SHORT GREEN GUIDES

OUR RENEWABLE ENERGY HERITAGE

Windmills, Watermills and Tide Mills
on and around the Roseland

PARTICIPA CORNWALL

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With special thanks to Kresen Kernow, the Cornwall Council Climate and Nature fund, Cornish Gems Limited, Gerrans Parish Heritage Centre, Falmouth Art Gallery, The National Central Library of Florence, Professor Andrew Cave, Marie Cave, Chris Pollard, and Joy Marie Perry.

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ABOUT PARTICIPA CORNWALL

'Community-led action for Cornwall to address the climate and biodiversity crises'

Participa Cornwall is a Community Interest Company (CIC) located on the Roseland on the south coast of Cornwall. We aim to assist local communities in Cornwall in answering the 'call to action' to tackle the climate crisis and biodiversity crisis. We work closely with our local partners to help build grassroots resilience and to find home-grown solutions to challenges and problems. All Participa's profits are reinvested in the local community. For further information visit *https://participacornwall.com/*

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PREFACE

This **Short Green Guide** aims to introduce the reader to some of the windmills, watermills and tide mills on and around the Roseland in Cornwall that were used in our communities for many generations.

The idea for the guide came about after a visit to Truro library to research the origins of a road name in the Cornish village of St Just in Roseland. The name in question was 'Windmill Hill'. Unfortunately, there was little if any material on Cornish windmills or any other locally used renewable technologies - although the bookshelves on the Cornish clay and tin mining industries seemed to creak under their collective weight!

It seems odd that such an important part of our past - the history and use of renewable energy – is so overlooked, particularly when one considers that windmills and watermills were the go-to technologies for many centuries including here in Cornwall. Even more mystifying is the relative lack of enthusiasm for the tide mills of the Percuil River[1], an area that should rightfully be considered a historic centre for such technology rivalled only in the South West by the sites of the Tamar Estuary[2].

We have put together this guide in part to help address such oddities. Our aim is to present, in an accessible

way, the facts about our area and to highlight our considerable **renewable energy heritage** of which everyone on the Roseland should be rightly proud. This includes our windmills, watermills and tide mills. We are not local historians. However, in reviewing local materials and sources it became clear that **renewable energy** technologies, based on wind and water, were employed extensively by our ancestors, had many productive uses and were widely accepted as **part of the landscape of the Roseland.** The evidence for this rich **renewable energy heritage** is all around us...in our art, on our maps, and in the names of our hills, fields and lanes.

We also hope to highlight to readers the importance of renewable energy in helping to combat climate change and in protecting our biodiversity – two of the greatest challenges of our time. We now know definitively the negative impact of our reliance on fossil fuels[3], on the climate, on nature, on our health, wealth, and security, so an understanding of the benefits of renewable energy has never been more vital. Furthermore, we are keen to increase awareness of how the renewable energy transition presents a specific opportunity for Cornwall given its many years of green energy expertise and abundant natural resources.

If this guide can also help correct the record and rebut the many misleading narratives on renewable energy, then all the better. It is our view that such action is greatly needed!

Thank you for picking up this Short Green Guide.

PARTICIPA CORNWALL

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Renewable energy defined

Renewable energy is energy from resources that are not depleted when used, such as sunlight, wind, moving water, including the sea and rivers, and geothermal heat. The UN defines renewable energy as energy derived from natural sources that are replenished at a higher rate than consumed[4]. In contrast fossil fuels, such as gas, oil, and coal are non-renewable and take hundreds of millions of years to form. When burned for energy fossil fuels cause greenhouse gas emissions, including carbon dioxide, which harm our planet and cause global warming. Using renewable energy creates far lower greenhouse gas emissions than fossil fuels.

ReNEWables?

Renewable energy is sometimes perceived as a new form of technology, unfamiliar, disruptive and even threatening to our local environments. The reality is the opposite. The harnessing of renewable energy is not new but an important part of our heritage, renewable sources such as wind and water employed widely across communities for generations. In fact, globally people have been using different types of renewable energy for several millennia. The Ancient Greeks and the Romans are known to have used wind-powered water pumps for irrigation whilst in Ancient Persia windmills and water-powered wheels were used to grind grain[5].

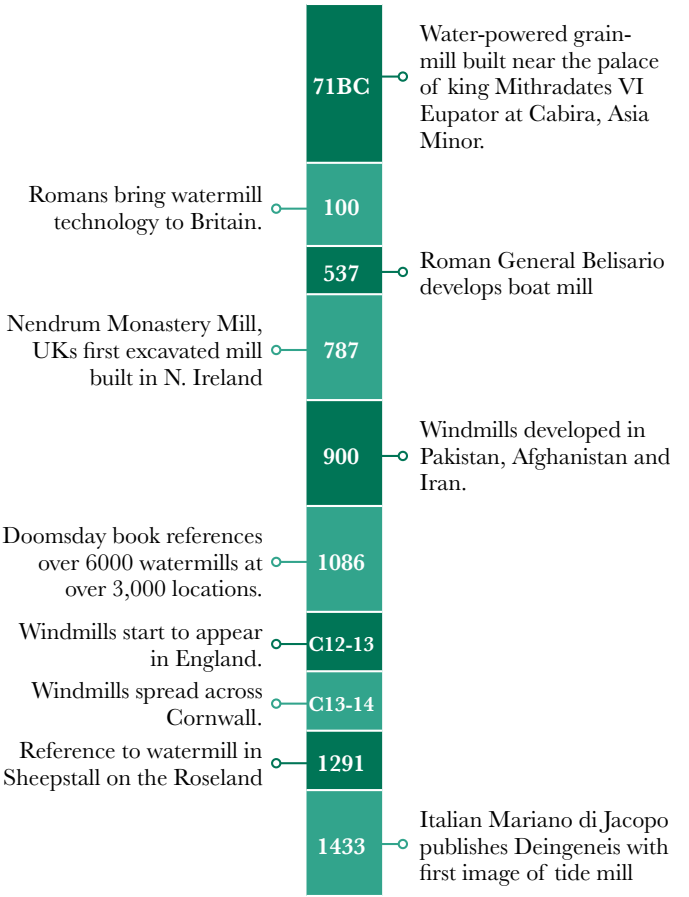
A form of concentrated solar power was even found to have been used in remote parts of Ancient China. In Europe, wind and water technologies were employed from the 11th and 12 Centuries onwards. It is our view that understanding our renewable heritage may help pave the way for wider community acceptance of it. After all, many of today's renewable technologies, such as wind turbines and small hydropower, are simply new versions of historic technologies adapted to improve efficiency to meet our community's current energy needs in a sustainable way.

Uses of renewable energy, then and now

Energy generated from renewable sources has been put to many specific productive uses over the centuries. In the UK grain milling and fulling cloth were primary reasons for generating power from the wind, water and our tides. In fact, it is estimated that as late as 1870 watermills alone produced around two thirds of the power available for British grain milling[6]. Tide mills and water mills similar to those built on and around the Roseland used water power for various other productive activities including to run sawmills, breweries and to pump sewage. Some Cornish windmills were even brought into service specifically to support Cornish mining[7]. Today, as in the past, renewable energy contributes to our national life in many ways. Currently more than 40% of the UK's energy is from renewable

sources[8]. The generated electricity is used domestically in our homes and helps to power all sectors of the UK economy. Renewable energy can also make our local communities more self-sufficient and resilient to change such as sudden energy price hikes and service disruptions[9].

RENEWABLE ENERGY TIMELINE



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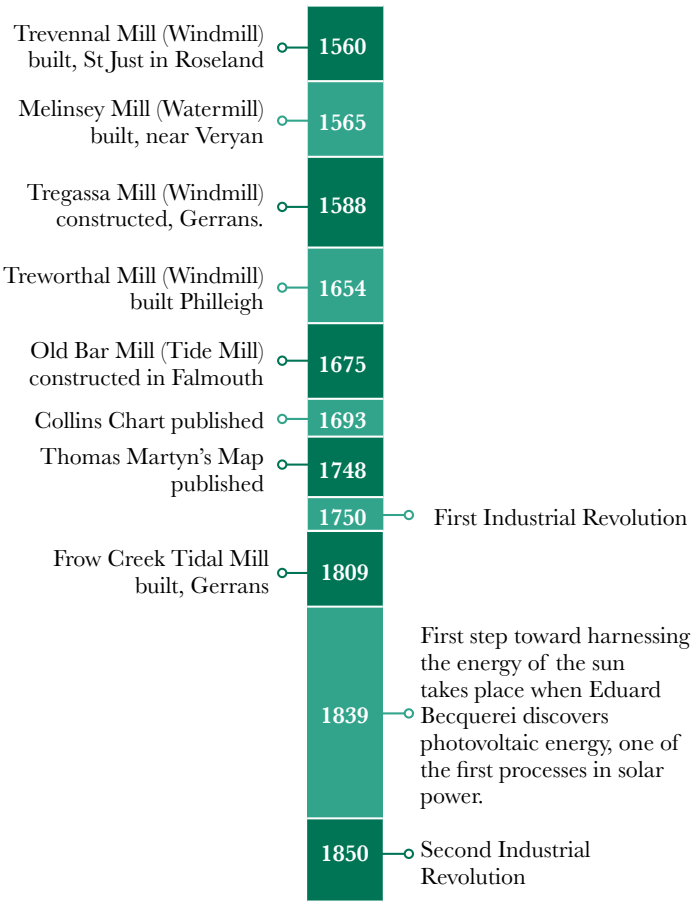


RENEWABLE ENERGY TIMELINE

1887 — Professor James Blythe creates first electricity generating windmill.

1921 — Albert Einstein wins the Nobel Prize for his theories (1904 research and technical paper) explaining the photoelectric effect.

1954 — Photovoltaic technology is born in the United States with development of the silicon photovoltaic (PV) cell.

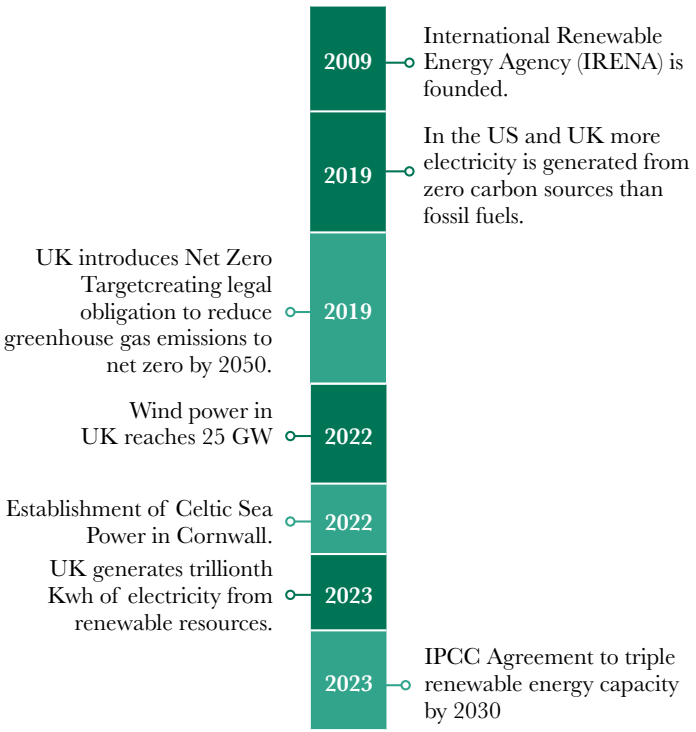
1973 — Oil price increases by 300% in 1 year. Global oil crises of 1970's leads to huge jump in interest in renewable energies in particular wind and solar.

1991 — First commercial UK onshore windfarm built in Delabole, Cornwall

2006 — Publication of the Stern Review: The Economics of Climate Change

2008 — Introduction of UK Climate Act to reduce greenhouse gas emissions.

RENEWABLE ENERGY TIMELINE



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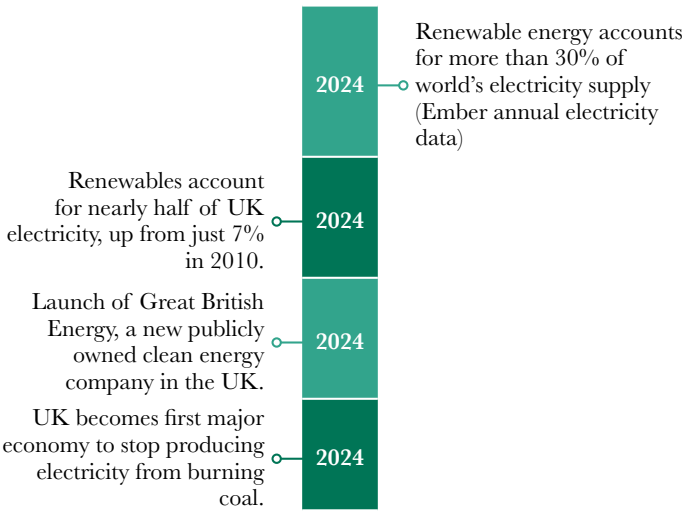


WINDMILLS

Humans have captured and used the power of the wind for more than a millennium. Early wind-technologies were used to pump water and grind grain in the 9th Century in what is now Pakistan, Afghanistan, and Iran. In England, windmills first started to appear from the late 12th Century onwards. Originally, many were fixed structures and would only work effectively if the wind was blowing in the specific direction of the fixing. To address this issue the 'post mill' was developed. Often sited on raised ground, they could be turned into the wind, and they were soon the preferred model of windmill.

Today's wind turbines are the modern equivalent of the old post mills – the main difference being that turbines now transform wind energy into clean, renewable electricity. They are also more productive and often use an anemometer and motor to make minor adjustments to maintain the most efficient position in relation to the wind[10].

In Cornwall windmills were built and successfully operated across the county from the 14th Century to the mid-1800's, a period of **over 6 centuries.** Despite this widespread use, Cornish windmills sometimes seem to be overlooked in our local histories[11]. Even

Celia Feinnes the celebrated C17 English travel writer on a visit to Cornwall in 1678 observed in her diary; "I saw not a windmill all over Cornwall or Devonshire tho they have wind and hills enough, and it may be it's too Bleake for them"[12].

Cornwall's abundant tidal estuaries and rivers meant that the use of watermills was sometimes preferred to windmills for specific economic activities such as the tucking of woollen cloth. Nevertheless, windmills were a popular and much relied upon technology in Cornwall and a visible part of the Cornish landscape dating back to medieval times. One Cornish windmill was even operating in Lantegloss-by-Fowey as early as 1322, whilst on the Isles of Scilly, St Mary's had a running windmill well into the C19.

In fact, had Ceilia Feinnes ventured on to the Roseland on her trip she would likely have found Trevennal windmill in St Just in Roseland, Rosteague and Tregassa windmills in Gerrans, and possibly a windmill in Philleigh[13]. Not much later, nearby Penryn merchant Benjamin Heame would soon be developing his own patented design to regulate the strength of windmill sails[14], such was the local interest in wind technology.

'Some Cornish millers preferred a mediterranean style of tower windmill over other regional variations. These structures would be a vertical windmill with a stone tower and rotating wooden cap to help ensure that the sails were brought into the wind'.

Wind power on and around the Roseland

Tregassa Mill, Gerrans

Cornmills played an important part in the rural and economic development of the Roseland and several grist mills grinding a variety of grains were actively used by local communities on the peninsula. One was Tregassa windmill[15]. It was located in the Parish of Gerrans close to Gerrans Church towards Tregassa, an early medieval settlement dating to 1322. Originally a fixed structure, the windmill is mentioned on Dutch sea charts as early as 1588 and again on the Map of Thomas Martyn, the Cornish surveyor, in 1748 (see below). Structurally nothing remains of the windmill today, but it is remembered in local field names such as Windmill Field, Windmill Meadow or Homer Windmill[16]. The Roseland was well known for the high quality of its corn, and some suggest the local barley, possibly passing through Tregassa, was even exported to Dublin to produce Guinness[17].

Thomas Martyn's map of 1748 depicts Tregassa windmill (marked as Tregalsah) just north of Gerrans church and Trevennal windmill pictured just below Lanzeague.

Trevennal Mill, St Just in Roseland

A second grist producing windmill, Trevennal Mill, sometimes also called Trevannal or Trevennel, was located on the high ground on the outskirts of St Just in Roseland on what was once the Trevennal estate. The windmill originally started as a post windmill in 1560 and early maps of Falmouth Harbour show that it was in fact a tripod post-mill. The original post mill was joined by a Tower windmill in 1695, and this structure continued to stand until 1810[18]. As with the windmill at Tregassa, Trevennal windmill would have been important to the local economy, and it too is marked on Martyn's map of 1748. Interestingly,

local records show it may have been subject to legal proceedings by St Just in Roseland church related to the non-payment of Tithes, essentially a 10% tax on its earnings. Historical leases also show that the windmill was worked by millers from Brittany - not unusual at the time with Bretons immigrating to C16 Cornwall often millers by profession. In fact, the 1541 subsidy roll shows Bretons worked mills in several local villages including St Just in Roseland, Goran, Philleigh, and Creed. Trevennal Mill is long eroded but the windmill lives on in the name of the road out of the village, which is 'Mena an Velinwyns'…or 'Windmill Hill'.

Windmill Hill on the main road out of St Just in Roseland was named after Trevennal Mill.

Rosteague Mill, Gerrans

Rosteague windmill was located in Gerrans Parish a few miles south of the windmill at Tregassa possibly at Greeb point[19]. It was part of the Rosteague estate, which included Rosteague manor which has medieval origins[20]. The windmills' date of construction is unknown although we do know that it was a very visible landmark on the Roseland and an established local sea marker including for "vessels hugging the shore on voyage to Fowey from the west of seeking entry to Falmouth Harbour"[21]. The windmill was brought down in early 1824 and nothing of it remains today, save the following announcement of its demolition published in the West Briton on Bonfire Night, 5th November 1823:

"Captains of vessels, coasters, mariners and others - whereas the remains or ruins of a windmill are now standing on the estate of Roseteage in the Parish of Gerrans, the property of Henry Harris Esq, on the Sea-Coast, and near the Clift to the East of the Entrance of Falmouth Harbour, and about midway between that Port and Gerrans Gull-Rock or a Rock called the Gray, off Pennare Point, in the Parish of Veryan, which may have been taken as a Land-mark from sea. Notice is hereby given that such remains or Ruins will be taken down and removed within two months from the date hereof".

As well as the windmill, there may also have been a watermill on the estate - a pond and an old millstone uncovered on the grounds[22]. Treworthall Mill[23], another medieval windmill, and thought to be a cornmill was located North East of Greeb Point in the Parish of Philleigh close to White Lane. It is visible on Thomas Martyn's historic map and is referenced in field names in a Tithe map of 1840. Built in 1654, it remained intact until at least 1753.

Little Molunan

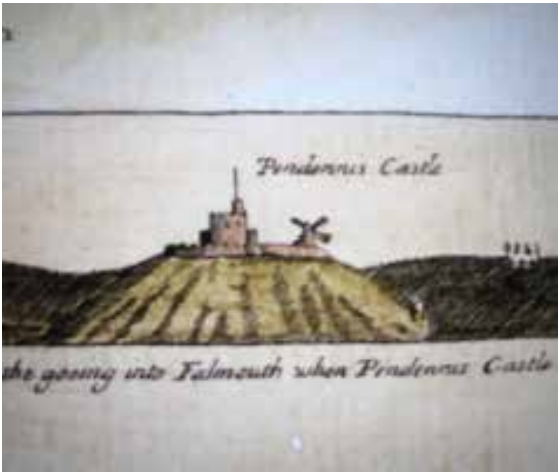
Topography and even etymology indicate that other local communities on and around the Roseland made use of the onshore south westerlies by building their own windmills. This includes just north of St Anthony's Head above the beach in between Little Molunan and Great Molunan. Ancient walls around the field at the site indicate there was a one time a form of built enclosure and the OS map suggests several outcrops as strong potential locations for a windmill. The name itself is a further clue, the Cornish for Molunan close to melyn wyns or melin wyns meaning windmill. According to National Trust records Little Molunan may also be a possible site of a post medieval tide mill, dam and pump house, earlier commentators noticing the site had been "twice dammed at its seaward end", the older (non-concrete[24]) dam composed of large

round stones and a type of gap at the centre where there could well have been located a waterwheel[25].

Pendennis

Almost directly west from Little Molunan across the Carrick Roads waterway at the mouth of the Fal once stood a Garrison windmill at Pendennis Castle. Estimates put the date of construction in the 1660's or perhaps even earlier and it remained standing until 1715.

The windmill appeared on sea charts of Captain Greenville Collins published in 1693 (as pictured) and prior to that it was captured in a detailed drawing by Dutch C17 artist Willem Shellinks.



The windmill at Pendennis castle as it appeared on Captain Collins' sea chart of the Falmouth River in 1693.

The sailed structure depicted would likely have been established to ensure a local and regular source of energy and therefore supplies for the garrison in times of military need. Rumour has it a similar windmill once stood close to the castle at St Mawes. However, as the castle was locally manned it is unlikely that a garrison windmill would have been required at this location.

TIDE MILLS

Coastal communities have been using the tides as an energy source for a variety of productive purposes for many centuries. Tide mills or sea mills, a type of watermill driven by tidal rise and fall, is one such innovation. No single individual is accredited with the invention of the tide mill. Rather they seem to have appeared spontaneously at different times and in differing places and settings both across Europe and around the globe.

Developed for a variety of practical uses, tide mills played an important socio-economic development role particularly in rural and coastal areas. A core attraction was that **they helped meet community desire and needs for an independent source of local energy** – something increasingly attractive to many local communities today. As renowned oceanographer Roger Charlier points out, *"Catering to local demands for power was the idea behind the tide mills, that once dotted the coast of England, Wales, France, Portugal, Spain, Canada and the United States"*[26]

It is generally agreed that UK tide mills begin with the Romans in the 1st century, who are likely to have brought with them water mill technology. One of the earliest excavated tide mills is at Nendrum Monastery

in Northern Ireland which dates to 787 AD although there is known to have been an earlier mill on this site as far back as 619. Tide mills became increasingly popular in the Middle Ages and at one point there was in excess of 200 tide mills active in the UK. At a global level tide mills were highly popular in western European coastal areas and on the East coast of the US and Canada where there were in excess of 300 sites.

Essentially tidal mills used the same sort of sustainable technology as watermills, and they usually had a storage pond to collect sea water with the incoming tide. The stored water, which sometimes included fresh water if the mill was also near a stream, was then released by the miller as needed to rotate the water wheel with the outgoing tide.

In essence this tidal technology was the forerunner of today's electricity generating tidal power stations and they can often be found in the same or similar locations. For example, the Rance estuary in Brittany France is home to many medieval tidal mills and is now home to La Rance Tidal power station, which was the world's first modern tidal power facility. The technology has moved on since the Middle Ages and both the incoming and outgoing tides can now be utilised to generate a regular, sustainable and renewable supply of electricity.

Taccola's Tide Mills

Some of the earliest images of tide mills were the work of Italian Mariano di Jacopo, known as Taccola. An Italian engineer and renaissance artist, Taccola's tide mill drawings appeared across two volumes of technical sketches and descriptions of various hydraulic and milling devices published under the titles **De ingeneis (1433, 1449) and De machini (1449).** It is interesting to note that no specific tide mills are depicted in the drawings; rather the drawings explain in a conceptual way how tide mills function through the use of a gate to control the water and a vertical wheel.

Taccola's pictures are even thought to have influenced the work of **Leonardo da Vinci,** who produced similar technical drawings of a similar style throughout his life.

Taccola's Tide Mill, "Mulino a marea" from Taccola's De Ingeneis, Libri III-IV). Courtesy of the Ministry of Culture - National Central Library of Florence. Any further reproduction by any means prohibited.

'Public databases suggest there were two main concentrations of tide mills in Devon and Cornwall. One was around the Tamar estuary. The other, the Roseland and Carrick Roads on the estuary of the River Fal'.

The Tide Mills of the Roseland

Tide mills were operating on the Percuil River on the Southern part of the Roseland from the early C15, possibly even as far back as the first Tudor King Henry VII. One such example was visited and immortalised by John Leland, the famous journeying antiquary and ''father of local history''[27], when detailing the topography and antiquities of England. In his Itinerary of 1538, Leland writes;

''Scant a quarter of a mile from the castel on the same side upper into the land is a praty village or fischar toun with a pere cawllid S. Maws… Half a mile from the hedde of this downward to the haven is a creke in manner of a poole with a round marke made in the charte on the which is a mille grinding with the tyde''[28].

In fact, over the years the Percuil River has been home to at least three separate tide mills - at the monastery at Place, at Froe (Frow) and at Polingey Creek. Considering the close proximity of tide mills at Falmouth (Old Bar Mill), Feock (Penpol) and Mylor Bridge, the Roseland and its surrounding area should rightly be considered something of a historic centre for use of sustainable tidal energy. Surprisingly, there is not even a plaque or sign to inform local people or visitors to the Roseland of this illustrious tide mill history.

Polingey Mill

Polingey Mill, located less than a kilometre west of the Church of St Gerrans at Polingey Creek, served Gerrans and the wider local community for nearly half a millennium. Effectively this small, local mill transformed the energy of water, pooled from the sea tide and a freshwater stream, into mechanical power to meet various community needs. This included grinding grain into flour, meal and animal feed for generations of local farmers and other patrons on the Roseland. The employed technology was impressive and Polingey utilised a sluice gate and an undershot wheel of oak and iron and had one pair of stones for grinding the grain. Early reference to the mill, which was once owned by the Bishops of Exeter, is made in the early fifteenth century.

The structure is thought to have continued to operate well into the C19 – a life span of well over 400 years. Under the stewardship of Joshua Rosevear[29], one of Polingey's last millers, it was even considered a well-frequented local meeting place[30]. The mill and its mill pond are recorded in the Tithe Map of c1840. However, by 1908 an OS map records that only half the dam remained. Today only the stone causeway crossing the creek survives making it easy to overlook the important role that Polingey mill, powered by nothing but water, once played in local economic and civic life of the peninsula.

The painting entitled 'The Old Tide Mill' (by William Pitt, 1818-1900) depicts Polingey Mill near Percuil at Polingey Creek in Gerrans.

Place Mill

From St Mawes the Place ferry makes the short crossing across the creek to the St Anthony side of the estuary and Place Landing. Close by once stood Place Mill, a local tide mill established by the Monks at the Monastery of Place. It is believed that the mill is the one referred to by Leland in 1538 (see above[31]) and it is also marked on Baptista Boazio's map of 1597, which was based on an actual survey of the Roseland. Originally a corn mill, the structure relied on a built dam or causeway across the head of the Bay of Place. The tidal water collected in the mill pool used to power

the mill wheel. The site, which included a mill house, mill pond, mill sluice, pier and quay, was active until at least the mid C19, and advertised for lease in 1848[32].

Originally the creek at Place went right up to Place House. However, in 1862, the owner, Sir Samuel Spry, demolished the mill and mill pool filling in the creek to create a grass lawn for his newly renovated manor house[33]. Angered that the new lawn had taken away a large part of their fishing creek, a group of local fishermen took the matter to court. However, in C19 Cornwall there would be only one winner – the landed knight.

Place Mill as marked on 'Thomas Martyn's new and accurate map of the county of Cornwall' 1748

Froe Mill

The third of the Roseland's historic tide or sea mills, Froe Mill (sometime Frow), was located on the parish boundary with Gerrans. Its name is thought to be a derivative of Fros, which is Cornish for flow or current, a reference no doubt to the passing water. According to local records Frow mill had two sets of millstones and produced fine flour for baking for sale direct to local people and businesses as well as grist for animal feed. It is thought that at least one pair of the stones was French buhr or Caen stones, the other pair made from locally sourced Cornish granite. As with the mill at Place and Polingey Mill, Froe Mill had a well-developed quay which also made the mill a local hub with the occupying miller a business merchant for the wider community. The mill buildings were advertised for auction as a 'rarely equalled construction' in the Royal Cornwall Gazette in 1809 and they are marked on the St Anthony in Roseland Tithe Award map of c1840. It is thought that Froe Mill continued to serve as a Roseland tide mill until at least the mid C19[34]. Although the mill building is long destroyed, the wall and 'causey' (causeway) across Froe creek used to create the tide mill pool remains intact and in actual fact are in a very good condition. It was recently discovered that a rather famous visitor to Froe Mill was no other than Beatrix Potter, who is pictured in a rowing boat in front of the small boat house during a Spring holiday to Falmouth.

Beatrix Potter at Froe Creek in 1894. Photographed by her father Rupert Potter.

The Old Bar Mill, Falmouth

A short way round from Pendennis castle once stood the 'The Old Bar Mill' in Falmouth[35], a well-known Sea Mill built in 1675 by Sir Peter Killigrew[36]. This mill supported the Falmouth boat building industry primarily through the provision of sawn timber. It was also part of the development of Falmouth which included the building of a new quay in 1676. The quay was used for delivery of goods from the neighbouring ports of Truro, Penryn and Helston. The mill appears to have been functional until the late 1860's although it would be demolished just before the outbreak of the first world war (1914). According to the Cornwall and Scilly Urban Survey, "remains of the walling of its tidal pound were found to resemble the form of quays, with

vertical killas (slate) slabs fronting a core of grey clay"[37]. The Old Bar Mill has been the muse of several artists over the years including Alfred Omega Townsend who captured its likeness in 1890 and then again in 1898 – showing the deterioration of the building over the 8 years. William J Boase Smith, a Falmouth artist well known for his watercolour landscapes, also painted the Old Bar Mill over a similar, if slightly early, period, though the mill was most likely inactive at the time.

The Old Bar Mill/The Old Bar Pool, Falmouth by William Boase Smith (1842-1896) Courtesy of Falmouth Art Gallery.

Penpol Mill

West of the Roseland across Carrick Roads in Restronguet Creek is Penpol Mill, another example of a local tide mill using the power of water in support of its' community's economic needs. The mill dates back to 1829 when William Stevens of Feock leased a piece of land "on the beach under Penpol estate with liberty to erect and build a mill on the plot of ground nearest to Lemon Quay". Primarily used to crush bone Penpol Mill was established alongside the lead smelting works, the crushed and burnt bone helping to separate precious silver from the lead. The mill building no longer remains. However, local archaeologists recently excavated the site and found the mill wheel pit, the remains of the large wooden mill wheel, the walls and footings of an adjacent mill building and the structure's associated sluices. The mill pond, known as 'Bone Mill Pond', also still exists, with stepping stones replacing the sluices, though today it is simply used to overwinter boats.

Mylor Bridge Mill

Mylor Bridge, less than half a kilometre west of St Mawes across the Carrick Roads waterway, may also have once boasted a historic tide mill. The mill is thought to have been located at Mylor Creek and operated for a short period in the C18-19. Local

historians suggest the mill pond, now a recreation field, was infilled in 1860, all that remains of the mill today being the stepping stones across the Creek. The brook at Mylor was also used for hydropower as can be seen on the 1887 OS map of the area, the leat, now a public car park, feeding a mill on Mill Quay.

Productive use of Tide Mills

Tide mills similar to those on the Roseland used the power of incoming tide water in a sustainable way for different activities including to run sawmills, breweries and to pump sewage. A main attraction of the use of tide mills was that their supply of energy – the moving tidal water – was dependable and free from risks such as drought or even man-made water diversions. They were also much cheaper to build than water mills primarily because there was no requirement to construct a full dam. Early tide mills in the UK were even referenced in the doomsday book of 1086. Tide millers including those working on the Percuil River not only used the power of the tide but also had control over the release of the water. As one local historian explains, "Dams were built at the heads of the creeks, the resulting pool filled by the flood tide, while the ebb was controlled so that its run turned the mill wheel. The miller could predict and plan his working hours precisely and was not affected by the vagaries of the weather. Droughts

were not a problem, and floods could be controlled by the mill sluices[38].

Wave Energy, a close relative of Tidal Power

Wave energy is a type of renewable power generation closely related to tidal power. This technology uses the movement of sea waves and wind, rather than actual tidal movements, to create energy and generate electricity. In one method, buoys are anchored to the sea floor and as waves raise and lower the device, electricity is generated in an electrical coil. The total amount of energy generated relates to the speed, height and frequency of the waves and the water density. Another ingenious method uses a floating 'Sea Snake'. The Snake's joints are linked to hydraulic arms that move with the wave motion and force hydraulic fluid to move turbines that power the devices' small generators.

WATERMILLS

Water has been harnessed as a source of energy in various forms in the UK for well over 1000 years. The Doomsday book of William the Conqueror (1086) references some 6,082[39] watermills at over 3,000 locations in England and Wales used for a variety of activities including grinding corn, dyeing and edge milling. According to one estimate watermills provided 30% of eleventh century England's energy requirements[40] and a few centuries ago they were still considered to be a key source of power generation.

Today, it is estimated that there are some 20,000 mill sites across the UK including many in Cornwall. By modern standards traditional water wheels such as those used in the 1800's have poor power efficiency. However, the turbines used in today's hydro-electric plants are very much like a water wheel, albeit with much improved efficiency. Many argue that there is a real potential today for the rollout of small or micro-hydropower[41] to generate electricity and meet our growing energy needs in a sustainable way at the community level. Such a rollout would have no or minimal environmental impact, follow the example of previous generations, and respect our renewable energy heritage.

Watermills in history

The Greek geographer Strabo reports in his Geography a water-powered grain-mill to have existed near the palace of king Mithradates VI Eupator at Cabira, Asia Minor, before 71 BC. In Ancient Rome watermills were used to process ore, increase flour production and to cut wood and stone as early as 250 AD. Whilst in 537AD, Roman general Belisario even developed a boat mill, a specific grinding system on barges whereby a boat or boats and installed mill(s) were attached to a bridge or bank, its' blades and wheels powered by the current of the river. It seems our ingenuity in use of sustainable renewable energy knows no bounds.

Watermills on and around the Roseland

In the informative 'The Roseland between the River and Sea', Lawrence O'Toole writes,

"Here in the Roseland every river of any size had one (watermill) and sometimes several. On Pendower stream, the Higher and Lower mills used the same stretch of water only half a mile from each other. On Percuil River alone there were four watermills, all working within an area of a few square miles".

For several centuries, watermills, like windmills, played an important role in the Roseland's economic life. Some operated as small corn mills. Others, such as the fulling mills in and around Tregony, played an active

part in the Roseland's fledgling, then bustling textile industry. Today, with a few notable exceptions, most are now withdrawn from public gaze, long abandoned, demolished or converted into private residences. But for a long time rivers and streams and the mills built upon them effectively powered the Roseland.

Melinsey Mill

Tucked away in the small hamlet of Melinsey close to Veryan is Melinsey Mill, a working water mill from the Middle Ages. In fact, the name Melinsey comes from the Cornish word 'melinjy', which means mill house. There is evidence that some form of mill has occupied this particular site since the early thirteenth century and may originally have been referred to as Higher Mill, Lower Mill using the same stretch of water but half a mile further downriver. The current mill at Melinsey was built in 1565. It's 5 metre, cast iron water wheel is relatively new and was sent from a Truro foundry in 1882, although previously the whole mechanism would have been wooden and made from elm, oak, and applewood. A local gristmill[42] Melinsey Mill produced fodder for livestock (middlings) and did so until 1928. Having two sets of millstones enabled the millers to also grind cereal grain to produce granary flour. It is thought that the stone used for grinding the flour would have come from northern France. This

would have most likely been from Brittany, which was known for its fine-grained stone, was a regular trade route for imports to Cornwall and had strong cultural links with the county at that time[43].

Melinsey Mill, a working water mill close to Veryan, dates back to the Middle Ages. Photo Participa Cornwall CIC.

Trethem Mill

A water-powered cornmill located on St Mawes road on the outskirts of St Just in Roseland. It was sometimes described as the Lord of the Manor's mill given its proximity to the Manor of Tregear. Unusually for the Roseland Trethem Mill employed an overshot wheel fed by a stream – a vertical device where the stream's water would have been channelled to the wheel at the

top, either striking paddles or perhaps collecting in buckets. The mill was recorded on the 1st edition OS map of 1809 and in 1819 it was noted as having two pairs of millstones suggesting good local productivity and it was occupied at least up until 1897[44]. Trethem Mill is also of some local archaeological interest with artifacts related to bronze age burials having been recovered near to the site.

Ruan Mill

Ruan Mill in Ruan Lanihorne was situated on the Ruan River, a tributary of the Fal, as it ran into Ruan Creek. It is mentioned in parish documents in the mid C17 but may well have been serving the local community as a corn and grist mill from a much earlier date. The mill, pond and race are shown east of the castle remains on the 1879 map of Ruan Lanihorne. Ruan Mill, which used an overshot wheel, had a long life span and continued to mill flour as late as 1926, though as with other local mills it would have been affected by gradual silting caused by the Cornish China clay industry upstream. Though today a sleepy backwater Ruan was once a much busier place, the main coach road from London to Penzance running through the village in the 18th and 19th centuries.

The Mills of Tregony

Sometimes referred to as the 'gateway to the Roseland', Tregony[45] once saw vessels navigating the Fal as far as Tregony Bridge. Such close proximity to the tidal River helped establish a busy milling industry and the town's fulling mills even produced a rough serge branded 'Tregony Cloth'. One by one the watermills would close as a result of the gradual silting of the river caused by streaming and mining upriver[46]. But for a long time the River Fal, and the renewable energy it provided, was central to the town's civic and commercial life.

Tregony Mill, the town's oldest mill, dates as far back as 1337[47]. It extended down into the river valley of the Fal from what is still today called Mill Lane. For centuries the mill, once owned by the vicarage of James, provided bread for the people of Tregony and it may also have functioned as a grist mill and fulling mill. Structurally nothing remains of it today, though the plan of the watermill and tail races is on the 1787 map of Tregony and the 1.5 mile leat is shown on the 1880 O.S map. Overall, it served the community of Tregony for over 500 years, the mill running well into the C19.

Less than a mile downstream, Nansacker Mill, a corn and fulling mill, worked the west (Cornelly) side of the flood plain for several centuries. The exact date of construction is unknown, but the mill is shown on

Boazio's illustrated map of 1597[48] as a building with a waterwheel on the side described as 'Mr Carmenes Mill', a local reference no doubt to an early owner. Unusually it is thought that Nansacker Mill may have used a breastshot wheel, rather than the more common overshot or undershot wheel, given the short leat and lack of water power. This would have involved the feeding of water via a sluice gate to strike the bucket-type paddles to drive the wheel. Local records also point to the existence of a cornmill and fulling mill at the now deserted village of Sheepstall, once located on the opposite side of the river from Nansacker. The legal documents refer to 'Shepestalle juxta Tregoni' in 1291, a notable early reference to watermills in Cornwall.

Creed and Grampound

A few miles northeast of Tregony near Creed is the site of **Mellyn Watt Mill**, also known as Bailey's Mill and on some maps, Tregidgeo Mill. A local grist mill it had an overshot water wheel presumably to compensate for low flow on the river. The structure is long gone, but the water wheel, cast by Oatley & Martyn of Wedebridge, survived at least until the new millennium. Approximately a mile southwest of Creed near Probus once stood **Golden Mill,** which specialised in cereal production. The Mill is marked on Martyn's Map of 1748, but it is likely there were mills at this site from the mid C16. A survey conducted in 1800 indicates that

the Golden Mill had two wooden overshot waterwheels over 3 metres in diameter. Interestingly, the survey also references a threshing machine used to separate the wheat from the chaff and driven by one of the mill wheels.

Close by and in the same Civil Parish[49], the Town of Grampound has a milling history going back almost 1,000 years with one site on Mill Lane mentioned in the doomsday book of 1086. Perhaps in part to its Roman history[50], partly due to its easy access to the Fal's tributaries,Grampound went on to develop as a strong economic centre based on milling and tanning. In fact, the **Town Mills**[51] site, also on Mill Lane, was at one point home to several types of mill including a corn mill, fulling mill, malt mill and grist mill, all powered by the local river.

Tucking or Fulling

Tucking mill (Melyn Droghya, from the verb troghya) was the Cornish term for a fulling mill, which was where spun cloth was dipped, before being cleaned and then dressed. The clothmaking process of tucking or fulling makes the material shrink, which is useful in that it creates a smoother, more insulated and water repellent fabric. Local maps indicate that there were several fulling mills located on the Roseland including off the Ruan river at what is still called today 'Tuckingmill Creek'.

WHY RENEWABLE ENERGY IS IMPORTANT TODAY

For our ancestors the use of renewable energy was a given and it played an important economic, social and development role in support of local communities. Our use of the power of the wind and water around us is even more important today as we now know definitively the negative impact of our reliance on fossil fuels[52] – on the climate, on nature, on our health and in our pockets…

Climate

For some time now the UK has been committed to ending our fossil fuel reliance and cutting carbon emissions. In 2008, with cross-party support (only 5 MPs out of 646 voted against), the UK passed the Climate Change Act which set a legally binding target for UK emissions and Parliament made sure that this was not just words by including 5-year targets and an independent body to advise and score-card the progress every year (the Climate Change Committee[53]). In Paris in 2015 the UK joined the world in committing to the goal of holding "the increase in the global average temperature to well below 2°C above pre-industrial levels" and pursuing efforts to limit the temperature increase to 1.5°C above pre-industrial levels[54], and

in 2019 the UK became the first major economy to legislate to reach net zero by 2050. As a step towards this the UK assigned itself a 'carbon budget' to reduce emissions by approximately 78% by 2035 compared to 1990 levels[55].

The increased use of renewable energy is vital to meet these commitments and targets. Even in the last year the countries of the world decided, in a 'global stocktake' of their progress, that they needed to ratchet up climate action before the end of this decade- that global greenhouse gases needed to be cut by 43% by 2030 compared to 2019 levels[56]. It was agreed that action should be taken for a **tripling of renewable energy capacity by 2030**. A bold commitment, and perhaps a measure of the consensus on its necessity that even the oil producing countries have been part of the negotiations and signatories to all these steps to tackle carbon emissions and putting renewable energy firmly at the forefront of global action. It is estimated that 90% of the world's electricity can and should come from renewable energy by 2050[57] and the UK government has announced its intention to play a significant part in this by becoming a clean energy superpower.

Nature

Renewable energy is also important for tackling biodiversity loss and encouraging nature recovery. It is well established that climate change, and the contribution of the use of fossil fuels to climate change, is a direct driver of biodiversity loss[58]. The UK has been shown to be one of the most nature-depleted countries in the world, ranking in the bottom 10%[59]. Crucially, the 2023 State of Nature report[60] identifies climate change, along with industrial-scale farming, as major threats to species and habitats in England, which are in serial decline, and emphasises that the threat of species extinction increases with every degree of global warming. In fact, the latest Cornwall specific State of Nature Report finds that 12% of species of principal importance are threatened with local extinction or complete loss in Cornwall[61]. This is why Cornwall Wildlife Trust highlights the importance of individuals and businesses switching to renewable energy sources as part of actions we can take for nature[62].

Health

Reducing our reliance on fossil fuels is also important for human health. Of course, using renewable energy prevents the air pollution associated with fossil fuels which has led to increased asthma and is linked to cancer and heart disease[63]. However, it is not just

the fumes. The use of fossil fuels to provide our heat and electricity drives wider climate change which the World Health Organisation describes as 'the defining health challenge of our time'. Meanwhile, the NHS in Cornwall and the Isles of Scilly has, itself recognising the public health threat of climate change, declared a climate emergency and has committed to switching their own electricity supply to 100% renewables and aim to be carbon net-zero by 2030[64]. Climate models and multiple evidence sources have also been used to identify **local health threats** including for **residents of the Roseland** (see the Local Climate Adaptation Tool launched in 2024[65]). Such local threats were found to include the direct risks of injury from increased intense wind, storms and flooding, and the risks to the population from heatwaves, as well as the more indirect impacts of climate change such as warmer temperatures and year- round humidity leading to damp houses and the health impacts of these conditions on those with respiratory conditions and the elderly.

Costs, energy security and economic prosperity

Renewable energy is economically beneficial and it boosts our energy security. In stark contrast a major negative impact of our over-reliance on fossils fuels is the cost to our finances. In 2023 record numbers of UK households were pushed into fuel poverty, with the

UK being revealed as the most vulnerable country in Western Europe to gas price shocks, leading it to inflict the worst price increases on its citizens[66]. Even with the North Sea gas supply the UK remains vulnerable as the UK is subject to the international markets and is a 'price taker' not a 'price maker'[67]. Moving away from fossil fuels is particularly important for Cornwall, the county found to be worst impacted by energy price increases and with the highest number of 'energy crisis hotspots' where there are less than average incomes but higher than average energy bills[68].

The current Government has committed to making the UK a 'clean energy superpower' and is championing renewable energy, not only to help reduce carbon emissions but because it recognises that homegrown renewable energy can provide the much-needed price stability for individuals and businesses and is key to insulating the UK from price shocks caused by international politics, wars or supply issues[69]. Renewables are also now the fastest form of power to deploy and the cheapest form of power to build and operate[70].

As Cornwall's Good Growth Plan 2024-2035 makes clear, Cornwall wants to be front-and- centre of this 'renewable energy revolution' and aims to harness its renewable energy resources and emerge from the

next decade as the 'national powerhouse' for energy[71]. Cornwall Council and Cornish businesses have made clear the importance for Cornwall's economic prosperity that Cornwall seizes the opportunity and is at the forefront of the move to renewable energy.

Cornwall's Good Growth Plan rightly trumpets the county's expertise in renewable energy, as well as its unmatched natural resources for the UK's transition away from fossil fuels[72]. The county has the highest concentration of renewable energy businesses in the country (232 at last count, and 4 times as many as other parts of the UK), with many of them operating globally, as well as having many businesses in the specialist sustainable marine sector[73]. With the latest review of UK progress towards its climate targets making clear that annual offshore wind installations must at least treble, onshore wind installations will need to double and that solar installations must increase by five times, renewable energy is set to bring more jobs and business to Cornwall[74].

'Cornwall has a particularly high concentration of specialised businesses in renewable sub-sectors including hydropower and onshore wind.' (Cornwall's Good Growth Plan 2024-2035)

With abundant natural resources, Cornwall can play

a leading role in powering the energy revolution. The sunshine in Cornwall provides one of the UK's best resources for solar, Cornwall has one of the best wind climates in Europe for turbines, and the long coastline and deep waters of the Celtic Sea provide hydropower and offshore wind resources[75].

Cornwall's massive potential for Floating Offshore Wind (FLOW) was recognised in the creation of the Cornwall Council-owned company Celtic Sea Power Ltd, which is tasked with maximising the once-in-a-generation economic opportunity for Cornwall and the socio-economic and environmental benefits for its communities[76]. In fact, floating offshore wind is set to become one of the biggest global industries of the 21st century, and the Celtic Sea off Cornwall's coast is already set to contribute to the UK's energy security by providing 4.5GW by 2035 and a further 12GW by 2045. For context, Hinkley C Nuclear power station in Somerset is forecast to provide 3.3 GW[77].

Cornwall's role as a key player in the renewable energy transition can also ensure the county will be considered as 'the start of the UK' rather than far from the centre of economic activity and at 'the end of the trainline'[78]. Renewable energy can also provide rural and coastal communities like the Roseland, which often rely on oil and LPG[79], the security of an independent source

of local energy. Moreover, the newly established GB Energy has been tasked with supporting a Local Power Plan to deliver renewable energy projects in local communities and ensuring that local power generation is part of the energy mix[80]. Cornwall also has a well-established network of groups and businesses with expertise in the delivery of renewable energy projects in local communities providing economic, social and environmental benefits[81].

It makes sense to us that an understanding of the importance of renewable energy coupled with an appreciation of our rich renewable energy heritage will help pave the way for further advancement of renewable energy in Cornwall. After all, there is little doubt that the renewable energy transition is as important to Cornwall as Cornwall is to the renewable energy transition.

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People's Climate Vote 2024

The results are in an according to the Peoples Climate Vote 2024, the world's largest ever climate poll, most people want a speedy transition from fossil fuels to clean energy. Jointly undertaken by Oxford University and UNDP, the 77-country survey found that globally 72% of people wanted a 'quick' energy transition from fossil fuels to clean energy, with only 7% believing there should be no transition at all. The poll also found **three-quarters of British people (76%) are in favour of a quick energy transition from coal, oil and gas to renewable energy** with a large majority of British people (84%) wanting stronger climate action from their leaders[82] For more detailed statistics visit **https://peoplesclimate.vote/ and https://peoplesclimate.vote/country-results.**

Jobs in Renewable Energy

Globally, renewable energy employed 13.7 million people in 2023, an increase of over 1 million jobs since 2021 and financial investment in energy transition is rapidly increasing[83]. The UK is well placed to ride the renewable wave with its' buoyant renewable energy labour market and high growth in green jobs[84]. In fact, direct UK jobs in the low-carbon and renewable energy economy are estimated to rise to almost 700,000 by 2030 and 1.18 million by 2050[85]. Renewable

energy is already a thriving sector in Cornwall with many internationally renowned Cornish companies harnessing local talent, innovation and the power of water and wind to make a greener, more sustainable future. There are currently 232 renewable energy companies in the county, which has a 4x higher concentration of renewable energy businesses than anywhere else in the UK. Areas of specialisation include onshore wind, floating offshore wind, and hydropower. Such companies, which are based across Cornwall from the North coast to just across the water in Falmouth, are an important modern-day link to our proud renewable energy heritage.

MIS- AND DISINFORMATION ON RENEWABLE ENERGY

Early this year the UN's Assistant Secretary General warned that fossil fuel companies are continuing to fund mis- and disinformation campaigns to slow down adoption of renewable energy and the transition away from carbon-intensive economies[86]. Regular false and/or misleading narratives on renewable energy are disseminated through social media, mainstream media, front groups and third parties. In the UK, they currently include the following;

'Renewable energy is unpopular and does not have public support': FALSE. Opinion polls have repeatedly shown that when asked the majority of people in the UK are supportive of taking action against climate change including a quick energy transition from fossil fuels to renewable energy. The recent joint University of Oxford and UNDP 'Peoples Climate Vote 2024' found that found **three-quarters of British people (76%) are in favour of a quick energy transition from coal, oil and gas to renewable energy**[87]. UK Department of Energy, Security and Net Zero (DESNZ) polling in Spring 2024 also found 84% of people supported the use of renewable energy such as wind power, solar energy and biomass to provide electricity, fuel and heat.

Geographically DESNZ figures showed the strongest support for renewable energy to be in Wales and the South West[88]. Moreover, a recent survey from CAST (Centre for Climate Change and Social Transformation) led by the University of Bath found Cornwall residents are more concerned about climate change than the rest of the UK and strongly back climate action[89]. It also found that 70% of participants in Cornwall are thinking about or currently using a renewable energy supplier, with one-third of Cornish homeowners considering installing domestic renewables.

'Renewable Energy takes up too much agricultural land space and is a threat to farming': FALSE. Land space arguments against renewable energy development have been repeatedly rebutted by academic studies. For example, earlier this year researchers at **Exeter University Environmental Intelligence Centre** showed how just **374,900 hectares** of land in England suitable for onshore wind development and new solar sites could increase the UK's renewable electricity generation **13 fold** to 130,421 GWh - some 2.5 times more electricity than currently required to power all households in England[90]. Moreover, the identified land avoided National Parks, AONBs, high grade agricultural land, and heritage sites and would account for just 2.9% of land in England[91]. To put this into context,

Golf courses in England currently account for 270,000 hectares or approximately 2% of land in England.

Land space arguments also ignore the concept of dual-use land, which allows for both electricity production and agriculture practices to coexist. Several academic studies have shown how such coexistence can lead to higher crop yields and reduced water consumption, making it a mutually beneficial relationship between agriculture and renewable energy development. Last year a **University of Exeter study** also showed there was an annual operating profit of 210% for use of agrovoltaic dual- land use systems in the UK. Studies have also shown that dual-use land can be beneficial to local biodiversity and that land leased for wind turbines and solar panels is often returned in an improved condition with biodiversity gain.

It is also noteworthy that most land in England is already agricultural land. According to DEFRA's 2024 figures, England has an area of 13 million hectares of which the utilised agricultural area (UAA) is 8.7 million hectares - some 67% of England's total area[92]. Although the total croppable area is over half (57%) of the UAA, **permanent grassland – that is land not sown in the last 5 years - currently accounts for a massive 38% of our UAA[93].**

'Wind turbines are a threat to bird populations': MISLEADING. It is true that somewhere between 10,000 to 100,000 birds are killed each year in the UK by wind turbine blade strikes. However, this number needs context. Approximately, **55 million birds are killed each year in the UK by domestic cats, with over 30 million killed by motorists on UK roads.** In truth, wind turbines account for less than 1 in 4,000 bird deaths. Interestingly, the Royal Society for Protection of Birds accepts that climate change poses the single greatest long-term threat to nature and recognises the essential role of renewable energy in addressing this challenge.

'Wind Turbines cannot be recycled and are piling up in landfills': MISLEADING. Versions of this narrative continue to make regular appearances across social media, in particular on Facebook in the US and UK[94]. In reality, all modern wind turbines can and are being recycled. Most of the wind turbine (80-90%) is in fact made of steel and/or iron and is easily assembled, disassembled and recycled. Recycling technology has evolved so much that companies[95] have now even found a way to chemically break down and recycle even first-generation composite wind turbine blades[96]. Meanwhile, since 2022 wind turbine manufacturers have started producing fully recyclable wind turbine blades[97].

'Carbon capture is the alternative to the renewable energy transition': FALSE. Carbon capture and storage is not a serious solution to climate change. Despite years of R&D and investment even today's biggest carbon capture projects only remove a few seconds worth of our annual greenhouse gas emissions. It is also much more expensive than renewable energy costing thousands of pounds for every ton of CO2 removed – and the carbon removal techniques consume excessive amounts of energy (fossil fuels) making it non scalable.

As indicated by the International Energy Agency, "*Continuing with business-as-usual for oil & gas while hoping a vast deployment of carbon capture will cut the emissions is* ***fantasy.*** *It would mean an implausibly large amount of carbon capture, requiring a huge leap in annual investment from $4 billion last year to $3.5 trillion!*"[98]. Renewable energy is more efficient, cheaper, and greener than carbon capture and storage.

'Renewable energy is unreliable and there may not be enough energy to meet demand'. MISLEADING. Some renewable energy sources are highly reliable including tidal power and geothermal (the heat of the earth). Moreover, by diversifying our national energy mix – solar, wind, tidal (and hydro), geothermal – along with improved energy storage,

our grid will be more resilient and less dependent on a single source of power. By following this diversified approach, we will be able to leverage the strengths of each energy source whilst minimising any impacts of their limitations. Not forgetting that the increased use of **renewable energy will improve our energy security** by making us less reliant on imported gas and oil from abroad.

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END NOTES

1 A notable exception being 'The Salt Water Mills of Gerrans and St Anthony-in- Roseland' by Hilary Thompson, first published in the Journal of the Cornwall Association of Local Historians, October 1992.

2 For further information see Public Databases such as the Tide Mill Institute Database see https://www.tidemillinstitute.org/Portal/

3 https://www.ipcc.ch/report/sixth-assessment-report-cycle/

4 https://www.un.org/en/climatechange/what-is-renewable-energy

5 In fact, the earliest windmill design for productive use can be traced back some 3,000 years to the Ancient Persians who used reed bundles to make vertical sails which span around a main axis and external walls to effectively create wind tunnels to further improve the system.

6 Otter, Chris (2020). Diet for a large planet. USA: University of Chicago Press. p. 22. ISBN 978-0-226-69710-9.

7 Local government, Cornwall, 1879. "We are glad to see an indication, or rather promise, of fresh economies in the proposals to use wind-power in mines. Cornwall is quite as windy as Wales".

8 2020 was the first year in UK history that electricity came predominantly from renewable energy, with 43% of the UK's power coming from a combination of wind, solar, bioenergy and hydroelectric sources.

https://www.nationalgrid.com/stories/energy-explained/how-much-uks-energy-renewable

9 29% from wind, 4.9% biomass, 4.5% solar, 1.2% hydro. UK Department for Energy Security and Net Zero, 2024.

10 The anemometer regularly measures wind speed and direction; the motor turns the nacelle and the wind turbine blades. This movement is called 'Yaw', a phrase borrowed from aeronautics and sailing.

11 The most notable exception being Cornish Windmills by H.L Douch.

12 The journeys of Celia Fiennes by Celia (1662-1741) Fiennes

13 Treworthal Mill.

14 The patent was entitled 'A new invented method of regulating the sails or vanes of engines and mills worked by force of wind'. https://www.cornwallheritage.com/ertach-kernow-blogs/ertach-kernow-i-saw-not-a-windmill-all-over-cornwall/

15 Sometimes referred to as Tregalsah.

16 As on the local tithe records.

17 The Roseland between River and the Sea, Lawrence O'Toole, Pg. 63.

18 The mill cottage sold as part of Trevennel Barton in 1834.

19 A complex and field system are visible in aerial photographs taken by the RAF in 1946. Cornwall Council.

20 Rosteague manor or house was marked on Boazio's map of 1597.

21 Cornish windmills, H.L. Douch. Pg.29.

22 It has also been suggested by local historians that the millstone may well have been imported in from a neighbouring mill for decorative purposes.

23 Sometimes called Treworthall Mill.

24 A more recent concrete dam was built in 1914 to supply water to the defences at the headland.

25 NT HBSMR Number: 906720; Heritage Gateway HER 18691 and Whittaker.

26 The rise and fall of the tide mill, Roger H. Charlier, Lo'ic MENANTEAU and Marie-Claire P. CHAINEU

27 Clarke, A. L. "John Leland and King Henry VIII". The Library. 3rd ser. 2: 132–149 (at 145).

28 Leland Itinerary, Part III, 1538. Leland also details a freshwater mill in this area; "This creke of S. Maws goith up a 2. myles by est north est into the land, and so far it ebbith and flowith, and ther is a mylle dryven with a fresch brook that resortith to the creke".

29 One of the last millers at Polingey

30 The Roseland between River and Sea, O'Toole.

31 Leland Itinerary, Part III, 1538. Leland also details a freshwater mill in this area; "This creke of S. Maws goith up a 2. myles by est north est into the land, and so far it ebbith and flowith, and ther is a mylle dryven with a fresch brook that resortith to the creke".

32 According to Gerrans baptism records post 1813, Amy and Louisa Allen (daughter of Amy Thomas) were Millers at Place Mill, St Anthony (1831 and 1837).

33 the current sea wall built approximately at the same time as the drainage arch under the renovation.

34 the last miller at Froe recorded in 1856 as John Blight.

35 Adjacent to current RNLI Lifeboat Station in Falmouth.

36 Killigrew was Second Baronet and briefly MP for Camelford in 1660 before election was declared void.

37 Cornwall & Scilly Urban Survey: Falmouth, May 2005, pg. 24.

38 Hilary Thompon, The Salt Water Mills of Gerrans and St Anthony in Roseland, first published in the Journal of the Cornwall Association of Local Historians, October 1992.

39 Not the figure of 5,600 watermills as regularly misquoted in literature; (H.C. DARBY, Domesday England, Cambridge 1977, p. 61;). Other estimates indicate that by 1300 the number of watermills in England was over 10,000, with 2,000 windmills (Holt).

40 J. MOKYR, Lever of Riches, cit., p. 38).

41 Latest UK government definitions are that small-scale capacity produce less than 5 megawatts and micro-scale capacity produce less than 50 kilowatts. https://www.gov.uk/guidance/harnessing-hydroelectric-power#

42 Gristmill refers to both the grinding mechanism and the housing or building in which the mechanism is contained. Grist is the grain that is separated from chaff.

43 Trade and cultural links between Cornwall and Brittany are well documented. In fact, there is evidence of a large migration from parts of Cornwall to what is now Brittany (Armorica) as early as the 5th century and the establishment of the kingdom of Cornouaille in Armorica.

44 It was occupied in 1897 by W Carkeek.

45 Tregony is located in the Parish of Tregony with Cuby and is not one of the civil parishes of the Roseland, which are St- Just-in-Roseland, Gerrans, Philleigh, Ruan Lanihorne and Veryan.

46 Including in St Austell and St Stephen.

47 The Caption Seisin in 1337, a valuation of property in the Duchy of Cornwall.

48 'The True desscryption of ye Great Baie of Falmouth', map by Italian cartographer Giovanni Battista Boazio in 1597.

49 Grampound with Creed.

50 It was originally a Roman encampment.

51 Local historians believe that the medieval mills on the Town Mills site were transferred to the borough in the first Borough Charter of 1332. See https://

www.grampound.org.uk/heritage-centre/a-brief-history-of-grampound/

52 https://www.ipcc.ch/report/sixth-assessment-report-cycle/

53 https://www.legislation.gov.uk/ukpga/2008/27/contents, https://www.theccc.org.uk/

54 See https://unfccc.int/process-and-meetings/the-paris-agreement]

55 The 6th Carbon Budget was proposed by the Climate Change Committee to guide the UK Government in reaching its climate goals and signed up to by UK Parliament.

56 See https://unfccc.int/topics/global-stocktake/about-the-global-stocktake/why-the-global-stocktake-is-important-for- climate-action-this-decade]

57 Estimate from the International Renewable Energy Agency, IRENA,

https://www.irena.org/news/pressreleases/2021/mar/fast-track-energy-transitions--to-win-the-race-to-zero]

58 IPBES (2019): Summary for policymakers of the global assessment report on biodiversity and ecosystem services of the Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services. S. Díaz, J. Settele, E. S. Brondízio E.S., H.T. Ngo, M. Guèze, J. Agard, A. Arneth, P. Balvanera, K. A. Brauman, S. H. M. Butchart, K. M. A. Chan, L. A. Garibaldi, K. Ichii, J. Liu, S. M. Subramanian, G. F. Midgley, P. Miloslavich, Z. Molnár, D. Obura, A. Pfaff, S. Polasky, A. Purvis, J. Razzaque, B. Reyers, R. Roy Chowdhury, Y. J. Shin, I. J. Visseren-Hamakers, K. J. Willis, and C. N. Zayas (eds.). IPBES secretariat, Bonn, Germany. 56 pages. https://www.ipbes.net/global-assessment. The warming of the planet has altered ecosystems around the world and caused the loss of local species and a decrease in populations, leading to climate-driven extinctions.

59 UK species have declined by an average of 19% since 1970. Farmland bird species numbers have fall by 50% in the same period, and 1 in 6 species is threatened with extinction. Natural History Museum's Biodiversity Intactness Index https://www.nhm.ac.uk/our-science/data/biodiversity-indicators/biodiversity-intactness-index-data

60 See https://stateofnature.org.uk/

61 State of Nature Cornwall 2020 https://www.cornwallwildlifetrust.org.uk/what-we-do/about-us/state-nature-cornwall-2020- report#:~:text=This%20report%20finds%20that%20nature,over%20the%20last%2030%20years.

62 https://www.cornwallwildlifetrust.org.uk/actions/change-your-energy-use

63 Air quality related diseases are responsible for almost 30% of preventable deaths each year in England See https://www.england.nhs.uk/greenernhs/publi-

cation/delivering-a-net-zero-national-health-service/

64 Cornwall and Isles of Scilly Health and Care Partnership Green Plan 2021-2026 https://www.england.nhs.uk/south/wp- content/uploads/sites/6/2022/06/Green-Plan-2021-26-Cornwall-and-the-Isles-of-Scilly-Health-and-Care-Partnership.pdf.

65 https://www.cornwall.gov.uk/environment/countryside/flood-risk/local-climate-adaptation-tool/

66 OFGEM figures show that total energy debt has risen 57% in one year to £3.3bn at end of Q4 2023 https://www.ofgem.gov.uk/publications/debt-and-arrears-indicators, Surging Energy Prices in Europe in the Aftermath of the War: How to Support the Vulnerable and Speed up the Transition Away from Fossil Fuels (IMF, July 2022, pp14–17): https://www.imf.org/en/Publications/WP/Issues/2022/07/28/Surging-Energy-Prices-in-Europe-in-the-Aftermath-of- the-War-How-to-Support-the-Vulnerable-521457].

67 See https://obr.uk/docs/dlm_uploads/Fiscal_risks_and_sustainability_2022-1.pdf].

68 See https://policy.friendsoftheearth.uk/print/pdf/node/279

69 Energy UK Conference 2024 https://www.gov.uk/government/speeches/energy-uk-conference-2024-keynote-speech-by- by-ed-miliband.

70 https://assets.publishing.service.gov.uk/media/66a235daab418ab055592d27/great-british-energy-founding-

statement.pdf, The price of renewables has been falling and is predicted to continue to fall. For example, the price of onshore wind has dropped by a third since 2015. The price of offshore wind has halved. The price of batteries, vital to enabling greater flexibility in the use of renewable energy, has fallen by more than two-thirds in the same period.

71 The Good Growth Plan provides the vision for Cornwall in 10 years' time as "Cornwall's renewable energy sector has powered the UK to become a clean energy superpower. Our renewable energy assets have allowed us to lead the charge in the UK's renewable energy revolution. We have harnessed our exceptional natural resources—including the UK's richest solar resource, the Cornubian granite batholith, Europe's most favourable wind climate, and extensive coastline and deep waters in the Celtic Sea —and emerged as the national powerhouse for clean energy innovation and production." Cornwall Good Growth Plan 2024-2035 See Page 10 https://www.cornwall.gov.uk/media/vzeppguj/cornwall-good-growth-plan-july- 2024.pdf.

72 See Page 72-77 Cornwall's Good Growth Plan 2024-2035 https://www.corn-

wall.gov.uk/media/vzeppguj/cornwall-good- growth-plan-july-2024.pdf

73 This includes local businesses such as: Morek in Falmouth, a leading force in offshore renewables; Hydrowing in Penryn, a world leader in tidal turbines; and Feritech Global based in Falmouth, a specialist engineering company trading in 40 countries and supporting Falmouth's development as global centre for offshore renewables through its innovation centre and its support for the delivery of floating offshore wind in the Celtic Sea.

74 https://www.theccc.org.uk/publication/progress-in-reducing-emissions-2024-report-to-parliament/

75 Other resources include much-needed lithium, the hard hot rocks to produce geothermal energy, as well as land and biomethane possibilities.

76 https://celticseapower.co.uk/summit-in-cornwalls-eden-project-marks-shift-from-development-to-delivery-for-floating- offshore-wind-flow-in-the-celtic-sea/

77 https://www.renewableuk.com/media/scccdrxe/floating-offshore-wind-2050-vision-final.pdf, https://ciosgoodgrowth.com/project/cornwall-flow-commission/

78 'In past decades, Cornwall has been thought of as remote and far away from the centre of economic activity; the end of the trainline. Now, our natural assets, sector specialisms and innovation culture mean that we are the start of the UK.' Cornwall's Good Growth Plan 2024-2035 https://www.cornwall.gov.uk/media/vzeppguj/cornwall-good-growth-plan-july- 2024.pdf

79 Cornwall currently has limited energy supply options and has one of the highest number of households in the UK not on the gas grid. Many homes rely extensively on fossil fuels such as oil and LPG.

80 Planning for 8 GW from local power to provide for 4.35 million homes. https://communityenergyengland.org/news/new- government-backs-local-people-to-tackle-climate-change-with-up-to-1bn-a-year

81 Community-focused organisations such as: Wadebridge Renewable Energy Network (WREN) https://www.wren.uk.com/, Community Power Cornwall https://communitypowercornwall.coop/, Communities for Renewables CIC https://cfrcic.co.uk/

82 According to the survey most British people also think about climate change on at least a weekly basis, are worried about the effects of climate change for the next generation and are more worried about climate change this year than they were last year.

83 Figures from the International Renewable Energy Agency indicate it was in excess of USD 1.3 trillion in 2022 (IRENA), 2022.

84 https://www.exeter.ac.uk/students/careers/research/sector/energyandnaturalresources/.According to the Office for National Statistics (ONS), growth in green jobs is the UK is nearly 4 times the rate of overall employment growth, (2020-2022).

85 https://www.local.gov.uk/report-local-green-jobs-report#:~:text=In%20 2030%20across%20England%20there,over%201.18%20million%20by%202050

86 https://www.theguardian.com/environment/article/2024/aug/08/fossil-fuel-industry-using-disinformation-campaign-to- slow-green-transition-says-un

87 https://peoplesclimate.vote/country-results.

88 https://www.gov.uk/government/statistics/desnz-public-attitudes-tracker-spring-2024/desnz-public-attitudes-tracker- renewable-energy-spring-2024-uk

89 https://cast.ac.uk/

90 https://www.exeter.ac.uk/research/networks/environmental-intelligence/

91 https://policy.friendsoftheearth.uk/insight/how-england-can-produce-more-onshore-renewable-energy-fast

92 the total area of England is 13, 046,000 hectares.

93 https://www.gov.uk/government/statistics/agricultural-land-use-in-england/agricultural-land-use-in-england-at-1-june-2024

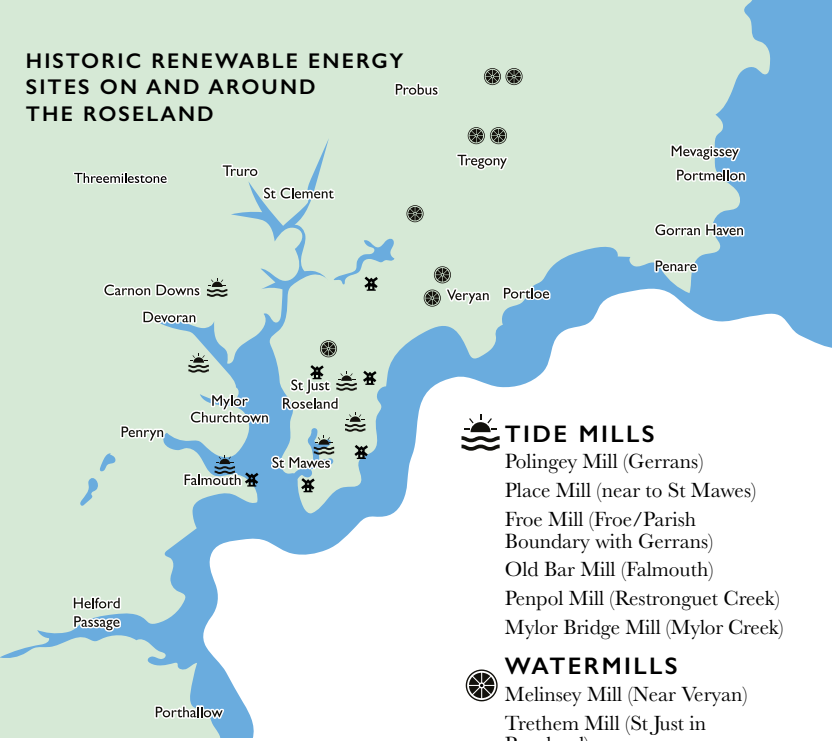
94 Initially this was published by Bloomberg in 2020.

95 Such as Vestas.

96 These blades were made without recycling in mind around 25 years ago.

97 Such as Siemens and Gamensa.

98 IEA Executive Director, Fatih Birol, Nov 2024; https://unclimatesummit.org/cop28-explainers-2/carbon-capture-and-storage/



TIDE MILLS

Polingey Mill (Gerrans)
Place Mill (near to St Mawes)
Froe Mill (Froe/Parish Boundary with Gerrans)
Old Bar Mill (Falmouth)
Penpol Mill (Restronguet Creek)
Mylor Bridge Mill (Mylor Creek)

WATERMILLS

Melinsey Mill (Near Veryan)
Trethem Mill (St Just in Roseland).
Ruan Mill (Ruan Lanihorne).
Tregony Mill (Tregony)
Nansacker Mill (near Tregony)
Mellyn Watt Mill (Creed)
Golden Mill (Probus)
Town Mills (Grampound)

WINDMILLS

Tregassa Mill (Gerrans)
Trevennal Mill (Trevannal) St Just in Roseland
Rosteague Mill, Gerrans (Greeb Point)
Little Molunan (North of St Anthonys Head)
Pendennis Castle (Falmouth)
Treworthal Windmill

*Map illustration purely indicative

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