CAMPAIGN FOR THE PROTECTION OF RURAL WALES

The NDF's Onshore Wind and Solar Assessment

1 The renewables target: 70% of electricity consumption to be generated from renewable energy by 2030

1.1 The Renewable Energy (or more correctly the Onshore Wind and Solar) Assessment in the NDF falls at the first hurdle. It has a fundamental flaw from which it never recovers. This is its unwarranted and counter-productive decision to limit the project to two terrestrial technologies – onshore wind and solar - and then to concentrate them in spatially defined Priority Areas (PAs).

1.2 This is in direct contradiction to the recently confirmed Welsh National Marine Plan (12th November 2019) which identifies offshore wind and other marine technologies as the key future means of expanding renewable output. Worse still, onshore wind and solar alone have no prospect of generating enough electricity to reach the target without extensive and previously unthinkable damage to the Welsh countryside in the PAs, which are in locations ruled out for major projects when TAN8 drew up the Strategic Search Areas (SSAs) in 2005.

1.3 These faults are compounded by a complete lack of factual justification. There are other flaws - on which most respondents will have impaled themselves – such as the wearisome and disorganised texts, the regurgitative, often irrelevant, and impenetrable detail – but it is this which invalidates the concept.

CPRW has many points of critical detail about the text in the Wind & Solar Assessment Stages 1 and 2, which - rather than becoming a distraction to the main text, are included among others in the compendium of errors **Appendix 1.** The Welsh Government should take note of these flaws.

2 The Onshore Renewable Energy Technologies used in the NDF

Key Questions and Answers

The focus on onshore wind and solar pv … and exclusion of others		
Question	NDF Answer (or not)	Actual Answer or comment
Why is the NDF's renewable energy target **confined to onshore wind and solar**?	No explanation other than that the NDF is described as a **land use concept**	Contradicts the policies of the Welsh Government. Significant range of viable marine technologies available as set out in the publication Energy Generation Wales [**EGW 2018]** and positive references to offshore wind and other marine technologies in the Welsh National Marine Plan **[WNMP]**

2.1 **Energy Generation Wales 2018** (published September 2019) notes that

> '*over the past decade the costs of offshore wind have rapidly declined, and it continues to receive strong support from BEIS. …. Wales is committed to developing sustainable marine energy generation. …. The Welsh Government considers these technologies to be part of the energy mix in Wales to provide a secure source of renewable energy* [**EGW p30].**

2.2 **The Welsh National Marine Plan (WNMP)** - also a 20 year 'vision' - https://gov.wales/welsh-national-marine-plan-document was published on 12th November 2019 and had been available in draft for a considerable time. It covers both the Welsh inshore region (from mean high water spring tides out to 12 nautical miles) and offshore region (beyond 12 nautical miles) in a single document.

2.3 The WNMP contains a large range of explicit text and policy references to the role of marine renewables in a strategic approach to the target. Examples are:

> Objective 3 [p5] – 'Support the opportunity to sustainably develop marine renewable energy resources with the right development in the right place, helping to achieve the UK's energy security and carbon reduction objectives ….
>
> 326. This Plan recognises that marine energy resources around Wales offer a good opportunity to deliver significant renewable energy generation and thereby to make a strong contribution to securing an appropriate mix of sustainable energy provision,
>
> 327. The Welsh Government's ambition is for marine renewable energy to make **an increasingly significant contribution to the overall energy mix** over the lifetime of this Plan, contributing to achieving the outcomes set out in the Energy Policy Statement Energy Wales: A Low Carbon Transition (2012)38.
>
> 331. The Plan area includes good wind resource in deeper water, particularly to the west and south west. Offshore wind energy is a proven and strategically important energy technology and the costs of deployment are decreasing rapidly, making this a viable and attractive renewable energy option for Wales, with considerable scope for further large-scale offshore wind activity. **Offshore wind has significant potential to contribute to renewable energy targets during the lifetime of this Plan**
>
> 332. Although currently less well progressed than offshore wind, both wave and tidal technologies also offer significant potential in the medium to long-term.
>
> 335. Welsh Government has considered alternatives to the need for large scale deployment of marine renewable technologies and concluded that …. **there is a strategic need to support the development of marine renewable energy generation capacity.**
>
> 339. The narrative underpinning the Energy – Low Carbon Sector Objectives sets out the Welsh Government's conclusion that there is **significant potential and a strategic need to develop marine renewable energy generation in the Plan area**. It identifies offshore wind energy as **a proven and strategically important technology with considerable scope in the near term for further large-scale development**. It also recognises that wave and tidal technologies may offer medium to longer term potential.

2.4 Only the architects and authors of the NDF will know the reason for its decision to advance two terrestrial technologies at the expense of the marine energy policies as set out in EGW 2018 and amplified in the WNMP. At a stroke, these two statements of current Welsh Government policy invalidate the NDF Wind and Solar Assessment, crucially because it takes on itself an exclusive aim to reach the 70% target by these two technologies alone – a choice which in turn results in unacceptable adverse impacts on rural Wales.

3 70% in 2030 - what does it mean and what does it involve?

3.1 Immediately, further key questions arise and are neither addressed nor answered in the NDF:

To what does the renewable energy target of 70% of consumption by 2030 relate? Is it the level of present consumption projected forwards to that date? Or is it the anticipated level of consumption in 2030 - which is certain to increase as we replace fossil-fuel usage in cars and appliances with extensive battery powered renewable electricity? And if so – what is that forecast level?

What is the level of current consumption and what proportion is already generated from renewables? Thus, what is the baseline of the process?

What does 70% of current consumption then require in terms of increased renewable generation? How many wind turbines, of what size, and how many hectares of solar panels would this require? How would these be distributed between the 15 ‘Priority Areas’ and what would be the impacts upon them?

If the 70% is instead to be related to the anticipated - rather than current - consumption in 2030, by how much would these numbers and consequences change?

3.2 In principle, the absence of this key information is unacceptable in any government document of such potential importance. In this case it is truly shocking because most of the missing answers to the missing questions were already available in a cogent and well-circulated public document issued by the Welsh Government - as Energy Generation in Wales 2017. An update for 2018 has now been published in September 2019 [**EGW 2018**].and has been used in this critique to address these issues. The process is set out in a simple format in the Table below.

Questions and Answers about the RE assessment in the NDF

The key NDF policy target to address the Climate Emergency: Raise RE generation to 70% of Welsh electricity consumption by 2030		
Question	NDF Answer (or not)	Actual Answer or comment
a) Is the target based on the **anticipated level of electricity consumption in 2030**? and if so, where is that defined or calculated?	Apparently, **NO** Not defined in NDF text	2030 current consumption is likely to increase due to widespread electrification of fossil fuel consumption - see below
b) Is the target instead based on the **current consumption** level?	Not clarified, but as no forecasts for 2030 are made the implication (rightly or wrongly) is **YES**	Latest figure for current total electricity consumption [2017] : **14.9 TWh pa** [EGW 2018 p4]
c) Where is that level defined?	Not defined in NDF text	
d) What is the **current level of RE electricity generation**?	Not defined in NDF text	**7.426 TWh pa** [EGW 2018 p5, p7]
e) What **percentage** is that of current consumption?	Not defined in NDF text	**c 50%** [EGW 2018 p8] (49.8% by calculation)
f) So, what is **70% of current consumption**?	Not defined in NDF text	**10.43 TWh pa**
g) **What increase in RE generation is required** to reach this at current consumption levels?	Not defined in NDF text	**3.004 TWh** f) minus d)
h) Are there any **indications within the NDF** of what level of RE generation is required to reach the 70% target?	**YES:** An obscure table at Wind & Solar Assessment Stage 2 **Appendix E** considers the need for extra grid connection to convey the additional power. In the process it estimates the MWh output and MW capacity needed in each PA to meet the [undefined] 70% target	These PA totals add up to **9.05TWh pa -** three times the amount calculated above to reach 70% of current consumption. Further unexplained estimates are made in Appendix E for Low, Medium and High coverage of the PAs giving 9.6, 48, and 96 TWh pa respectively
i) However, what might be the **anticipated consumption level in 2030 (**allowing for electrification of fossil fuel usage) and how might that affect the 70% calculation?	Not mentioned in NDF text	Adapting a range of estimates to Welsh circumstances, a cautious estimate is to **double current consumption by 2030.** [sources available]

j) What impact would that anticipated level have on current-basis forecasts?	Not considered in NDF text	RE extra generation would need to double from 3TWhpa to **6TWh pa**
k) So why is the Appendix E forecast for **9TWh pa -** and more in the three Low Medium and High options – while ignoring any contribution from marine technologies?	Not explained in NDF text	This is open to speculation. It may relate to a greater anticipated consumption level 3x current rather than 2x. It may represent the ambition of vested interests. Nevertheless, the data in Appendix E '*to meet renewable energy target*' should be taken as a declared minimum intention of future expansion – irrespective of any additional marine generation.

4 The 15 'Priority Areas' (PAs)

4.1 The PAs have been selected to accommodate the wind and solar expansion by a negative method which involves first excluding areas and locations of acknowledged sensitivity and in some cases constructing buffer zones around them. There are many flaws in this process, which are reviewed in the ERRORS document, while other objectors have made critical comments.

4.2 However, the consequence of this process is that the PAs have been left as merely those residual areas which are not ruled out by the initial process. Despite CPRW's view that they are unrealistic and inappropriate, for present purposes the NDF proposals have to be assumed to be tangible - and the impacts they would create need to be factualised. Policies 10 and 11 also anticipate an undefined scatter of turbines and solar arrays outside the PAs, while current consents and pending planning applications elsewhere will also lead to a significant additional number of projects being built.

Two main problems arise:

a) there is no systematic account or justification of the wind and solar capacity attributed within the overall totals for each PA in Appendix E, and thus no indication of the numbers or specification of wind turbines or the extent of solar arrays which are forecast to be located within each;

b) no systematic (even a 'high level') attempt has been made to assess the landscapes, settlement pattern, or other vulnerabilities within each PA, and thus their susceptibility to the proposed level of wind and solar development.

4.3 Calculations from Appendix E of Output and Capacities in the PAs

The Table below derives from the initial option set out in Appendix E '*to meet renewable energy target'* and totalling 9.1 TWh, which provided individual figures for electricity generation (MWh) and overall installed capacity (MW) for each PA. The recalculation assumes a roughly equal capacity split between wind and solar in each PA.

PA	Wind or Solar	Area [ha]	MWh pa by year 2030	MW total	est. MW Wind	est. MW Solar
1	W+S	19278	701606	324	224	100
2	S	3266	234912	113	-	113
3	W+S	14733	994650	468	300	168
[15]	W+S	20486				
4	S	2643	170656	84	-	84
5	W+S	29381	290254	142	100	42
6	W+S	43092	765777	377	200	177
7	W+S	3853	129041	62	30	32
8	W+S	19015	400748	192	100	92
9	W+S	33079	543846	263	163	100
10	W+S	17935	391772	182	100	82
11	W+S	73223	1197407	577	377	200
12	S	20522	965394	450	-	450
13	S	23355	364317	181	-	181
14	W+S	93598	1899623	933	433	500
all		**417459**	**9050003**	**4348**	**2027**	**2321**
		20.09% Wales	[9.1 TWh]			
			9.18TWh	<<<<<<<<	6.75 TWh @ 38% CF	2.43 TWh @ 12% CF

Notes: Areas calculated by CPRW

PA 15 was defined later and is shown here as part of PA 3

Capacity Factors - 38% for wind,
[Arup Step 4 Table 4 for largest turbines only - likely to be an underestimate]
12% for solar as cited in EGW p6

The solar 'panel efficiency' (or CF) of 22% claimed by Arup at Stage 1 para 2.5.1 and described in the cited source is not valid for UK conditions and contradicts that defined at EGWp6 as 12%. This exaggerates output claims made by Arup

The next Table translates these capacities into the implied realities of turbine numbers and solar array extent for each PA. Three turbine size options have been considered, ranging from the typical current large machines of 110m to the two very large and super-large machines canvassed by Arup at Stage 1, 2.5.1 Table 4, and Stage 2, 3.1.1.1 Figure 2. While the largest machines might only prove practicable in the heart of some PAs, the probability is that only 110m turbines or a size below 181 might be used in many parts nearer to habitation or other sensitive receptors. Greater numbers would be needed, as suggested by the three options in the Table.

At present, solar arrays use standard devices and so their spread can be calculated more simply.

PA	Wind or Solar	Area	MW total	Est. MW Wind	No of turbines			Est. MW Solar	Area ha @ 2 ha /MW
					110m @ 2.5MW	181m @ 5MW	250m @10MW		
1	W+S	19278	324	224	89	45	22	100	200
2	S	3266	113	-	-	-	-	113	216
3	W+S	14733	468	300	120	60	30	168	336
[15]	W+S	20486							
4	S	2643	84	-	-	-	-	84	168
5	W+S	29381	142	100	40	20	10	42	84
6	W+S	43092	377	200	80	40	20	177	354
7	W+S	3853	62	30	12	6	3	32	64
8	W+S	19015	192	100	40	20	10	92	184
9	W+S	33079	263	163	64	32	16	100	200
10	W+S	17935	182	100	40	20	10	82	164
11	W+S	73223	577	377	152	75	38	200	400
12	S	20522	450	-	-	-	-	450	900
13	S	23355	181	-	-	-	-	181	362
14	W+S	93598	933	433	172	87	43	500	1000
all		**417459**	**4348**	**2027**	**808**	**405**	**202**	**2321**	**4.642 km^2**
		20.09% Wales							

Taking all the PAs together, the result is that there would need to be between 808 turbines of 110m and 202 turbines of 250m – or various combinations . To this would be added an overall area of 4.6 sq km of solar arrays – which are likely to be on unsuitably sloping sites where visibility would be exaggerated.

4.4 What are we told about the PAs themselves?

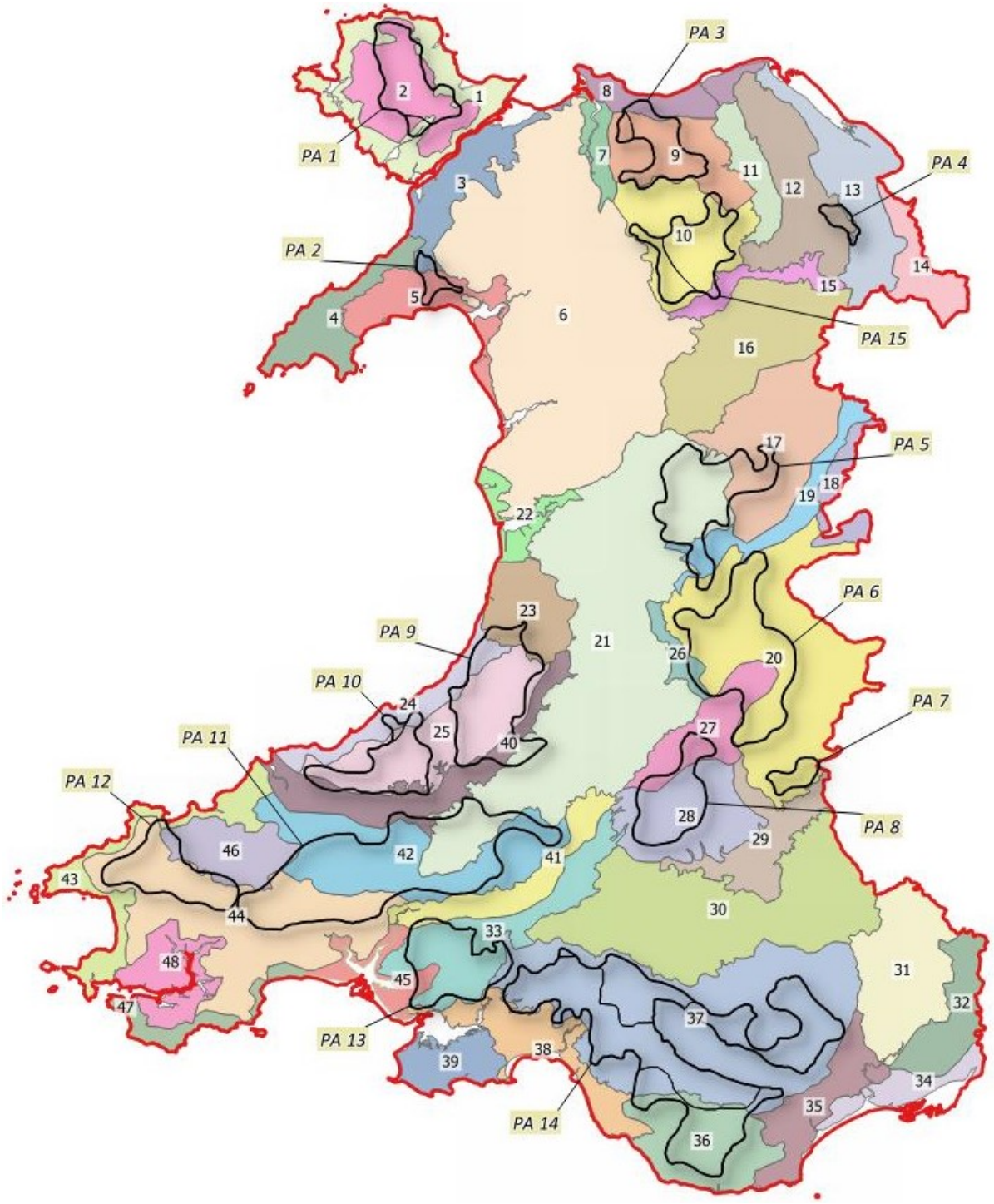
Table 9 in Stage 1 para 5.5 (optimistically titled Spatial Analysis) reveals that the simple answer is – nothing. It sets out for each PA a '*Rationale for area included'* but this consists purely of attributes relating to '*areas of greatest opportunity'* [for renewable energy developments].

There are no assessments of what is inside the PAs – only what is **outside** and is to be protected from the 10MW+ schemes. Contrary to the spin in the text, the PAs have been defined in purely negative terms as dump zones for renewable energy projects which are excluded from the 'no-go' areas.

A general indication of the nature of each PA can be found in NRA's National Landscape Character Assessment (NLCA) maps, which are not of recent date but are designed for use at the strategic level.
https://naturalresources.wales/evidence-and-data/maps/nlca/?lang=en
NLCAs contained within each PA are listed in the Table below. This relationship can be appreciated more accurately by reference to the map further below which also allows the PAs to be shown in their local and national context. Each NLCA has a simple Summary (reproduced below) which serves as an excellent general introduction. A range of other details plus excellent photographs are presented for each individual NLCA. It is appreciated that this is relatively broad 'high level' material but it can be focussed further by reference to LANDMAP.

PA	Wind or Solar	Area	Location	Relevant NLCAs		
1	W+S	19278	Ynys Mon	2		
2	S	3266	Llyn	5	3	
3	W+S	14733	North Denbighshire	9	8	
4	S	2643	Brymbo	12		
5	W+S	29381	Mid Montgomeryshire	21	17	
6	W+S	43092	North Radnorshire	20	27	
7	W+S	3853	Painscastle	20		
8	W+S	19015	Epynt	28	27	
9	W+S	33079	Mid Ceredigion	25		
10	W+S	17935	West Ceredigion	25		
11	W+S	73223	West Carmarthenshire	42	44	21
12	S	20522	Mid Preseli	44		
13	S	23355	East Carmarthenshire	33		
14	W+S	93598	Glamorgan	37	36	
15	W+S	20486	Hiraethog	10		
all		**417459**				

National Landscape Character Assessment with PAs



Wind and solar Priority Areas digitised from Welsh Government document ‘draft National Development Framework’.

PA	Wind or Solar	Area	Location	Main NLCAs		
1	W+S	19278	Ynys Mon	2		

Summary description **NLCA 2 Central Anglesey**

[Dominates PA1 and consists of main part of NLCA]

The area forms the agricultural core of the island, the part that earned it the name of 'Môn mam Cymru', 'Anglesey mother of Wales'. Although it's a gentle lowland landscape, the south-west to north-east geological trend of fault lines influence changes in topography, with a few hills and rock outcrops. In addition, there are a number of fens and extensive areas of drumlins, especially in the north and west. But for the hedgerows, 'cloddiau' hedge banks and occasional sheltered copses and areas of scrub, the area has an open, rolling and windswept character. It is the least wooded lowland landscape in Wales.

The interior is rich in archaeology, as well as in tales and traditions. Strong elements of the Medieval landscape survive, in the form of remote churches and place-names, though the clearest imprint on the area's landscape occurred in the 19th century, with the construction of Thomas Telford's London to Holyhead post road, the Chester to Holyhead railway and the substantial estate-sponsored courtyard farm settlements, many of which are now falling into disrepair.

Although generally rural, the county town of Llangefni has expanded with new housing and industrial estates during the C20th, which are visible from surrounding countryside. The rural area has not been subject to the level of tourism and recreation activities that affect the adjacent coastal area. However, two large reservoirs have been built, and more recently a completely new dual carriageway route has opened across the area.

PA	Wind or Solar		Area	Location	Main NLCAs		
2	S		3266	Llŷn	5	3	

Summary description **NLCA 5 Tremadoc Bay**

[Three-quarters of PA2 but small section of NLCA5]

This is the northern crook of Cardigan Bay, a lowland coastal region of exceptional interest and scenic beauty. It forms the land between the sea and the mountains. To the east of Porthmadog there are extensive sandy estuaries with salt marsh, to the south there are miles of near-continuous and sometimes remote, dune-backed sandy beaches, whilst to the west lies a notably more extensive agricultural hinterland.

The area contrasts dramatically with the adjacent and enclosing mountain backdrop of northern Llŷn and Snowdonia. The Moelwyn peaks, Cnicht, the Rhinogydd Yr Eifl and even Snowdon stand out in views. By Porthmadog, the smaller but rugged outlying peak of Moel-y-gest rises dramatically out from this area. To the south of Porthmadog, the sea and mountains constrain the width of the area, ultimately meeting just south of Fairbourne.

The area contains many villages and generally retains a rural, agricultural character, except in and around the towns of Barmouth, Porthmadog and Pwllheli. Ancient coastal churches and great castles overlook the shore, being reminders both of how important the sea was for travel and of the strategic importance of this region. This is echoed in the link drawn in the Mabinogion tales, between Harlech and Ireland, while in later times, the Medieval settlements at Pwllheli, Criccieth, Harlech and Barmouth were all revitalised with the growth of tourism in the 19th century. Around Traeth Mawr and Traeth Bach, where the rivers Glaslyn and Dwyryd flow into the bay, the remarkable settlements of Tremadoc and Porthmadog grew up, built around William Madocks's sea-defence works. Porthmadog became one of the great slate ports of Wales, famous for the 'western ocean yachts', the distinctive schooners that carried Blaenau Ffestiniog slate all over the world. It is also famous for the narrow-gauge railway that transported the slates on the first leg of their journey from the mountain mines, and which in the 1870s brought engineers from Russia and America to admire and emulate.

The fantasy Italianate village of Portmerion is also located here. Parts of the area along the Ardudwy coast are within the Snowdonia National Park, while Harlech Castle is a World Heritage Site. The area remains very popular for tourism today, with beaches, water sports, castles and built heritage, the railways, and the mountains combining with a strong linguistic heritage to provide a very distinct Welsh experience.

Summary description **NLCA 3 Arfon**

[Northern tip of PA2 and peripheral part of NLCA3]

unique environments of the great slate quarries, whose working faces and tips Arfon is literally the land which is ar-fon, 'against Anglesey', being the lowland area bounded on the one side by the Menai Strait and on the other by the Snowdonia foothills and the adjacent glaciated valleys that open into it. Extending from Penmaen-bach Point in the north east to Bryncir in the south, it includes the Anglo-Norman boroughs of Caernarfon (with its World Heritage Site castle and town walls) and the cathedral and university city of Bangor. This coastal plateau area also includes the 19th century neo-Norman Penrhyn Castle, which dominates the view and whose estate extends for many miles around, as well as the less apparent, gentry houses and parklands at Faenol (now an internationally-recognised concert venue) and Glynllifon.

As well as the dwellings of the once-wealthy and powerful, this is also pre-eminently the landscape of the Welsh gwerin, the industrious, progressive and cultured population of the farm, the small-holding, the cottage and the quarry. Their way of life, brought into being by the tremendous industrial slate quarrying workings of the late 18th and the 19th centuries, has far from vanished, and the Welsh language remains particularly strong. The landscape of the gwerin is everywhere, in the form of settlements, chapels, field-boundaries and in the dominate the Ogwen and Nantlle valleys and the Llanberis-Llanddeiniolen area. The time depth of the area is also evident, in an exceptionally rich legacy of earlier archaeology, and in the rich traditions of myth and legend.

PA	Wind or Solar	Area	Location	Main NLCAs		
3	W+S	14733	North Denbighshire	9	8	

Summary description **NLCA 9 Rhos**

[Dominates PA3 and is half of NLCA9]

Comparatively little known by tourists, this is nevertheless a subtly appealing and attractive rural landscape of rolling and undulating countryside. It is sparsely settled, but is traversed by a network of narrow rural lanes and interspersed only occasionally with compact, nucleated villages of stone, slate and white-washed render, or by valley-floor settlement such as Llanfair Talhaiarn and Llangernyw. Much of the area has a character verging on upland, yet the Rhos Hills include some lowland valleys. Historically the area nurtured some important writers and poets, such as Twm o'r Nant, the poet and writer of interludes, and the erratic genius Robert Roberts 'Sgolor Mawr'. Within this area lived the first attested Welsh man, in a cave at Pontnewydd in the Lower Elwy Valley, around 225,000 years ago. The yew tree in Llangernyw churchyard is one of the oldest living things in the world. This area remains strongly Welsh in speech.

Summary Description **NLCA 8 North Wales Coast**

[Northern edge of PA3 and small section of NLCA8]

Limestone hills back the northern coastline and hinterland for much of its length between the Great Orme and Point of Ayr. Their steep sides run close to the coast in the western half, where the development of seaside resorts and main transport links have squeezed into the limited available flat land, and started to spread up some hillsides. The hills run back from the coast in the central section, allowing the broad Vale of Clwyd to reach the sea, flanked to the east by the distinctive line of the Clwydian Range of hills, and finally issuing its river between Rhyl and Towyn. Much of the coastal strip has been developed for tourism, from planned Victorian seaside resorts, notably Llandudno, Colwyn Bay and Rhyl, through country hotels and sanatoria, to more recent and less formal sea-front developments, holiday camps and caravan parks. Traditionally this was where the folk of the north west of England took their holiday, and although the nature of holidays has changed, the area is still known for it's seaside holiday destinations and some, notably Llandudno and Colwyn Bay, appear to be surviving and adapting accordingly.

Inland are the estates and wooded parklands of Bodysgallen, Gloddaeth, Bodelwyddan, Kinmel, Gwyrch Castle and Bodrhyddan. Far older are the landscapes of the Great Orme, a focus of settlement for millennia, with evidence for occupation extending back to the Upper Palaeolithic (10,000BC+) and where extensive underground, Bronze Age copper workings were discovered and opened as a visitor attraction.

PA	Wind or Solar	Area	Location	Main NLCAs		
4	S	2643	Brymbo	12		

Summary description **NLCA 12 Clwydian Range**

[Almost the whole of PA4 but a peripheral part of NLCA12]

This extensive upland area forms the broad ridge between the Vales of Clwyd and Llangollen, and the western (Deeside) part of the Cheshire plain. Extending from Gronant in the north to Acerfair and Gwyddelwern in the south, it includes a number of distinct areas of high ground that encompasses the Clwydian Range core (Moel Famau, Moel Llys y Coed and Moel Arthur), Llantysilio Mountain (Moel y Gamelin, Moel Morfydd, Moel y Faen and Moel y Gaer), Ruabon Mountain and Cyrn y Brain, and Halkyn Mountain / Moel y Gaer).

This area is remarkable for the spectacular limestone outcrops at Creigiau Eglwyseg, above the Dee valley between Trevor and Craig y Cythraul, and for the great string of Iron Age hillforts topping the summits of the Clwydian Range, itself an AONB. The mineral wealth of the area has been exploited since early times; notably lead and zinc at Holywell Common and Halkyn Mountain, and coal in the east, where the area includes the upper parts of the industrial landscapes above Brymbo and Wrexham. The area is culturally distinguished by its mix of English and Welsh cultural associations, reflecting the historical interface between predominantly Welsh influences to the west and English to the east.

PA	Wind or Solar	Area	Location	Main NLCAs		
5	W+S	29381	Mid Montgomeryshire	21	17	

Summary Description **NLCA 21 Cambrian Mountains**

[Core of PA5 but NE section only of NLCA21]

The Cambrian Mountains form an extensive upland plateau, being an inland spine that divides western and eastern river catchments and forms one of the most extensive and tranquil areas of Southern Britain. The rivers Wye, Severn and Tywi emerge from this area, amongst others. Deep valleys and glacial features are abundant, including a number of 'U' shaped valleys, lakes and moraines. Peat bogs, pools open moorland and areas of extensive coniferous forestry collectively cover much of the area, except in the margins and deeper valleys where lush green fields are sheltered by thick hedges. There are also a number of major reservoirs, whose shapes meander sinuously with the many changes in topography. It is a windswept, remote and sparsely populated area with very few settlements. The area's mineral wealth has been exploited, with remains still visible at a few locations. Few roads cross from east to west, and the cultural character between eastern and western fringes is quite different. Tourism and marketing the area as a brand have not distracted from the predominantly undeveloped character. However the abundance in some areas of reservoirs, forestry and wind farms, together with the legacy land cover from extensive plateau sheep rearing, reminds us of the significant effects of human activity on the overall character of the area.

Summary description **NLCA 17 Montgomeryshire Hills**

[Eastern edges of PA5 and SW segment of NLCA17]

This very rural hill and valley landscape occupies the lower sections of the rivers Tanat, Vyrnwy, Banwy, Cain and Rhiw. Some of the hills are distinctively shaped, occasionally of upland character, or seen as isolated and rising from the general lowland that prevails across the rest of this area. There are many quiet, sylvan river valleys with a locally distinct character, from broad flood plain and meandering river, to steep wooded hillsides and narrow incised valley. There are neatly managed mixed fields in the richer valley bottoms and grazing on higher slopes and moorlands. Hedgerows enclose pastures that often reach right over the tops of the lesser intervening ridges. For a wide area around neighbouring Welshpool, many estate woodlands provide a parkland character in places.

There are a number of villages in the river valleys, and farmsteads on the valley sides. Timber and red brick appear as well as stone on traditional buildings scattered across the landscape especially in the east. The valleys of the larger rivers contain ancient places of settlement. There is much evidence of defence, from the Iron Age hillforts and Roman forts and fortlets, to the intensive proliferation of mottes and stone castles in the border landscapes guarding the entrances to valleys and overlooking the Severn Plain from high vantage points.

The different names of the County in Welsh and English – Sir Drefaldwyn and Montgomeryshire – echo the way in which the eastern part looks towards England while the west preserves much of the historic culture of Wales. This eastern area also displays the influence of English in place names, though there are many with Welsh roots across the border into Shropshire.

PA	Wind or Solar	Area	Location	Main NLCAs		
6	W+S	43092	North Radnorshire	20	27	

Summary description **NLCA 20 Radnorshire Hills**

[Major part of PA6 and one-third of NLCA20]

This is an area of gentle, smooth, upland hills, rising gradually from the border in the east, to the Wye Valley in the west. Similar character extends into England's Clun Forest area, north of Knighton.

Radnorshire's topography is breathtaking and varied, with smooth, rolling, open moors, dissected by steep sided valleys with hedgerow-enclosed pastures by small rivers and streams, and ancient woodlands. Unfenced moorland roads reinforce the sense of openness and being away from the confines and pressures of other, more urbanised landscapes. The varying topography straddles the upland-lowland divide in many places, giving rise to marginal agriculture.

Radnorshire, the old county name that included this area, historically had the lowest population of any of the Welsh counties. Offa's Dyke runs through part of the area and there are a mix of English and Welsh influences to the east in this Marches landscape. It is a very rural, and in the main it is a quiet area, away from the focus of tourism, despite promotion as 'Kilvert Country'.

Summary description **NLCA 27 Vales of Irfon and Ithon**

[Minor part of PA6 but about a quarter of NLCA27]

This is an undulating lowland vale entirely surrounded by upland areas. The main river is the Wye, which enters and leaves the area in much narrower valleys. The tributary rivers, whose lowland vales define the extent of this character area, are the Irfon and Ithon. Woodlands are common, mostly small blocks along the valley sides and along tributaries. This is an enclosed, rolling landscape of pasture and sheep grazing with a patchwork of small fields enclosed by hawthorn hedges and mature hedgerow trees.

This is a rural area with small settlements. The Heart of Wales railway passes through, NE-SW, along the Ithon and Irfon vales, with very local stations. In contrast the roads focus on Builth Wells, the home of the very large and popular annual Royal Welsh Show, the highlight of Welsh agricultural calendars, during which the greater hinterland becomes extremely busy.

The area was known historically for its Spa towns, the three best-known being Builth Wells, Llandindrod Wells and Llanwrtyd Wells. Each has a distinctive character, Llandindrod notably for its elegant red-brick terraced houses and town parks, and in recent decades Llanwrtyd (the smallest of these three) has become popular through outdoor sports including Bog-Snorkelling, Mountain Biking and a 24-mile Man-versus-Horse race.

PA	Wind or Solar	Area	Location	Main NLCAs		
7	W+S	3853	Painscastle	20		

Summary description **NLCA 20 Radnorshire Hills**

[Exclusively within PA7]

This is an area of gentle, smooth, upland hills, rising gradually from the border in the east, to the Wye Valley in the west. Similar character extends into England's Clun Forest area, north of Knighton.

Radnorshire's topography is breathtaking and varied, with smooth, rolling, open moors, dissected by steep sided valleys with hedgerow-enclosed pastures by small rivers and streams, and ancient woodlands. Unfenced moorland roads reinforce the sense of openness and being away from the confines and pressures of other, more urbanised landscapes. The varying topography straddles the upland-lowland divide in many places, giving rise to marginal agriculture.

Radnorshire, the old county name that included this area, historically had the lowest population of any of the Welsh counties. Offa's Dyke runs through part of the area and there are a mix of English and Welsh influences to the east in this Marches landscape. It is a very rural, and in the main it is a quiet area, away from the focus of tourism, despite promotion as 'Kilvert Country'.

PA	Wind or Solar	Area	Location	Main NLCAs		
8*	W+S	19015	Epynt	28	27	

Summary description **NLCA 28 Epynt**

[Vast majority of PA8 and core of NLCA28]

Epynt lies in central eastern Wales and is defined by the windswept, sandstone plateau of Mynydd Epynt, which is intersected by pastoral valleys and fast flowing streams. Much of the plateau is used as a military training range and this has had a number of unusual effects on landscape character. Public access is limited on the unenclosed land whilst some former agricultural landscapes and farmsteads have been abandoned since their compulsory acquisition for military training in the 1940s. Curious new coniferous plantations appear on the otherwise open high moorland plateau.

The southern parts of the plateau are lower in altitude and in consequence have field enclosures running higher up valley sides, and a network of narrow lanes and thick hedgerows. The area is sparsely populated, with the few hamlets located in the lower valleys. There is a pattern of scattered stone farmsteads, rendered and whitewashed in many cases.

There are many sheep in the upland area and many instances of a clear division between the unimproved, open military range, including abandoned fields, and the improved, enclosed field pastures of lower levels that continue to be farmed today. The area has historically been associated with horses and the name 'Epynt' is derived from Brythonic words 'ep' + 'hynt', meaning "horse paths".

Summary description **NLCA 27 Vales of Irfon and Ithon**

[Peripheral extension of PA8 and minor part of NLCA27]

This is an undulating lowland vale entirely surrounded by upland areas. The main river is the Wye, which enters and leaves the area in much narrower valleys. The tributary rivers, whose lowland vales define the extent of this character area, are the Irfon and Ithon. Woodlands are common, mostly small blocks along the valley sides and along tributaries. This is an enclosed, rolling landscape of pasture and sheep grazing with a patchwork of small fields enclosed by hawthorn hedges and mature hedgerow trees.

This is a rural area with small settlements. The Heart of Wales railway passes through, NE-SW, along the Ithon and Irfon vales, with very local stations. In contrast the roads focus on Builth Wells, the home of the very large and popular annual Royal Welsh Show, the highlight of Welsh agricultural calendars, during which the greater hinterland becomes extremely busy.

The area was known historically for its Spa towns, the three best-known being Builth Wells, Llandindrod Wells and Llanwrtyd Wells. Each has a distinctive character, Llandindrod notably for its elegant red-brick terraced houses and town parks, and in recent decades Llanwrtyd (the smallest of these three) has become popular through outdoor sports including Bog-Snorkelling, Mountain Biking and a 24-mile Man-versus-Horse race.

PA	Wind or Solar	Area		Location	Main NLCAs		
9	W+S	33079		Mid Ceredigion	25		

Summary description **NLCA 25 Bro Ceredigion**

[Dominates PA9 and forms northern half of NLCA25]

This is a rolling pastoral landscape of small farms and fields in the heart of the county of Ceredigion. Land rises to over 300m in at the summit of Mynydd Bach, and the area is bounded by the rivers Ystwyth in the north, and Teifi in the south and east. The linear grain of ridged topography effects the alignment of local drainage patterns. Sheep-farming predominates on the hills, which include a number of peat bogs and mires. Sparse and gappy gorse and thorn hedges typify these windswept upland areas. There is a mosaic of small improved fields, bounded by species-rich hedges on the better soils in valleys, with areas of wet grassland, rush-infested grassland and rhos pastures on the wetter land.

The settlement pattern is one of scattered hamlets and isolated dwellings, with some loose-knit villages. Buildings are typically simple stone cottages, often whitewashed, with slate roofs, though there is some earth-walling and use of thatch as well as of corrugated iron, a vernacular material in this part of the world. However, there are also a number of more recent, 'suburban' style houses and bungalows and some large farms with modern outbuildings, often sheltered by coniferous shelter belts.

The area is very rural with surviving elements of a traditional way of life and much spoken Welsh. Marginal land played its part in the poverty of the C19th, with the area being a place of emigration. Yet there are also a number of important gentrified parks and designed landscapes in this area. In contrast today, a modern communication mast at Mynydd Bach stands out against its wild and windswept landscape, while the wind farm at Tefenter occupies its northern summits.

PA	Wind or Solar	Area	Location	Main NLCAs		
10	W+S	17935	West Ceredigion	25		

Summary description **NLCA 25 Bro Ceredigion**

[Dominates PA10 and forms south-western section of NLCA25]

This is a rolling pastoral landscape of small farms and fields in the heart of the county of Ceredigion. Land rises to over 300m in at the summit of Mynydd Bach, and the area is bounded by the rivers Ystwyth in the north, and Teifi in the south and east. The linear grain of ridged topography effects the alignment of local drainage patterns. Sheep-farming predominates on the hills, which include a number of peat bogs and mires. Sparse and gappy gorse and thorn hedges typify these windswept upland areas. There is a mosaic of small improved fields, bounded by species-rich hedges on the better soils in valleys, with areas of wet grassland, rush-infested grassland and rhos pastures on the wetter land.

The settlement pattern is one of scattered hamlets and isolated dwellings, with some loose-knit villages. Buildings are typically simple stone cottages, often whitewashed, with slate roofs, though there is some earth-walling and use of thatch as well as of corrugated iron, a vernacular material in this part of the world. However, there are also a number of more recent, 'suburban' style houses and bungalows and some large farms with modern outbuildings, often sheltered by coniferous shelter belts.

The area is very rural with surviving elements of a traditional way of life and much spoken Welsh. Marginal land played its part in the poverty of the C19th, with the area being a place of emigration. Yet there are also a number of important gentrified parks and designed landscapes in this area. In contrast today, a modern communication mast at Mynydd Bach stands out against its wild and windswept landscape, while the wind farm at Tefenter occupies its northern summits.

PA	Wind or Solar	Area	Location	Main NLCAs		
11	W+S	73223	West Carmarthenshire	42	44	21

Summary description **NLCA 42 Pembroke and Carmarthen Foothills**

[Forms core of PA11 and includes most of NLCA42]

These foothills and valleys span the gap between the more widely known and extensive Cambrian Mountains and Preseli Hills. There are no major towns in the area and the main routes are 'through' rather than 'to' this area. The area has a quiet beauty of its own. It has gentle rolling uplands and sheltered wooded valleys with regular pasture fields grazed by cattle and sheep, hamlets and a few villages, linked by a network of narrow winding rural roads. There are many high, mature hedgerows and regular-shaped medium sized fields with a mix of improved pasture and marginal upland.

The area is essentially a plateau that drains tributaries to the Teifi in the north to the Tywi and Taf in the south. One of the most distinctive characteristics is that numerous streams have become deeply incised in narrow, wooded valleys, dividing the farmlands that lie between. Within the plateau, smaller individual hills rise, notably Frenni fawr (395m), Moelfre (335m) and Mynydd Figyn (325m).

Summary Description **NLCA 44 Taf and Cleddau Vales**

[Southern sector of PA11 and northern edge of NLCA44]

The area is a broad, undulating, agricultural, lowland, generally sloping southwards and forming the rural hinterland to the settlements and more populous areas that lie outside its confines to the south-west and south-east. It is dissected by numerous small, deeply cut minor river valleys, often with wooded sides. It is crossed by main road and rail routes, notably the South Wales to Ireland routes to nearby Fishguard. The area forms the inland setting to the more established visitor destinations in Pembrokeshire Coast National Park. The area is predominantly enclosed with well kept, mature hedgerows and narrow lanes.

A historic cultural division, the Landsker Line, runs across part of the area. To its north are Welsh place names and traditions amidst a more marginal farmland, while to the south names are Anglicised, amidst a gentler, improved farmland of dairying, root crop and cereal production.

Summary Description **NLCA 21 Cambrian Mountains**

[Northern portion of PA11 and terminal edge of NLCA21]

The Cambrian Mountains form an extensive upland plateau, being an inland spine that divides western and eastern river catchments and forms one of the most extensive and tranquil areas of Southern Britain. The rivers Wye, Severn and Tywi emerge from this area, amongst others. Deep valleys and glacial features are abundant, including a number of 'U' shaped valleys, lakes and moraines. Peat bogs, pools open moorland and areas of extensive coniferous forestry collectively cover much of the area, except in the margins and deeper valleys where lush green fields are sheltered by thick hedges. There are also a number of major reservoirs, whose shapes meander sinuously with the many changes in topography. It is a windswept, remote and sparsely populated area with very few settlements. The area's mineral wealth has been exploited, with remains still visible at a few locations. Few roads cross from east to west, and the cultural character between eastern and western fringes is quite different. Tourism and marketing the area as a brand have not distracted from the predominantly undeveloped character. However the abundance in some areas of reservoirs, forestry and wind farms, together with the legacy land cover from extensive plateau sheep rearing, reminds us of the significant effects of human activity on the overall character of the area.

PA	Wind or Solar	Area	Location	Main NLCAs		
12	S	20522	Mid Preseli	44		

Summary Description **NLCA 44 Taf and Cleddau Vales**

[Almost all of PA12 and within more exposed western sector of NLCA44]

The area is a broad, undulating, agricultural, lowland, generally sloping southwards and forming the rural hinterland to the settlements and more populous areas that lie outside its confines to the south-west and south-east. It is dissected by numerous small, deeply cut minor river valleys, often with wooded sides. It is crossed by main road and rail routes, notably the South Wales to Ireland routes to nearby Fishguard. The area forms the inland setting to the more established visitor destinations in Pembrokeshire Coast National Park. The area is predominantly enclosed with well kept, mature hedgerows and narrow lanes.

A historic cultural division, the Landsker Line, runs across part of the area. To its north are Welsh place names and traditions amidst a more marginal farmland, while to the south names are Anglicised, amidst a gentler, improved farmland of dairying, root crop and cereal production.

PA	Wind or Solar	Area	Location	Main NLCAs		
13	S	23355	East Carmarthenshire	33		

Summary description **NLCA 33 Gwendraeth Vales**

[Almost all of PA13 and entire southern part of NLCA33]

This is an area of rolling hills, ridges and minor valleys, comprising the area between the coastal and valley parts of the Tywi, the South Wales Valleys and the Black Mountain part of the Brecon Beacons. Despite it's pear-shape, the area is unified through its geology. That part running north-east is within the Brecon Beacons National Park and is quiet and rural compared to the more heavily settled main area. The main area has been heavily mined for coal and quarried for limestone. In consequence, this part of the area has developed a distinctive linear or ribbon pattern of settlement along roads. Today, modern residential and industrial estate development breaks the ribbon pattern but nevertheless focuses new development around existing settlements and road crossings.

The countryside setting contrasts entirely, being a complex network of small geometric fields surrounded by lush, high hedgerows and small copses. Seasonally waterlogged soils in the valleys support rushy grazing of poor agricultural quality while well drained coarse loamy and sandy soils across much of the character area are used for sheep and dairy pasture. Significant areas have now been reclaimed from former quarries and mines and the somewhat simpler and less mature restoration field layouts can be picked out, despite the inclusion of new woodland planting belts. The spectacular limestone crag and castle of Carreg Cennen is a landmark feature in the middle area, just into the National Park.

PA		Wind or Solar	Area	Location	Main NLCAs		
14		W+S	93598	Glamorgan	37	36	

Summary Description **NLCA 37 South Wales Valleys**

[The vast majority of PA14 and all but some eastern parts of NLCA37]

Many deep, urbanised valleys dissect an extensive upland area. Combined with industrial heritage and the distinct identity of its people, the South Wales Valleys provide some of Wales' most widely known and iconic national images.

Extensive ribbon development fills many valley bottoms and lower slopes. Their urban and industrial character is juxtaposed with dramatic upland settings with steep hillsides, open moors or forests. Networks of railways and roads connect valley settlements. Topography constrains passage between valleys, and there are only a limited number of high passes between valleys. The noise and business of many valleys contrast with the relatively remote and wild qualities of adjacent hill plateaux.

Underlying geology and mineral deposits provided the resources that fuelled a rapid spread of industrial development in the C19th. Once rail transport became possible, new coal, steel and iron industries created an extensive infrastructure of large buildings, furnaces, towers, chimneys, viaducts, spoil heaps and levels. Housing for workers resulted in the extensive and iconic rows of terraced houses that run along hillsides. Their needs in turn brought chapels, shops, schools and other facilities to create new settlements with an urban character. The way of life and harsh environment resulted in the image of a tough, rugby playing and radically minded society. But the decline of industries in the late C20th resulted in the closure, removal, abandonment or redevelopment of many former industrial sites. These changes continue today, as do the consequential social changes to the way of life and community identity. The area is now seen as part of a wider, increasingly post-industrial, 'city region', the largest in Wales. A new iconic image is at times unclear, but heritage-based activities set within a softer, greener environment are emerging as part of this.

While greenness is returning to some former industrial landscapes many of the new woodlands are coniferous. Waterways are slowly welcoming back fish, and mammals such as otters. The importance of wildlife conservation being undertaken hand-in-hand with economic regeneration is being recognised as one of the keys to the sustained revitalisation of this most iconic Welsh 'bro', in the Heads of the Valleys and Valleys Regional Park initiatives.

Summary description **NLCA 36 Vale of Glamorgan**

[A southern extension of PA14 and core of NLCA35]

The Vale is a distinctive, gentle lowland landscape, largely comprising a rolling limestone plateau. Glacial till contributes to its undulating topography. A variety of rural land uses characterise the area, reinforced by thick hedgerows, frequent small woodlands and trees, which create a sense of enclosure and intimacy. This is despite the proximity to large towns such as greater Cardiff, Barry and Bridgend, and a number of large built features within the Vale.

The landscape terminates abruptly at the heritage coast with vertical cliffs. There are a few sandy beaches, as well as shingle, but many images depict the exposed geology of the inter-tidal area, including bedding and pavements. There are long distance cliff top views towards Somerset. A notable feature affecting part of the coast is the large, modern, noisy, Aberthaw Power Station.

In the centre of the Vale, compact and historic settlements reinforce the area's distinctive sense of place, but with limited modern development. Yet the area has attracted many professionals, who commute to Cardiff and Bridgend, adding to the more prosperous character of places like Cowbridge and Llanblethian.

The area's historic character was shaped by Anglo-Norman influences. Norman castles and medieval villages centred on churches are key features. The registered landscape of Llancarfan is astoundingly beautiful as well as being a relatively unspoiled gem of historical evolution. All this is despite the relatively close proximity to nearby large towns.

PA	Wind or Solar	Area	Location	Main NLCAs		
15	W+S	20486	Hiraethog	10		

Summary description **NLCA 10 Denbigh Moors**

[Entirety of PA15 and southern half NLCA 10]

A desolate but scenically attractive landscape, comprising a gently undulating upland moorland plateau in central North Wales, situated between Snowdonia to the west and the Vale of Clwyd to the east. The area has been partially afforested, but elsewhere there are extensive tracts of blanket bog, heather moorland and a significant variety of archaeological sites dating from the prehistoric period onwards.

Though it has been sparsely inhabited in recorded history, there has been much human activity – farming, forestry, hunting and the building and maintenance of the extensive water-catchment systems and reservoirs based on the headwaters of the Aled, which flow into the Elwy and then into the Clwyd, and on the Alwen and Brenig, which flow into the Dee. The area is popular for outdoor activities, many of which are focused on the Brenig Reservoir and Visitor Centre, while an archaeological trail has been established at north end of the reservoir. Wind-turbines developments have also been recently established here.

Thomas Telford's post road, the modern A5, runs through the area, and reaches its second highest point between London and Holyhead near Cerrigydrudion. It divides the moorland afforested landscape to the north-east (the area traditionally ascribed as being 'Mynydd Hiraethog' in Welsh) from the gentler farmlands around Llangwm. Hugh Evans' classic Cwm Eithin (translated into English as Gorse Glen) vividly describes life and farming customs in this area in the mid-19th century.

5 The Rational Solution

If the target is to be secured by the use of marine technology – as advocated by the Welsh National Marine Plan (WMNP) – the following illustrative example should be borne in mind, although there are obviously many variants possible including other much larger-scale solutions as described in EGW2018, WNMP and elsewhere.

The following text is merely intended to outline a single, technically feasible, way of how to reach the three variants of the 70% target described earlier in this report. Individual marine schemes using the technologies described in EGW2918 and WNMP could surpass this example.

At November 2019 the largest and most powerful commercially available offshore wind turbine is GE's Haliade-X.

https://www.ge.com/renewableenergy/wind-energy/offshore-wind/haliade-x-offshore-turbine

With a 150m tower, and a 110m blade radius it is only 10m taller to its tip (260m) than the largest size canvassed by Arup for use in the onshore PAs. It is designed for installation far away from coasts and compared to the proposals for the PAs would create minimal visual, ecological and noise impacts when subjected to the rigorous environmental impact assessment that such a machine would impel.

The size and location of the turbine groups would depend on a number of factors and could range from one mega windfarm to several smaller groups. Typical distances from shore are likely to be at least 30-50km.

2030 Target:	**Offshore wind turbines**				
	MW each	Number	MW total	Output per turbine @63% CF	Total output
70% of current output **3TWh**	12	45	540	67 GWh pa	2.98 TWh
70% of forecast output **6TWh**	12	90	1080	67 GWh pa	5.96 TWh
Arup indicative output **9TWh**	12	135	1620	67 GWh pa	8.94 TWh

5 Conclusion – what should the Welsh Government now do?

On 7th November 2019 CPRW wrote an urgent interim letter to the three Ministers with overview or direct responsibility for the NDF.

Its conclusions are borne out by the detail contained in this report:

a) the RE assessment does not set out a clear statement of current and projected electricity generation and consumption, ignores the fact that Wales is a net exporter of electricity, and fails to quantify the level of additional output required to reach the target of 70% by 2030;

b) it considers only onshore wind and solar technologies as contributors and ignores the role of other existing and viable sources over the target period, notably the [then] draft Marine Plan's commitment to expand offshore wind;

c) it is full of fundamental errors in defining the 15 wind and solar Priority Areas and fails to describe or assess potential impacts of its proposals upon them;

d) although incredibly complex, it is not a fully-fledged document and has emerged into the NDF process without prior consultation or public debate;

e) in its present form it is not therefore a Framework document conforming to the aims and scope of the NDF as a whole - and is **unfit for that purpose.**

There are other consequential issues. In CPRW's opinion the Welsh Government should:

… Take steps to examine why and how this section of the NDF has emerged in a form that contradicts declared polices and known facts;

… Consider the impression given that this has resulted from deep 'fault-lines' which have prevented a proper dialogue between different sectors;

… Consider the cost of this flawed exercise, and ask where were the supervising and mentoring facilities available to the Welsh Government;;

… Consider that without a radical review, how much more difficult it now is to arrive at a rational and effective solution to the climate emergency.