Broad Character: Industry
Character Type: Energy Industry
National Perspective

INTRODUCTION: DEFINING/DISTINGUISHING ATTRIBUTES

The Character Type Energy Industry includes the following Sub-Character types:

- Hydrocarbon field (gas)
- Hydrocarbon field (oil)
- Hydrocarbon installation
- Hydrocarbon pipeline
- Hydrocarbon refinery
- Power station (fossil fuel)
- Power station (nuclear)
- Renewable energy installation (wind)
- Renewable energy installation (tidal)
- Renewable energy installation (wave)
- Submarine power cable
- Overhead power cable

The Energy Industry Character Type covers areas whose dominant character is concerned with the extraction, processing and/or storage of hydrocarbons (oil, oil derivatives, and gas, but not coal); installations relating to all forms of renewable energy generation, by wind, wave or tide, and power stations of all fuels, together with their associated transmission facilities and directly associated transport facilities.

Hydrocarbon field (gas) refers to a production area for natural gas from naturally occurring reserves. Those reserves occur in organic-rich rocks such as oil shales or coal; hydrocarbons form when they are subjected to high pressure and temperature over extended periods. Mapping of these areas by HSC relates to the areas dominated by the production activity, not the full known area of the geological reserves.

Hydrocarbon field (oil) refers to a production area for oil from naturally occurring reserves. Those reserves occur in organic-rich rocks such as oil shales or coal; hydrocarbons form when they are subjected to high pressure and temperature over extended periods. Mapping of these areas by HSC also relates to the areas dominated by the production activity, not the full known area of the geological reserves.

England's offshore oil and gas originate from two sources: 1) from subsidence and burial of marine limestones under thick accumulations of basin sediments approximately 140 million years ago which have generated gas from coal source rocks; and 2) from deeply-buried mudstone source rocks from approximately 65 million years ago. Thus commercial petroleum reservoirs occur in almost every sedimentary succession ranging in age from approximately 410-36 million years (BGS 2001). Most of the UK-produced oil and gas for domestic consumption comes from the UK Continental Shelf. As that resource is in decline, it is expected that England will increasingly depend on imported oil and gas.

Hydrocarbon installation refers to an installation, for example a drilling platform, directly involved in the extraction of oil and natural gas. Closely associated structures include pipelines, platforms, tanker moorings, storage containers, warning signals and lights. Unauthorised navigation is prohibited within 500m of all such structures. Whether HSC depicts individual hydrocarbon installations or subsumes them under a 'hydrocarbon field' is guided by the dispersal of such installations within a production area, the purpose of the HSC and, especially, its intended viewing scale.

Hydrocarbon pipeline refers to a pipeline involved in the transmission of oil or natural gas between facilities involved in their extraction, processing, storage or distribution.
Hydrocarbon refinery is a building or structure that processes and refines oil and natural gas, such as an oil refinery or gas compressor station. This includes directly associated storage, transmission and transport facilities such wharves and docks.

Power station (fossil fuel) refers to a building or set of buildings and structures where power, especially electrical or mechanical, is generated, using fossil fuels: coal, oil or natural gas (http://thesaurus.english-heritage.org.uk/). This includes a power station's directly associated storage, transmission and transport facilities.

Power station (nuclear) refers to a complex of buildings producing power derived from nuclear energy (http://thesaurus.english-heritage.org.uk/). This also includes these power stations' directly associated transmission facilities.

Renewable energy installations are subdivided for HSC into their main power sources, wind, tidal and wave pawer, and refer to buildings, sites and structures associated with the harnessing of those sources for electrical power generation. This includes windfarms, tidal mills, tidal barrages and wave power-generation technology, their directly associated electrical transmission and distribution facilities and other related features such as tidal pools.

Submarine power cable refers to a cable used to transmit electricity from the mainland to islands or to offshore installations, or to link offshore electricity generators to the onshore national electricity grid.

Coverage by HSC is limited to areas of energy industry character where its imprints are situated along the coast and within the marine zone. Those imprints show some distinctive features within the overall energy industry, for example the coastal emphasis in the siting of nuclear power stations and the increasing focus on offshore locations for some of the UK largest wind-farms. UK hydrocarbons output is now in long term decline but in 2001 there were still almost 500 platforms and 10,000 kilometres of oil and gas pipelines running between offshore production wells and terminals on land, mostly in the North Sea.

HISTORICAL PROCESSES; COMPONENTS, FEATURES AND VARIABILITY

Typical historical components of this Type include:

- oil and gas fields;
- slag heaps and offshore spoil dumping grounds;
- sub-sea wells and wellheads;
- fixed platforms and drilling rigs;
- large, sprawling industrial complexes;
- cooling towers, chimneys;
- distribution depots and customer service centres; and
- associated transport systems (such as railways, roads, ships, docks and tanker terminals). It is important to note that transport links are covered by the relevant 'Transport' Sub-types.

Oilfields are mostly found offshore in the UK, in the North Sea. A small onshore coastal oilfield is exploited on the Isle of Purbeck, Dorset. From the 1960s, while coalmines and railways were closing, oil and gas refineries were opening, both trends having impacts on the communities they were supporting and their coastal infrastructure. An example is the sharp decline in the 1980s in coal exports from Blyth Harbour, Northumberland, already under economic pressure from closure of its shipbuilding industry in the 1960s.

Natural gas from land-based reservoirs has been utilised to provide heating and lighting since the late 18th century. However, the situation changed in the 1960s and 1970s when a national conversion programme from 'town' gas to natural gas took place, with natural gas first discovered in English waters in 1965 and oil in the 1970s. By the mid 1980s there were over 100 oil and gas installations in the North Sea although the industry has been in decline since the beginning of the millennium.

When the first full scale nuclear power station was opened at Calder Hall, now Sellafield on the Cumbrian coast, by the Queen in 1956 the Lord Privy Seal, Richard Butler, described the event as "epoch-making" (www.news.bbc.co.uk). Subsequently 11 magnox power stations were built in the UK. Nuclear power stations have a markedly coastal distribution, facilitating their requirements for huge quantities of cooling water. Within that coastal spread their tendency towards more remote locations reflected, from the start of the industry, concerns over the safety of the technology but also a recognition of the industry's strong defence links and a desire ensure their operation was secure and, to an extent, hidden from the public gaze. By 1997, nuclear power contributed 26% of the UK electricity. Since then, UK nuclear power electricity generation has declined with the closure of several nuclear power stations with a number of others currently planned to close at the end of their planned functional lives by 2015. It is possible however that some at least will have their lives extended.

The UK has huge resources in wind, tidal and wave power. Wind power is the fastest growing form of global electricity generation and has become increasingly important in recent years, following the UN Framework Convention for Climate Change agreed in Rio in 1992 and the subsequent Kyoto protocol of 1997. This proposed a global cut of 5.2% greenhouse gas emissions by 2008-2012, specifically committing the UK government to reducing greenhouse gas emissions to 12.5% below 1990 levels by 2008-2012. In 2000, the Crown Estate announced the first round of UK offshore wind farm development (Round 1). Round 1 was to cater for demonstration scale projects of up to 30 turbines with the selection of sites largely driven by developers. Later, the Round 2 tender process was for commercial scale projects within the Greater Wash, the Thames Estuary and Liverpool Bay areas, with the aim of meeting the offshore wind capacities identified by the Strategic Environmental Assessment (SEA). In 2008, and following an announcement made from the Department for Business, Enterprise and Regulatory Reform (BERR) on the launch of an SEA of UK waters to open up the seas to up to 33 GW of offshore wind energy, The Crown Estate announced proposals for Round 3 offshore wind farm leasing comprising nine zones: Moray Firth, Firth of Forth, Dogger Bank, Hornsea, Norfolk, Hastings, West Isle of Wight, Bristol Channel and Irish Sea. Wave power in the UK is at an early stage of development. For tidal power, between 2008 and 2009, five options were being considered for a tidal barrage across the Severn Estuary. The UK Government ended that consideration in October 2010 by announcing it saw no strategic case for such a barrage for the foreseeable future. Advancing wave energy technologies, the South West Wave Hub, which was installed off Hayle on the north coast of Cornwall in 2010 is a grid-connected offshore facility for the large scale testing of technologies that generate electricity from the power of the waves.

Submarine power cables are represented in the England by the HVDC Cross-Channel which is a high voltage direct current (HVDC) connection that operates under the English Channel between continental Europe and the UK. The first HVDC Cross-Channel went into service in the 1960s. Because this first installation did not meet the increasing requirements, it was replaced in the 1980s by a new HVDC line with over 45 kilometres of submarine cables present in the sub-sea floor.

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VALUES AND PERCEPTIONS

This Character Type is often stimulates varied and complex and strongly held views, differing according to the interests being considered, the energy source, and the region and place concerned. In the most generalised terms some think that energy generation by any available means is a 'necessary evil' to support our society; others that we should move to more renewable methods which generate energy in ia 'clean, safe and reliable' way. Others feel that the energy production is inherently an 'eyesore', 'noisy', cannot be wholly environmentally friendly and is just one aspect of a more universally unsustainable relationship between human economies and the world we inhabit.

The controversy is exemplified by Sizewell power station in Suffolk. The industrial complex incorporating the characteristic dome of Sizewell B dominates the coastline, as do the power lines that emanate from it. The structure is located within an Area of Outstanding Natural Beauty (AONB) and has therefore been the subject of much debate, some seeing the visual effects as now an iconic aspect of the distinctive character of this stretch of the Suffolk coastline, while others see it as an iconic visual symbol of the unacceptable intrusion of unsustainable and dangerous modern technology into an 'unspoiled' area (albeit one considerably shaped by previous human activity including a strong military presence).

The use of nuclear power has always been controversial, not least because of the problems and uncertainities surrounding radioactive waste storage for indefinite periods. The potential for severe radioactive contamination by accident or sabotage, and the possibility that its use could indirectly lead to a proliferation of nuclear weapons are also viewed as unacceptable by some communities of thought.

Renewable energy generation also produces strong and sometimes polarised views. It is considered by many as a 'sustainable' means of energy generation, offering solutions to issues of global concern in all dimensions of sustainable development: economical, ecological, and social. From that standpoint, renewable sources of energy may be perceived as benign symbols of hope. However, renewable energy complexes are also seen by many as high-profile visually-intrusive features impinging on familiar and highly valued landscape and seascape, also add to levels of noise, smell and activity in 'tranquil' settings.

The UK Government agrees that renewable energy is central to securing a diverse and sustainable energy supply which will achieve the UK's carbon dioxide emission reduction targets. Questions about the capacity of renewables to meet that aim alone, coupled with a future 'energy gap' apparent in the UK's generation capacity against its energy demands, have led to proposals to build a new generation of nuclear power stations coupled with a major expansion of offshore wind generation under the Round 3 leases being offered by the Crown Estate (http://www.thecrownestate.co.uk/offshore_wind_energy).

RESEARCH, AMENITY AND EDUCATION

Decommissioning of nuclear power plants offer opportunities to undertake research into the landscape/seascape character perceptions surrounding such highly visible complexes, building on recent Scottish work on the heritage aspects of the Dounreay Nuclear Power Station.

The development and maintenance of the offshore energy industry creates large amounts of data relating to the seabed, most notably geophysical data. This is an invaluable resource for the offshore historic environment, providing information on past landscape surfaces as well as shipwrecks and other intrusive features. In addition renewable energy developments are often accompanied by educational facilities in order

to inform the general public about the benefits of this type of installation and any additional data produced.

The hydrocarbon industry is declining and a record of its history may be valuable. A recent project undertaken by the British Library National Life Story Collection and the University of Aberdeen entitled 'Lives in the Oil Industry' recorded first hand oral accounts of working in the oil and gas industry in order to preserve this history.

Considerable numbers of these industrial areas are founded on reclaimed land, often drained saltmarsh and mudflats, infilled from the late 19th century onwards. These buried deposits may have considerable potential for preserving palaeoenvironmental material and artefacts and features associated with estuarine environments.

Public amenity may be limited by health and safety considerations but other possibilities could be explored such as virtual and interactive displays. Even so, the former nuclear power station at Sellafield, Cumbria, has a visitor centre and is a key tourist attraction for the west Cumbrian coast, outside of the Lake District National Park.

General policy trends show an expansion of renewable energy with an encouragement of wind power, especially in offshore locations where more consistent strong wind speeds are available. Within this context, recognition of existing historic environment considerations in planning future wind farms is expressed, for example, by the Collaborative Offshore Wind Research Into The Environment (COWRIE), a company set up by The Crown Estate to raise awareness and understanding of the potential environmental impacts of the UK offshore wind farm programme. COWRIE published a guidance note for best practice in survey, appraisal and monitoring of the historic environment during the development of offshore renewable energy projects in the UK (Oxford Archaeology and George Lambrick Archaeology and Heritage 2008; Wessex Archaeology 2007). Historic Seascape Characterisation (HSC) can inform that on the typical historic character of areas under consideration for renewable energy developments, adding area-based context of the commonplace processes that have shaped an area to the more traditional point-based records of the rare and the special in the historic environment.

CONDITION AND FORCES FOR CHANGE

Output from the largest oil producers – the UK and Norway – has now peaked and entered a period of long term decline. In 2001, around 500 platforms and 10,000 kilometres of rigid and flexible oil and gas pipelines were running between offshore production wells and terminals on land (CEFAS 2001).

Increasing concerns relating to the finite nature of hydrocarbons and the burning effect these resources have on global warming places is increasing pressure on the energy industry sector. Nuclear power has been the main form of alternative energy production with renewables increasing as a share of overall UK energy production. Renewable energy is viewed by the UK Government as an essential element to tackle climate change. Recent debates suggest that new nuclear power stations are unlikely to make a significant contribution to current needs. However, it has also been stated by government that even though '*the share of renewables will grow, it is likely that fossil fuel generation will meet some of these needs. Given the likely increase in fossil fuel generation…, it is important that much of this nuclear capacity is replaced with low carbon technologies. New nuclear power stations could make an important contribution to meeting our needs for low carbon electricity generation and energy security…'* (BERR 2008; for further details also see http://www.decc.gov.uk; http://www.defra.gov.uk/environment/radioactivity/mrws/waste/new-nuclear-power-stations.htm).

Expansion of offshore windfarms raises many concerns about seascape impacts, both visually and across the full depth of the marine levels, where the material imprints occur which inform our understanding of marine historic character, These considerations will be accommodated for particular windfarm proposals by the landscape considerations required to be included in their necessary Environmental Impact Assessments (EIA). HSC has a particular role in informing those EIAs on the historic cultural dimension of seascape.

RARITY AND VULNERABILITY

Oil and gas working installations are found in coastal expressions within the overall English mainland and territorial and continental waters. If any remains of installations are found, statutory designation for modern structures exists in the form of designated safety zones around them. The purpose is to protect the safety of people working on or in the immediate vicinity of the installation and the installation itself against damage. They also provide the additional benefit of protecting fishermen and other mariners by reducing the risk of collision with the installation and preventing loss of gear which can become snagged on underwater equipment (Val Baker *et al* 2007).

An environmentally responsible approach will continue to be encouraged within this sector. There is government legislation that ensures consistent standards throughout the offshore industry (e.g. DEFRA 2002; HM Government 2009). Relevant archaeological guidance notes regarding the energy industry sector are also publicly available (Oxford Archaeology and George Lambrick Archaeology and Heritage 2008; Wessex Archaeology 2007). Since their publication, Historic Seascape Characterisation (HSC) has emerged providing an area-based assessment of the historic character of the typical in the coastal and marine zones.

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