and the government regulator for gas and electricity markets in the UK (OFGEM) published a report entitled *UKCS Energy Integration: Final Report*. This report reflected the findings of Professor Kemp and colleagues, stating that "*the UKCS has enough CO<sub>2</sub> storage to fully support the UK needs and oil and gas infrastructure which can be reused*". The report also states that "*energy hubs, linked to existing and future onshore and net zero clusters can accelerate development and improve project economics*". The report further emphasises "*leveraging oil and gas assets and capabilities, essential for CCS*" and the need for "*enhancing regulatory coordination, to anticipate and address regulatory barriers and/or enablers for CCS*". The same report subsequently states that reuse of oil and gas infrastructure "*can give 20%-30% capex savings*" [S8, S10].

In 2020, BEIS published a report entitled *Carbon Capture, Uses and Storage, a Government response on Reuse of Oil and Gas Assets for Carbon Capture and Storage Project*. This

acknowledged the advantages of the reuse of oil and gas assets as modelled by Professor Kemp. In December 2020, BEIS also published a report entitled *Carbon Capture Uses and Storage: An Update on Business Models for Carbon Capture Uses and Storage*. This highlighted the issues involved in designing business models and incentives to investors in the context of the need to accommodate the linkages in the chain of capture, transportation and storage as emphasised by Professor Kemp and colleagues. In December 2020, the OGA published *Response to the Consultation on Proposals to Revise the MER UK Strategy* in response to the need to accommodate the Net Zero Emission targets. The Response incorporated all the proposals suggested by Professor Kemp in his Memorandum submitted to the Consultation in July 2020 [S9i, ii, iii].

**5. Sources to corroborate the impact** (indicative maximum of 10 references)

- [S1] Press and Journal article (June, 2015) <https://bit.ly/2OCxwQ4>
- [S2] Oil and Gas Authority, UKCS Energy Integration, Final Report, August 2020
- [S3] ECITB-approved CPD course at the University of Aberdeen
- [S4] OGUK video informed by A Kemp, <https://vimeo.com/500854192/441197861f> (general release, 2021)
- [S5] Feasibility studies undertaken by Pale Blue Dot (2019)
- [S6] Testimonial from Head of Industry and Member Network, OGTC
- [S7] BEIS uptake of research evidenced by Decommissioning Guidance Notes
- [S8] UKCS Energy Integration Final Report, 2020 (<https://bit.ly/3c8NeeW>)
- [S9] (i) OGA Consultation, (ii) Memorandum and (iii) final report
- [S10] Testimonial statement from CEO of OGA