

## Evidence gaps

### 1. EXECUTIVE SUMMARY

- 1.1 During the process of working on the work packages to inform the climate action plan report, numerous areas for further work were identified. These include further research required to understand the current situation, modelling to understand future scenarios and monitoring that needs to be implemented.
- 1.2 This list is an initial attempt to bring these evidence gaps together, but further work is required to identify the key gaps and to prioritise them for delivery.
- 1.3 They have been grouped into the following categories;
- Funding and Finance;
  - Infrastructure;
  - Research;
  - Monitoring and Mapping;
  - Education and Implementation;
  - Waste & Other Greenhouse Gases; and
  - Further Emission Reductions.
- 1.4 It is important to note that the knowledge gaps identified should not be taken out of context and readers are advised to read the related appendix for further clarity. The knowledge gaps do not necessarily indicate a decision to progress with a particular project, and only recognise missing information which should be investigated at a later stage.

### 2. FUNDING AND FINANCE

Code	Knowledge gaps	Evidence required
F1	Substantiate costs for each weft.	<ul style="list-style-type: none"> <li>- Estimated costs checked and verified</li> <li>- Estimate additional cost where further evidence/research is required</li> </ul>
F2	Appropriate funding mechanism identified for each weft i.e. publicly or privately.	<ul style="list-style-type: none"> <li>- Expert financial analysis of each weft</li> </ul>
F3	Estimate potential income generated through income tax or a 'carbon levy', to quantify available funds for decarbonisation projects.	<ul style="list-style-type: none"> <li>- Determine wefts with tax /levy implications</li> <li>- Estimate potential funds generated</li> <li>- Determine taxation regulations with treasury relating to 'ring-fencing' for decarbonisation</li> </ul>
F4	Consider the introduction of voluntary carbon	<ul style="list-style-type: none"> <li>- Calculate emissions</li> </ul>

	offsetting scheme for TT visitors.	generated - Establish viability of the scheme i.e. how would funds be offset on island (relevant to weft 3)
F5	Investigate agricultural payments options under an Agri-environment scheme	- Feasibility and costing assessments for all/most appropriate options. i.e results based payments, high nature value farming payments
F6	Investigate grant schemes for woodland creation	- Determine costs and resource requirements for the implementation of an island-wide woodland creation and maintenance grants scheme. - Determine feasibility of additional grant scheme to support other environmental options for non-active farmers
F7	Biodiversity Strategy Implementation	- Undertaking a scoping exercise to determine the necessary level of resources and funds for wide-scale implementation of the Biodiversity Strategy, including Biodiversity Action Plans for priority species and habitats, across Government and the wider Isle of Man.
F8	Investigate the public sector investment required to balance & store intermittency of offshore wind	- Comprehensive technical and financial analysis of integrating renewable energy
F9	Financial impact of change in Manx Utilities Authority generation mix on consumer (20MW wind)	- Financial impact assessment
F10	Determine investment required to manage / balance / export additional renewable generation for onshore renewables	- Technical analysis & financial impact assessment
F11	Investigate route to market for gas (where the gas will be burnt)	- Business proposal
F12	Determine levelised cost of energy on nuclear impact on consumers	- Financial impact assessment
F13	Establish cost of Interconnector, financing options (public v private investment), impact on consumer price	- Technical analysis & financial impact assessment

### 3. INFRASTRUCTURE

Code	Knowledge gaps	Evidence required
I1	Research how companies could be incentivised to install electric vehicle charging facilities for staff.	- Identify levers and disincentives, and consider costs and impacts
I2	Further research on provision of charging facilities for those without off-street parking.	- Further research and consultation with stakeholders
I3	Identify local community energy generation opportunities.	- Work with community and stakeholders to identify opportunities
I4	Assess potential for heat pumps on rivers, sewers, sea and heating on major buildings or district heating.	- Feasibility study and ecological impact assessment
I5	Quantify current situation and options for future aviation/airport development etc.	- Watching brief for technological development in this area
I6	Estimate cost for household upgrades to existing properties.	- Estimate from a quantity surveyor or properly expert
I7	Hydrogen storage capability on island e.g. creation of salt caverns	- Scoping study similar to that of the H21 Leeds Gateway project i.e. geological requirements
I8	Whether a blend of 20% hydrogen be introduced into the existing gas network	- Await results of trials by the Health and Safety Executive Laboratory in coming months.
I9	Determine whether the current steel pipeline be suitably converted to hydrogen	- Research potential of PE pipe for compatibility
I10	Suitable sites for Bio-methane processing & storage facilities and validation plant for injection into network	- Site suitability assessment/constraints and opportunities mapping
I11	How the introduction of bio-methane into the gas network could be managed	- Scoping study

### 4. RESEARCH

Code	Knowledge gaps	Evidence required
R1	Practicalities regarding the introduction of biofuels in the short term to reduce emissions.	- Further discussions with stakeholders and industry experts
R2	Carbon sequestration potential of sustainable urban drainage systems (SuDS)	- Research specific carbon sequestration rates for individual SuDS elements relevant to temperate/UK climates
R3	Further research on mechanisms that would increase active travel within the community – particularly for individuals within a 20 minute	- Public survey and/or census

	commuting radius, however all distances should be assessed	
R4	Research benefits and opportunities from leasing a Government electric vehicle fleet	- Further research combined with discussions with Treasury
R5	Cost of restoration/creation of blue carbon ecosystems currently unquantified	- Gather evidence from literature and UK based researchers to quantify the costs for restoration and creation of Manx blue carbon habitats.
R6	Research alternative systems that have the potential to reduce agricultural emissions by more than 28% i.e. tree planting, renewable energy generation etc	- Industry expert to research and model the carbon saving, costs and other pro's and con's related to alternative farming systems - Any options identified need to be assessed in terms of local industry/business viability.
R7	Research low carbon options for vehicles in fishing and farming	
R8	Consider mechanisms/programs to eliminate fuel poverty	- Consult with experts and identify mechanisms and systems that prioritise this
R9	Fully consider the potential for geothermal	- Expand upon existing work to fully quantify viability.
R10	Research Government fleet use, distances etc. and opportunities for reduction in use, and transition to electric vehicles	- Extensive study suggested, similar to that conducted by the University of Southampton
R11	Detailed knowledge on carbon storage and sequestration rates within different semi-natural habitats types	- More information/research required on sequestration and storage rates per habitat type.
R12	More research required prior to wide-scale woodland and semi-natural habitat creation to determine suitable areas, avoiding negative impacts and ensure long-term viability and climate change resilience.	- Further research and information gathering, habitat mapping
R13	Land-use-change and opportunity cost for other climate change projects (e.g. woodland)	- Geographical & carbon accounting analysis of specific wind/solar proposals.
R14	Suitable land for creation of Government Woodlands	- There is a political commitment to immediately plant 4 additional woodlands. More research is required determine suitability of

		government sites.
R15	Review existing tree protection policy	- Assess options for the alteration of the existing tree protection policy to increase tree planting activity and provide better protection for ecologically valuable species
R16	Potential for electrolysis from offshore wind to power combined cycle gas turbine with hydrogen (produced from wind)	- Results from technical trials in the UK; financial impact assessment of CCGT conversion to hydrogen in £ per kWh
R17	Levelised cost of energy for onshore wind in Isle of Man	- Business appraisal of wind farm sites
R18	Tidal energy - generation capacity of tidal range / stream in areas of the island's seabed	- Advanced hydrographic modelling of specific areas of the IOM tidal stream
R19	Levelised cost of energy for tidal	- Business appraisal of tidal sites
R20	Methane leak potential resulting from extraction of natural gas	- Specific infrastructure and extraction proposals with system risk analysis
R21	Quantity of natural gas available for exploitation	- Results from seismic survey
R22	How to manage radioactive waste is nuclear was explored further	- Comprehensive life-cycle / system analysis of nuclear power plant
R23	Cost of nuclear small modular reactor	- Costings from producers
R24	Risk to 'island-mode' and economy from change to importer	- Technical analysis
R25	Direct air capture - research the efficiencies in Air-to-fuel systems	- Systems analysis
R26	Direct air capture – Whether Air-to-fuel liquid is subject to hydrocarbon oil fuel duty	- Advice from AGs
R27	Current and expected demand profile for gas on island	- Need to establish optimal mix of renewable electricity generation capacity, hydrogen generation capacity and hydrogen storage capacity
R28	Feasibility of producing 15,000 – 20,000 acres of grassland be used to create silage for bio-methane	- How would this affect food production - Can silage be sourced from marginal grassland - Can it be used as a break crop - How much subsidy would be required to incentivise production

## 5. MONITORING AND MAPPING

Code	Knowledge gap	Evidence required
M1	Ground truth blue carbon thesis used to estimate blue carbon sequestration and storage rates in Manx waters	<ul style="list-style-type: none"> <li>- Substantiate report through existing data to fully map existing blue carbon habitats and quantify their carbon sequestration and storage capacity</li> <li>- Monitor blue carbon habitats and historical sites to establish condition for potential restoration and creation of new habitat</li> </ul>
M2	Potential for zero tillage agriculture on the island	<ul style="list-style-type: none"> <li>- Need to model and map areas where no/reduced tillage may be viable and quantify the potential carbon saving</li> </ul>
M3	Carbon sequestration capacity on agricultural land	<ul style="list-style-type: none"> <li>- Quantify and map the agricultural lands that could potential be converted to carbon sequestration habitats/renewable energy generation (without impacting local food production)</li> <li>- Estimate potential carbon stored/saved</li> </ul>
M4	Establish governance for oversight and reporting of climate change plan	
M5	Fully quantify peatland extent, depth and condition	<ul style="list-style-type: none"> <li>- Requires additional local surveying and monitoring (outlines in Appendix 10a)</li> </ul>
M6	Establish whether current peatland is a net sink or source of GHG emissions	<ul style="list-style-type: none"> <li>- Requires full survey of peatland condition and sources and sinks identified</li> </ul>
M7	Determine appropriate tree planting areas within the uplands	<ul style="list-style-type: none"> <li>- Ecological assessment required</li> </ul>
M8	Future commercial forestry management established in relation to climate change	<ul style="list-style-type: none"> <li>- Assessment by DEFA forestry professionals.</li> </ul>
M9	Update figures on the Isle of Man area coverage of semi-natural habitats and their existing condition to estimate carbon offsetting potential (1994 data has been used within the report).	<ul style="list-style-type: none"> <li>- Updated habitat survey required to determine extent of IoM semi-natural habitats and their condition.</li> </ul>
M10	Further planning, assessment and collaboration is required prior to wide-scale woodland and semi-	<ul style="list-style-type: none"> <li>- Working groups and collaboration to compile an</li> </ul>

	natural habitat creation to determine the best areas, to avoid negative impacts and ensure long-term viability and climate change resilience.	evidence base to determine areas for connected, where woodlands should and should not be created (through impact on existing habitats and biodiversity.) Similarly increased collaboration with landowners to get creates joined-up semi natural habitats across the Isle of Man.
M11	Natural Flood Risk Management	- Initiating a Natural Flood Risk Assessment of all Island catchments, to prioritise the best areas for the recreation of natural features

## 6. EDUCATION AND IMPLEMENTATION

Code	Knowledge gaps	Evidence required
E1	Specific consideration for careers likely to be affected by climate change plan in line with a Just Transition e.g. Mechanic	- Identify options to retrain/offer alternative programmes
E2	Investigate the potential for formal climate science training for teachers in schools	- DESC to provide details of how teachers currently receive training on Climate Science. - Need research and evidence appropriate training in relation to climate change
E3	Further work is needed on education beyond the school curriculum, for example pre-school and post 16 and lifelong learning	- Work with stakeholders to identify existing position and opportunities.
E4	Develop and implement a programme of climate action awareness and education across the IOM	- Ongoing, however updates/review will be required
E5	Develop and agree policies proactively managing mental health in relation to climate change and the benefits of the natural world in wellbeing	- Work with experts to create guidance
E6	Departments need to systematically update program from government to consider climate change	- This will be based upon the outcomes of the climate change report

## 7. WASTE &amp; OTHER GREENHOUSE GASES

Code	Knowledge gaps	Evidence required
W1	Percent or amount of EfW energy produced that can technically be classified as renewable to confirm the role the EfW can play in delivering renewable energy	- Calculation of EfW renewable energy based on waste feedstock analysis
W2	Data to provide the imperative for introduction of legislation to prohibit unregulated burning of incinerable waste: reduction in CO <sub>2</sub> and CO <sub>2</sub> e emissions from open air burning or disposal; increased EfW efficiency (no unscheduled shutdowns, increased renewable energy production).	- Tonnage of incinerable waste that is currently disposed of via unregulated burning or other unregulated methods on Island; the carbon impact of this unregulated waste management; and the potential energy produced/CO <sub>2</sub> e saved if this waste is managed via the EfW.
W3	CO <sub>2</sub> /CO <sub>2</sub> e savings realised by decommissioning the EfW and exporting waste; loss of renewable energy contribution.	- Cost and environmental impact of decommissioning the EfW at 2029 (or sooner, although this would incur costs associated with contractual obligations; cost and environmental impact of building a Material Recovery and Refuse Derived Fuel Baling facility; cost and environmental impact of exporting waste to UK for incineration; legal status of exporting IOM incinerable waste to UK for disposal.
	CO <sub>2</sub> /CO <sub>2</sub> e savings realised by managing biogenic waste via Anaerobic Digestion rather than EfW.	- The role of industrial scale Anaerobic Digestion in strategic waste management on Island, including data/information on: waste types; use for methane gases; environmental impact and cost of collection systems; environmental impact; the cost and environmental impact of residue management; and, the total carbon impact of industrial scale AD.



	<p>CO<sub>2</sub> and CO<sub>2</sub>e Local Authority refuse collection schemes; potential CO<sub>2</sub> savings through optimisation of collection rounds and LA schemes, and use of Euro VI vehicles.</p>	<ul style="list-style-type: none"> <li>- Contemporary data on fuel use/km travelled for each Local Authority Refuse Collection Scheme: waste collection; and delivery to EfW. RC Vehicle type; vehicle optimisation (how well vehicle capacity is used and opportunities for achieving full payload)</li> </ul>
	<p>CO<sub>2</sub>/CO<sub>2</sub>e savings from retrofitting heat recovery technology to the EfW facility where the heat replaces a fossil fuel based heat source and for a new development.</p>	<ul style="list-style-type: none"> <li>- Contemporary information on the technical options and costs of retrofitting heat recovery technology to the EfW; impact on EfW energy production through heat recovery; identified use for the recovered heat, business case, and infrastructure requirements;</li> </ul>
	<p>The total IoM non CO<sub>2</sub> emissions; to what extent proposals to reduce CO<sub>2</sub> will effect a reduction or increase in non CO<sub>2</sub> emissions</p>	<ul style="list-style-type: none"> <li>- Full review of IOM GHG emission data for non CO<sub>2</sub> GHGs in accordance with the Aether 'Guide to the Isle of Man Greenhouse Gas Inventory' to ensure the data is both accurate and Isle of Man specific. Once this is data review is completed, options for reducing emissions, with reference to relevant CO<sub>2</sub> focussed work programmes, will need to be identified, and potential sources for new CO<sub>2</sub>e emissions, particularly those associated with renewable energy, waste management and the decarbonising of the transport system, identified.</li> </ul>

**8. FURTHER EMISSION REDUCTIONS**

Code	Knowledge gaps	Evidence required
P1	Consider offsetting carbon emissions from Heritage Railways	<ul style="list-style-type: none"> <li>- Calculation emissions</li> <li>- Calculate of cost of offsetting</li> <li>- Determine policy decision regarding offsetting scheme</li> </ul>
P2	Continue to carbon offset the TT qualifying and racing and consider the other carbon costs arising from running the event e.g. tourists travelling to the island, helicopters etc.	
P3	Assess the carbon emission associated with vintage vehicles on the Isle of Man	<ul style="list-style-type: none"> <li>- Further research into the number of vintage vehicles</li> <li>- Seek to identify approach of other jurisdictions</li> </ul>
P4	Quantify carbon footprint of ferry/train vs flights from IOM to main destinations	