

NORTH WEST
BUSINESS
LEADERSHIP
TEAM



Optimising our Essential Resources

Creating business advantage by 2040

How **England's North West** will sustain future supplies of food, water and energy

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'Optimising our Essential Resources'

CREATING BUSINESS ADVANTAGE BY 2040

How England's North West will sustain
future supplies of food, water and energy

A report by:



June 2014

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NWBLT

The North West Business Leadership Team is an independent group of influential business leaders, who work together to promote the sustainable economic development and long-term well-being of North West England. It was launched by HRH The Prince of Wales in July 1989. Membership of the Team is made up of senior executives from the region’s major businesses (see Appendix C). It operates as an independent business voice for the whole North West, thus providing valuable strategic support for the region’s Local Enterprise Partnerships.

Further information regarding the work of the North West Business Leadership Team can be obtained by writing to the Chief Executive, NWBLT, Daresbury Laboratory, Sci-Tech Daresbury, Keckwick Lane, Daresbury, Warrington WA4 4AD or by visiting www.nwblt.co.uk

EXECUTIVE SUMMARY

This report outlines the future challenges and opportunities facing England's North West in relation to food, water and energy. The nexus of these three essential resources not only offers the key to future security but also opens up business opportunities for those prepared to invest in the solutions. It is now widely accepted that there are fundamental questions over such issues as the reliability of energy supply, the sufficiency of food production and the availability of a resilient water supply.

Such resources will therefore become increasingly important and the report considers the availability of food, water and energy in the North West and the compelling reasons for investment in business going forward.

The most compelling business opportunities stem from achieving, before 2040, the following improvements:-

Food

1. Primary and secondary food producers in the North West will be able to co-locate their own research and development programmes within a cluster of world class food research institutions in the region. This will aid the development of new approaches to resource efficient livestock production and food manufacturing, and the incubation of new technology and skills for world-wide export. The North West should create a High Value Manufacturing Catapult for the Food and Beverage sector to foster collaboration between research institutions and facilitate links with industry;
2. The North West will champion new methods of economically sustainable and resource-efficient food production to supplement existing local supply. Methods such as the farming of fresh produce in urban environments or sustainable fish farming will help to ease reliance on food imports, lower transportation costs and generate new employment;
3. The North West will be a global leader in the development of cost-effective techniques for the recovery of valuable resources such as energy, water and fertiliser nutrients from existing food and agricultural waste streams to improve economic returns whilst minimising environmental harm for food producers locally and around the world.

Water

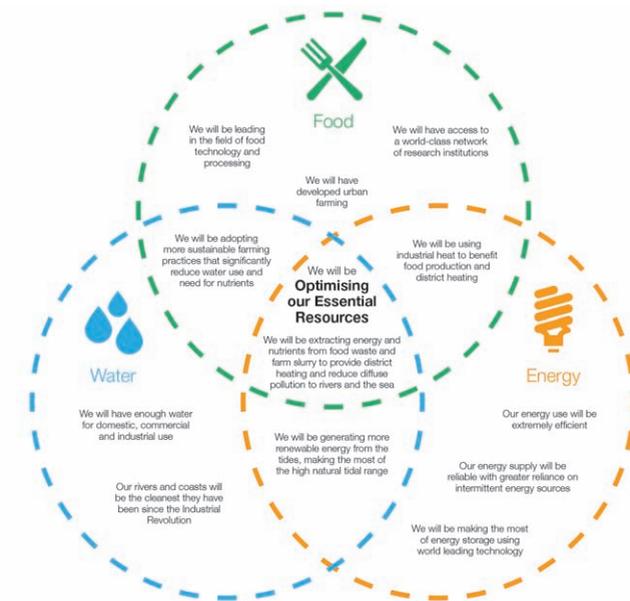
1. Businesses based in the North West will be able to access a reliable and climate resilient water supply, helping water intensive businesses in particular, and will benefit from measures to help the region's resilience to flooding.
2. The North West will boast great bathing waters, and some of the cleanest beaches and rivers in Europe supporting coastal tourism and coastally located businesses;
3. The North West will be a leading centre for water-efficient commercial and industrial use.

Energy

1. Businesses based in the North West will be able to access an energy efficient network and energy efficiency expertise, to economically manage supply and demand. This will be achieved through the latest energy efficient technologies, exploitation of waste energy and creation of the necessary communities for concepts such as district heating, demand side response and energy storage;
2. Businesses based in the North West will be able to access the full spectrum of energy generation technologies delivering a reliable and affordable energy mix through existing strengths in gas, nuclear and wind but also through further globally leading energy technologies such as biomass and tidal power;
3. Businesses based in the North West will be able to access a secure UK gas supply through responsible utilisation of the North West's shale gas reserves, reducing the UK's and the region's reliance on imported gas.

Nexus Issues

The three resources identified also overlap with one another and create a number of Nexus opportunities. These overlapping opportunities will provide further opportunities for businesses within our region, as set out below:



Energy and Water

- There will be a reliable water supply to support energy production in the North West.
- There will be alternative, renewable energy sources in tidal power.

Energy and Food

- Waste from the food processes can be used to produce alternative energy sources.
- There will be improved energy efficiency in the production of our food.

Water and Food

- Diffuse pollution will be managed through smarter farming practices and better catchment management thus creating cleaner rivers and bathing waters.

The 'Jackpot'

- The North West will be world-leading in energy extraction from food waste, municipal waste and wastewater.

Through its members' collaborative action and commitment to the above Vision, NWBLT will act as a catalyst and help lead England's North West into a new era of compelling business advantage, based upon its capacity to sustain the future supply of food, water and energy.

1. INTRODUCTION

This report entitled "Optimising our Essential Resources" outlines the future challenges and opportunities facing England's North West in relation to Food, Water and Energy. It has been produced for publication during the UK's International Festival for Business 2014 and is the fourth in a series of thought leadership papers being produced by the North West Business Leadership Team (NWBLT). It follows our 2013 reports on 'Skills for Industry' and 'Transport Investment' and another, published in March 2014, on 'Exploiting the Excellence' of the North West's science, technology and innovation. All four documents contain important calls for action and, in this report, we emphasise the pressing need for concerted action if the UK is to deal successfully with the very serious challenges which now face the nation, as well as many other parts of the world, in terms of ongoing access to adequate supplies of food, water and energy.

The nexus of these three essential resources not only offers the key to future security but also opens up business opportunities for those prepared to invest in the solutions. It is now widely accepted that there are fundamental questions over such issues as the reliability of energy supply, the sufficiency of food production and the availability of a resilient water supply. These all need to be properly addressed – by business, by government and by society as a whole – if the ever-increasing population, not merely of the North West but of the UK and indeed the whole planet, is to adapt successfully and sustainably to the inevitable challenges it faces in the years ahead.

For the North West, the future offers distinct opportunities from performing an essential role in meeting these challenges. As the report demonstrates, this part of the country is rich in its potential for generating additional energy (from predominantly renewable resources), as well as in the provision of water, processing of wastewater and in the production and processing of food. These vital resources are not yet being tapped to the extent likely to be required in the years ahead, not only to meet the North West's own needs but also to contribute to those of the UK as a whole. The potential to extract energy from wastewater, waste from food processing and farm slurry through anaerobic digestion or advanced techniques such as thermal hydrolysis, is a good example of how the nexus can operate in practice.

The approach which NWBLT has taken in this report is to examine the role which the North West has the capacity to perform – economically and environmentally – in addressing some of the UK's most challenging resource requirements. As a body of significant business leaders, which already brings together the relevant expertise and potential collective impact of companies such as Arup, Grosvenor, Siemens and United Utilities, NWBLT firmly believes that it is only through a holistic, collective national commitment that these very serious challenges will be addressed. The rewards for determining clear, coherent policies and delivering the requisite business investment will be considerable – whilst failure to act could be disastrous for all concerned.

In the remainder of the report we look separately at the main issues facing food, water and energy. It is the impact which failure to act could have upon all three that is the most compelling reason why addressing overall resource availability now presents such an opportunity for business in the North West.

2. FOOD

The North West of England is a significant food producer for the UK with strength in dairy and red meat production and a large secondary food processing sector that is a vital source of regional employment. In order to ensure resilience and maintain global competitiveness in an intensifying marketplace for the essential resources of production, producers located in the North West will benefit from the following opportunities:

1. Primary and secondary food producers in the North West will be able to co-locate their own research and development programmes within a cluster of world class food research institutions in the region. This will aid the development of new approaches to resource efficient livestock production and food manufacturing, as well as the incubation of new technology and skills for world-wide export. The North West should create a High Value Manufacturing Catapult for the Food and Beverage sector to foster collaboration between research institutions and facilitate links with industry;
2. The North West will champion new methods of economically sustainable and resource-efficient food production to supplement existing local supply. Methods such as the farming of fresh produce in urban environments or sustainable fish farming will help to ease reliance on food imports, lower transportation costs and generate new employment;
3. The North West will be a global leader in the development of cost-effective techniques for the recovery of valuable resources such as energy, water and fertiliser nutrients from existing food and agricultural waste streams to improve economic returns whilst minimising environmental harm for food producers locally and around the world.

2.1 Food resource in the North West

The food sector is a critical component of the North West economy. The food supply chain is a major employer within the region and accounts for approximately 10% of regional Gross Value Added (GVA). Nationally the North West is particularly strong in the secondary production of food (food and drink manufacturing), with many globally recognised food brands operating facilities in the region and contributing 10.7% to total UK Food & Beverage manufacturing GVA.

The agricultural sector is responsible for the management of 80% of the region's land. The sector's contribution to the regional economy is relatively modest in terms of employment¹ It however plays a crucial role in ensuring the upkeep of agricultural land which is a vital resource, not only for food production but for tourism, environmental management and wildlife protection.

Businesses in the North West already enjoy access to a strong base of research capabilities in the food and farming sectors to support the development of new innovation and to provide training. In the dairy sector for example, Tesco has partnered with the Veterinary School at the University of Liverpool to create a

¹ The Pion report March 2005

centre for Applied Dairy Farm research and veterinary training at Wood Park Farm at the University's Leahurst Campus.

On the food processing side, Manchester Metropolitan University's Food Research Centre provides assistance to small and medium sized food companies looking to commercialise new food products. The Food Centre at Reaseheath College in Cheshire provides facilities and training for businesses looking to improve food manufacturing efficiency.

2.2 Future food resource in the North West

The overall trend of increased costs of food production is one of the major concerns for the North West food sector. Increasing global competition for basic production factors such as fuel, water and grains, continues to drive up production costs in the North West.

Substantial price rises have been felt on several imported goods: cereal market prices have risen 160% over the last decade in the UK with similar rises affecting oil and protein crops. The North West is the second largest net importer of cereals after London and largest net importer of animal and vegetable fats in the UK. Food price inflation has also had an effect on fruit and vegetables, where import costs have increased by 60%.

Whilst the North West has a strong dairy and red meat industry, the number of cattle in the region has not increased despite the general rise in the consumption of meat and dairy products. This has led to a 38% increase in tonnes of imports of such products and associated price rises. The key concern for farmers is how to balance the rising price of feed and fuel with the additional costs required to ensure their operations minimise disease outbreaks and environmental harm.

The report² by the Department for Environment, Food and Rural Affairs (Defra) into sustainable farming and food identified that the UK food industry already has a considerable effect on the environment, accounting for about 14% of UK business energy consumption and 7 million tonnes of carbon emissions per year. The run-off of agricultural residues from land fertilisation into the waterways is also one of the main causes of the national degradation of water quality. A recent review from the Environment Agency identified the run-off from agriculture as the largest single factor contributing to poor bathing water quality in the North West by accounting for 35% of pollutants measured.

Whilst major river basins in the North West exhibit nitrate and phosphate concentrations that are still below national averages, continued investment is needed to ensure that the 6 million cubic metres of slurry³ generated annually by livestock in the region is sustainably managed.

² Defra – Food Industry Sustainability Strategy – 2006
<http://archive.defra.gov.uk/foodfarm/policy/foodindustry/documents/fiss2006.pdf>

³ Defra and Adas - Appendix to the Report of the Joint Government and Industry Slurry Management and Storage Project:

https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/260399/pb14045-slurry-management-storage-report-appendix.pdf

2.3 Food resource threats and opportunities for North West businesses

Threats

The predicted substantial growth in the number of affluent consumers across the globe by 2040 means the shift in the consumption of dietary protein from basic grains to meat is expected to drastically increase livestock and dairy production. As a relatively more resource-intensive and environmentally damaging form of food production, concern is mounting that there will not be an equitable availability of the essential resources (water, fuel, fertilizer, labour) to meet future food production demand. Competition for basic crops from the bio-fuels industry will exacerbate this resource scarcity issue.

Whilst the North West enjoys good access to freshwater and other essential resources for production, the region must accept that it already relies significantly on importing such resources and acknowledge that it is competing in a global marketplace for such commodities. Furthermore, there will continue to be the risk of a changing climate and commensurate pressure to minimise the environmental impact of food production in the region. As such, the North West food supply chain will face the following threats:

1) The Long-term Upward Trend in Input Costs

Businesses are likely to face even greater pressure on profit margins if they are not able to pass input price inflation downstream. At the consumer level, further food price inflation seems evident although government will likely maintain pressure on food retailers to curb inflation. This typically results in the greatest squeeze on income and livelihoods occurring at the primary producer level.

2) Inability to Expand Regional Food Production

Freshwater and land resources are finite and farm businesses will face more intense competition from the energy/manufacturing sectors and urban planners to utilise these resources. This may ultimately damage food export business for North West producers.

3) Production Losses from Environmental Damage, Pests and Disease

The effects of a changing climate may mean that producers will be forced to spend more on expensive chemical protection that can be harmful to wildlife or therapeutics for livestock that can diminish the quality of end product. This can also have a damaging effect on the productivity of soils by reducing the essential microbiological activity that plays a crucial role in aiding the uptake of nutrients by plants.

4) Pressure to minimise food waste and improve waste management practices

Concerns around the ongoing environmental impact of farming practices from greenhouse gas emissions, nitrogen/phosphorus leaching and slurry handling will result in much tighter regulation on farmers to find new methods to reduce their environmental footprint and maintain natural ecosystems. Secondary producers will also be expected to address the significant issue of food waste and spoilage within the food chain.

Opportunities

Food and Drink Innovation Cluster in the North West

To meet the challenges of economically, environmentally and socially sustainable food production, businesses in the region will need to change and adapt. Resource efficient intensification of production will be at the core of the future opportunity for a sustainability led economy. In preparing for this change, businesses involved in food production and supply will benefit from the following opportunities in the North West:

1. Primary and secondary food producers in the North West will be able to co-locate their own R&D programmes within a cluster of world class food research institutions in the region to aid the development of new approaches to resource efficient livestock production and food manufacturing, as well as incubate new technology and skills for world-wide export. The North West should create a High Value Manufacturing Catapult for the Food and Beverage sector to foster collaboration between research institutions and facilitate links with industry;
2. The North West will champion new methods of economically sustainable and resource-efficient food production to supplement existing local supply. Methods such as the farming of fresh produce in urban environments or sustainable fish farming will help to ease reliance on food imports, lower transportation costs and generate new employment;
3. The North West will be global leader in the development of cost-effective techniques for the recovery of valuable resources such as energy, water and fertiliser nutrients from existing food and agricultural waste streams to improve economic returns whilst minimising environmental harm for food producers locally and around the world.

Previous research highlighted ⁴ the extensive capabilities in the region to deliver world-class research into food and drink manufacturing. Businesses will be able to reap the benefits of co-locating their own R&D initiatives within a cluster of higher education institutions to support their move towards more resource efficient production.

At the farm gate, institutions such as Lancaster University, the University of Liverpool Veterinary School and Reaseheath College, Nantwich, are already helping farmers to develop integrated approaches to productivity improvement and environmental management. Businesses in the future will be able to combine research across animal genetics, nutrition and husbandry to deliver greater feed conversion efficiency, disease resistance and GHG emission reductions to the industry. Advancements in animal diagnostics, feed additives, genomics and robotics will be critical opportunities that businesses in the North West will exploit in order to deliver this.

⁴ Food & Drink Capabilities in the Northwest – North West Regional Development Agency & Food Northwest – http://www.nwua.ac.uk/HLSP/Sectors/FD/Docs/Food_and_Drink_Capabilities_Matrix.pdf

CASE STUDY 1

Food innovation centre - Reaseheath College, Cheshire

Reaseheath College is located near Nantwich in Cheshire and is one of the leading specialist land-based colleges in the UK. The College has recently invested £2 million in developing its Food Innovation Centre for supporting businesses in developing and growing new products and skills. The centre boasts an array of small-scale, pre-industrial equipment for processing milk into a range of products from flavoured drinks to yoghurt, butter and ice cream. Companies use the facilities to develop their ideas and test the market.

The Food Innovation Centre also hosts the Eden Project, which trains the milk food processors and technologists of the future. This training programme is industry led, allowing students to learn on the job with companies such as Muller-Wiseman and Arla Foods.

Reaseheath has also recently announced a £10 million investment in a new Food Futures Centre, an educational and knowledge exchange centre which will operate nationally in the area of sustainable food and farming. Chancellor of the Exchequer, George Osborne, cut the first sod for the site on 9th May 2014 and the centre will be open for business in September 2015.

The Principal of Reaseheath College, Meredydd David OBE, commented that: "The new centre will put the Reaseheath team and businesses in the North West at the forefront of translating new science into commercial farming and food practice. And that's where we need to be if we are to support agri and food businesses in the region in making the most of the wonderful resources and markets that the area provides".

A key focus of the centre will be the development of a new generation of young people with a broad base of skills and operating experience to aid the adoption of new technologies to help farmers and growers develop further and faster.

Supporting the drive for resource efficient food and drink manufacturing in the North West are institutions such as Liverpool John Moores University, the University of Bolton, the University of Chester, the University of Manchester and Manchester Metropolitan University. Advancements in food storage and preservation technology, energy efficiency and waste recovery will be key to sustaining profitable food production.

CASE STUDY 2

Industry led research into dairy efficiency - Tesco Dairy Excellence Centre

Tesco Dairy Centre of Excellence is based at the University of Liverpool, School of Veterinary Science, Wood Park Farm at Neston, Cheshire. It is a commercially run dairy farm and research and knowledge exchange platform to engage the 700 dairy farmers who make up the Tesco Sustainable Dairy Group (TSDG) which supply Tesco with all their own brand milk. 300 of these farms are in the North West. Farm scale research projects are developed by a committee of University, farmer, milk processors and Tesco representatives working with organisations throughout the dairy supply chain from SMEs to multinational animal breeding, feed and pharmaceutical companies. Projects undertaken at the Centre are incorporated into best practice and disseminated to other TSDG members.

Responding to the issue of falling fertility rates in dairy cows raised by its members, Tesco funded research on the most common activity meter systems to improve detection of reproductive behaviour of cows to be tested at Wood Park Farm. University of Liverpool staff carried out a study comparing the systems - the first independent assessment of such systems in the UK. The study developed recommendations on how best to use the systems as well as identifying their limitations. The key benefit to the TSDG members was the communication of best practice methods to improve the rate of conception in their dairy herds and thereby increase the efficiency of milk production.

Graham Wilkinson, Tesco Agriculture Manager, said "We are proud of our unique alliance with the University of Liverpool at the Tesco Dairy Centre of Excellence. It is a national resource for Tesco Sustainable Dairy Group farmers that offers research-based expertise in cattle lameness, fertility and calf health. It has enabled us to work on many initiatives which have a direct impact on improving resource efficiency, longevity of dairy animals and ultimately the long-term sustainability of the Dairy sector".

CASE STUDY 3

Efficiency and food waste reduction - Goodlife Foods

Goodlife Foods manufactures a range of frozen vegetarian products from a large, purpose built factory in Warrington. After a period of significant growth the business was facing increasing business costs (particularly energy costs) and limited additional manufacturing capacity that were constraining further expansion. Goodlife elected to collaborate with the Manchester Metropolitan Food Research Centre (MFRC) to create a Knowledge Transfer Project (KTP) which aimed to increase productivity in facilities that the company was quickly outgrowing, as well as improving sustainability.

Using MFRC's expertise in frozen food preparation and lean manufacturing, Goodlife were able to identify new processing regimes and adjust existing machinery to optimise output and minimise food waste. This resulted in savings of £100k across Goodlife's high volume production line and the creation of new skills to accommodate changes to production.

Championing New Sources of Local Production

Production of healthy food close to centres of demand reduces transportation costs and thereby carbon emissions. The North West is well positioned to support new sources of local production, such as urban farming and aquaculture, to supplement the supply from existing local producers in order to reduce the region's reliance on food imports as well as generating new employment.

The farming of produce in urban environments has been practised for several decades but has struggled to be economically sustainable due to a natural lack of cheap land upon which to achieve adequate production scale. Recent innovation in hydroponics and aquaponics are, however, creating fresh opportunities to create farming operations that are both highly resource efficient and economically sustainable even at a very small-scale. The large urban areas of Manchester and Liverpool are likely to provide numerous sites, enabling urban farmers to take advantage of these new technologies to develop their own ventures.

With the plans to improve the quality of rivers, and bathing and coastal waters, the North West coastline offers the potential for sustainable fish farming operations, providing a healthy and less resource intensive source of meat protein for local consumption or international export. Research is also ongoing to develop new integrated in-land aquaculture systems to farm fish with minimal impact to the marine environment. Developing such systems in the UK will allow the North West to take advantage of the strong predicted growth in aquaculture by exporting the knowledge and skills generated to other countries.

Waste Management

Waste reduction can be boosted by taking advantage of their new value. Municipal solid waste is already being used as a high-energy source of fuel for heat networks or as a source of localised electricity generation. Technology is also developing rapidly to provide farms with more environmentally friendly ways to extract and reuse the fertiliser nutrients contained within livestock slurry and to generate renewable heating or electricity. Innovative zero-waste policies can increase the level of leaner manufacturing processes, water recycling, heat recovery and energy management software.

Alternatively, projects that are only beginning to emerge today to bio-convert organic food waste into new sources of healthy protein (by using the waste as feed for fly larvae which are subsequently processed into feed) may become mainstream and thereby an opportunity to also help primary producers to reduce their reliance on expensive imported animal feed.

The North West has the opportunity to build upon existing expertise to become a world leader in the development of nutrient and energy recovery technologies, particularly in the management of livestock slurries and food processing waste – for example, extracting waste fat, oil and grease and generating fuel has the dual benefit of creating energy and reducing the risk of flooding from blocked sewers. Key opportunities lie in reducing the capital costs of nutrient recovery and improving their efficiency. By 2040, the North West will be exporting its technology and know-how across the world to support the movement towards a more circular global economy.

3. WATER

Water is of course an essential resource and the opportunities related to water are a key strength for the North West. Water resources are essential for industrial and commercial use, important to the leisure and tourism industry and could also be a significant resource for future energy production. But alongside these strengths there are some future threats that need to be managed, notably risks to water quality in lakes, rivers, bathing and coastal waters and the devastating impact of flooding.

By 2040, water management in the region will provide the following business opportunities and benefits:

1. Business based in the North West will be able to access a reliable and climate resilient water supply and will benefit from measures to help the region be resilient to flooding;
2. The North West will boast great bathing waters and some of the cleanest beaches and rivers in Europe, supporting coastal tourism and coastally located businesses;
3. The North West will be a leading centre for water-efficient commercial and industrial use.

3.1 Water resource and management in the North West

The three key current issues concerning water within the North West are: water supply; dealing with excess water; and the quality of water and wastewater. Good quality clean water from reliable supplies is a key strength of the region and is essential for our businesses and the tourism economy.

Water supply and wastewater in the North West has been managed and developed by a variety of bodies over the last 150 years and is now the responsibility of United Utilities. The company has published a strategic direction statement, 'Playing our part to support the North West'⁵ reporting on their best view of what the next 25 years hold for the region. In the period 2010 to 2015, the company is investing some £3.5 billion in the region's water and wastewater infrastructure – when indirect impacts are taken into account, that is worth some £7 billion to the regional economy and it supports 9,000 jobs. Similar levels of investment are planned between 2015 and 2020.

Much of the UK's remaining industrial base is located within the North West, which includes the two great cities of Manchester and Liverpool as well as many other urban conurbations. Future plans must be closely aligned to the needs of these growing communities and reflect the challenges associated with providing their populations with good quality water, treating their wastewater whilst protecting and enhancing the environment and managing volumes of water to reduce flood risk.

The quality of water in lakes, rivers, bathing and coastal waters plays an important role in our tourism economy. The North West is home to some of the most beautiful rural areas of the UK. These areas, including the coastline,

⁵See <http://corporate.unitedutilities.com/future.aspx>

support a tourism industry that contributes £3.2bn per annum to the regional economy.⁶

Water supply: The United Utilities' Water Resources Management Plan⁷ describes the expected pattern of water resource availability in our region until 2040. The majority of the North West benefits from an integrated network that supports movement of water across the region accommodating its changing supply and demand balance. A reduction in water demand is predicted despite an increase in population. Action is needed, however, to improve the security of supply to West Cumbria which is not part of this network.

CASE STUDY 4

Integrated water supply network – United Utilities

United Utilities operates one of the most integrated water supply networks in the UK with the ability to move water from the Lake District to Manchester and water from Lake Vyrnwy in Wales to Liverpool. The company has plans to link West Cumbria to this integrated network in the next decade to meet the demands of households, industry and the natural environment for the next 25 years. Experts have said the current water sources for West Cumbria have increasingly delicate habitats and that eventually the biggest source, Ennerdale, will no longer be available to meet the needs of between 80,000 and 140,000 people.

While there are three main options, United Utilities' preferred scheme is to bring water from its existing reservoir at Thirlmere as Thirlmere has all the capacity needed. It was built for the job of supplying water so there is much less environmental impact. More details can be found at: <http://www.unitedutilities.com/documents/cumbria-info-booklet.pdf>

Excess water: There is significant pressure on the sewerage, drainage and flood defence infrastructure in the region as a result of population growth and the anticipated impact of climate change, increasing the risk of flooding to homes, businesses and land. This issue brings together various agencies including United Utilities, local authorities and the Environment Agency in efforts to build the resilience of the region. In its national assessment of flood risk in 2009⁸, the Environment Agency identified Warrington as one of the ten local authorities with the highest number of properties in areas with significant chance of flooding. Since this assessment, in partnership with Warrington Borough Council, the Environment Agency is now building a £23 million flood alleviation scheme.⁹

Water quality: The region's geography, the legacy of the Industrial Revolution, population growth and long term underinvestment in the region's wastewater infrastructure means that new European environmental legislation is now having

⁶Office of National Statistics 2008 regional trends no--43--2011-edition "Portrait of the North West"

⁷See <http://corporate.unitedutilities.com/documents/WRMPSummaryReport.pdf>

⁸https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/292928/geho0609bqds-e-e.pdf

⁹See case study 7 on page 18

a significant impact, most notably the Water Framework Directive and the revised Bathing Water Directive¹⁰. These are significant, new challenges and will drive high levels of capital expenditure but meeting these requirements will have significant economic benefits, particularly as the quality of bathing water poses a big risk to the reputation of seaside resorts like Blackpool and Morecambe.

For example, as a result of introduction of the revised Bathing Water Directive in 2015, any bathing area which fails to meet the standard will be required to install signs advising people against bathing in that area. Clearly this poses a big risk to the reputation and economies of seaside resorts and it has been estimated that the impact to the Fylde economy could be around £1 billion¹¹. At present, applying the revised standard to current bathing waters' performance would mean that around 44% of the region's bathing waters would comply.

Population growth and climate change will place increased pressure on the sewer and drainage networks. In building resilience for both water quality and flooding, partnership working will be essential between local authorities, developers, water companies and others throughout the local planning process to ensure future demand is met and investment and economic growth is not held back.

3.2 Future water management in the North West

To successfully meet the demand for water resources in the North West, there are several key issues to address including:

- Balancing the needs of all customers – household, industrial, agricultural and the environment itself
- Planning for future uncertainty and climate change, especially in relation to floods
- Providing evidence based plans to enable people to make informed decisions
- Protecting the landscape and amenity of the areas in which we live, work and play

For those businesses located in our region, but highly dependent on water in their supply chains, to flourish, the focus cannot solely be on water supplies in the region. It is estimated¹² that about 70% of the total water used in production and consumption in the UK is imported from other countries in the form of embodied water, making the UK one of the most water import-dependent nations. The UK cannot substitute all foreign imports with domestic production so water management measures need to be encouraged down

¹⁰More details about the Water Framework Directive can be found at <https://www.gov.uk/government/policies/improving-water-quality>; for the revised Bathing Water Directive see <https://www.gov.uk/government/collections/bathing-waters>

¹¹Environment Agency Report in conjunction with URS Infrastructure & Environment UK Limited

¹²ENDS Report, February 2014 – research from the University of Bath and University of Loughborough published 20 February 2014

company supply chains. Alternatively, companies might consider developing new trade relationships with countries that are more resilient to climate change, providing lower-cost or more reliable supplies. Boardrooms should ask themselves if they understand their dependence on water, especially through their supply chains.

Climate change and flooding

The risk and impact of flooding is becoming increasingly significant. These risks have been highlighted by the UK's flooding events in 2012 and the winter of 2013/14. Flooding in 2012 is estimated to have cost the UK economy up to £600 million with the impact on businesses in England around £200 million. Other indirect impacts – such as lost working days – hit companies and local economies by around £33 million and affected businesses suffered an average of £60,000 in setbacks. Nearly two-thirds of UK businesses said they suffered supply chain problems because of the extreme conditions. An estimated 175,000 businesses are at risk of flooding in England and Wales¹³.

Flood management is a complex issue that involves a number of institutions including local authorities, water companies, the Environment Agency and all customers. This complexity also exists because of the different types of flooding:

- river flooding, when a watercourse cannot cope with the water draining into it;
- coastal flooding, that results from a combination of high tides and stormy conditions;
- surface water, flooding when heavy rainfall overwhelms drainage capacity;
- sewer flooding, when sewers are overwhelmed by heavy rainfall or become blocked, potentially causing pollution to land, property and rivers; and
- groundwater flooding, when water levels in the ground rise above surface levels.

Eliminating flooding entirely is prohibitively expensive so the risks to business, households and the natural environment need to be managed. These will only be addressed if there is cross-sector partnership working to share experience, knowledge and resources. Greater emphasis needs to be placed on tackling the root causes of flooding, such as reducing the flow of storm water entering the drainage network to ensure businesses and households are less likely to be flooded. By re-introducing natural green areas, such as ponds and soakaways into the urban environment, excess storm water can soak naturally back into the ground rather than entering sewers and drains where it might cause flooding and pollution further downstream.

¹³Statistics from Environment Agency - <https://www.gov.uk/government/organisations/environment-agency>

CASE STUDY 5

The impact of flooding – Cumbria County Council

Between 18th and 20th November 2009 up to 372mm of rain fell over Cumbria - the 314mm of rain that fell in Seathwaite amounted to a record daily rainfall for the UK. As a result, there was widespread flooding across the county and a total of 2,239 properties, business and domestic, were inundated with water. Cumbria County Council has estimated damage to shops, farms and factories at £124m, damage to residential and other properties at £91m and £34m worth of damage to the county's transport network. In total, the Council has estimated the total bill to be in the region of £276m. There were 25,000 flood and storm damage insurance claims, according to the Association of British Insurers, with £174m paid out. Twenty road bridges across Cumbria were destroyed or damaged, including the one in Workington which sadly claimed the life of a local police officer, and the cost to tourism was £2.5m.¹⁴

Coastal infrastructure is also projected to see increasing vulnerability due to average sea level increases by the 2080s of up to 63cm (UKCP09) across most of the region and from more frequent storm surges.¹⁵ Low lying and coastal locations are at high risk from sea level inundation. The 2009 scenarios indicated sea level rise in Liverpool of between 30 and 32cm by 2080.

CASE STUDY 6

Coastal impacts of climate change – Sefton Borough Council

Sefton Borough Council has undertaken a study to consider the potential impacts of climate change on the Sefton Coast to ensure they are well placed to manage the changes in the years ahead. While one of the major threats is sea level rise, other water related climatic changes such as increasing storminess and changes in rainfall patterns could also have significant implications. The knock on effects could see the Sefton Coast alter dramatically for both better and worse and initial studies have identified the potential for significant impacts on a range of habitats. The key broad areas identified as being at risk include nature conservation, tourism, leisure and recreation, agriculture, infrastructure and development, archaeology, industry and people.¹⁶

¹⁴Figures quoted in the following article: <http://www.bbc.co.uk/news/uk-england-cumbria-11791716>

¹⁵See <http://media.climateuk.net/sites/default/files/00112a%20CCRA%20NW%20Pack.pdf>

¹⁶See http://www.coastaladaptation.eu/images/sefton_final%20coastal%20adaption%20study%20oct%202010.pdf

3.3 Water resource threats and opportunities for North West businesses

Water supply

Businesses in the North West will benefit from a secure and good quality water supply¹⁷ in the coming decades. There is no deficit of water supply forecast in the North West, meaning that businesses can be confident in their water supply, a position further reinforced by businesses adopting more sustainable water use. Using less water means less cost which equals a more efficient operation and competitive advantage – there is additional benefit in reducing energy bills if less hot water is used.

Taking a wider perspective, the North West is a good place for business investment given its reliability of water supply compared to other regions such as the South East. One southern water company is forecasting circa 400 million litres a day shortfall in supply versus demand by 2040 (to put that into context, that is slightly less than a quarter of all the water consumed in the entire North West each day). Unlike other areas of the country, United Utilities aims to implement water use restrictions and drought permits, on average, once in 20 years; ban non-essential use only once in 35 years; and consider it unacceptable to plan for rota cuts or standpipes even in the most severe droughts. The potential also exists for the North West to export water to other regions.

Excess water

Many of the solutions to address the various forms of flooding rest with organisations like water companies, the Environment Agency and local authorities, in some cases reinforced by statute. For example, the creation of Sustainable Urban Drainage Approval Bodies (SABs) will encourage developers to adopt sustainable urban drainage solutions to help improve management of surface water flooding.

CASE STUDY 7

Flood alleviation scheme – Warrington Borough Council/Environment Agency

Warrington is at risk from tidal and river flooding with records of flooding dating back to 1767. The most significant recent flood events were in 1990 and 2000 – in February 1990, the River Mersey over-topped its banks flooding the A50 and properties in places such as Westy, Latchford, Howley and Lower Walton. In partnership with Warrington Borough Council, the Environment Agency is building a £23 million flood alleviation scheme to reduce the flood risk to around 2,000 homes and businesses. The scheme is constructing a series of walls and embankments along the River Mersey and its tributaries. The first phase was actually put to the test in December 2013 during the biggest tidal surge on the river since 1990 when it prevented around 1,500 homes and businesses from flooding, holding the water on the natural flood plain in Victoria Park.

¹⁷For further details, please see United Utilities Water Resource Management plan and the case study on investment in West Cumbria on page 14 above

Ultimately flooding from any source cannot be prevented and so it has to be prepared for. If North West businesses are to be resilient and prepared for this, they need to take action to reduce the likelihood of an adverse economic impact should flooding occur either near to their premises or down their supply chain. To address this, our region's businesses should consider if:

- they understand the risk from flooding. Do business continuity plans cover flooding risk? Do they know where wastewater drains to and whether what is disposed of down the drains could create flooding risk?
- the provision of goods and services by their suppliers may be susceptible to flooding and so impact their operations?
- there are actions that can be taken to reduce the risk or take advantage of the opportunities? For example, could a business invest in upstream solutions to hold back flood waters through their corporate responsibility investments or employee volunteering programmes?
- they are prepared if flooding does actually happen so they can recover quickly?

Other opportunities could potentially emerge as we consider the food – water – energy nexus. The tidal range in the North West offers the potential to generate renewable energy through the construction of marine hydropower infrastructure and is a promising opportunity for the region's coastline. But such schemes can deliver multiple benefits and the possibility exists that such infrastructure could help manage the risk of coastal flooding linked to rising sea levels. It has already been argued that a tidal lagoon in the River Severn would be a better way to combat the floods in the Somerset levels than dredging.¹⁸

CASE STUDY 8

Floodplain management – Cheshire Wildlife Trust

At its largest nature reserve, the 165 hectare Gowy Meadows near Ellesmere Port, the Cheshire Wildlife Trust is managing the floodplain grazing marshes in partnership with Essar (formerly Shell) for a wide range of farmland birds. In times of flood, these marshes can be allowed to accept large quantities of water to limit the effects on industry to the north including the Stanlow Refinery. This periodic flooding allows water into scrapes and wetlands that host hundreds of wildfowl over winter, and birds like snipe and lapwing during the summer. Rather than adopt a more traditional, hard engineering solution to flood protection, Shell/Essar have recognised that there are alternative options for managing flood risk that can bring wider community and environmental benefits.

¹⁸Article in The Times, 25th February 2014

Water Quality

It is in the region's best interests to sustain a vibrant tourist economy. Reducing the risk of bathing water non-compliance is something many businesses, large and small, can contribute towards. Such contributions range from the simple and straightforward (thinking about what is disposed of down the drains as this could lead to blockages that create flooding that runs into river systems that pollutes bathing waters) through to the more complex (do companies understand where their wastewater drains to and could there be drainage misconnections?) In the agricultural sector, could more be done to prevent water run-off from fields into river systems? It will be important that measures taken to improve the productivity of food production do not have adverse consequences for water quality through agricultural run-off, pesticides especially, from fields into water courses. Conversely, opportunities to generate energy from farm slurry may result in reducing the risk to water quality through better slurry management. The Turning Tides initiative, as described in section 5.3 below, offers an example of how partners with a vested interest can come together to identify collaborative actions to address these important issues.

The EU Water Framework Directive has reinforced the notion of the catchment, a discrete geographical area into which water drains into a river system – the Mersey Basin is a good example of this. In response, Defra has promoted the creation of catchment partnerships¹⁹, bringing together local stakeholders to devise a plan of interventions that can improve water quality in water catchments – there are sixteen of these in the North West. Businesses should be encouraged to think if there is a role for them to engage with such partnerships, especially if they are dependent on good quality waters for their business success, directly or indirectly. In the Mersey Basin, a multi-agency group has already convened to look at the social, environmental and economic benefits that will accrue from continued water quality improvements.

Research capabilities

The North West has the potential to become a leading centre for water-efficient commercial and industrial use. The approach taken by institutions across the region to tackle water management issues is underpinned by the academic commitment to water related issues. The table on the right illustrates.

In addition to university-related research, in 2013 the region's Environmental Sustainability Technical Assistance Project commissioned a report entitled "Understanding Water Innovation Capacity in Liverpool City Region²⁰" (LCR) to explore the potential for leveraging excellence in water management for economic development. The report sought to better understand water innovation capacity within the LCR and to recommend what policy enabling framework or support infrastructure should be put in place to accelerate growth in the water sector.

¹⁹See <https://www.gov.uk/government/publications/catchment-based-approach-improving-the-quality-of-our-water-environment>

²⁰<http://www.enworks.com/resources/FINAL%20WATER%20INNOVATION%20CAPACITY%20REPORT%20-%20JUNE%202013.pdf>

University	Hydrology or Environmental Science Dept.	Key research areas (inc. areas of innovation)	Capabilities
University of Lancaster	Yes	Hydrological modelling, research into flood risk, rainfall/runoff modelling, water catchment management, climate change and meteorology, flood related engineering solutions, climate change research.	Research, consulting, teaching
University of Liverpool	Yes, including the National Oceanography Centre and the British Oceanographic Data Centre	All aspects of water research, including energy (marine and hydro), planning and policy. The National Oceanography Centre undertakes research and technology dev. from the coast to the deep ocean	Research, consulting, teaching
University of Manchester	Yes	All aspects of water research, including energy (marine & hydro), computer modelling, meteorology, planning & policy, and climatology.	Research, consulting, teaching
University of Central Lancashire	Geography	Flood risk analysis, Water Framework Directive and policy expertise, climate change and meteorology.	Research, consulting, teaching
Liverpool John Moores University	School of the Built Environment	Water and wastewater treatment research, water recycling	Research, teaching, consulting and enterprise activities
University of Cumbria	No	Energy (hydro power).	Research and teaching
University of Chester	No	Plans to grow research into water related areas	Research, consulting, teaching, Thornton Science Park

4. ENERGY

Energy supply is a key future challenge globally. The North West is in a good position to meet future energy needs in terms of energy generation and demand both within the region and nationally. The region is currently home to one of Europe's largest nuclear energy centres along Britain's Energy Coast, and has the potential for significant expansion of the current renewable energy resources. Alongside energy supply and generation resources in the region, there is also a large amount of manufacturing and academic expertise in the sector.

The North West region has both the opportunity and skills to create continued advantage for business in the region through (i) its existing skills and experience in the full spectrum of energy generation technologies, (ii) strength in research and development in renewable energy generation technologies and (iii) unique opportunities available through Britain's Energy Coast and shale gas reserves.

By 2040, energy resource management in the region will provide the following opportunities and benefits:

1. Businesses based in the North West will be able to access an energy efficient network and energy efficiency expertise, to economically manage supply and demand. This will be achieved through the latest efficient technologies, exploitation of waste energy, creation of the necessary communities for concepts such as district heating, demand side response and energy storage;
2. Businesses based in the North West will be able to access the full spectrum of energy generation technologies delivering a reliable and affordable energy mix through existing strengths in gas, nuclear and wind but also through further globally leading energy technologies such as tidal power;
3. Businesses based in the North West will be able to access a secure UK gas supply through responsibly utilising the North West's shale gas reserves, reducing the UK's and the region's reliance on imported gas.

4.1 Energy resource in the North West

The North West currently boasts the full spectrum of energy generation technologies, from coal power generation at Fiddler's Ferry, gas at Rocksavage and Carrington, nuclear at Heysham and offshore wind at Walney and Burbo Bank. Looking into the future, the North West is well placed to exploit low-carbon generation technologies, particularly in wind, nuclear, biomass and tidal.

In 2012, the UK's total generating capacity was 89.2 GW²¹ with the main sources being Gas CCGT (35.3 GW), Coal (31.0 GW), Nuclear (10.0 GW), Wind (3.8 GW) and other renewable energy supply (7.6 GW). The North West has capacity to supply 6.4 GW of the overall UK generating capacity from all energy sources. The region contributes approximately 24% of the UK's nuclear power generation and a similar proportion of its wind supply.

²¹Digest of UK Energy Statistics (DUKES) 2013

The majority of the overall energy consumption in the North West is for commercial or industrial uses (38%), followed by domestic (32%) and finally transport (28%)²². Energy supply is a key challenge for manufacturing. The North West is the UK's largest manufacturing region contributing 13% of the UK's total manufacturing output, with an economy worth over £120 billion a year, making it a key region in the UK's strategy to rebalance the economy.

4.2 Future energy challenges in the North West

Globally, nationally and regionally there is an overall challenge concerning future energy supply to meet energy demand. The challenges surrounding energy relate to supply of energy from new sources and changes in energy consumers behaviour. The largest challenge is around sources of new energy whether through low carbon resources or through more efficient use of current resources.

National Grid has produced an assessment of future energy demand using a range of scenarios over the next 25 years. The scenario estimates that overall energy use will increase from 318 TWh in 2012 to 323 TWh by 2035 due to an increase in population, use of heat pumps and electrical car charging. This paper focuses on the Gone Green scenario that assumes that 15% of all energy produced by 2020 will be from renewable sources. The Gone Green scenario also assumes that energy capacity within the UK will almost double to 163GW from 89.3GW in 2012. In order to meet this future supply the following will take place:

- (i) A move to nuclear as the base source (with an average seven year life extension and the first new nuclear plant in early 2020's giving a net rise of 2.4GW by 2035);
- (ii) A phase out of coal and replacement with wind (total wind capacity rising from 3.8GW in 2012 to 59.2GW in 2035);
- (iii) A growth in other renewable from 7.6GW to 20GW of capacity by 2035, of which 4GW will be from biomass;
- (iv) A relatively flat profile for gas with a total increase of 1.9 GW by 2035 but playing a pivotal role as an immediate generating source to complement the intermittent nature of the renewable energy sources.

4.3 Energy resource opportunities for North West businesses

This changing energy landscape creates a number of significant opportunities for the North West region. The North West is therefore in a strong position to lead the transition from the current power generation sources to an energy mix based more heavily upon renewable, such as nuclear, wind and tidal energy sources.

The region already has a wealth of power generation assets, skills and experience across the full spectrum of key technologies for the future, including gas, nuclear, anaerobic digestion and wind. The region also has the natural

²²Sub-national total energy consumption 2011, DECC

resources to support the development of energy including tidal resources and shale gas. However, before addressing the supply side opportunities, the NWBLT believes that energy efficiency measures can be the key source of competitive advantage for the North West.

A number of global manufacturers with manufacturing operations in the North West region have adopted energy efficiency programmes aimed at dramatically reducing consumption and using smart systems to match production times with energy pricing. There is best practice knowledge and technology that could be shared within the region's business community.

CASE STUDY 9

Energy efficiency programmes - NSG Pilkington, UK

NSG Pilkington, one of the UK's foremost glass manufacturers and based in the North West, is driving a major energy management programme across its UK production sites. The programme is designed to enhance overall energy performance, cut costs and drive a more sustainable and environmentally friendly future. A holistic approach covering a range of technology solutions across the entire manufacturing plant is on target to achieve total energy cost savings in excess of £1 million over a three year period. Projects include the installation of new drive technologies and automation controls, pump system upgrades and intelligent lighting systems.

Steps have been taken by businesses to exploit waste energy where possible and there are a number of good examples of this on a small scale within the region.

However the wider steps to create full scale closed loop systems, like those in Swedish towns such as Gothenburg and French towns such as Dunkirk, have not been deployed. These systems use waste heat from industrial processes to provide cheaper heating to residential areas through district heating. The schemes have worked in the Scandinavian countries and have to some extent been adopted in UK cities such as Sheffield and Peterborough.

A key target for the future will also be to develop technically and commercially successful electrical and thermal solutions to store surplus energy as part of an overall solution for load balancing. These possible technologies include electrolysis to store energy as hydrogen gas, battery technology, compressed air storage and superconducting magnetic energy storage. Again the North West is in a unique position to utilise the salt, coal and iron ore mine cavities in the region for various energy storage technologies.

Finally the North West business community could lead the development of projects for efficiently balancing supply and demand through the opportunity to identify pilot projects for electricity demand side response (DSR) under the UK Energy Act 2013. A pilot in the North West region would allow the region to take advantage of commercial benefits by reducing demand upon the request of the electricity provider.

4.4 Future energy generation potential in the North West Offshore Wind Power Generation

With its 650 mile long coast line on the Irish Sea, the North West region has already been identified as one of the most promising regions for offshore wind, with the current Round 3 Celtic Array opportunity delivering initially an additional 2.2GW of capacity through the Rhiannon Wind Farm. However there is further potential to increase this to 5GW through the North East and South West potential development opportunities. The region is already working towards further developing the Walney and Burbo Bank wind farms.

Tidal Power Generation

CASE STUDY 10

District heating - Dunkirk, France

Following the oil crises of 1973 and 1979, the cities of Dunkirk and Saint Pol sur Mer needed to find an alternative to fossil fuels. Together, they decided to build a heating network that would be supplied primarily from a local industrial process. The local industrial process was the ArcelorMittal steel works which specialised in the production of flat carbon steel. As France's largest steel mill, it accounts for approximately 1.5% of the country's total energy consumption.

Construction on the heating network began in early May 1985 and a capture hood to recover heat at the ArcelorMittal steel works was brought on stream in early 1986. A large hood placed over the cooling bed draws hot air through a heat exchanger where it heats water that is then distributed via the network. By 1990, the heating network was already supplying 120 substations. In April 2008, a new hood was installed on the cooling bed which increased heating capacity from 20 MW to 28MW.

The Dunkirk district heating network's environmental performance achieves the following benefits:

- The use of recovery of industrial heat replaces 2,500 tonnes of heavy fuel oil with a pollution free energy source;
- More than 80 percent of the energy used in the network is recovered energy;
- The recovery of industrial heat enables annual savings of 26,000 tonnes of CO₂ compared with a gas-fired solution

The UK holds the second highest tidal range in the world. This tidal range offers significant potential for the extraction of low carbon renewable energy through the construction of marine hydropower infrastructure and is a promising opportunity for the North West coastline. It is hoped that plans for the world's first tidal lagoon power plant in Swansea Bay will kick-start a new UK industry.

CASE STUDY 11

Tidal lagoons – Swansea Bay Tidal Lagoon

The Swansea Bay Tidal Lagoon has a proposed installed capacity of 320MW and has been accepted for consideration by the UK Government's Planning Inspectorate in a process that its developers, Tidal Lagoon Power, hope will see construction start in early 2015 for first power in 2018. The inherent flexibility of tidal lagoon infrastructure, together with its 120 year design life, predictable power output and ability to offer a multi-use public amenity to the surrounding community, has led to high levels of interest and support for the project, both locally and nationally.

It is suggested that in tidal lagoons, the UK has finally found a means of harnessing its tidal range resource while striking an acceptable balance between economic, social and environmental impacts. Should the industry's flagship project continue to progress, a rapid roll-out of UK tidal lagoons is anticipated, with several potential sites identified across Liverpool Bay and the Cumbrian coast.

The North West has three potential sites at Morecambe, Solway Firth and the Mersey. The attraction with tidal is that it is capable of generating more electricity per square metre than wind, and is a predictable source of energy. The challenge in rolling out tidal energy installations across the UK is being able to strike an acceptable balance between the economic, social and environmental impacts. If tidal power is to be exploited, a clear path needs to be identified by the industry to reduce the project costs through innovation and research and development and to consider how best to connect this generation source to electricity distribution networks.

CASE STUDY 12

Biomass CHP – Iggesund Paperboard, Workington, Cumbria

Igesund Paperboard in Workington is the UK's only producer of folding box board and has 400 employees. Incada, the paperboard made at the mill, is constructed of a middle layer made of mechanical pulp produced on site, which gives a low weight combined with high stiffness. The outer layers are made of a purchased chemical pulp to create high whiteness and good printability

In a drive to become self sufficient in electricity and heat, the company made an investment of £108m in a biomass CHP plant that took two years to build and was completed in March 2013. Compared to its previous fossil-fuel operation, the biomass CHP plant has reduced carbon dioxide emissions at the paper mill by more than 190,000 tonnes a year and is equivalent to the annual emissions of 65,000 cars each being driven 20,000 kilometres.

Biomass / Waste to Energy production

Biomass refers to both virgin material, such as wood residues, agricultural crops, farming residues and the biogenic fraction of waste material, such as municipal solid waste, other biodegradable waste including food and landfill and sewage gas. The policy to increase Biomass power generation by 4GW by 2035 is an opportunity for the North West to exploit farming and municipal waste to produce bio-gas electricity. The advantages are that the produced electricity is both predictable and controllable.

CASE STUDY 13

Sustainable heating of turkey farms – Baxi UK

Baxi UK, part of the BDR Thermea group, a leading provider of heating solutions in Europe with manufacturing facilities in the North West, is one of two contractors engaged in the delivery of packaged plant rooms to heat turkey farms in Norfolk. The £20M project seeks to convert 248 poultry sheds over 21 sites from utilising traditional LPG heating to biomass heating systems. The packaged plant room concept is similar to district heating, with a total of 179 boilers (either 151kW or 199kW) providing heating throughout all of the sheds utilising Cubo Heaters for localised delivery of heat. The project is economically viable as a result of the renewable heat incentive (RHI) payments that are available for commercial biomass installations (in this case at 8.6p/kWh). The project is financed by a third party which benefits from the RHI payments whilst the farm enjoys a new, clean, low carbon heating system running at lower cost than its existing solution (saving estimated at £3M/annum). The biomass boilers burn woodchip or pellets but there is also the prospect of turkey litter being approved for the RHI in the future, which would make the heating system sustainable within a local context. The concept may also be extended to chicken farms.

Nuclear Power Generation

The North West is the centre of the UK's nuclear industry and has the advantage of local specialism in this industry. With up to a further 3.6GW of nuclear power generation capability proposed by NuGen through the Moorside project in West Cumbria, the North West has a further opportunity to demonstrate its position as an international centre of nuclear excellence.

Prolong coal generation through carbon capture and storage

If we are to keep fossil fuels (coal and gas) as an element of the UK's power generation mix, an effective way to capture carbon dioxide and store it is required to support the carbon reduction targets. Key to progress in this area will be the first results from the White Rose FEED Study at the Drax site in North Yorkshire and the Peterhead project in Scotland.

CASE STUDY 14

Nuclear power - NuGen, Cumbria

On 1st May 2014, the Government announced a major step towards a new nuclear power station at Moorside, West Cumbria.

The Nuclear Decommissioning Authority has agreed key commercial terms with Toshiba and its partner GDF Suez to extend a land option agreement that reaffirms the consortium's commitment to build three reactors at Moorside. The reactors, to come online from 2024, will deliver up to 3.6GW of new nuclear capacity, enough to power up to 6 million homes.

It is estimated that the project will result in 14,000 jobs over the construction period for the three reactors, including peak on-site employment of more than 6,000 people. In the operational phase the three reactors will sustain around 1,000 permanent jobs over the course of the reactors' lifetimes

Improve gas supply security via shale gas reserves

Currently the UK's gas supply is heavily dependent upon imports with 50% coming from Europe, 40% from the Middle East and 10% from local supply. The UK has significant potential areas of shale gas reserves – taking advantage of these would reduce the UK's reliance on gas imports. The development of shale gas reserves could provide a sizeable contribution to the UK gas supply and it is estimated that by 2020, 2% to 4% of the UK gas demand could be met from shale gas, increasing to 15% to 20% by 2035. The North West is one of the potential key shale gas areas. Development of shale gas locally will provide an economic advantage for the North West in the development of new jobs and industries for businesses in the region. Any shale gas extraction development should be balanced with an analysis of potential environmental and physical risks.

The main advantage of shale gas development would be the improvement in the security of the UK's gas supply. Exploiting new shale gas reserves in the UK would reduce reliance on imported gas and reduce the risk to the nation's and region's gas supply.

5. THE NEXUS ISSUES

There are a number of interconnections between the resource opportunities discussed above. Where the issues overlap we have described them as 'nexus issues'. These nexus issues provide increased business opportunities and demonstrate ways in which the North West businesses can benefit from the resources within the North West. The diagram on the following page explains these issues in more detail.

5.1 Water and Energy

On the basis that there is no deficit of water supply forecast in the North West, water availability for energy production is not a significant issue with the exception of West Cumbria. However action is needed to improve the security of supply to West Cumbria, because the need to protect the local environment puts the future supply and demand balance at risk. Given the focus on Britain's Energy Coast, it is important that the area can rely on long term, sustainable suppliers of water.

The emergence of a shale gas industry in the North West is not forecast to give rise to any significant issues for water availability and it is highly unlikely to generate tensions between competing demands for water supplies. Under the most optimistic assumptions for shale gas production in the North West, the water required for hydraulic fracturing would amount to less than 1% of United Utilities' current water production. The company is confident it can supply these volumes without compromising its ability to supply water to its existing customers, subject to some reinforcement of local water networks.

There will be a reliable water supply to support energy production in the North West

CASE STUDY 15

Tidal technologies - Solway Energy Gateway (SEG)

Two significant cross border tidal energy projects are being proposed by SEG. The first will be an initial trial project between Bowness, Cumbria, and Annan, Dumfries and Galloway. This is the inner reaches of the estuary and at this point the estuary is just 2km across. This project will feature the VerdErg VETT technology which uniquely will capture 80% of available energy for less than half the price of a barrage. The technology allows the estuary to flow relatively as normal, consequently having only a minor environmental impact. The plan currently is considering possible additional infrastructure links. The current thinking around this initial project is that it would provide an effective 'proof of concept' with 108MW installed capacity and an annualised output of 36MW. Lifetime expectancy is at least 120 years. Potential build costs are circa £300m.

The second, and more ambitious, plan involves the development and construction of a scheme, again using the VETT technology, across a 30km span of the outer reaches of the Solway. It is calculated that the power potential capacity at this point is between 6.5 – 8.2GW. This scheme would clearly have a major impact not only in terms of energy generation but also in terms of connectivity to Scotland and Northern Ireland.

In 2040, England's North West will be an even better place to do business

Where will the business opportunities be in 2040?

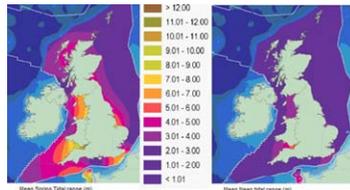
Thermal hydrolysis and possibly gasification of sewage sludge

Regenerating our coastal communities and tourist businesses through clean rivers, beaches and bathing waters

The reassurance of a reliable and resilient water and energy supply



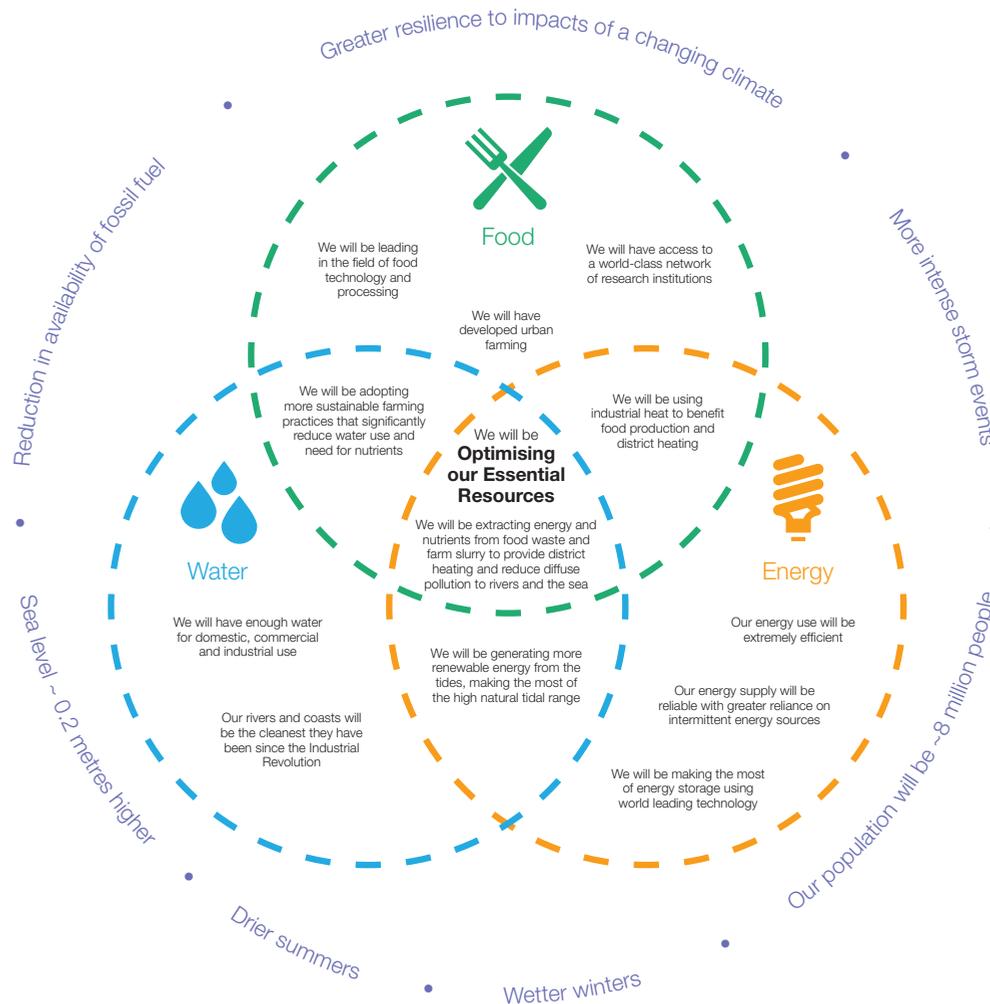
Regional - Davyhulme Sludge Recycling Centre
This facility was recognised as the world's most innovative green energy scheme when it won the Institute of Chemical Engineers' 2013 Energy Award. The plant uses a process called Thermal Hydrolysis to digest wastewater sludge and convert it into a high quality farm fertiliser while releasing enough biogas to power the entire Davyhulme site. The dome-shaped biogas holders are the largest in Europe, each with a 9,000 cubic metre capacity. The gas is cleaned and used as fuel for five combined heat and power engines and three steam boilers. It generates over 60GWh of electricity every year – the equivalent of the needs of 25,000 homes.
Source: United Utilities



UK Tidal Range Maps
The UK has the second highest tidal range in the world.
Source: UK Energy Research Centre

Regional - Mersey Tidal Power
A tidal power scheme in the Mersey Estuary could deliver enough electricity to meet the needs of over 200,000 homes.
Source: Peel Energy

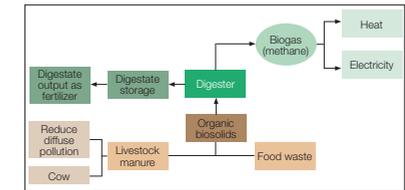
¹Extrapolated from Office of National Statistics Sub-regional Population Projections (2012)



Anaerobic digestion of food waste and farm slurries

Colocation of businesses and industry with synergies around food, water, waste, energy and technology

More sustainable farming practices that recover nutrients and reduce diffuse pollution significantly



Global - Biogas Plant, Karachi
The overall study is to assess the supply of manure waste and mixed municipal, agricultural and food processing waste to the proposed biogas plant. The Biogas plant will be located in or adjacent to the Landhi Cattle Colony, approx 20km to the south east of Karachi City. LCC has 140,000+ cattle predominantly buffalo and milking cows, spread over 1,000 farms. It will be constructed in 2 phases – each generating 7.5 MW, and will reduce diffuse pollution to the environment.
Source: Arup/IFC

Regional - Anaerobic Digestion, Cumbria
The plant consists of three 3,000 tonne Glass-Fused-To-Steel AD Tanks complete with industry-leading BIOCOM Double Membrane Reactors. The biogas that is produced as part of the AD process is captured in the roofs before it is cleaned and sent to the CHP Unit, where electricity is produced for exporting to the National Grid. The plant uses grass and maize silage grown on farm and in the surrounding area to produce 2.0MW of electricity, enough continuous power for more than 4,000 homes.
Source: Dryholme Farm, Silloth

Making better use of heat

Expanding our use of wind

Developing tidal power



Global - Waste-to-Energy Facility in Malmö, Sweden
In 2008, the waste-to-energy plant of Sysav was extended by a new facility producing heat and power by processing industrial and municipal solid waste from approx. 1/2 million inhabitants in the 14 municipalities of Southern Skåne. The annual capacity is now 650,000 tonnes of waste, and it produces 1.4 TWh heat and 0.3 TWh power. The waste volumes are reduced through thermal treatment and power and district heating are produced for the benefit of Sysav's owner municipalities. It now supplies the district heating system of Malmö (the third largest city in Sweden) with 60% of its heat demand.
Source: Ramboll

Regional - Biomass: Barton Renewable Energy Plant, Manchester
The Barton Renewable Energy Plant is a consented multi-million pound scheme in Trafford (Greater Manchester) that would generate electricity from locally sourced biomass for at least 25 years. The 20MW plant will be capable of generating enough low carbon electricity to meet the needs of up to 37,000 homes. Heat in the form of steam of hot water could also be available to nearby homes and businesses. It will utilise approximately 200,000 tonnes of biomass annually, with much of the fuel comprising reclaimed wood, potentially diverting this material from going into landfill.
Source: Peel Energy

5.2 Energy and Food

Given the focus on reducing waste being sent to landfill, increasing targets on levels of recycling, composting and recovery and identification of reliable and economic renewable sources, it is important that we further develop waste to energy sources in the area. Facilities such as the VLGM operation (Viridor Laing and Greater Manchester Waste Disposal Authority) are good examples of how the region can utilise waste to produce refuse derived fuel for CHP generation.

Waste from the food processes will be used to produce alternative energy sources

CASE STUDY 16

Anaerobic digestion – Dryholme Farm, Silloth, Cumbria

The plant consists of three 3,000 tonne Glass-Fused-To-Steel AD Tanks complete with industry-leading BIODOME® Double Membrane Roofs. The biogas that is produced as part of the AD process is captured in the BIODOME® Roofs before it is cleaned and sent to the CHP Unit, where electricity is produced for exporting to the National Grid. The plant uses grass and maize silage grown on farm and in the surrounding area to produce 2.0MW of electricity, enough continuous power for more than 4000 homes, producing a significant boost to Cumbria's rural economy and contributing to the business as a whole.

5.3 Water and Food

Whilst we should strive always to be efficient with our water use, no deficit of water supply is currently forecast in the North West and water availability for food is not therefore considered to be a significant issue. Of greater concern are some of the consequences of farming techniques to grow food more efficiently and manage livestock more effectively, in particular the run-off of nutrients from fertiliser use and slurry from farmland into river systems and bathing waters. Can the same levels of efficiency and effectiveness be achieved through different methods that do not have the same water consequences?

Diffuse pollution will be managed through smarter farming practices and better catchment management thus creating cleaner rivers and bathing waters

As mentioned above, the tensions between the two will be felt outside the North West. Companies with supply chains in areas where water supplies are under pressure may need to think carefully about the long term resilience of these.

5.4 The 'Jackpot'

One of the opportunities that is currently being piloted by some specific businesses but will be mainstream by 2040 is the processing of waste from whatever source to extract energy for re-use.

The North West will be world-leading in energy extraction from food waste, municipal waste and wastewater.

CASE STUDY 17

Turning Tides – Fylde Coast

Ensuring that the region's bathing waters meet the requirements of the revised Bathing Water Directive in 2015, so reducing the risk to the reputation and economies of seaside resorts, requires collaborative working across a number of organisations. Turning Tides²³, a cross-sector partnership chaired by Blackpool Council CEO, is bringing together organisations such as the Environment Agency, United Utilities, local authorities and the National Farmers Union with a role to play in protecting and improving bathing water quality. With a vision to secure "Bathing waters we can be proud of, that are valued by communities and that support a vibrant economy", the objectives of Turning Tides include changing perceptions and values of key decision makers, politicians, the private sector and the wider community; collaboratively striving to raise the quality of north west bathing waters; and identifying and raising awareness of funding streams for bathing water improvements. This joined up approach to stakeholder engagement includes political and regulatory bodies and has the support of Defra. The external facing campaign of Turning Tides, LOVEmyBEACH²⁴, is developing an understanding of the role the general public, businesses, schools and volunteer groups can play.

²³See <http://www.unitedutilities.com/turning-tides.aspx>

²⁴See <http://lovemybeach.org/>

CASE STUDY 18

Anaerobic digestion for the farmer – Reaseheath College

Anaerobic digestion (AD) is a way of taking waste slurry from animals (mainly cows in the context of the North West) and allowing it to ferment under controlled conditions so that it produces methane gas. The gas is then collected and burnt in a CHP (combined heat and power) unit that produces electricity and heat, thus generating power from a renewable waste. The bi-product is a digestate that can then be applied to land as a fertiliser.

Reaseheath College, Nantwich, has two demonstration digesters on the College farm, which were commissioned in 2011 and take slurry from the 250 dairy cows and a small pig unit. The digesters run for 20 hours per day allowing 4 hours for maintenance. Every day the digesters use 23 m³ of slurry and produce 475 m³ of biogas, which is 60% methane. The CHP engine has a 50 kw/hr capacity and runs at 38 kw/hr, providing the College with 15% of its energy needs.

The College has overcome many technical challenges in order to achieve stable operation of its AD unit using only slurry as a feedstock; thus avoiding the use of crops that might feed animals or humans directly.

Because the College AD site is there to test the concept and spread the learning to the community, there is a strong educational push to the effort. Further and higher education students as well as the regional farming community, AD technologists, planners and financiers have all benefited from the facility.

The digestate bi-product of the AD unit is a low odour, pathogen reduced substance that has been tested extensively in grass growing trials at the campus farm. Results demonstrate that the valuable plant nutrient content within the slurry (nitrates and phosphates) is maintained through the AD process. Furthermore, the amount of nitrogen and phosphorus that is available in the soil for crops has been found to be greater following the application of the digestate than would be achieved if the slurry was applied directly to the field (i.e. fewer nutrients are washed away or trapped within the soil structure). Using digestate from an AD plant therefore has the potential to both improve the fertiliser-use efficiency of arable operations and reduce the level of agricultural pollutants leaching into the groundwater.

In pure economic terms, on-farm AD plants offer the opportunity to improve farm incomes by either lower energy and fertiliser purchase costs or by selling the generated gas and the digestate as a valuable fertiliser.

6. Conclusion

This report has set out some of the many issues which face not only England's North West but much of the UK, and the world as a whole, in relation to the maintenance of adequate supplies of food, water and energy. Whilst the North West may enjoy a relative degree of security in respect of its supply of these resources, the report has demonstrated how much action still needs to be taken if the region is to sustain the necessary future supplies to meet its own requirements, let alone contribute to those of the remainder of the UK. Concerted and prompt action is therefore required if serious challenges are to be overcome in the years ahead.

Provided it can successfully address these challenges, England's North West does however have the opportunity to create substantial business advantage for its region. In relation to food, for example, producers in the North West will have the opportunity to be part of a world-class network developing new approaches to resource efficient livestock production and food and beverage manufacturing. Our report makes a strong case for a food and beverage high value manufacturing catapult to be established in the North West.

With regard to water, a reliable and climate-resilient water supply can be expected to continue providing the North West's many water-intensive businesses with the security required to meet growing market opportunities. In what remains the UK's leading manufacturing region, the combination of secure water and energy supplies is of paramount importance.

As far as energy is concerned, the North West is fortunate in already having a wealth of power-generation assets, combined with the skills and experience across the full spectrum of key technologies including gas, nuclear and wind. In addition, it is now in a strong position to accelerate further renewable power regeneration through Britain's Energy Coast, whilst the region also has significant shale gas reserves which could substantially improve energy security, not only in the North West but for the UK as a whole.

The authors of this report, the North West Business Leadership Team, believe that through their own collaborative action and commitment, alongside that of the relevant public agencies, other businesses and the community as a whole, this report can act as a catalyst in helping to lead England's North West into a new era of sustainable economic growth. The commitment to action in sustaining future supplies of essential resources can also provide England's North West with compelling business advantage for generations to come.

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APPENDIX B – ACKNOWLEDGEMENTS

The North West Business Leadership Team (NWBLT) would like to acknowledge the work of all those who have contributed to the production of this report. In particular, we would like to thank Mark Fletcher of Arup, Steve Foxley of Siemens Industry UK, Chris Matthews of United Utilities and both Graham Ramsbottom and Tim Shaw of Wearsheaf Group – part of the Grosvenor Estate - who together formulated the vision as well as providing the text, upon which the report is based.

We are also indebted to those organisations which have provided the case studies for the report, enabling us to illustrate the many potential benefits of the report's recommendations.

Finally, we would like to thank Alan Torevell, of Dewhurst Torevell, whose inspiration and commitment to the NWBLT's overall resources project – including the provision of an interactive display and relief model at the UK's International Festival for Business 2014 – contributed so imaginatively towards our aim of promoting greater awareness of the resources which North West England has to offer.

APPENDIX C

THE NORTH WEST BUSINESS LEADERSHIP TEAM

The voice of leading businesses in North West England

TEAM MEMBERS, MAY 2014

Life Presidents: His Grace The Duke of Westminster, Lord Thomas of Macclesfield, Sir Alan Cockshaw and Neville Chamberlain

Juergen Maier (Chairman)	Managing Director Industry UK, Siemens
Mike Blackburn (Deputy Chairman)	North West Regional Director , BT
Simon Allport	Senior Partner – Manchester Office, Ernst & Young LLP
Steve Anderson-Dixon	Managing Director North West, Trinity Mirror Plc
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Kath Brown	HR Director UK Operations, Pilkington UK Limited
Charlie Cornish	Group Chief Executive, The Manchester Airport Group
Paul Devitt	Managing Partner, Addleshaw Goddard
Dr Chris Doherty	Vice President, Alderley Park Site Options, Innovative Medicines, AstraZeneca
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David Pinder	Chief Executive, Baxi Heating UK Limited
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