Energy in Mylor Parish

Prepared for the Environment Committee of the Mylor and Flushing Neighbourhood Development Plan process on behalf of Transition Falmouth

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The aim of this assessment is to inform the Mylor Neighbourhood Development Plan process. The recent scientific report from the International Panel on Climate Change makes it clear that the world community has until 2030 to reduce climate change emissions by 45% to avoid extremely dangerous climate disruption. As the report also makes clear it is up to each community to take responsibility for its own emissions and their reduction. This report aims to help the NDP process by showing how and where emissions occur at present, how they can be reduced via through the Plan process and suitable policies to help this process be successful.

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1 Energy used in the Parish

It has proved difficult to determine the amount of energy used in the Parish for several reasons. Although electricity and gas statistics are available for relatively small areas, in the case of Mylor Parish the areas have different boundaries for each topic. This has necessitated making several assumptions using pro-rata data based on population or household numbers. These assumptions are reasonably robust for the electricity and gas use, but less so for transport and wood energy.

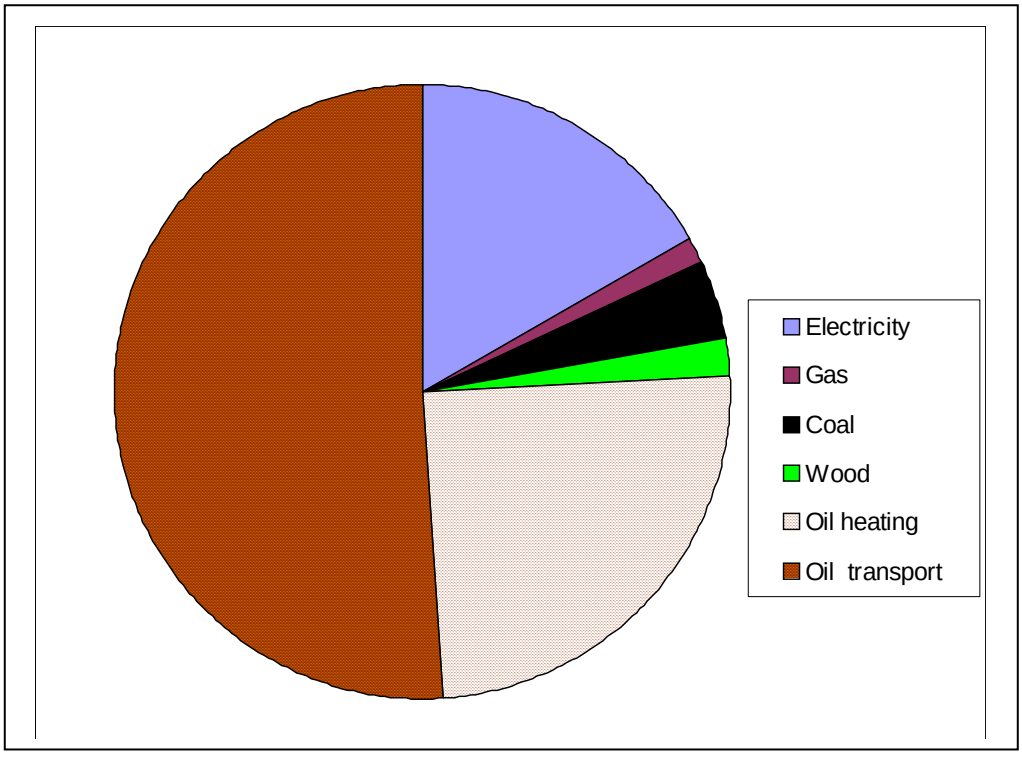
Approximate energy demand in Mylor 2016 MWh *

	domestic	non domestic	total	
Buildings energy demand			**MWh**	**%**
electricity	10,117	8,178	18,296	17%
gas	1,462	-	1,462	1%
oil & LPG	16,100	11,200	27,300	25%
coal/solid fuels	2,000	2,700	4,700	4%
wood	2,200		2,200	2%
total buildings	**31,879**	**22,078**	**53,958**	**49%**
Transport energy demand				
transport	23,838	32,288	56,127	**51%**
Total energy demand				
total	**55,717**	**54,366**	**110,085**	**100%**

** 1MWh equals 1,000kWh*

This table shows that Mylor is very dependent on oil for both heating and for all transport needs, with oil making some three quarters of total energy demand.

An assessment of the 2011 census data indicates that around 4,500 cars and vans are in use in the Parish, and potentially they are driven a collective 20 million or more miles a year.



2 Climate change emissions

The recent publication of the world's top scientists on climate change and its impacts stated that action on climate change is both very urgent and something with which everyone can help. It is therefore important to understand at every level of society what are the key elements of local climate change emissions and how they can be reduced to zero in a very few years, with a halving in twelve years being the first target.

The table below shows an estimate of the emissions from direct energy use in the Mylor area. This does not include the emissions from agriculture, the flights taken by local inhabitants, nor the emissions from imported goods such as new clothes, new furniture, new mobile phones etc.

Estimate of greenhouse gas emissions in Mylor from energy use

Source of emissions	**CO2e emissions factor kgCO2e/kWh**	**Emissions t CO2e**	**% CO2e**
electricity	0.28307	5,179	18%
gas	0.20437	299	1%
oil & LPG	0.29417	8,031	27%
coal/solid fuels	0.36288	1,706	6%
wood	0.01506	33	0%
total buildings		**15,247**	**52%**
transport	0.25478	14,300	48%
Total emissions		**29,547**	**100%**

The CO2e emissions factor is taken from the government guidelines on estimating greenhouse gas emissions for each energy source. It refers to the carbon dioxide equivalent of emissions. CO2 being the main greenhouse gas is taken as the standard, ie 1, and other emissions such as methane, CFCs etc are measured against this standard to give an equivalent figure. This enables comparisons to be made of the seriousness of each type of emission.

The table shows that energy use in buildings amounts over 50% of the local energy emissions and that oil makes up three quarters of emissions. Thus both buildings energy use and oil use need to be reduced if the Parish wishes to join the global pursuit of a low carbon and sustainable society.

The much heralded recent report from the UN International Panel on Climate Change states very clearly the urgency of the global need to cut emissions very quickly to avoid the very worst impacts. This new report is a considered concensus view from 2,000 scientists of the present situation which considers scientific papers which have been published through the peer review process

since Spring 2018. However since then there have been significant papers showing some of the risks and feedback mechanisms not considered by the IPCC. This indicates that the situation is even more serious than this new report suggests. The IPCC make clear that it is up to each and every one of us to take part in reducing our individual climate change impacts, as well as to business and government to achieve similar results through immediate and long lasting action.

The target set by this new report is a 45% reduction from 2010 emissions by 2030, ie within 11 years. They also mandate a reduction to Zero by 2050. This means every individual and organisation in the world has to make reductions urgently.

For the Parish the table below shows where the reductions need to be made by 2030, ie within eleven years.

Table of remaining fossil fuel use by 2030 for 45% reduction in emissions against 2010 figures MWh pa

Energy source	Domestic	Non domestic	Total	% of 2016 figures
Buildings				
electricity	9,982	8,069	18,052	99%
gas	621	-	621	42%
heating oil	6,158	4,284	10,442	38%
coal/solid fuels	630	1,033	1,663	35%
wood	3,500	1,000	3,500	159%
Total buildings	**20,591**	**14,386**	**34,977**	**60%**
Transport oil	8,740	16,028	24,768	41%
Total	**29,331**	**30,414**	**59,745**	**54%**

This table shows that electricity has largely reached the low carbon target against 2010 emissions requirements, mainly because the UK has switched to a high percentage of wind and solar electricity whilst curtailing coal generation. The urgent need is therefore to replace oil uses with electricity in particular. This conundrum can also be approached by ensuring all electricity is zero carbon which allows higher oil use for transport. To achieve zero carbon electricity it is vital to generate local electricity as much as possible. It is also important to dramatically increase the use renewable sources of heat via technologies such as heat pumps, wood heaters and solar thermal systems.

Electric vehicles using local renewable electricity can make a major contribution to reducing climate emissions.

Although the imperative of tackling climate change is not directly a land use planning issue, any resulting policies to reduce emissions will have impacts on land use and its planning. Tackling climate change is also one of the NDP topics to be included when developing local policies.

3 Local renewable energy in use now

A search of the detailed databases available from government, Cornwall Council and the Renewable Energy Foundation shows that the Parish has no commercial scale renewable energy installed at all. This is disappointing for the Parish as it indicates that there is a long way to go to achieve any level of energy resilience in the local area.

The most detailed database goes to the first four characters of post codes only, ie TR11. However this includes areas to the south of Falmouth, well outside the Parish boundaries. It has therefore been necessary to make an informal assessment by making the assumption that the populations of the whole of the TR11 area have installed approximately the same level of household PV as the population of Mylor Parish. If this is the case the approximate level of small scale PV installed in the Parish is as shown in the table below.

Approximate estimate of installed PV in Mylor Parish

Scale of installation	**kW installed**
5-10kW	15
4-5kW	59
3-3.99 kW	19
under 3kW	48
Total	**141**
Expected output kWh pa	**154,690**
% of local electricity	**<1%**

The expected output from these installations is around 154,700 kWh pa, or 154.7 MWh pa which is less than 1% of the electricity used locally.

No wind turbines have been installed and there is no trace of hydro electric plants either. There may be some heat pumps and solar thermal systems installed, but the publicly available information on these sources is less well developed. The energy demand information does indicate that wood provides a useful source of heating for a significant number of homes.

4 Potential for renewable energy in Mylor Parish

The market for renewable energy is changing, with examples being tried for local electricity generation and local purchasing via Blockchain methods. In the next few years it is likely that local generators will be able to sell direct to local consumers. This direct connection to the local windmill or hydro plant would make a significant difference both to local views on the acceptability of visual changes locally as well as having the potential to reduce costs to the consumer.

4.1 Wind

There is potential for wind turbines in the Parish, depending on the community's view of the importance of preserving parish community life vs preserving the present views around the countryside. If it is intended to increase local energy resilience and to join the global call for 45% carbon emissions reductions within eleven years then installing a few local wind turbines is an effective and viable solution.

Assessment of the potential for wind has been carried out ensuring that all requirements for no noise nuisance are met, as well as not visually dominating any settlement. This shows that there is one site suitable for up to three 2MW wind turbines, which collectively could produce around 18,000 MWh pa or some 98% of the present electricity demand in the Parish. Such an approach would provide a "quick win" in the race to cut carbon emissions, with only three turbines.

If a higher percentage of local zero carbon electricity is hoped for this could be achieved with 500-600kW scale wind turbines. Selecting the lowest tower height feasible for this scale of turbine at 35m, reduces electricity output but it also reduces the visual impact. There are up to six sites which could accommodate this scale of turbine without noise nuisance, up to a total of 30 wind turbines. This would give around 15MW of installed capacity if all sites were developed, and deliver around 52,000 MWh pa or 285% of local electricity demand, or about 70% of energy demand in local buildings. Given that not all landowners would wish to be involved, it is perhaps a useful to aim for 10MW of wind capacity at this or the larger scale. This would provide nearly half of the energy requirement for buildings in the community.

In such a situation there would be significant savings in energy costs locally as well as a local driver to electrify all buildings to a much higher degree than at present. This can be achieved by for example changing oil boilers for heat pumps as a standard approach whenever a new boiler is needed, or installing wood pellet or wood fuel stoves – which would support a local industry and meet regenerative agriculture approaches to reducing carbon emissions.

Smaller turbines could also be accommodated without noise nuisance. If a 60kW wind turbine of 25m hub height is chosen for accessing the wind resource, this requires a very large number of wind turbines to obtain any reasonable level of electricity production. There are around 250 locations within the Parish at the higher altitudes of 50m or more. However to use this number of sites would mean peppering the whole area with turbines. To produce the same amount of electricity as this (250 of 60kW machines) would only need 27 of the 500-600kW turbine, which could much more easily be absorbed into the landscape.

Smaller machines however could have a place in the Parish to meet the electricity and heating needs of specific buildings and businesses. Depending on the size of the demand to be specifically met, turbines of 5kW up to 100kW could be a useful method of keeping electricity costs down for many years to come, as well as reducing their carbon footprint.

It is proposed that the Parish should investigate the options for wind technology as part of the NDP process, particularly in the light of the recent IPCC report and its requirement for all parties to reduce carbon emissions by 45% by 2030.

To meet locally adopted targets for emissions reductions it will be necessary to change most fossil fuel based heating systems to electricity and probably use heat pumps to do this. This approach has an advantage in that heat pumps are an efficient method of using electricity for heating as they use the heat in air or the ground and concentrate it for heating the building. This method provides three to four times as much heat energy as the electricity used. For heating needs, local wind electricity is the best source. This would be allied to local storage to allow for low wind periods.

To meet heat demands, winter electricity and winter transport using electric vehicles around 19,000 MWh of wind is needed. This leaves out any extra requirement for losses in wires or in battery storage.

This level of wind electricity could be produced by:-

- Three 2MW wind turbines *or*
- Ten 500-600kW wind turbines

4.2 Hydro

There are two potential hydro sites in the area: the old mill site at Perranarworthal and the Mylor river. Together they could produce around 1% of the present electricity demand for the Parish, with systems would could last one hundred years, with little maintenance.

Hydro potential in Mylor Parish

River	kW	MWh pa
Perranwell	39	166
Mylor	10	41
Carclew	6	34*
Total	**55**	**241**

* estimate from Energy Analysis

A survey is underway at present by Energy Analysis which includes an update of earlier hydro assessments for the local area. This has been funded by the Rural Community Energy Fund. The report of this study was due to be presented to the Parish in January 2019.

4.3 Solar photovoltaic panels

There are some 1,200 households in the Parish. Solar surveys for the Falmouth area found that around 42% of local homes would be suitable for solar installations. This suggests that c.500 homes could have PV and/or solar thermal panels on their roofs. If each suitable roof had 2.5-3.0kW installed, which requires around 14m^2 of roof space facing in any direction from SE via S to SW, this would mean some 1,450 kW installed. Allowing for the new higher efficiency panels on the market now, this level of installed PV could yield some 1,600 MWh of clean electricity a year, or nearly 9% of local electricity demand.

If the Parish wishes to move towards meeting climate change targets then some land based PV would make a very useful contribution to local green energy production.

Assuming that the climate change targets suggested as essential by the IPCC are adopted in Mylor Parish the amount of land based solar energy which would be needed within twelve years can be calculated.

Energy use figures given earlier suggest that to meet the reduction targets for energy demand, leaving aside energy efficiency which could be adopted to minimise any increase in demand, around 9,000 MWh of solar PV would be

needed. This is assuming that electric vehicles are in use in reasonable numbers and that a large percentage of electricity needs are met from local PV.

This level of PV could be accommodated by using around 18ha or 44 acres of local grassland. There are numerous methods of incorporating PV arrays into the landscape in sensitive ways, particularly in Mylor where the hedges are high and sightlines tend to be restricted.

It is proposed that the Parish should investigate the options for land based solar arrays as part of the NDP process, particularly in the light of the recent IPCC report and its requirement for all parties to reduce carbon emissions by 45%by 2030, against 2010 emissions..

4.4 Biomass

Existing woodland in the Parish includes County Wildlife sites such as Devichoys and Perran Woods. Other woodland within the Parish includes areas on the main estates such as Carclew and Bagatelle Plantation and Ash Wood. A very rough estimate suggests that there are around 400 ha of mainly mixed deciduous and softwoods in the Parish.

Figures for expected sustainable yield can be variable, but a reasonable average would be around 6 dry tonnes per ha/a for existing deciduous woodland if it is managed. Coppice yields are higher in a range of 8-16 dtpa/ha, and miscanthus (elephant grass) can yield around 15 dtpa/ha in Cornwall.

As part of the change to 100% renewable energy sources, local wood and biomass production will become important once again. Traditionally woods were coppiced, providing a long term sustainable output with significant eco-diversity benefits from the changing light conditions over the several years of each cutting rotation. Wood can also be a very useful building material, provided that woodland is correctly planted and managed for such harvests. From the climate change emissions angle, the use of wood for buildings ensures that a carbon is locked up in the building for a long time, as well as not causing emissions from the use of other materials instead.

If the present use of wood for heating homes is to be increased on a sustainable basis, through for example either woodland coppicing or the use of agroforestry or silviculture then around 720ha of such land use is likely to be needed. This would suggest another 320-350ha of woodland, an increase of 55%, of which a large fraction would be coppiced as it is more productive on a long term basis.

Such an increase in woodland in the Parish would enable all the gas heating to be replaced with wood heat and say 30% of the present oil heating to be wood based. This increases local employment and heating resilience as fuels are not being imported to provide a local necessity. Increased woodland also increases the local sequestration of carbon into the wood and roots of trees as well as increasing biodiversity.

It is proposed that the NDP process allow for the potential for increased wood planting and encourages the planting of suitable coppiced woodland plantings. This process would enable special vistas to be preserved and potentially enhanced by ensuring views are appropriately framed.

4.5 Summary emissions reductions for 1.5^0 C

The analysis presented in this report indicates that there are many ways to reduce the greenhouse gas emissions produced within Mylor Parish in accordance with the recent IPCC scientific report. Energy is an important part of every activity we all undertake and hence the options are also complex and intertwined.

There are also emissions from local land use such as farming which have not been considered here.

Present land use in the Parish in shown in the table below taken from the Generalised Land Use Database produced by the government. The most recent survey is 2005.

Present land use in Mylor

land use		**% of total land**	**ha**
domestic buildings		1%	32
domestic gardens		5%	201
non domestic buildings		0.3%	13
road, rail, path		3%	103
water		4%	147
other land uses		1%	44
greenspace		86%	3,286
of which	woodland	10%	400
	agriculture	75%	2,886
All land		**100%**	**3,824**

This shows that only around 10% of the area is under woodland and that homes and gardens amount to 6% of the land area. As around three quarters of land

use in agriculture there is potentially room to install renewable energy capture devices.

The table below indicates in outline two potential methods of achieving the 45% reduction in emissions required to meet the Parish responsibilities by 2030. The approach taken by the Parish and the citizens and businesses within the area can emphasise different approaches which would also be successful in meeting reduction targets. Other techniques include a large change to air and ground source heat pumps using local wind and solar PV sources, or possibly a community bus using electric vehicles or significant ride sharing compared to the present day.

This analysis has not included energy efficiency measures- which are a very important part of cutting emissions, with many options being simple and cheap to implement. Energy efficiency is not a land use issue: hence its exclusion from this analysis. Suffice it to state the obvious point that reducing demand immediately reduces the need for new local supply.

Two potential options to meet climate change targets for 2030

Option A: high EV use				
	electricity	**heat**	**transport**	**total needed**
% energy locally produced	1%	61%	56%	
MWh pa needed	244	31,875	31,360	**63,479**
change to EV reduces transport energy demand to 1/3rd of previous needs			10,976	**43,095**
Can be met by combinations of	wind solar PV	wood solar thermal wind solar PV	wind solar PV	
Option B: high electrification, lower EV				
	electricity	**heat**	**transport**	**total needed**
% energy locally produced	85%	66%	30%	
MWh pa needed	15,552	34,720	5,893	**56,165**
Can be met by combinations of	wind solar PV	wood solar thermal wind solar PV	wind solar PV	

Option A: high EV use

This option indicates that the following new supply would be needed for year round energy supply:-

- A single 2MW wind turbine plus 2 of 500-600kW scale
- Around 10 ha of solar arrays (split into smaller areas behind hedges)
- Around 320ha new coppice and woodland
- 200 homes with solar thermal systems

Option B: High electrification

For this approach the following would be needed to meet the 2030 targets:-

- three 2MW wind turbines or nine of the 500-600kW size
- about 19ha of solar arrays – which can be split into smaller fields
- around 730ha new coppice and woodland, minus existing woods brought into management and use
- 300 homes with solar thermal systems