



The Carbon Advisory Service Ltd

5 Westhill Court
Millfield Lane
London N6 6JJ
office + 44(0)208 347 0800
fax + 44(0)208 347 0801
enquiries@carbonadvisoryservice.com

Offer of Services to Ensure the Achievement of Carbon-Neutrality in the Maldives by 2019

by The Carbon Advisory Service Ltd., supported by Imperial College London

August 2009

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1. Meeting the Challenge of Climate Change – Executive Summary

In March 2009, the President of the Maldives, Mr Mohamed Nasheed, set out a bold policy objective: to make the Maldives carbon-neutral by 2019. This ambitious vision sets a benchmark for other countries' actions on climate change.

To help the Maldives turn this goal into reality, The Carbon Advisory Service Ltd. (CAS) and Imperial College London offer their services in the following areas:

a) The creation of a "Maldives Carbon Plan" to provide a road map towards carbon-neutrality.

CAS will lead the development of a Maldives Carbon Plan that will include an integrated energy strategy. We expect that this plan will include the following key elements:

- i. A plan for waste-to-energy from Thilafushi – the national waste collection and incineration site;
- ii. Identification of practical energy efficiency measures to be incorporated into new building designs and retro-fitted to existing buildings;
- iii. Recommendations and detailed costs for implementing island-wide cooling strategies such as evaporative, solar and deep-seawater;
- iv. An island-wide electrical generation strategy based on renewable sources, such as photovoltaics and concentrated solar collectors;
- v. Suggested use of agricultural land with a focus on soil drainage systems and implementation of biochar production;
- vi. Provide due diligence advice on all carbon-reduction initiatives and projects proposed by various organisations, screening for technical feasibility, compatibility with social conditions, affordability, and extent of emissions reductions; and,
- vii. National building energy regulations to assist in the creation of building policy (please refer to section 3a below for further information)
- viii. Strategic analysis of aviation and shipping/boating sector contributions to greenhouse gas emissions.

The plan would be developed in consultation with key ministries and businesses, and would also involve a round of public consultation.

b) The development of a national greenhouse gas (GHG) monitoring programme to provide an accurate measure of the nation's progress on reducing emissions towards zero.

Imperial College London will provide training support and software to set up a national programme for monitoring greenhouse gas emissions. We suggest that the monitoring programme should be developed along the following lines:

- i. Be compatible with the national greenhouse gas inventory structure for reporting under the UN Framework Convention on Climate Change;
- ii. Provide a breakdown of the sources of GHG emissions from different sectors and economic activities, to enable an assessment of the effectiveness measures implemented within the Carbon Plan;
- iii. Enable specific companies to feed in data to fulfil reporting requirements that may be part of the national Carbon Plan;
- iv. Provide annual and six-monthly updates on emissions to the Cabinet;
- v. Be set up within the Provincial Information Management System and in collaboration with the Ministry of Housing Transport and Environment;
- vi. National staff will be trained by CAS-Imperial College London and provided with assistance to run the system in the long-term.

c) Help the government find funding and routes to capital.

An advisory service is available from James Cameron of Climate Change Capital. Note a budget item for this would be put forward if necessary in the final proposal. This would include:

- i. Introductions to potential funders;
- ii. Programmatic CDMs;
- iii. Advice on most efficient routes to capital.

d) Advise on offset projects.

Airline emissions are one of the highest remaining unavoidable sources of CO₂ that need to be offset within the Maldives and in developing and developed countries globally. We can advise on best practise for this, including:

- i. Advice on offsets from the regulated voluntary market.

2. Roles and Capabilities

CAS and Imperial College London offer their combined resources towards the achievement of the Maldives' goal of carbon-neutrality. We propose that CAS will be the principal contractor, lead development of the National Carbon Plan and provide advice on financing emission reduction measures. Imperial College London will be responsible for setting-up the greenhouse gas monitoring and reporting programme, and will be sub-contracted by CAS.

The services of James Cameron of Climate Change Capital may be employed if necessary to consult on effective routes to funding and advise on the application and implementation of CDM projects to gain the maximum benefits of these.

These teams have worked together successfully on a number of previous assignments over many years.

a) The Carbon Advisory Service Ltd.

CAS provides solutions in emissions reductions, energy efficiency and offsetting of unavoidable emissions. CAS was founded in 2007 by Daniel Morrell, who has worked in the area of climate change since 1988. He trademarked the term 'carbon neutral' and founded The Carbon Neutral Company, which is now a global brand leader in voluntary carbon offsetting. Many clients of these companies helped achieve a breakthrough in popular consciousness by campaigning for awareness of climate change with a charity Daniel founded in 2004, Global Cool.

CAS is currently working with Six Senses Spas and Resorts, to oversee the coordination of several CO₂ mitigation technologies within their resorts, including Soneva Fushi in the Maldives. The systems we are proposing for this project include: photovoltaics, biochar production, deep-ocean water-cooling, concentrated solar, anaerobic digestion, evaporative cooling, and optimised building structures through dynamic thermal modelling.

Through working on Six Senses Spas and resorts, CAS has already gained extensive insight into the various factors influencing climate change in the Maldives and experience of the implementation of consequent projects.

Darren Ball (CEng, MCIBSE), CAS' senior environmental engineer, is a chartered engineer and has practiced low- and zero-carbon building design for over 20 years, during which time he has advised on some of the largest and most prestigious low-carbon projects in the world (see especially energy master planning below).

Darren served for six years as Associate Director and Head of Technical Excellence at global consultant WSP's Head Office. During this period he led mechanical, electrical and public health design teams delivering projects in the following sectors: banking, speculative development, residential, pharmaceutical, museums and archives.

Darren's strategy is to look at each project with an open mind to find the opportunities and constraints peculiar to the project in hand, and then to align and mold a blend of technologies for the optimum solution. This approach runs counter to the current common practice of deploying the same standardised solutions in all instances, all over the world, without adaption for local conditions and fortuitous project features; what Darren describes as the "one size ill-fits all" approach, which is tried,

tested and proven to be mediocre. Significant energy-efficiency opportunities are being traded for efficiency of effort.

Frequently solutions are chosen on the basis of the tools that are readily available to the designers, even though a better solution might be used for want of better design tools: this is the tail wagging the dog and is an anathema to Darren, who would always prefer to write or commission bespoke software to provide the necessary project-specific insight. For this reason, Darren continues to develop an impressive library of computer programmes to prove his design concepts where they go beyond the scope of commercially available software.

Darren believes that carbon reduction strategies cannot succeed when divorced from other design considerations. Carbon reduction considerations must take their place around the design table, along with a host of other aspirations, targets and constraints, in order to produce the overall best solution. Darren was a founder member of the Association of Consulting and Engineering (ACE) Sustainability Special Interest Group and is registered as a Low Carbon Consultant with the CIBSE.

b) Imperial College London

Imperial College embodies and delivers world class scholarship, education and research in science, engineering, medicine and business, with particular regard to their application in industry, commerce and healthcare. We foster interdisciplinary working internally and collaborate widely externally. We strive for the following goals in all that we do:

- To remain amongst the top tier of scientific, engineering and medical research and teaching institutions in the world.
- To harness the quality and breadth of our research capability, across multiple disciplines, to address major challenges.
- To continue to attract and develop the most able students and staff worldwide.
- To develop our range of academic activities to meet the changing needs of society, industry and healthcare.
- To communicate widely the significance of science in general and the purpose and ultimate benefits of our activities in particular

We have more than 300 experts in climate change mitigation and adaptation among all major disciplines and fields of service delivery. We specialise in research, analysis and interpretation of greenhouse gas emissions and sustainability metrics. Our collaborations take place with the world's leading organisations in the private sector, the carbon economy generally, government, regional and multilateral organisations, universities, NGOs and think tanks.

We provide independent analysis, research and advice in the following areas:

- GHG assessment; corporate GHG impacts, product life-cycle assessments and the development of carbon calculators. Our team of GHG analysts has over 30 years of experience in GHG emissions assessments and are familiar with all major reporting standards for companies, products and national inventories.
- Land use and ecosystem assessment: monitoring and evaluation of land use change, carbon stock changes, biodiversity indices, water use, ecosystem viability, bioenergy resources and other ecosystem functions.
- Policy and research; studies, policy papers, tools and high-level advisory work.

We work with funders to build sustainability assessment and zero carbon strategy into all aspects of institutional design and delivery of goods and services. Our ethical stance on environment and sustainability is one which we maintain in relation to all organisations with which we collaborate and serve.

c) Climate Change Capital

Climate Change Capital (CCC) is an investment manager and advisor specialising in the opportunities generated by the global transition to the low carbon economy. It advises and invests in companies that recognise combating global warming is both a necessity and an economic opportunity.

James Cameron is an Executive Director, CCC's Vice Chairman and Chairman of the Advisory Board. He is responsible for strategic and sector development and represents the firm at the highest levels of business and government. James is a pre-eminent expert in developing market based policy responses to climate change. Prior to CCC he was Counsel to Baker & McKenzie and was the founder and the head of their Climate Change Practice. James has spent much of his legal career working on climate change matters, including negotiating the UNFCCC and Kyoto Protocol as an adviser to the Alliance of Small Island States. He has held academic positions at Cambridge, London, Bruges and Sydney and is currently affiliated with the Yale Centre for Environmental Law and Policy. As a barrister he appeared in several of the leading cases in environmental law. He is the Chairman of the Carbon Disclosure Project, a treasurer of REEEP and a senior advisor to The Climate Group. He is a member of the board of GE, Ecomagination and a member of the Copenhagen Climate Council.

3. Activities and Outputs

This section contains further in-depth information regarding each of the services suggested in the summary above.

Energy efficiency strategies and policies must be integrated with the energy supply strategy. As an example, if the Maldivian electricity supply is derived entirely from plentiful renewable sources, then electric water heating will likewise be carbon-neutral and therefore could be a viable option. If however the electricity supply uses an element of hydrocarbon fuels, then electric water heating would be inappropriate and an alternative strategy would be required, such as solar-thermal or waste heat.

In order to properly integrate a low-carbon demand- and supply-side energy strategy, we need to identify those opportunities on both sides, which complement each other. For this reason it is important to resist adopting technologies, however viable in and of themselves, in an ad hoc fashion.

CAS will start by preparing a cohesive overall strategy using the resources best suited to the country, such as its climate, sea water, fish oil, biomass, waste streams, etc., and then carry this one strategy through all of the implementation phases, from electricity production to building codes, transportation, water, waste and agriculture.

CAS proposes the following scope of services and associated fees:

a) Sustainability methodology

We shall produce a high level strategy document, informed by the nationwide carbon assessment (below), detailing how all GHG emissions from energy, water, waste and refrigerants could be reduced to their practical minima.

In order to prepare this document, we shall consult widely with relevant government ministries, municipalities, utility companies, airports, all major industries and major employers. The purpose of this document is to inform overall policy direction and to create the framework for further investigations, leading ultimately to new legislation and government policies. Some of the key areas to be explored under the Sustainability Methodology follow.

i. Proposals for waste-to-energy from Thilafushi.



Thilafushi is reportedly the world's biggest refuse island, covering 50 hectares and growing by one square metre a day. 330 tonnes of rubbish is deposited there daily, mostly from Malé. Some is incinerated but most buried in landfill sites. There is a risk of toxic heavy metals such as mercury, lead, and cadmium leaching out into the sea, damaging marine ecology.

The Digest of United Kingdom Energy Statistics (DTI, 1997) reports the gross (upper) calorific value of unsorted municipal solid waste (MSW) at 9 – 9.5 MJ/kg. On which basis, the energy content of the waste at 330 tonnes per day is over 300 MWh (thermal) per year, or about 100 MWh (electrical).

The approach will follow a hierarchy of: reducing waste, recycling waste, and converting waste into energy and/or other useful by-products. The available energy is relatively small but the benefits go beyond energy production into; avoiding emissions of methane which is 23-times more potent as a GHG than CO₂, avoiding damage to the marine ecology from leaching toxins, and recycling materials thereby avoiding energy use in manufacturing.

To develop this section of the Carbon Plan it will be necessary for The Carbon Advisory Service Ltd. to understand existing waste streams; the influence the Maldivian Government can bring to bear on suppliers; trends amongst principal suppliers (short-, medium- and long-term); recycling opportunities within the Maldives and abroad; and quantity and type of residual unrecyclable waste.

The output from this activity will be a document setting out the options for re-structuring the waste management in the Maldives, and will provide approximate costs and technical requirements for potential solutions. The document will contain a summary that will inform policy makers and legislators.

ii. Energy efficiency in building design

Development on the Maldives is set to increase largely over the next decade, with the licensing of 60 new resorts. The government also has plans to create housing with the planned rollout of 10,000 new homes, 2,000 new villas and a new transport system, which will include an airport. This needs to be integrated with the supply strategy to ensure a cohesive overall building strategy, so that an overall standard is maintained into the future.

This sub-section will recommend the nature and form of a suitable nationwide mandatory Building Energy and GHG Code to be complied with on all new buildings. The intention is to place demanding but achievable limits on emissions without unnecessarily restricting design flexibility. The Code will include energy-in-use and the embodied energy of materials.

To write this sub-section it will be necessary to determine the practical minimum emissions for each building type, what sort of technologies would be necessary to deliver them, and in principle what the strategy should be for providing a uniform and consistent method of measuring compliance against the standards.

The conclusion of this sub-section will form the brief for writing the Code.

iii. Advice on island-wide cooling strategies such as evaporative, solar and deep-seawater.

This sub-section will provide detailed advice and recommendations on the use of each of these technologies, including likely costs, benefits and design guidance.

It is envisaged that developers of new resorts will be required to adopt one or a combination of these technologies, or otherwise prove they are adopting an equivalent alternative.

iv. Advice on island-wide electrical generation strategies, such as photovoltaics and concentrated solar collectors.

This sub-section will provide detailed advice and recommendations on the use of each of these technologies, including likely costs, benefits and design guidance.

It is envisaged that developers of new resorts will be required to adopt one or a combination of these technologies, or otherwise prove they are adopting an equivalent alternative.

v. Suggested use of agricultural land with a focus on soil drainage systems and implementation of biochar production projects.

Biochar's potential for climate mitigation, restoration of degraded soils and beneficial effect on soil moisture retention can make it an important part of Maldivian agricultural and climate policy. The availability of biomass for biochar production means that considerable amounts of CO₂ can be removed from the atmosphere and stored permanently in the soil.

Simple robust technologies in biochar can be supplied that can enable farmers and resort operators to offset their CO₂ emissions.

The fertility benefits of biochar can be enhanced with the addition of coir, fishery waste and other organic material to increase the fertility of Maldivian farms and reduce the need for imported fertiliser.

Outputs

The principal outputs of this investigation will be incorporated into the overall, cohesive sustainability report for the country. In summary, the principal outputs of the Sustainability Methodology shall be a report, supported by research, calculations, approximate costs and energy modelling, giving suggested overall policy direction across energy supply, energy demand, waste, agriculture and transport. This will provide a framework for further investigations, leading ultimately to new legislation and government policies.

b) National greenhouse gas assessment

A GHG assessment quantifies emissions of all six Kyoto greenhouse gases and is measured in units of carbon dioxide equivalence, or CO₂e¹. The six Kyoto gases are carbon dioxide (CO₂), methane (CH₄), nitrous oxide (N₂O), hydrofluorocarbons (HFCs), sulphur hexafluoride (SF₆) and perfluorocarbons (PFCs). The global warming potential (GWP) of each gas is illustrated in Table 1.

Table 1. GWP of Kyoto gases (IPCC 2007)

Greenhouse Gas (GHG)	GWP
Carbon dioxide (CO ₂)	1
Methane (CH ₄)	25
Nitrous oxide (N ₂ O)	298
Hydrofluorocarbons (HFCs)	124 – 14,800
Perfluorocarbons (PFCs)	7,390 – 12,200
Sulfur hexafluoride (SF ₆)	22,800

The GHG assessment and monitoring system for the Maldives will be structured to be compliant with the national reporting requirements of the UNFCCC and also to provide a breakdown of sources that is relevant for the purposes of measuring the effectiveness of GHG reduction measures within the Carbon Plan.

¹ CO₂e is the universal unit of measurement to indicate the global warming potential (GWP) of each of the six greenhouse gases, expressed in terms of the GWP of one unit of carbon dioxide (WBCSD/WRI) 2004

Imperial College London will conduct a visit to the Maldives to identify all significant sources of all six Kyoto GHGs, agree the structure of the report with the Maldivian authorities and provide training for local staff. Activities will include:

- A workshop / meeting with government agencies to identify key data holders, data quality / availability issues
- A workshop for businesses in the Maldives to explain the purpose of the GHG inventory and to show how they can submit data on online forms
- Training of local Maldivian staff within the relevant government agency on how to complete the assessment (mentoring and support will be available once Imperial College London staff have returned to the UK)

Following on from the field visit, the data collection is anticipated to take up to four months with the first draft of the calculation results being presented in mid-January 2010. Assuming that there are no delays in the data collection process the final report shall be submitted to the Ministry of Environment by the beginning of March 2010.

Data will be entered on Imperial College London's online system will be customised to produce a National GHG Reporting Tool that will allow Maldivian staff to access, upload and analyse data on an annual or six-monthly basis. Access to the system will be set up so that relevant staff controls access to national data.

The system will also be compatible with corporate GHG reporting tools that could be provided to companies within the Maldives. In this way the Government could monitor which companies are directly responsible for components of the National GHG footprint.

Outputs

The national GHG monitoring and reporting tool will provide the following outputs:

- Calculation of all GHGs for any reporting period where there is data available
- "Dashboard" style executive summary
- Key performance benchmarks (to be discussed with the Government)
- Comparison of results to previous years (once data is available)
- Analysis of the impacts of any specific GHG reduction activities during specified periods
- Analysis of the GHG performance in absolute and relative terms (per unit GDP or other measure) over the last 5 years
- Analysis of uncertainty

c) Help the government find funding and routes to capital

CAS can engage the services of James Cameron of Climate Change Capital to offer consultancy for private investment capital.

In addition to this, we can advise on and implement an emissions reductions trading strategy, including a facility for full CDM applications to trade the efficiencies and carbon reductions that are being created in the proposed Maldivian developments.

Thirdly, CAS can assist in research to find the most efficient routes to capital through various global public funding organisations, both governmental and non-governmental. From there we can assist in

proposing the Maldivian initiatives to these organisations for their consideration, maximising the potential for receiving funds.

d) Advise on offset projects

Once the reduction process has taken place the remaining unavoidable emissions can be offset through the purchase of credits from offset projects. CAS can advise on numerous aspects of the offset process including different types of projects, pricing and policies that surround these. We offer carbon credits from highly reputable projects in the regulated and voluntary carbon markets to complete the steps towards carbon neutrality.

Daniel Morrell has 21 years experience in this area, and through his founding of The Carbon Neutral Company and involvement in the origination of the voluntary carbon market is well placed to access cost effective and reliable carbon credits.

e) Provide due diligence advice on national carbon reduction initiatives and projects

CAS will appraise proposals to provide a general review of the viability and value of the project as well as comment on the likely benefits and compatibility with national policy.

4. Indicative Costs and Timescale

The costs presented here are indicative only and will be revised following initial discussions.

Activity	Budget	Timescale
Waste-energy from Thilafushi	£72,000	6 months
Energy Efficiency in building design	£72,000	6 months
Island-wide cooling strategy	£108,000	4 months
Island-wide electrical generation strategy	45,000	6 months
Agricultural land use solutions	Project by project basis	Project by project basis
National GHG Monitoring and Reporting (Imperial College London)	£40,000	4 months
National GHG Monitoring and Reporting Management fee (CAS)	£20,000	4 months
Funding and routes capital	Project by project basis	Project by project basis
Offset of unavoidable emissions	No fee required	Project by project basis
Due diligence on all carbon reduction projects	Project by project basis	Project by project basis