

## **APPENDIX 2**

### **Flintshire CC Renewable Energy Plan**

#### **RE11 & RE10 Response (July 2016)**

##### **John Purchase**

###### **1. Introduction**

1.1 The report provides an analysis of how much of Flintshire's energy needs could be met by the harvesting and processing of locally sourced biomass. The report attempts to quantify the amount of biomass which can be produced from its own woodlands and investigates the potential supply of woodchip that can be produced from its agricultural holdings. In addition to the above, the report provides information relating to a supplementary source of wood based material which can be utilised in the production of biomass.

Although every effort has been made to ensure that the information is accurate the author cannot accept liability for errors or omissions. The report includes confidential information pertaining to the county's woodland resource and asset structures.

With reference to the county perspective, Flintshire has approximately 3500ha of woodland. Approximately 2750ha of this is broadleaved (predominantly ash, sycamore and oak) and 750ha of softwood. This roughly translates to 9% of the county being covered by woodland which is substantially lower than the national average of 14.5% woodland cover. Nonetheless, there is a clear opportunity for a local wood fuel sector to develop in which to create a wood base service sector.

This report provides an understanding of the opportunities and barriers specific to Flintshire CC Renewable Energy Plan, using knowledge of Flintshire's existing woodland resource and structures.

###### **2. Background**

2.1 The report has been undertaken at the request of Mr Will Pierce as a component of Flintshire CC Renewable Energy Plan (RE11, RE10). The aim of this report is consider the use of dry biomass as an alternative energy source to supplement and/or replace current oil and gas based heating systems. It is proposed that the new heating systems will consume woodchip fuel derived from Flintshire public and private woodlands, recycled timber, sort rotation coppice (SRC) and other suitable forms of biomass.

###### **3. About Biomass**

3.1 Biomass is defined as organic matter derived from plants or animals. Biomass used for the generation of renewable energy is generally produced by farming techniques, land management activities and the forestry sector.

3.2 Dry Biomass is accepted as a carbon lean renewable energy because the majority of the carbon used for heating is re-absorbed by plants during growth (CO<sub>2</sub>). Therefore, biomass may be regarded as carbon neutral, heating systems using biomass are low in carbon emission, especially when compared to traditional heating systems which use vast quantities of carbon in the form of oil and gas (including electricity generated carbon based power stations).

3.3 Modern biomass heating systems are highly efficient, self-regulating and capable of maintaining a steady supply of heat over a number of days with minimal intervention. The benefits and principals of using sophisticated and efficient biomass heating systems are: capable of creating and consolidating a local based biomass market, potential to support rural employment, stimulate management of neglected woodlands thus improving the woodland habitat and biodiversity.

3.4 Although a number of products and by-products can be defined as biomass (straw, grain husks, bracken and animal waste), this report will focus on the two main types of biomass traditionally used in woodchip fuel heating systems: trees (including lop and top and cordwood) and willow and hybrid poplar cultivars utilised in short rotation coppice systems (SRC).

3.5 Whilst the report will focus predominantly on the production forecast for woodchip fuel derived from Flintshire CC woodland resource and the production potential of SRC grown on Flintshire CC agricultural holdings, the supplementary inclusion of additional supplies of woodchip biomass from alternatives streams will be considered.

#### 4. Methodology

4.1 The purpose of the study is to quantify the supply of biomass that the authority has at its disposal in order investigate the opportunities of propagating willow and poplar in a SRC system utilising Flintshire CC agricultural land. In addition to the above, the report will consider the opportunities for supplementing the intrinsic supply of woodchip fuel with timber derived from private woodlands, arboricultural activities and other opportunistic woodchip biomass streams and clusters.

4.2 With reference to Flintshire CC woodland resource and information pertaining to standing timber and productivity, this data has been extrapolated from the current woodland inventory records. However, information pertaining to other woodlands outside the jurisdiction of Flintshire CC management has been estimated and may be subject to some discrepancy.

4.3 With regards to Flintshire's Agricultural Department and tenancy agreements, there appears to be a degree of uncertainty concerning policy direction, future provisions and tenancy agreements. Asset/Legal Officers were unable to provide information regarding the authority's rights to retain timber and the authority's capacity to alter land management practices (due to the land agent position being vacant).

## **5. Woodland Resource**

### **5.1 Flintshire CC Woodland Resource**

Flintshire County Council is actively managing its woodland resource in a sustainable way. The majority of the authority's woodlands are managed within Flintshire's Countryside Services, however a number of woodlands are overseen by the Agricultural Department. The majority of the woodlands are subject to a management programme and have been privy to the Forestry Commission Better Woodlands for Wales Grant Schemes. Presently the majority of Flintshire CC woodlands are out of scheme and need licencing.

5.1.2 Flintshire CC woodlands are subject to a number of designations, which include SAC, SAM, SSSI and Wildlife Status and are therefore managed within a sympathetic management regime. Additional management constraints include no specialist forestry machinery, access challenging, landscaping objectives, provision for educational and community involvement.

5.1.3 Flintshire CC has approximately 118 ha of woodland. The majority of the woodland component is managed by Countryside Services (95ha) and the remaining 23ha is managed within the Agricultural Department (2011 Census).

5.1.4 The woodland composition is predominantly broadleaved with a modest mixed conifer component. Stocking densities are moderately high with respectable yield classes (6 to 8 m<sup>3</sup>/ha/year broadleaved and 12 to 16m<sup>3</sup>/ha/year softwood). Access is challenging and species composition is predominantly ash, sycamore and oak for hardwood species and larch, Douglas Fir and pine for softwood.

5.1.5 With reference to the propagation of woodchip, Flintshire CC has the necessary capacity to supply 200m<sup>3</sup> of timber per annum. FronDudur Woodland is the only woodland within the agricultural department which has the necessary structure to be managed specifically for timber which can be utilised in the propagation of woodchip fuel (10ha equating to 24m<sup>3</sup> annual production of timber HW/SW).

5.1.6 The presence of a number of key conservation designations and social inclusion agreements, on a number of the woodlands, limits the ability of the authority to manage woodlands purely for timber production. Nevertheless, collectively the woodlands have the capacity to sustainably produce approximate 220m<sup>3</sup> of timber per annum.

### **5.2 Flintshire's Woodland Resource**

5.2.1 With reference to a county perspective, Flintshire has approximately 3500ha of woodland. Approximately 2750ha of this is broadleaved (predominantly ash, sycamore, birch and oak) and 750ha of softwood. Flintshire has approximately 9% woodland cover substantially lower than the national average of 14.5%.

5.2.2 A significant proportion of Flintshire's commercial woodlands are managed within formal estates structures or within large farm units. These privately owned woodlands have the necessary capacity to supply the local authority with quantities of timber/woodchip fuel.

5.2.3 Generally timber destined for woodchip fuel is relatively poor in quality and commands a poor return from the timber market. Thus it would be necessary to

obtain timber from lower sectors of the timber market, competing with local sawmills, wood based panels, pulp, paper and fencing (the lower end of the timber market), avoiding the medium to high quality saw log sectors.

5.2.4 Other opportunities for acquiring timber/woodchip fuel are from small farm units or privately owned woodlands. However, the acquisition of timber/woodchip fuel from these woodlands will not be easy or cost effective when compared with purchasing timber from traditional estate woodlands. Nevertheless, acquiring timber/woodchip fuel from this sector may stimulate formal woodland management within neglected woodlands. It is estimated that 10% of Flintshire's woodland resource are contained within woodland units smaller than <5ha., consequently too isolated and difficult to justify consideration for commercial exploitation.

5.2.5 Taking all factors into consideration, Flintshire as a county has the theoretical capacity to produce in excess of 15,000m<sup>3</sup> of timber per annum. Flintshire CC, could engage with woodland owners and purchased biomass directly from the local woodlands in the form of timber (in the round) or processed (Woodchip fuel). Although biomass systems claiming the Relative Heat Incentives (RHI) must use certified timber from registered producers.

### 5.3 Neighbouring Woodlands

5.3.1 Other market opportunities to obtain woodchip fuel is by purchasing timber from within the AONB and/or the county of Wrexham.

5.3.2 The Clwydian Range has a woodland resource of approximately 934ha evenly distributed throughout its length. Although these woodlands are safeguarded against clearfelling and over exploitation, the overall desire of the AONB Management Plan is to improve and maintain woodlands in "favourable condition". However, access to many of these smaller woodlands is challenging, thus making timber harvesting and extracting unprofitable. Nevertheless, some woodlands do lend themselves to timber production and are capable of producing significant quantities of timber.

5.3.3 With reference to exploitation of the woodland resource in Wrexham, the county has in the order of 4,700ha of woodland (broadleaved and coniferous), proportionally the same as Flintshire, however significantly larger in quantity. A large proportion of Wrexham's woodland resource is easily accessible and open to market exploitation.

## 6. Short Rotation Coppice

6.1 Short Rotation Coppice (SRC) is an energy crop which consists of densely planted (15,000 stems per ha) high yielding varieties of willow and poplar. Crop yields vary between 7 and 12 dry tonnes/ha/year (21m<sup>3</sup> to 36m<sup>3</sup>/ha/year) and are dependent on soil fertility, moisture availability and aspect/shelter. Mineral soils are ideal for growing willow and poplar cultivars (loams, clay loams and heavy clays suitable), pH values between 5.5 to 7.5 with excessive slopes and uneven ground being unsuitable (above 15%).

6.2 The establishment of SRC plantations has much in common with agricultural and horticultural crops as well as forestry practices, hence the acceptance by the farming community to consider propagating SRC. Trees are planted in windrows and are reminiscent of fields of maize and are harvested by Terrain Chipping Harvesting Systems. Appropriate management of SRC systems provides a source of renewable energy with virtually no net carbon emissions. Harvesting cycles are in the order of 2 to 5 year cycles, following the establishment phase.

6.3 If managed sensibly, SRC can remain productive for a period of thirty years, after which old coppice stools are replaced with maiden trees. Due to the inherent silvics of salicaceae (willow and poplar) very little soil improvement is required. Nevertheless applications of suitable fertilisers are generally applied, post harvesting, January to April.

6.4 Crops are harvested by purpose built harvesting machines or foragers (harvested, chipped and trailered). Chips are then bunkered within a woodchip store, turned and dried to approximate 30% moisture content and burned as and when required. Dried salicaceae wood chip has a density of approximately 200kg to 400kg/m<sup>3</sup> or a volume conversion of 2.5m<sup>3</sup> to 5.0m<sup>3</sup>/tonne. Thus large commercial plantations of wood biomass should be established near or in close proximity of suitable engineered road systems with adequate capacity.

6.4 Although commercial plantations of SRC can be perceived as being too uniform a monoculture and may impact negatively on the vernacular landscapes, any visual impacts are normally offset by the environmental and ecological benefits of planting copious amounts of willow and poplar.

6.5 Diversification of farm enterprises has become increasingly important in recent years and the propagation of willow and poplar in SRC systems can offer farmers a means of diversifying their economic activities. Flintshire has a number of farms which have the potential to propagate energy crops in the form of woodchip biomass.

6.6 Although salicaceae as a species is very site accommodating, research on willow and poplar cultivars has focused on the best genetic material for lowland regions in which to maximise growth yields. There appears to be a lack of research into the best clones suitable for low-grade land and on land above 250m.

6.7 Consequently, should Flintshire CC propagate biomass from willow and poplar cultivars, sizable agricultural holdings from Sealand and/or Kinnerton should be considered (Sealand 130ha within 3 units and Kinnerton 223ha within 5 units). These agricultural units have the necessary attributes for propagating biomass on a scale which can be viable i.e. sufficient annual rain fall between 600 to 1000mm, sandy loams of clay soils, reasonably fertile, neutral pH levels, flat or slightly sloping grounds no greater than 7%, gateways wider than 4.5m supported by adequate extraction routes.

6.8 Other attributes associated with the farm units in Sealand are that planting schemes can easily fit into the local landscape, field units can accommodate the optimum row lengths and that the recommended 10% open space can provide room for some of Flintshire more endangered wildlife species. Sealand is ideally placed to take advantage of Flintshire's intrinsic road network, thus reducing travelling costs and ultimately increasing the NPV of the project. In addition to the production

capacity of Sealand farmland, the erection of a processing and storage facility adjacent to the biomass plantation would not look out of place within this military/industrialised area of Flintshire.

6.9 A processing and storage site established in Sealand would also enable the biomass programme to take advantage of neighbouring timber reserves, intercepting timber streams (neighbouring estates, NRW and FE England) and is close to Flintshire's largest woodland resource.

6.10 Other Flintshire CC holdings have been excluded on the evidence of being too small, fragmented, isolated, too difficult a terrain and inadequate soil moisture and nutrition levels.

## **7. Other Sources of Biomass**

### **7.1 Tree Surgery and Arboriculture**

7.1.1 Due to the nature and unpredictability of the work associated with tree surgery, it is difficult to quantify the total annual biomass which may be available to Flintshire CC. However, it is estimated that within NE Wales approximate 21 local trees surgeons actively work to maintain trees within the urban communities of Flintshire, Denbighshire and Wrexham.

7.1.2 Through informal consultation, tree surgeons annually collect and dispose of approximately 120m<sup>3</sup> of timber and 200m<sup>3</sup> of woodchip, these figures being slightly lower than the London average. Many tree surgeons state that approximately 30% of the annual timber felled remains on site in the form of firewood (owner's requirements) with 70% removed. Small trees and lop and top (<7cm) is chipped, removed from site and disposed of through composting, mulching and in exceptional circumstances biomassed (Clifford Jones Ruthin).

7.1.3 Nevertheless, wood chip derived from arboricultural activities has the necessary capacity to provide a strategic quantity of biomass to meet part of Flintshire's energy needs. However, the green vegetative waste within the woodchip would require removal, as too high a vegetative quantity would inhibit burning, reduce efficiency and generate larger volumes of ash. In addition, tree surgeons tend to fell large trees, which would necessitate access to large industrial size chippers.

7.1.4 In addition, other sources of woodchip which could contribute to this biomass component are those derived from highways maintenance programmes, developments and subsequent land clearances, site maintenance/landscaping programmes and powerline clearance. Many of the above on site activities are directly controlled by Flintshire CC managers with ground work undertaken by Flintshire CC direct labour or by private contractors.

7.1.5 The formation of a central processing plant would enable Flintshire CC to capitalise on this particular element. However, the current processing system employed at Greenfield is not adequately tuned to remove the bulk of available woodchip biomass. The system adopted at Greenfield is designed to produce compost and is therefore too bias a system to generate woodchip biomass.

## 7.2 Waste Wood or Co-product

7.2.1 The acquisition of waste wood for biomass can be separated into two categories.

7.2.2 The first category deals with the recycled timber from Flintshire's recycling centres. Timber and wood products are deposited into silos and delivered to Shotton Paper for processing into biomass and subsequently electricity. Flintshire CC currently delivers 1100tonnes of timber to Shotton and a further 2100tonnes of timber waste to Thornccliffe for further processing/segregation. If Flintshire CC decides to utilise this product in its own woodchip and biomass system then it would need minimal coordination and small logistic changes.

7.2.3 The second category deals with the waste product created by the primary and secondary processing of timber within the timber industry.

7.2.4 A number of small sawmills work within and in close proximity to Flintshire process softwood (spruce, larch, Douglas Fir and pine). This is a sector of the wood processing industry that is heavily dependent on processing high volumes with relatively small returns.

7.2.5 Due to the inherent properties of softwood timber and the need to capitalise on all opportunities, softwood mills tends to have a relatively healthier conversion factor when compared to the hardwood sector. Hardwood sawmills have a relatively low conversion factor which transpires to a recovery rate of 40% when compared to the 65% recovery rate associated with softwood mills.

7.2.6 Nevertheless, all the sawmills have a conversion factor and generate waste or rather co-products. These co-products can be further compartmentalised into 60% sent for chip (cants or offcuts), 20% classified as sawdust and 11% utilised as bark mulch.

7.2.7 Presently a large proportion of the co-products derived for our sawmills are processed into biomass. Should Flintshire CC wish to acquire a proportion of this material then the authority would have to compete with competitors on the open market.

7.2.8 With reference to fine sawdust and planer chips, Flintshire has a significant wood processing sector, composing of sawmills, joiners and furniture makers. All of whom together produce a significant quantity of sawdust which is collected and processed into wood pellets or consumed in the production of electricity by large power stations.

7.3 The report did not consider the biomass potential of bracken, Misacanthus and arable crops.

## **8.Opportunities**

### 8.1 Potential biomass from Flintshire CC existing woodlands.

8.1.1 This report has briefly focused on the volume of biomass available within Flintshire CC estate, the potential of propagating biomass from its agricultural holdings and investigating other opportunities within the biomass supply chain.

8.1.2 Due to the uncertainty of future economic grant aid from the British Government and European Community, the report does not provide information on grants or financial incentives offered towards renewable energy projects.

8.1.3 However, should Flintshire embark on a programme of harvesting timber for biomass/wood fuel, then it would be prudent to gain financial assistance on matters pertaining to the establishment of suitable energy crops (SRF and SRC), woodland management, capital support for developing an appropriate processing and storage system and capital support for installing appropriate heating systems whilst gaining long-term agreements on available RHI.

8.1.4 The total operational biomass available from Flintshire's woodland resource for heating is 220m<sup>3</sup>/annum. This is the increment of timber that Flintshire's woodland resource gains each year which can be harvested without depleting its capital reserve of timber. However, due to pasT management intervention, Flintshire's woodlands contain a significant proportion of medium to high quality timber. Medium to high grade timber should be directed to appropriate market niches or processed in house, thus maximising returns. Traditionally, biomass consists of lop and top, first and second thinnings and trees of poor form and character. Thus the majority of timber recommended for biomass should be small round wood, poor quality stems, defective and diseased trees and branches and branch tips.

8.1.5 As a primary producer of timber, Flintshire CC should be more active in exploiting this resource. Recently Flintshire Countryside Service have embarked on a programme whereby Wepre timber has been utilised in the construction of buildings, cladding, revetments and countryside fixtures. As part of this programme, unsuitable timber, a by-product of the harvesting, which should have been directed towards biomass but was retained within the woodland environment.

8.1.6 With reference to the commercial capability of Flintshire's woodlands, any increase in productivity will be offset by the inherent restriction imposed by social requirements. Due to their location, Flintshire's woodlands are very productive woodlands, high yielding and stocked with appropriate tree species (high calorific values). In addition, these woodlands are exceptionally rich in biodiversity and are important recreational features. Nevertheless, the potential to produce biomass from a proportion of Flintshire's woodlands should be viewed as an opportunity. Currently, Flintshire CC woodlands are overstocked and in need of an extensive thinning programme. However, people don't take lightly to felling trees. Years of visiting our woodlands creates a sense of familiarity and ownership. This public antipathy towards tree felling would require addressing. Nevertheless, a strategic change in the silvicultural systems would increase productivity and increase the proportion of available biomass i.e. using short rotation forestry (SRF) to optimise growth volumes (where trees are managed 12 to 15 year rotation, not to be confused with short rotation coppice (SRC)).

8.1.7 One note of caution is the possibility that Ash Dieback and Phytophthoraramorum could severely affect the productivity of our woodlands.

## 8.2 Short Rotation Coppicing Flintshire's Agricultural Estate

8.2.1 With reference to SRC, the establishment of a biomass crop at Sealand has the capacity to supply a strategic quantity of woodchip fuel. The surrounding area provides sufficient capacity to construct and install a woodchip processing and



storage facility which would reduce handling costs to a minimum. In addition, a storage and processing site, strategically placed adjacent to the A55 link road, would be perfectly positioned to exploit additional timber streams and accept industry co-products, waste timber and unwanted biomass from Flintshire's recycling service.

8.2.2 A biomass processing and distribution site at Sealand would be ideally placed to supply the county should Flintshire embark on a programme of installing a number of small/medium size boilers or construct one large biomass unit. Thus transportation costs would be reduced to a minimum and transportation efficiency and networking increased.

8.2.3 If the information from the agricultural department is correct and the land is adopted for the propagation of biomass, hypothetically Sealand has the capacity to sustainably propagate in excess of 1300 tonnes of willow/poplar biomass annually.

### 8.3 Other Sources of Biomass

8.3.1 Other sources of biomass are from the arboriculture industry, trees surgeons and land maintenance crews (private and public) who provide a service to our community and also undertake some contractual work regarding site clearance, site maintenance, highway maintenance and line clearance. This sector has the potential of supplying in excess of 1500m<sup>3</sup> of biomass per annum. However, for this element to succeed a high degree of organisation is required to coordinate materials to a central point. This provision would easily engage with aspects of our current composting programme.

8.3.2 Approximately 40% to 65% of the volume of timber sold to the sawmills will be converted into timber/timber products. The remaining co-products are recycled into woodchip fuel and/or pelleting (bark being a horticultural product). Should Flintshire wish to obtain a proportion of this material, then it would have to compete with other businesses on the open market.

8.3.3 The acquisition of timber from Flintshire's recycling service would further enhance the total volume of biomass. However, the issues relating to processing this timber and potentially burning pollutants within an urban setting needs further investigation. Nevertheless, it is estimated that a further 2000 tonnes of recycled timber can be redirected into Flintshire's biomass programme.

8.3.4 As previously discussed, the largest supply of biomass open to exploitation is from woodlands (private and public). Flintshire, as a county, has the capacity to produce in excess of 1500m<sup>3</sup> of timber annually. There is an opportunity for Flintshire CC to gain timber from NRW and/or local private estates. Presently the softwood timber markets are depressed (a reliance on the housing market to generate a demand). In addition, UK timber production of softwood is set to increase and peak 2020-2025 which could further depress the UK market.

## **9. Report Limitations**

9.1 Due to the limited time constraint of compiling this document, sections have not been referenced. The document has been written with a view of investigating the possibility of exploiting the existing timber resource. Should the local authority embark on a programme of utilising biomass for energy, then it is highly

recommended that a formal consultation with specialist biomass engineers be undertaken.