



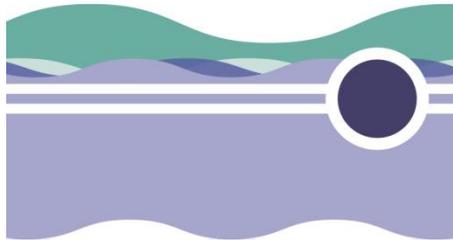
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MARKET STUDY ON BULK SHIPPING OPPORTUNITIES

March 2014

Final report

LO·PINOD
LOGISTICS OPTIMISATION FOR PORTS



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Programme



*Investing in the future by working together
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Contents

Contents	2
List of figures	4
List of tables.....	5
Executive summary.....	6
1 Introduction.....	6
1. Introduction.....	10
2. Characteristics of the bulk shipping market.....	12
3. The existing bulk freight market in Scotland.....	14
3.1 The role of bulk cargo in UK port traffic.....	14
3.2 Bulk freight flows – domestic traffic	17
3.3 Bulk freight flows – international shipping	20
4. Close analysis of major bulk commodities in Scotland	24
4.1 Liquid bulk.....	24
4.1.1 Crude Oil & NGLs.....	24
4.1.2 Refined oil products.....	26
4.2 Dry bulk	28
4.2.1 Aggregates	28
4.2.2 Coal.....	32
4.3 Forestry products	34
5. Major Scottish ports involved in bulk freight shipping	38
5.1 Forth.....	38
5.2 Clyde.....	40
5.3 Glensanda.....	41
5.4 Sullom Voe	42
5.5 Cromarty Firth	44
5.6 Aberdeen.....	46
6. Smaller Scottish ports involved in bulk freight shipping.....	49
7. Vessel provision and operators	51
7.1 Overview of Scottish bulk shipping supply	51
7.2 Insights into the shipping market.....	52
7.2.1 Vessel supply in different commodity markets	53
7.2.2 Vessel size.....	56
7.2.3 Ship age.....	57
7.3 Impacts of emission control	58
8. Conclusions and recommendations for action	60

References:.....64

List of figures

Figure 1. Types of bulk and non-bulk cargo	12
Figure 2. UK port freight traffic by cargo type 2011	14
Figure 3. Map of Scotland showing ports and airports by cargo volume	16
Figure 4. Scotland Major Port Freight Traffic by cargo type 2011	17
Figure 5. Domestic bulk freight traffic at Scottish ports	19
Figure 6. Domestic bulk freight at Scottish ports by commodity, inbound and outbound*	19
Figure 7: Crude oil production in the UK	24
Figure 8: NGLs production in the UK	25
Figure 9: UK and Scottish exports of refined petroleum products	27
Figure 10: Imports of refined petroleum products	28
Figure 11: Regional distribution of Scottish natural aggregates production, 2011	29
Figure 12: UK coal supply, 2002 – 2012	32
Figure 13: Delivery of UK grown softwood, 2012	36
Figure 14: UK forestry products imports and exports, 2012	36
Figure 15. Map showing the Scottish ports operated by Forth Ports	38
Figure 16. Bulk freight by commodity in the Forth	39
Figure 17. Map showing Scottish ports operated by Peel Ports	40
Figure 18. Bulk freight by commodity at Clyde ports	41
Figure 19. Map showing location of Glensanda port	42
Figure 20. Map showing location of Sullom Voe	43
Figure 21. Map showing location of the port of Ivergordon on the Cromarty Firth	44
Figure 22. Map showing location of the port of Aberdeen	47
Figure 23: Freight vessel calling number at Scottish ports by vessel type	53
Figure 24: Average size (DWT) of different vessel type calling at Scottish ports	56
Figure 25: Average age of ships call at Scottish ports	58
Figure 26: The Sulphur Emission Control Area (SECA)	59

List of tables

Table 1. UK port freight traffic by cargo type 2011	14
Table 2. Scottish waterborne freight traffic 2011	15
Table 3. Major bulk freight routes in Scotland by commodity.....	18
Table 4. International bulk freight flows through Scottish ports.....	20
Table 5: International movement of liquid bulk through Scottish ports.....	22
Table 6: International movement of dry bulk flows through Scottish ports.....	23
Table 7: International trade of crude oil and NGLs in Scotland.....	26
Table 8: Scotland production of aggregates.....	29
Table 9. Sale of Scottish aggregates production in 2005.....	31
Table 10: UK coal imports in 2011.....	33
Table 11: Area of woodland 2013	34
Table 12: Scotland wood production	35
Table 13. Bulk cargo flows at Sullom Voe (2011)	43
Table 14. Bulk cargo flows at Cromarty Firth (2011)	46
Table 15. Bulk cargo flows at the port of Aberdeen 2011	47
Table 16. Total tonnage at Scottish ports, 2012.....	49
Table 17: Bulk ship arrival at Scottish ports, 2012.....	51
Table 18: Oil products tanker fleet by James Fisher.....	54
Table 19: Cement fleet used in Scotland	55
Table 20. Details of dry bulk vessels calling at Scottish ports over the sample period.....	55

Executive summary

1. Introduction

This study focus on both the most well-known liquid bulk commodity flows through Scottish ports and the large diversity of dry bulk and general cargos not revealed in public statistics including timber, grain, paper, agricultural products, fertilizers, road salt and scrap metal. They were explored through desktop research and industry interviews, and represent perhaps the largest area of opportunity for European partner involvement.

2. Bulk freight market in Scotland

Scotland accounts for about 9 per cent of the UK population and contributes about the same proportion of UK GDP. However, the actual freight traffic through Scottish ports by tonnage is disproportionately high, about 15 per cent of the UK total. This is to a large degree because of liquid bulk traffic due to North Sea oil, although dry bulk and general cargo are also high. For example, traffic data revealed by the DfT (2012) show that more than 85 per cent of Scottish port throughput was contributed by bulk freight movements.

Liquid bulk cargoes play a key role in Scotland's economy as well as its freight shipping market. Movements of liquid bulk cargoes achieved more than 47 million tonnes in 2011, almost two-thirds of total Scottish waterborne freight traffic that year. The majority of this figure was contributed by crude oil, while natural gas liquid and other oil products only accounted for about 12 million. In the bulk sector, coal and ore hold the most significant proportion, followed by aggregates, agricultural and forestry products.

Scottish bulk freight transportation shows an imbalanced structure between domestic and international movements. The latter accounts for more than twice the former in terms of traffic volume. Crude oil within the liquid bulk category and coal from the dry are the dominant contributors in regards to both types of movement. In addition, Scotland also imported more the two and a half million tonnes of crude oil from Norway and Nigeria in 2011. Traffic volumes of Natural Gas Liquids (NGLs) and oil refinery products are not as significant as crude oil, but all exhibit a common feature of higher loading ratio and are mainly moved to and from continental and Scandinavian countries including Netherlands, Germany, Belgium, France and Sweden. Coal imports hold the most significant proportion

and arrive mainly from Colombia, Russia and the United States. Inbound ore comes primarily from Morocco and Greece, while outbound goes almost entirely to Spain. Agricultural products come inbound primarily from France and Brazil, and outbound to the Netherlands. Other dry bulk flows are more mixed, although outbound are solely to European countries while inbound include European countries as well as South American and North African countries. Forestry products are a smaller category but nevertheless remain quite relevant to Scotland. All significant flows in both directions are in Europe, particularly Scandinavia.

3. Port handling and shipping capacity supply

Forth ports and port Clyde are the two busiest ports in Scotland, followed by Aberdeen and others. Geographical distribution of bulk freight traffic, both domestic and international, is mainly concentrated on the east coast, where Forth Grangemouth, Sullom Voe, Aberdeen, Cromarty Firth and Orkney handle large amount of liquid bulk. On the west coast, Clyde and Glensanda are the dominant ports due to the large coal import terminal at Hunterston and a 9 million tonne granite aggregates quarry, respectively. Bulk traffic between Scotland and Northern Ireland is mainly completed through Cairnryan and Stranraer by RoRo services.

In addition to the above major ports, it is also relevant in the Scottish context to examine the role of smaller ports, many of which are moving smaller quantities of neo-bulk commodities like timber and construction products. For example, Montrose handles a diverse range of cargo, including the majority of pulp products imported into Scotland, as well as paper, forest products, aggregates, grain, scrap metal, animal feed, malting barley, fertiliser and oil products. Peterhead is primarily a fish port but also serves the offshore oil and gas industry and some timber and agricultural products. Dundee moves over 250,000 tonnes of agricultural products per year. Inverness handles a variety of general cargo, with the major cargo being fuel imports. Imports include packaged timber from Scandinavia and the Baltic, round logs from the west of Scotland, road salt, coal and grain from the continent, and animal feed and fish oil. The main exported general cargo is sterling board (mostly to Belgium and the Netherlands), while the rest are primarily agricultural and industrial products, such as potatoes, salmon smolts, machinery, barley, rapeseed, pulpwood, fish waste and woodchips.

Small and specialised vessels with frequent calls is the dominant feature of Scottish bulk freight shipping capacity supply. According to the data revealed by DfT (2013), dry bulk and

general cargo vessels contributed the majority of the total vessel calls at Scottish ports, and more than 80 per cent of them were under 5,000 dwt. Calls by large vessels are highly related to the specific trade commodities and port facilities. For instance, looking at the vessels over 100,000 dwt, these were the dry cargo vessel calls made at Clyde ports for coal delivery, and tankers on the east coast for crude oil loading and discharging.

The type and size of vessel demand are mainly determined by the features of commodity, trade volume, length of route and value of product. However, it does not necessarily mean that the market opportunity to develop more bulk handling business at regional ports is limited by this. In contrast, the recovering economy and changes in the structure of bulk trade bring more opportunities to smaller ports. For example, the port of Inverness is expanding its port activities due to the shift of its primary trade commodity from liquid bulk to more diverse dry bulk cargoes.

4. Conclusions

The key findings were the continuing importance of traditional cargoes, both importing and exporting. The future for the oil trade remains positive, as new fields are coming online and more difficult fields are becoming economically viable now that prices are rising. The volume of coal imports will continue to grow due to a decreasing tendency of Scottish production over the last ten years. Timber has been a relatively stable commodity for the last few decades and is expected to remain so, or at least any changes should be predictable through consultation with industry associations such as the Timber Transport Forum.

Renewable fuels related business, both importing and exporting, emerged as a new sector in bulk shipping. For example, a plan of the largest biomass power plant near Grangemouth, about 120 MW for both heat and power purpose (CHP), has been approved by the Scottish government and is expected to be put in operation in 2017. Similar business plans already exist in the port of Oostende. However, this new trend is highly tied by a large degree to political decisions which may change in the future (e.g. waste and biomass).

Unlike unitised cargo, bulk cargo is tied much more to the economy of the region, being based on specific local resources (exports) or local businesses with specific input requirements, such as coal or barley (imports). This means that, while on the whole such

flows tend to be fairly stable, they can also be cut drastically if a business closes down or relocates. On a positive note, it means that action by public authorities to attract a particular business to an area can result in a large sudden demand for specific commodities. It also means that SECA restrictions are less of a problem as, unlike the container market, bulk flows are more tied to specific locations and will continue to use the closest ports to those locations.

1. Introduction

SEStran is the Statutory Regional Transport Partnership for South East Scotland. SEStran was established under the Transport Scotland Act (2005) as the strategic transport planning authority for an area covering the eight local authorities of Borders, East Lothian, West Lothian, Midlothian, Edinburgh, Fife, Falkirk and Clackmannanshire. SEStran aims to develop a sustainable transportation system for SE Scotland that will enable business to function effectively, and provide everyone living in the region with improved access to healthcare, education, public services and employment opportunities. The development of SEStran's Regional Transport Strategy (RTS) was an historic opportunity to plan for the transport needs of 1.5 million people, living in Scotland's most economically vibrant region. It is a blueprint for transport development in South East Scotland that will form the core of our work for the next 15 years.

SEStran is working with local authority partners to make the objectives of the RTS a reality in South East Scotland. However, in this time of fiscal retrenchment they are also seeking additional sources of funding to enable them to carry forward major transport initiatives. So far, SEStran has been successful in bidding for EU match funding to roll out a range of projects that will contribute towards the goal of building a sustainable transportation system for the region.

One such project is LO-PINOD (Logistics Optimisation for Ports Intermodality: Networks, Opportunities, Developments). The LO-PINOD project was created to facilitate co-operation amongst regional ports leading to a sharing of best practice, enhancement of multi-modal capabilities, increase in throughput, delivery of new and innovative services and a more prominent role within the local community. This project will improve accessibility to more isolated regions, lessen the environmental impact of freight transport and spread growth and opportunity more evenly around the North Sea Region. Project partners include a range of ports, local community authorities and other relevant organisations in each of the North Sea Region countries of Belgium, Denmark, Germany Netherlands, Norway, Sweden and the UK.

The project itself focuses on four main areas:

1. Improving multi-modal landside links: Optimising road, rail and inland shipping links to regional ports. Co-ordinating and enhancing associated national policies and investment programmes.
2. Developing regional ports: Creating efficient and diversified trans-shipment nodes through joint initiatives and knowledge sharing. This includes benchmarking and implementing best practice as well as developing new markets and business opportunities.
3. Enhancing access by sea: Developing maritime connections with the main hub ports.
4. Improving linkages with towns: Allowing the port to take a more prominent place in the local community.

A need was identified among project partners to analyse the bulk shipping market as an opportunity of particular relevance for regional ports. SEStran has commissioned the Transport Research Institute at Edinburgh Napier University to carry out this piece of research. The work is initially based on bulk shipping in Scotland (and the wider UK), but once the report is finalised the results will be shared with project partners. Sharing the results will be beneficial in two ways. First, as an exemplar of issues faced by several partners and an analysis of best practice in resolving them, which can then be applied in other contexts. Second, as a source of information for potential business development between Scotland and partner regions.

The report is based on both desktop study and interviews with industry experts. The report will begin with an overview of the characteristics of the bulk and general cargo shipping markets and then analyse the existing bulk freight market in Scotland, including domestic and international flows. Section four provides a detailed analysis of the major bulk commodities in Scotland, before a section focusing on individual Scottish ports. The next major input is to analyse vessel provision in the sector. The key findings from these sections can then be brought together to draw conclusions on future opportunities, along with recommendations for future action.

2. Characteristics of the bulk shipping market

For the purposes of this analysis, a division has been made between general (packed) and bulk (unpacked) cargos (see Figure 1). While the initial brief of the study was to examine the bulk market, it was quickly realised that in Scotland neo bulk commodities, especially timber products, are vital to the economy and especially important to smaller regional ports. The decision was therefore taken to include analysis of this commodity in the report.

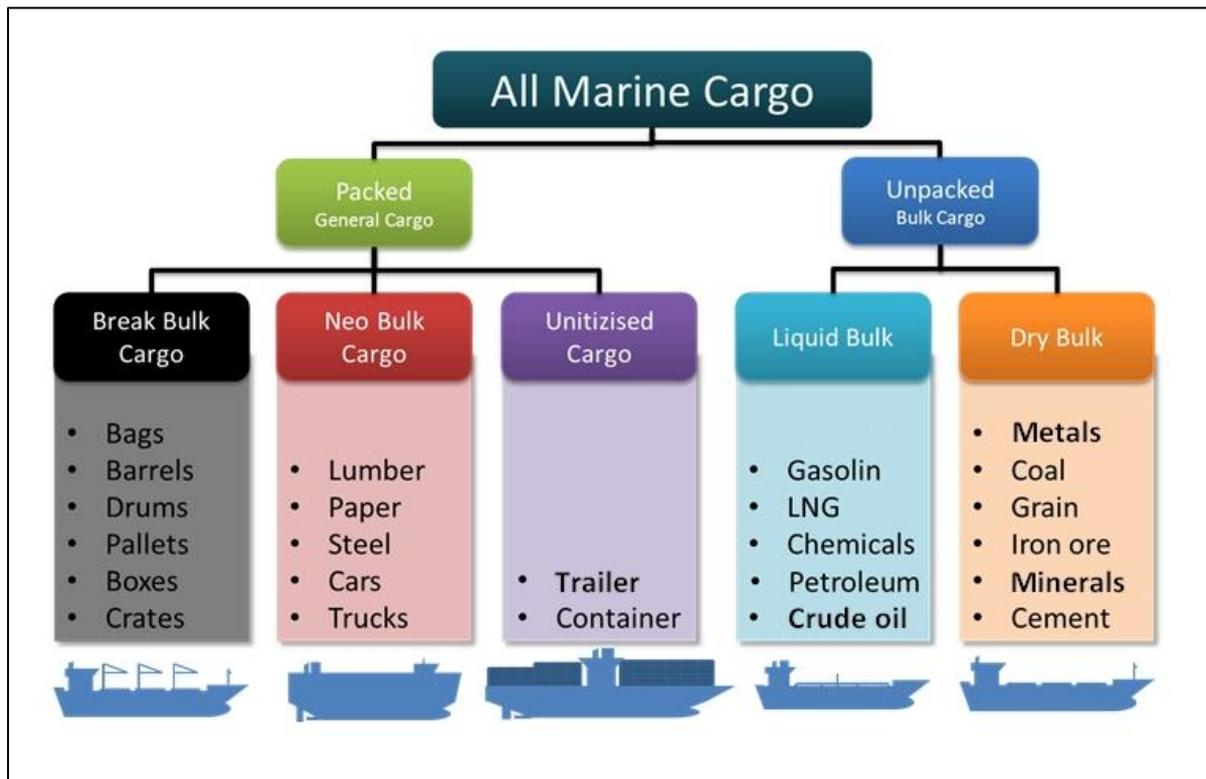


Figure 1. Types of bulk and non-bulk cargo

Source: www.shipipedia.com

Bulk cargo is commodity cargo that is transported unpackaged in large quantities. Specialised vessels are designed to transport them and such ships will only transport that one commodity. The physical characteristics of bulk commodities are such that they can be handled in volume easily, albeit with the use of specialised loading and unloading equipment. Ports have specialised terminals with automated equipment to fill cargo holds with bulk commodities such as crude oil or grain. The large quantities and low time sensitivity means that for transport to and from the port bulk commodities are well-suited to rail transport. There is often no “last mile”, because a railhead will be built at the mine, quarry, etc. at one end and in the port terminal at the other. Unlike container shipping, therefore, the structure of the bulk shipping market is able to generate economies of scale not just on the sea leg but throughout

the entire transport system. Neo-bulk commodities are those such as lumber or steel that can be transported loose or packed in bags or on pallets. Such products are often carried in smaller general-purpose vessels that can change cargo types, unlike the large specialised bulk vessels that transport vast quantities of liquid and dry bulk across the globe. This report will include consideration of these commodities also because they are of high importance for Scotland.

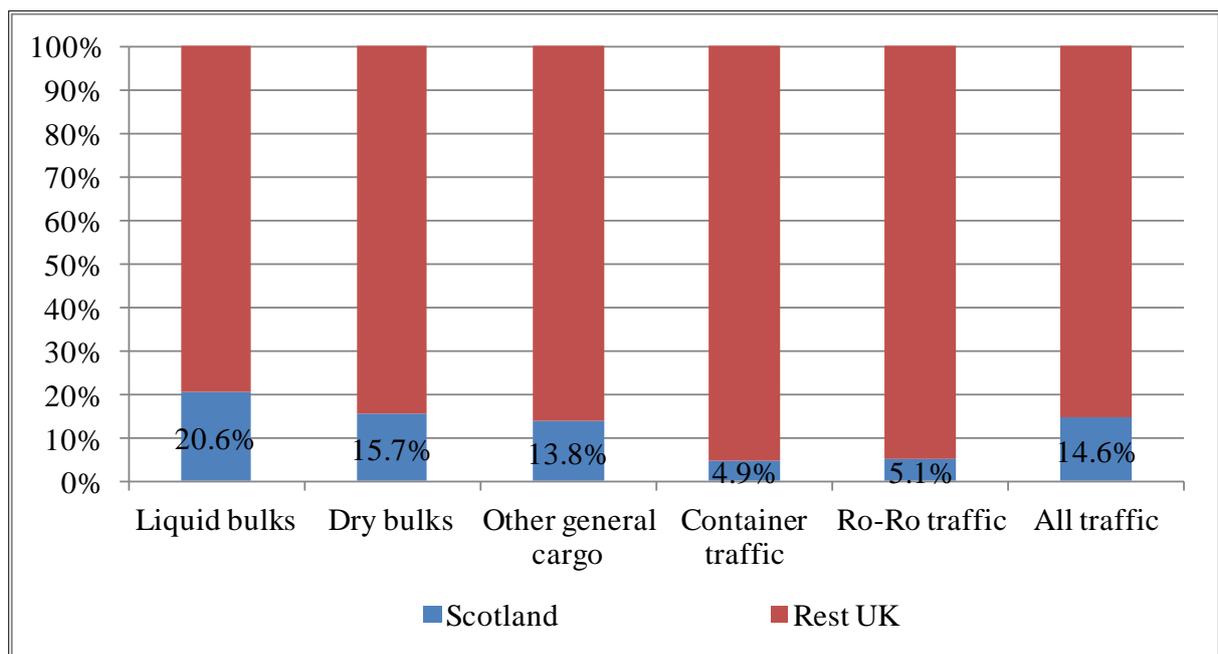
Scotland is famous for its oil and gas business, which constitutes the vast majority of bulk commodity flows through Scottish ports. Coal imports at Hunterston and aggregate exports from Glensanda in the western isles are also significant flows. What is of more interest for this study and is not revealed in public statistics is the diversity of dry bulk and general cargo moved through Scottish ports, such as timber, grain, paper, agricultural products, fertilizers, road salt and scrap metal. These were explored in the industry interviews and represent perhaps the largest area of opportunity for European partner involvement.

3. The existing bulk freight market in Scotland

3.1 The role of bulk cargo in UK port traffic

Figure 2 and Table 1 show the composition of Scottish port traffic relative to the UK, for each category of cargo.

Figure 2. UK port freight traffic by cargo type 2011



Source: authors, based on DfT (2012)

Table 1. UK port freight traffic by cargo type 2011
(thousand tonnes)

	Liquid bulk	Dry bulk	Other general cargo	Container traffic	Ro-Ro traffic	All traffic
Scotland	47,408	16,254	2,488	2,843	4,959	73,957
UK Total	230,558	103,408	18,017	57,703	97,309	506,996

Source: DfT (2012)

As Scotland has around 9% of UK population and contributes around 9% of UK GDP, the data reveal that a total of 14.6% of traffic by tonnes is disproportionately high for Scotland. This is to a large degree because of liquid bulk traffic due to North Sea oil, although dry bulk and general cargo are also high. Unitised traffic is far below what would be expected of

Scotland, and even lower once the majority of the RoRo traffic is removed, which is mostly transit movements on the RoRo link with Northern Ireland moving through England to access the European continent. Container traffic would be expected to be higher, except that due to Scotland's small size relative to the UK, container movements mostly come through the large south eastern UK ports and then through distribution centres in the Midlands, meaning that the majority of Scotland's unitised traffic moves overland in road trailers rather than directly through Scottish ports.

Table 2 shows Scottish traffic only.

Table 2. Scottish waterborne freight traffic 2011
(thousand tonnes)

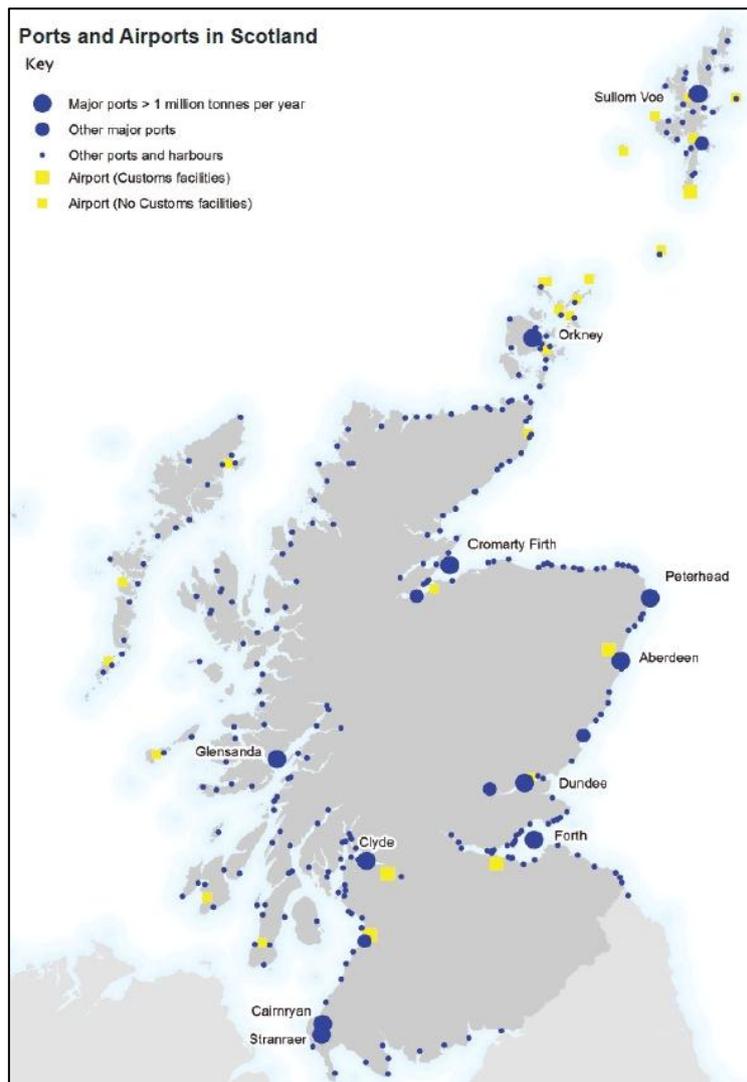
Cargos	Foreign		Foreign Total	Domestic		Domestic Total	Total
	Import	Export		Inward	Outward		
Crude Oil	3,323	20,451	23,774	2,629	8,801	11,430	35,202
Other Liquid Bulk	2,637	4,660	7,297	1,771	3,137	4,908	12,206
Dry Bulk	6,689	5,870	12,559	883	2,813	3,696	16,254
Containers	590	1,627	2,217	193	433	626	2,843
Ro-Ro	415	238	653	2,083	2,225	4,308	4,959
Other General Cargo	560	513	1,073	445	971	1,416	2,488
Total	14,216	33,358	47,574	7,999	18,378	26,377	73,957

Source: DfT (2012)

The table reveals that, out of a total of almost 74 million tonnes of bulk traffic in 2011, crude oil took by far the largest share, accounting for over half of the total (liquid and dry) bulk market. Obviously, it is mostly export cargo. Other liquid bulk shows double the amount of export by weight than import, while inbound and outbound flows of dry bulk traffic are more balanced.

The next step is to consider individual ports (see Figure 3).

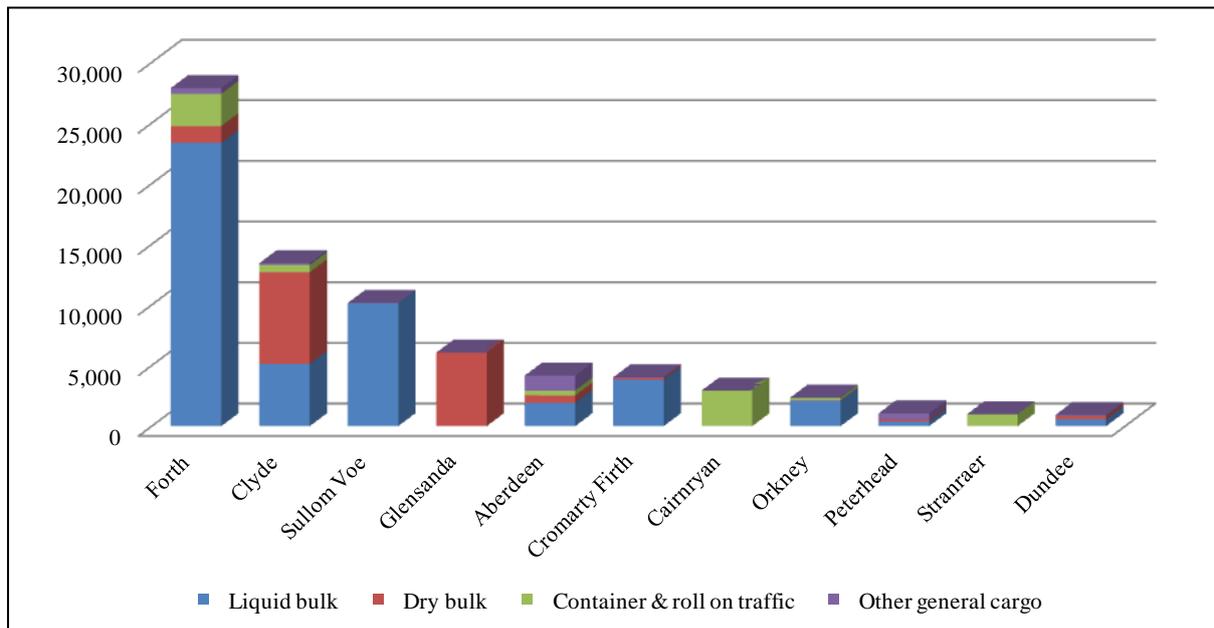
Figure 3. Map of Scotland showing ports and airports by cargo volume



Source: Scottish Government (2013a)

Figure 3 shows the major container ports Forth Grangemouth and Clydeport Greenock, and RoRo ports Cairnryan and Stranraer. The other ports (Glensanda, Dundee, Aberdeen, Peterhead, Cromarty Firth, Orkney and Sullom Voe) handle more bulk and general cargo. Figure 4 looks at these ports by traffic type to identify the leading bulk ports.

Figure 4. Scotland Major Port Freight Traffic by cargo type 2011
(thousand tonnes)



Source: DfT (2012)

Figure 4 shows that, besides the unitised ports already identified, general cargo is a major traffic type at Aberdeen, Peterhead and Dundee. Liquid bulk from the petroleum industry is understandably dominant at Forth Grangemouth, Sullom Voe, Aberdeen, Cromarty Firth, and Orkney. Dry bulk is concentrated at Clyde (due to the large coal import terminal at Hunterston) and Glensanda.

3.2 Bulk freight flows – domestic traffic

Table 3 lists the major bulk traffic routes between Scottish ports and UK ports, by commodity group. The most significant feature is that total tonnages discharged and loaded in Scottish ports exhibit a significantly imbalanced structure. The former was almost 5 million tonnes in 2011, while the latter was more than three times higher. As shown in the table, it is mainly due to the large export volumes of crude oil and oil refinery products to the rest of UK.

What this table also reveals is that domestic liquid bulk traffic departing east coast Scottish ports travels mostly to Lancashire and Cumbria. Coal is loaded at west coast ports and shipped to Lancashire and Cumbria, being foreign coal imported to Hunterston and then shipped south to power stations in England. Movements of other bulk traffic between

Northern Ireland and Scotland, mainly through Calmryan and Stranraer, are quite significant on the west coast side.

Table 3 shows the major domestic bulk freight routes in Scotland by commodity

Table 3. Major bulk freight routes in Scotland by commodity
(thousand tonnes)

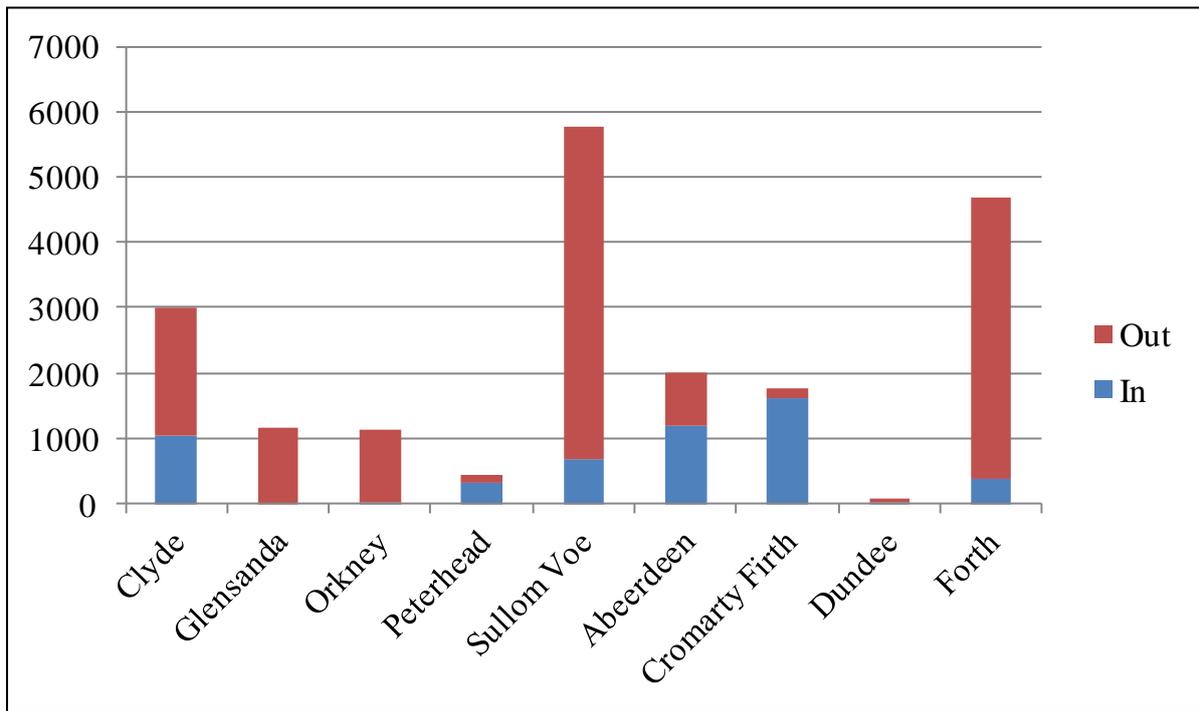
Cargo	Route	Loading	Discharging
Liquid Bulk	Scotland West Coast	595.53	387.31
	Scotland East Coast	10,520.34	1,671.95
	<i>of which:</i>		
	<i>to Thames and Kent</i>	<i>1,285.70</i>	
	<i>to Sussex and Hampshire</i>	<i>1,412.02</i>	
	<i>to West and North Wales</i>	<i>1,713.03</i>	
	<i>to Lancashire and Cumbria</i>	<i>4,506.75</i>	
Coal	Scotland West Coast	667.03	-
	<i>of which:</i>		
	<i>to Lancashire and Cumbria</i>	<i>660.97</i>	
	Scotland East Coast	-	81.97
Other Coastwise Traffic	Scotland West Coast	3,657.01	2,714.85
	<i>of which:</i>		
	<i>to Thames and Kent</i>	<i>814.03</i>	
	<i>to Northern Ireland</i>	<i>2,205.31</i>	
	Scotland East Coast	875.67	1,114.00

Source: DfT(2012)

The next step is to identify the major Scottish ports involved in bulk shipping. Figure 5 shows inbound and outbound domestic bulk freight by tonnage at Scottish ports. The figure shows that the vast majority of domestic bulk flows through Scottish ports are outbound. This is primarily because of oil exports as well as coal being moved from Clyde Hunterston to English ports.

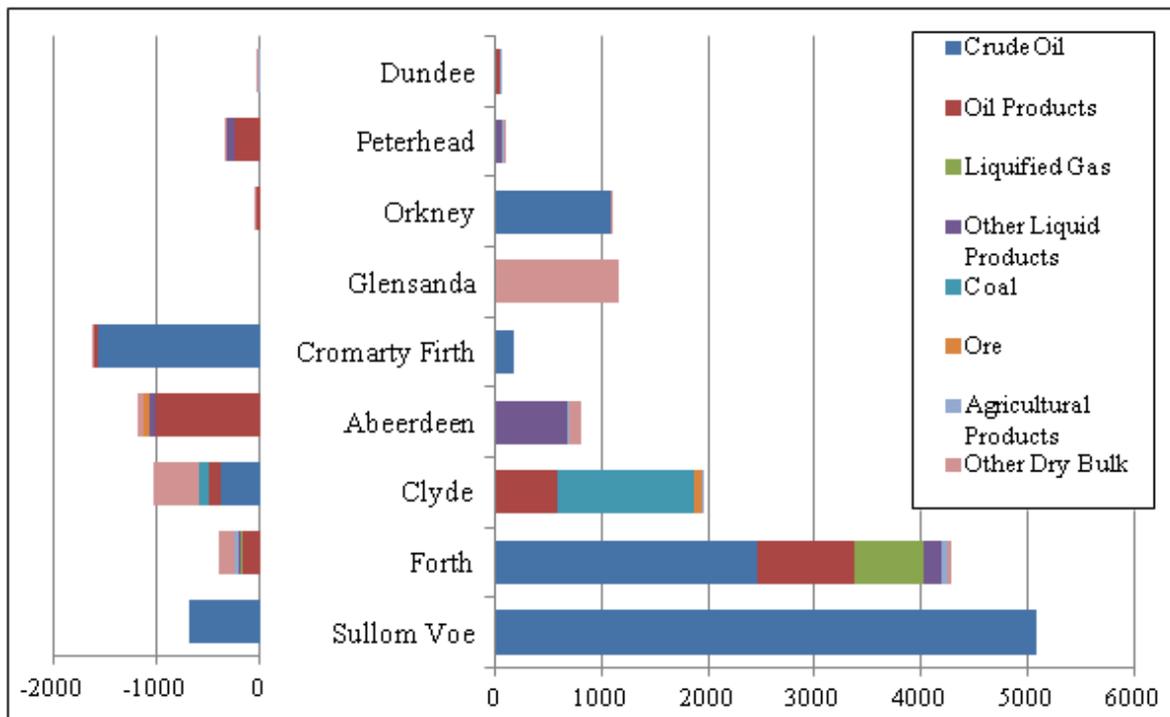
Figure 6 breaks these tonnages down by commodity.

Figure 5. Domestic bulk freight traffic at Scottish ports
(thousand tonnes)



Source: DfT (2012)

Figure 6. Domestic bulk freight at Scottish ports by commodity, inbound and outbound*
(thousand tonnes)



Note *: inbound flow indicated by the left bars, while outbound represented by the right one.

Source: DfT (2012)

These data are useful for identifying domestic flows but the quantities are significantly smaller than the international movements, which are therefore of more interest to this study. These will be considered in the next section.

3.3 Bulk freight flows – international shipping

International bulk freight flows through Scottish ports are depicted in Table 4.

Table 4. International bulk freight flows through Scottish ports
(thousand tonnes)

Bulk Cargo	Entering	Leaving	Total
Crude Oil	3,322	20,451	23,773
Other Dry Bulk	681	5,105	5,786
Oil Products	2,238	3,145	5,383
Coal	5,337	18	5,355
Liquefied Gas	86	1,331	1,417
Ore	219	520	740
Agricultural Products	452	226	679
Other Liquid Products	315	183	498
Forestry Products ¹	214	76	290
Total	12,864	31,057	43,921

Source: DfT (2012)

The data show the oil exports on the east coast and coal imports on the west coast. Other dry bulk is the other significant commodity, but smaller commodity flows such as agricultural and ore must be considered. Barley imports and exports fluctuate according to market conditions. In some years it is imported for whisky production (including imports from England). But it is also exported from Scotland too. It depends on whether they get a better price overseas or from Scottish whisky producers. The port of Aberdeen, for example, used to export malted barley but it is currently being used by whisky producers in Scotland, so the barley they export is for animal feed. Other commodities like scrap metal are important to

¹ Forestry products and other general bulk cargo are included in this report due to their significance to Scottish maritime shipping.

regional ports. It is produced both from oil sector pipes as well as other sources like scrap cars, then processed into a suitable form for exporting to manufacturers who require it.

The next step is to identify Scotland's main trading partners in bulk shipping, broken down by each commodity. These are presented in the following Table 5 and Table 6. A few interesting findings are raised from an analysis of the preceding tables related to different bulk commodities. Looking at liquid bulks, crude oil dominated the exported volume and achieved more than 20 million tonnes in 2011. Netherlands was the top destination due to its significant demand for re-export business, followed by Germany, USA and France. Meanwhile, Scotland also imported more the two and a half million tonnes of crude oil from Norway and Nigeria. Traffic volumes of Natural Gas Liquids (NGLs) and oil refinery products are not as significant as crude oil, but all exhibit a common feature of higher loading ratio and mainly moved to and from continental and Scandinavian countries including Netherlands, Germany, Belgium, France and Sweden.

In the dry bulk sector, coal imports hold the most significant proportion and arrive mainly from Colombia, Russia and the United States. Inbound ore comes primarily from Morocco and Greece, while outbound goes almost entirely to Spain. Agricultural products come inbound primarily from France and Brazil, and outbound to the Netherlands. Other dry bulk flows are more mixed, although outbound are solely to European countries while inbound include European countries as well as South American and North African countries. Forestry products are a smaller category but nevertheless remain quite relevant to Scotland. All significant flows in both directions are in Europe, particularly Scandinavia.

Table 5: International movement of liquid bulk through Scottish ports
(thousand tonnes)

Trading Countries	Crude Oil		NGLs		Oil Products		Other Liquid products	
	Entering	Leaving	Entering	Leaving	Entering	Leaving	Entering	Leaving
Algeria	97.4						2.1	
Argentina						9.4		
Belgium		654.5		449.9	57.6	357.0	12.0	60.1
Canada		546.2				51.0		
Chile		461.7						
Denmark		465.0			495.9	346.8	29.0	7.0
Egypt						8.0	11.9	
Estonia					12.1			
Finland						31.8	2.3	
France		1,538.8	1.2	259.4	67.7	240.2	2.0	
Germany		4,730.6		77.6	6.5	249.6	25.8	
Gibraltar		97.5						
Iceland							2.5	
Irish Republic					23.3	18.2		
Italy		708.7						
Latvia					95.0			
Morocco				43.0				
Netherlands		6,617.9	69.8	325.8	462.2	1,325.3	64.3	79.9
New Zealand					8.7	10.1		
Nigeria	1,193.3				172.4			
Norway	1,454.7	185.7	11.1	31.0	99.6	77.7	146.9	13.2
Poland		468.1			2.7		4.3	
Portugal						13.1		
Russia	51.5				68.7	6.7		
South Africa						59.0		
South Korea		372.2						
Spain		190.9			26.4			
Sri Lanka							1.6	
Sweden	195.2	298.3		144.3	639.3	301.6	10.3	
USA		2,960.0	4.1			39.7		10.7
Venezuela	329.9							
Total	3,322.0	20,451.0	86.1	1,330.9	2,237.9	3,145.2	315.0	170.8

Source: DFT (2012)

Table 6: International movement of dry bulk flows through Scottish ports
(thousand tonnes)

Trading Countries	Coal		Ore		Agricultural Products		Other Dry Bulk Cargos	
	Entering	Leaving	Entering	Leaving	Entering	Leaving	Entering	Leaving
Argentina					29.0			
Belgium					13.6	25.1	22.6	229.6
Brazil					105.6			
Bulgaria							3.0	
Chile							68.4	
Colombia	2,074.3							
Denmark		2.8				2.8	5.3	42.2
Egypt				20.7			59.5	
Finland			12.0		9.8		7.5	
France				56.2	129.6	3.8	4.2	230.2
Germany					30.5	27.7	68.4	1,603.2
Greece			93.9				2.1	
Iceland							2.9	
Irish Republic						32.6		
Italy								3.5
Latvia	143.8					7.7	4.1	
Lithuania							1.5	
Morocco			108.9				23.0	
Netherlands	45.0			10.8	57.5	63.0	92.7	1,732.9
Norway		15.4	4.5				117.1	2.4
Peru							47.7	
Poland	7.1				2.2	15.9	11.5	1,250.6
Portugal				53.7		7.7		
Russia	2,028.7							
Spain	8.7			379.0	3.3	40.0	62.5	4.2
Sweden					17.1			6.5
Tunisia							32.3	
Turkey							44.8	
Ukraine					34.7			
USA	1,029.2				19.7			
Total	5,336.6	18.2	219.4	520.4	452.4	226.4	681.1	5,105.2

Source: DfT (2012)

4. Close analysis of major bulk commodities in Scotland

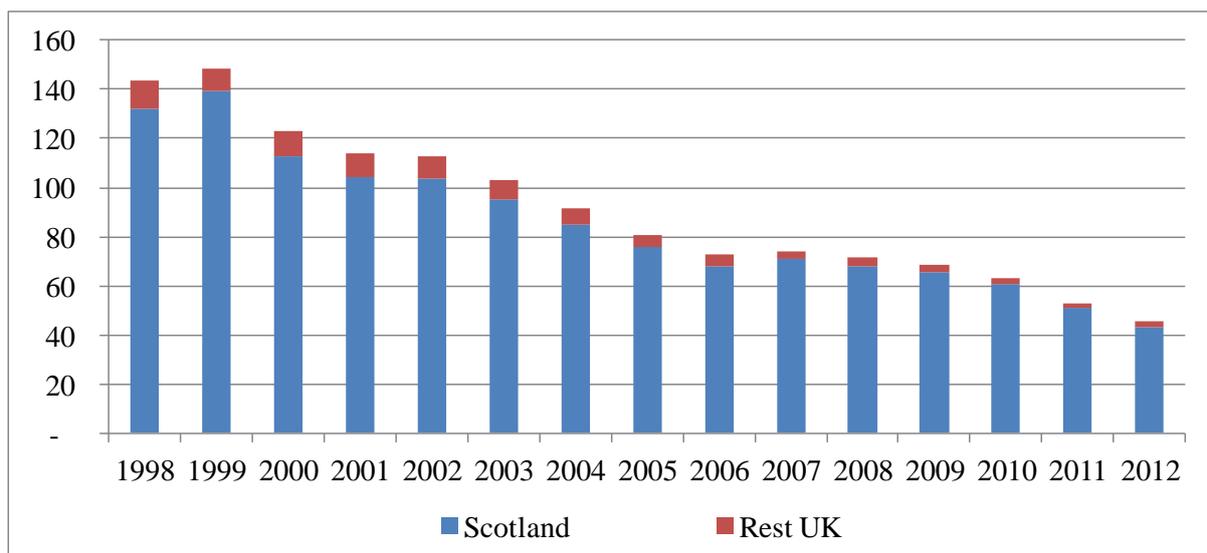
4.1 Liquid bulk

4.1.1 Crude Oil & NGLs

Extraction of crude oil and natural gas liquids (NGLs) plays a key role in Scotland's economy. Total production in this sector contributed £19.2 billion in 2012, equivalent to 13% of total Scottish GDP in that year. Meanwhile, according to the economic report of Oil and Gas UK (2013), approximately 450,000 jobs are supported by the industry across the UK as a whole, of which around half are based in Scotland.

Figure 7 shows the historical data of crude oil production in Scotland and the UK as a whole. Despite the continuous decrease of UK crude oil production, the proportion of Scottish contribution has increased slightly over time. In 2012, Scotland is estimated to have produced 43.3 million TOE of crude oil, which is about 95% of total UK production.

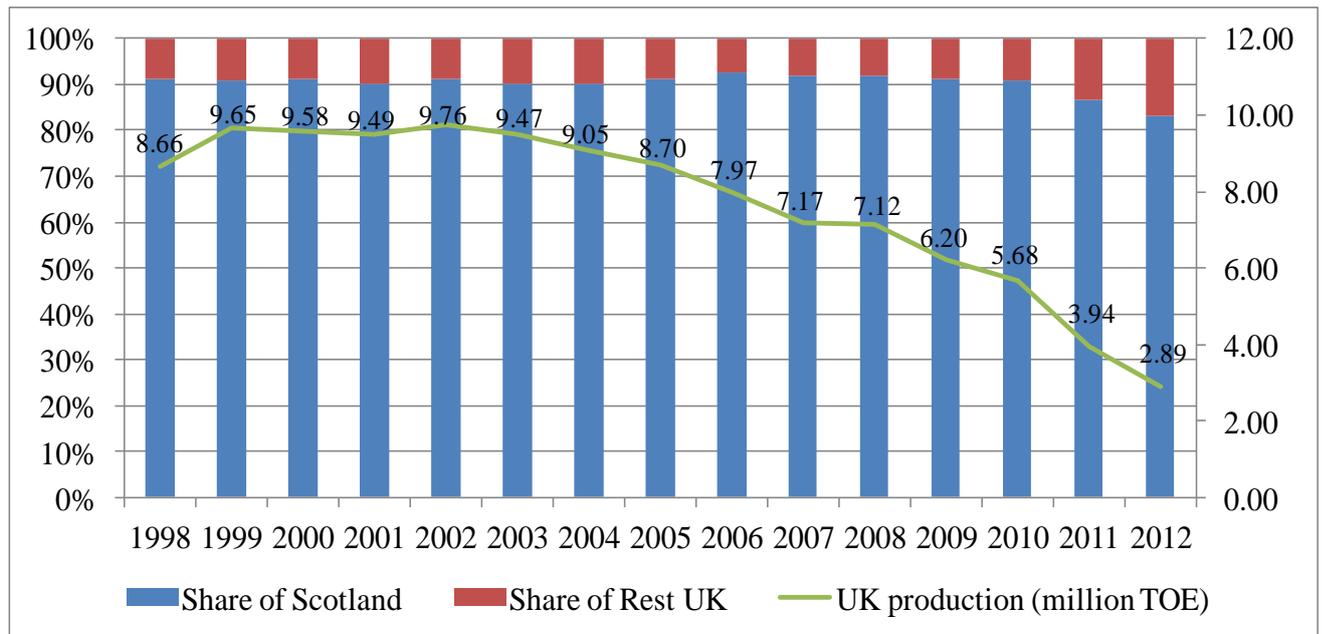
Figure 7: Crude oil production in the UK
(million TOE)



Source: Scottish Government (2013b)

Compared to the volume of crude oil production, NGLs is not that significant but still followed a similar downward trend over the same period. As shown in Figure 8, it dropped from its peak of 9.65 million in 1999 to only 2.89 million TOEs in 2012.

Figure 8: NGLs production in the UK
(million TOE)



Source: Scottish Government (2013b)

Again this production is dominated by Scotland. For example, in 2012, there were 2.4 million TOEs of NGLs produced in Scotland out of the 2.89 million UK total.

Scotland is both an importer and exporter of crude oil and NGLs products, even though the scale of imports is far less than exports. For instance, annual Scottish trade statistics of crude oil and NGLs from 1998 to 2012 are listed in Table 7. As pointed out, imports of crude oil and NGLs into Scotland have been quite stable over the last fifteen years, about 5.5 million TOEs in average per year from the international market. However, in the export sector, annual exports decreased at an average 8% rate from 125.6 million in 1998 to 39.7 million TOEs in 2012. In addition, the destination of exports is not as concentrated as the import origin – about 40% of produce stays in the UK domestic market while the remaining 60% are directed to the rest of the world.

Table 7: International trade of crude oil and NGLs in Scotland
(million TOE)

Year	Scotland Imports			Scotland Exports		
	Total	RUK	RoW	Total	RUK	RoW
1998	5.08	0.12	4.96	125.64	0	125.64
1999	4.67	0.11	4.56	131.74	56.3	75.44
2000	5.69	0.13	5.55	120.76	44.39	76.37
2001	8.91	0.1	8.82	115.51	42.99	72.52
2002	3.86	0.04	3.83	108.18	35.64	72.55
2003	2.09	0.07	2.02	97.55	37.91	59.64
2004	8.18	0.76	7.42	89.42	36.02	53.4
2005	5.23	0.5	4.74	77.47	35.35	42.12
2006	6.11	0.12	5.99	71.35	33.39	37.96
2007	4.05	0.11	3.94	71.21	30.35	40.86
2008	7.03	0.02	7.01	68.94	28.03	40.9
2009	5.53	0.19	5.34	64.39	23.5	40.89
2010	5.13	0.89	4.24	59.3	23.54	35.77
2011	5.68	0.54	5.14	48.36	20.85	27.51
2012	5.92	0.56	5.36	39.74	12.06	27.68

Source: Scottish Government (2013b)

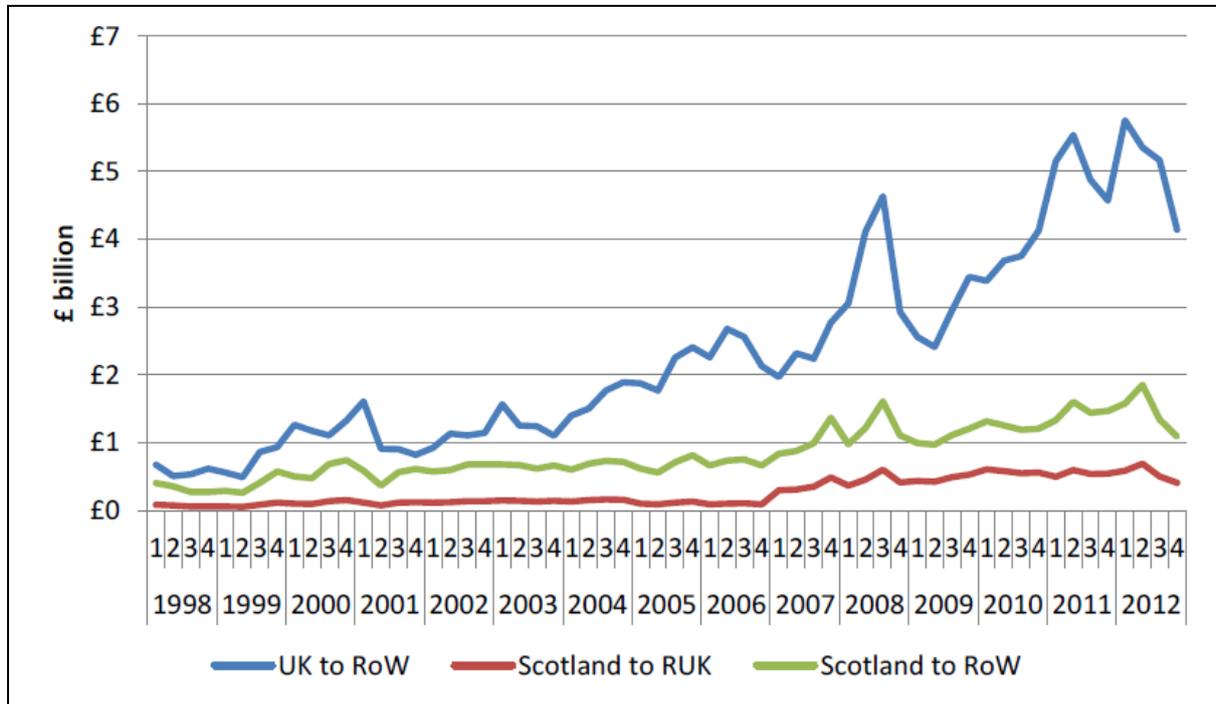
4.1.2 Refined oil products

Refined oil products are a significant source of energy in the UK, especially in the transport sector. The UK has the fourth largest total refining capacity in the EU and some UK refineries are among the largest in Europe (UKPIA, 2013).

Most refineries in the UK are based in England, with only one, namely Petroineos Refining and Trading, located in Scotland, next to Grangemouth. Petroineos process up to 420,000 barrels of crude oil per day, and supplies the majority of fuel consumption in Scotland. On the other hand, limited refining capacity means that much of the crude oil and NGLs produced in Scotland has to be refined in the rest of the UK. As a consequence, as shown in

Figure 9, Scottish international exports of refined petroleum products only represents a small proportion of the UK total.

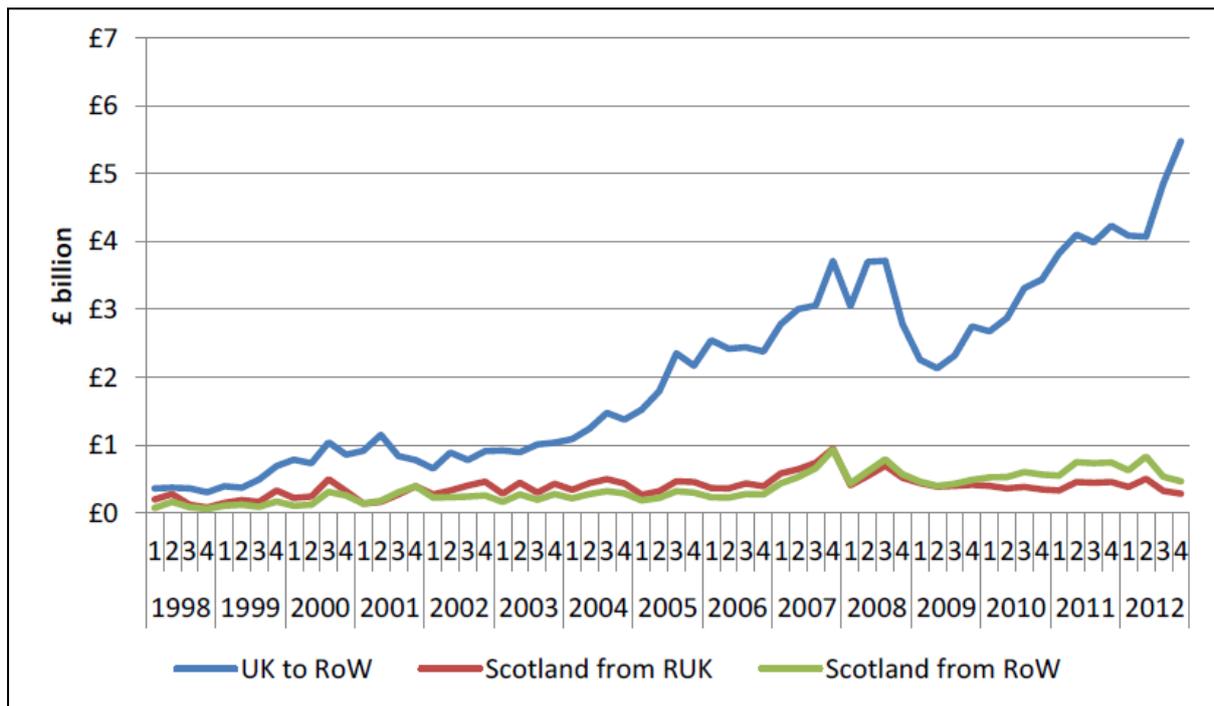
Figure 9: UK and Scottish exports of refined petroleum products



Source: Scottish Government (2013b)

Other than the decline of UK oil refining production, imports from overseas have increased drastically over the past decades (see Figure 10). In 2011, 58.1 million tonnes of oil products were imported to supply the UK market, which is about one and a half times higher than domestic production. However, import into Scotland is far less significant, with only about 2.2 million tonnes overseas imports landed at Scottish ports. Meanwhile, there were 3.1 million tonnes of oil products delivered to the rest of the UK and the international market which reflects the importance of Petroineos as a source for international refined petroleum products exports.

Figure 10: Imports of refined petroleum products



Source: Scottish Government (2013b)

4.2 Dry bulk

4.2.1 Aggregates

Aggregates are the most commonly used minerals in the construction of transport infrastructure, housing and other building works. In 2011 the total value of construction and industrial minerals² produced in the UK was approximately £2,894 million (BGS, 2013a).

The most important sources for aggregates in Scotland are crushed rock (mainly from igneous rock, limestone and sandstone) and sand and gravel. Crushed rock, dominated by the source of igneous rock, accounts for more than 70% of the total production, and, unlike England, there is no marine-dredged sand and gravel landed in Scotland.

Table 8 shows the amount of crushed rock and sand and gravel produced annually in Scotland between the years of 2005 and 2011. Significant drops of both categories appeared

² Construction and industrial mineral production includes igneous rock, limestone and dolomite, chalk, sand and gravel, sandstone, silica sand, clay and shale, china clay, ball clay, potash, salt, gypsum and anhydrite and miscellaneous minerals.

due to the strong influence of the economic recession on the construction and house building sectors – production of igneous rock fell by 38% between 2007 and 2011, while sand and gravel fell almost 42% over the same period. In 2011, 22.3 million tonnes of crushed rock and 6.4 million tonnes of sand and gravel were produced in Scotland.

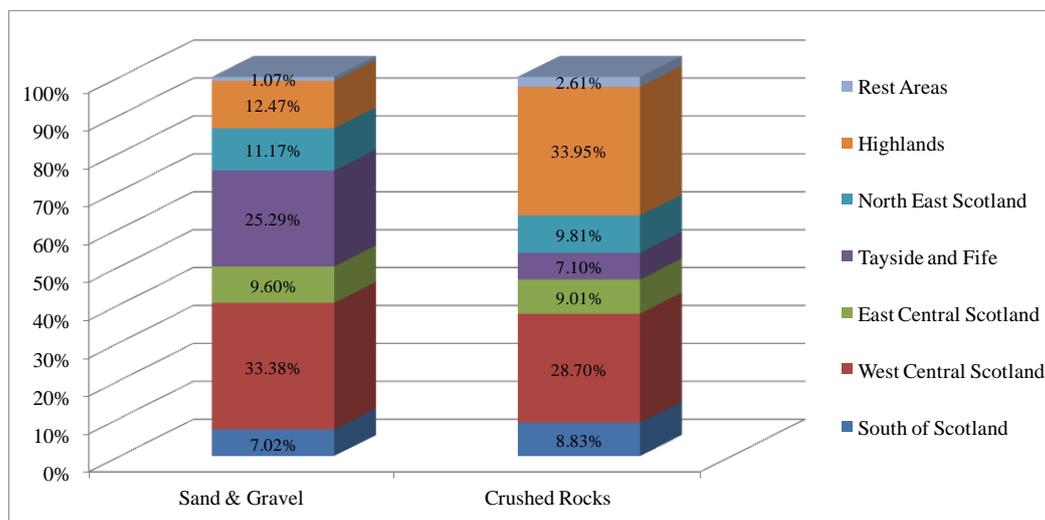
Table 8: Scotland production of aggregates
(thousand tonnes)

Production	2005	2006	2007	2008	2009	2010	2011
Crushed Rock	26264	26100	29402	25779	22187	22562	22274
Igneous rock	23052	23194	26345	22925	19082	19684	19113
Limestone	1746	1534	1555	1473	1210	1072	1251
Sandstone	1466	1372	1502	1381	1895	1806	1910
Sand & Gravel	8808	8592	9025	8097	7512	7365	6366

Source: BGS (2013b)

Figure 11 shows the geographical spread of Scottish aggregates production in 2011. Not surprisingly, Highland (mainly from Glensanda) is the dominant contributor to the Scottish crushed rock sector, accounting for more than one third of the total production in that year. West Central Scotland holds significant advantages in both crushed rock and sand and gravel, about 28.7% and 33.4% respectively over the same period. Tayside and Fife, the second largest supplier of sand and gravel, contributed 1.6 million tonnes, which was about 25% of total production.

Figure 11: Regional distribution of Scottish natural aggregates production, 2011



Source: DCLG (2013)

In terms of Scottish aggregates distribution, this study takes a sample survey of 2005 (Scottish government, 2007) due to a lack of recent data. As shown in Table 9, Scottish sand and gravel products generally remains in the area where it was produced, with only 150 thousand tonnes produced in Highland and the South of Scotland being sold to England and outside of the UK.

Distribution of crushed rock shows a slightly different outcome, with more than 5 million tonnes, about 24% of the total Scottish produce, being delivered to destinations outside of Scotland. Produce from Highland, mainly Glensanda, accounts for the highest proportion. In contrast, the North East of Scotland, Orkney and Western Isles all retain 100% of the material they produce.

Table 9. Sale of Scottish aggregates production in 2005

Regions	Crushed Rock				Sand & Gravel			
	Production	Retained in Region	England	Outside GB	Production	Retained in Region	England	Outside GB
East Central Scotland	2520	2462	58	0	371	371	0	0
Highland	5936	843	1644	3448	491	408	30	53
North East Scotland	1321	1321	0	0	926	926	0	0
Orkney	53	53	0	0	2	2	0	0
Shetland	173	131	40	2	0	0	0	0
South of Scotland	1217	1189	27	1	573	509	64	0
Tayside and Fife	2493	2472	20	2	1813	1813	0	0
West Central Scotland	8062	7957	45	60	3309	3309	0	0
Western Isles	177	117	0	0	27	27	0	0
Scotland	21952	16605	1834	3513	7512	7365	94	53

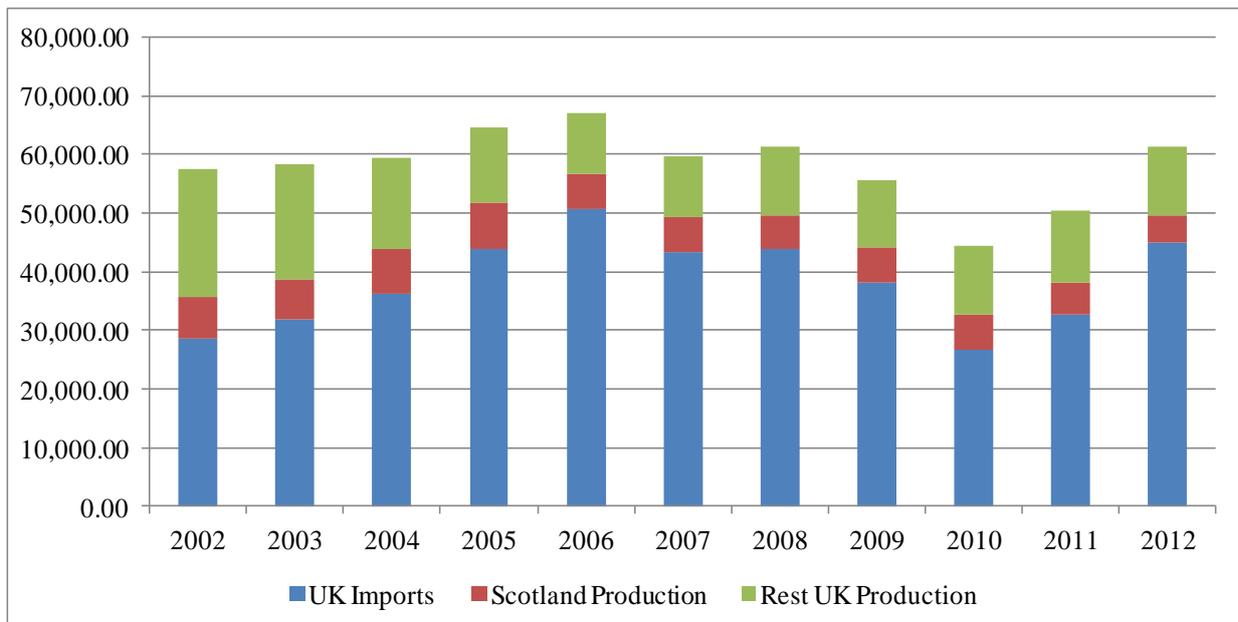
Source: Scottish Government (2007)

4.2.2 Coal

The Scottish coal mining industry contributes about a third of total UK production, with more than 2.8 million tonnes mined in 2013. However, as shown in Figure 12, coal production in Scotland exhibits a decreasing tendency over the last ten years, from 7.1 million tonnes in 2002 to 4.8 million tonnes in 2012. This decline was mainly due to a combined influence of falling prices, rising operational costs, exhausting of reserves, and restrictions by current EU and UK governments relating to CO₂ emission reduction policies.

On the other hand, coal is one of the major sources for electricity generation – coal fired power stations provided 41% of the UK’s electricity in 2012 (DECC, 2013). As a consequence, imports from overseas markets play a significant role in relation to the UK coal supply. Coal imports increased at a rate of 15% annual growth from 2002 and reached a peak of 50.5 million tonnes in 2006. After a slight drop due to the economic recession, coal imports picked up again from 2010. In 2012, total UK coal imports increased to 44.8 million tonnes, an increase of 33% on 2011 levels.

Figure 12: UK coal supply, 2002 – 2012
(thousands tonnes)



Source: DECC (2013)

Coal imports are generally completed by maritime bulk shipping due to its low value, large volume and long transport distance. As shown in Table 10, the majority of supplies are from Russia, Colombia and the United States, which accounts for about 83% of the total UK imports. There was only 17% of imports landed in the Scottish ports, mainly the port of Clyde. Again, 96% of traffic flows originated from the three major exporters mentioned above.

Table 10: UK coal imports in 2011
(millions tonnes)

UK Import		Entering Scotland	
Russia	12.16	Colombia	2.07
Colombia	7.97	Russia	2.03
USA	6.09	USA	1.03
Australia	3.14	Latvia	0.14
Poland	0.65	Netherlands	0.04
South Africa	0.62	Spain	0.01
Canada	0.3	Poland	0.01
Others	0.81		
Total	31.74	Total	5.34

Source: DfT (2012) and DECC (2013)

Longannet Power Station in Fife, with its total 2304 megawatt generating capacity, is the only coal-fired station in Scotland and the second largest power station in the UK. The coal consumption of Longannet Power Station in 2010 was about 4 million tonnes, where a third of supply was Scottish-produced. The internationally-sourced coal imports to Hunterston are transported to Longannet by rail.

A significant amount of coal, both locally produced and imported from overseas, will be transported to England by domestic waterborne shipping and rail services (see section on domestic shipping).

4.3 Forestry products

The forest-based industry in Scotland employs, both directly and indirectly, around 40,000 people and is worth in excess of £1.7 billion to the economy, possessing significant growth potential³. More importantly, this industry offers a net positive carbon impact which matches the aim of strengthening a low carbon, sustainable growth and a more resilient and adaptable economy highlighted in the Scottish government economic strategy⁴.

Scotland dominates the forest-based industry in the UK. Table 11 shows the woodland coverage in Scotland and the UK respectively in 2013. The total woodland area in Scotland was 1.4 million Ha, about 46% of the total planting in the UK. In contrast to the relatively small proportion (23%) of broadleaves sector accounts, Scotland contributed almost two thirds of the UK conifer planting. In addition, private (non- FC/FS) managed planting holds more than half of the total woodland area, especially the broadleaves sector.

Table 11: Area of woodland 2013
(thousand hectares)

		Conifers	Broadleaves	Total Woodland
FC/ FS	Scotland	447	34	480
	UK	756	117	873
Non-FC/ FS	Scotland	619	310	930
	UK	863	1,391	2,254
All Woodland	Scotland	1,066	344	1,410
	UK	1,619	1,508	3,127

Note: FC/FS = Forestry Commission/ Forest Service; Non-FC/FS = all other woodland, including some other.
Source: Forestry Commission (2013)

Statistics of wood productions in Scotland over the last ten years are listed in Table 12. It is interesting to find that softwood production increased drastically from 4.3 million in 2002 to 6.4 million in 2012, while the hardwood production was comparatively less significant,

³ <http://www.forestryscotland.com>

⁴ <http://www.scotland.gov.uk/News/Releases/2011/09/12101424>

between 0.03 – 0.05 million green tonnes over the same period. It is also worth noting that the most significant increase occurred in the private sector (non-FC); its total wood production jumped from 2.1 million to 3.8 million green tonnes.

Table 12: Scotland wood production
(thousand green tonnes)

Year	Softwood			Hardwood		
	FC	Non FC	Total softwood	FC	Non FC	Total hardwood
2002	2,268	2,078	4,346	0	48	48
2004	2,527	2,481	5,008	1	39	40
2006	2,454	2,729	5,183	0	34	34
2008	2,362	2,827	5,189	1	33	34
2010	2,434	3,442	5,877	2	40	42
2012	2,627	3,764	6,391	0	41	41

Note: 1 green tonne equal to approximately 0.98 m³ underbark softwood or 0.88 m³ underbark hardwood.

Source: Forestry Commission (2013)

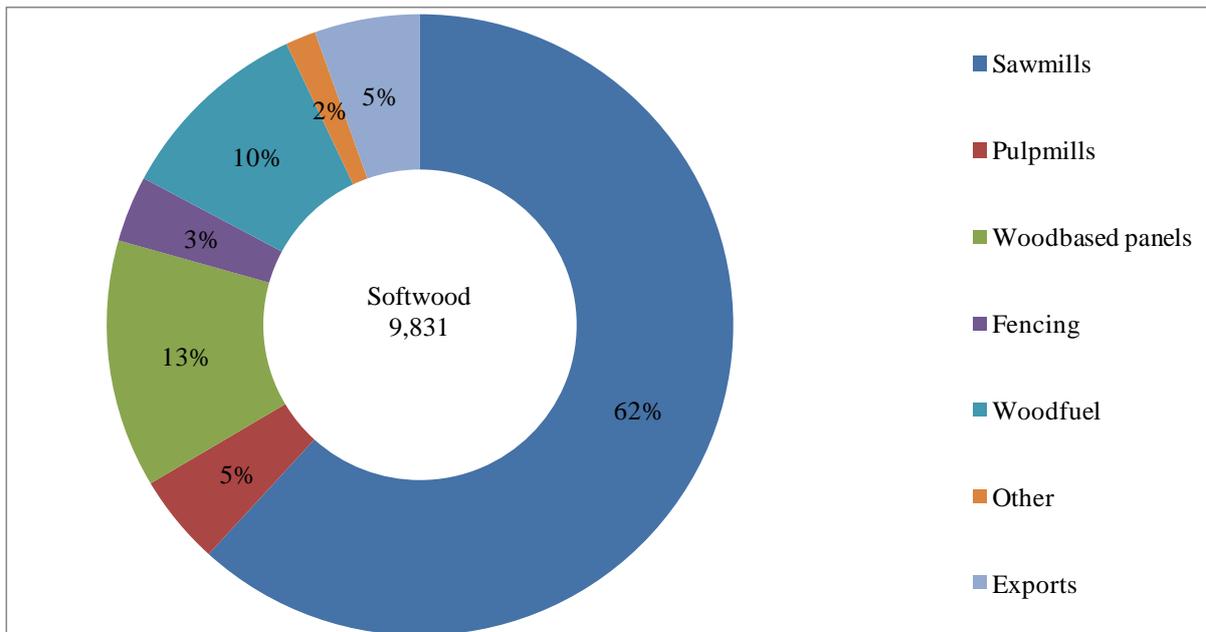
Apart from the direct forest planting and harvesting, many downstream activities of the forestry sector create extra added value to the Scottish economy. Timber, wood-based panels, pulp and paper and woodfuel are the main products associated with the forestry industry. Taking an example of the UK as a whole, as shown in Figure 13, sawmills consumed more than 60% of UK-grown softwood production in 2012; 1.3 million green tonnes outputs were made to woodbased panels; and about one million were consumed as the source of woodfuel. Pulpmills consumed and logs exported were about same, around half million green tonnes.

Unfortunately, domestic supply cannot meet the continuous increase of industrial demand. As a result, a large volume of wood products has to be imported from overseas markets. In 2012, as shown in

Figure 14, imports of sawn wood reached 5.2 million cubic meters, mostly from Sweden, Finland and Latvia. Another wood product which is highly demanded in the UK is paper; more than 6 million tonnes were imported in 2012. One million tonnes of pulp were also imported to supply paper mills across the UK. In the export sector, the most significant

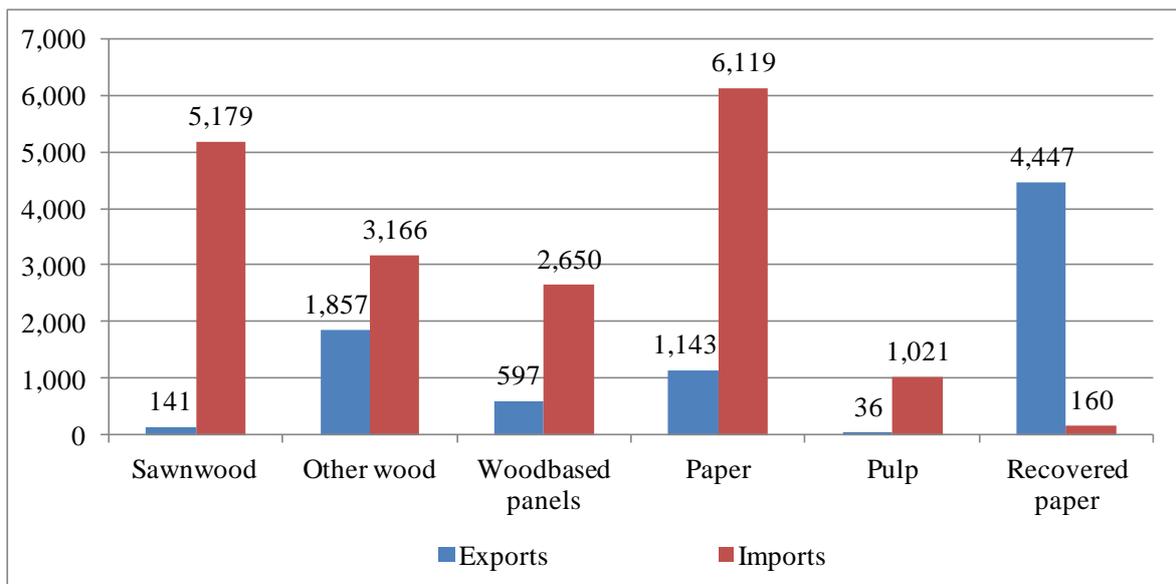
products were the 4.5 million tonnes of recovered paper sold internationally. The export of roundwood, together with other wood products including wood charcoal, chips, particles, residues and wood pellets, achieved 1.8 million cubic meters against its 3.2 million imports.

Figure 13: Delivery of UK grown softwood, 2012
(thousand green tonnes)



Source: Forestry Commission (2013)

Figure 14: UK forestry products imports and exports, 2012
(thousand m³ or tonnes)



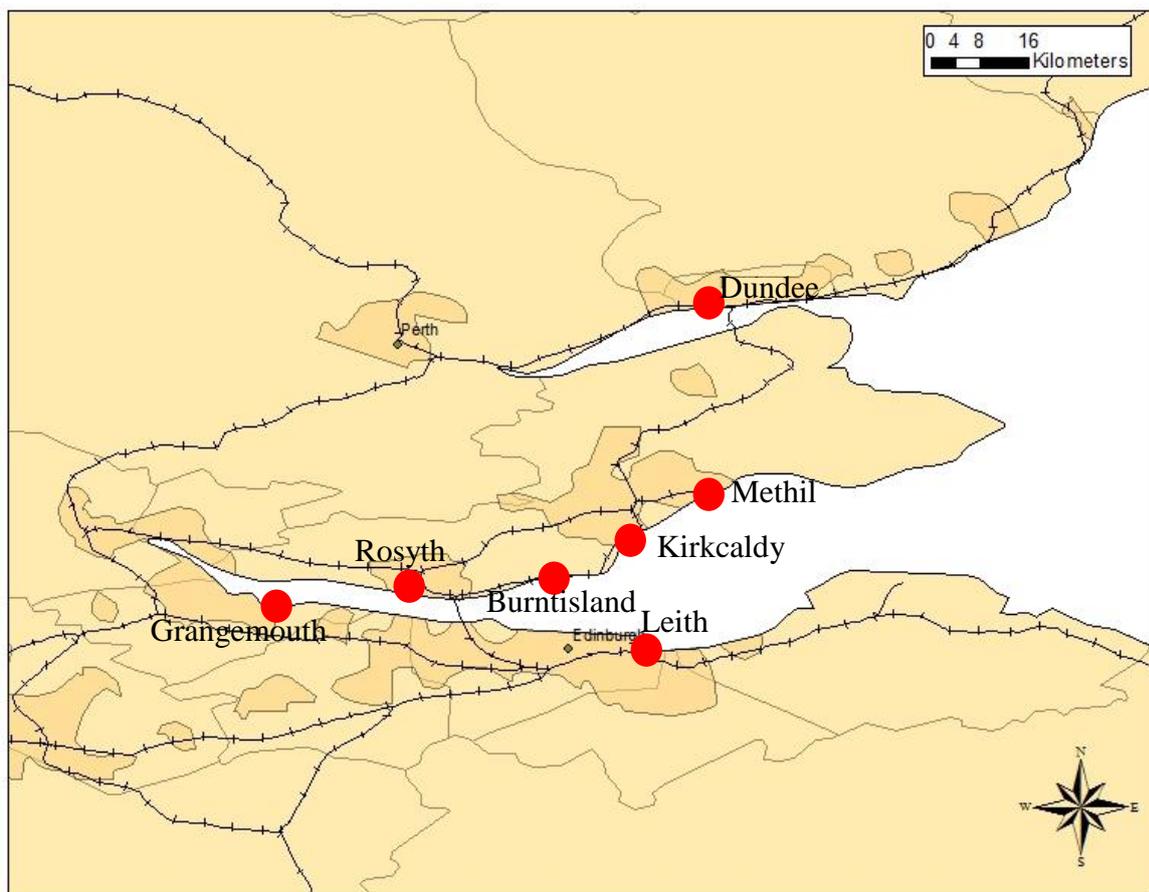
Note: Other wood includes roundwood, wood charcoal, chips, particles, residues and wood pellets.
Source: Forestry Commission (2013)

5. Major Scottish ports involved in bulk freight shipping

5.1 Forth

Forth Ports is a private port operator owning and operating ports in the firth of Forth and beyond. They operate Scotland's primary container port Grangemouth and part of the port of Rosyth (where the Rosyth-Zeebrugge ferry berths, the rest of Rosyth being operated by Babcocks), as well as smaller ports Leith, Burntisland and Methil. Kirckcaldy has also recently returned to commercial use with grain deliveries to the flour mill. Outside the Forth, Forth Ports operate the port of Dundee on the river Tay as well as the major container port of Tilbury on the Thames.

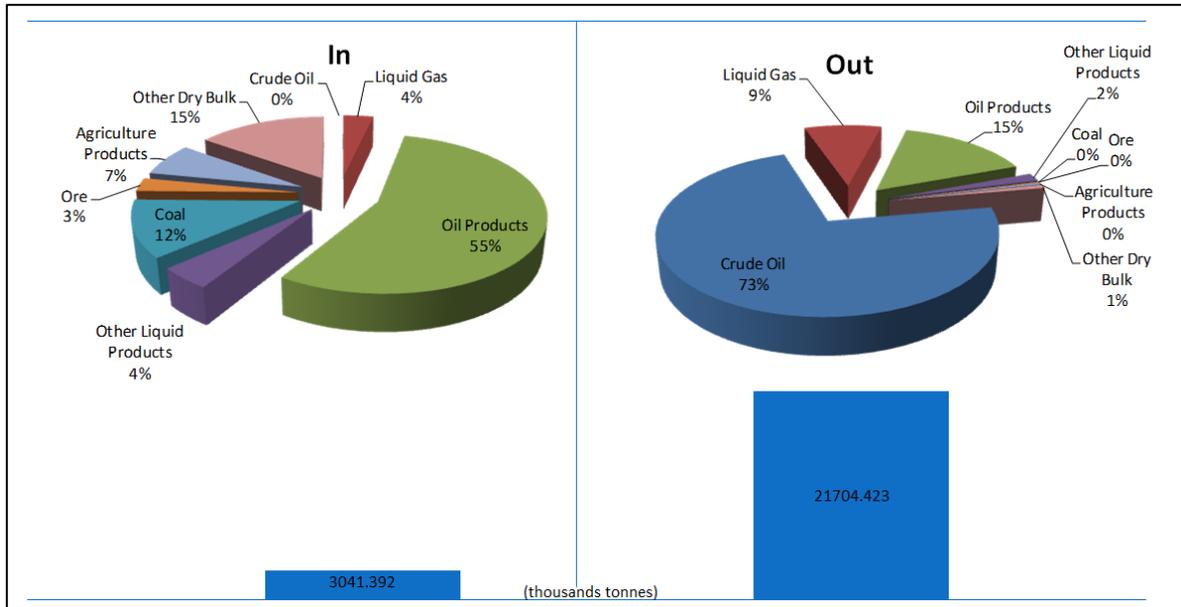
Figure 15. Map showing the Scottish ports operated by Forth Ports



Source: authors

The DfT statistics for Forth include Grangemouth, Rosyth, Leith, Burntisland and Methil, as well as small flows like grain coming into the flour mill at Kirkcaldy (Figure 16).

Figure 16. Bulk freight by commodity in the Forth



Source: DfT (2012)

Figure 16 reveals that the main commodities of interest, besides oil and gas products and coal, are imports of dry bulk and agricultural products.

The port of Grangemouth handles various dry bulks, such as soya meal, fish meal, soda ash, road salt and cullet. In terms of general cargo, they move around 250,000 tonnes of paper, timber and other products per year. A lot of timber products from Scandinavia are imported through Grangemouth and Rosyth. They also have a specialised forestry products terminal for handling paper and pulp products. Their other ports handle bulk cargo as well, including grain and animal feed at Leith, timber at Methil and wheat imports to the flour mill at Kirkcaldy.

Biomass will be a key commodity in the future in the Forth, due to the aspirations to develop biomass plants in the region. Another key commodity is waste. Refuse-derived fuel (RDF –

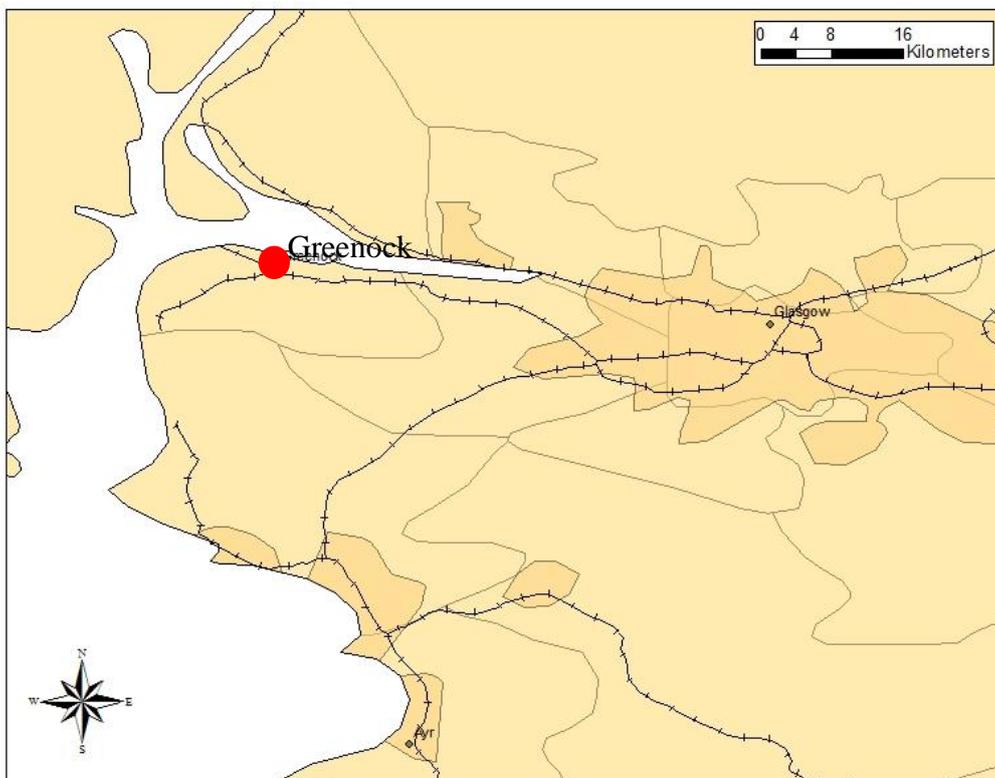
essentially baled rubbish) is exported through Grangemouth to destinations such as Hamburg and Scandinavia. It is currently not allowed to be burned in the UK so it has to be exported. However, it is cheaper to export it than to put it in landfill so exporters make their margin based on that difference.

Recycled timber is imported through Methil for paper manufacturers Tullis Russell in Fife. It is very dusty which causes air issues for local residents and needs to be managed. In addition, some problems have been reported that have caused some movement of this trade to other ports.

5.2 Clyde

The Clyde ports are owned and operated by private port operator Peel Ports, and include the ports of Glasgow, Greenock, Ardrossan and Hunterston (Figure 17). Greenock is Scotland's second-busiest container port and Hunterston is a specialist coal import facility.

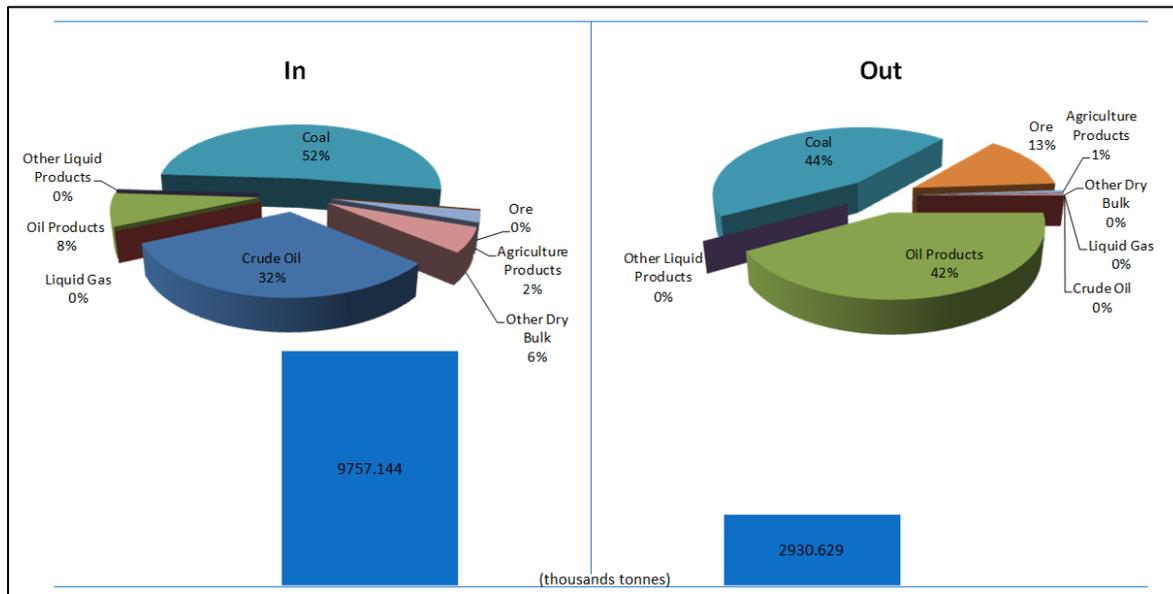
Figure 17. Map showing Scottish ports operated by Peel Ports



Source: authors

Figure 18 shows the expected coal movements through the port of Hunterston, as well as significant oil products moving through Greenock. Other dry bulk and agricultural products inbound are also relevant.

Figure 18. Bulk freight by commodity at Clyde ports



Source: DfT (2012)

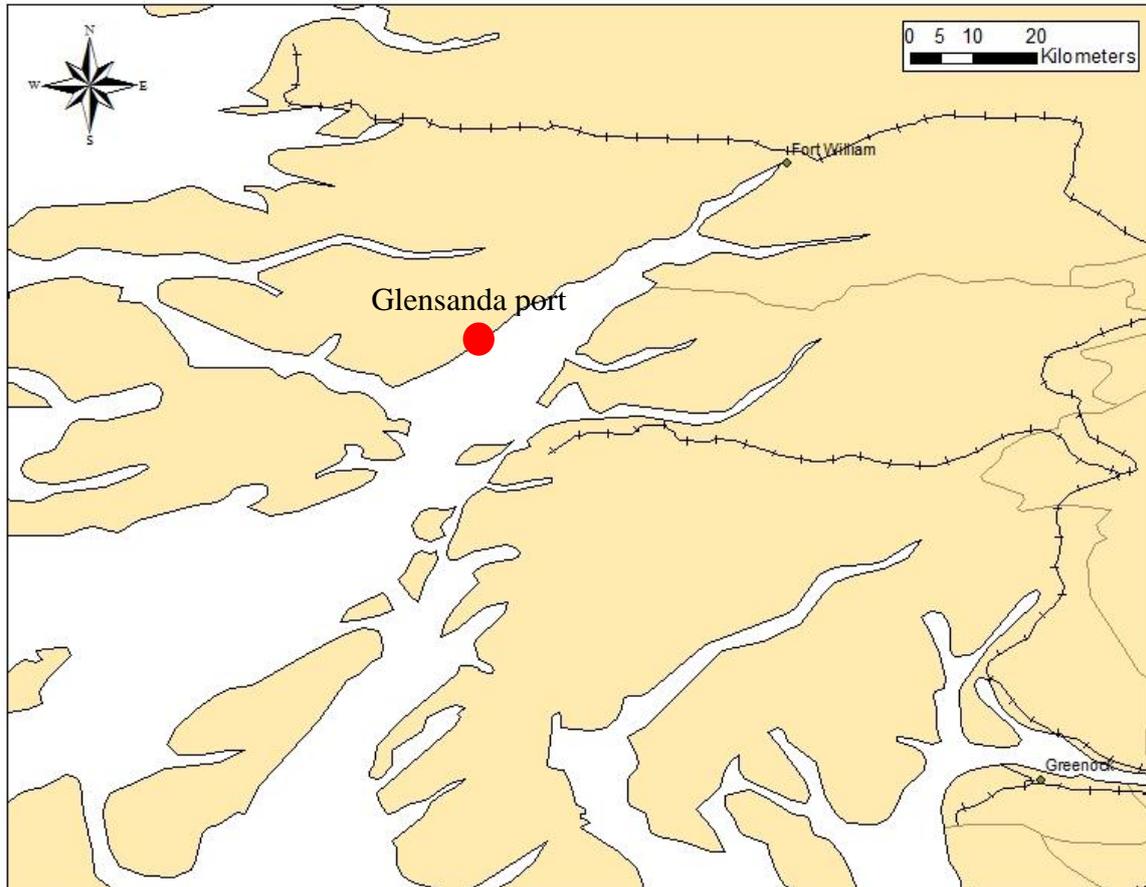
5.3 Glensanda

Glensanda is located on the west coast of Scotland (Figure 19) and is the site of a huge granite aggregates quarry, the so-called Glensanda Super Quarry opened in 1982. More than 6m tonnes of granite aggregates are export annually from the site. The quarry has no road or rail access so all transport is done by water.

As the only superquarry in Britain, Glensanda is operated by the Aggregate Industries (formerly known as Foster Yeoman Ltd) and designed to produce 15 million tonnes crushed rock (granite) per year. The current annual production capacity is about 9 million tonnes per

year, two-thirds of which is exported to Europe and the rest serves the UK market. Aggregate is loaded directly into self-discharging ships with cargo capacity of up to 97,000 tonnes.

Figure 19. Map showing location of Glensanda port

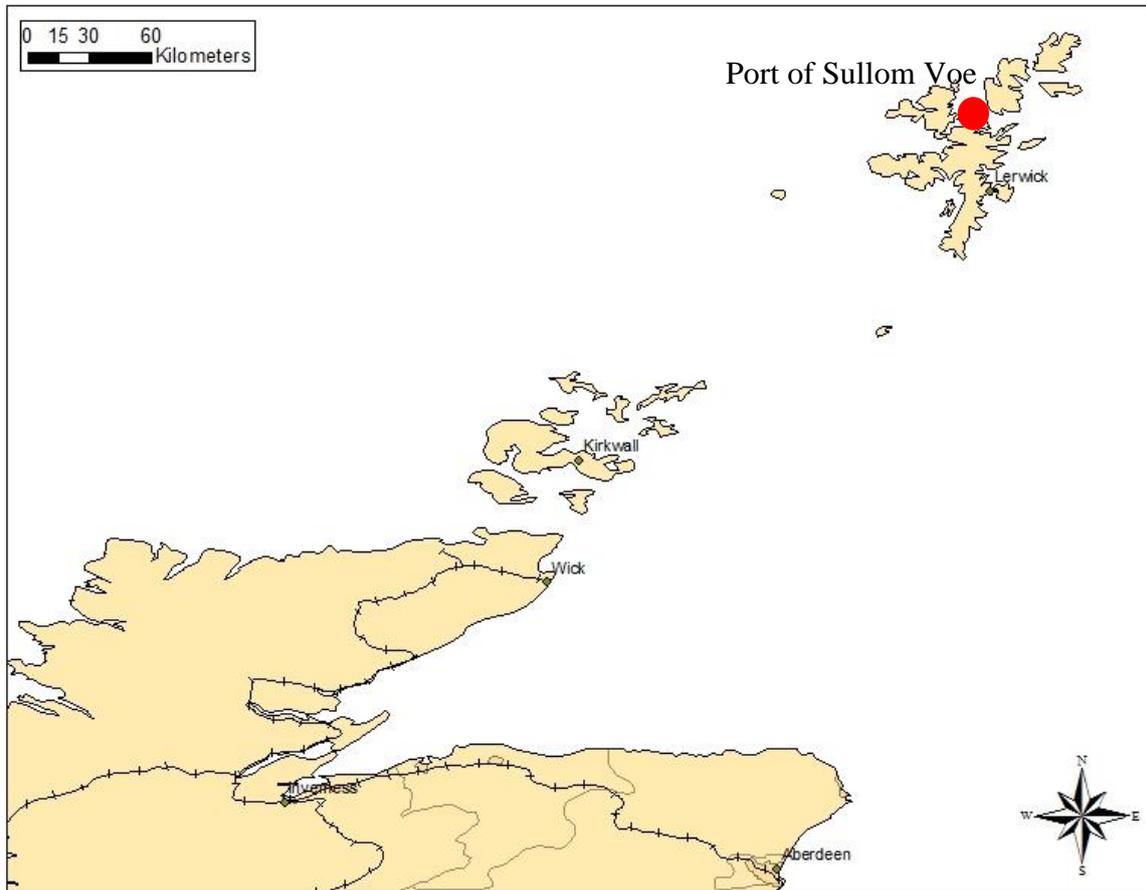


Source: authors

5.4 Sullom Voe

Sullom Voe is located in the Shetland Islands (Figure 20). It is a specialised oil and liquefied gas terminal to store crude oil extracted from the North Sea before it is shipped to refineries on the mainland. It is owned and operated by the Ninian and Brent partners.

Figure 20. Map showing location of Sullom Voe



Source: authors

Table 13. Bulk cargo flows at Sullom Voe (2011)
(thousand tonnes)

Bulk Commodities	In	Out	Total
Crude Oil	729.221	9404.45	10133.67
Liquid Gas	0	0	0
Oil Products	0	0	0
Other Liquid Products	0	0	0
Coal	0	0	0
Ore	0	0	0

Agriculture Products	0	0	0
Other Dry Bulk	12.497	0	12.497

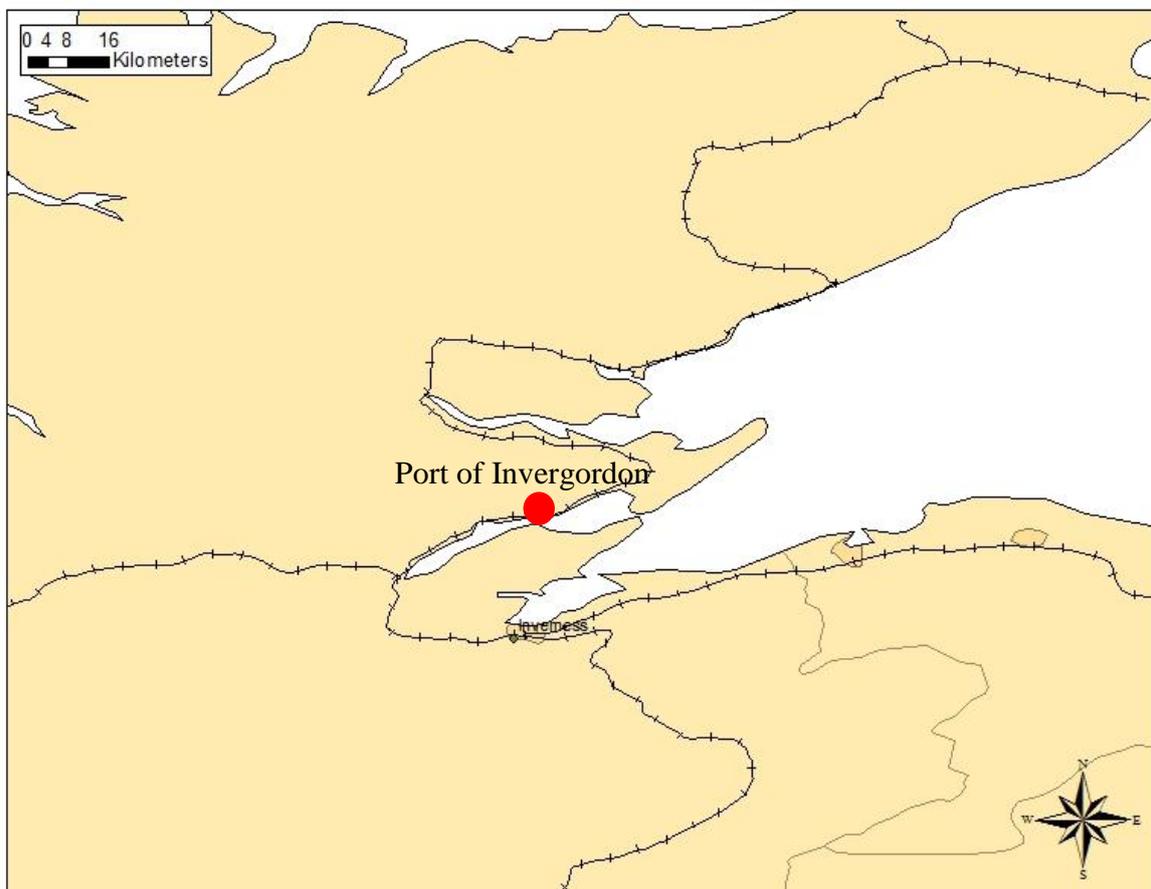
Source: DfT (2012)

Bulk flows at Sullom Voe in 2011 are shown in Table 13. It reflects that this is a specialised terminal focusing on crude oil flows between the source and the refineries.

5.5 Cromarty Firth

The Cromarty Firth branches off to the west of the Moray Firth. A port terminal is located at Invergordon, owned and operated by the Cromarty Firth Port Authority (Figure 21).

Figure 21. Map showing location of the port of Invergordon on the Cromarty Firth



Source: authors

Bulk flows in the Cromarty Firth in 2011 are shown in

Table 14.

Table 14. Bulk cargo flows at Cromarty Firth (2011)
(thousand tonnes)

Bulk Commodities	In	Out	Total
Crude Oil	1748.122	2025.043	3773.165
Liquid Gas	0	0	0
Oil Products	32.954	0	32.954
Other Liquid Products	14.432	0	14.432
Coal	14.74	0	14.74
Ore	0	22.91	22.91
Agriculture Products	2.394	0	2.394
Other Dry Bulk	38.803	79.941	118.744

Source: DfT (2012)

The data show that, again, other dry bulk is a significant commodity. Breaking these large commodities of dry and liquid bulk down, the imports are fish meal, road salt, fish oil, oil-related equipment and pipes and fertiliser. Exports include fuel, pipes, scrap metal and fish feed. Other business is related to support vessels for the offshore industry, not just oil but wind turbines.

5.6 Aberdeen

The port of Aberdeen is located on the northeastern coast of Scotland (Figure 22). It is a trust port, operated by a board on a not-for-profit basis. Table 15 shows bulk cargo for the port of Aberdeen in 2011. It reveals that agriculture and dry bulk are also of interest besides the oil and other liquid movements.

For the port of Aberdeen, offshore traffic (i.e. supply vessels) is larger than commercial traffic. There is a long list of items moving on supply vessels in small quantities per movement but on frequent services to the rigs, e.g. fuel, food, pipe, 50 tonnes at a time of ores, cement, brine, “mud”, etc. They had 8,000 vessel arrivals last year, because of so many small supply ships.

Figure 22. Map showing location of the port of Aberdeen



Source: authors

Table 15. Bulk cargo flows at the port of Aberdeen 2011
(thousand tonnes)

	Bulk Cargo	In	Out	Total
Liquid Bulk	Crude Oil	0	0	0
	Liquid Gas	0	0	0
	Oil Products	1017.844	0	1017.844
	Other Liquid Products	223.149	681	904.149
Dry Bulk	Coal	0	0	0
	Ore	171.571	167.718	339.289
	Agriculture Products	0	39.275	39.275
	Other Dry Bulk	105.957	121.885	227.842

Source: DfT (2012)

The port also handles many smaller dry bulk cargoes, such as powdered ore used for the oil rigs and road salt for the local authority. Powdered cement imports are landed but then go offshore to the rigs. Liquid bulk cargoes relevant to the oil sector include calcium carbonate slurry, brine and “mud”. Pipe imports come in, are stored temporarily nearby, then sent out on supply ships to the rigs. Oil well specialist machinery also comes in from the rigs then is re-exported, so they are actual imports per se but are returning from use elsewhere, e.g. Africa, where there is a lot of oil exploration at the moment. Scrap from the rigs is also a significant commodity; the port sends around 100,000 tonnes of scrap metal to Spain and Portugal. They also land fish from Shetland and the Faroes, which is then moved. For example, it is often driven by road to Heathrow to fly to the United States.

6. Smaller Scottish ports involved in bulk freight shipping

In addition to the major bulk flows that show up in the DfT data, it is also relevant in the Scottish context to examine the role of smaller ports, many of which are moving smaller quantities of neo-bulk commodities like timber and construction products. Total tonnage at all Scottish ports is listed in Table 16.

Table 16. Total tonnage at Scottish ports, 2012

	Scottish port	Thousand tonnes		Scottish port	Thousand tonnes
1	Forth	25,332	15	Ayr	304
2	Clyde	15,421	16	Stornoway	284
3	Sullom Voe	11,398	17	Corpach	211
4	Glensanda	5,541	18	Inverkeithing	172
5	Aberdeen	4,493	19	Scrabster	119
6	Cromarty Firth	2,628	20	Troon	114
7	Cairnryan	2,610	21	Buckie	90
8	Stranraer	1,815	22	Fraserburgh	81
9	Orkney	1,729	23	Perth	62
10	Peterhead	1,024	24	Ardrishaig	59
11	Dundee	842	25	Gill's Bay Scotland	40
12	Lerwick	670	26	Wick	35
13	Inverness	521	27	Scalloway1	14
14	Montrose	518	28	Kyle of Lochalsh	11

Source: DfT (2012)

The data reveal that, besides the larger ports already discussed (Forth, Clyde, Sullom Voe, Glensanda, Aberdeen and Cromarty Firth), other tonnages are relevant. Details on the commodities of these flows are not available in public data, but, from interviews and other sources, these commodities can be identified.

Cairnryan and Stranraer are moving unitised RoRo, while Orkney and Lerwick handle a mix of unitised (mostly RoRo) and general cargo. Peterhead is primarily a fish port but also serves the offshore oil and gas industry and some timber and agricultural products. Dundee moves over 250,000 tonnes of agricultural products per year. Inverness handles a variety of general cargo, with the major cargo being fuel imports. Imports include packaged timber from Scandinavia and the Baltic, round logs from the west of Scotland, road salt, coal and grain from the continent, and animal feed and fish oil. The main exported general cargo is sterling board (mostly to Belgium and the Netherlands), while the rest are primarily agricultural and industrial products, such as potatoes, salmon smolts, machinery, barley, rapeseed, pulpwood, fish waste and woodchips.

Montrose handles a diverse range of cargo, including the majority of pulp products imported into Scotland, as well as paper, forest products, aggregates, grain, scrap metal, animal feed, malting barley, fertiliser and oil products. Pulp is imported from all over the world and then distributed to paper producers in Fife (Tullis Russell) and Aberdeen (Archie Wiggins). Extensive storage for these products is also available. Scottish forest products are exported to Scandinavia. A range of dry bulk (malting barley, feed barley, oats, rapeseed and wheat) is also handled here, and storage facilities are utilised too, in particular a new grain handling terminal opened in 2011. The county of Angus is a large user of fertiliser, but some of these imports are actually reprocessed into new forms and then re-exported from Montrose to destinations such as the Faroes and Iceland. In recent times the port has benefited from congestion at traditional oil sector supply ports Aberdeen and Peterhead, by securing an increase in oil-related business. This is not necessarily traditional supply vessel work but jobs like under-sea construction, chain and anchor handling; these require quay space that Montrose has available.

Some of these commodities, such as timber, agricultural products, scrap metal, etc. are more relevant to this study than major bulk commodities and were investigated in the interviews.

7. Vessel provision and operators

7.1 Overview of Scottish bulk shipping supply

Maritime freight transportation plays a dominant role in the international bulk trade, which becomes evident when reviewing the major trade commodities (i.e. bulk and general cargo) and volumes through Scottish ports. As mentioned earlier in the report, continuous increases in trade volume will in consequence lead to an increased demand in shipping capacity supply.

Table 17: Bulk ship arrival at Scottish ports, 2012

Ports	Deadweight tonnes:	Tankers					Dry cargo vessels*					Total all vessels
		1 - 4,999	5,000 - 19,999	20,000 - 99,999	100,000+	Unknown	1 - 4,999	5,000 - 19,999	20,000 - 99,999	100,000+	Unknown	
Aberdeen	East Coast	239	110	3	0	0	377	107	0	0	0	836
Ardrishaig	West Coast	0	0	0	0	0	65	0	0	0	0	65
Ayr	West Coast	0	0	0	0	0	123	2	0	0	0	125
Buckie	East Coast	0	0	0	0	0	34	0	0	0	0	34
Cairnryan	West Coast	0	0	0	0	0	0	0	0	0	0	0
Clyde	West Coast	15	157	16	38	0	698	171	83	20	0	1,198
Corpach	West Coast	0	0	0	0	0	38	1	1	0	0	40
Cromarty Firth	East Coast	34	0	26	23	0	98	7	0	0	0	188
Dundee	East Coast	9	44	0	6	0	157	14	0	0	0	230
Forth	East Coast	390	528	101	110	0	519	60	20	0	0	1,728
Fraserburgh	East Coast	0	0	0	0	0	26	1	0	0	0	27
Gill's Bay	East Coast	0	0	0	0	0	0	0	0	0	0	0
Glensanda	West Coast	0	0	0	0	0	33	13	115	0	0	161
Inverness	East Coast	69	25	0	0	0	130	0	0	0	0	224
Lerwick	East Coast	63	21	0	1	0	175	12	5	0	0	277
Montrose	East Coast	7	0	0	0	0	183	18	0	0	0	208
Orkney	East Coast	26	4	8	9	0	133	0	0	0	0	180
Perth	East Coast	0	0	0	0	0	44	0	0	0	0	44
Peterhead	East Coast	60	22	0	0	0	66	10	0	0	0	158
Scrabster	East Coast	23	0	0	0	0	128	4	0	0	0	155
Stornoway	West Coast	29	3	0	0	0	47	2	0	0	0	81
Stranraer	West Coast	0	0	0	0	0	0	0	0	0	0	0
Sullom Voe	East Coast	6	0	48	124	0	23	0	0	0	0	201
Troon	West Coast	0	0	0	0	0	85	3	0	0	0	88
Scotland		970	914	202	311	0	3,182	425	224	20	0	6,248
United Kingdom Total		9,899	7,799	2,119	1,411	121	22,832	4,792	2,565	354	56	51,948

Note*: Dry cargo vessels here exclude Ro-Ro and fully cellular container vessels

Source: DfT (2013)

Table 17 above offers an overview of bulk freight vessels calling at Scottish ports in 2012. First of all, there were 6,248 calls at Scottish ports, which was only 12% of the UK total. The liquid bulk section was even lower than this figure, while dry bulk and general cargo vessels contributed the majority of the total number. Second, sizes of vessels calling at Scottish ports are generally quite small. For example, more than 80% of dry bulk and general cargo vessels and 40% of tankers visiting were made by vessels under 5,000 dwt. Large size vessel visits

are highly related to the specific trade commodities and port facilities. For instance, looking at the vessels of the size of over 100,000 dwt, these were the dry cargo vessel calls made at Clyde ports for coal delivery, and tankers on the east coast for crude oil loading and discharging. In addition, geographical distribution of vessel calls is highly concentrated on the East Coast of Scotland, about two and a half times higher than the West Coast.

Regarding particular port visits, Forth ports and port Clyde are the two busiest ports in Scotland, followed by Aberdeen and others. The top two hold a significant advantage at calling numbers of both total visiting and large size vessel hosting. Glensanda and Sullom Voe are the two specifically developed ports for single bulk commodity transportation and it is a common feature that most calls made at these two ports are by large vessels (i.e. 20,000+ dwt).

As mentioned above, the majority of Scottish bulk freight transportation is dominated by small and specialised vessels due to the nature of bulk trade in Scotland. The type and size of vessel demand are mainly determined by the features of commodity, trade volume, length of route and value of product. On the other hand, it does not necessarily mean that the market opportunity to develop more bulk handling business at regional ports is limited by this. In contrast, the economic recovery and changes in the structure of bulk trade bring more opportunities to smaller ports. For example, the port of Inverness is expanding its port activities due to the shift of its primary trade commodity from liquid bulks to more diverse dry bulk cargoes.

7.2 Insights into the shipping market

Ship arrival statistics released by DfT (2013) are rather aggregated with only limited consideration given to particular commodity markets. This report, on the basis of the vessel movement history⁵ through Scottish ports within a given sample month⁶, provides a more detailed analysis of the current Scottish bulk shipping capacity supply.

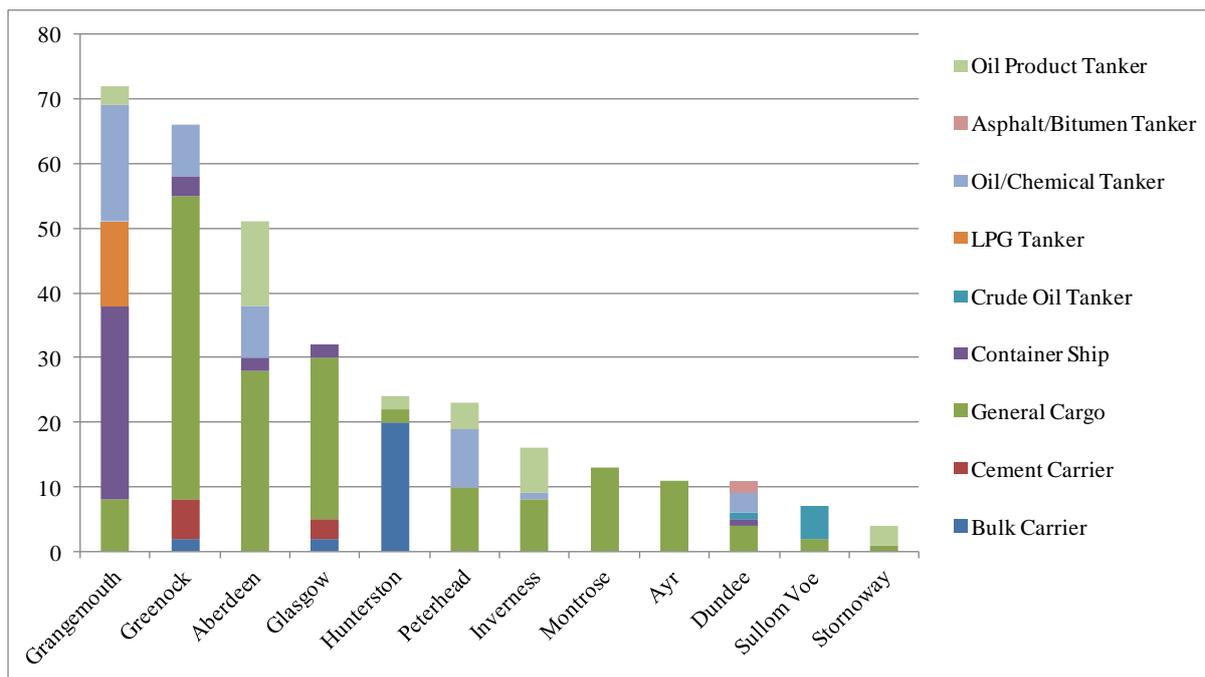
⁵ Vessel movement history was collected from the database of Marine Traffic (www.marinetraffic.com).

⁶ Example data month was from October 23 to November 22, 2013.

7.2.1 Vessel supply in different commodity markets

Within the sample month, there were 170 vessels in total deployed in the Scottish maritime shipping market, and 330 calls were made across Scotland. Vessel type, arrival number and host ports are summarised in Figure 23.

Figure 23: Freight vessel calling number at Scottish ports by vessel type



Source: authors

The geographical distribution of ship arrivals was exactly consistent with the result obtained from the annual data summarised in Table 17. However, it is more interesting to have some numerical evidence to explore the business structure of maritime freight shipping at different ports. First of all, container vessels called at Grangemouth exclusively. Greenock, Aberdeen, Dundee and Glasgow also had few visits, but not in significant numbers. In addition, a small volume of container throughputs were recorded at some other smaller port but these were completed by multi-purpose general cargo vessels. Second, arrivals of LPG tankers can only be observed in Grangemouth as the nearby Petroineos refinery plant is the only one in Scotland. For the same reason, specialised cement carriers call at Greenock and Glasgow terminals exclusively, and Hunterston is the major hub for coal transportation. Finally, and

most importantly, general cargo vessels have been the most widely used vessel type for the transportation of timber, agricultural products, animal feed, chemical fertiliser and other general cargoes.

Liquid Bulk

The primary mover of oil products along the Scottish coast is James Fisher and Son, who controls about 80% of the total shipping capacity within the sample data month. The company has 23 tanker vessels in total in operation. Fleet information (Scottish business involved) is listed in Table 18.

Table 18: Oil products tanker fleet by James Fisher

Vessel Name	Type	DWT	Built	Draft	Length
SHANNON FISHER	OIL PRODUCTS TANKER	5420	2006	6.31	85.3
SOLWAY FISHER	OIL PRODUCTS TANKER	5422	2006	6.31	85.3
ASPERITY	OIL PRODUCTS TANKER	3778	1997	5.6	88.8
MERSEY FISHER	OIL PRODUCTS TANKER	4765	1998	6.02	91.4
SOLENT FISHER	OIL PRODUCTS TANKER	4970	1997	6.2	91
THAMES FISHER	OIL PRODUCTS TANKER	4765	1997	6.02	91.4
SARNIA LIBERTY	OIL PRODUCTS TANKER	3515	2008	4.4	80
SENIORITY	OIL/CHEMICAL TANKER	4430	2006	5.89	95.1
SUPERIORITY	OIL/CHEMICAL TANKER	4415	2007	5.89	95.1
SPECIALITY	OIL/CHEMICAL TANKER	4426	2006	5.89	95.1

Source: www.james-fisher.com

The sample data reveals a rather deconcentrated market in crude oil, LPG, and chemical products shipping capacity supply. There is no single company has dominated control to either of these markets. However, it is worth to mention that a large number of vessels are either managed or owned by companies based in Netherland and Germany.

Dry Bulk

Cement carriers calling at Scottish ports (Greenock and Glasgow mainly) were dominated by a German company named BRISE Bereederungs GmbH & Co. KG. There are three vessels in operation, as shown in Table 19.

Table 19: Cement fleet used in Scotland

Vessel Name	Type	DWT	Built	Draft	Length
CEMVALE	CEMENT CARRIER	4257	1992	6.11	88.2
CEMISLE	CEMENT CARRIER	5183	2000	6.67	120
CEMBAY	CEMENT CARRIER	4216	1997	6.11	88.2

Source: www.marinetraffic.com

In the coal sector, large vessels are mainly deployed on the services between Scotland and the main coal exporting countries (Table 20). The largest vessel observed during the sample month was a capesize bulk carrier namely Sideris GS sailed from the USA. Domestic services were dominated by V.Ships UK with much smaller vessels of 7000+ dwt.

Table 20. Details of dry bulk vessels calling at Scottish ports over the sample period

Vessel Name	Vessel Type	Manager/Owner	DWT	Port	Next Destination
N LOIRE	bulk carrier	Nord Klaus Oldendorff Reederei	37212	Greenock	Russia
GOLDEN LYDERHORN	bulk carrier	Thome Ship management	74242	Glasgow	Egypt
CSL CLYDE	bulk carrier	V.Ships UK	7182	Hunterston	Domestic
ATHINA L	bulk carrier	Kyla Shipping Enterprise	81358	Hunterston	USA
SPLIT	bulk carrier	Jadroplov	42584	Hunterston	Sweden
NINGBO WHALE	bulk carrier	Whale Shipping	76039	Hunterston	USA
SIDERIS GS	bulk carrier	Diana Shipping	174187	Hunterston	USA
PORT STAR	bulk carrier	Kobe Ship management	82177	Hunterston	USA
GOLDEN BULL	bulk carrier	Golden Ocean Group	74500	Hunterston	Russia

Source: www.marinetraffic.com

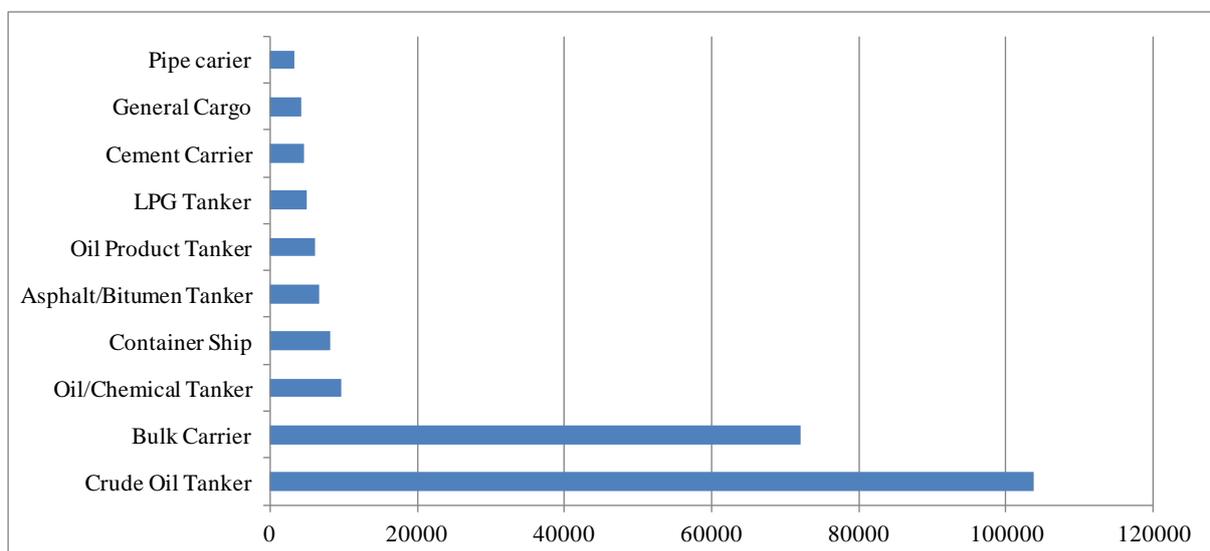
General Cargo

General cargo ships are the largest single category in terms of number of vessels of the world merchant fleet. Within the context of this study, general cargo vessels accounted for 48% of total port visits to Scotland during the sample month. However, it is a rather deconcentrated market, where 82 vessels in total were supplied by 56 different operating or management companies. This finding can mainly be attributed to the trade structure of general cargo in Scotland involved that most deliveries need to be completed on a small scale but higher frequency.

7.2.2 Vessel size

Figure 24 shows the average sizes of different type of vessels calling at Scottish port during the sample month.

Figure 24: Average size (DWT) of different vessel type calling at Scottish ports



Source: authors

Results indicate that vessel size is highly related to the market characteristics of each cargo type. Due to the long sailing distance and the goal of scale economy, crude oil tankers are

generally very large, with a size of over 100,000 dwt on average. The average size of bulk vessel is over 60,000 dwt, but individual sizes vary from the smallest at 7000+ dwt (e.g. CLS Clyde owned by V.Ships UK for domestic coal transportation) to the largest at 174,000+ dwt (e.g. Sideris GS operated between Hunterston and USA). The other types of tankers are mainly deployed on the routes of either domestic coastwise shipping or between Scotland and continental or Scandinavian ports, and as a consequence the average size is generally less than 10,000 dwt. Cargo vessels of this size can carry about 5818m³ grain or 130 TEUs if it is a multi-purpose vessel. The average size of a container feeder serving Scotland is about 8000 dwt, equivalent to a 700 TEU capacity.

7.2.3 Ship age

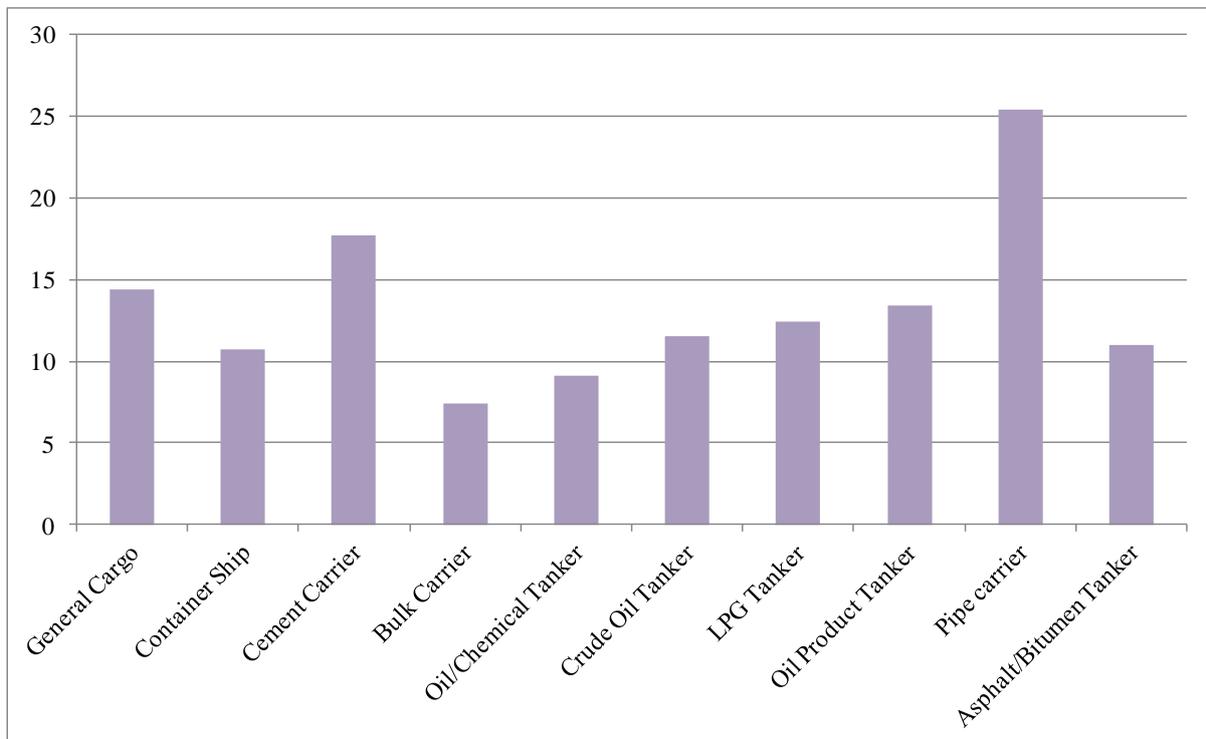
Ships are built for a specified design life, and require continuous maintenance and repair until scrapped. Old age vessels could be a real issue in practical operation, in particular the high maintenance costs and new regulatory restrictions (e.g. emission control).

The average age of ships arriving at Scottish ports during the sample month is 13 years, which is younger than the average of the world cargo carrying ships of 19 years⁷. Breaking the data down further according to each category (see Figure 25), bulk ships are the youngest vessel group, in which five out of nine vessels were built after 2012, one in 2006 and the remaining three were built in the late 1990s.

In contrast, pipe carriers, mainly for the offshore industry in Scotland, are all more than 20 years old, with one even having been built in 1979. Most tankers deployed on domestic routes are generally more than 15 years old, which is slightly higher than the average age of this market. Finally, general cargo vessels exhibit a trend of decreasing vessel size (i.e. dwt) along with the increase of ship age. However, as discussed in previous sections, there is no significant increase expected in the general cargo trade, which consequently means that those old and small vessels will remain in use in this market.

⁷ Source: Lloyd's Register Fairplay – World Fleet Statistics 2011

Figure 25: Average age of ships call at Scottish ports



Source: authors

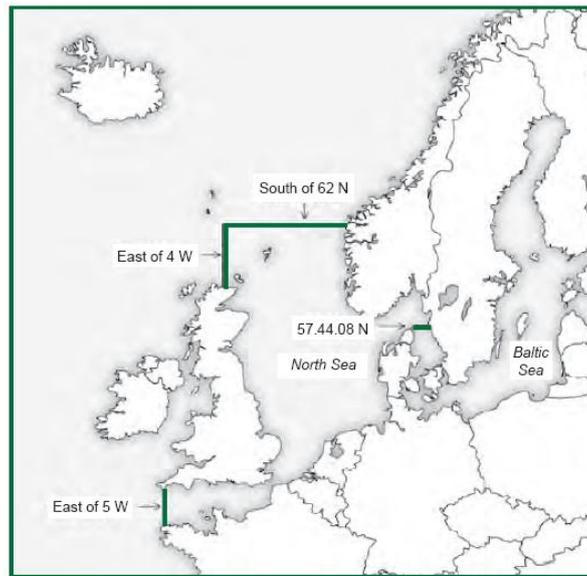
7.3 Impacts of emission control

In addition to the uncertainty of the global economy, stricter emission controls represent the next potential threat to the service viability of global maritime transportation. In Europe, the Sulphur Emission Control Area (SECA) will enter into force from 1st January 2015. All vessels within, steaming into and out of the Baltic, North Sea and English Channel (see

Figure 26) are obliged to reduce fuel emissions from ships to 0.1% sulphur compared to the current limit of 1.5%. As a result, all vessels serving east coast Scottish ports will either have to switch to low sulphur fuels or upgrade the ship engines (e.g. sulphur scrubbers) to meet the

requirement. The unknown factor at present is how the shipping industry will react to the new regulation and what effect this will have on the supply of bulk shipping capacity for Scotland.

Figure 26: The Sulphur Emission Control Area (SECA)



Source: ECG (2011)

In fact, neither switching to low sulphur fuel nor the installation of sulphur scrubbers are easy solutions for ship operators. For example, the currently used Heavy Fuel Oil (HFO) is about £350 per tonne, while switching to Marine Gas Oil (MGO) means the fuel cost will increase to £525 per tonne⁸. Alternatively, a one-off capital investment to install scrubber technology could cost up to several million pounds depending on engine size, and has therefore to be recouped by increasing the relevant freight rate over the rest of the vessel life.

As mentioned before, the mainstream vessels utilised for Scottish bulk freight shipping are more than ten years old and less than 10,000 dwt. It means that vessel owners or operators are unlikely to invest in upgrading engines on those old vessels to meet the new sulphur requirement. The choice is then either to use newer vessels with modified engines including scrubbers or to pay the increased cost of switching from HFO to MGO (Jiang et al., 2014).

⁸ Fuel price checked on the March 5th 2014 at www.shipandbunker.com.

Either way, freight rate will have to increase. Industry respondents are fully aware of this situation and have not expressed major concerns over the future of the bulk shipping sector. For example, one interviewed timber shipping company confirmed their confidence in maintaining their business and planned to buy more second-hand vessels in future operation. In addition, unlike unitised cargo, bulk freight traffic relies heavily on maritime shipping due to the industry characteristics of low value, large volume and often distant origins and destinations. Such freight flows are far less likely to shift to road transport. Also unlike the container market, bulk flows are more tied to specific locations and will continue to use the closest ports to those locations.

8. Conclusions and recommendations for action

In general, the bulk cargo market is less prone to fluctuation than the container market. Publicly available statistics on the movement of bulk and neo-bulk cargo flows tend to be aggregated, without breakdowns of the detail of different sub-categories of commodities. This study has explored such categories in more detail through both desktop and interview research, in order to identify and discuss categories relevant to Scotland, and particularly to the southeast of Scotland, of relevance to the SEStran area.

The key findings were the continuing importance of traditional cargoes (with some small changes) and new trends relating to renewable fuels, both importing and exporting. These latter trends are tied to a large degree to political decisions which may change in the future (e.g. waste and biomass). For example, a plan of the largest biomass power plant near Grangemouth, about 120 MW for both heat and power purpose (CHP), had been approved by the Scottish government and is expected to be put in operation in 2017. Besides the large liquid bulk categories relating to the oil sector and dry bulk relating to coal and aggregates, neo-bulk categories identified in this study were primarily forestry products (raw and processed timber and pulp for paper mills in eastern Scotland), scrap metal, biomass and waste.

Timber has been a relatively stable commodity for the last few decades and is expected to remain so, or at least any changes should be predictable through consultation with industry associations such as the Timber Transport Forum. It is generally processed wood products

that are imported through east coast ports, while Scotland exports raw wood, moving mostly out the west coast. Having said that, fluctuations do occur according to changes in the external economic environment. Timber imports and domestic consumption dropped significantly along with the construction business decline due to the economic recession since 2008. This has been evidenced by consulting with one specialised timber shipping company whose imports from Sweden dropped about 40% and its Irish export market almost disappeared between 2008 and 2010.

The future for the oil trade remains positive, as new fields are coming online and more difficult fields are becoming economically viable now that prices are rising. Up to the late 90s oil was a very volatile business, but the last decade has been more stable. However, development has slowed recently due to the political complexity of new developments, such as companies looking for tax breaks before making large investments. In addition, a lot of offshore projects have been cancelled due to safety issues, e.g. helicopters. Aberdeen and Peterhead are the main offshore ports but they are at capacity. Montrose benefits from this but even so, capacity is stretched and there is a danger of losing some business to Norway.

There are also some business uncertainties in the oil refinery industry in Scotland. For example, the petrochemical plant of Petrobrines in Grangemouth was threatened to be shut down permanently due to the dispute of changing pay and conditions in 2013. New forms of energy for the UK economy (both import and export) need to be monitored over time. Coal imports are expected to wane as coal-fired power stations are shut down. New flows like biomass and waste will be future growth areas.

Unlike unitised cargo, bulk cargo is tied much more to the economy of the region, being based on specific local resources (exports) or local businesses with specific input requirements, such as coal or barley (imports). This means that, while on the whole such flows tend to be fairly stable, they can also be cut drastically if a business closes down or relocates. On a positive note, it means that action by public authorities to attract a particular business to an area can result in a large sudden demand for specific commodities. It also means that SECA restrictions are less of a problem as, unlike the container market, bulk

flows are more tied to specific locations and will continue to use the closest ports to those locations.

Recommendations for SEStran and LO-PINOD:

- SEStran should consider the role of bulk flows at ports in the region in their next RTS. Grangemouth and Rosyth remain important but the roles and functions of other smaller ports require clear strategies. For example, consumption of imported timber and aggregates are concentrated in the central belt area. The question to consider is whether local ports could offer specialised terminals and improved services to meet the demand instead of leaving this business to ports in the north of Scotland.
- Repaid expansion of wood fuel biomass identified in this report suggests that SEStran should keep abreast of changing regulations on waste and biomass. Local supplies, especially those from remote and less accessible areas, should be shipped by efficient and sustainable transport mode, while there is also a risk of significant level of imports due to the surge of demand. There will be potential opportunities to work with the Port of Oostende and other LO-PINOD partners on this sector.
- It is suggested that hub and cluster policies should be encouraged and developed when reshaping relevant transport policies, especially for those traditional bulk freight flows.
- SECA regulations may not be as much of an issue in the bulk sector, but still SEStran should remain involved and informed. SEStran could consider being involved in the Scottish Ports Group and maintaining regular liaison with Transport Scotland which is already involved. SEStran could also discuss bulk shipping regularly with other RTPs to ensure a common agenda.
- The primary focus of this study is on the Scottish market. However, research findings of this study may raise market opportunities (e.g. freight traffic bundling and matching) to collaborate with European partners who are involved in the bulk trade with Scotland. For example, forestry products with Scandinavia and construction

materials with Germany and Belgium. Further research on particular markets/commodities could generate evidence for any future bulk pilot trial.

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