Renewable Energy Targets for the North West

A report to the North West Regional Assembly

FUTURE ENERGY SOLUTIONS

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RENEWABLE ENERGY TARGETS FOR THE NORTH WEST

The Nature and Scale of Renewable Energy Targets

The current targets for renewable energy (RE) across the region in Regional Planning Guidance are based on the report "From Power to Prosperity" (SNW, 2001). This report advocated a RE electricity target based upon the installed capacity of RE schemes, and proposed a regional target figure of 857MW. This capacity figure represented 8.5% of the region's installed capacity for electricity generation (this total installed capacity being composed of coal-fired, nuclear, gas-fired and other kinds of energy generation technology).

Since the production of "From Power to Prosperity", some of the specific technology assumptions on which it was based have become dated. In addition, it has become clearer that wider national and regional energy issues - such as the levels of greenhouse gas emissions and security of energy supply - have become progressively more pressing and require vigorous action[1].

The Government has continued to support the development of renewable energy schemes through the Renewables Obligation and other measures. The Renewables Obligation requires electricity suppliers progressively to provide greater quantities of electricity from RE over the next decade, rising to 10% of UK electricity from RE by 2010 and continuing to increase to 15% by 2015.

Given these contexts, and in order for the North West to provide "its share" of these targets - now and into the future - it is considered appropriate that regional targets should be defined by reference to the amount of electricity actually generated from RE schemes.

The following calculations are intended to show how such regional targets can be derived, and to provide indicative breakdowns of the targets at sub-regional level across the North West. Targets are proposed for 2010, 2015 and 2020.

Electricity Generation as a Basis for RE Targets

If the region is to determine regional RE electricity targets on the basis of "providing its share" of national targets, an equitable approach would be to <u>set RE targets as a percentage of the electricity actually used within the North West</u>. In order to do this, it is first necessary to estimate how much electricity the region will be using in the future, projecting forward from today's usage. Three indicative Scenarios are used to generate these estimates.

Future Use of Electricity Across the North West

SCENARIO 1 – Assumes an increase of regional electricity use of 1% per annum, lower than the current rate of increase and a decrease in real terms
SCENARIO 2 – Assumes no increase in regional electricity usage over the 15 year period to 2020
SCENARIO 3 – Assumes a decrease in regional electricity usage of 1% per year

[1] "North West Sustainable Energy Strategy", North West Regional Assembly – in preparation.

All scenarios represent a decrease in the recent trend of electricity demand. Scenarios 2 & 3 represent progressively more stringent and sustained efforts to reverse these long-running trends.

To estimate the future use of electricity across the three scenarios, it is necessary to know the current regional electricity demand. Data from DTI Energy Trends[2] gives the regional electricity demand in 2003 as 33.449 TWh[3]. Using this as the baseline, it is possible to project forward to future years under each of the three scenarios.

Table 1 – Projected Regional Electricity Demand for the North West (TWh / year)

	SCENARIO		
	1	**2**	**3**
2010	35.92	33.5	31.22
2015	37.75	33.5	29.69
2020	39.67	33.5	28.24

It can be seen that the choice of Scenario for future electricity demand is crucial in determining the scale of RE target. In particular the level of target is dependent upon the extent to which the region can successfully achieve sustained reductions in electricity demand.

Given this uncertainty, it is proposed that the targets should be subject to bi-annual review, allowing them to be revised periodically through an active process of monitoring and review. More specifically, monitoring should be carried out for:

- RE deployment against proposed targets; and
- Regional electricity consumption.

Scale of Renewable Energy Targets for 2010, 2015 & 2020

In line with current national Government targets and aspirations, it is proposed that regional RE targets of 10%, 15% & 20% of electricity demand should be adopted for 2010, 2015 & 2020 respectively.

Assuming that Scenario 1 is the closest approximation to current reality, and in line with likely energy requirements arising from the implementation of RSS (and RES), overall regional targets for RE electricity would be:

Table 2 – Proposed Regional RE Electricity Targets for the North West (TWh / year)

2010	**3.59**
2015	**5.66**
2020	**7.93**

Indicative Breakdowns of RE Technology Types within Regional Targets

Previous analyses such as “Power to Prosperity” and the more recent report “Advancing Sustainable Energy in the North West” have provided indicative breakdowns of how North West RE targets might be composed. These breakdowns are “snapshot” judgements of the

[2] http://www.dti.gov.uk/energy/inform/energy_trends/mar_05.pdf
[3] TWh (Tera-Watt hours) is a unit of energy generation or consumption. See Glossary for a fuller explanation.

way in which targets might be composed and so may be perceived to become dated if actual developments differ from those originally proposed.

Nevertheless, in order to illustrate how these proposed RE targets might be achieved, and how they might be composed, Tables 4-6 below show indicative means of reaching the proposed targets. These tables are prefaced by Table 3, a current summary of existing RE electricity schemes across the region.

Table 3 – Existing Regional RE Schemes as at November 2005[4]

RE Type	No of Schemes	Installed Capacity (MW)
Off-shore wind	0	0
On-shore wind	16	68.9
Biomass (incl. Co-firing)	4	114.1
Small hydro	9	2.7
Solar Photovoltaics	V small	V small
Landfill Gas	52	113.4
Sewage Gas	16	13.4
Thermal treatment of waste	1	10.5
TOTAL	**98**	**323**

Assumptions Underlying Indicative Regional Targets

A commentary on the derivation of the numbers within Tables 4-6 is set out in Appendix 1, by reference to each technology type. The approaches are based largely upon those set out within the background reports to "*From Power to Prosperity*" (in particular the Annex to the Task 2 report) and the more recent report for the NWRA, *"Advancing Sustainable Energy in the North West – Mapping the Way Forward to 2020"*.

Indicative Breakdown of Targets Across the Sub-Regions

Tables 7-9 show how the regional targets might indicatively be broken down across the sub-regions, using the assumptions and approaches set out in Appendix 1.

Commentary on Evolution of Targets over Time

In the short term, on-shore wind continues to dominate the targets, representing ca. 50% of the installed capacity for 2010 in this analysis. With time however, other technologies emerge, with offshore wind, biomass, micro-wind, photovoltaics and thermal treatment of waste all becoming more important with time.

[4] Derived from data supplied by Renewables North West and from the RESTATS database which Future Energy Solutions maintains on behalf of the DTI.

Table 4 – Indicative Breakdown of Target for 2010

Target = 3.59 TWh / yr (3,590 GWh / yr)

RE Type / Scale	Existing Schemes		Indicative Composition of Target		
	No of Schemes	Capacity (MW)	No of schemes	Capacity (MW)	Energy Output (GWh / yr)
Offshore wind farms	0	0	3	297	937
On-shore wind farms	16	68.9	37 - 51	600	1,183
On-shore wind clusters					
Single large wind turbines			30	45	88.7
Small stand-alone wind turbines	Small	Small	50	1.5	3.0
Bldg.-mounted micro-wind turbines	0	0	1000	1	1.7
Biomass-fuelled CHP / electricity schemes	2	11.1	7	31.1	150.5
Biomass co-firing	2	103	2	103	498.5
Anaerobic digestion of farm biogas	0	0	5	10	48.4
Small hydro	9	2.7	12	3.5	7.1
Solar photovoltaics[5]	V small	V small	1000	2	1.7
Tidal energy	0	0	0	0	0
Wave energy	0	0	0	0	0
Energy from waste					
Landfill gas	52	113.4	52	113.4	548.8
Sewage gas	16	13.4	16	13.4	64.9
Thermal treatment of municipal / industrial waste	1	10.5	1	10.5	50.8
TOTAL	**98**	**323**	**215-229 + PV + Micro Wind**	**1231.4**	**3,584.1**

[5] This category is assumed to consist of a variety of different scales of domestic, commercial and "motorway" scheme with an average size of 2kW.

Table 5 – Indicative Breakdown of Target for 2015

Target = 5.66 TWh / yr (5,660 GWh / yr)

RE Type / Scale	Existing Schemes		Indicative Composition of Target		
	No of Schemes	Capacity (MW)	No of schemes	Capacity (MW)	Energy Output (GWh / yr)
Offshore wind farms	0	0	4	747	2,356
On-shore wind farms			44 – 62	720	1,561
On-shore wind clusters	16	68.9			
Single large wind turbines			50	75	162.6
Small stand-alone wind turbines	Small	Small	75	2.25	4.9
Bldg.-mounted micro-wind turbines	0	0	10000	10	16.6
Biomass-fuelled CHP / electricity schemes	2	11.1	12	56.1	271.5
Biomass co-firing	2	103	0	0	0
Anaerobic digestion of farm biogas	0	0	10	20	96.8
Small hydro	9	2.7	12	3.5	7.1
Solar photovoltaics[6]	V small	V small	25000	50	52
Tidal energy	0	0	2	30	67
Wave energy	0	0	0	0	0
Energy from waste					
Landfill gas	52	113.4	19	79.1	382.8
Sewage gas	16	13.4	16	13.4	64.9
Thermal treatment of municipal / industrial waste	1	10.5	3	125.5	607.4
TOTAL	**98**	**323**	**247 – 265 + PV + Micro Wind**	**1931.9**	**5,650.6**

[6] This category is assumed to consist of a variety of different scales of domestic, commercial and "motorway" scheme. With domestic PV now encouraged via the Bldg. Regulations the number of domestic installations increases greatly.

Table 6 – Indicative Breakdown of Target for 2020

Target = 7.93 TWh / yr (7,930 GWh / yr)

RE Type / Scale	Existing Schemes		Indicative Composition of Target		
	No of Schemes	Capacity (MW)	No of schemes	Capacity (MW)	Energy Output (GWh / yr)
Offshore wind farms	0	0	5	1347	4,248
On-shore wind farms	16	68.9	44 – 62	720	1,561
On-shore wind clusters					
Single large wind turbines			50	75	162.6
Small stand-alone wind turbines	Small	Small	75	2.25	4.9
Bldg.-mounted micro-wind turbines	0	0	20000	20	33.3
Biomass-fuelled CHP / electricity schemes	2	11.1	15	106.1	513.5
Biomass co-firing	2	103	0	0	0
Anaerobic digestion of farm biogas	0	0	15	30	145.2
Small hydro	9	2.7	12	3.5	7.1
Solar photovoltaics[7]	V small	V small	50000	100	124.8
Tidal energy	0	0	2	30	67
Wave energy	0	0	1	30	39.4
Energy from waste					
Landfill gas	52	113.4	0	0	0
Sewage gas	16	13.4	16	13.4	64.9
Thermal treatment of municipal / industrial waste	1	10.5	6	215.5	1043
TOTAL	**98**	**323**	**241 – 259 + PV + Micro Wind**	**2692.8**	**8,014.7**

[7] This category is assumed to consist of a variety of different scales of domestic, commercial and “motorway” scheme. With domestic PV now encouraged via the Bldg. Regulations the number of domestic installations increases greatly.

Table 7 – Indicative Sub-Regional Breakdown[8] of Target for 2010

Indicative Renewable Energy Generation Type/Size	Region-Wide Targets	Blackpool, Blackburn & Darwen	Cheshire	Cumbria	Greater Man-chester	Lancs	Mersey-side	Warrington & Halton	TOTAL
Offshore wind farms	3 (297)	-	-	-	-	-	-	-	**3 (297)**
On-shore wind farms	-	2-3 (37.5)	5-7 (82.5)	13-18 (210)	5-7 (90)	9-13 (157.5)	2 (15)	1 (7.5)	**37-51 (600)**
On-shore wind clusters									
Single large wind turbines	-	1 (1.5)	3 (4.5)	4 (9)	8 (12)	6 (9)	6 (9)	2 (3)	**30 (45)**
Small stand-alone wind turbines	-	2 (0.06)	8 (0.24)	10 (0.3)	12 (0.36)	8 (0.24)	8 (0.24)	2 (0.06)	**50 (1.5)**
Bldg.-mounted micro-wind turbines	-	Within Lancs.	95 (0.095)	75 (0.075)	370 (0.37)	205 (0.205)	190 (0.19)	65 (0.065)	**1000 (1)**
Biomass-fuelled CHP / electricity schemes	-	0	1 (4)	2 (8)	1 (4)	1 (9)	1 (4)	1 (2.1)	**7 (31.1)**
Biomass co-firing	2 (103)	-	-	-	-	-	-	-	**2 (103)**
Anaerobic digestion of farm biogas	-	0	1 (2)	1 (2)	1 (2)	1 (2)	1 (2)	0	**5 (10)**
Hydro power	-	0	0	8 (2.4)	2 (1)	2 (0.1)	0	0	**12 (3.5)**
Solar photovoltaics[9]	-	Within Lancs.	95 (0.19)	75 (0.15)	370 (0.74)	205 (0.41)	190 (0.38)	65 (0.13)	**1000 (2)**
Tidal energy	0	-	-	-	-	-	-	-	**0**
Wave energy	0	-	-	-	-	-	-	-	**0**
Energy from waste									
Landfill gas	-	1 (0.5)	7 (16.2)	6 (5.4)	13 (23.7)	13 (19.7)	7 (13.5)	5 (34.4)	**52 (113.4)**
Sewage gas	-	0	3 (0.7)	0	5 (8.5)	4 (1.2)	2 (2.0)	2 (1.0)	**16 (13.4)**
Thermal treatment of municipal / industrial waste	-	Within Lancs.	0	0	1 (10.5)	0	0	0	**1 (10.5)**
Total[10]	**5 (400)**	**6-7 (39.6)**	**28-30 (110.4)**	**44-49 (237.3)**	**48-50 (153.2)**	**44-48 (199.4)**	**27 (46.3)**	**13 (48.2)**	**215-229 (1231.4)**

[8] Figures in Tables 7,8 and 9 are numbers of schemes. Installed capacities are shown in brackets.
[9] This category is assumed to consist of a variety of different scales of domestic, commercial and “motorway” scheme.
[10] All totals are exclusive of micro wind and photovoltaics installations

Table 8 – Indicative Sub-Regional Breakdown of Target for 2015

Indicative Renewable Energy Generation Type/Size	Region-Wide Targets	Blackpool, Blackburn & Darwen	Cheshire	Cumbria	Greater Man-chester	Lancs	Mersey-side	Warrington & Halton	TOTAL
Offshore wind farms	4 (747)	-	-	-	-	-	-	-	**4 (747)**
On-shore wind farms	-	2-3 (37.5)	7-10 (120)	15-21 (247.5)	6-8 (97.5)	11-17 (195)	2 (15)	1 (7.5)	**44-62 (720)**
On-shore wind clusters									
Single large wind turbines	-	1 (1.5)	6 (9)	6 (9)	14 (21)	10 (15)	10 (15)	3 (4.5)	**50 (75)**
Small stand-alone wind turbines	-	3 (0.09)	12 (0.36)	15 (0.45)	18 (0.54)	12 (0.36)	12 (0.36)	3 (0.09)	**75 (2.3)**
Bldg.-mounted micro-wind turbines	-	Within Lancs.	950 (0.95)	750 (0.75)	3700 (3.7)	2050 (2.05)	1900 (1.9)	650 (0.65)	**10000 (10)**
Biomass-fuelled CHP / electricity schemes	-	0	2 (9)	3 (13)	2 (9)	2 (14)	2 (9)	1 (2.1)	**12 (56.1)**
Biomass co-firing	0	-	-	-	-	-	-	-	**0**
Anaerobic digestion of farm biogas	-	1 (2)	2 (4)	2 (4)	2 (4)	2 (4)	1 (2)	0	**10 (20)**
Hydro power	-	0	0	8 (2.4)	2 (1)	2 (0.1)	0	0	**12 (3.5)**
Solar photovoltaics[11]	-	Within Lancs.	2375 (4.75)	1875 (3.75)	9250 (18.5)	5125 (10.25)	4750 (9.5)	1625 (3.25)	**25000 (50)**
Tidal energy	2 (30)	-	-	-	-	-	-	-	**2 (30)**
Wave energy	0	-	-	-	-	-	-	-	**0**
Energy from waste									
Landfill gas	-	1 (0.5)	2 (8.7)	3 (3.9)	2 (12)	6 (13.8)	3 (9.7)	2 (30.5)	**19 (79.1)**
Sewage gas	-	0	3 (0.7)	0	5 (8.5)	4 (1.2)	2 (2.0)	2 (1.0)	**16 (13.4)**
Thermal treatment of municipal / industrial waste[12]	-	Within Lancs.	1 (25)	0	2 (100.5)	0	0	0	**3 (125.5)**
Total[13]	**6 (777)**	**8-9 (41.6)**	**35-38 (182.5)**	**52-58 (284.8)**	**53-55 (276.2)**	**49-55 (255.8)**	**32 (64.5)**	**12 (49.6)**	**247-263 (1931.9)**

[11] This category is assumed to consist of a variety of different scales of domestic, commercial and "motorway" scheme. With domestic PV now encouraged via the Bldg. Regulations the number of domestic installations increases greatly.
[12] The indicative sub-regional figures shown here have been derived from regional estimates of municipal waste arising. At this stage waste treatment options across the region are still subject to the outcome of current and future tendering processes, and so the figures presented here should be subjected to further review in due course.
[13] All totals are exclusive of micro wind and photovoltaics installations

Table 9 – Indicative Sub-Regional Breakdown of Target for 2020

Indicative Renewable Energy Generation Type/Size	**Region-Wide Targets**	**Blackpool, Blackburn & Darwen**	**Cheshire**	**Cumbria**	**Greater Man-chester**	**Lancs**	**Mersey-side**	**Warrington & Halton**	**TOTAL**
Offshore wind farms	5 (1347)	-	-	-	-	-	-	-	**5 (1347)**
On-shore wind farms	-	2-3 (37.5)	7-10 (120)	15-21 (247.5)	6-8 (97.5)	11-17 (195)	2 (15)	1 (7.5)	**44-62 (720)**
On-shore wind clusters									
Single large wind turbines	-	1 (1.5)	6 (9)	6 (9)	14 (21)	10 (15)	10 (15)	3 (4.5)	**50 (75)**
Small stand-alone wind turbines	-	3 (0.09)	12 (0.36)	15 (0.45)	18 (0.54)	12 (0.36)	12 (0.36)	3 (0.09)	**75 (2.3)**
Bldg.-mounted micro-wind turbines	-	Within Lancs.	1900 (1.9)	1500 (1.5)	7400 (7.4)	4100 (4.1)	3800 (3.8)	1300 (1.3)	**20000 (20)**
Biomass-fuelled CHP / electricity schemes	-	0	2 (9)	4 (18)	2 (9)	3 (19)	2 (9)	2 (42.1)	**15 (106.1)**
Biomass co-firing	0	-	-	-	-	-	-	-	**0**
Anaerobic digestion of farm biogas	-	1 (2)	2 (4)	3 (6)	3 (6)	4 (8)	2 (4)	0	**15 (30)**
Hydro power	-	0	0	8 (2.4)	2 (1)	2 (0.1)	0	0	**12 (3.5)**
Solar photovoltaics[14]	-	Within Lancs.	4700(9.5)	3750 (7.5)	18500 (37)	10250 (20.5)	9500 (19)	3250 (6.5)	**50000 (100)**
Tidal energy	2 (30)	-	-	-	-	-	-	-	**2 (30)**
Wave energy	1 (30)	-	-	-	-	-	-	-	**1 (30)**
Energy from waste									
Landfill gas	-	0	0	0	0	0	0	0	**0**
Sewage gas	-	0	3 (0.7)	0	5 (8.5)	4 (1.2)	2 (2.0)	2 (1.0)	**16 (13.4)**
Thermal treatment of municipal / industrial waste[15]	-	Within Lancs.	1 (25)	0	2 (100.5)	1 (40)	1 (40)	1 (10)	**6 (215.5)**
Total[16]	**8 (1407)**	**7-8 (41.1)**	**33-36 (179.5)**	**51-57 (292.4)**	**52-54 (288.4)**	**47-53 (303.3)**	**31 (108.2)**	**12 (73)**	**241-259 (2692.8)**

[14] This category is assumed to consist of a variety of different scales of domestic, commercial and "motorway" scheme. With domestic PV now encouraged via the Bldg. Regulations the number of domestic installations increases greatly.
[15] The indicative sub-regional figures shown here have been derived from regional estimates of municipal waste arising. At this stage waste treatment options across the region are still subject to the outcome of current and future tendering processes, and so the figures presented here should be subjected to further review in due course.
[16] All totals are exclusive of micro wind and photovoltaics installations

GLOSSARY

Units of energy

The watt (W) is the unit of measurement which is used most commonly to represent electrical energy. One watt-hour is equivalent to one watt of power consumed (or generated) for a period of one hour of time.

One kilowatt hour (kWh) = 1,000 watt-hours
One megawatt hour (MWh) = 1,000 kWh
One gigawatt hour (GWh) = 1,000 MWh
One terawatt hour (TWh) = 1,000 GWh

The regional electricity demand in 2003 was 33.449 TWh[17] and this figure is taken as the baseline for this report.

Installed Capacity & Energy Generation

The *installed capacity* of an energy scheme is measured in the unit of power, Watts (W) [1GW = 1000MW = 1,000,000kW]. This measure is an indication of the relative size of the scheme but does not directly show how much energy the scheme can produce.

The *annual energy generation* or *output* from an energy scheme is a function both of the scheme's installed capacity and various other factors influencing energy output. One unit that can be used to measure energy is the Watt-hour (Wh) [1TWh = 1000 GWh = 1,000,000 MWh = 1,000,000,000 kWh]. The theoretical maximum annual energy output from an energy scheme in Watt-hours is equal to the Installed Capacity * 8760 (number of hours per year) although this theoretical figure cannot ever actually be achieved in practice due to losses, efficiencies of operation and so on.

Typical sizes and scales for different kinds of energy scheme are shown below for illustrative purposes.

Technology Type	Typical Capacity	Approximate Annual Energy Output
Large coal-fired power station	2 GW	7 TWh
On-shore wind turbine	1 MW	2 GWh
Domestic PV system	1.5 kW	1.5 MWh

[17] Data from DTI Energy Trends: http://www.dti.gov.uk/energy/inform/energy_trends/mar_05.pdf

APPENDIX 1 – ASSUMPTIONS UNDERLYING INDICATIVE REGIONAL AND SUB-REGIONAL TECHNOLOGY BREAKDOWNS

Offshore Wind
These targets are based on projects receiving support from the DTI's Offshore Wind Capital Grants programme. These schemes largely already exist, and a judgment has been made over those that can be expected to emerge in some form over the next 10 years. In particular we assume that:

- By 2010, three of the "Round One" schemes (Burbo, Barrow and the "hybrid" Barrow project) are all in place and operational;
- By 2015, one of the two "Round Two" schemes is also operational;
- By 2020, a new Phase of offshore wind projects has been agreed and that one such "Round 3" scheme with a capacity of 600MW is installed off the North West coast

Onshore windfarms
For onshore wind farms, a method has been adopted derived from earlier work estimating the UK's wind resource[18]. This method used factors such as Average Mean Wind Speed, landscape designations and economic factors within a Geographic Information System (GIS) to determine the possible number of windfarms of certain sizes and characteristics that could be accommodated within certain geographical areas. Professional judgment has also been used to estimate how these figures could be deployed in practice in the light of evolving technology and public acceptability issues. This approach was the basis of the regional and sub-regional figures set out in "*From Power to Prosperity"*.

Single 'on-site' wind turbines and small-scale wind
Judgments on the possible uptake of single wind turbines are based on the premise that these installations will occur principally at industrial, commercial or 'municipal' sites. These will be where site owners or occupiers stand to gain financially from their installation, or will – in the case of the public sector – be looking to demonstrate their contribution to environmental education or other public sector commitments to green energy production. Larger turbines can be expected to be present primarily in urban or semi-urban locations.

Building-mounted wind
A new generation of building-mounted wind technology - suitable for deployment at the domestic scale - is now starting to emerge. It is assumed that uptake of this technology within the domestic sector is primarily dependent upon:

- the development of wider consumer markets for domestic energy products;
- the extent to which the technology is 'endorsed' (or possibly subsidised) by Government, through initiatives such as the DTI's emerging "Micro Generation" programme;
- regulatory requirements, such as the need to achieve a certain proportion of domestic or commercial developments' energy requirements from renewable energy sources (as proposed elsewhere within RSS)

Specifically, it is assumed that regional uptake of building-mounted wind is given major impetus after 2010 through its adoption within both the national Building Regulations and Local Authorities' planning policy requirements.

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[18] 'A Review of the UK Onshore Wind Resource', ETSU- R99

Biomass-fuelled CHP / electricity and biomass co-firing
In *"From Power to Prosperity"* a GIS was used to derive estimates of wood arising within and around the region from conventional forestry operations and the potential growth of fast-growing energy crops. These estimates set a context for the possible number of combustion plant that could be deployed across the region using available wood resources. In practice however, the market for electricity from "stand-alone" biomass projects has proved very difficult and the indicative technology targets for this area in *"From Power to Prosperity"* are very unlikely to be met.

However the market for usage of biomass has instead recently been driven by large-scale biomass co-firing in conventional coal power stations such as Fiddler's Ferry.

To derive future regional targets in this area the following is assumed:

- Until 2010 – and beyond – the primary market for biomass fuel for power generation will be through co-firing at Fiddler's Ferry. A few small-scale local schemes also appear by that time;
- By 2015, the conditions and requirements associated with biomass co-firing[19] mean that this use of biomass ceases within the region. More local biomass-fuelled projects have emerged and their average size is increasing as commercial and operational experience continues to develop;
- By 2020, independent biomass-fuelled power plants are beginning to make headway. A large-scale project (40MW) is now situated at the Fiddler's Ferry site, making use of the existing supply and fuel storage infrastructure.

Farm biogas
A GIS was used in *"From Power to Prosperity"* to estimate available digestible resources from slurry. As for wood biomass, this was used to generate estimates of possible numbers of schemes across the region. This approach has been maintained within this analysis, assuming that the numbers of such schemes increases slowly but steadily over the next 15 years.

Small-Scale Hydro Power
A primary source[20] for understanding small hydro opportunities was used within *"From Power to Prosperity"* to identify 84 possible small hydro sites across the North West. However experience to date suggests that the regulatory and economic hurdles associated with the development of small hydro projects have been very difficult to overcome. It is therefore assumed that only a small increase will take place in deployment of hydro schemes across the region.

Photovoltaics
Three categories of possible deployment for PV were identified within *"From Power to Prosperity"*; domestic, commercial and 'motorway' schemes.

<u>Domestic</u> PV installations are assumed to be adopted at only a slow rate to 2010 due to cost considerations. However in the period from 2010 to 2020, it is assumed that a major proportion of all new-build housing across the region adopts PV as a result of forcing action through the Building Regulations and the widespread adoption of PV within forthcoming Local Plan Documents and associated development briefs for major sites.

<u>Commercial</u> PV installations may be somewhat more favoured where individual companies perceive the value of this demonstration for their 'green credentials', but major

[19] Primarily the Government's main incentive mechanism for renewable energy, the Renewables' Obligation.
[20] 'Small-Scale Hydroelectric Generation in the UK', ETSU SSH-4063 Parts 1-3 (1989)

uptake may again be very dependent upon Building Regulations.

Motorway installations represent roadway verge schemes integrated into sound barriers or other structures. We assume that their uptake broadly parallels that of the other PV categories.

Marine technologies
The North West is unlikely to be amongst the forefront of UK locations for the deployment of tidal or wave energy devices, due to more favourable resources in other regions. However over the period to 2020 it is possible that technology, economics and infrastructure issues will improve for these technologies, allowing commercial deployment to take place off the coast of the North West. It is assumed that schemes of this kind appear within the region from 2015 onwards.

Waste-to-energy technologies
Three main categories of waste-to-energy technology are considered here[21], landfill gas, sewage gas and thermal treatment of municipal / industrial waste. The level of deployment of energy-from-waste technologies will depend primarily upon the success of the region's approach to adopting and implementing the waste hierarchy, rather than these technologies' capacity to act as sources of energy supply.

Landfill gas schemes are currently the single largest contributor to the region's renewable energy supply. It is assumed that energy from landfill gas sites will diminish greatly with time. In particular the assumption is made that by 2020 there will no longer be any energy generation from residual landfill sites within the region, an assumption which is consistent with the operation of the waste hierarchy.

Sewage gas schemes are a continuing part of the water and waste treatment infrastructure across the region. It is assumed that no change occurs in current levels of energy generation from sewage gas over time.

Thermal treatment of municipal / industrial waste. Estimates have been made of the future quantities of municipal waste arising across the North West[22]. From these estimates, sub-regional plans are in preparation for waste processing and treatment plants across the region. Most of these plans foresee some future role for thermal treatment of waste.

Using these data on waste arisings and the likely approaches of each of the six waste authorities, estimates have been made of the likely scale and timing of possible thermal treatment plants across the region.

[21] Anaerobic digestion of farm slurries is considered separately above
[22] Personal communication from waste advisor working for NWRA