



Executive Summary

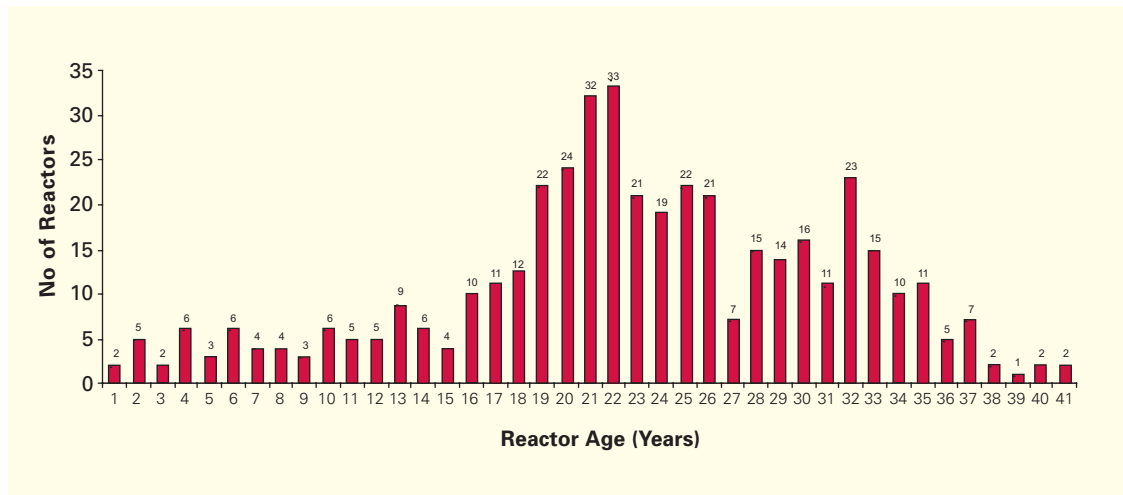
Executive Summary

This report has been prepared as a result of a study carried out jointly by the Nuclear Industry Association and Optimat Ltd commissioned by the Department of Trade and Industry, UK Trade and Investment and Scottish Development International. It provides a comprehensive review of the global nuclear decommissioning market and non-nuclear decommissioning markets (UK only) to assess opportunities for the development of a strong and internationally competitive UK supply industry. The report clarifies and addresses energy supply chain capacity and capability requirements to meet future demands for nuclear and non-nuclear decommissioning work. It is aimed at informing companies at all tiers in the energy supply chain, but especially Small or Medium Enterprises (SME's), of potential supplier opportunities in the global decommissioning markets including the UK, in terms of scale, timing and demand. It also provides an understanding of supply chain dynamics and scope for technology and skills transfers.

UK and Global Nuclear Decommissioning Opportunities

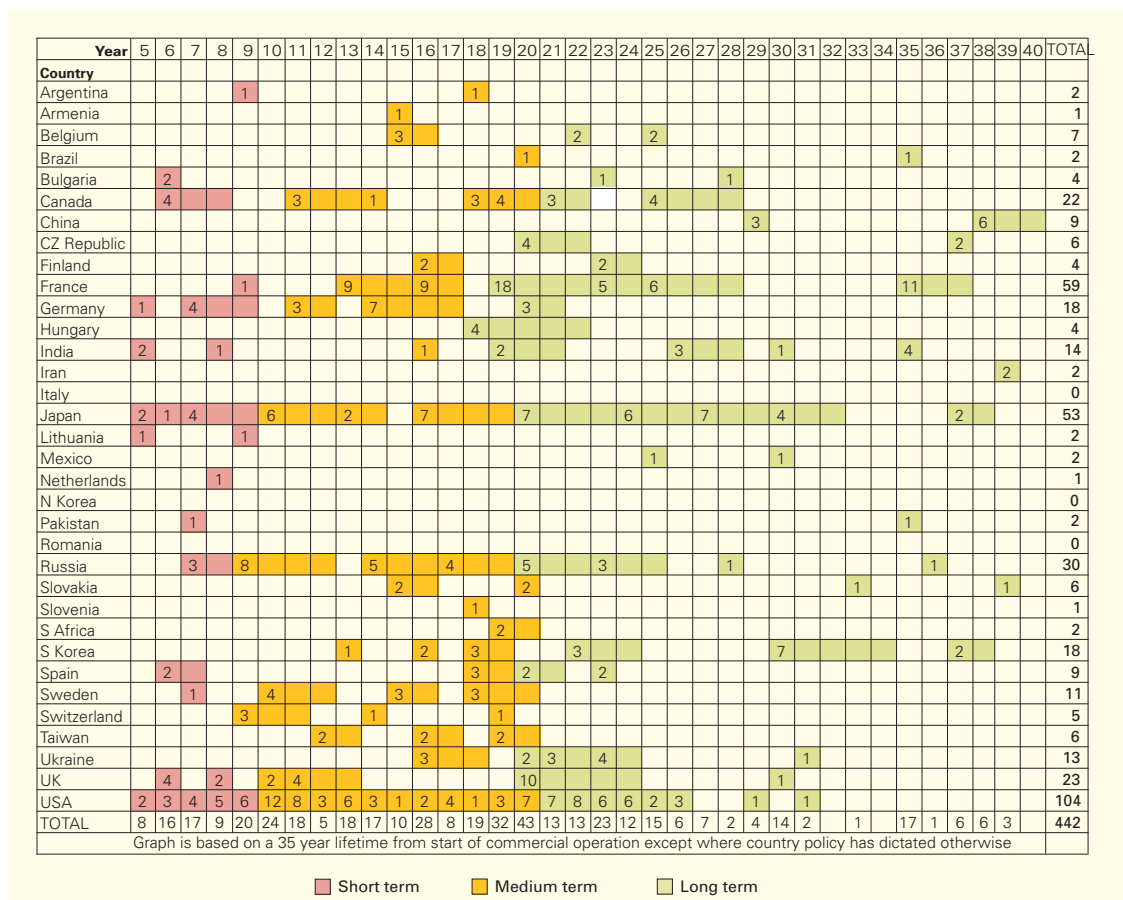
Decommissioning and cleanup of the global civil nuclear legacy represents a massive management, technological and environmental challenge for the UK and international community over the next century. The Nuclear Decommissioning Authority (NDA) are responsible for a work programme lasting for decades worth billions of pounds and the development of a long-term, diverse, robust and competitive supply chain. The scale of investment required by the UK alone is £56bn, opening up opportunities for both existing companies and committed new entrants. This is dwarfed by the global market, estimated to be worth £300bn over the next 30 years, providing major opportunities for the UK. For example, over 400 civil nuclear reactors in operation worldwide will need to be decommissioned over the next several decades.

Number of Reactors by Age (as of June 2005)



Although plans for lifetime extension in a number of countries are being formulated which may allow some reactors to operate beyond their design lifetimes of around 35 years, this does not impact significantly on the ultimate scale of the potential opportunity.

Global Operational Nuclear Reactors – Forecast Decommissioning Timeline



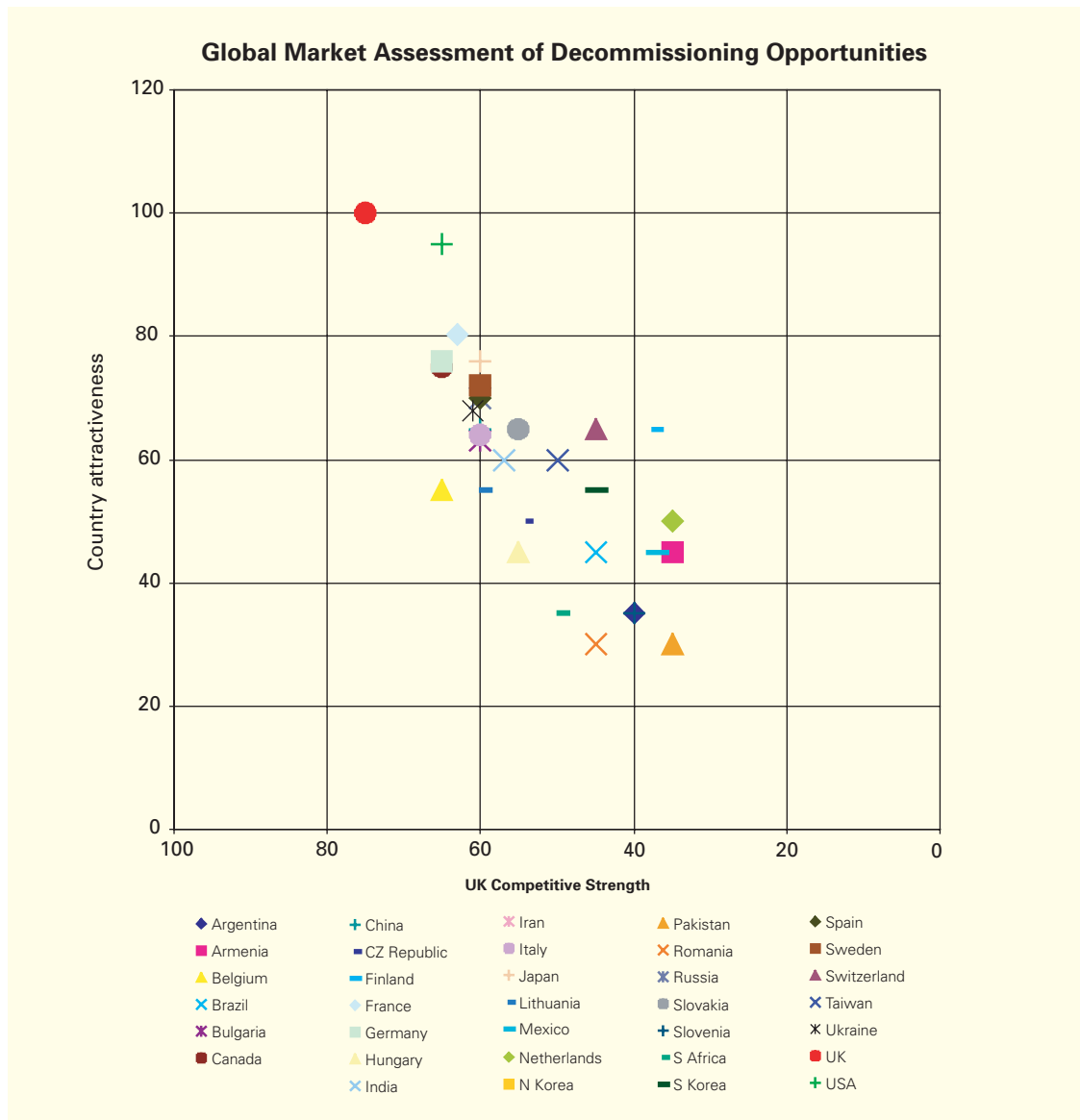
The timeline forecast offers an indication of those countries that are likely to provide short, medium and long term opportunities for decommissioning civil nuclear power reactors. It suggests that countries such as France, Japan, Russia, USA, UK, Canada and Germany will have the greatest long term need for decommissioning. The forecasts also indicate that over 50% of the world's civil nuclear reactors will be due for shutdown and decommissioning by 2016 where demand could outstrip supply, opening up opportunities for new entrants. However, it should be noted that many of these countries already have some decommissioning supply industry capability.

For any UK company, identifying the right global decommissioning markets to enter is very important as it can be a major determinant of success or failure. An assessment of all the global nuclear decommissioning markets was undertaken based on desk research and interviews with a cross section of companies in the UK supply chain operating in global markets. Each market was scored between 1 (very poor) and 5 (very good) in terms of market attractiveness and relative competitiveness using the following screening criteria.

Market Assessment Criteria

Global Market Attractiveness	Relative Competitive Strength (UK company Vs Foreign Company)
Market Size	Product/service demand
Market Growth	Prices & conditions
Market potential & timing	Market presence
Profit potential	Communication
Market access	Marketing plan
Political/economic risks	Market share obtainable
Buying power	Financial strength
Socio-cultural distance	

Total combined scores were converted to a percentage and an indicative measure of market attractiveness and the UK's competitive strength in each country. The results were used to compare and rank the overall attractiveness of the markets from the following matrix.



Based on this analysis the top ten most attractive global nuclear decommissioning markets for UK companies wishing to establish a long term presence were:

- 1) UK
- 2) USA
- 3) France
- 4) Germany
- 5) Canada
- 6) Japan
- 7) Sweden
- 8) Russia
- 9) Spain
- 10) Ukraine

Profiles of the decommissioning market are contained in this report for each of these countries, including more detailed information on markets and contacts on the top three countries can be found for UK (Part D), USA (Part F) and France (Part F).

UK Non-Nuclear Decommissioning Opportunities

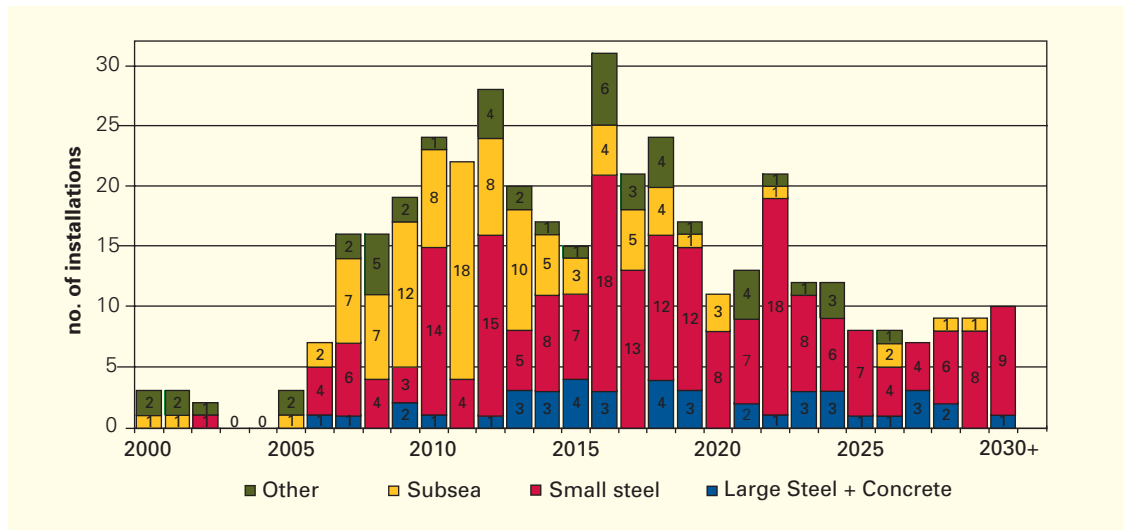
In addition to the nuclear industry, many other sectors also have historic legacies with environmental implications that have to be addressed. These sectors also have long term decommissioning requirements that provide potential business opportunities for UK industry. Key findings from a brief review were undertaken to assess the key drivers, requirements and potential decommissioning opportunities in the following seven UK industry sectors, are summarised:

- UK offshore decommissioning
- Fossil fuel power plant
- Ship breaking, recycling and salvage
- Mining
- Defence
- Refineries
- Industrial plant

UK Offshore Decommissioning

- Offshore oil & gas installations, footings, pipelines, drill cuttings
- The industry is regulated by the Petroleum Act 1998
- Eventual decommissioning of steel jacket platforms (220), concrete (11), floating production systems (18)
- Opportunity potential – installations: c £10bn, subsea structures: c£3bn, pipelines: £ 2-6bn Total: £15-19bn
- Drill cutting volumes ~700,000 m³ in the central North Sea and 500,000 m³ in the northern North Sea
- Requirements – drill cuttings removal/treatment, disposal, encasement

Offshore Decommissioning Activity



Ship breaking, recycling and salvage

- World merchant fleet >36000 vessels – 80% tankers, bulk carriers
- Accelerated single hull tanker phase out scheme
- EU and IMO adopted legislation in 2003 Regulated by the Petroleum Act 1998
- 3000 ships worldwide scrapped per year by 2010
- UK has 9% of the EU's single hull tanker fleet
- Current global ship scrapping practices often violate HSE standards
- Shortage of global 'Green Ship Recycling' facilities
- Opportunity – remediation, dismantling, disposal and recycling
- US cost of dismantling warships (\$900-\$1300 per dt)
- Potential to develop a long term UK green ship recycling industry
- Requirement for advanced remediation, dismantling, disposal and recycling technologies
- Scope for advanced technology transfer and potential diversification opportunities for oil & gas, nuclear and defence decommissioning supply industries

There are currently no suitable green ship recycling facilities in the UK, although Harland & Wolff was cited by the IMO as a potential candidate. Development of this opportunity would involve substantial investment, planning issues and public concerns.

Mining

For the purposes of this study, mining includes coal, minerals and metal extraction. Key issues and potential opportunities are:

Coal

- 42 open cast sites and 8 deep mines operating in the UK
- Coal Authority has 200 historic liability sites, pumping stations, monitoring stations and gas venting sites, contaminated mine water, settlement lagoons etc
- Licensed contractors work to environmental codes
- £25m UK annual spend

Metals and Mineral

- 2400 active UK mines, quarries and hundreds of processing plants
- National and regional government regulation
- Early planning for closure required for land and community care
- Often large-scale development that can impact on the environment
- Sites often turned over to nature conservation, recreational and regeneration

Opportunity

- Long term growth prospects over next 30 years
- Legislation driven, although currently limited expenditure
- Established supply industry
- Niche diversification opportunities for nuclear decommissioning supply industry
- Environmental services, demolition, waste management, land remediation, civil engineering, monitoring and maintenance services
- Post site monitoring likely to become responsibility of third parties with insurance bond or special funding
- Limited overall opportunity potential

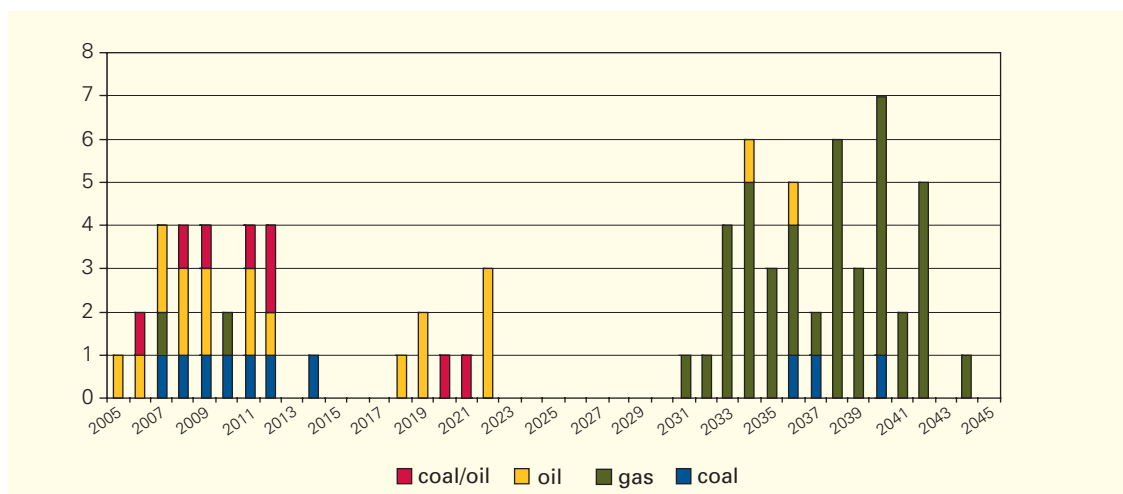
Defence

- Trend towards disposal of MOD buildings and facilities
- Decommissioning of nuclear weapons carried out at Aldermaston
- Long term recovery programmes to recover armaments from the Irish sea and other parts of the UK
- Potential opportunities for technology transfer e.g. remote handling, recovery technologies
- Capability fit with the nuclear and non-nuclear supply industries e.g. oil & gas
- Attractive overall decommissioning opportunity potential

Fossil fuel power generation

- 12 operational coal fired power stations
- 43 operational gas fired power stations
- 8 coal/oil fired power stations
- 19 oil fired power stations
- 10 other various power stations
- UK coal fired power stations more than 30 years old
- UK fossil fuel decommissioning market >£4bn
- Decommissioning offset by life extension technologies
- Growth in new build coal fired power stations overseas
- Capability fit with the nuclear, oil & gas and construction industries
- Attractive overall decommissioning opportunity

Forecast UK Fossil Fuel Power Plant Decommissioning Activity



Refineries

- Total number declined from 17 in 1976 to 12 in 2005
- 12 operating in 2000
- Most refineries 30-40 years old
- Demand driving plant extensions
- Drive to extend plant life
- >90% of plant re-used or recycled
- Opportunity for gas storage
- Refinery decommissioning market >£800m
- Limited overall opportunity potential

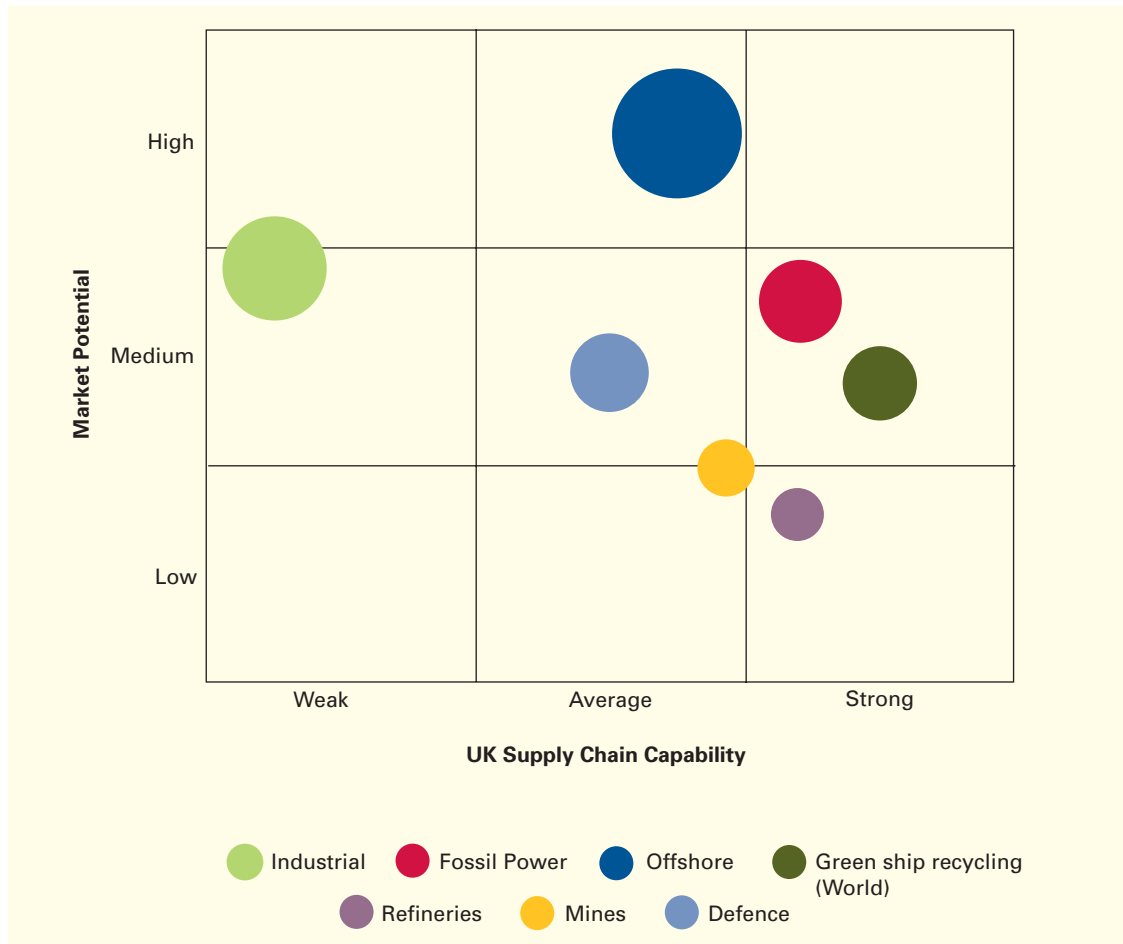
Industrial plant

For the purposes of this study, industrial plant covered chemicals, metal processing, agrochemicals, and pharmaceutical sectors.

- Typical services include demolition, land remediation, explosive demolition, dismantling, decontamination, asbestos removal, industrial cleaning, asset recovery
- Legislation driven e.g. Provisions of the Occupiers' Liability Act 1957 – covers visitors, Occupiers' Liability Act 1984 – covers others, Water Resources Act 1991
- Owners need to limit ongoing liability
- Maximising the site value
- Outsourcing manufacturing overseas is making industrial plant redundant
- Substantial regeneration of brownfield sites taking place across the UK
- Strong supply industry already exists
- Limited overall opportunity potential

An assessment of all seven UK non-nuclear decommissioning markets was undertaken in terms of relative market potential and competitive strengths of the UK decommissioning supply chain. These were scored in a similar way as the global nuclear decommissioning markets to rank overall opportunity attractiveness.

UK Non-Nuclear Decommissioning Opportunity-Capability Matrix



Taking into account all of the screening criteria, the most attractive UK non-nuclear decommissioning markets for UK industry in order of priority were:

- 1) Offshore
- 2) Fossil power plant
- 3) Defence (non-nuclear)
- 4) Green ship recycling
- 5) Industrial plant
- 6) Mining
- 7) Refineries

It should be noted the above rankings are only to provide an indication of opportunity potential. Companies should undertake a detailed assessment before making decisions on market entry. Summaries of each non-nuclear market are included in the main report.

Global Nuclear Decommissioning Market Entry Strategies

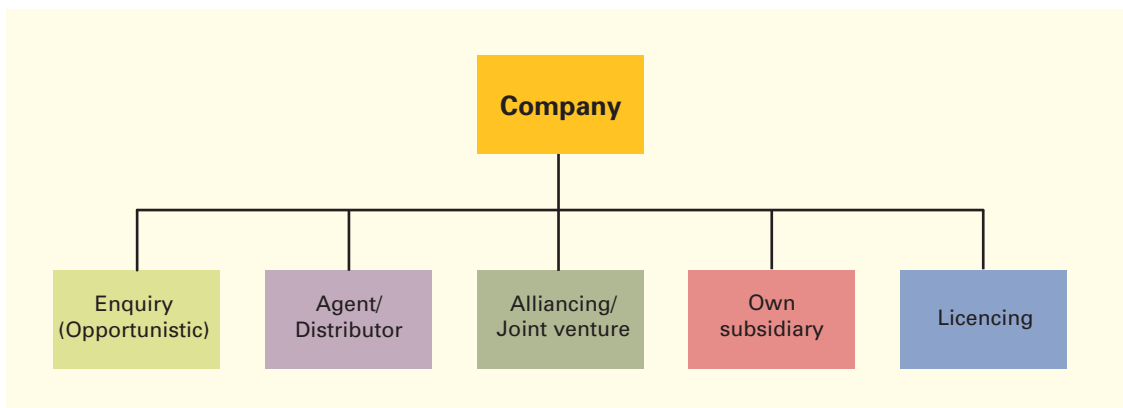
Before entering into international markets, companies are strongly advised to first consider their motives for internationalisation, identification of the best entry modes or routes to market and selection criteria used to identify which markets are right for them.

Reasons for exporting are usually based on a number of factors, rather than just the development of new income streams. Ten major motives identified for UK companies in the nuclear supply chain starting to export include:

- The desire for short term profit
- Management motivated towards global marketing activities
- Limited competition or have gained technological advantage in specialised fields
- Securing resources to respond to market opportunities
- Potential to increase output and rapidly climb the learning curve
- Tax incentives to help exporters
- Reaction to competitive pressures
- Low share or saturation of domestic markets
- Excess capacity for domestic markets
- Enquiries generated from overseas dealing departments

There is no one ideal market entry strategy and different approaches are adopted by UK companies entering the same market and/or by the same firm entering the different markets. For example, market entry is a critical first step for most SME's, while exploiting opportunities more effectively within existing global operations is important for established companies. Market entry modes adopted by UK companies include:

Typical Market Entry Modes



From a UK decommissioning supply chain perspective, market entry modes have to encompass the entire supply industry and have been classified into three groups:

- Export modes – low control, low risk, high flexibility etc
- Intermediate modes (contractual model) – shared control and risk, split ownership etc
- Hierarchical modes (investment modes) – high control, high risk, low flexibility etc

When selecting a market entry mode, companies will need to take into account key factors including:

Internal Factors – firm size, international experience, product or service capability

External Factors – sociocultural distance between UK and host country, country risk/demand uncertainty, market size and growth, direct/indirect trade barriers, competition intensity and small number of relevant intermediaries available

Desired Mode Characteristics – aversion to risk, control and flexibility

Transaction Specific Factors – tacit nature of know-how preventing knowledge transfer

This study cannot prescribe which foreign market or entry mode should be adopted due to different company circumstance, capabilities, experience and market dynamics. However, the authors recommend that companies should carry out appropriate due diligence and evaluation of all the factors before making decisions on market entry mode.

UK Nuclear Decommissioning Market Entry Strategy

The previous sections considered the reasons for internationalisation, market entry modes and selection of target markets. Companies interested in entering the top ranked UK nuclear decommissioning markets are advised to consider the following as an input to development of a business strategy.

- Gathering market intelligence on key stakeholders, customers, partners and competitors
- Specific sources of information about contract opportunities
- Market positioning
- Survival issues
- Constraints, regulations and risks
- Skills and capabilities

Detailed information relating to these issues is provided in the top ten market profiles (see Parts D to F in the main report). Further information, assistance and practical advice is available for those companies wishing to engage in global nuclear decommissioning markets and can be obtained from the following websites with links to other related organisations:

- UK Trade & Investment (UKTI) www.uktradeinvest.gov.uk
- Scottish Development International (SDI) www.scottishdevelopmentinternational.com
- Department of Trade & Industry (DTI) www.dti.gov.uk/energy/nuclear/fsu
- Business Link www.businesslink.gov.uk
- SITPRO www.sitpro.org.uk
- Foreign & Commonwealth Office www.fco.gov.uk
- Nuclear Decommissioning Authority (NDA) www.nda.gov.uk
- Nuclear Industry Association (NIA) www.niauk.org

UK Non-Nuclear Decommissioning Market Entry Strategy

Due to the diverse nature of non-nuclear markets considered and limited information available, more research will be required to define appropriate market entry strategies for new players. However, apart from ship breaking and recycling which is not established in the UK, most of the markets already have established supply industries. Tier one companies will have to compete directly with existing main contractors, while attractive opportunities for SME's are to supply niche specialist services where there is less competition.

UK Nuclear Supply Chain Capability Gap Analysis

Results from a survey of a typical cross section of nuclear industry suppliers drawn from 90 Nuclear Industry Association members shows that the UK has varying levels of capabilities for 26 different categories of products and services. Results from the breakdown tempered by the views of a number of representatives from companies working in the sector indicate there are current weaknesses in the UK supply chain capability and a shortage of companies providing:

- Nuclear ventilation
- Asbestos removal
- Effluent treatment
- Utility fabric upgrading services

Furthermore, a distinct shortage of radiochemists, radiation protection advisors and health physics monitors has been reported by those companies servicing the industry. Some niche specialist engineering services are also in short supply in nuclear design and safety case services. The results also indicate a relative strength in project management for smaller projects and consulting services. This has implications for global resource diversification.

Global Nuclear Decommissioning Demand Versus Capability

Due to the limited information on the capability strengths and weaknesses of the global nuclear community, a subjective assessment was undertaken based on desk research and interviews with UK and overseas companies and Embassies/Consulates working in those countries. The following conclusions are drawn from the results:

- For the UK, major project management skills, nuclear design, facilities management, health physics services, safety case services and depository design are all areas where there are likely to be shortages and major supply chain development needed. Development is also needed in contaminated coolant treatment.
- Areas requiring more resource capacity where demand is strong include decontamination services, nuclear ventilation, effluent treatment, mechanical handling, remote mechanical handling and EC&I.
- The UK, USA and France already have a developed nuclear decommissioning infrastructure with major contracting companies providing project management expertise.
- Nuclear retention steps are being taken by the UK, USA and France to ensure they have the technical skills and expertise for their nuclear decommissioning programmes, although further nuclear skills retention measures are required.
- A shortage in a number of skills areas exist in several Western and Eastern European countries, mainly for specialist technical expertise such as those already in limited supply in the UK.
- Russia and the Ukraine do not have the resources alone to deal with their nuclear legacies and they are receiving international funding and technical assistance. These countries and some other FSU and Eastern European countries may provide the best opportunity for UK SME's by partnering or alliancing with a UK or foreign company already operating in the market.

- For all countries it is clear that the demand for the techniques, technologies and skills required for nuclear decommissioning are set to increase over the next 10 to 15 years, although it is by no means clear that sufficient capability will exist at the appropriate time.
- Future supplier capacity could be compounded as worldwide demand for potentially similar skills is anticipated across the whole industrial arena in areas such as new nuclear power plant construction, defence, oil & gas, shipbuilding and conventional power plant etc

The report findings strongly suggests that transfer of appropriate capabilities from non-nuclear sectors will be required to address the skills shortages in order to meet the UK's nuclear decommissioning targets and exploit opportunities in the global market.

UK Non-Nuclear Supply Capability Gap Analysis

A review of the current UK supplier capability was assessed by identifying the number of companies supplying 29 categories of goods and services to seven non-nuclear decommissioning markets in the UK.

The survey indicates that the UK has a relatively strong decommissioning supply industry, covering most non-nuclear markets. It should be noted that suppliers may provide services to several markets. The results indicate relatively strong cross-sector supplier capability in:

- Project management
- Facilities management
- Safety case services
- Decontamination services
- Asbestos removal
- General construction
- Effluent treatment
- Mechanical handling
- Site remediation
- Consultancy services
- Legal services
- Waste management/recycling

The main area of UK supply chain weakness appears to be in Green Ship Breaking, where the UK has limited facilities and no IMO approved sites, although existing shipyards or appropriate offshore fabrication yards could potentially be adapted for this role.

Opportunity/Capability Mapping

Nuclear

Assessment of capabilities existing in the UK nuclear decommissioning supply chain suggests there is potential for capability transfer into other sectors of industry in the UK requiring decommissioning services. Typical decommissioning supplier opportunities where there is some degree of capability fit with the UK nuclear supply chain include oil & gas, MOD/defence, fossil power generation, refineries and other industrial plant. The main capabilities that could be transferred are:

- Project management
- Asbestos removal
- Decontamination services
- General construction
- Conventional design
- Conventional demolition
- Mechanical handling
- Site remediation
- IT and IC&E
- Measuring instrumentation
- Fabric upgrading
- Consulting, legal and insurance services
- Conventional component supply

It should be noted that the demand for capability and skills transfer from nuclear to non-nuclear markets is mixed and that most of the non-nuclear sectors already have established supply industries in the UK.

Non-Nuclear

A major barrier to transfer supplier capabilities from non-nuclear to nuclear decommissioning is the strict health and safety regime operating in the nuclear industry. Nevertheless, other sectors that also operate in hazardous environments such as oil & gas, MOD/defence and refineries/petrochemicals have the potential to transfer capabilities and skills into the nuclear industry. The main capabilities that could be transferred include:

- Project management
- Facilities management

- Decontamination services
- Asbestos removal
- Effluent treatment
- Mechanical handling
- Remote handling
- Site remediation
- Waste management services
- Maintenance and monitoring services

Opportunities for Product/Market Diversification

Nuclear

Decommissioning nuclear facilities involves a wide range of dismantling, waste management and remediation activities using a range of conventional and advanced techniques where health and safety is a primary issue. Remote techniques developed in non-nuclear industries, especially offshore oil & gas, MOD/defence, fossil power generation etc could be adapted for decommissioning nuclear facilities. Examples of potential opportunities for product/market diversification in nuclear decommissioning include:

- Remote cutting and removal equipment
- Remote control and handling underwater and hazardous environments
- Shielding and installation of appropriate ventilation systems
- Safe handling, treatment, storage and containment of hazardous wastes

Non-Nuclear

Opportunities also exist to adapt capabilities and expertise in the UK nuclear industry for decommissioning in non-nuclear sectors, opening potential areas for product and process diversification. For example, the nuclear industry has considerable capabilities and expertise in project management, decontamination, waste management etc. Results from this study suggest potential opportunities for product/market diversification to meet future demand in non-nuclear decommissioning include:

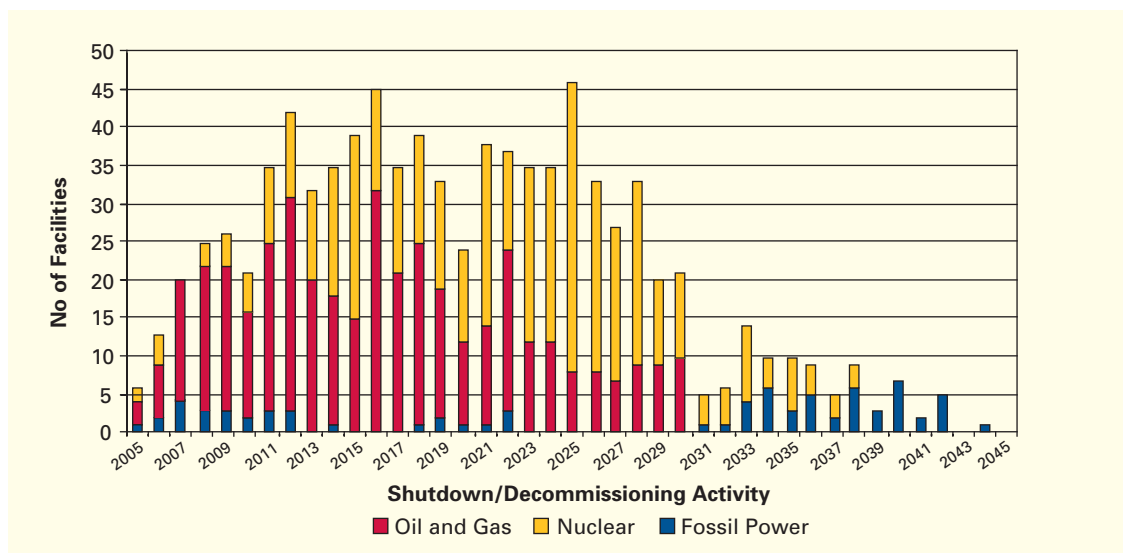
- Removal of offshore oil & gas platforms, pipelines and footings
- Treatment, handling and disposal of hazardous waste MOD/defence materials and facilities
- Dismantling, removal and remediation of fossil power generation plant
- Dismantling, removal and disposal of industrial plant

UK companies considering product/market diversification either in nuclear or non-nuclear markets must have some capability strengths that offer a competitive advantage in the new market e.g. having leading edge technology, unique specialist services etc.

Supply Chain Capacity

Results from the study show there is scope for capability transfer between nuclear and non-nuclear industries. However, decommissioning in nuclear and non-nuclear industries combined with wider sectoral activity e.g. new power station construction, MOD shipbuilding, transportation etc; in the UK and overseas over the next 40 years could result in acute skills and capacity shortages. For example, the combined decommissioning timelines for the energy sector alone suggests a sevenfold increase in decommissioning over the next 12 years.

Forecast Energy Decommissioning Activity (2005-2045)



Results earlier in the study identified a number of current gaps and weaknesses in decommissioning supply chain capabilities in the UK to meet current demand. The above growth forecasts suggest that the UK will have to substantially increase its supply chain capacity as well as capability to meet future UK and global market demand. There is a risk that supplier capacity weaknesses could impact on planned decommissioning targets, lost export opportunities and increased competition from overseas companies. This strongly suggests action will be required by government and industry to increase UK supplier capability and capacity through skills transfer and development; technology and capability transfer from other sectors and develop the existing supply industry.

Opportunities and Issues for Scotland

All of the information in this report that applies to the UK decommissioning supply chain concerning global nuclear decommissioning opportunities also applies to Scotland. The following information is of particular relevance to Scotland and is additional to the main report.

Scotland has four nuclear licensed sites (Torness, Hunterston, Chapelcross and Dounreay), representing 16% of the UK's nuclear power infrastructure. Decommissioning has either started or is planned to start in the next few years at Hunterston A, Chapelcross and Dounreay. This offers substantial opportunities for Scottish and UK companies either in the nuclear supply chain or the wider energy supply industry, where Scotland has world class capabilities. NIA estimates the potential spend, including externally outsourced spend during 2005/06 to be;

Site	Total by site £M	External spend £M
Hunterston A	56.1	34.8
Chapelcross	67.3	41.7
Dounreay	149.7	104.8
Totals	366.7	181.3

Full details of the NDA Annual Plan, its site Lifecycle Baselines and Near Term Work Plans can be accessed from their website which includes information on Dounreay, Hunterston A and Chapelcross. External spend is the estimated value of work subcontracted to third parties from each site.

Although not part of the civil nuclear programme, AWE at Aldermaston undertakes legacy work through a Legacy Programme which extends over 70 years with a total cost of about £2.5B. It includes a 10 year programme with a £30M annual spend. The MOD has requested proposals from industry regarding the safe disposal of decommissioned nuclear powered submarines. Over the next 30 years up to 27 submarines will be taken out of service. The 11 laid up submarines at Rosyth and Devonport are de-fuelled and future decommissioned submarines will be de-fuelled at Devonport prior to entering the Interim Storage of Laid up Submarines (ISOLUS) programme. The project is on hold pending the outcome of the CoRWM review of long term storage of nuclear waste in the UK.

Development of Scotland's Nuclear Decommissioning Industry

It will be necessary for Scotland to capitalise on these opportunities to utilise them to full advantage and the question is how best to achieve this. Key issues and conclusions drawn from this study include:

- ***Which opportunities have the most potential for Scottish companies?***

The majority of Scottish companies wishing to enter the decommissioning supply chain are likely to be tier 3 and 4 suppliers and global markets may not be the initial best choice. Going international can be expensive, in terms of both money, management time and commitment so a company needs to gain competitive advantage by going international. Some of the FSU and Eastern European countries may provide the best opportunity for a Small or Medium Enterprise wishing to enter the overseas decommissioning market by partnering or alliancing with a UK or foreign company already having a presence in the market there.

- ***What comprises the decommissioning resource in Scotland, who are the companies, what do they supply and what are the supply chain strengths and weaknesses in Scotland?***

These questions are all answered in this report to a certain extent. The same companies and their strengths and weaknesses, apply to companies working at the Scottish nuclear sites as the rest of the UK. However, there is an additional resource in Scotland that has yet to be tapped and it is this resource and its capability that needs to be identified such that it can be assisted and utilised.

- ***What are the skills required for decommissioning and what needs to be done for Scottish suppliers to improve the decommissioning skill base?***

The skills required for Scottish companies will be the same as those companies already working in the nuclear industry and which are identified in the main body of this report which also points to those skills that are in short supply. What needs to be done for Scottish people and suppliers either as new entrants to the nuclear decommissioning market or diversifying into another part of it is an area for further development.

- ***How many jobs are likely to be created as a result of global decommissioning activities in Scotland (a) in Scotland (b) globally?***

The jobs at Scottish decommissioning sites can be split into permanent site staff and contract staff employed at site required at each stage of decommissioning. The global picture will depend upon the known uptake by UK companies. There is a need for further research in this area to understand, monitor and address the impact on regional and national economies.

- ***What will be the impact upon unemployment and income in Scotland and its regions be as a result of decommissioning activities?***

There is a need for further research in this area to understand the impact on Scottish regional and national economies and allow any deterioration to be addressed.

For nuclear decommissioning the right business environment has been created by the advent of the NDA to attract companies and industries to Scotland. Which companies/organisations wish to set up businesses in Scotland and where, to take advantage of the opportunities? What more can and needs to be done to enhance the business environment, e.g., communications infrastructures or research? There is need for further research to answer these questions.

It is also necessary to understand what opportunities exist for diversification of companies working in other industries in Scotland into nuclear decommissioning, such as North Sea Oil & Gas and overseas and how best to exploit this opportunity. Answers to this question are contained in Part C sections 6.1.1, 6.1.2 and 6.2.2.

- ***What needs to be done to address the above questions further?***

This report goes a long way to answering the above questions for the UK as a whole and much of it is also relevant to the Scottish situation. Where answers are not available a number of recommendations are made to Scottish Enterprise, HIE, their LEC's and SDI to address them in the main report.

Conclusions

The main conclusions drawn from this study are summarised as follows:

Nuclear

The main conclusions and recommendations drawn from this study for UK and world decommissioning are:

- Nuclear decommissioning both within the UK and in global markets will become a major opportunity for the UK's energy supply chain.
- The commercial opportunity offered by a programme of work, the responsibility of the NDA, is worth approximately £56bn, with a stated annual expenditure of around £2bn.
- Although not part of the civil nuclear programme, AWE at Aldermaston undertakes legacy work through a Legacy Programme which extends over 70 years with a total cost of about £2.5bn. It includes a 10 year programme with a £3m annual spend.
- The MOD has requested proposals from industry regarding the safe disposal of decommissioned nuclear powered submarines. Over the next 30 years up to 27 submarines will be taken out of service and decommissioned.
- The global decommissioning opportunity outlined in this report is estimated to be worth around £300 bn over the next thirty years. This is the global estimation for reactors but if the decommissioning of reactor support infrastructures defence and deterrent decommissioning and clean up is included this figure could increase to £450bn.
- It is likely that a long term waste store will be built in the UK in the foreseeable future. This together with its supporting infrastructure is likely to become a significant worth several £bn.

These nuclear decommissioning opportunities in the UK and globally provide hugely significant opportunities for the UK's energy companies, both for existing companies and committed new entrants to establish a major market share and deliver cost effective and innovative solutions. This is heightened when one considers the future worldwide demand for a number of potentially similar skills across the whole industrial arena in areas such as new nuclear power plant construction and non nuclear industries such as oil, gas, shipbuilding, conventional power plant, rail, aerospace, mining, defence, etc; some of which have some very large projects currently being formulated. All of these may provide further opportunities. However, there are a number of key issues relating to the existing UK nuclear supply chain capability and capacity to exploit future global opportunities in nuclear or non nuclear decommissioning.

Creating an open and competitive environment has opened up greater opportunities for companies at all tiers in the supply chain. The level of awareness in other industry sectors, especially by Small or Medium Enterprises (SME's) of potential supplier opportunities, understanding supply chain dynamics and scope for technology/skills transfer is mixed. There is generally lower awareness overall of the greater opportunities offered by the global nuclear decommissioning market, in terms of scale, timing and demand forecasts. This has implications on the UK's supply chain capability and capacity to exploit the global market place. Companies therefore need to be better informed in order to respond to future opportunities. This report has been produced to address all of these issues.

Non-Nuclear

The main conclusions and recommendations drawn from this study for UK non nuclear decommissioning markets are:

- Non-nuclear decommissioning in the UK offers new growth opportunities for the UK energy supply industries over the next 30 years and beyond.
- The UK has a relatively strong non-nuclear decommissioning supply industry, especially in general construction/dismantling, waste management/recycling, environmental services, site remediation, maintenance and environmental monitoring. The main supplier capabilities that could be transferred to nuclear decommissioning are remote cutting/removal, remote control/handling, shielding and installation of appropriate ventilations, safe handling and waste management of hazardous wastes.
- The top three non-nuclear decommissioning markets that offer greatest potential are offshore installations, fossil power generation plant and MOD/defence facilities, jointly estimated to be worth £20bn over the next thirty years.
- Green ship recycling, which is being driven by EU and IMO adopted legislation, offers potential opportunities to break up and recycle the world's fleet of over 36000 merchant vessels under an accelerated phase out scheme. However, there are currently no approved facilities in the UK although existing shipyards and oil rig construction yards could possibly be adapted. This would require major investment and there could be major planning issues and public concern.

- The UK non nuclear industry has capability strengths that fit with capability/capacity shortages in nuclear decommissioning. These include asbestos removal, effluent treatment, mechanical handling and remote handling/control. These offer potential product/market diversification opportunities for capability transfer into nuclear decommissioning.
- Other non-nuclear decommissioning markets include industrial plant, mining and refineries/petrochemicals, although there is limited scope for development or product/market diversification by the nuclear industry.
- This report only considered the UK non-nuclear decommissioning markets. However, as opportunities are usually driven by the same or similar international environmental legislation and drivers, there are potentially major opportunities for the UK supply chain in global markets.

Recommendations to exploit UK and global opportunities, development of the UK decommissioning supply chain and address supply chain weakness are provided in the main report.