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Green buildings: A Maltese perspective

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GREEN BUILDINGS:
A MALTESE PERSPECTIVE

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Green Buildings: A Maltese Perspective

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AUTHOR'S DECLARATION

This is to confirm that this dissertation, **"Green Buildings: A Maltese Perspective",** is solely the work of Mr. Kevin Muscat.

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ABSTRACT

As construction and building development increases in the local scene, and the threat of climate change escalates, addressing green buildings on the national agenda is of vital importance. The building sector has a significant potential to implement positive change and hence become more efficient in terms of resource use.

The term ‘green’ has been widely used throughout the last few decades to denote environmentally friendly policies, principles and measures. The ever growing popularity of the term was brought about by increasing concerns and issues such as those pertaining to climate change, energy crisis and resource depletion.

Central to this debate are buildings, land use and development. Buildings have been identified as a major contributor and driver of climate change. In Malta, the ‘green debate’ emerged in the early nineties with its importance increasing year after year on the national agenda. This was further stimulated through Malta’s accession to the European Union; a process which saw local premature environmental legislation becoming coherent to EU futuristic policies.

This thesis examines green building concepts, principles and practices within the Maltese context. This thesis explores the concept of a green building and the elements associated with its design and construction as well as the characteristics and influence of the various building rating systems.

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To the Almighty God,
For always feeling his presence
whenever I turn to Him.

To my dearest Family,
For their love, patience and support,
For always reminding me that
my best is good enough.

And to all those who helped
me discover my strengths.

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LIST OF ABBREVIATIONS

Abbreviation	*Description*
ASHRAE	American Society of Heating, Refrigerating, and Air-Conditioning Engineers
BAS	Building Automation System
BICC	Building Industry Consultative Council
BPE	Building Performance Evaluation
BRE	Building Research Establishment
BREEAM	Building Research Establishment Environmental Assessment Method
BRO	Building Regulations Office
CEC	Commission for Environmental Cooperation
CIB	"Conseil International du Bâtiment" (in English this is referred to as: The International Council for Research and Innovation in Building and Construction)
CFC	Chlorofluorocarbon
CPD	Construction Product Directive
EC	European Commission
EPA-ED	Energy Performance Assessment of Existing Dwellings
EPBD	Energy Performance Building Directive
EPC	Energy Performance Certificate
EPRDM	Energy Performance Rating of Dwellings in Malta
ERDF	European Regional Development Fund
EU	European Union
FTS	Foundation for Tomorrow's Schools
GDP	Gross Domestic Product
GPP	Green Public Procurement
HA	Housing Authority
HCFC	Hydrochlorofluorocarbon
ICT	Information Communications Technology
IBPSA	International Building Performance Simulation Association
IPCC	Intergovernmental Panel on Climate Change
LEED	Leadership in Energy and Environmental Design
LOM	Laws Of Malta
MCAST	Malta College of Arts, Science and Technology
MEEREA	Malta Energy-Efficiency and Renewable Energy Association
MEPA	Malta Environment and Planning Authority
MRA	Malta Resources Authority
MRRA	Ministry for Resources and Rural Affairs
NGO	Non Governmental Organisation
NSO	National Statistics Office
ODZ	Outside Development Zone
OFEE	Office of the Federal Environmental Executive
ROI	Return On Investment
UNCED	United Nations Conference on Environment and Development
UNEP	United Nations Environment Programme

UOM	University of Malta
USEPA	United States Environment Protection Agency
VOC	Volatile Organic Compounds
WBCSD	World Business Council for Sustainable Development

CHAPTER 1

Introduction

Buildings, too, are children of Earth and Sun.

Frank Lloyd Wright
American Architect and Interior Designer
(1867 – 1959)

1.1 Background to the Study

Buildings and their construction are the principal elements of human settlements and are therefore directly linked to the livelihood of human kind. Consequently, constructing sustainable human settlements is vital for human and ecological well-being.[1]

A recent report published by the United Nations Environment Programme[2] states that, '[w]orldwide, 30-40% of all primary energy is used in buildings.'[3] The growth and evolution of world economies as well as populations, has increasingly induced stresses on land, natural resources and natural habitats. Undoubtedly, the building and construction industry contributed to the exploitation of the environment and its resources. Considering that '[a]part from agriculture, building is probably the largest single industry in the world,'[4] mitigation of environmental impacts from building construction, operation and demolition, needs to be constantly addressed.

The debate on increasing efforts to reduce buildings' energy demands is further compounded by the two-fold argument of whether one should promote the use of renewable energy sources as opposed to increasing support for energy conservation measures and practices. Thus, the risk may be that '[i]f we only concentrate on energy efficiency we could reduce the quality of life, but if we only concentrate on renewable energy we could end up using more energy.'[5] Even though energy efficiency and energy conservation are different concepts, they are related and consequently often confused. By consuming energy more efficiently, building occupants can get the same levels of indoor comfort by making use of devices, equipment or systems consuming less energy. Meanwhile, energy conservation relates to the various patterns of human action by which unnecessary energy use is avoided. The value of energy efficiency in buildings is enhanced and its implementation facilitated by a pre-existing ethic of energy

[1] Beyer, D. (2002) *Sustainable Building and Construction Implementing Green Building in Western Australia*. Degree of Bachelor of Science (Honours) in Sustainable Development at the Institute for Sustainability and Technology Policy (ISTP). Murdoch University. p. 3. [Online]. Available at: http://www.istp.murdoch.edu.au (Accessed: 25 July 2010)

[2] Hereafter referred to as "UNEP". UNEP is an organisation providing leadership and encouraging partnerships in caring for the environment by inspiring, informing, and enabling nations and peoples to improve their quality of life without compromising that of future generations. For further information on the UNEP, refer to [Online] http://www.unep.org (Accessed: 25 July 2010)

[3] UNEP, (2007) 'BUILDINGS AND CLIMATE CHANGE, Status, Challenges and Opportunities' *United Nations Environment Programme Report*, [Online]. Available at: http://www.inogate.org (Accessed: 25 July 2010)

[4] Fullerton, R.L. (1979) *Building Construction in Warm Climate.* 2nd edn. Oxford: Oxford University Press. Vol. 1, p. vii.

[5] Yousif, C. (2010) 'Increasing energy Security' *The Sunday Times.* February 28, p. 67.

conservation that may permeate a society, investors and governing authorities who are therefore more likely to prioritise energy efficiency investments if they believe that resources are valuable, limited and ought to be conserved.

Fostering positive attitudes towards green concepts and principles, and nourishing environmentally conscious societies is no easy feat since '[t]he entire history of shelter engineering reveals an unremitting effort by mankind to achieve as high a degree of indoor comfort as possible.'[6] However, there is a growing sense of urgency to address energy efficiency in buildings at all levels of the building and construction industry. This sense of urgency is reinforced by recent global issues, including but not limited to the oil / fuel crisis[7] and climate change.[8]

> Improving energy performance of buildings is a cost-effective way of fighting climate change and improving energy security, while also creating jobs. The issue is deemed crucial in Europe, so much that the EU [[9]] has issued a directive aimed at achieving 'zero energy buildings.'[10]

It is important to point out that while the green building debate is taking place on a worldwide level, it is considered to be more sensible to focus this work on legislative developments and green measures implemented locally and on an EU level. Key international organisations involved in this high-level discussion include the Intergovernmental Panel on Climate Change,[11] The Commission for Environmental Cooperation,[12] and The World Business Council for Sustainable Development.[13]

[6] Bansal N. K. *et al* (1994) *Passive Building Design.* The Netherlands: Elsevier Science B.V. p. 7.
[7] This is an issue that is being dealt with extensively in international and local media, and is being tackled by economists and other industry-related sectors. For further information, refer to [Online] http://www.oilcrisis.com/ (Accessed: 25 July 2010)
[8] For further information, refer to [Online] http://www.unep.org/climatechange/ (Accessed: 25 July 2010)
[9] EU refers to the European Union. The EU is an economic and political union of 27 member states which are located in Europe. Committed to regional integration, the EU was established by the Treaty of Maastricht in 1993 upon the foundations of the European Communities. For further information refer to [Online] http://europa.eu (Accessed: 26 July 2010)
[10] Xuereb, A. (2010) 'Towards energy performance buildings' *The Sunday Times*. Classified, June 6, p.1.
[11] Hereafter referred to as "IPCC". For further information on IPCC, refer to [Online] http://www.ipcc.ch/ (Accessed: 25 July 2010)
[12] Hereafter referred to as "CEC". For further information on CEC, refer to [Online] http://www.cec.org/ (Accessed: 25 July 2010)
[13] Hereafter referred to as "WBCSD". The WBCSD is a CEO-led, global association of some 200 companies dealing exclusively with business and sustainable development. The Council provides a platform for companies to explore sustainable development, share knowledge, experiences and best practices, and to advocate business positions on these issues in a variety of forums, working with governments, non-governmental and intergovernmental organizations. Members are drawn from more than 30 countries and 20 major industrial sectors. The Council also

Regardless of their diverse strategies, all their efforts are aimed at making the building and construction industry a more sustainable one.

1.2 Aims and Objectives

The underlying scope of this thesis is to provide an academic document for the purpose of furthering knowledge in the green building field within the Maltese context. Being such a new concept to the Maltese building industry and the Maltese citizens, this thesis evolves from the most elementary stage by defining a green building and the elements associated with its construction. All that follows is then founded on eight principal objectives:

- To analyse the development of green policies in Malta pertaining to building design and construction. Amongst others, this entails an in-depth analysis of the EU Directive on the Energy Performance of Buildings[14] (2002/91/EC) and the Leadership in Energy and Environmental Design[15] scheme, and discussing their relevance to the Maltese building industry;
- To discuss and debate the best way forward to ensure green building standards are rapidly developed, promoted, accepted and implemented;
- To investigate and discuss concrete green measures currently being implemented by the building and construction industry in Malta;
- To identify policy approaches implemented by both governmental entities and the private sector in Malta;
- To understand the opportunities inherent in each approach as well as the success of their implementation to date, and to identify the barriers to the adoption of green building standards and practices;
- To assess the applicability of these policy approaches, formulate concrete recommendations in order to develop a realistic and achievable policy pathway;

benefits from a global network of some 60 national and regional business councils and regional partners. For further information on WBCSD, refer to [Online] http://www.wbcsd.org (Accessed: 25 July 2010)

[14] This is the main legislative instrument at EU level to achieve energy performance in buildings. Under this Directive, the Member States must apply minimum requirements with regards to the energy performance of new and existing buildings, ensure the certification of their energy performance and require the regular inspection of boilers and air conditioning systems in buildings.

[15] Hereafter referred to as "LEED". In the United States and in a number of other countries around the world, LEED certification is the recognised standard for measuring building sustainability. The LEED green building rating system (developed and administered by the U.S. Green Building Council), is designed to promote design and construction practices that increase profitability while reducing the negative environmental impacts of buildings and improving occupant health and well-being.

- To increase awareness and to further promote education on environmental building and planning issues by presenting the findings of this research;
- To contribute in giving birth to a local green building movement, comprising the government, the private sector, Non-Governmental Organisations and civil society.

The ultimate aim of this study is to provide policy makers and stakeholders, in particular those related to the fields of building design and construction, a better picture of the past and the present with regards to the implementation of green policies in building development, and present a number of possible actions on which a strategic framework of policies could be developed to lessen Malta's energy demands, to prevent further degradation of natural resources, to meet current and future EU targets, and to promote the use of alternative energy sources.

1.3 Structure of the Study

This thesis is intended to give the reader a thorough understanding of the current status of the building and construction sector vis-à-vis the adoption of green principles and concepts. It investigates key elements of building and construction with the aim of determining the key strategies that, if implemented, would lead to the sector becoming more sustainable in Malta. It is important to note that the terms "sustainable" and "green" are used interchangeably throughout this thesis, as they are throughout the sector. Hence, both have equivalent meaning.

Realisation of each of the goals identified in the previous section is accomplished through the following four chapters. Chapter 2 lays out a theoretical argument for the role of laws and regulations, standards and codes in construction innovation and green building.

Building on the conceptualisation developed in Chapter 2, Chapter 3 focuses on the local perspective. The issue explored here is how to build upon existing initiatives, government and industry policy statements, in order to facilitate broader, deeper and lasting implementation. Whilst the main elements of sustainable building and construction remain the same, local climatic and geophysical conditions, and the structure of the local building industry necessitate an approach tailored to local issues of

design, construction and operation of buildings in Malta. This understanding shall be achieved through the feedback gathered from several interviews conducted with key personnel representing both public and private organisations within the local building industry.

Chapter 4 attempts to look at the challenges that the required change is facing. Having established this context, this chapter also looks at the various conflicts and limitations that exist or have emerged. Additionally, this section seeks to discuss issues and barriers, and responses and initiatives that are relevant to this sector within an institutional, organisational and management perspective and with which the industry must contend if it is to become more sustainable.

The final chapter synthesises this work by offering recommendations for practitioners and policy makers. This chapter also discusses how current initiatives might evolve and what a more comprehensive strategy pertaining to green buildings might include.

CHAPTER 2

Literature Review

The art of land doctoring is being practiced with vigor,
but the science of land health is yet to be born.

Aldo Leopold
American Ecologist and Environmentalist.
(1886 – 1948)

2.1 Introduction

Over the last years, the "green building movement" has gained momentum. There also seems to be a universal positive consensus on the environmental and social benefits of green buildings.[16]

Following the 1992 Rio Earth Summit[17] and the advent of Agenda 21,[18] part of the building and construction sector has taken up the challenge of sustainability to provide a more efficient, lasting and healthy product. In a report published by the International Council for Research and Innovation in Building and Construction,[19] it is stated that through its numerous and varied organisations and associations, '…the sector has systematically identified its negative impacts on environmental, social and human health and has since laid down sustainability strategies for all stages of the building and construction life-cycle.'[20]

This leap was assisted by legislative enactments enforced by governments and other regulatory bodies across the globe. In Malta, the green building concept was first entrenched into its system of laws following accession to the European Union[21] in 2004. This was done, primarily by means of the Energy Performance Building Directive (2002/91/EC)[22] of the European Parliament and of the Council of 16 December 2002, which was later transposed into the Laws of Malta by way of Legal Notice 261 of 2008.

[16] Acuff, Z. (2005) '*BUILDING GREEN FOR THE FUTURE, Case Studies of Sustainable Development in Michigan'*. University of Michigan, [Online]. Available at: http://www.epa.gov/P3/success/michigan.pdf (Accessed: 26 July 2010)

[17] United Nations Conference on Environment and Development (UNCED) held in 1992. For further information refer to [Online] http://www.un.org/esa/earthsummit/ (Accessed: 26 July 2010)

[18] A comprehensive plan of action to be taken globally, nationally and locally by organizations of the United Nations System, Governments, and Major Groups in every area in which human impacts on the environment. Agenda 21, the Rio Declaration on Environment and Development, and the Statement of principles for the Sustainable Management of Forests were adopted by more than 178 Governments at the UNCED held in Rio de Janeiro, Brazil, 3 to 14 June 1992. For further information refer to [Online] http://www.un.org/esa/dsd/agenda21/index.shtml (Accessed: 26 July 2010)

[19] Hereafter referred to as "CIB". CIB is the leading international organisation for research and collaboration in building and construction. Its purpose is to provide a global network for international exchange and cooperation in research and innovation in building and construction, in support of an improved building process and of improved performance of the built environment. For further information refer to [Online] http://www.cibworld.nl (Accessed: 26 July 2010)

[20] Refer to Acuff.

[21] Hereafter referred to as "EU". The EU is an economic and political union of 27 member states which are located in Europe. Committed to regional integration, the EU was established by the Treaty of Maastricht in 1993 upon the foundations of the European Communities. For further information refer to [Online] http://europa.eu (Accessed: 26 July 2010)

[22] Hereafter referred to as "EPBD". This directive shall be discussed in further detail in Sub-Section 2.4.2

Additionally, over the last decades, a number of tools have been developed to provide building designers, owners, and users to review and improve the environmental performance of a building throughout its life span. Notably, a pioneering voluntary measurement rating system for green buildings was established in 1990 in the United Kingdom by the Building Research Establishment[23] referred to as the BRE Environmental Assessment Method.[24]

Meanwhile, in the United States, the Green Building Council[25] was founded in 1993 with its main purpose being that of driving the change of sustainability in the construction and development of buildings. In fact, in the year 2000, the Leadership in Energy and Environmental Design[26] was launched to encourage the adoption of sustainable green building and development practices.[27] The LEED rating scheme has also been implemented on two major projects currently being undertaken in Malta, both of which shall be discussed in detail in Chapter 3.

These regulatory policies and programmes, coupled with the rapid developments in information technology brought about the development of cutting edge computer simulation software to help engineers and architects assess the performance of residential and commercial buildings. The demand for simulation packages to suit such applications has grown internationally and has subsequently given birth to a new breed of building professionals; a combination of architects, engineers and software specialists.[28]

[23] Hereafter referred to as "BRE". The BRE is a former UK government establishment (but now a private organisation), funded by the building industry that carries out research, consultancy and testing for the construction and built environment sectors in the United Kingdom.
[24] Hereafter referred to as "BREEAM". BREEAM was established in 1990 as a tool to measure the sustainability of new non-domestic buildings in the United Kingdom. It has been updated regularly in line with UK building regulations and has undergone a significant revamp in 2008. For further information refer to [Online] Available at: http://www.breeam.org (Accessed: 1 August 2010)
[25] Hereafter referred to as "USGBC". For further information refer to [Online] http://www.usgbc.org/ (Accessed: 26 July 2010)
[26] Hereafter referred to as "LEED". For further information refer to [Online] http://www.leed.net/ (Accessed: 26 July 2010)
[27] Zigenfus, R. E. (2008) *Element Analysis of the Green Building Process.* Masters of Science in Environmental, Health & Safety Management. Rochester Institute of Technology. [Online] Available at: https://ritdml.rit.edu/bitstream/handle/1850/8040/RZigenfusThesis11-2008.pdf?sequence=1 (Accessed: 26 July 2010)
[28] Spiteri, C. (2010) 'Innovation, creativity and sustainability', *Engineering Today,* 35, March, p. 21.

2.2 Overview of Green Buildings

2.2.1 What is a Green Building?

An important concept in approaching this thesis is defining a green building. Definitions as to what makes a building green are varied and therefore need framing within a particular context to hold a specific meaning. Nevertheless, a broad agreement exists as to what binds the environmental, social and economic elements.

The Office of the Federal Environmental Executive[29] defines a green building as the practice of:

> …increasing the efficiency with which buildings and their sites use energy, water, and materials, and reducing building impacts on human health and the environment, through better siting, design, construction, operation, maintenance, and removal of the complete building life cycle.[30]

Green buildings use resources and land more efficiently and effectively than buildings that are simply built to code. Developers and builders create healthier working, learning and living environments by putting into practice green principles and concepts.

In his book "The Green Building Revolution," Jerry Yudelson,[31] a prominent leader in the green building world, describes a green building as, '…a high-performance property that considers and reduces its impact on the environment and human health.'[32] Though similar to a green building, a high-performance building's ultimate aim is to be energy efficient. Thus, '[h]igh-performance buildings and their design are an all-inclusive philosophy taking into consideration the interaction of the whole building structure and systems.'[33]

[29] Hereafter referred to as "OFEE". The OFEE is responsible for promoting sustainability and environmental stewardship throughout Federal government operations. Created by Executive Order in 1993, the Office is housed at the President's Council on Environmental Quality, is administered by EPA, and stewards the interagency Steering Committee on Federal Sustainability. For further information refer to [Online] Available at: http://www.ofee.gov/about.asp (Accessed: 26 July 2010)

[30] Howard, J. L. (2009) *The Federal Commitment to Green Building: Experiences and Expectations*, Office of the Federal Environmental Executive. [Online] Available at: http://www.p2pays.org/ref/41/40912.pdf (Accessed: 26 July 2010)

[31] Founder of a green building consultancy firm called 'Yudelson Associates'. Yudelson is an author of eleven green building books and was chairman of the Greenbuild between 2004 and 2009.

[32] Yudelson, J. (2008) *The Green Building Revolution*. Washington. Island Press.

[33] Refer to Zigenfus, p. 9.

"Green", sometimes even referred to as "sustainable" buildings are sensitive to:[34]

- Environment
- Natural resources
- Impact on people
- Financial impact
- The world at large

In view of the vulnerability of the above elements to building developments and its responsibility for protecting human health and the environment, the United States Environmental Protection Agency[35] supports the green building initiative and describes this concept as:

> …the practice of creating structures and using processes that are environmentally responsible and resource-efficient **throughout a building's life-cycle from siting to design, construction, operation, maintenance, renovation and deconstruction.** This practice expands and complements the classical building design concerns of economy, utility, durability, and comfort.[36]

Despite the numerous definitions that have evolved as to what constitutes a green building, the widely-accepted underlying principle of any definition remains that of sustainability[37] and high performance in the built environment.

[34] Kast, G. (2003) *The Costs and Financial Benefits of Green Buildings*, A Report to California's Sustainable Building Task Force. [Online] Available at: http://evanmills.lbl.gov/pubs/pdf/green_buildings.pdf (Accessed: 26 July 2010)

[35] Hereafter referred to as "USEPA". USEPA is an agency of the federal government of the United States charged with protecting human health and the environment, by writing and enforcing regulations based on laws passed by Congress. The EPA was proposed by President Richard Nixon and began operation on December 2, 1970. For further information refer to [Online] Available at: http://www.epa.gov/ (Accessed: 26 July 2010)

[36] *United States Environmental Protection Agency.* Available at: http://www.epa.gov/greenbuilding/pubs/about.htm (Accessed: 26 July 2010) [Emphasis added].

[37] Sustainability is defined as 'Development that meets the needs of the present without compromising the ability of future generations to meet their own needs'. This definition was created in 1987 at the World Commission on Environment and Development (the Brundtland Commission). It is enshrined in the Swiss federal constitution. It is similar to the "seventh generation" philosophy of the Native American Iroquois Confederacy, mandating that chiefs always consider the effects of their actions on their descendants seven generations in the future. For further information refer to [Online] Available at: http://sustainabilitydictionary.com/ (Accessed: 27 July 2010)

2.2.2 Why Green?

From the early stages of siting and construction through operation, maintenance, renovation, to demolition, buildings impact many aspects of the environment.[38] Green building involves minimising these negative environmental and human health impacts, thereby pursuing a commitment in achieving positive results throughout the building's entire life cycle. In addition to environmental benefits, green buildings can be constructed at the same or at even lower costs than conventional buildings.[39] Potential benefits of a green building may include:[40]

- Environmental benefits
    - Enhance and protect biodiversity and ecosystems
    - Improve air and water quality
    - Reduce waste streams
    - Conserve and restore natural resources
- Economic benefits
    - Reduce operating costs
    - Create, expand, and shape markets for green product and services
    - Improve occupant productivity
    - Optimise life-cycle economic performance
- Social benefits
    - Enhance occupant comfort and health
    - Improve aesthetic qualities
    - Minimise strain on local infrastructure
    - Improve overall quality of life

Each of these benefits shall be discussed in further detail in Section 4.4.

2.2.3 Elements of a Green Building

Earmarking each of the elements used in making a green structure or build is an essential part of determining the benefits of sustainable building.[41] An "Element" is

[38] Refer to Howard.
[39] *Ibid.*
[40] USEPA. [Online] Available at: http://www.epa.gov/greenbuilding/pubs/about.htm (Accessed: 26 July 2010).
[41] Refer to Zigenfus, p. 2.

defined as '…the practice and use of construction principles that make a building efficient with regard to the use of resources.'[42]

The number of elements attributed to a green building may differ from one assessment (or rating) scheme to another. However, the underlying principles and criteria tend to be the same irrespective of the specific ratings agency.[43] The LEED rating system addresses eight major elements or categories:[44]

- Location and Planning
- Sustainable Sites
- Water Efficiency
- Energy and Atmosphere
- Materials and Resources
- Indoor Environmental Quality
- Innovation and Design Process
- Regional Priority

Each of the above categories, including the principles underlying the LEED system, will be examined in further detail in Sub-Section 2.5.1. Despite having been formally identified in modern times, building elements have been explored and investigated in early historical periods as shall be discussed further in Section 2.3.

2.3 Early Green Buildings Concepts

During the reign of the Knights of St. John[45] and British Rule,[46] many green building concepts emerged in pursuit of constructing well lit and ventilated buildings and with adequate water resources. In view of Malta's warm and humid climatic conditions,

[42] *Ibid.*
[43] Shalley, M. J. (2008) Property Tax Symposium: Green Buildings: A New Paradigm in Real Estate. 2nd – 5th November. Texas: Institute for Professionals in Taxation. [Online] Available at: http://www.property-tax.com (Accessed: 27 July 2010)
[44] LEED. [Online] Available at: http://www.leed.net/ (Accessed: 26 July 2010)
[45] The Knights Hospitaller is a Christian organization that began as an Amalfitan hospital founded in Jerusalem in approximately 1023 to provide care for poor, sick or injured pilgrims to the Holy Land. After the Western Christian conquest of Jerusalem in 1099 during the First Crusade, it became a religious/military order under its own charter, and was charged with the care and defence of the Holy Land. Following the conquest of the Holy Land by Islamic forces, the Order operated from Rhodes, over which it was sovereign and later from Malta where it administered a vassal state under the Spanish viceroy of Sicily. Malta was ruled by the Order of the Knights of St. John between 1530 and 1798.
[46] Malta was ruled by Great Britain between 1800 and 1979.

concrete measures were taken in order to address three main building elements; use of natural ventilation and natural sunlight, and rainwater harvesting.

Such innovative concepts are still evident in many buildings[47] around the Maltese islands, these being primarily situated in rural towns and villages. On a larger scale, government buildings, particularly those in Valletta, boast numerous examples of green construction principles.

Maximising the use of natural ventilation so as to minimise the reliance on forced mechanical environmental control systems was achieved by employing a number of building construction concepts, including but not limited to:

- Having adequate shafts at the rear of the building to permit natural draught to flow from the front to the aft of the building.
- Having roofed porches or corridors surrounding either the exterior parts of the building, and/or an internal courtyard. This principle also permitted natural light to infiltrate the rooms encompassed by the building.
- High ceilings permitted cool stable temperatures within the building. Storeys built on fifteen courses of Maltese stone, was a common practice as opposed to the ten / nine courses employed in modern building construction.

The *'persjana'*, comprising a series of horizontal louvers, usually made from solid wooden members, permitted the penetration of sufficient amounts of natural light whilst avoiding heat-gains within the building. This concept is still being employed in contemporary building architecture however using other materials such as aluminum and polymer-based materials.

With regards to water conservation the Knights had introduced the first legislation regarding the harvesting of water, including the building of cisterns.[48] Smart water catchment systems were designed to optimise water harvesting from roofs, terraces and yards.

[47] Mainly "Town Houses" and "Houses of Character".
[48] (2010) 'Waste water treatment plants - No sense in having new infrastructure', *The Times.* 23 June [Online] Available at: http://www.timesofmalta.com.mt (Accessed: 1 August 2010)

It is important to mention that buildings featuring such avant-garde concepts are now being restored to their original glory.[49] Thanks to adequate laws and enforcement structures, such innovative treasures are preserved to maintain their use and benefits for future generations.

2.4 Legal and Regulatory Frameworks

2.4.1 Developments in Local Building Laws and Regulations

The advent of local building laws and regulations dates back to 1854 with the establishment of the Code of Police Laws[50] that incorporated specific clauses pertaining to 'Inhabited Areas, Houses and other Tenements.'[51] It is important to note that such legislation had incorporated a set of rules and guidelines regulating 'green concepts', such as the requirement of a cistern for each dwelling.[52]

In general, building developments in Malta have to adhere to a set of standard rules dictated by standing legislation, some of which were established under British rule. The main legislation that governs building activity in Malta are the following:

- Sanitary Laws of Malta of 1936[53]
- The Planning Act of 1992[54]
- Legal Notice 261 of 2008 bringing into effect the Energy Performance Building Directive (2002/91/EC)[55]
- Building Regulations, 2006, Document F[56]

Being a member of the EU, Malta is obliged to transpose EU directives and regulations pertaining to improved building efficiency, construction waste reduction and recycling

[49] MEPA has issued a set of guidelines for preserving such features. For further information refer to 'Urban Conservation Areas Design Guidance' [Online] Available at: www.mepa.org.mt (Accessed: 1 August 2010)
[50] Chapter 10 Laws of Malta ("LOM"). All the laws of Malta are available online in the English language (the English language being an official language of Malta) at http://www2.justice.gov.mt (Accessed: 27 July 2010)
[51] Chapter 10 of LOM, hereafter referred to as the "CPL". For further information see articles 95 – 134 of the CPL.
[52] Article 97 (n)(viii) of the CPL states that "every house shall also have a cistern in good condition, of a capacity of at least three cubic metres, for every five square metres of the surface of the floor of each room of such house".
[53] Chapter 10 of LOM.
[54] This act had established the setting up of the Planning Authority, now revamped and incorporating an Environment monitoring unit, renamed as the Malta Environment & Planning Authority (MEPA). All building permits issued have a standard set of conditions which over rule any legal notices, such as the use of stone on facades. Other conditions are tailored to the site and according to the nature of the project or proposed development. For further information refer to [Online] http://www.mepa.org.mt/home (Accessed: 27 July 2010)
[55] This directive shall be discussed further in Section 2.3.2.
[56] Services Division; Building Regulations Office (2006) *Document F – Conservation of Fuel, Energy and Natural Resources (Minimum Requirements on the Energy Performance of Building)* [Online] Available at: https://secure2.gov.mt/epc/home (Accessed: 27 July 2010)

etc. into its system of laws. Examples include the Construction Product Directive[57] and the Water Framework Directive.[58] Within its strategy for sustainable development,[59] the European Union has set clear targets to mitigate adverse impacts on the environment and ecological systems resulting from building construction, operation and demolition.

2.4.2 The Energy Performance Building Directive and Recast

Environmental protection and sustainable development are areas of major interest to the EU. The Maastricht Treaty[60] had wide ranging implications for the future practice of building design and architecture. The Treaty contains the statement that one of the tasks of the European Commission[61] is the promotion of 'sustainable and non-inflationary growth respecting the environment.'[62]

Prior to the Treaty, the EC's Green Paper[63] on the Urban Environment, published in 1990, was a turning point in environmental awakening. It was primarily concerned with establishing the broad framework for effective community action on a wide range of environmental problems. The Green Paper listed seven important areas of action or policy changes to facilitate the transition necessary in European cities. One of the key areas identified was Energy Consumption. Two main fields were addressed in this area,

[57] Hereafter referred to as "CPD". The CPD (89/106/EEC) asks the Member States to take all necessary measures to ensure that construction products, which are intended for use in works, may be placed on the market only if they are fit for this intended use, that is to say they have such characteristics that the works in which they are to be incorporated, assembled, applied or installed, can, if properly designed and built, satisfy the essential requirements. For further information refer to [Online] http://eur-lex.europa.eu/RECH_naturel.do (Accessed: 31 July 2010)

[58] The Water Framework Directive (2000/60/EC, amended by 2001/2455/EC) is to establish a framework for the protection of inland surface waters, transitional waters, coastal waters and groundwater, which among others, ensures the progressive reduction of pollution of groundwater and prevents its further pollution. For further information refer to [Online] Available at: http://eur-lex.europa.eu/RECH_naturel.do (Accessed: 31 July 2010)

[59] Council for the European Union (2006) *RENEWED EU SUSTAINABLE DEVELOPMENT STRATEGY* [Online] Available at: http://register.consilium.europa.eu (Accessed: 31 July 2010)

[60] The Treaty of Maastricht (formally, the Treaty on European Union), was signed on 7 February 1992 by the members of the European Community in Maastricht, the Netherlands. The treaty led to the creation of the euro currency, and created what is commonly referred to as the pillar structure of the European Union. For further information refer to [Online] http://europa.eu/ (Accessed: 31 July 2010)

[61] Hereafter referred to as "EC". The EC is the executive body of the European Union. The body is responsible for proposing legislation, implementing decisions, upholding the Union's treaties and the general day-to-day running of the Union. For further information refer to [Online] http://ec.europa.eu (Accessed: 31 July 2010)

[62] Wilkinson, D. (1992) 'Maastricht and the Environment' *Journal of Environmental Law*, Vol 4, No.2, p. 233

[63] A green paper released by the EC is a discussion document intended to stimulate debate and launch a process of consultation, at European level, on a particular topic. A green paper usually presents a range of ideas and is meant to invite interested individuals or organizations to contribute views and information. It may be followed by a white paper, an official set of proposals that is used as a vehicle for their development into law. For further information on the Green Paper on the Urban Environment published on 27 June 1990, refer to [Online] http://aei.pitt.edu/1205/ (Accessed: 31 July 2010)

one of them being the 'building design of both new and existing buildings and urban energy planning.'[64]

In 2002, the EU adopted the Energy Performance of Buildings Directive, which set minimum efficiency standards for both residential and commercial buildings. Member States were obliged to implement the provisions of the Directive in 2006, but most decided to delay transposition until January 2009 due to a lack of qualified independent experts. The EC started infringement procedures against several countries that had failed to introduce adequate measures.

The EPBD of 2002 was formulated '…on the basis of previously established EU directives [[65]] that recommended measures for more rational energy consumption, construction products and the proper use of appliances.'[66] It was designed to reduce emissions and help Member States meet their targets under the Kyoto Protocol.[67] Minimising energy waste in a sector that covers almost 40% of the Union's energy demand was seen as a crucial element in reducing Europe's dependence on foreign fossil fuel imports.[68]

The directive provided a common methodology for calculating the energy performance of buildings and obliged Member States to draw up minimum standards. These were to be applied to all new buildings and to existing buildings with a usable floor area above 1,000 square metres when they undergo a major renovation.[69]

The EU took an integrated approach to calculating efficiency standards. This extends beyond insulation to aspects like heating and cooling, and heat recovery and lighting installations. As a result, regular inspections of boilers and central air-conditioning

[64] Edwards, B. (1999) *SUSTAINABLE ARCHITECTURE EUROPEAN DIRECTIVES & BUILDING DESIGN*. 2nd edn. Oxford: Reed Educational and Professional Publishing Ltd.
[65] The previously established EU directives included; the SAVE Directive (93/76/EC), the Construction Products directive (89/106/EEC), and the Boiler Directive (92/42/EC). For further information on each of these directives, refer to [Online] http://eur-lex.europa.eu/RECH_naturel.do (Accessed: 31 July 2010)
[66] Buhagiar, C. (2006) *The Energy Performance of Building Directive (EPBD): Its Implementation in Malta*. Degree of Bachelor of Engineering and Architecture. University of Malta.
[67] The Kyoto Protocol to the United Nations Framework Convention on Climate Change strengthens the international response to climate change. Adopted by consensus at the third session of the Conference of the Parties (COP3) in December 1997, it contains legally binding emissions targets for Annex I (developed) countries for the post-2000 period. The EU and its Member States ratified the Kyoto Protocol in late May 2002. For further information, refer to [Online] http://unfccc.int/resource/docs (Accessed: 31 July 2010)
[68] [Online] Available at: http://eur-lex.europa.eu/RECH_naturel.do (Accessed: 31 July 2010)
[69] EPBD (2002/91/EC). Article 5

systems and assessments of heating installations that include boilers more than 15 years old were made mandatory.[70]

To promote greater public awareness and debate on energy savings in buildings, the directive introduced an energy performance certificate,[71] which has to be made available each time a house is built, sold or rented out.[72]

Although EU building legislation has introduced energy savings from buildings into national political debates, the expected energy savings have been delayed by insufficient workforces and lack of ambition. The implementation of the directive first encountered problems due to the lack of qualified experts to issue certificates and carry out inspections. Moreover, the directive excluded a large segment of existing building stock from having to comply with energy performance standards by imposing the 1,000 square metre threshold.

In order to rectify these shortcomings, the Commission proposed a revamp of the 2002 directive as part of its Second Strategic Energy Review[73] in November 2008. The EU executive expects the overhaul to bring the bloc's energy consumption down by 5-6%, consequently reducing carbon dioxide emissions by 5% by 2020.[74]

On 19 May 2010, a recast[75] of the Energy Performance of Buildings Directive was adopted by the European Parliament and the Council of the European Union in order to strengthen the energy performance requirements and to clarify some of the provisions from the 2002 Directive it replaces. The recast proposal confirms the importance of effective implementation at the Member State level, the importance of Community-wide co-operation and the strong long-term commitment and role of the Commission itself to support such effective implementation.[76]

[70] EPBD (2002/91/EC). Article 8
[71] Hereafter referred to as "EPC". An EPC of a building is a certificate recognised by the Member State or a legal person designated by it, which includes the energy performance of a building calculated according to a specific methodology. An example of an EPC is shown in Appendix A.
[72] EPBD (2002/91/EC). Article 7
[73] For further information refer to [Online] http://ec.europa.eu/energy/strategies/ (Accessed: 31 July 2010)
[74] *Ibid.*
[75] Directive (2010/31/EU) of the European Parliament and of The Council of 19 May 2010 on the energy performance of buildings. [Online] Available at: http://eur-lex.europa.eu/RECH_naturel.do (Accessed: 31 July 2010)
[76] [Online] Available at: http://eur-lex.europa.eu/RECH_naturel.do (Accessed: 31 July 2010)

The European Parliament has adopted a strict stance on the recast, amending the proposal by adding a condition that new buildings constructed as of 2019 would have to be 'zero-energy.'[77] All new buildings would consequently produce their own energy using renewable energies like solar panels while minimising energy loss with better insulation, double-glazing and similar measures.

Within the local context, all of these developments in EU legislation will pose increased challenges to all those working in the building sector. This is why:

> …new buildings will also be required to have high-energy saving standards. This means **the Maltese will have to re-think the methods used to build residences and other edifices.**[78]

2.4.3 Minimum Requirements on the Energy Performance Of Building Regulations

The Minimum Requirements on the Energy Performance of Buildings, often referred to as the Technical Guidance Document F,[79] applies to new buildings and existing buildings that undergo major renovation or alteration, whose building permit applications in terms of the Development Permission Regulations[80] of 1992, had been received by the Malta Environment and Planning Authority on or after the 2nd January of 2007.

The document aims to guide and assist building designers, architects and all others involved in the building construction industry to implement green measures. The document is written both as a reference and as an instructional guide. The regulations require that:

[77] A 'zero-energy' building means a building that has a very high energy performance. The nearly zero or very low amount of energy required should be covered to a very significant extent by energy from renewable sources, including energy from renewable sources produced on-site or nearby.
[78] Emphasis added. Camilleri, I (2009) 'Our dream homes will have to be green' *The Times.* November 30, p. 1.
[79] Services Division; Building Regulations Office (2006) *Document F – Conservation of Fuel, Energy and Natural Resources (Minimum Requirements on the Energy Performance of Building)* [Online] Available at: https://secure2.gov.mt/epc/home (Accessed: 31 July 2010)
[80] L.N. 133 of 1992 Article 3(1) [Online] Available at: http://www2.justice.gov.mt (Accessed: 31 July 2010)

> [a] building shall be so designed and constructed as to secure, insofar as is reasonably practicable, the conservation of fuel, energy and other natural resources.[81]

With regards to the control of heat, power and lighting, the regulations stipulate the following:[82]

- Limiting the heat loss in winter and the heat gain in summer through the fabric of the building,
- Controlling the operation of the space heating, and hot water systems,
- Controlling the operation of the space cooling systems,
- Limiting the energy loss from water storage vessels and water service pipe work,
- Limiting the energy loss or gain from water pipes and air ducts used for space heating and cooling,
- Installing artificial lighting systems that use no more fuel and power than is reasonable in the circumstances and making reasonable provisions for controlling such systems,
- Providing sufficient information with the heating and cooling services so that building occupiers can operate and maintain the services in such a manner as to use no more energy than is reasonable in the circumstances.

The document tabulates U-values[83] for a wide range of materials used by the local building industry and also gives a detailed explanation on how to calculate U-values by considering the effect of thermal bridges in addition to other factors, such as wall ties and air gaps.

2.4.4 Energy Performance Certificate

The EPBD requirement vis-à-vis Energy Performance Certificates,[84] offers great scope for combination with other policy instruments. Local entities implementing policies and

[81] Services Division; Building Regulations Office (2006) *Document F – Conservation of Fuel, Energy and Natural Resources (Minimum Requirements on the Energy Performance of Building)* [Online] Available at: https://secure2.gov.mt/epc/home (Accessed: 31 July 2010)
[82] *Ibid.*
[83] The U-value (or U-factor), more correctly called the overall heat transfer coefficient, describes how well a building element conducts heat. It measures the rate of heat transfer through a building element over a given area, under standardised conditions.
[84] An example of an EPC is shown in Appendix A.

programmes should place greater emphasis on this, as part of a European effort to capitalise on the considerable energy-saving potential in buildings. The European dimension should involve setting strategic objectives, which oblige and also support implementing parties to analyse and address barriers, and monitor the results.

Article 7 of the EPBD states that:

> Member States shall ensure that, when buildings are constructed, sold or rented out, an energy performance certificate is made available to the owner or by the owner to the prospective buyer or tenant, as the case might be. The validity of the certificate shall not exceed 10 years.[85]

The EPC for buildings should include reference values such as current legal standards and benchmarks in order to make it possible for consumers to compare and assess the energy performance of the building, display an indication of current carbon dioxide emissions, provide an indication of potential emissions on an annual basis and also the potential energy use of the building. The certificate must also include any recommendations for the cost-effective improvement of energy performance.[86]

Meanwhile, the recast directive published in 2010 went a step further in specifying certain elements of an EPC, in that the certificate:

> …**may** include additional information such as the annual energy consumption for non-residential buildings and the percentage of energy from renewable sources in the total energy consumption.[87]

As explained earlier in the introduction to this chapter, the EPBD and hence the guidelines governing the issuing of an EPC, was transposed into local legislation by

[85] Directive (2002/91/EC) Article 7(1) of the European Parliament and of The Council of 16 December 2002 on the energy performance of buildings. [Online] Available at: http://eur-lex.europa.eu/RECH_naturel.do (Accessed: 31 July 2010)
[86] Directive (2002/91/EC) Article 7(2) of the European Parliament and of The Council of 16 December 2002 on the energy performance of buildings. [Online] Available at: http://eur-lex.europa.eu/RECH_naturel.do (Accessed: 31 July 2010)
[87] Emphasis added. Directive (2010/31/EU) Article 11(1) of the European Parliament and of The Council of 19 May 2010 on the energy performance of buildings. [Online] Available at: http://eur-lex.europa.eu/RECH_naturel.do (Accessed: 31 July 2010)

way of Legal Notice 281 of 2008. In the case for Malta, the EPC is only valid if obtained from an independent assessor and registered with the Malta Resources Authority[88] before being issued to the person who commissions it.[89]

2.5 Assessing Building Performance

Performance measurement and environmental assessment of buildings have attracted intensive research during the last decade. This is mainly attributed to the fact that the life-cycle of buildings, i.e.: design, construction, operation, and demolition, are highly resource and energy-intensive. Environmental assessment methods provide a basis to certify buildings in terms of environmentally sound design and occupation.

Building Performance Evaluation[90] is an innovative approach to the planning, design and occupancy of buildings. It is based on feedback and evaluation at every step of the building process.[91] The overall procedure to assess the performance of a building includes three phases conducted in the following order:[92]

- data collection
- detailed investigation
- final building classification

With regards to the Energy Performance Assessment of Existing Dwellings,[93] the method entails a complete consultancy process suitable for issuing an EPC for existing houses or apartment buildings, based on a set of tools that can be easily certified.[94] The available tools enable the assessor[95] to audit and assess a dwelling or an entire building

[88] Hereafter referred to as "MRA". The MRA is a public corporate body with regulatory responsibilities relating to water, energy and mineral resources in the Maltese Islands. It was set up by the Maltese Parliament through the Malta Resources Authority Act of 2000. The MRA has wide ranging responsibilities essentially involving regulation of water and energy utilities, industrial enterprises exploiting resources such as oil exploration, quarry operators and private abstractors of groundwater, retailers, operators and tradesmen in the regulated sectors.
[89] L.N. 261 of 2008. Article 9(2) [Online] Available at: http://www2.justice.gov.mt (Accessed: 31 July 2010)
[90] Hereafter referred to as "BPE".
[91] Preiser, W. *et al* (2005) *Assessing Building Performance.* Oxford: Elsevier.
[92] [Online] Available at: http://hope.epfl.ch/results/results (Accessed: 1 August 2010)
[93] Hereafter referred to as "EPA-ED". The EPA-ED project has resulted in an Energy Performance Assessment method for existing dwellings that can easily be applied in all the European member states. In addition, crucial implementation issues are addressed by a number of reports and brochures directed to policy makers. The method consists of a number of practical tools including a calculation model.
[94] European Policy on Energy Performance Assessment of Existing Dwellings [Online] Available at: http://www.epa-ed.org (Accessed: 1 August 2010)
[95] In Malta, to become an EPB assessor, a person must be duly registered with the Malta Resources Authority. Such person is to be in possession of a degree in either architecture or building services or mechanical or electrical engineering conferred by the University of Malta or an equivalent degree and who has successfully undergone a period of training on using software packages for assessing the efficiency of air-conditioning, space cooling and ventilation systems, and such training is approved by the Authority. Training courses are organised by the Building

in a uniform way. The assessor is then supported to provide homeowners with a client tailored advice for energy conservation measures that can improve energy performance by installing thermal insulation, double glazing, high-efficiency boilers or air conditioners, active solar systems etc.

The EPA-ED calculation model is the core of the available tools, and can be used to calculate the energy consumption of an existing dwelling or residential building and identifies potential energy-saving measures (based on cost-effectiveness) related to the building. After selecting suitable energy-saving measures, the software calculates the new energy consumption based on the actual energy consumption of the occupants, including the investments, savings, carbon dioxide emission reduction and annual savings on energy costs.

2.5.1 United States Green Building Council (USGBC) and Leadership in Energy and Environmental Design Rating System (LEED)

The United States Green Building Council, a national non-profit entity, was created to promote the design and construction of buildings that are environmentally responsible, profitable, and healthy places to live and work.[96] The council's efforts are focused on integrating building industry sectors and leading a market transformation towards greener construction. The organisation consists of various trade associations, architects, designers, and individuals all interested in the greening of the construction business.[97]

The USGBC created and maintains the Leadership in Energy and Environmental Design[98] Green Building Rating System, the emerging national standard for high-performance, sustainable buildings. LEED provides building owners and operators a concise framework for identifying and implementing practical and measurable green building design, construction, operations and maintenance solutions.[99] New and existing commercial, institutional, and high-rise residential buildings are rated according to their environmental attributes and sustainable features.[100]

Regulations Office within the Ministry for Resources and Rural Affairs. A copy of the Training Programme is shown in Appendix B.

[96] USGBC [Online] Available at: http://www.usgbc.org/ (Accessed: 31 July 2010)

[97] *Ibid.*

[98] LEED [Online] http://www.leed.net/ (Accessed: 31 July 2010)

[99] *Ibid.*

[100] Refer to Kast.

Buildings are classified as Certified, Silver, Gold, or Platinum[101] depending upon the number of points they acquire within the eight building components earmarked earlier in Sub-Section 2.2.3. Within each of these categories, there are a specific number of credits available via many subcategories, some of which are earmarked in the list below:[102]

- Sustainable Sites
  - Construction Activity Pollution Prevention
  - Site Selection
  - Development Density and Community Connectivity
  - Alternative Transportation: Public Transportation Access
  - Alternative Transportation: Bicycle Storage and Changing Rooms
  - Alternative Transportation: Low-Emitting and Fuel Efficient Vehicles
  - Alternative Transportation: Parking Capacity
  - Site Development: Protect or Restore Habitat
  - Site Development: Maximize Open Space
  - Storm water Management: Quantity Control
  - Light Pollution Reduction

- Water Efficiency
  - Water Efficient Landscaping
  - Innovative Wastewater Technologies
  - Water Use Reduction

- Energy and Atmosphere
  - Fundamental Commissioning of the Building Energy Systems
  - Minimum Energy Performance
  - Fundamental Refrigerant Management
  - Optimize Energy Performance
  - On-Site Renewable Energy
  - Enhanced Commissioning
  - Enhanced Refrigerant Management
  - Measurement and Verification

[101] LEED [Online] http://www.leed.net/ (Accessed: 31 July 2010)
[102] [Online] Available at: http://leedonline.usgbc.org/Project/Scorecard.aspx (Accessed: 21 August 2010)

- Green Power

- Materials and Resources
  - Storage and Collection of Recyclables
  - Building Reuse
  - Construction Waste Management
  - Resource Reuse
  - Recycled Content
  - Regional Materials
  - Rapidly Renewable Materials
  - Certified Wood

- Indoor Environmental Quality
  - Outdoor Air Delivery Monitoring
  - Increased Ventilation
  - Low-Emitting Materials: Adhesives and Sealants
  - Low-Emitting Materials: Paints and Coatings
  - Low-Emitting Materials: Carpet Systems
  - Indoor Chemical and Pollutant Source Control
  - Controllability of Systems: Lighting
  - Controllability of Systems: Thermal Comfort
  - Thermal Comfort: Design
  - Thermal Comfort: Verification

- Innovation and Design Process
  - Innovation in Design
  - LEED Accredited Professional

LEED is not the only certification standard[103] available for sustainable buildings, but it is the most common and covers the widest range of building types. However, LEED has often been criticised for the following two major reasons:[104]

- It focuses primarily on the structure and does not do enough to encourage "smart growth,"[105] and
- The points-system drives people to focus on "winning" points for the sake of getting points instead of emphasising the importance of the underlying green objectives.

2.5.2 Building Research Establishment Environmental Assessment Method (BREEAM)

The Buildings Research Establishment's Environmental Assessment Method[106] is the UK's leading and most widely used environmental assessment method for buildings and has become the leading UK standard.[107] Developed in the early 1990s, BREEAM is based on many years of construction and environmental research and validated by input from the construction and property industries, government and building regulators.[108]

Although it is a voluntary standard, the energy performance assessment adopts the U.K. Building Regulation as a benchmark to rate the level of performance improvement. Similar to the LEED rating system described earlier in Sub-Section 2.5.1, BREEAM defines categories of credits according to the building impact on the environment including management, health and wellbeing, energy, transport, water, materials, waste, land use, ecology and pollution.[109] The total score is calculated based on the credits available, number of credits achieved for each category, and a weighting factor.[110]

[103] Another popular green building rating system is "Green Star". Green Star is a voluntary environmental rating system for buildings in Australia. It was launched in 2003 by the Green Building Council of Australia. The system considers a broad range of practices for reducing the environmental impact of buildings and to showcase innovation in sustainable building practices, while also considering occupant health and productivity and cost savings. For further information refer to [Online] http://www.gbca.org.au/ (Accessed: 31 July 2010).
[104] Refer to Acuff.
[105] Smart Growth is an urban planning and transportation theory that concentrates growth in infill sites within the existing infrastructure of a city or town to avoid urban sprawl; and advocates compact, transit-oriented development, walkable, bicycle-friendly land use, including mixed-use development with a range of housing choices.
[106] Hereafter referred to as "BREEAM". For further information refer to [Online] Available at: http://www.breeam.org (Accessed: 1 August 2010)
[107] [Online] Available at: http://www.colorcoat-online.com (Accessed: 1 August 2010)
[108] *Ibid.*
[109] McEwan, D. *et al* (2009) 'COMPARISON OF ENERGY PERFORMANCE ASSESSMENT BETWEEN LEED, BREEAM AND GREEN STAR' *Eleventh International IBPSA Conference*, Glasgow – Scotland 27-30 July. [Online] Available at: http://www.ibpsa.org (Accessed: 1 August 2010)
[110] *Ibid.*

BREEAM assesses buildings against a set criteria and provides an overall score which will fall within a band providing either a; Pass, Good, Very Good, Excellent or Outstanding rating.[111]

The BREEAM scheme assesses the environmental impacts arising as a result of an individual building development at two stages:[112]

- Design Stage; which leads to an Interim BREEAM Certificate, and
- Post-Construction Stage; leading to a Final BREEAM Certificate.

A post-construction review serves to confirm the interim assessment and, more importantly, confirms that the 'as built' performance matches that of the design stage.[113]

The popularity of BREEAM is mainly attributed to the fact that the method addresses wide-ranging environmental and sustainability issues and enables developers and designers to prove the environmental credentials of their buildings to planners and clients. This type of assessment approach:[114]

- uses a straightforward scoring system that is transparent, easy to understand and supported by evidence-based research,
- has a positive influence on the design, construction and management of buildings, and
- sets and maintains a robust technical standard with rigorous quality assurance and certification.

In Malta, the BREEAM assessment method has been applied by Sky Parks Development Limited[115] in the development of a corporate office building block, thus being the first and only building on the island to obtain this certification to date.[116] The project entails the development of a business centre which '…will achieve high levels of functionality, flexibility and maintainability and durability, coupled with low

[111] [Online] Available at: http://www.breeam.org (Accessed: 1 August 2010)
[112] *Ibid.*
[113] *Ibid.*
[114] *Ibid.*
[115] A subsidiary of Malta International Airport (MIA) plc entrusted with the development of a EUR16 million business centre in Gudja, Malta. For further information refer to [Online] http://www.skyparksbusiness.com (Accessed: 22 August 2010)
[116] Jaeger, J. (2010) 'Sky Parks applies for international eco-certification' The Sunday Times. August 22, p. 76.

environmental impacts and consequently attaining high user satisfaction, quality and control.'[117]

2.6 The Role of Energy Simulation in the Design of Green Buildings

For many years, the analysis of physical phenomena was merely dependent on technical developments and scientific knowledge. In the past, performance assessment relied heavily on rules of thumb and hand calculation. At present, the advent of building simulation programs[118] has enabled non-trivial performance appraisals.[119] The current generation of applications for the assessment of building performance ranges from simple spreadsheets based on simplified calculation methods to advanced programs, which allow the simulation of transient physical processes using complex numerical methods.[120]

Advanced architectural developments require an integrated approach to design. The domains of heating, lighting, ventilation and acoustics, amongst others, are often closely related and it is only by taking into account their interactions that a complete understanding of building performance can be obtained. Thus, '…it can be argued that computer simulation is the preferred option for the holistic appraisal of design options.'[121]

Through its underlying philosophy, The International Building Performance Simulation Association[122] was founded in order:

> … to advance and promote the science of building performance simulation in order to improve the design, construction, operation, and maintenance of new and existing buildings worldwide.[123]

[117] *Ibid.*
[118] Refer to Appendix C for a List of Simulation Software Applications used for determining the Energy Performance of Buildings.
[119] Citherlet, S. (2001) *Towards the Holistic Assessment of Building Performance Based on an Integrated Simulation Approach.* Degree of Doctor es Sciences Swiss Federal Institute of Technology. p. 173. [Online] Available at: http: //www.citeseerx.ist.psu.edu (Accessed: 2 August 2010)
[120] *Ibid.*
[121] *Ibid.*
[122] Hereafter referred to as "IBPSA". The IBPSA is a non-profit international society of building performance simulation researchers, developers and practitioners, dedicated to improving the built environment.
[123] [Online] Available at: http://www.ibpsa.org/ (Accessed: 2 August 2010)

Building simulation offers the potential to cope adequately with building performance related concerns, as well as with the construction process. As a matter of fact, '[a]ccurate prediction of building loads through computer simulation has reduced the need for over-sizing, allowing plants to operate more efficiently.'[124] For these reasons, computer-based programs are increasingly being employed to aid in the design, operation, and management decision making process.

The national calculation tool for Energy Performance of Residential Dwellings in Malta,[125] is the basis of the Maltese official procedure for calculating the energy performance of dwellings. Through a computer software application[126], the tool calculates the annual values of delivered energy consumption, primary energy consumption and carbon dioxide emissions, both as totals and per square metre of total useful floor area of the dwelling per annum.[127] The procedure consists of a monthly calculation within a series of individual modules that contain algorithms representing the relationships between various factors contributing to the annual energy demand of the dwelling.[128]

Despite their versatility, building performance software packages do have their limitations. Uncertainties regarding behaviour of building occupants limit the ability of energy models to accurately predict actual building performance. Although numerous modelling simplifications are made, more research is needed to further evaluate the sensitivity of energy modelling results to the variability in occupant behaviour.[129]

[124] Refer to Spiteri.
[125] Hereafter referred to as "EPRDM".
[126] Refer to Appendix D for typical screen shots extracted from the Maltese software application tool.
[127] Abela, A. *et al* (2009) Energy Performance of Residential Dwellings in Malta, p. 3.
[128] *Ibid.*
[129] Clevenger, C. M. THE IMPACT OF THE BUILDING OCCUPANT ON ENERGY MODELING SIMULATIONS [Online] Available at: http://www.stanford.edu/ (Accessed: 2 August 2010)

CHAPTER 3

The Maltese Perspective

I go to nature every day for inspiration in the day's work. I follow in building the principles which nature has used in its domain.

Frank Lloyd Wright
American Architect and Interior Designer
(1867 – 1959)

3.1 Introduction

Sustainability may become the construction industry's most important and challenging issue in Malta. With greater public demand for green products and new government initiatives and targets concerning carbon emissions, the demand on the industry to champion sustainability is increasing accordingly.

The natural habitat, together with agricultural land uses, is in continuous conflict with the increasing demand for dwellings and commercial building developments. Chart 3.1 shows the number of development permits which have been granted by the Malta Environment and Planning Authority[130] over the past ten years. These development permits range from the construction of new dwellings for residential purposes to the extraction of minerals for the building of such developments. Moreover, Table 3.1 gives an indication of the type of urban development most popular in Malta. The largest share of the urban fabric is dedicated to the erection of new dwellings. On average this makes up 57 per cent of the permits granted by MEPA each year.

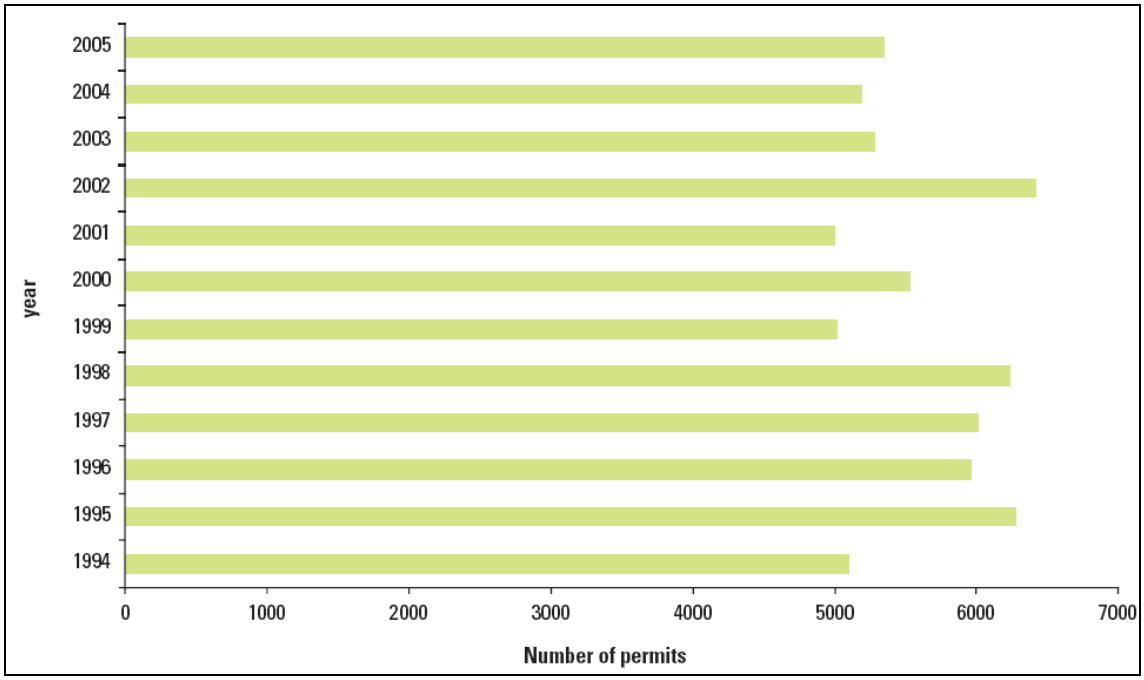

Chart 3.1: Total Number of Development Permits granted by MEPA.[131]

[130] Hereafter referred to as "MEPA".
[131] NSO, (2006) 'Environment Statistics 2006', National Statistics Office – Malta. [Online] Available at: http://www.nso.gov.mt (Accessed: 28 August 2010)

ANNUAL AVERAGE PERMITS GRANTED BY MEPA BY CATEGORY		
CATEGORY	**NUMBER**	**PERCENTAGE**
Change of Use (no substantial works)	539	19.17
New Dwellings (inc by conversion)	1619	57.64
Mineral Working	7	0.24
Manufacturing/Industrial	46	1.63
Offices	31	1.09
Shops and retail services	69	2.45
Restaurant/cafe/bar	21	0.76
Listed Building Demolition	4	0.15
Listed Building Alterations	25	0.89
Car parking and vehicle garaging	147	5.23
Community and Health Services	38	1.34
Agricultural (inc fish farms & ag rooms)	168	5.99
Warehousing (Commerce/Industry storage)	37	1.31
Recreational	27	0.95
Hotel/tourist accommodation	17	0.62
Educational	15	0.55

Table 3.1: Annual Average Permits granted by MEPA by Category.[132]

Whilst having regard to these figures, a growing concern about global warming, natural resource depletion, and environmental degradation has been observed. This has prompted action by private individuals, governmental and regulatory bodies, non-governmental organizations, corporations, academics and industrial research community. Efforts by each of these stakeholders seek to reduce environmental problems by implementing technologies that are materially more environmentally responsible, and by influencing and helping people to be more environmentally conscious.

This chapter presents a qualitative study based on fourteen interviews conducted with local industry-related professionals, developers, investors etc. The aim is to explore existing green practices and norms. The subsequent sections of this chapter shall describe the motivations and experiences of the participants in relation to the said practices. Interviews shall demonstrate that the efforts of most participants to improve their practices required significant dedication of time, attention and other resources. Since this level of commitment and desire to adopt unique and unprecedented approaches may not be readily generalised to the broader population, this chapter shall

[132] *Ibid.*

discuss the importance of introducing other interactive technologies to increase environmental responsibility by society at large. The ultimate goal is to encourage future design efforts by presenting concrete information about existing green initiatives and beliefs. This shall be accomplished through a holistic investigation of environmentally responsible practices and experience.

3.2 Interviews

The qualitative research brought forward in this chapter, exploring local green initiatives in terms of policy formulation, legal enforcement and regulation, measures and practices, is achieved through a series of interviews conducted with experts and professionals from key stakeholder organisations and entities. Fourteen potential participants were sent an invitation letter to participate in one-to-one interviews. Subsequently, all interviews were transcribed into text for reporting in this thesis. Due to the nature of the data collected, transcription and descriptive analysis were the only form of analysis pertinent. The collected data was filtered to report herein only the commentary specifically answering the research questions. Thus, the functional transcription of each of the interviews conducted was not *verbatim.* Some extensive answers, including long-winded examples and explanations, were summarised. Questions set for each of the interviews are available in Appendix E.

3.2.1 Authorities, Foundations and Regulatory Bodies

As in any other industry or sector, regulation is key in controlling human actions and activities. It is worthwhile distinguishing the responsibilities taken up by the relevant entities in Malta. The Ministry for Resources and Rural Affairs has the mission to bring about and sustain a balance between the preservation and enhancement of the environment. More specifically, policy-making, public consultation and participation with the various industry stakeholders is achieved by way of two main entities falling within the ministry's portfolio: these being the Malta Resources Authority and the Building Industry Consultative Council. The Malta Environment and Planning Authority has the competence to regulate and enforce environmental law. The Malta Housing Authority, responsible for the development of low rent or free housing to qualified residents, is pursuing a long-term commitment to implement green initiatives in social housing projects and hence set an example for the private sector to emulate.

What follows are the salient points from each interview with a representative of the relevant stakeholders.

3.2.1.1 Ministry for Resources and Rural Affairs (MRRA)

Malta has Community obligations to fulfil insofar as energy performance of buildings, generation from renewables and emission reductions are concerned. Buildings play a vital role in helping Malta meet these obligations. However, buildings must be comfortable to live and work in. Thus, achieving the optimum energy consumption should not be detrimental to user comfort.

The interviewee indicated that over the past years, the government created incentives to entice the building industry to adopt more environmentally friendly buildings. One such example was a financial award to the building with the best environmental performance. However, due to poor participation this award was never granted. The interviewee added that until the electricity and water consumption rates were subsidised, no one actually considered designing a green building. Nothing comes cheaper than subsidised energy. Today, greater awareness of energy efficiency has been instilled together with the introduction of incentive schemes for building insulation, solar water heaters and photovoltaic panels. Developers are starting to have a deeper understanding of the need for change. Furthermore, a number of building assessors have the necessary training to competently assess a building designs' environmental performance viewpoint.

With regards to the use of green technologies, it can be objectively stated that the government is doing its fair share. Namely, the government has made available roofs on public buildings for the installation of photovoltaic systems. The government is maintaining a strong commitment to subsidise systems that contribute towards green buildings.

A network of green leaders (one from each Ministry) was established so that together they can conduct energy audits on public buildings and recommend best ways to render ministries more environmentally friendly.

Considering the advantages, the interviewee maintains that sustainable building is a new economic activity upon which our future economic growth relies. Environmentally

acceptable buildings require new technologies and techniques leading to new skills and knowledge that may aid prosperity of the economy. Another advantage of such growth is that this type of prosperity indirectly reduces our impact on the environment.

Vis-à-vis the awareness of the green development concept, given that today building users are paying the true cost for the consumption of energy, the interviewee feels that awareness is at its peak. A number of incentives have already been implemented or are in the pipeline. Net metering, grant schemes, feed-in tariffs etc., are already in place or shall be very soon. However, it is to be appreciated that the needs of the sector are best known by the sector itself. That is why, prior to the annual budget, a rigorous consultation process is undertaken. It is at that stage that these ideas should be nurtured and presented to government by the industry for further evaluation and adoption.

Green building design is in its infancy as is installation and maintenance of green technologies for buildings. Malta must develop its expertise in these areas so that these technologies do not come at significant high prices to the end user.

The greatest barrier remains that of public acceptance. The government encounters resistance to almost every proposal because it is natural for human beings to wish to maintain the status quo. This is why the industry plays a very important role in overcoming these issues. Unless the industry pursues a positive attitude, it will always be a ‘government’ versus ‘consumer’ attitude.

Malta’s future is strongly tied to the targets that have to be achieved as a full member of the EU. The challenges are tough but the opportunities are substantial. As explained earlier on, the industry must take the lead. It is far better positioned to influence the market than any other regulatory body. In turn, the government will act as the catalyst as soon as the options to the end user become available.

3.2.1.2 Malta Resources Authority (MRA)

As part of Malta’s alignment to EU policies, Parliament passed the Malta Resources Authority Act back in the year 2000. As a public corporate body, its mandate is to regulate and advise the government on matters related to energy, water and mineral resources. Additionally, the authority is to advise, co-ordinate and assist other

government entities to promote and administer energy legislation and to conduct analysis and assessments of developments in the energy sector. Through the MRA, the Maltese government has launched a number of energy efficiency programmes as part of a holistic energy policy, running in parallel with the three pillars of the EU Energy Policy, namely security of supply, open market competition and the protection of the environment.

One of the main remits of the authority is that of promoting energy conservation and efficiency. In fact, the National Energy Efficiency Action Plan published in 2008[133] outlines key cost-effective measures that will result in increased energy efficiency amongst the various economical sectors, including the building and construction industry. The interviewee from the MRA explains that amongst other objectives, the strategy aims to achieve the following:[134]

- Ensure that the public sector becomes a role model in energy efficiency;
- Promote increased awareness and behavioural change by consumers on an individual level;
- Adopt financing tools and economic incentives targeting all sectors, implemented in full compliance with the applicable State Aid rules, that will stimulate take up of more efficient technologies;
- Take advantage of, and support, international efforts – in particular at EU level – to ensure that more efficient energy using products become available to the consumer;
- Use legislation and fiscal instruments judiciously, for example by setting standards for energy performance in buildings or for providers of energy services such as auditors or installers;
- Carry out research in energy efficient technologies and practices suitable for adoption in Malta; and
- Create the organisational structures necessary to support the achievement of these objectives.

[133] [Online] Available at: http://www.mra.org.mt/library_publications.shtml (Accessed: 29 September 2010)
[134] These objectives are further explained in the National Energy Efficiency Action Plan cited above.

3.2.1.3 Building Industry Consultative Council (BICC)

The BICC supports the introduction of Green Public Procurement[135] criteria relating to construction as an important part in the drive towards sustainable development. The Council believes that by supporting the implementation of green measures in the local building and construction industry, central authorities would not only be leading by example but more importantly, would positively influence the market by incentivising the uptake of ecologically sensitive green technologies.

The BICC believes that the implementation of a green strategy for the building sector must put into perspective the current operational realities of both the contracting authorities and the contractors. Whilst acknowledging that green building is an opportunity for stimulating innovation, the BICC is concerned about the possible damaging effects of imposing a too rapid timeframe for its implementation in Malta.

The interviewee holds that a culture in favour of green buildings in the local construction industry requires years to develop. This requires appropriate regulations supported by suitable awareness campaigns. Additionally, there exists insufficient local experience for designing green buildings amongst the local design profession. To date, only the larger local construction projects currently benefit from a design brief.

In view of these shortcomings, the BICC recommends that the involvement of the contracting authorities[136] in support of the contractors requires to be sustained over a long period of time. Moreover, it should be mandatory for all contracting authorities to compile project briefs for all construction projects. These should comprise clear project requirements including specific green provisions. Construction processes should be thoroughly examined in order to identify ways and means on how to reduce energy demand, waste and emissions, and increase recycling.

[135] Hereafter referred to as "GPP". GPP is a process whereby public authorities seek to procure goods, services and works with a reduced environmental impact throughout their life cycle when compared to goods, services and works with the same primary function that would otherwise be procured. GPP is a voluntary instrument, which means that individual EU Member States and public authorities can determine the extent to which they implement it. For further information on GPP, refer to [Online] Available at: http://ec.europa.eu/environment/gpp (Accessed: 17 August 2010)
[136] In Malta's case, this is the Department of Contracts.

The Council points out that it is essential to assess the future needs for skills and competencies in green construction according to anticipated technological, economic, environmental and social developments. Furthermore, research and innovation especially with regards to the eco-potential and limitations of local construction materials (such as "Franka"[137] masonry blocks) are to be supported.

3.2.1.4 Malta Environment and Planning Authority (MEPA)

The predominant regulator in the environmental field is MEPA. By virtue of its wide responsibilities for, and involvement in almost every aspect of the environment, the interviewee maintains that MEPA probably exercises the greatest influence on the quality of the environment in Malta. If MEPA does not function efficiently, any detrimental effects are felt by everybody.

In 2009, the government embarked on an intensive programme to implement a radical reform[138] aimed at making MEPA more consistent in its decisions, more efficient in its operations, more accountable to society and more equipped to enforce its decisions.

In addition to consistency, efficiency and accountability, the fourth pillar of this reform focuses on the actions required in order to ensure that the regulator's activities are indeed effective. Land and natural resources, being both limited resources on the Maltese islands, makes the regulation of land use and activities affecting the environment very critical. The success of the reform, and more importantly the effectiveness of MEPA's regulation, is dependent upon the establishment of a robust enforcement regime in order to secure respect of the sustainability principle.

As part of this reform, the government also made provisions for the migration of responsibility for construction site management to a new structure, the Building Regulations Office within the Service Division at the MRRA. Hence, enforcement

[137] The "Franka" bed of the Lower Globigerina is the most important building material in the Maltese Islands. Its lower strata known as "Franka" or freestone is massive and very soft when freshly quarried and is easily cut into any shape by means of hand tools. It also possesses very good weathering properties due to the development of an outer patina for protection. However, its properties may be variable in which case the stone weathers quickly. Its most common use is for the construction of single or double skin walls in the form of blocks of various sizes but is sometimes cut in long roofing slabs ("xorok"), paving slabs ("cangatura") or large moulding blocks ("vazi").

[138] For further information on this reform, refer to [Online] https://opm.gov.mt/mepa_pillars?l=1 (Accessed: 28 August 2010)

responsibilities related to the Environmental Management Construction Site Regulations have been removed from MEPA's portfolio of responsibilities.

Vis-à-vis the promotion of renewable sources of energy in dwellings and other building developments, MEPA issued a set of guidelines[139] outlining details pertaining to the installation of micro-wind turbines. The guidelines state that micro wind turbines can generate up to a maximum of 20 Kilowatts of energy. There are roof and tower mounted turbines that can be installed on both residential and industrial premises.

The guidelines allow the installation of both types of turbines in industrial areas up to a maximum height of 20 metres. The interviewee explains that with regards to installation on residences, this will only be allowed for research purposes and cannot exceed five metres above roof level. Wind turbines may be installed on existing large buildings in Outside Development Zones[140] but may not be installed in scheduled buildings such as historical buildings. However, these guidelines do not establish noise limitations due to lack of research data. The authority is currently in the process of compiling such data and the guidelines will therefore be reviewed once more data is available.

3.2.1.5 Housing Authority (HA)

The Housing Authority actively promotes more environmentally friendly building through:

- Energy efficient building - a block of apartments[141] has been designed and constructed to incorporate a number of green concepts and measures including photovoltaic cells, solar water heaters and passive measures such as the use of louvers, light traps and double-glazing.
- Energy saving features - as from November 2004, all the Housing Authority projects include the following sustainable building features: roof and wall insulation, double-glazing, louvers, installation of solar water heaters and photovoltaic panels and a well or cistern wherever possible. The Authority has also been successful in applying for EU funding for converting its own offices into an eco-friendly building.

[139] MEPA, (2010) 'Planning Guidance for Micro-Wind Turbines'. Malta Environment and Planning Authority [Online] Available at: http://www.mepa.org.mt (Accessed: 28 August 2010)
[140] Hereafter referred to as "ODZ".
[141] This has been constructed in an area known as "*Tal-Ftieh*" in Birkirkara.

The interviewee affirms that in undertaking social housing development projects, the Housing Authority follows no specific guidelines of its own, but rather the requirements emanating from various regulations in force and/or those enforced by MEPA. In addition to the regulations earmarked earlier in Sub-Section 2.4.1, the Authority also follows the Department of Contracts Green Procurement requirements relating to building materials' manufacture and method of construction, including measures for re-use and recycling.

When asked about the initial capital investment costs, the interviewee stated that although no detailed cost analysis has been made to date, the initial capital outlay would certainly be high. However, this should be recovered during the payback period for each installation type.

Regarding green building experience and know-how by local building contractors, the interviewee maintains that only renowned contractors of an above-average resource capacity possess the necessary expertise. Other contractors may need guidance from architects or from mechanical and electrical works consultants.

With regards to the two-fold argument of how would one justify investing in green buildings rather than spending money to construct more traditional units, thus offering even more units to those in need, the main justification provided was that the increasing cost of fossil fuels will result in higher energy bills to the end user.

In setting an example to the private sector about the use of green technologies, the Authority believes that this should be a joint initiative between the public and the private sector. Since the Authority's building programme may vary during the years and there might be times when no or very limited construction would be undertaken by the Authority, setting such an example may not always be possible.

Furthermore, the problem in implementing energy saving measures, especially on roof structures, is that most of these require continuous maintenance and care. This is rather difficult to achieve in social housing since tenants are normally reluctant to contribute to

the general upkeep and possibly share any maintenance costs, not to mention that in certain cases energy saving installations may be subject to vandalism.

It has been emphasised that the Housing Authority is aware of issues relating to global warming. It is also conscious of the need to avoid unnecessary energy waste. In this climate of finite natural fossil fuel resources and rising energy costs, the Authority will take up any sound initiative in the use of alternative energy resources in both newly built structures and existing ones, in the management of its office premises and in the use of transport in its daily operations.

3.2.1.6 Foundation for Tomorrow's Schools (FTS)

The FTS was set up following a government's decision with the main objective of transforming primary and secondary schools into "Tomorrow's Schools" in line with the guiding principles of the National Curriculum requirements. In particular, the National Curriculum states that the physical learning environments are important features of the educational fabric. There is an intimate relationship between, on one hand, these physical conditions including the allocated space, the educational resources and the specific learning environments, and on the other hand, student attitudes and behaviour.[142]

Inevitably, the rebuilding and refurbishment of schools, particularly at secondary level, had to be undertaken to improve the public school estate to cater for the ever increasing requirements posed by quality education. Amongst other objectives, undertaking this ambitious programme entailed the incorporation of green concepts and technologies from the early stages of building development to construction and operation.

The Pembroke New Primary School, forming part of St. Clare's College, is a new primary school which welcomed its first students in September 2009. It is the first school in Malta capable of generating its own electricity. This is due to the fact that it is equipped with photovoltaic panels[143], solar water heaters and tubular day lighting units. This school is also equipped with an intelligent lighting system. It is designed to provide lighting according to the ambient needs by calculating the level of natural light and thus

[142] [Online] Available at: http://www.fts.com.mt (Accessed: 28 August 2010)
[143] A 21 Kilowatt system has been installed on the school's roof areas.

increasing or decreasing artificial lighting levels by means of sensors and specialised control software.

Figure 3.1: Photovoltaic panels installed at Pembroke Primary School.[144]

Furthermore, as the interviewee explains, a vertical axis wind turbine was installed and it is designed to generate 2.5 Kilowatts of clean renewable electricity. The main advantage of this type of wind turbine is that it has noise and vibration free features. This school also has a dedicated reservoir to collect rainwater from the roofs. This second class water is used for flushing water cisterns and cleaning purposes. Rainwater for irrigation is collected in a separate reservoir from the internal yard and the school playgrounds.

St. Benedict's College, a boys' secondary school inaugurated back in 2005, is a three-storey facility, the first new school building to be constructed by the Foundation. The new college incorporates four rainwater catchment reservoirs capable of storing over 800,000 gallons of secondary class water situated beneath the sports facilities.

FTS is currently building a new secondary school to replace the boys' secondary school, Ninu Cremona Lyceum in Victoria Gozo. The school is expected to cater for up to 1,000 students. It shall be built on four storeys and shall include environment-friendly

[144] (2010) 'Dozens more government buildings to get solar panels, *The Times*. 30 August [Online] Available at: http://www.timesofmalta.com.mt (Accessed: 30 August 2010)

initiatives such as the use of solar energy. The design allows for natural daylight and ventilation in classrooms and public spaces together with the acoustic design of the individual spaces.

3.2.2 Building Developments

3.2.2.1 Hotels

Tourism is one of the most important sectors of the Maltese economy, contributing to around 14% of Malta's GDP in 2002.[145] Tourism plays a major role in economic growth, job creation and foreign exchange generation and is closely linked to other sectors of the local economy. An industry of this size has a considerable impact on social, economic and environmental conditions in a small island like Malta.

The hospitality industry faces a number of issues, risks and opportunities related to sustainability. These include addressing climate change and resource consumption, and minimising generation of waste. The industry must also respond to sustainability-related expectations expressed by customers and the local community. In addition, an environmentally responsible supply chain has become an even more important priority.

3.2.2.1.1 Hilton Malta

Winner of the local European Eco-award[146] back in 2006, the Five Star Hilton Malta Hotel was awarded this prestigious award after having satisfied a number of criteria. Amongst others, the interviewee outlined the following achievements:

- Exploiting the high potential for energy cost saving through water saving devices installed on taps and shower mixers, thus reducing consumption by 40 percent,
- Firing boilers on gas instead of diesel thus consuming cleaner fuel thereby achieving high cost savings,
- Incorporating energy recovery systems in the reverse osmosis plant,
- Enhancing process characteristics of the sewage treatment plant. Over a one to two year period, the plant was retrofitted with a sequence reactor thus

[145] Noordam, S. (2002) Tourism on Malta. Study of the situation of enterprises and the industrial and service sectors in Turkey, Cyprus and on Malta, IBM Business Consulting Services. [Online] Available at: http://fama2.us.es:8080/turismo/turismonet1/economia%20del%20turismo/turismo%20zonal/europa/tourism%20on%20Malta.pdf (Accessed: 29 September 2010)

[146] The award scheme, organised by the Product Planning and Development Directorate of the Malta Tourism Authority, is aimed at encouraging hotels to reduce their impact on the environment. Hotels are assessed on their environmental management systems, waste management, products and material, energy use, water use, air quality, noise protection, buildings and green areas, local culture and guest information.

> eliminating odours and smells. Treated water, amounting to 33,000 cubic metres every year, is in turn used for cisterns and irrigation purposes. This, among other initiatives, renders the hotel 100 percent self-sufficient vis-à-vis water consumption.

Moreover, a lighting audit was carried out in two phases. The first phase entailed the replacement of conventional light bulbs with energy-saving light bulbs. The interviewee records a total of 6,500 bulb replacements. In the ongoing second phase, Compact Fluorescent Lamps (CFLs) are being changed to Light Emitting Diodes (LEDs). These are mainly installed on the pool deck and indoor pool areas, as well as in the ball room.

With regards to waste management, the hotel management encourages and promotes waste separation in guest rooms through the use of a three-compartment bin for the separation of plastic, paper and metal. Meanwhile, in the loading bay, used cooking oil, glass, baled cardboard and guest rooms' separated waste are collected, loaded onto trucks and transported to recycling or civic amenity facilities.

The hotel premises are equipped with seawater cooled chillers. Waste heat from the chillers is used to heat domestic water, thus resulting in a 50 percent saving in energy consumption. Chillers are also equipped with an energy management system further improving efficiency. Power factor correctors have been installed on all motors; this initiative alone resulting in an 8 to 10 percent reduction in energy consumption. Presence detection sensors and door-lock sensors have been installed in all guest rooms to prevent energy wastage resulting from key card tampering. Electrical power in guest rooms is therefore only restored once the door lock opens. This measure alone has resulted in a further decrease in energy consumption of twelve to sixteen percent.

Nevertheless, the Management of Hilton Malta have laid out an ambitious program for the future encompassing of a number of green initiatives. Detailed studies are currently underway to investigate the feasibility of investing in a trigeneration system whereby the heat from a gas powered generator is first transferred to a two-stage absorption chiller, with the waste heat from the latter being then used for preheating domestic water or the outdoor pool water. It has been estimated that such a system will carry a two to three year payback period.

Motors for all air handling units shall be equipped with variable speed drives. An inverter-driven kitchen cooker hood which varies the fan speed depending on the number of burners ignited and the amount of fumes being generated is also being considered.

3.2.2.1.2 Westin Dragonara Resort

The resort possesses a highly efficient rainwater catchment system capturing water from roofs and terraces which is then used for irrigation and cleaning of pool deck areas. Native plants are used to minimise water demands whereas water limiters have been installed to control water flows in irrigation pipes. Additionally, two reverse osmosis plants produce 95 percent of the hotel's water demands.

Power factor correction has been installed at mains level. Meanwhile, the hotel's technical team of engineers and technicians is also in the process of implementing power factor correction at load level including but not limited to induction motors and refrigeration units. It is envisaged that this measure will result in a 6 percent reduction in energy consumption. The interviewee introduced a new project which is currently underway related to the implementation of a room management system through the installation of occupancy sensors and other 'intelligent'[147] devices. Ultra violet films are also being installed on windows and apertures to minimise heat gains.

In the near future, to take advantage of the large roof space spreading over three thousand square metres, the hotel management is considering the installation of photovoltaic panels and/or wind generators for powering outdoor lighting.

Through its green council, involving hotel senior management chaired by the hotel's chief engineer, staff training is provided in order to increase environmental awareness and expedite the process for implementing green initiatives.

[147] In this context, the term 'intelligent' is used to describe microprocessor-based controllers of power system equipment, such as circuit breakers, transformers, and capacitor banks. Intelligent devices receive data from sensors and power equipment, and can issue control commands, such as tripping circuit breakers if they sense voltage, current, or frequency anomalies, or raise/lower voltage levels in order to maintain the desired level. Common types of intelligent devices include protective relaying devices, load tap changer controllers, circuit breaker controllers, capacitor bank switches, reclose controllers, voltage regulators, etc.

3.2.2.1.3 Radisson Blu Resort & Spa, Golden Sands Malta

Since its inception, the founders of this development sought to adopt a holistic approach towards the accomplishment of a green build; by reducing energy requirements through design and minimising energy requirements during operation. However, as the interviewee points out, the design brief had clearly stipulated that any measures aimed at reducing energy demands are not to have any negative effect on guest comfort, property aesthetics, and the environment at large.

From an architectural standpoint, the building features a number of passive green elements including double glazed windows and doors, insulated ceilings and a system of louvers on south-facing windows.

The hotel plant comprises two reverse osmosis units each producing 90 litres of potable water per minute. Furthermore, a 30 percent saving on energy consumption is achieved through the use of energy recovery units. Water from balconies, roads and terraces is collected in an in-house sewage treatment plant capable of treating 380 cubic metres of second class water per hour.

Due to the limited roof area, installation of photovoltaic panels has not been deemed feasible and a 1.8MW wind turbine is thus being considered as a renewable means for generating electrical power. The turbine shall also provide electrical power to the new HalFerh tourist complex situated close by: a development that is currently in its design stages. Additionally, the management shall soon implement a waste separation scheme aimed at separating waste at source. Apart from investing in a cardboard and plastic baling machine, technologies for extracting biogas from organic waste are being explored. Finally, the hotel management regularly invests in staff training and educational programmes on minimising energy consumption, environmental good practices and waste reduction.

3.2.2.2 Apartment Projects

As in any other sector, the property market is subject to the trends of the moment and market forces. As lifestyles change, the public's choice when it comes to buying property reflects these changes. Two major apartment development projects are

currently being undertaken in Malta: the Pender Gardens project in St. Julians and the Fort Cambridge development in Sliema.

3.2.2.2.1 Pender Gardens

The Pender Gardens development[148] consists of residential and commercial buildings, as well as ample open spaces for both residents and the general public. The concept behind Pender Gardens aims at achieving a modern and contemporary lifestyle based on quality, open spaces, generous living spaces and convenience. The project consultants have engaged a person solely responsible for safeguarding the sustainable aspect of this development.

In addition to the three hundred and thirty residential units and office blocks, the development also includes a substantial area designated for sixteen semi-detached exclusive villas. The entire design incorporates energy conservation features such as solar power heating, efficient heating and cooling systems, building insulation, secondary water use through the incorporation of water collection and storage facilities, solid waste disposal and management, as well as an intelligent lighting system for the internal yard. Drip irrigation systems shall be used for watering green areas. However, lawns and the use of turf have been avoided since these require nearly continuous irrigation.

3.2.2.2.2 Fort Cambridge

Fort Cambridge[149] is a contemporary-style apartment complex on Sliema's Tigné peninsula in Malta. It is designed to offer all the conveniences of modern life, maximising the use of space without giving up the luxury of spacious room comfort. The reflection and flow of natural light is maximised by the use of thick, reinforced recycled glass to front the balconies, terraces and parts of the facade.

Fort Cambridge is the first local residential project of its size to have thermal insulation installed on the frontal walls of each block. The thermal insulation consists of a special polystyrene protection layer of five centimetre thickness covered by a plaster coating. This unique green measure will help to reduce heat loss in the winter months and

[148] For further information refer to [Online] http://www.pendergardens.com (Accessed: 29 August 2010)
[149] For further information refer to [Online] http://www.fortcambridge.com (Accessed: 29 August 2010)

cooling in the summer months, thereby drastically reducing energy costs. Furthermore the insulation will also act as a soundproofing component for residents of the block.

Other energy saving initiatives include a water-cooled air-conditioning system as well as thermal, glazed-glass apertures to ensure good solar protection. Additionally, the construction of a reservoir beneath the properties will accumulate water from roofs and terraces to irrigate the surrounding gardens.

3.2.2.3 Other Developments

As explained in Section 2.1, two major building developments in Malta are implementing the Leadership in Energy and Efficiency Design rating scheme[150]; the new American Embassy Compound in Ta' Qali and the Smart City Project in Kalkara. The following two sub-sections shall outline key green initiatives taken by both developments in acquiring LEED certification.

3.2.2.3.1 New American Embassy Compound, Ta' Qali

The U.S. Embassy will be moving from its current location in Floriana to a new building in Ta' Qali. The new site sits on ten acres of land which was purchased by the United States Government back in 2005.

U.S. government architects prepared a preliminary design and visited Malta in early August 2005 to present and explain this design to MEPA and government officials, and to the U.S. embassy staff. Following feedback, the design team incorporated suggestions received into the next version of the building design. The interviewee delves into how the design emphasises green technologies, including state-of-the-art strategies for sustainable site development, water savings, energy efficiency, materials selection and indoor environmental quality. Green features include double glazed windows, sun deflection elements, appropriate landscaping and water catchment systems. A comprehensive list of green measures which are being implemented includes:

[150] Hereafter referred to as "LEED".

- Addressing storm water runoff:
  - Erosion and sediment control during construction entailed the use of sediment traps, basins and silt fencing.
  - An underground storm water retention tank will be permanently installed to retain 95% of storm water runoff from the site.

- Reduced demand and consumption of potable water through sustainable irrigation techniques:
  - Demand for water consumption for irrigation to be reduced by 50% from the baseline scenario through the use of native plants.
  - Drip irrigation is to be installed to deliver water directly to the plant roots and reduce losses from evaporation.

- Reduced demand and consumption of potable water through water conserving plumbing fixtures:
  - Building plumbing fixtures reduce potable water demand by at least 20% against the baseline case.
  - Strategies used to reduce demand include; waterless urinals, low flow fixtures, and automatic shut-off fixtures.

- Reduced energy consumption in the building:
  - The project is designed to consume 20% less energy than the ASHRAE 90.1[151] baseline case.
  - Reduced energy demand by installing Variable Speed Drives (VSDs) for pumps, fans, and motors.
  - The incorporation of a Building Automation System (BAS) for the control and monitoring of plant equipment.
  - The use of sunshades to reduce solar heat gains.
  - Installation of solar water heaters for heating pool water.
  - Installing gearless electric traction elevators.

[151] The American Society of Heating, Refrigerating, and Air Conditioning Engineers approved Standard 90.1-1999, "Energy Standard for Buildings except Low-Rise Residential Buildings". This is the latest revision in the 90 Series originally published in 1975. The 1999 revision is significant in that, for the first time, metal building walls and roofs are treated as distinct envelope elements. For further information refer to [Online] http://www.insulation.org/metalbuilding/pages/resources/articles/ashrae.html (Accesses: 29 August 2010)

- Refrigerant Management: no Chlorofluorocarbons (CFCs), Hydrochlorofluorocarbons (HCFCs) or Halons will be used for refrigeration purposes.

- Air Quality:
  - Carbon dioxide sensors will monitor the indoor air quality and increase outdoor air intake when air quality becomes undesirable.
  - All rooms storing or containing materials producing hazardous fumes will be exhausted and negatively pressured.
  - An advanced air filtration system will provide superior air quality to the occupants.

- Low Volatile Organic Compounds (VOCs) containing materials will be used inside the building envelope:
  - Low VOC paints and coatings will be used.
  - Low VOC carpets and furniture will be installed.

- Reduce energy consumption through intelligent lighting systems:
  - Each workstation will have individually controlled energy efficient task lights allowing the occupants to make individual adjustments and reducing overall lighting levels.
  - Occupancy sensors will automatically turn off lights when rooms are vacant.

- Daylight harvesting techniques include:
  - Automatic daylight dimming illumination for fixtures adjacent to windows to utilise daylight.
  - Light shelves reflect natural daylight back into open office spaces.

The project will be submitted for LEED Certification after commissioning activities have been completed. The project is expected to achieve the certified level of LEED for New Construction.[152]

[152] The LEED for New Construction rating system is designed to guide and distinguish high-performance commercial and institutional projects, including office buildings, high-rise residential buildings, government buildings,

3.2.2.3.2 Smart City Malta

Smart City[153] is a planned technology park currently being constructed in Kalkara. The plan is to transform the Ricasoli Industrial Estate into a state-of-the-art information technology and media city modelled on Dubai Internet City[154] and Dubai Media City.[155] The project will cost at least 275 million Euros. The whole development, which covers an area of 360,000 square metres, is to be fully completed by 2021, although the first offices will be in operation by October 2010.

Amongst others, elements of the Smart City project include:

- State-of-the-art Information and Communication Technologies[156] and urban infrastructure
- Office blocks
- Retail facilities
- Residential complex
- Hotels
- Recreational facilities
- Smart apartments
- Car park for residents as well as visitors

In view of the above elements, the investors behind the Smart City project announced plans to adopt globally-benchmarked environmentally-friendly practices to make its global network of self-sustained business townships highly energy and resource efficient.

The construction of the first Smart City Malta building in Phase One (SCM01) is currently underway. It will consist of approximately 12,000 square meters of ready-to-

recreational facilities, manufacturing plants and laboratories. For further information refer to [Online] http://www.usgbc.org (Accessed: 29 August 2010)

[153] [Online] Available at: http://www.smartcity.ae/ (Accessed: 29 August 2010)

[154] Dubai Internet City (DIC) is an information technology park created by the government of Dubai as a free economic zone and a strategic base for companies targeting regional emerging markets. For further information refer to [Online] http://www.dubaiinternetcity.com/ (Accessed: 29 August 2010)

[155] Dubai Media City (DMC) is a tax-free zone within Dubai, United Arab Emirates. It has been built by the Dubai government to boost UAE's media foothold, and has become a regional hub for media organisations ranging from: news agencies, publishing, online media, advertising, production, and broadcast facilities. Dubai Media City is the hub for the media industry in the Middle-East, with more than 1,300 companies registered under the Free Zone, from where they serve the entire region. For further information refer to [Online] http://www.dubaimediacity.com// (Accessed: 29 August 2010)

[156] Hereafter referred to "ICT".

use offices and is expected to be completed and handed over to the first business partners by the end of 2010.

The buildings' envelope shall be composed of curtain walls, sun shading devices and stone cladding. Such systems will exhibit high performance, in terms of thermal insulation, visible light transmittance and solar factor, thus maintaining SCM01's green building approach. This consolidates the sustainable approach of Smart City Malta to ensure the comfort and wellbeing of all tenants.

Smart City Malta is developing the project in line with the international LEED standards, which is a first in the development sector in Malta. The adoption of these standards within the Smart City township has required a significant investment to make sure the sustainability element of the project is not only promoted but also put into practice.

Smart City Malta's green buildings within the entire self-sustained business village will be highly energy and resource efficient, contributing to an overall reduction in waste and pollution. The buildings adapt well to local site conditions which makes them flexible and suitable for long-term functionality. Their efficient performance will have a positive effect on the carbon footprint of Smart City Malta, reducing carbon dioxide emissions generated by daily building operations.

3.2.3 Educational Institutions

As shall be discussed in detail in Chapters 4 and 5, education is of significant importance in enhancing knowledge on green building concepts and practices among all levels of society. On a professional level, the University of Malta is the main local institution contributing to the accomplishment of this mission.

3.2.3.1 Faculty for the Built Environment, University of Malta

Initially, the Faculty bore the name of the 'Faculty of Architecture and Civil Engineering'. Following a revamp in the course structure, the faculty is now identified as the 'Faculty for the Built Environment'. This restructuring process is founded on the concept of designing and constructing buildings in a sustainable manner vis-à-vis passive design, energy efficiency, and materials.

This restructuring plan encompasses a five year degree programme which shall be subdivided into the following learning processes; the first year providing the theoretical background, the second and third year focusing on applied architectural science, the fourth and fifth year dedicated to environmental science.

The faculty incorporates the Department of Heritage Building, specifically dedicated to the preservation of historical buildings and sites, and to the conservation of early sustainable and eco-friendly design concepts such as those developed by the Knights and the British Rule[157]. In the future, the faculty plans to establish two new departments: the 'Department of Building Construction and Built Environment' and the 'Department of Architectural Science'. Furthermore a new Masters programme is being developed in Environmental Design and Architectural Science.

The interviewee indicates that students opting for the degree programme are already well versed on green concepts and the ever growing relevance of the subject. This is mainly attributed to increased public awareness as well as experience and knowledge gained from undertaking green projects for the Systems of Knowledge module during their post secondary education. Moreover, an increasing number of architecture undergraduates are subsequently interested in reading for Masters degree courses in environmentally-related areas, provided both locally and overseas.

In turn, architectural and building design firms are increasingly investing in junior architects to pursue studies in environmental design and related areas of study. Hence, the continual professional development process is instilling greater levels of knowledge in the younger generation of architects, particularly in applying green design principles such as those pertaining to building insulation, ventilation, natural lighting, passive heating and cooling. However, the interviewee exposed the need of adequate facilities for the undertaking of practical research work and pilot studies. Additionally, a number of research projects have been or are being carried out in this field in collaboration with local industry and foreign universities. Extensive research has also been carried out in the sustainable building field, particularly in the use of green materials, such as lightweight concrete and polyurethane insulation.

[157] Refer to Section 2.3 for further information.

In terms of future accomplishments, the interviewee emphasised that buildings need to be sustainable from the design stage. Thus, the conceptual design of any building development has to incorporate energy conservation measures. Meanwhile, heritage buildings, such as townhouses have to be carefully modified and retrofitted with modern green technologies. Nevertheless, early green building concepts are to be carefully restored and preserved. With regards to contemporary and modern dwellings, advantage can be taken from the absence of shade resulting from large spaces between buildings and low building heights in order to maximise solar energy 'extraction'. This is the case in certain urban areas accommodating bungalows and villas.

Despite water scarcity in the Maltese islands, development of green and soft areas is to be encouraged since tree planting aids in carbon sequestration processes. Furthermore, due to limited land availability, new developments are to take place in the vicinity of or within existing urban areas in order to minimise utility and infrastructural capital and operational costs.

On the macro level, the interviewee believes that the government should adopt a green strategy which aims to promote energy conservation without hindering or being detrimental to the quality of life of citizens. However, the coordination between the various public entities, such as MRA, MEPA and Enemalta, leaves much more to be desired. The interviewee reiterates that there is the urgent need for a 'one-stop-shop' responsible, *inter alia*, for the establishment of green policies and guidelines, the issuing of permits and the administration of grant schemes. Heavy consumers are to be encouraged to invest in renewables by increasing feed-in tariffs for this strata of society. Certain buildings, such as schools, are to be incentivised to install solar technologies on their roofs by putting in place, for instance, a 3:1 feed-in tariff mechanism. Making use of roofs on school buildings will increase revenues from electricity provision to the national grid, which could in turn be used to finance in-house maintenance expenses, invest in IT and science laboratory projects, or fund other investments.

3.3 Interview Results and Conclusions

The study shows that familiarity with green building practices proved useful since building developers and other stakeholders translated their knowledge into practice and concrete actions. The study further demonstrates that the private sector is on the forefront of this transition. Evidently, the hospitality industry has already achieved a remarkable milestone in implementing green strategies, which have rendered significant cost savings whilst still keeping the industry on a competitive edge despite the global economic turmoil. It is this drive and stable commitment, and not simply the measures adopted, that society should seek to emulate.

A common denominator in the interviewee replies was the emphasis on the need for education and formal training across all levels of industry-related parties, failing which the shift towards having greener buildings would be difficult to accomplish. The Faculty of the Built Environment strongly affirms this belief.

Perhaps the greatest opportunity to shape the future of green buildings in the coming years lies in public policy regulation at a local level. The interviewees share the view that such regulations, if properly implemented, will foster a far more proactive approach than would be possible if only volunteer based methodologies are employed. Public policy carries significant authority, as it defines the parameters that regulate sustainable construction. In simple terms, local policies have the ability to affect the overall public outcome. No matter which type and form of national regulatory authority is adopted, the prime regulatory objective should be the establishment of a trustworthy, sustainable, consistent and legitimate structure that serves specific policy goals and public interests.

The first step needed in a successful transition to a sustainability pathway is to slow the growth in overall energy consumption and carbon emissions and demonstrate that consumption and emissions can be not merely stabilised but decreased.

CHAPTER 4

Discussion: Perceptions, Barriers and Conflicts

Never doubt that a small group of thoughtful, committed citizens can change the world. Indeed, it's the only thing that ever has.

Margaret Mead
American Cultural Anthropologist
(1901 - 1978)

4.1 Introduction

The green debate has become more relevant to our contemporary situation in that the issues are now much clearer. Inevitably though, there is a wide range of views and divergent opinions on these issues. The different levels of involvement of governments, societies, green movements, business communities etc., all have an impact on public opinion and perception, despite their strategic divergences and the many disagreements on the subject.

Certainly, the growth of consumer awareness has brought about increasing pressures for eco-friendly products, clean production technologies and lower energy demands.[158] Regardless of all the efforts, many still doubt whether this is enough to achieve increased sustainability. Meanwhile, others may have serious concerns whether energy consumption is to continue on existing trends, stimulated by ever-growing standard of living expectations, particularly those pertaining to comfort in homes and office buildings.

The benefits of green building design currently focus on interior environmental quality and individual performance, health, comfort, and overall satisfaction. Although these outcomes are a critical component of the overall benefits perspective, the focus on these topics has led people[159] working in the field to ignore the potential and far-reaching relationship between buildings and strategic performance.[160] This latter perspective is very likely to be a critical factor in the market growth of green buildings.

This chapter attempts to look at the challenges that the required change is facing. Having established this context, this chapter shall then look at the various conflicts and limitations that exist or have emerged. Additionally, this section seeks to discuss issues and barriers, and responses and initiatives that are relevant to this sector within an institutional, organisational and management perspective and with which it must contend if it is to become more sustainable.

[158] Elliot, D. (1997) Energy, Society and Environment. London: Routledge.
[159] Referring to engineers, architects, designers, and other related professions.
[160] Heerwagen, J. H. (2000) *Green Buildings, Organizational Success, and Occupant Productivity,* Building Research and Information. [Online] Available at: http://www.wbdg.org/pdfs/grn_bldgs_org_success.pdf (Accessed: 3 August 2010)

4.2 Perceptions and Realities

One of the issues in the green building industry is whether there is a significant advantage to building green as opposed to the use of standard building products and practices. It is not uncommon for some members of the construction industry to say that the cost of building green can result in increased '…cost of construction even though there are studies that indicate that this is not the case.'[161]

The perceptions of the financial cost and reliability of green buildings is a major barrier to their implementation and acceptance by owners. Albeit the costly initial purchase, over the life span of a sustainable building, net costs are typically lower than traditional development; this is primarily achieved through energy savings.[162] A key factor in ensuring cost effective green development is the integration of sustainability into the project from the outset. This means that green concepts and principles are employed at the design stage rather than retrofitting green elements to a traditional building design.[163]

Key perceptions identified in a study conducted by Bill Bordass, a building performance specialist, were that green buildings cost more to design, operate and maintain. He argued that '…these perceptions represent genuine concerns about cost, value and risk, sometimes from bitter experience.'[164] In order to overcome these mistaken financial perceptions, Bordass maintains that owners must change their mindset and improve the current design process by minimising energy and material wastage.[165]

Some also perceive green building materials as lower quality than traditional building materials, not as readily available, and that it may prove difficult to find contractors who know how to use them.[166] However, green products are usually just as durable as traditional 'non-green' materials. In some cases, green products may even be unnecessary for a project as one can use traditional materials in a sustainable manner

[161] Berman, H. W. (2010) *The cost of building green - perception vs. reality* [Online] Available at: www.annarbor.com (Accessed: 3 August 2010)
[162] Acuff, Z. (2005) 'BUILDING GREEN FOR THE FUTURE, Case Studies of Sustainable Development in Michigan'. University of Michigan, [Online]. Available at: http://www.epa.gov/P3/success/michigan.pdf (Accessed: 26 July 2010)
[163] *Ibid.*
[164] Bordass, B. (2000) *Cost and value: fact and Fiction.* Building Research and Information. pp. 338-352.
[165] *Ibid.*
[166] Refer to Acuff.

through an integrated design approach that considers building operation. Spacing the lights further apart near exterior windows to reap the maximum benefit of natural sunlight is one such example.[167]

The prevalence of other factors, such as insufficient information and demanding building codes and regulations, indicates that the challenges for acceptance of green alternatives in buildings go beyond the technical merits of the alternative on which decisions for approval or denial are made.[168]

4.3 Green Building Practices: Status and Challenges

The emergence of green buildings as a popular environmentally-beneficial alternative to conventional practices may be desired by many building-related professionals. Innovative technologies and products, along with revived traditional practices, stimulate the creation of healthier homes with less environmental impacts than conventional ones.

Green building practices are commonly defined by the areas of the environment they affect: energy, water, site, air quality, and materials.[169] As seen in Chapter 3 for example, hotel buildings and residential apartment developments are adopting green landscaping practices that minimise water requirements for irrigation purposes and make use of native rather than invasive plants; which therefore restore rather than deplete local ecologies.

Additionally, indoor air quality systems and low-toxicity materials create healthier indoor environments. A variety of finishing materials, including but not limited to those used in flooring and furniture applications, are now being made from recycled or sustainably harvested materials. The use of these materials contributes to the protection of natural resources and fragile habitats.[170]

While many specific environmental building practices or products have existed for decades, since the 1990s green building has become more defined as a distinct system

[167] *Ibid.*
[168] Eisenberg, D. (2002) *Breaking Down the Barriers: Challenges and Solutions to Code Approval of Green Building.* [Online] Available at: http://www.mrsc.org/artdocmisc/breaking_down_barriers.pdf (Accessed: 3 August 2010)
[169] Wilson, A. *et al* (2001) EBN's priority list for sustainable building. Environmental Building News. [Online] Available at: http://www.fypower.org/pdf/EBN_GrnBuild_Priorities.pdf. (Accessed: 5 August 2010)
[170] *Ibid.*

of construction practices.[171] Furthermore, green building has become increasingly viable because of greater product availability and an increase in programs that support green building, such as LEED and BREEAM, which have been discussed in detail in Section 2.5.

'Growth projections for green building still project that 90 percent of construction will not be green through 2010.'[172] The potential drawback of this is that whatever environmental gains are made in the green building industry, these could be offset by environmentally destructive conventional building practices, and trends towards luxury amenities requiring high water and electricity consumption. Nevertheless, it is hoped and believed that people '…are seeking comfortable homes that consume the least energy and have the right aspect and general layout.'[173]

Several factors pose a threat to the future growth of green building practices. Most environmental impacts remain externalities for construction costs. Green products are still seen as expensive and technically unreliable by some practitioners, and environmental issues may still not be of major concern to society at large.

4.4 The Benefits of Green Development

Proponents of sustainable design argue that green technologies and design strategies will enhance interior environmental quality and thus be more conducive to human health and productivity than buildings that use standard practices. Common green building features that are likely to influence indoor environmental quality include:[174]

- Advanced natural and/or mechanical ventilating systems to increase air flows,
- Selection of building materials and furnishings that have low toxicity,
- Increased use of day lighting to reduce energy demands and enhance interior lighting quality,

[171] Scheuer, C.W. (2007) *ADOPTION OF RESIDENTIAL GREEN BUILDING PRACTICES: UNDERSTANDING THE ROLE OF FAMILIARITY.* Doctor of Philosophy in Natural Resources and Environment. University of Michigan. [Online] Available at: http://deepblue.lib.umich.edu (Accessed: 5 August 2010)
[172] Bernstein, H. M. (2006). Green Building Smart Market Report: Design and Construction Intelligence. New York: McGraw Hill.
[173] Naudi, M. J. (2010) 'Quality leap' *The Property Standard.* February 1, p. 1.
[174] Browning, W. *et al* (1995) Greening and the Bottom Line: Increasing Productivity through Energy Efficient Design. In Proceedings of the Second International Green Buildings Conference and Exposition, National Institute of Standards and Technology (NIST) [Online] Available at: www.rmi.org/cms/ (Accessed: 5 August 2010)

- Inclusion of high quality, energy efficient lighting to reduce glare and increase visual comfort,
- Increased contact with the natural environment through more open views to outdoor areas and through the inclusion of indoor plants for psychological reasons and for air quality enhancement,
- Greater attention to construction, maintenance and operation of buildings to reduce build-up of microbial agents, especially in HVAC systems and construction materials,
- Inclusion of water harvesting techniques, water reduction and water reuse strategies.

As this list demonstrates, promoting and realising the human-centred advantages of green building can help realise environmental benefits. Even those who are sceptical or disempowered about their ability to resolve the global ecological crisis, can be influenced and as result change their attitude, and possibly change their behaviour, if they can achieve an immediate improvement in their health, productivity and financial situation as a result of green building.[175]

With regards to finance and economics, advantages are three-fold. Green buildings:[176]

- Reduce capital costs,
- Result in lower risks and liabilities, and
- Reduce operating and maintenance costs.

On the social level, sustainable buildings are increasingly becoming popular for fostering stronger social networks and increasing environmental awareness.[177] However, the focus is on demonstrating the financial benefits of green products and practices as well as highlighting the environmental benefits.

[175] Beyer, D. (2002) *Sustainable Building and Construction Implementing Green Building in Western Australia*. Degree of Bachelor of Science (Honours) in Sustainable Development at the Institute for Sustainability and Technology Policy (ISTP). Murdoch University. p. 3. [Online]. Available at: http://www.istp.murdoch.edu.au (Accessed: 25 July 2010)
[176] Refer to Acuff.
[177] *Ibid.*

4.5 Implications for Design & Construction

As discussed in previous sections, the nature of a building is such that it is both a process of conception, in the design stage, and realisation in the construction stage. A building, as defined by Atkin, is '… a product of physical systems that enclose and control an environment in order to create a particular, desired effect.'[178]

An ongoing trend for architecture and engineering firms, and the construction sector at large is related to the shortage of qualified professionals. This places a high priority on identifying and developing the next generation of green building leaders. New educational programs are being offered on a national level by various public and private institutions, including the Malta College of Arts, Science and Technology[179] and the University of Malta.[180] These programs seek to attract more students, undergraduates and even qualified architects and engineers into "green" professions by giving them a well-rounded skill set that integrates management principles and advanced technologies with their design skills.

From a construction point of view, materials or products are usually compared and decisions made on the basis of one or a few isolated environmental attributes without taking into consideration the full array of environmental impacts and implications present in the total life cycle. The extensive use of concrete is one such example. Importance is often given to its structural characteristics whilst the impacts of batching processes and thermal mass properties are often put aside. Such simplistic decisions can be risky and lead to a poor choice. Nevertheless, making the proper decision requires a more thorough analysis.

As pressures mount to keep project costs down and increase efficiency, new project tools, processes and practices are introduced. This entails a meticulous study of current building methods, material transportation techniques and waste management strategies.

[178] Atkin, B. (1988) *Intelligent Buildings.* Great Britain: Billings & Sons. p. 42.
[179] Hereafter referred to as "MCAST". Its mission is to provide universally accessible vocational and professional education and training with an international dimension. For further information refer to [Online] http://www.mcast.edu.mt (Accessed: 7 August 2010)
[180] Hereafter referred to as "UOM". The UOM is the highest teaching institution in Malta. It is publicly funded and is open to all those who have the requisite qualifications. For further information refer to [Online] http://www.um.edu.mt (Accessed: 7 August 2010)

In order to deal with future trends, it will be necessary for building firms to collaborate with their counterparts in the construction industry, and with clients, owners and others involved in creating our built environment. This degree of collaboration has not been common in the past, but will become a necessity in the future as pressures mount to streamline the building development process. Radical innovations in green building design and construction processes can be more challenging to adopt than incremental ones because they can be complex and benefits may be hard to identify.

4.6 Barriers to Energy Efficiency Improvements In Buildings

It is essential to clearly portray the current state of play in the sector if there is to be a unified move towards sustainability; as a starting point, identifying the barriers to change will give insight for moving forward.[181] The "Conseil International du Bâtiment"[182] cites key barriers to progress in green building development as: professional and institutional inertia, lack of understanding of the problem among construction professionals, and inadequate structures for participation by stakeholders.[183] Additionally, the 1999 CIB report[184] lists other barriers to progress in terms of process and management issues:

- Market delay,
- Insufficient data,
- Lack of communication between sectors and stakeholders, and
- Political insecurity.

The above list may be regarded as a common list of barriers across the globe. Meanwhile, in the local scenario, administrative, organisational and fiscal barriers also impede the full-scale implementation of the green building concept. These include:

- Incomplete integration of authorities and regulatory bodies,

[181] Beyer, D. (2002) *Sustainable Building and Construction Implementing Green Building in Western Australia*. Degree of Bachelor of Science (Honours) in Sustainable Development at the Institute for Sustainability and Technology Policy (ISTP). Murdoch University. p. 3. [Online]. Available at: http://www.istp.murdoch.edu.au (Accessed: 25 July 2010)

[182] Hereafter referred to as "CIB". In English this is referred to as: The International Council for Research and Innovation in Building and Construction. CIB is the leading international organisation for research and collaboration in building and construction. Its purpose is to provide a global network for international exchange and cooperation in research and innovation in building and construction, in support of an improved building process and of improved performance of the built environment. For further information refer to [Online] http://www.cibworld.nl (Accessed: 26 July 2010)

[183] *Ibid.*

[184] CIB (1999) Agenda 21 on Sustainable Construction, International Council for Research and Innovation in Building and Construction (CIB). [Online] Available at: http://www.cibworld.nl/pages/begin/AG21.html (Accessed: 7 August 2010)

- Fragmented committees,
- Lack of life-cycle costing and in-depth processes' analysis,
- Insufficient performance and operating standards,
- Lack of expertise in the subject,
- Lack of incentives, and
- Insufficient technical information pertaining to local building practices.

In addition to the perception of higher up-front costs earmarked in Section 4.2, there are hidden costs and benefits for the end-user not captured directly in financial flows, such as transaction costs associated with securing the energy efficient solution and risks associated with the replacement technology.[185]

It is evident that there is much room for improvement in this sector but various barriers stand in the way and these may be difficult to overcome solely through market mechanisms. Scheuer rightly maintains that '[g]reen building won't really enter the mainstream until its energy-efficient features, health and productivity benefits and durability are accurately valued in the real-estate market.'[186] Under such circumstances, government policies are expected to play an important role in surmounting such obstacles. Recommendations and strategic choices needed to make this forward leap shall be discussed extensively in Chapter 5.

4.7 Environmental and Economic Conflicts

As with any new industry, there are issues and conflicts that must be resolved. The green building industry is no different. Environmental degradation is increasingly perceived as a security challenge at the national and international level.[187] The opposition between the environment and economic growth does not reflect a clear two-fold opposition but constitutes a complex variety of interpretations and disputes.

[185] Koeppel, S. *et al* (2007) 'Assessment of policy instruments for reducing greenhouse gas emissions from buildings' *Report for the UNEP- Sustainable Buildings and Construction Initiative*, [Online] Available at: http://www.unep.org (Accessed: 7 August 2010)
[186] Scheuer, C.W. (2007) *ADOPTION OF RESIDENTIAL GREEN BUILDING PRACTICES: UNDERSTANDING THE ROLE OF FAMILIARITY.* Doctor of Philosophy in Natural Resources and Environment. University of Michigan. [Online] Available at: http://deepblue.lib.umich.edu (Accessed: 5 August 2010)
[187] Gaus, A. *et al* (2009) 'Environmental Conflict Trainings' *A Synopsis of Approaches and Further Needs*, [Online] Available at: http://www.initiativeforpeacebuilding.org (Accessed: 7 August 2010)

The mutual influence of the environment and trade is a challenging issue to tackle. The relevance of trade and environmental policy for a small country like Malta may be even more complex when considering economies of scale.[188] However, it is normally believed that trade brings about economic growth. In fact, the building and construction industry in Malta has always been thought of as a major economic driver. Despite having many inter-industry linkages and hence generating income and employment in other sectors of the economy, the building and construction industries '…are relatively small sectors in the Maltese economy, directly generating about 3 percent to GDP [[189]].'[190]

Renewable energy in buildings could provide part of a solution to global and local environmental problems, '… but no technology can be entirely benign in environmental terms.'[191] Although the impacts of most renewables are relatively small and localized compared to conventional technologies, there can still be problems on a local level. In Malta, a major hurdle hindering renewable energy production from wind and solar energy sources on a national level is limited land availability. With regards to the introduction of wind turbine, solar thermal or photovoltaic technologies in buildings, even though these may involve less environmental modification, they may also intrude on landscape aesthetics. Meanwhile, considerations of foreign investment opportunities, job creation and economic growth by the green technology sector should not be underestimated.

4.8 Institutional Resistance to Change

Introducing new concepts, practices or policies often means risk and uncertainty. Getting people to open up and embrace change is always a challenge, especially when it involves the investment of their capital. However, '…culture and mindset play an important role in implementing green practices.'[192] Change is difficult to implement

[188] Refers to the cost advantages that a business obtains due to expansion. There are factors that cause a producer's average cost per unit to fall as the scale of output is increased.
[189] GDP stands for "Gross Domestic Product". GDP is a measure of a country's overall official economic output. It is the market value of all final goods and services officially made within the borders of a country in a year.
[190] Briguglio, L. *et al* (2004) A Draft Sustainable Development Strategy for Malta. [Online] Available at: http://www.mrra.gov.mt (Accessed: 7 August 2010)
[191] Elliot, D. (1997) *Energy, Society and Environment*. London: Routledge. p. 150.
[192] Bilau, G. (2008) Challenges Facing the Green Building Industry [Online] Available at: http://www.iapmo.org (Accessed: 8 August 2010)

since people have long been working in specific manners and building using traditional or conventional techniques, materials and products with which they are familiar.

Innovation in the building industry lags behind virtually every other economic sector, with a few notable exceptions.[193] The industry fails to understand that innovation is an essential part of socio-economic development of a nation. Because construction projects often involve collaborative relationships,[194] control over decision making may be distributed among stakeholders. Social dynamics often mediate collaborative decision making.[195] If project participants know each other well, they are likely to know what to expect from each other. These long-term relationships tend to foster trust and stability. In turn these elements help to build shared models, extend participants' effectiveness, and contribute to a collective effort in achieving concrete action. While understandable from an informational needs perspective, the importance of these relationships may create resistance to change, thus inhibiting the adoption of innovative practices in the building sector. By addressing informational needs, resistance to the shift to green building may be reduced and stakeholders may approach adoption decisions more creatively, offering openings for innovation that they were previously unable to foresee or appreciate.[196]

Investigating institutional behaviour requires attention to the social, economic and ecological dimensions. Moreover, the concept of sustainable building inherently challenges the status quo, which is comprised of formal and informal institutions with regulative, normative, and cognitive elements.[197] Regulative changes in the building sector at large may not necessarily induce transformative change towards sustainability without changes in norms of practice, values, and beliefs. Uncertainty or lack of information about a particular programme or policy can also stall change. Other

[193] Vittori, G. (2002) *Green and Healthy Buildings for the Healthcare Industry*, Center for Maximum Potential Building Systems [Online] Available at: http://www.healthybuilding.net (Accessed: 8 August 2010)
[194] Such as the formation of Joint Ventures or a Consortium. A Joint Venture is a legal entity formed between two or more parties to undertake an economic activity together. The parties agree to create, for a finite time, a new entity and new assets by contributing equity. They then share in the revenues, expenses, and assets and control of the enterprise. A consortium is an association of two or more individuals, companies, organizations or governments (or any combination of these entities) with the objective of participating in a common activity or pooling their resources for achieving a common goal.
[195] Refer to Scheuer.
[196] *Ibid.*
[197] Markvart, T. I (2009) *Understanding Institutional Change and Resistance to Change Towards Sustainability: An Interdisciplinary Theoretical Framework and Illustrative Application to Provincial-Municipal Aggregates Policy.* Master of Environmental Studies in Environment and Resource Studies. University of Waterloo. [Online] Available at: http://uwspace.uwaterloo.ca (Accessed: 8 August 2010)

important resources include public participation and consultation, where social learning might occur. Lack of administrative capacity and financial resources may also hinder progress for the necessary changes to take place.

4.9 The Need for Consensus

Consensus processes encourage creative and innovative solutions to complex problems by bringing a diversity of knowledge and expertise together to resolve issues.[198] When used in appropriate situations, consensus processes reward expenditures in time and effort by generating creative and lasting solutions to complex problems.[199]

A consensus building approach to collective decision-making is the only way Malta will be able to promote green technology innovation in buildings at a sufficient scale to achieve a meaningful shift to more sustainable patterns of development. Efforts of one group or segment of society to impose its views about the benefits of green development on others who are unwilling, will fail. The difficulties associated with law enforcement make the imposition of sustainable development policies on 'reluctant-to-change' segments of society almost impossible.

Many parties need to contribute to the success of sustainability concepts in buildings. Owners, asset managers, property developers and tenants all play vital roles. All parties must work together to define expectations, balancing the ideal with the practical, and incorporating the flexibility needed to cope with difficult and volatile markets.

If consensus is not reached vis-à-vis the sustainability of green buildings, and one or more parties does not fully embrace the initiative, this could potentially damage other parties' expectations or reputations when desired outcomes and performance levels are not achieved. A balanced policy development framework is thus needed, providing a balance between higher-level guidance, knowledge sharing and action. Members of civil society must work to develop governance structures to encourage and put into practice the required strategies and methods. Other sectors of civil society will have to work through the as yet unforeseen plans, challenges and opportunities in delivering

[198] An in-depth description of the said processes is available at: [Online] http://www.mediate.com/articles/consen.cfm (Accessed: 9 August 2010)
[199] *Ibid.*

environmentally and energy-sustainable built environments. Higher-order knowledge development and transfer is therefore equally important. With a balanced policy framework, collaboration is thus needed.

Building a sustainable future requires processes that reconcile competing interests, forge new co-operative partnerships, and explore innovative solutions. These processes need to employ the abilities of all parties to enhance the quality of life for present and future generations. Although consensus processes are not appropriate for all issues, they are an invaluable tool which can be used to solve many complex environmental, economic, and social problems. Consensus processes can work and have been successfully implemented on a number of issues.[200]

As discussed in Chapter 4, the terms sustainability and sustainable development embrace the concept that environmental, economic and social needs are complex and require integrated decision making. More than ever before, we need to understand how decisions made today affect the quality of life for future generations since people are increasingly demanding more meaningful input to decisions that directly affect them or the place where they live.

4.10 The Need for Social Change

As has been stated in the introductory chapter of this thesis, this work should be useful not just for those involved in the building industry, but for anyone interested in how fundamental social change vis-à-vis green buildings can take place. Such change requires a long term vision of what and how green buildings should be. The attempt is to define that vision while calling attention to the efforts already underway to realise aspects of this vision.

The social goals for green design relate to ensuring a sustainable future for our society, with respect to both resources and ecological health. A sustainable building industry will result from the continuing development of technology and knowledge, so that future generations can overcome any environmental problems created by present generations. However, there is no certainty that the requisite technology and knowledge

[200] *Ibid.*

will develop sufficiently quickly. Avoiding harm to the environment is ultimately a question of individual and collective ethical judgements.

Throughout history, the ability of architecture or design to be an agent of social change has often been embraced and then rejected. History has proven that society will not truly change until people's minds and attitudes change. Society at large needs to harness faith in the human capacity to transform itself in order to make the necessary changes with regards to lifestyles and expectations.

Unfortunately, society still faces a major hurdle which must be overcome in that '[w]hen one thinks of an eco-house, the pictures that come to mind aren't always positive.'[201] People need to be educated otherwise. Ultimately, a framework needs to be established which opens up the possibility for people working for social change to move beyond the polarised methods of thinking, and to create a more sophisticated analysis capable of guiding a more grounded and strategic practice for social change.

The government, together with Non-Governmental Organisations[202] and other stakeholders, needs to utilise the synergy of all parties concerned, and adopt a multi-dimensional approach to bring about social change; support individuals and the building industry to strengthen their practice in multiple quadrants.

Furthermore, social change should be constantly fuelled through a process of grassroots relationship building, leadership development, and collective action, which is supported by the creation of community-led organisations. Educating the public will ultimately facilitate acceptance of policy by the general public.

4.11 The Need for Public Acceptance

Public acceptance is recognised as an important issue shaping the widespread implementation of green policies and the achievement of energy policy targets. It is commonly assumed that public attitudes need to change to make more radical scenarios about the implementation of new energy technologies feasible. For this reason '[i]t is

[201] Stivala, V. (2010) 'Living in a green house' *The Sunday Times.* Homes and Design, August 15, p. 60.
[202] Hereafter referred to as "NGOs". An NGO is a legally constituted organisation created by natural or legal persons that operates independently from any government.

essential that sustainable development is not considered to be an add-on but it is seen as integral to our way of life.'[203]

There are many factors that will eventually determine the successful implementation of green building laws and regulations. The recognition that public acceptability is a necessary condition of technology development is significant. However, many questions arise about the psychological processes shaping public responses about the ways in which they are being perceived and responded to by key stakeholders such as local government, industry and interest groups. Whilst research has an important role in providing critical analysis, insight and evaluation in this area of green building design and construction, our current level of understanding of public responses to green technologies in buildings is limited.

Instead of seeing public attitudes as an obstacle or a barrier towards technological progress, one would argue that we need to better understand the dynamics of public engagement in the development of green building principles. This can be facilitated by inter-disciplinary research using innovative qualitative and quantitative social research methods with a greater emphasis on the symbolic, affective and socially-constructed nature of beliefs on green buildings.

Community green building programs, particularly those in the USA and mainland Europe, are making great strides towards promoting public acceptance of green building and its benefits, as well as encouraging builders to adopt green building practices. However, the problem of public acceptance is compounded by the fact that there is confusion among the public over the expenditure required to develop a green building when compared to a conventional or traditional building.

Public acceptance of green buildings influences people's evaluation of green buildings. We still need a better understanding of the dynamic processes of attitude formation and technology evaluation and more insights into the effects of values on technological attitudes. The main hurdle in this respect, however, is not so much the lack of studies or data, but the slow process of making insights from these investigations accessible and useful for public policy making.

[203] Green, S. (2009) *Sustainable Development Awareness and Policy Making in Malta.* Degree of Masters in Science Education. University of Malta.

With respect to green technologies in buildings, public interest has been increasing over the last decade, primarily as a result of increasing energy prices. There is strong support among most Europeans to decrease the dependence on foreign oil imports, but not at any price. In particular, energy systems that are believed to harm the environment are clearly rejected even if they promise more energy independence. Furthermore, energy issues are part of a larger framework of beliefs that relate to the role and function of technologies with respect to environmental quality and economic prosperity. As soon as both value clusters come into play, environmental concerns usually take priority over economic benefits.

CHAPTER 5

Conclusion & Recommendations

In the end we will conserve only what we love. We love only what we understand.
We will understand only what we are taught.

Baba Dioum
Senegalese Environmentalist
(1937 –)

5.1 Introduction

As explained in the previous chapters of this work, the building and construction sectors belong to a complex industrial chain, involving a wide range of actors, an extended life cycle of products and user preferences implications, making it a complex environmental policy target group. In order to achieve large scale energy efficiency improvements, a range of approaches are required, each of which tailored to local needs. Many tools, whether they constitute legislation, economic incentives, technical access, research and development programmes, need to be based on wider governmental policies.

Policies can take many different forms. This chapter presents a few examples of policies aimed at improving the energy efficiency in buildings. However, no single instrument can capture the entire, or even the large share of the economic potential in the sector alone. Due to the numerous and diverse barriers in the building sector, and to the variety of local conditions, a portfolio of instruments is necessary to overcome several barriers, to take advantage of synergistic effects and thus maximise the impact of policies. Informative and to a lesser extent, market-based instruments are usually implemented in combination with other instruments which makes assessments of single policy instruments rather difficult.

5.2 Strategic Choices for the Future

Different strategies must be adopted in order to control the energy consumption level of buildings in Malta. As outlined in Chapter 2, existing regulations and standards cover indoor conditions, health and safety standards, operation and maintenance procedures and energy calculation methods. Building codes are therefore crucial to help induce the much needed improvement in energy efficiency of the local building sector.

The building sector is usually guided by regulations and standards in its approach to how to design, build and operate buildings, including the type of energy systems, and how these are operated. Within the framework provided by regulations and standards, however, the behaviour of the sector is very much based on economic considerations. These are typically limited to the short term and rarely take into account the energy efficiency over the entire life span of the building.

Economic instruments and incentives should therefore be recognised as very important means for encouraging stakeholders in the building sector to adopt more energy efficient approaches in design, construction and operation of buildings. Such instruments typically provide an economic advantage to energy efficient approaches. The primary purpose of establishing economic instruments and incentives is to change market conditions in a way that makes energy efficient buildings more financially attractive than ordinary buildings. Thus, one may consider profit as the strongest trigger of environmental change.

Subsequently, Foreign Direct Investment could further exploit a growing market niche such as that pertaining to green and renewable technologies. In fact, through diplomatic relations, the present US Ambassador to Malta Douglas Kmiec stated that he '…hope[s] to encourage US green technology firms to look for opportunities to promote business links in Malta.'[204]

In addition to economic instruments, a number of social, political, legal and technological factors influence the flow and quality of green technology transfer. Consumer and business awareness, access to information, availability of a wide range of technical skills, and sound economic policy and regulatory frameworks, are essential elements of successful technology transfer. Technology transfer targeted to local needs and priorities is more likely to be successful. Policy actions therefore need to be tailored to the specific context and interests of the Maltese society.

Even if access to information does not always lead to energy-efficient behaviour, information and education campaigns are of significant importance in forging the green building perception. The interactive roadmap[205] laid down by the World Business Council for Sustainable Development[206] could serve as an inspirational model in this regard. Without relevant and up-to-date information, people will find it difficult to

[204] Manduca, A. (2009) 'New US Ambassador keen to promote green technology' *The Times.* Business, September 24, p. 6.
[205] [Online] Available at: http://wbcsd.3xscreen.co.uk/wbcsd-eeb.html (Accessed: 17 August 2010)
[206] Hereafter referred to as "WBCSD". The WBCSD is a CEO-led, global association of some 200 companies dealing exclusively with business and sustainable development. The Council provides a platform for companies to explore sustainable development, share knowledge, experiences and best practices, and to advocate business positions on these issues in a variety of forums, working with governments, non-governmental and intergovernmental organizations. Members are drawn from more than 30 countries and 20 major industrial sectors. The Council also benefits from a global network of some 60 national and regional business councils and regional partners. For further information refer to [Online] Available at: http://www.wbcsd.org (Accessed: 17 August 2010)

concretely implement energy efficiency improvements in buildings or even to be aware of the behavioural change required to bring about the much desired shift. As for educational campaigns, these must use the Maltese[207] language taking into account the level of knowledge of the target group.

Capacity-building and training are indispensable for small countries like Malta. Sustainable construction know-how needs to be introduced into the basic curriculum of architects, engineers and other construction-related professions. As the training of local professionals will take some time, technical assistance through international consultants and organisations can bridge this gap. In order to ensure that the right kind of technical expertise is provided, it is important that the government chooses experts according to the needs of local professions.

Even with cost-reflective energy prices, the higher first cost of energy efficient technologies may still hamper their penetration in Malta, especially if the technologies have to be imported. However, in Malta, solar water heaters have already achieved a high level of market penetration due to their relatively low price and existing subsidy schemes.

Although best practices and experiences can be shared and European regional cooperation is useful, the success of programs depends, among other factors, on their adaptation to the local social, economic, political and cultural context. Therefore, a thorough assessment of the local socio-economic, political and cultural fabric as it affects the operation of the policy instrument is very important before any decision is taken.

As shown earlier in this chapter and in Chapter 4, applying policy instruments in a holistic manner increases the overall effectiveness since all single tools have their limitations and shortcomings. In addition, individual instruments are tailored to best overcome a small number of market barriers, thus, only several instruments can address the larger number of prevailing barriers.

[207] In addition to the English language.

5.3 Recommendations

The following recommendations are given as general guidance for actions that stakeholders may wish to consider in order to promote more energy efficient buildings in Malta. It should be kept in mind that each individual, organisation, authority and company needs to interpret these recommendations within the local settings and parameters and in the area they are active in.

5.3.1 Policies

The behaviour of the building sector is dictated by a wide array of signals from authorities, customers, contractors, etc. covering virtually every aspect of building activities. Governmental polices have a special role in that they often not only influence the building sector itself, but also other relevant economic sectors, including but not limited to tourism and transport.

Policies are however not always designed with consideration of their impact outside the direct target group. Taxing renovation works is one such example. Taxes may discourage investors to undertake renovations that would achieve substantial energy savings, in spite of them being profitable over a longer period of time. Clearly there is a need for policies and associated tools that encourage a wide support for more energy efficient buildings, including policies regarding energy pricing and taxation, awareness and education, technology access, and building safety. Furthermore, one must ensure that standards compliment each other, not sending conflicting signals to the target groups about their desired behaviour. The capacity for constant innovation in terms of technology and construction practice into green building policies leaves much to be desired. Policy innovation is also important because programs that remain stagnant will quickly become obsolete due to the rapid developments of technological change. Since jurisdictions in Malta are new at developing policies for green buildings, they have the opportunity to embed future innovation into their existing policy structure.

5.3.2 Benchmarks

The understanding of what constitutes a green building is now fairly well developed, and in some countries certification systems have been adopted based on specific local criteria related to the use of materials, water, energy, comfort etc. However, most countries lack such mechanisms. Thus there isn’t a universal definition of what

constitutes a sustainable building, more so an energy efficient building. It can be argued that such a global definition would probably be quite meaningless because of the widely different conditions in different countries, even within the same continent. For example dwelling cooling requirements are more of a concern in Malta than they are in Scandinavian countries. In response to this argument, there is therefore an ever growing need to qualify what may constitute an energy efficient building under different conditions and to quantify the associated benefits in economic terms. Such benchmarks would be necessary to:

- Develop national standards for energy efficient buildings,
- Support national emission reduction mechanisms, and
- Identify and quantify projected benefits from investments in green buildings

5.3.3 Regulations

Regulations do exist for the construction of new buildings, as well as for the renovation of existing ones. In the Maltese scenario, these have been laid down by the Building Regulations Office with the input of other local entities, including the University of Malta, the Malta Environment and Planning Authority, the Building Industry Consultative Council, and the Chamber of Architects. The regulations are adhered to by various degrees, depending on the perceived relevance of the regulated issue and the level of enforcement. Regulations do provide an important yardstick of what is considered as minimum standards in the national context. Even if legislation is not always able to bring stakeholders into full compliance, it still serves as a strong and effective tool in achieving desired outcomes.

It is therefore important to ensure that appropriate regulations are in place and that these provide relevant signals on the desired reduction in energy consumption within buildings. Furthermore, such regulations should as far as possible cover the energy use over the entire life span of buildings, and their scope should be new buildings as well as existing ones.

5.3.4 Economic Tools

Economic tools encompass a wide range of different measures that impact the economics of an activity. Tools may include taxes, fees and rebates. Since economic

factors, such as costs and Returns on Investment[208], are primary considerations when decisions are made on how buildings are designed, constructed and operated, economic tools are extremely powerful in changing the behaviour of stakeholders. Clearly there is a need to ensure that suitable economic signals are sent to the building sector, creating market conditions that provide quantifiable economic advantages to buildings that are built and operated so as to achieve increased energy efficiency. It is important to ensure that the economic signals are channelled to the correct actors, including investors and/or buyers.

Needless to say, reaping the maximum benefits from EU grant schemes and funding programmes should be maintained and encouraged. Governmental institutions as well as private organisations are to provide the necessary awareness, guidance and assistance to local firms and organisations in applying for financial grants channelled through the various EU funding mechanisms. These include Structural Funds and Direct Funding schemes. One particular funding scheme provides a grant of EUR10 million that has been allocated towards the Grant Scheme for Sustainable Tourism Projects.[209] The scheme is financed through the European Regional Development Fund (ERDF) which forms part of the EU's Structural Funds for the period 2007-2013 for Malta. The scheme, which is being administered by the Tourism and Sustainable Development Unit within the Office of the Prime Minister, directs funds towards the economic development of the tourism sector. Amongst others, sustainable tourism projects submitted should increase good environmental practices by tourism enterprises as well as invest in environmentally-friendly measures to ensure the development of a sustainable tourism industry.

5.3.5 Education and Awareness

Increasing the general awareness about the benefits of building green is a basic requirement underpinning any change in the behaviour of decision makers and users of buildings. Labelling products[210] and rating of buildings increase the consciousness of

[208] Hereafter referred to as "ROI". ROI is a performance measure used to evaluate the efficiency of an investment or to compare the efficiency of a number of different investments. To calculate the ROI, the benefit, or return, of an investment is divided by the cost of the investment; the result being expressed as a percentage or a ratio.
[209] For further information refer to [Online] https://secure2.gov.mt/TSDU/grant_scheme (Accessed: 23 August 2010)
[210] Such as the European Eco-label. The European Eco-label is a voluntary scheme, established in 1992 to encourage businesses to market products and services that are kinder to the environment. Products and services awarded the Eco-label carry the flower logo, allowing consumers to identify them easily. The EU Eco-label covers a wide range

developers and users of buildings. Education should not be targeted merely to professionals and industry-related people. Children are to be encouraged to contribute their fair share for having greener homes and environments. Moreover, the younger generation could serve as a means of educating older age groups, and hence '[t]he 'use today, throw tomorrow' idiom has to be recalculated with their help and understanding.'[211] The Institute for Energy Technology has been fully engaged in education and awareness and has been on the forefront for bringing about the necessary cultural change.

5.3.6 Understanding Human Behaviour

No matter how well designed a building is, its energy performance will in the end very much depend on how the people living or working in it are using the building and to what extent are they making use of green initiatives. In other words, improved energy efficiency requires conscious choices and responsible use of facilities. In Malta, the understanding of why individuals are behaving in a certain way in relation to indoor climate and use of energy efficient appliances is still limited, and the understanding of how to influence their behaviour in a positive way is even less well understood. Research in this area should therefore be a priority.

5.3.7 The Role of the Public Sector

The public sector is a major actor in the building sector. Energy efficiency policies implemented in the public sector and applied when local authorities and other public organisations and companies are purchasing, contracting and operating buildings can create a demand for energy efficient buildings that in turn has a positive direct impact on the market. The government should seek to explore this opportunity to influence the building sector not only as a regulator, but also as an actor, setting a good example for others to emulate. By improving its own energy efficiency, the public sector can not only save costs, but also demonstrate to the private sector the potential and feasibility of energy efficiency improvements and trigger market transformation. The awareness-raising conference[212] organised on 2nd July 2010, dealing with Green Public

of products and services, with further groups being continuously added. Product groups contributing to increased energy efficiency in buildings include; appliances, home and garden products, furniture, paints and varnishes.

[211] Azzopardi, M. (2010) 'Our Kids and the environment' The Malta Independent on Sunday. The Environment, January 17, p. 6.

[212] For further details refer to [Online] https://secure2.gov.mt/tsdu//gpp (Accessed: 17 August 2010)

Procurement[213] is a positive public initiative and definitely a step in the right direction towards achieving greener procurement practices and supporting the purchase of best environmental products by governmental entities.

5.4 Conclusion

Having thus identified the barriers stalling the shift towards an energy-efficient approach and frame of mind, recommendations have been forged, all of which are instrumental and none of which can be discarded as irrelevant or of minor importance. Finding the right balance between these recommendations and taking them up on a practical level is imperative.

Generally speaking, as the actors responsible for the operational phase of a building differ from those involved in the building process, there is often a conflict of interest that can impede the introduction of energy-efficient technologies in buildings. The lack of information about energy efficiency is another obstacle, especially relevant for the residential sector. The typical home builder[214] who makes the decisions about passive energy systems and principles, more often than not, possesses little knowledge about energy efficiency opportunities. Their decisions are normally based on what other builders have done or recommended.

As discussed previously in Sub-Section 5.3.6 as well as throughout Chapter 4, human behaviour can be a barrier for promoting increased energy efficiency in buildings: energy efficiency cannot be improved with technological solutions alone but depends on the willingness of building occupants to make use of energy saving features in the building. It is thus well justified to invest in education and raising awareness. Moreover, the major impediments to increased energy efficiency in the building sector are institutional barriers and market failures rather than technical problems.

Even though in Malta technical competence pertaining to green buildings does exist to a certain degree, institutional and economic conditions hinder the effective application of

[213] Hereafter referred to as "GPP". GPP is a process whereby public authorities seek to procure goods, services and works with a reduced environmental impact throughout their life cycle when compared to goods, services and works with the same primary function that would otherwise be procured. GPP is a voluntary instrument, which means that individual EU Member States and public authorities can determine the extent to which they implement it. For further information on GPP, refer to [Online] Available at: http://ec.europa.eu/environment/gpp (Accessed: 17 August 2010)
[214] In Maltese, referred to as *"il-bennej"*.

technical competence in design, construction, and operation of buildings. The need for professional training is of importance as professionals in small and medium size enterprises need to be aware of new technologies and processes.

Country-specific solutions that analyse in detail the local market structure, culture, climate, traditions and construction styles are more likely to be successful. It is important that the traditional construction know-how is conserved and its components that are still applicable are integrated into the educational curriculum of architects and other industry-related professionals.

The key approach in energy-efficient design is that a building is considered more than just a structure, but an integrated set of elements all contributing to the overall performance of the building particularly in terms of its interaction with the climate. By utilising natural resources and passive concepts of lighting, heating and cooling, additional energy for these requirements is minimised. As discussed in Chapter 3, dwellings in Malta can be enhanced with the implementation of the right energy efficiency principles to allow for day lighting, solar heating, and natural ventilation through proper orientation, thermal storage, insulation, appropriate glazing, and external shading.

The building sector in Malta is particularly complex because it includes a wide range of building types for a wide range of uses. Thus, understanding how energy is used in buildings is complex. Energy use in buildings is affected by human behaviour but that has not been the focus of this work. Instead, this thesis has looked at local efforts to see if and how best practices are being implemented to promote the green building concept.

As shown in this thesis, there are many different approaches taken by the various industry stakeholders. This is healthy and needs to be encouraged. The potential for improving the thermal characteristics and energy demands of buildings is high and it is uncertain whether current initiatives are sufficient to achieve EU energy targets. This work has given considerable attention to EU-wide efforts, particularly those pertaining to the Directive on Energy Performance of Buildings. There is a lot of activity at all levels but it still has to be proven whether it will be effective in achieving meaningful and concrete results.

Nevertheless, the current framework for energy efficiency in buildings developed throughout the EU can and should succeed. A positive perception towards this commitment does exist since the United Nations Environment Programme[215] identifies that '…Europe leads the world in renewable energy investment because of 'supportive policies' and a willing investor base.'[216] The elements are there. It will now take a substantial effort by the various partners to make them work in Malta by pursuing a long-term commitment to the process.

After years of implementation, momentum and interest often fades. For the building sector, this cannot be allowed to happen. It is a dynamic sector in that many houses are built and renovated each year. But it is also a stable sector in that there is a large stock of existing houses that cannot be made more efficient overnight. Long-term signals are needed by property supply industries as well as owners and consumers.

No green policy plan is complete if it does not involve the participation of environmental NGOs. Maltese NGOs have a vital role in the preservation of the natural and cultural heritage; through their expert advice on the subject and the pressure they put on the government to adopt green policies. Environmental NGOs should be consulted on an ongoing basis in order to give their input in implementing national policies in line with the principles of sustainable development.

Furthermore, the government must pave the way for the private sector to follow suit. Setting regulations and standards and enforcing them is a requisite but not necessarily a sufficient condition for success. As the value chain in the building sector is long and diversified, with plenty of stakeholders acting on individual perceptions of risks and benefits, it is of highest importance that economic signals such as energy tariffs and incentives orientate the actors in the market. Manufacturers of green building products and materials, architects and engineers, developers and investors, construction companies and contractors, property managers, and tenants do react to these signals. However, resistance to change, initial market failures and high transaction costs tend to slow down or even impede this reaction and development of the market for green

[215] Hereafter referred to as "UNEP".
[216] Brincat, L. (2009) 'Why clean technology should prosper' *The Sunday Times.* Eco Times, October 11, p. 2.

building products and services, and it is these limiting factors that need to be tackled and overcome.

An integrated package of regulation and standards, financial support and incentives, information, awareness, training, education as well as research and development activities, has to come along with improved economic framework conditions. Just like other countries, Malta needs to work out a comprehensive analysis of individual framework conditions and barriers and has to design an adapted policy package. In this process, stakeholder participation, definition and monitoring of quantitative objectives and the synergetic combination of instruments are major general success factors.

In this regard, the government's commitment in establishing a "green economy" has been outlined in its recently published Pre-Budget document for 2011. One of the eight main areas on which the government's "green policy" will focus over the next five years will be that of 'the promotion and requirement of more energy-efficient buildings.'[217] Furthermore, Section 10.5.5[218] of this document outlines a number of concrete initiatives which should be implemented over the short and medium term, all aimed at increasing the sustainability of Malta's buildings. In pursuit of this commitment, the government has set up a "Green Economy Working Group" made up of professionals from various sectors in the private as well as the public sector. Its remit is to provide a discussion paper that will propose a strategy for the accelerated growth of the green economy in Malta, as well as a number of initiatives which could be implemented between the period 2011 and 2015.

Evidently, a combination of policies according to different framework conditions is necessary. 'There is no doubt that we need energy to drive our economy,'[219] and with its high energy prices Malta increasingly demands strong political will for building a coherent, well coordinated approach. Political commitment, through enforced regulations, standards and fiscal incentives are therefore essential for green building concepts to flourish. Despite the concerted efforts of regulations and standards,

[217] Ministry of Finance, the Economy and Investment (July 2010) PRE BUDGET 2011: Ideas, Vision, Discussion. p. 133. [Online] Available at: www.finance.gov.mt (Accessed: 21 August 2010)
[218] *Ibid*. p. 140.
[219] Ghirlando, R. (2009) 'Energy, Economy, Environment – a Bermuda triangle?'. Faculty of Engineering, University of Malta. p. 1.

information, training and financial incentives crafted by the government and other local institutions, the legislative framework provided through the European Union is and remains an important foundation for national efforts.

It is augured that the changes proposed in this work be considered, debated and hopefully implemented over a reasonable period of time. The underlying purpose for proposing such recommendations is to place Malta in a position to give better support to the concept of green building development for the benefit of present and future generations. We face a choice; either to take a proactive stance and take logical steps in creating homogenous linkages between the social, economic and environmental elements, or to preserve a general inertia, not to say go a step backwards in consolidating ourselves as a reactionary community which reacts to, rather than invents the future.

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http://sustainabilitydictionary.com
http://unfccc.int/resource/docs
http://www.breeam.org
http://www.cec.org/
http://www.cibworld.nl
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http://www.dubaiinternetcity.com/
http://www.epa.gov/
http://www.epa-ed.org
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http://www.fortcambridge.com
http://www.fts.com.mt
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APPENDICES

Appendix A: An example of an Energy Performance Certificate.[220]

Energy Performance Certificate

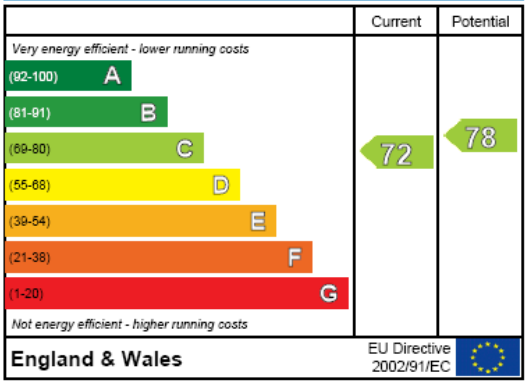
SAP

32 Harbour View
Poole
Dorset
BH12 6TA

Dwelling type:	Detached house
Date of assessment:	30 August 2007
Date of certificate:	01 September 2007
Reference number:	1111-2222-3333-4444-5555
Total floor area:	122 m2

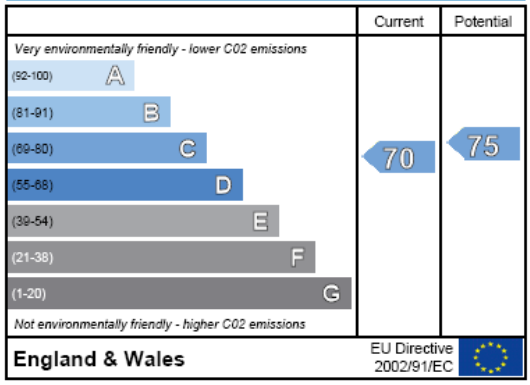
This home's performance is rated in terms of the energy use per square metre of floor area, energy efficiency based on fuel costs and environmental impact based on carbon dioxide (CO2) emissions.

Energy Efficiency Rating



The energy efficiency rating is a measure of the overall efficiency of a home. The higher the rating the more energy efficient the home is and the lower the fuel bills will be.

Environmental Impact Rating



The environmental impact rating is a measure of a home's impact on the environment in terms of carbon dioxide (CO2) emissions. The higher the rating the less impact it has on the environment.

Estimated energy use, carbon dioxide (CO2) emissions and fuel costs of this home

	Current	Potential
Energy use	186 kWh/m2 per year	152 kWh/m2 per year
Carbon dioxide emissions	3.8 tonnes per year	3.1 tonnes per year
Lighting	£106 per year	£53 per year
Heating	£345 per year	£307 per year
Hot water	£114 per year	£101 per year

Based on standardised assumptions about occupancy, heating patterns and geographical location, the above table provides an indication of how much it will cost to provide lighting, heating and hot water to this home. The fuel costs only take into account the cost of fuel and not any associated service, maintenance or safety inspection. This certificate has been provided for comparative purposes only and enables one home to be compared with another. Always check the date the certificate was issued, because fuel prices can increase over time and energy saving recommendations will evolve.

To see how this home can achieve its potential rating please see the recommended measures.

energy saving recommended

Remember to look for the energy saving recommended logo when buying energy efficient product. It's a quick and easy way to identify the most energy efficient products on the market.

For advice on how to take action and to find out about offers available to help make your home more energy efficient call 0800 12 012 or visit www.energysavingtrust.org.uk/myhome

[220] [Online] Available at: http://www.hipmanager.com/samples/Energy_Performance_Certificate.pdf (Accessed: 1 August 2010)

32 Harbour View, Poole, Dorset, BH12 6TA
01 September 2007 RRN: 1111-2222-3333-4444-5555

Energy Performance Certificate

About this document

The Energy Performance Certificate for this dwelling was produced following an energy assessment undertaken by a qualified assessor, accredited by BRE Certification, to a scheme authorised by the Government. This certificate was produced using the RdSAP 2005 assessment methodology and has been produced under the Energy Performance of Buildings (Certificates and Inspections)(England and Wales) Regulations 2007. A copy of the certificate has been lodged on a national register.

Assessor's accreditation number:	STTF514887
Assessor's name:	John Smith
Company name/trading name:	Spark Energy Assessors Ltd
Address:	15 Craggy Lane, Poole, Dorset, BH16 3NN
Phone number:	01742 555222
Fax number:	01742 555223
E-mail address:	MrSpark@Sparky-Energy.co.uk
Related party disclosure:	

If you have a complaint or wish to confirm that the certificate is genuine

Details of the assessor and the relevant accreditation scheme are on the certificate. You can get contact details of the accreditation scheme from our website www.breassessor.co.uk together with details of their procedures for confirming authenticity of a certificate and for making a complaint.

About the building's performance ratings

The ratings on the certificate provide a measure of the building's overall energy efficiency and its environmental impact, calculated in accordance with a national methodology that takes into account factors such as insulation, heating and hot water systems, ventilation and fuels used. The average energy efficiency rating for a dwelling in England and Wales is band E (rating 46).

Not all buildings are used in the same way, so energy ratings use 'standard occupancy' assumptions which may be different from the specific way you use your building. Different methods of calculation are used for homes and for other buildings. Details can be found at www.communities.gov.uk/epbd

Buildings that are more energy efficient use less energy, save money and help protect the environment. A building with a rating of 100 would cost almost nothing to heat and light and would cause almost no carbon emissions. The potential ratings in the certificate describe how close this building could get to 100 if all the cost effective recommended improvements were implemented.

About the impact of buildings on the environment

One of the biggest contributors to global warming is carbon dioxide. The way we use energy in buildings causes emissions of carbon. The energy we use for heating, lighting and power in homes produces over a quarter of the UK's carbon dioxide emissions and other buildings produce a further one-sixth.

The average household causes about 6 tonnes of carbon dioxide every year. Adopting the recommendations in this report can reduce emissions and protect the environment. You could reduce emissions even more by switching to renewable energy sources. In addition there are many simple every day measures that will save money, improve comfort and reduce the impact on the environment, such as:

- Check that your heating system thermostat is not set too high (in a home, 21oC in the living room is suggested) and use the timer to ensure you only heat the building when necessary.
- Make sure your hot water is not too hot - a cylinder thermostat need not normally be higher than 60oC
- Turn off lights when not needed and do not leave appliances on standby. Remember not to leave chargers (e.g. for mobile phones) turned on when you are not using them.

Visit the Government's website at www.communities.gov.uk/epbd to:

- Find how to confirm the authenticity of an energy performance certificate.
- Find how to make a complaint about a certificate or the assessor who produced it.
- Learn more about the national register where this certificate has been lodged.
- Learn more about energy efficiency and reducing energy consumption.

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Recommended measures to improve this home's energy performance

32 Harbour View
Poole
Dorset
BH12 6TA

Date of certificate: 01 September 2007
Reference number: 1111-2222-3333-4444-5555

Summary of this home's energy performance related features

The following is an assessment of the key individual elements that have an impact on this home's performance rating. Each element is assessed against the following scale: Very poor /Poor / Average / Good / Very good.

Elements	Description	Current performance	
		Energy Efficiency	Environmental
Walls	Cavity wall, as built, insulated (assumed)	Good	Good
Roof	Pitched, 100 mm loft insulation	Average	Average
Floor	Solid, insulated (assumed)	-	-
Windows	Fully double glazed	Good	Good
Main heating	Boiler and radiators, mains gas	Good	Good
Main heating controls	Programmer, room thermostat and TRVs	Average	Average
Secondary heating	Room heaters, mains gas	-	-
Hot water	From main system	Good	Good
Lighting	No low energy lighting	Very poor	Very poor
Current energy efficiency rating		C 72	
Current environmental impact (CO2) rating			C 70

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32 Harbour View, Poole, Dorset, BH12 6TA
01 September 2007 RRN: 1111-2222-3333-4444-5555

Energy Performance Certificate

Recommendations

The measures below are cost effective. The performance ratings after improvement listed below are cumulative, that is they assume the improvements have been installed in the order that they appear in the table.

Lower cost measures (up to £500)	Typical savings per year	Performance ratings after improvement Energy efficiency	Environmental
1 Increase loft insulation to 250 mm	£25	C 74	C 71
2 Low energy lighting for all fixed outlets	£43	C 76	C 73
Sub-total	**£68**		
Higher cost measures (over £500)			
3 Replace boiler with Band A condensing boiler	£36	C 78	C 75
Total	**£104**		
Potential energy efficiency rating		C 78	
Potential environmental impact (CO2) rating			C 75

Further measures to achieve even higher standards

The further measures listed below should be considered in addition to those already specified if aiming for the highest possible standards for this home.

4 Solar photovoltaics panels, 25% of roof area	£38	C 80	C 78
Enhanced energy efficiency rating		C 80	
Enhanced environmental impact (CO2) rating			C 78

Improvements to the energy efficiency and environmental impact ratings will usually be in step with each other. However, they can sometimes diverge because reduced energy costs are not always accompanied by a reduction in carbon dioxide (CO2) emissions.

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32 Harbour View, Poole, Dorset, BH12 6TA
01 September 2007 RRN: 1111-2222-3333-4444-5555

Energy Performance Certificate

About the cost effective measures to improve this home's performance ratings

Lower cost measures (typically up to £500 each)

These measures are relatively inexpensive to install and are worth tackling first. Some of them may be installed as DIY projects. DIY is not always straightforward, and sometimes there are health and safety risks, so take advice before carrying out DIY improvements.

1 Loft insulation

Loft Insulation laid in the loft space or between roof rafters to a depth of at least 250 mm will significantly reduce heat loss through the roof; this will improve the levels of comfort, reduce energy use and lower fuel bills. Insulation should not be placed below any cold water storage tank, any such tank should also be insulated on its sides and top, and there should be boarding on battens over the insulation to provide safe access between the loft hatch and the cold water tank. The insulation can be installed by professional contractors but also by a capable DIY enthusiast. Loose granules may be used instead of insulation quilt; this form of loft insulation can be blown into place and can be useful where access is difficult. The loft space must have adequate ventilation to prevent dampness; seek advice about this if unsure.

2 Low energy lighting

Replacement of traditional light bulbs with energy saving recommended ones will reduce lighting costs over the lifetime of the bulb, and they last up to 12 times longer than ordinary light bulbs. Also consider selecting low energy light fittings when redecorating; contact the Lighting Association for your nearest stockist of Domestic Energy Efficient Lighting Scheme fittings.

Higher cost measures (typically over £500 each)

3 Band A condensing boiler

A condensing boiler is capable of much higher efficiencies than other types of boiler, meaning it will burn less fuel to heat this property. This improvement is most appropriate when the existing central heating boiler needs repair or replacement, but there may be exceptional circumstances making this impractical. Condensing boilers need a drain for the condensate which limits their location; remember this when considering remodelling the room containing the existing boiler even if the latter is to be retained for the time being (for example a kitchen makeover). Building Regulations apply to this work, so your local authority building control department should be informed, unless the installer is registered with a competent persons scheme{1}, and can therefore self-certify the work for Building Regulation compliance. Ask a qualified heating engineer to explain the options.

About the further measures to achieve even higher standards

Further measures that could deliver even higher standards for this home

4 Solar photovoltaics (PV) panels

A solar PV system is one which converts light directly into electricity via panels placed on the roof with no waste and no emissions. This electricity is used throughout the home in the same way as the electricity purchased from an energy supplier. The Solar Trade Association has up-to-date information on local installers who are qualified electricians and any grant that may be available. Planning restrictions may apply in certain neighbourhoods and you should check this with the local authority. Building Regulations apply to this work, so your local authority building control department should be informed, unless the installer is registered with a competent persons scheme{1}, and can therefore self-certify the work for Building Regulation compliance. Ask a suitably qualified electrician to explain the options.

{1} For information on competent persons schemes enter "existing competent person schemes" into an internet search engine or contact your local Energy Saving Trust advice centre on 0800 512 012.

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Appendix B: Energy Performance of Buildings Training Course for Assessors of Dwellings in Malta.[221]

Energy Performance of Buildings
Training Course for Assessors of Dwellings
in the Republic of Malta

General Aims

Attendees who successfully complete an Assessor Training Programme for the Energy Assessment Procedure for Dwellings in Malta should be able to:

- Explain key objectives and the background to the EPBD
- Demonstrate the ability to accurately collect data from plans, specifications and physical surveys to correctly calculate the energy demand of dwellings and the associated CO_2 emissions performance using the EPRDM software for both new and existing dwellings of varying complexity
- Produce Energy Performance Certificates and Advisory Reports for dwellings making recommendations to improve energy performance of dwellings
- Explain the significance of varying the specifications for dwellings.

Course Structure

The course structure is grouped into the following units

Unit 1 The Energy Performance Certificate in Malta

1.1 Background to the EPBD
1.2 Overview of LN 261 of 2008
1.3 Building Regulations Guide F
1.4 Introduction to the Energy Performance Rating of Dwellings Malta, assessment Procedure (EPRDM)
1.5 EPC Administration
1.6 Assignment 1

Unit 2 Building Construction and Building Energy Performance

2.1 Lighting and Internal Loads
2.2 Fabric and Ventilation
2.3 Solar Gains
2.4 Tutorial on Assignment 1
2.5 Assignment 2

Unit 3 Building Systems

e-mail address: sd.mrra@gov.mt Page 1 of 4

[221] Services Division; Building Regulations Office [Online] Available at: https://secure2.gov.mt/epc/home (Accessed: 1 August 2010)

MALTA RESOURCES AUTHORITY

BUILDING REGULATIONS OFFICE
SERVICES DIVISION
MINISTRY FOR RESOURCES AND RURAL AFFAIRS

ENERGY PERFORMANCE RATING OF DWELLINGS IN MALTA

3.1 Domestic Hot Water
3.2 Heating Systems
3.3 Cooling Systems
3.4 Solar Water Heating
3.5 Tutorial on Assignment 2
3.6 Assignment 3

Unit 4 Overall Energy Performance, CO_2 emissions
4.1 Renewables
4.2 Fuel factors
4.3 Tutorial on Assignment 3

Unit 5 Advisory Reports for Dwellings

5.1 Format and content of Advisory Reports for Dwellings
5.2 Design Advice Opportunities
5.3 General revision

Test

The test is to be conducted by the Building Regulations Office of the Services Division in conjunction with MRA.

1 Attendance to Course and Assignments

In order to be able to sit for the test, participants will have to attend to at least 80% of the whole duration of the course.

The three individual assignments will require the participants to produce evidence that demonstrates an understanding and the application of the range of specific learning outcomes. The assignments will be of a sufficiently complex form to ensure that participants demonstrate that they can apply the EPRDM to a variety of dwelling types of varying complexity both new and existing.

Assignment 1: U-values

Participants would be required to source thermal conductivity information for components of a wall, floor, roof, and either a floor or wall adjacent to an unheated space from any of the sources referenced in the software manual of the EPRDM and calculate the U-values for those building elements from first principles.

e-mail address: sd.mrra@gov.mt

MALTA RESOURCES AUTHORITY

BUILDING REGULATIONS OFFICE
SERVICES DIVISION
MINISTRY FOR RESOURCES AND RURAL AFFAIRS

ENERGY PERFORMANCE RATING OF DWELLINGS IN MALTA

Assignment 2: Assessment from plans and specifications and achieving a specified improvement

Participants would be required to complete an assessment of a dwelling from plans and specifications, and produce an Advisory Report for that dwelling. They would then be required to vary the specification to achieve a specified improvement in the EPC.
These variations would focus on the most practical and least cost options.

Assignment 3: EPC of an existing dwelling (trainer selected dwelling)

Participants would be required to survey an existing dwelling and produce an EPC for that dwelling. Full supporting evidence in the form of site notes, photographs, sketches and survey notes must be compiled as part of the assignment and participants must provide further information if so required by the trainer.

Participants would then be required to vary the dwelling specification to achieve a specified improvement in the EPC. These variations would focus on the most practical and least cost options.

2 TEST

The test will include the following minimum criteria:

Part 1: Short Answer Questions

The training providers will devise a test consisting of 10 questions that assess participants' understanding of the EPRDM methodology, EPC policy, QA requirements, and surveying dwellings.

The questions would examine the participants' ability to recall, apply theory, define information and identify products and systems in a dwelling that affect an EPC.

The answers would be in written form, including any illustrations and must be categorized as short in length.

The Test will cover all Units of the course. The format of the Test will be short questions of equal marks.

Participants must attempt all questions.

Part 2 Practical

The training providers will devise a practical test that requires learners to demonstrate their ability to use the EPRDM software in a supervised setting for a previously unseen dwelling to

e-mail address: sd.mrra@gov.mt

MALTA RESOURCES AUTHORITY

BUILDING REGULATIONS OFFICE
SERVICES DIVISION
MINISTRY FOR RESOURCES AND RURAL AFFAIRS

ENERGY PERFORMANCE RATING OF DWELLINGS IN MALTA

produce an EPC and Advisory Report. The practical test will be of such depth and breadth that will require the candidate to apply all aspects of the EPRDM software.

Course Certificate

A certificate will only be issued to participants who will obtain at least 80 % out of a total 150 marks that will be allotted as follows;

Attendance to the course and completing assignments:	max. marks 50
Test:	max. marks 100

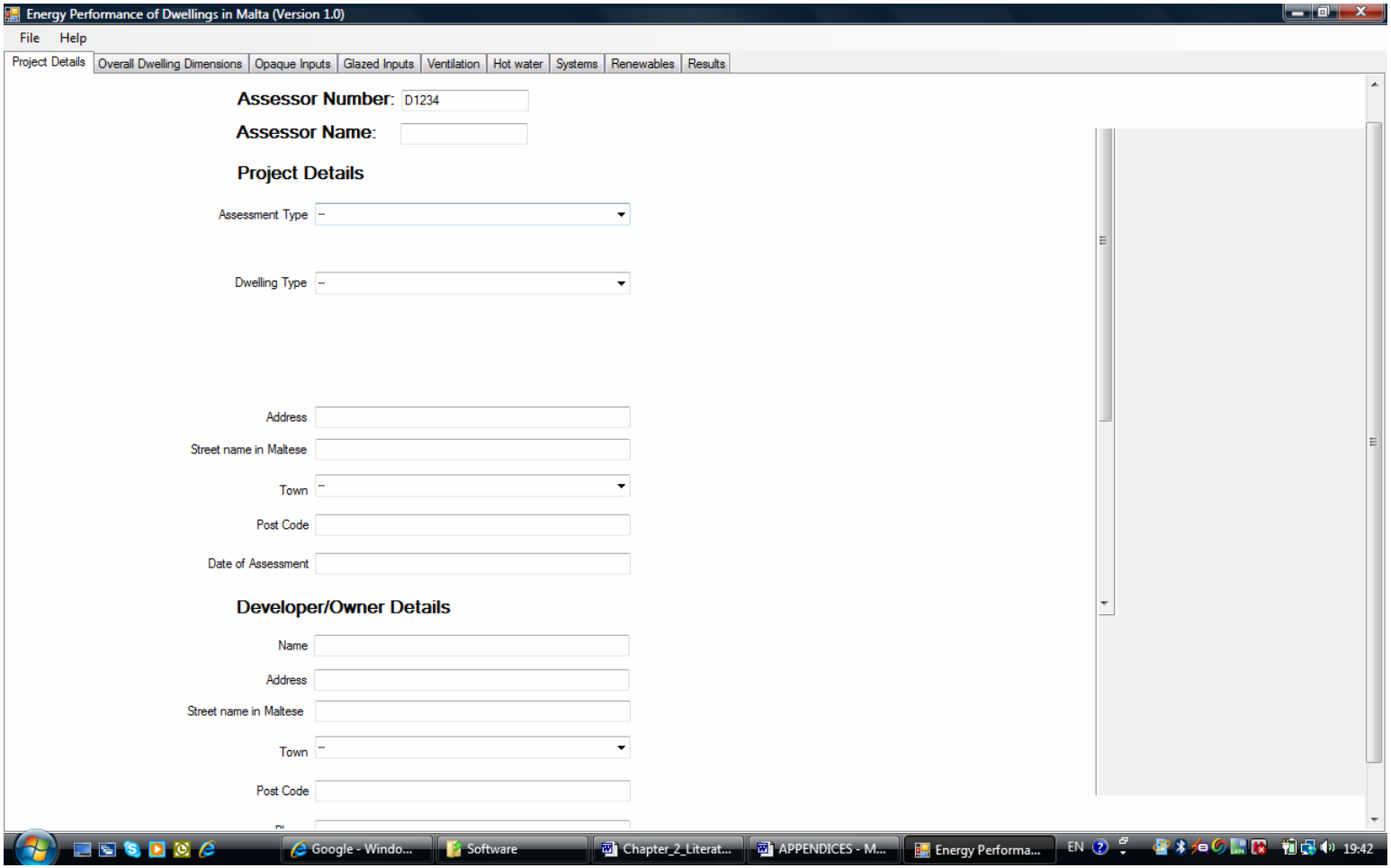
e-mail address: sd.mrra@gov.mt

Appendix C: List of Simulation Software Applications used for determining the Energy Performance of Buildings.[222]

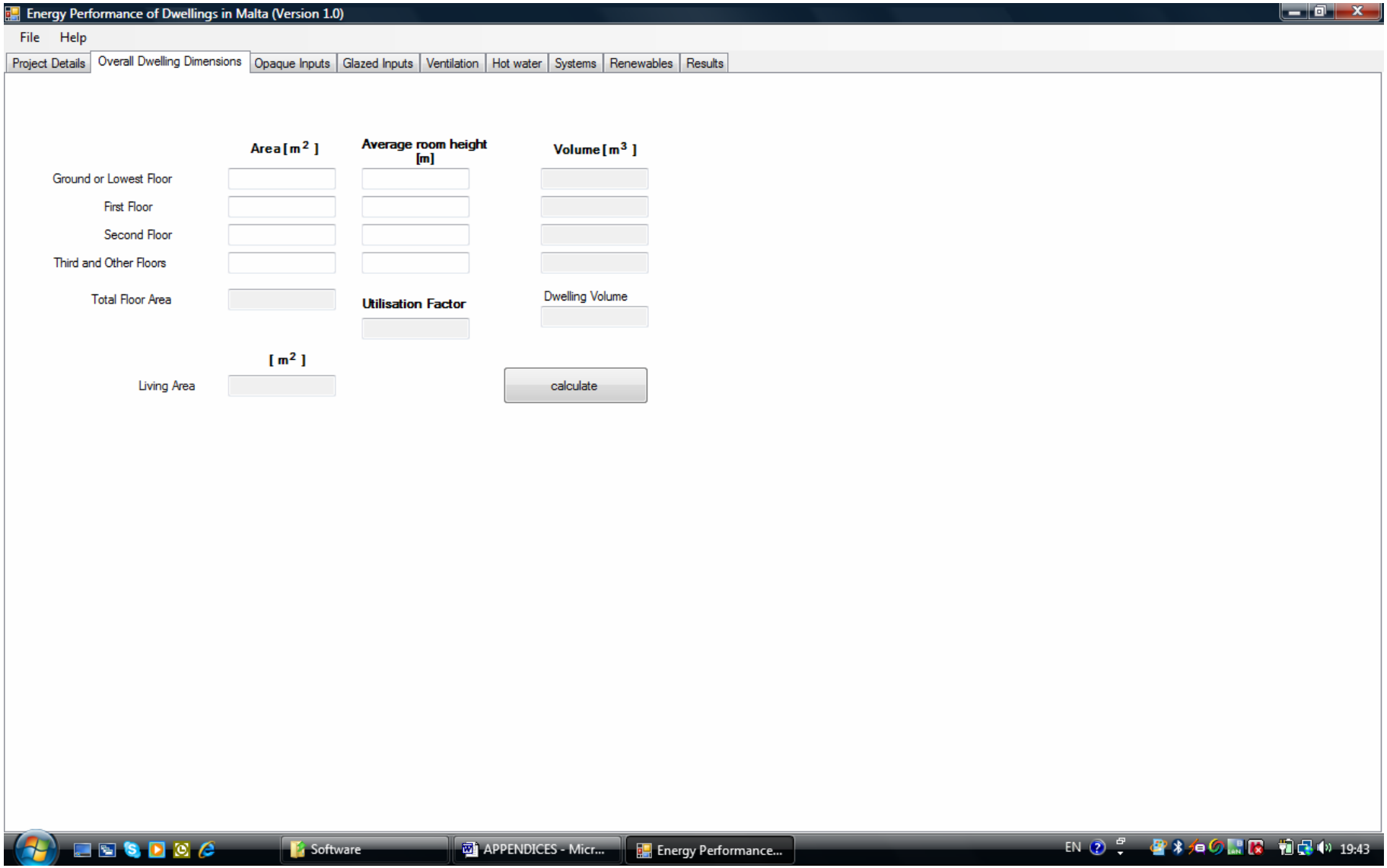
Name	Origin	Reference	Web site
ADELINE	International Energy Agency (IEA)	[Erh1997]	http://www.radsite.lbl.gov/adeline/HOME.html
BUS++ (BUilding Simulation tool coded by C++)	VTT Building Technology, Finland	[Tuo1997]	/
Bsim2000 (successor to Tsbi3)	By og Byg, Horsholm, Denmark	[Gra1999]	www.by-og-byg.dk/english/publishing/software/bsim2000
COMBINE (COmputer Models for the Building INdustry in Europe)	EU Commission's Directorate General XII	[Aug1994]	http://erg.ucd.ie/combine.html
BDA (Building Design Advisor)	Lawrence Berkeley National Laboratory, USA	[Pap1997]	http://kmp.lbl.gov/BDA/
EcoPro	Institut für Industrielle Bauproduktion (IFIB), Germany	[Koh1997]	http://www.ifib.uni-karlsruhe.de
Eco-Quantum (SimPro)	Dutch governement	[Mak1997]	http://www.ivambv.uva.nl/uk/producten/product7.htm
EnergyPlus (DOE-2 and BLAST	U.S Department of Energy (DOE), USA	[Hua1999]	http://www.eren.doe.gov/buildings/energy_tools/energyplus/
EQUER / COMFIE	Ecole des mines de Paris, France	[Peu1999]	http://www-cenerg.ensmp.fr/english/themes/index.html
ESP-r (Environmental Systems Performance; r for "research")	Energy System Research Unit, UK	[Cla1997]	http://www.esru.strath.ac.uk/ESP-r.htm
Radiance	Lawrence Berkeley National Laboratory, USA + Solar Energy and Building Physics Lab. CH	[Lar1998]	http://radsite.lbl.gov/radiance/HOME.html
RIUSKA	Olof Granlund Oy, Finlande	[Wri1997]	http://www.granlund.fi/English/tyo-riuska.htm
UO (Dutch abbreviation of Uniform Environment)	Association for Computerisation in the Building and Installation Technology, The Netherlands	[Plo1997]	http://www.vabi.nl/uo/uoe.htm
TAS (Thermal Analysis Software)	Environmental Design Solutions Limited (EDSL), UK	See web site	http://ourworld.compuserve.com/homepages/edsl/
TRNSYS (Transient Systems Simulation Program)	Solar Energy Lab (SEL) at Uni. of Wisconsin-Madison, USA	[Bec1994]	http://sel.me.wisc.edu/TRNSYS/Default.htm

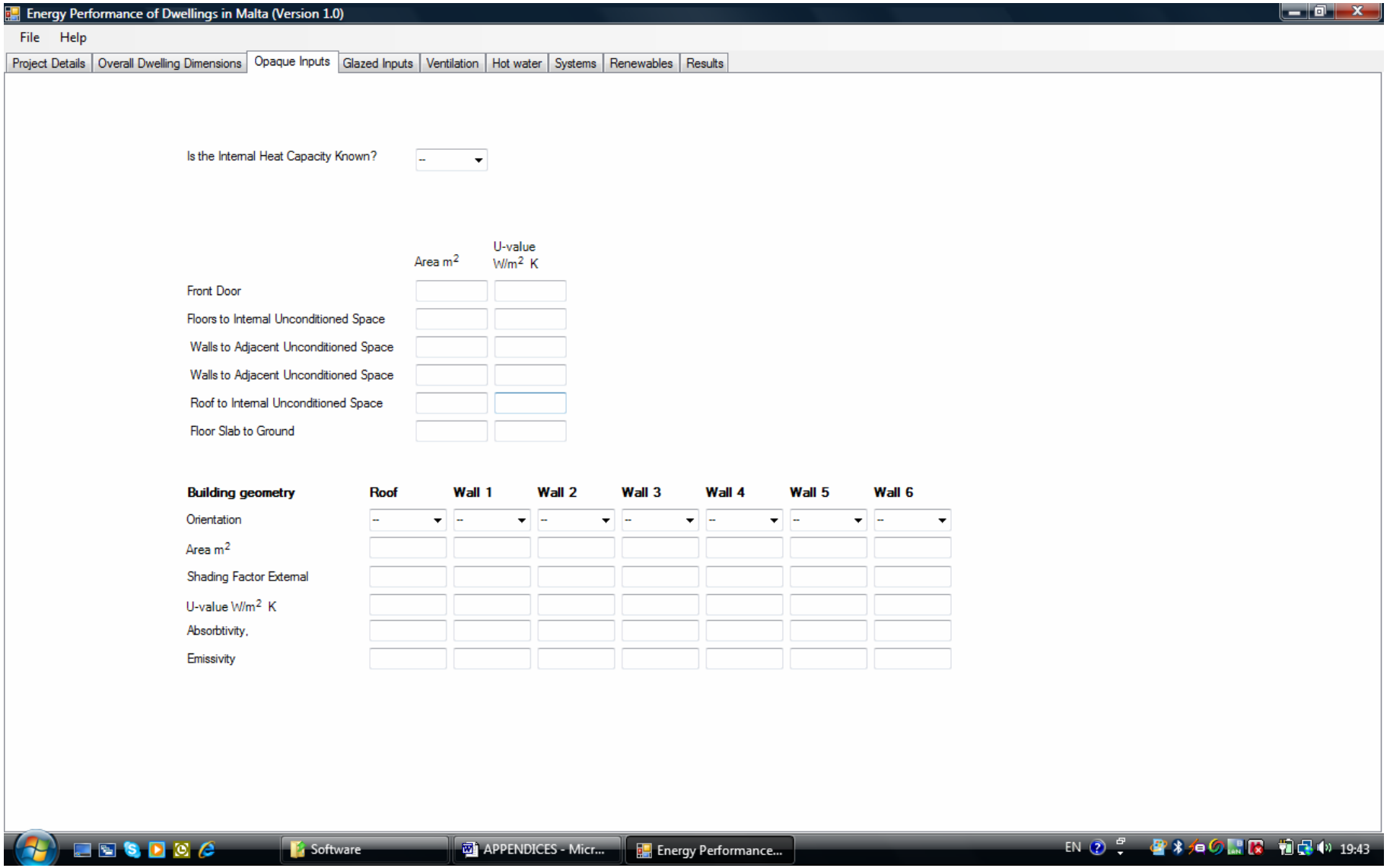
[222] Citherlet, S. (2001) *Towards the Holistic Assessment of Building Performance Based on an Integrated Simulation Approach.* Degree of Doctor es Sciences Swiss Federal Institute of Technology. p.173. [Online] Available at: http: //www.citeseerx.ist.psu.edu (Accessed: 1 August 2010)

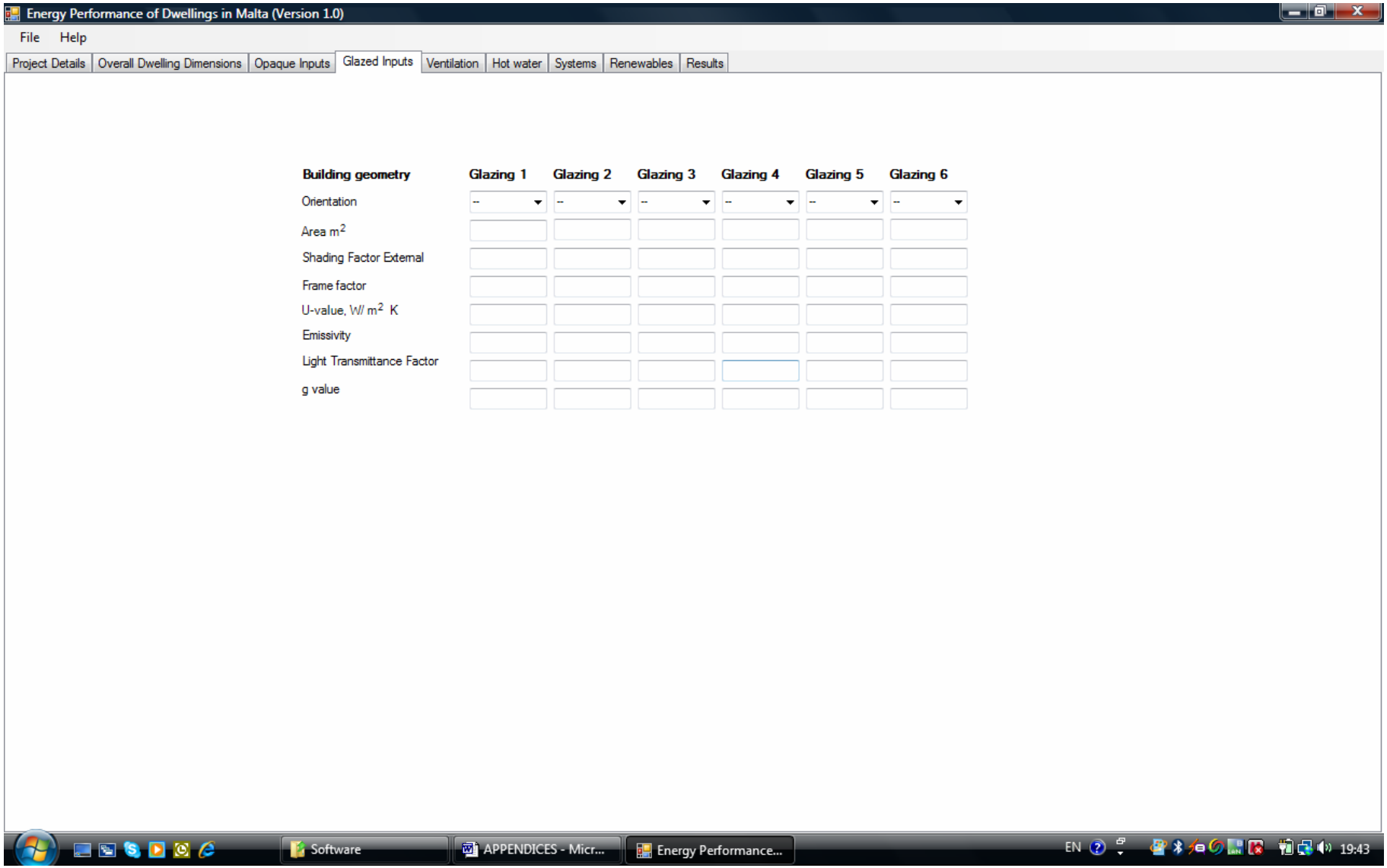
Appendix D: Typical Screen Shots Extracted from the Maltese Software Application Tool (EPRDM).[223]

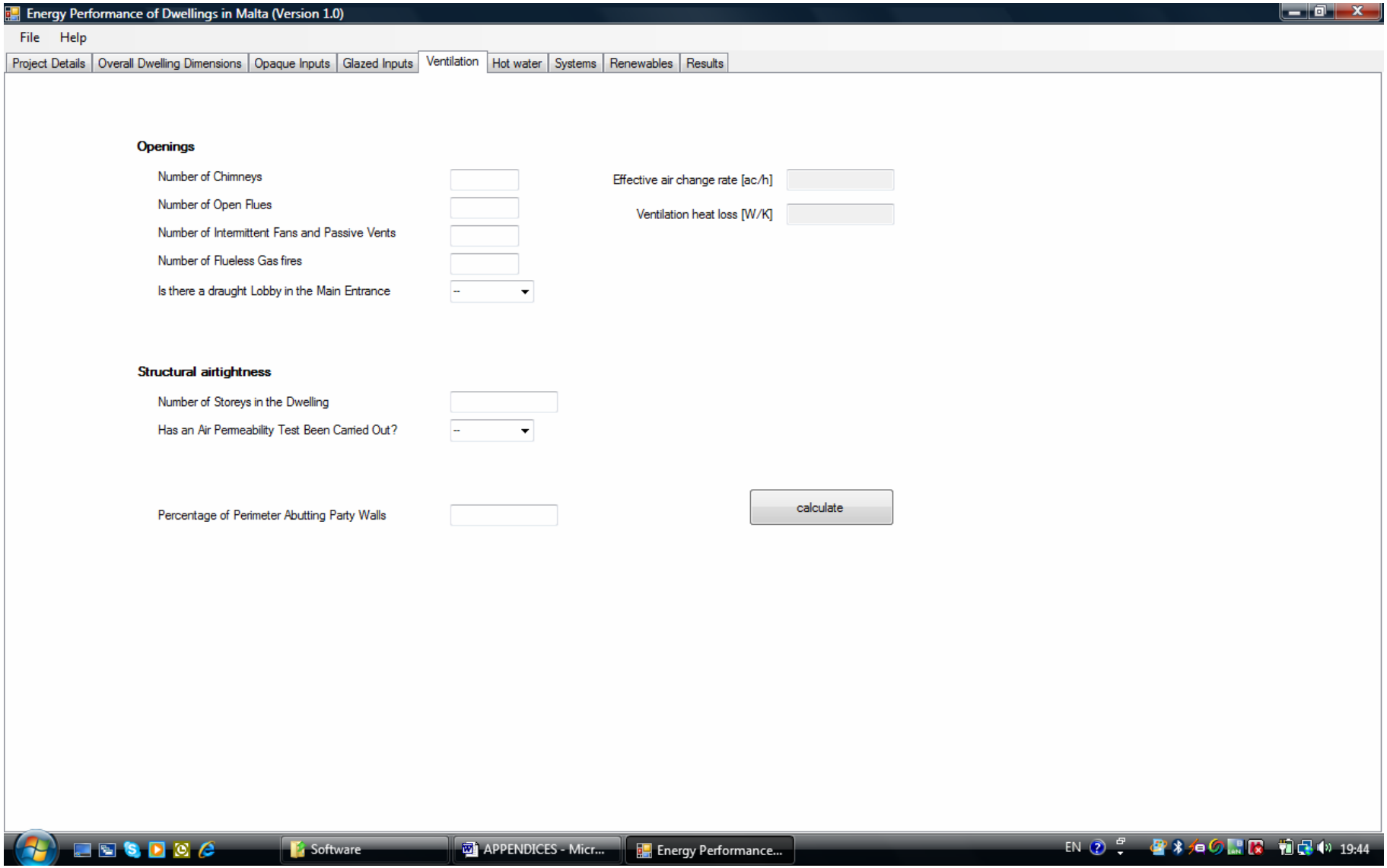


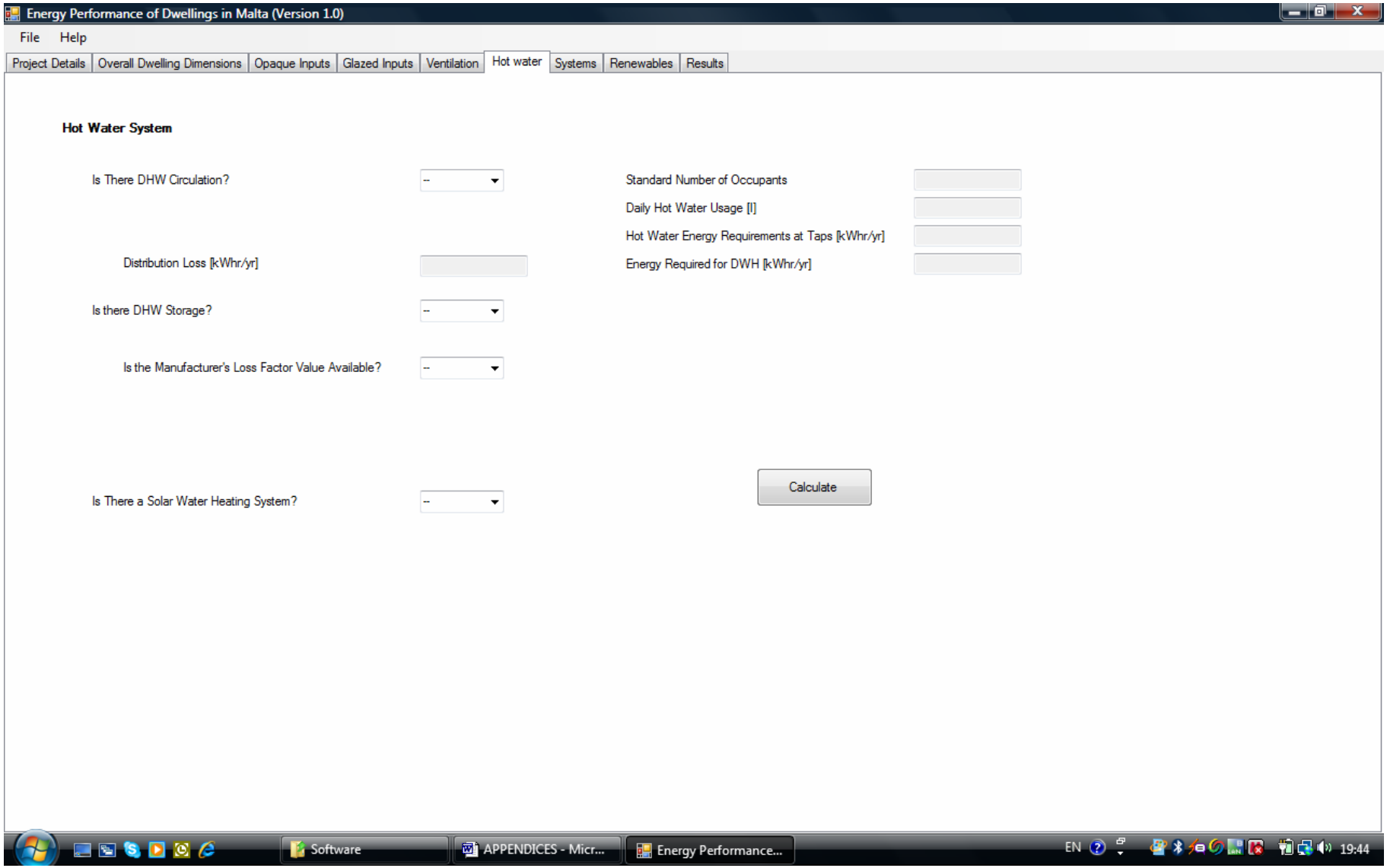
[223] Energy Performance Rating of Dwellings in Malta, Calculation Software, Version 1.0 (2010) CASAinginiera. [Online] Available at: https://secure2.gov.mt/epc/calculation_software (Accessed: 28 September 2010)

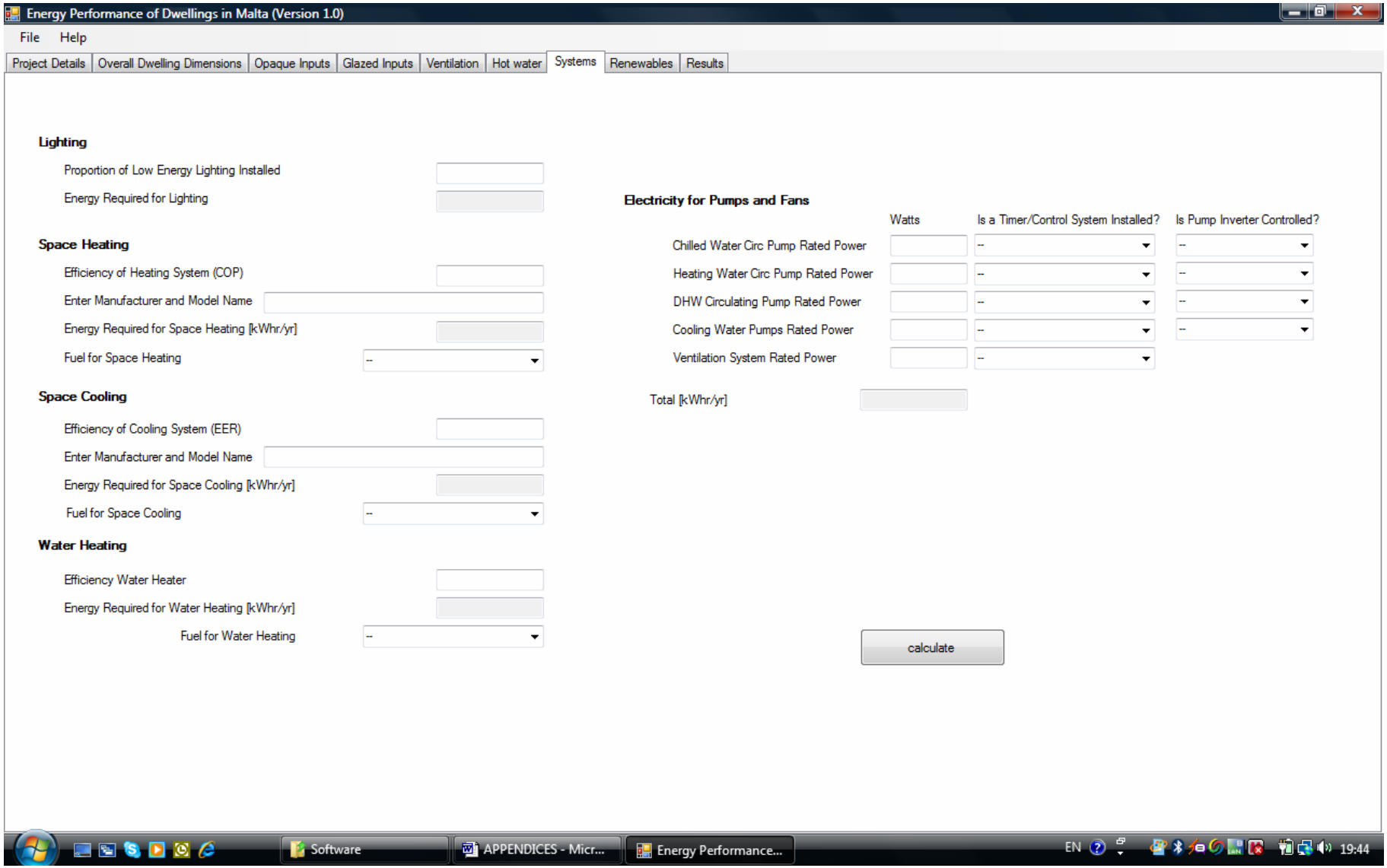

Energy Performance of Dwellings in Malta (Version 1.0)
File
Help
Project Details
Overall Dwelling Dimensions
Opaque Inputs
Glazed Inputs
Ventilation
Hot water
Systems
Renewables
Results
Area [m2]
Average room height [m]
Volume [m3]
Ground or Lowest Floor
First Floor
Second Floor
Third and Other Floors
Total Floor Area
Utilisation Factor
Dwelling Volume
[m2]
Living Area
calculate
Software
APPENDICES - Micr...
Energy Performance...
EN
19:43

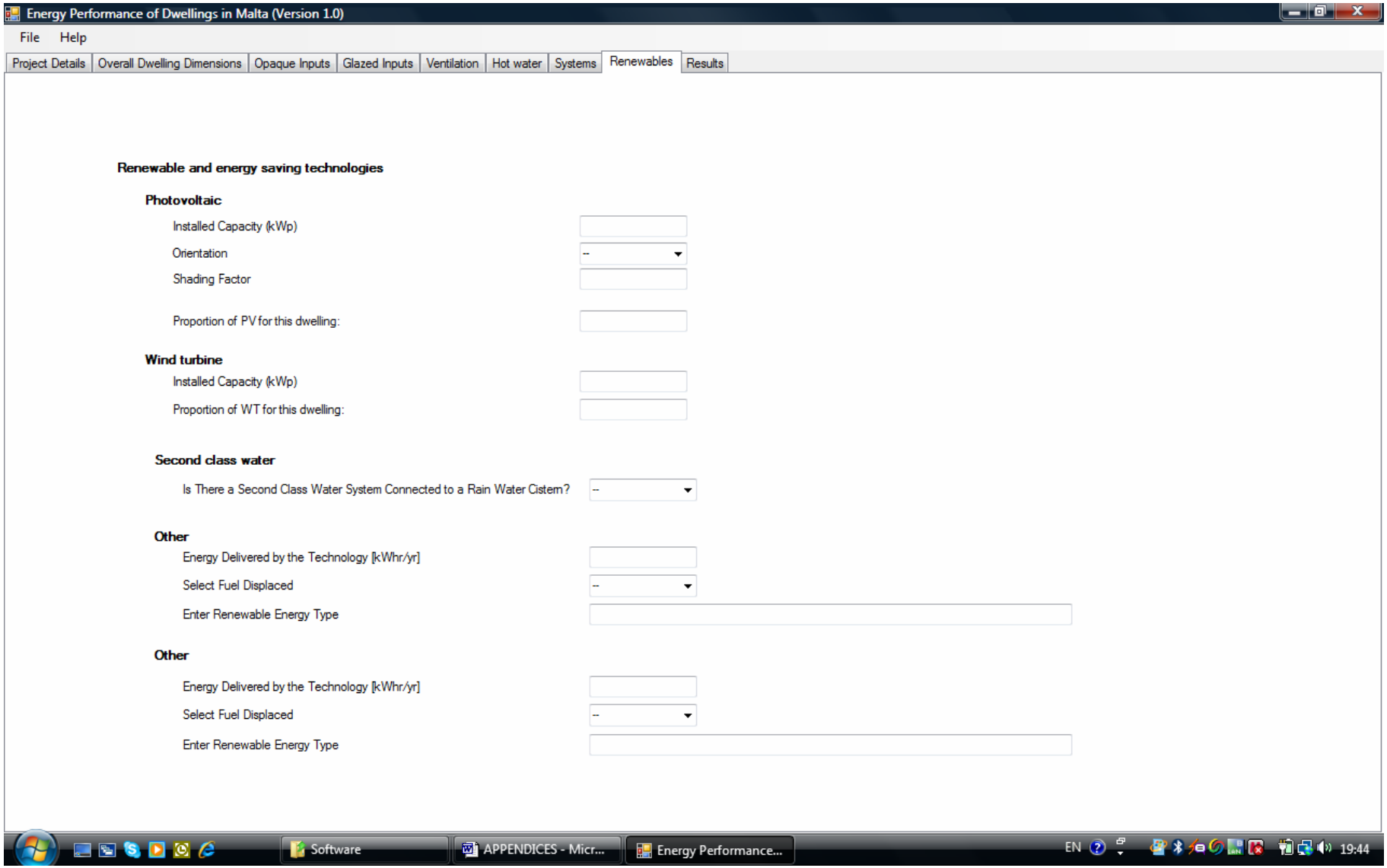

Energy Performance of Dwellings in Malta (Version 1.0)
File
Help
Project Details
Overall Dwelling Dimensions
Opaque Inputs
Glazed Inputs
Ventilation
Hot water
Systems
Renewables
Results
Is the Internal Heat Capacity Known?
Area m2
U-value W/m2 K
Front Door
Floors to Internal Unconditioned Space
Walls to Adjacent Unconditioned Space
Walls to Adjacent Unconditioned Space
Roof to Internal Unconditioned Space
Floor Slab to Ground
Building geometry
Roof
Wall 1
Wall 2
Wall 3
Wall 4
Wall 5
Wall 6
Orientation
Area m2
Shading Factor External
U-value W/m2 K
Absorbtivity,
Emissivity
Software
APPENDICES - Micr...
Energy Performance...
EN
19:43

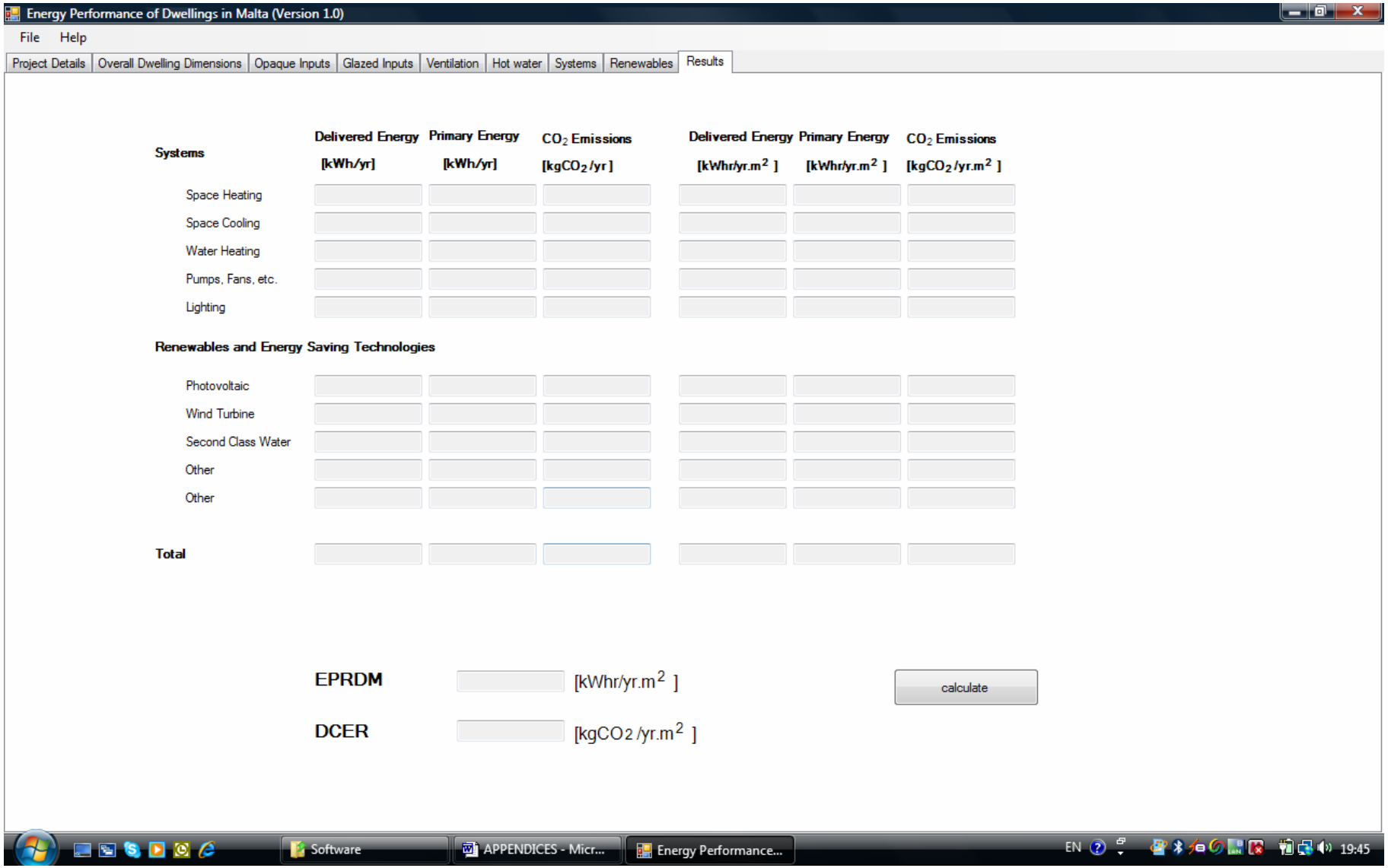

Energy Performance of Dwellings in Malta (Version 1.0)
File
Help
Project Details
Overall Dwelling Dimensions
Opaque Inputs
Glazed Inputs
Ventilation
Hot water
Systems
Renewables
Results
Building geometry
Glazing 1
Glazing 2
Glazing 3
Glazing 4
Glazing 5
Glazing 6
Orientation
Area m2
Shading Factor External
Frame factor
U-value, W/ m2 K
Emissivity
Light Transmittance Factor
g value
Software
APPENDICES - Micr...
Energy Performance...
EN
19:43


Energy Performance of Dwellings in Malta (Version 1.0)
File
Help
Project Details
Overall Dwelling Dimensions
Opaque Inputs
Glazed Inputs
Ventilation
Hot water
Systems
Renewables
Results
Openings
Number of Chimneys
Number of Open Flues
Number of Intermittent Fans and Passive Vents
Number of Flueless Gas fires
Is there a draught Lobby in the Main Entrance
--
Effective air change rate [ac/h]
Ventilation heat loss [W/K]
Structural airtightness
Number of Storeys in the Dwelling
Has an Air Permeability Test Been Carried Out?
--
Percentage of Perimeter Abutting Party Walls
calculate
Software
APPENDICES - Micr...
Energy Performance...
EN
19:44


Energy Performance of Dwellings in Malta (Version 1.0)
File
Help
Project Details
Overall Dwelling Dimensions
Opaque Inputs
Glazed Inputs
Ventilation
Hot water
Systems
Renewables
Results
Hot Water System
Is There DHW Circulation?
Distribution Loss [kWhr/yr]
Is there DHW Storage?
Is the Manufacturer's Loss Factor Value Available?
Is There a Solar Water Heating System?
Standard Number of Occupants
Daily Hot Water Usage [l]
Hot Water Energy Requirements at Taps [kWhr/yr]
Energy Required for DWH [kWhr/yr]
Calculate
Software
APPENDICES - Micr...
Energy Performance...
EN
19:44


Energy Performance of Dwellings in Malta (Version 1.0)
File
Help
Project Details
Overall Dwelling Dimensions
Opaque Inputs
Glazed Inputs
Ventilation
Hot water
Systems
Renewables
Results
Lighting
Proportion of Low Energy Lighting Installed
Energy Required for Lighting
Space Heating
Efficiency of Heating System (COP)
Enter Manufacturer and Model Name
Energy Required for Space Heating [kWhr/yr]
Fuel for Space Heating
Space Cooling
Efficiency of Cooling System (EER)
Enter Manufacturer and Model Name
Energy Required for Space Cooling [kWhr/yr]
Fuel for Space Cooling
Water Heating
Efficiency Water Heater
Energy Required for Water Heating [kWhr/yr]
Fuel for Water Heating
Electricity for Pumps and Fans
Watts
Is a Timer/Control System Installed?
Is Pump Inverter Controlled?
Chilled Water Circ Pump Rated Power
Heating Water Circ Pump Rated Power
DHW Circulating Pump Rated Power
Cooling Water Pumps Rated Power
Ventilation System Rated Power
Total [kWhr/yr]
calculate
Software
APPENDICES - Micr...
Energy Performance...
EN
19:44


Energy Performance of Dwellings in Malta (Version 1.0)
File
Help
Project Details
Overall Dwelling Dimensions
Opaque Inputs
Glazed Inputs
Ventilation
Hot water
Systems
Renewables
Results
Renewable and energy saving technologies
Photovoltaic
Installed Capacity (kWp)
Orientation
Shading Factor
Proportion of PV for this dwelling:
Wind turbine
Installed Capacity (kWp)
Proportion of WT for this dwelling:
Second class water
Is There a Second Class Water System Connected to a Rain Water Cistern?
Other
Energy Delivered by the Technology [kWhr/yr]
Select Fuel Displaced
Enter Renewable Energy Type
Other
Energy Delivered by the Technology [kWhr/yr]
Select Fuel Displaced
Enter Renewable Energy Type
Software
APPENDICES - Micr...
Energy Performance...
EN
19:44


Energy Performance of Dwellings in Malta (Version 1.0)
File
Help
Project Details
Overall Dwelling Dimensions
Opaque Inputs
Glazed Inputs
Ventilation
Hot water
Systems
Renewables
Results
Systems
Delivered Energy [kWh/yr]
Primary Energy [kWh/yr]
CO2 Emissions [kgCO2/yr]
Delivered Energy [kWhr/yr.m2]
Primary Energy [kWhr/yr.m2]
CO2 Emissions [kgCO2/yr.m2]
Space Heating
Space Cooling
Water Heating
Pumps, Fans, etc.
Lighting
Renewables and Energy Saving Technologies
Photovoltaic
Wind Turbine
Second Class Water
Other
Other
Total
EPRDM
[kWhr/yr.m2]
DCER
[kgCO2/yr.m2]
calculate
Software
APPENDICES - Micr...
Energy Performance...
EN
19:45

Appendix E: Interview Questions

Ministry for Resources and Rural Affairs (MRRA)

1. What is the government's policy on green buildings etc.?
2. What has the government done so far vis-à-vis green buildings?
3. Is the government setting enough of an example in the use of green technologies? How?
4. What are the advantages to our economy of having green buildings?
5. Do you think that there is enough awareness re: use of green technology – both by building developers and those who are purchasing?
6. What incentives are in the pipeline? E.g free light bulbs, net metering, grants etc
7. Do you think that the required expertise to introduce such technologies is available locally? If not, what other expertise were required?
8. What barriers have been encountered in introducing such measures?
9. What is envisaged for the future? How do you foresee the government's role in the future re: green buildings etc?
10. What are your recommendations to improve accessibility to such technologies and increased market penetration?
11. What is the government's long-term vision vis-à-vis minimisation of environmental impact and improving the energy performance of buildings?

Malta Resources Authority (MRA)

1. What are the main functions of the organisation vis-à-vis energy performance of buildings?

2. Do you consider MRA as a major player within the context of building efficiency etc? If yes, how?

3. What policies are in place? (Energy, water, air quality etc.) Have any policies/guidelines been issued by MRA specifically re: green buildings / constructions? If yes, which are they?

4. What measures have been taken so far? (PVs, solar heaters, etc.)

5. What kind of incentives have been introduced? Please state what incentives have been granted by MRA re: energy saving etc?

6. Have any consultations been conducted by MRA specifically re: building efficiency etc?

7. What results have been achieved so far? (cost savings, emissions, etc.)

8. Has there been any system/s or technology/s which has not proved to be viable?

9. Do you think that the required expertise to introduce such technologies is available locally? If not, what other expertise were required?

10. What barriers have been encountered in introducing such measures?

11. What is envisaged for the future? How do you foresee MRA's role in the future re: green buildings etc?

12. What are your recommendations to improve accessibility to such technologies and increased market penetration?

13. What is the organisation's long-term vision vis-à-vis minimisation of environmental impact and improving the energy performance of buildings?

Building Industry Consultative Council (BICC)

1. What is the role of BICC in a green building scenario?

2. What has BICC done to date re: green building policy etc?

3. What is it currently doing?

4. What are its intentions for the future?

5. Is the building industry conscious enough of the advantages of having green buildings? Is it aware as to what is available on the market re: green materials etc?

6. Does the building industry have any preoccupations when it comes to adopting green initiatives? Costs? Lack of expertise etc?

7. Does the building industry appreciate the fact that if our buildings become greener then this will make our island even more competitive re: the property / estate industry?

8. Where do you see Malta's building industry re: green initiatives in the next 10 years?

9. Do you think that the local building industry is in need of a change in the way that it has conducted its operations to date in order to adapt itself to green technologies?

10. Are courses/training being held by the BICC re: green building, construction etc?

11. Has the BICC contributed locally / abroad in the drafting of any policy / law etc re: green buildings etc? Is the BICC affiliated with any foreign organisation that relates specifically to green buildings?

Malta Environment and Planning Authority (MEPA)

1. What are the main functions of the organisation vis-à-vis energy performance of buildings?

2. What policies / guidelines are in force re: green buildings etc.?

3. What is the role of MEPA in the green building scenario?

4. Do you think that the building industry is now even more conscious on the advantages of building green? Do you see an increase in green initiatives from the local building industry?

5. Do you see an increase in awareness by the general public re: green technology etc?

6. Are we far away from a scenario were it would become compulsory for buildings to take a number of green initiatives and one would need to obtain certification of compliance?

7. Do you think that the required expertise to introduce such technologies is available locally? If not, what other expertise were required?

8. What barriers have been encountered in introducing green measures?

9. What is envisaged for the future? How do you foresee MEPA's role in the future re: green buildings etc?

10. What are your recommendations to improve accessibility to such technologies and increased market penetration?

11. What is the organisation's long-term vision vis-à-vis minimisation of environmental impact and improving the energy performance of buildings?

Housing Authority (HA)

1. What guidelines / policies / codes is the HA following in its building developments?

2. Can you please mention examples of green initiatives taken by the HA so far? (eg: re 'Tal-Ftieh' project)

3. Do you consider going green as an excessive cost?

4. Do you think that our building contractors are well equipped to develop and construct green buildings? Do they possess the required expertise?

5. How do you justify investing in green buildings rather then using the money spent on green buildings to build more traditional units thus offering even more units to those in need?

6. Do you think that the HA should be that authority which sets the example to the private sector when it comes to the use of green technologies? If so, how?

7. What is the authority's long term vision vis-à-vis implementation of green principles in its developments?

Foundation for Tomorrow's Schools (FTS)

1. What guidelines / policies is FTS following in its developments?

2. Can you provide examples of green initiatives taken by FTS in school buildings etc.?

3. Do you consider going green as an excessive cost? Is cost still the major hurdle to go green?

4. What results have been achieved so far?

5. Do you consider green technology as an investment? If yes, why?

6. Do you think that the public is aware of the benefits of green technologies?

7. Do you think that the local market is well equipped with green materials/ products?

8. Are we ensuring that the green technology which we are implementing is truly green? Are we ensuring that the solar panels we are installing on our roof tops for example are truly efficient and giving the true benefits?

9. Do you think that the local market has the required expertise / professionals who are versed on the subject? E.g. do you think that our building contractors have the required expertise?

10. Has there been any system/s or technology/s which has not proved to be viable?

11. What barriers have been encountered in introducing such measures?

12. What is the organisation's long-term vision vis-à-vis minimisation of environmental impact and improving the energy performance of education buildings?

Hilton Malta

1. Does the organisation have an environmental policy?

2. What green measures have been taken so far? (Such as those pertaining to; Air-conditioning, Ventilation, Lighting, power generation, water heating, water conservation etc.)

3. What investment has been made in introducing green technologies? (financial terms)

4. What results have been achieved so far? Savings?

5. Has there been any system/s or technology/s which has not proved to be viable?

6. Has your organisation been rewarded for its achievements? (Awards etc.)

7. Are employees aware of the importance of such technologies and conscious about their impact on;
    a. The environment?
    b. General operating costs?

8. Do you think that the required expertise to introduce such technologies is available locally? If not, what other expertise were required?

9. What barriers have been encountered in introducing such measures?

10. Did you find the necessary support from local entities and/or regulatory bodies? (Authorities, government etc.)

11. What is envisaged for the future?

12. What are your recommendations to improve accessibility to such technologies and increased market penetration?

13. What is the organisation's long-term vision vis-à-vis minimisation of environmental impact and improving the energy performance of its building?

14. What sorts of new policies or programs would make it easier for you to become more involved in incorporating sustainable building strategies into your privately-funded projects in the future?

Westin Dragonara Resort

1. Does the organisation have an environmental policy?

2. What green measures have been taken so far? (Such as those pertaining to; Air-conditioning, Ventilation, Lighting, power generation, water heating, water conservation etc.)

3. What investment has been made in introducing green technologies? (financial terms)

4. What results have been achieved so far? Savings?

5. Has there been any system/s or technology/s which has not proved to be viable?

6. Has your organisation been rewarded for its achievements? (Awards etc.)

7. Are employees aware of the importance of such technologies and conscious about their impact on;
    a. The environment?
    b. General operating costs?

8. Do you think that the required expertise to introduce such technologies is available locally? If not, what other expertise were required?

9. What barriers have been encountered in introducing such measures?

10. Did you find the necessary support from local entities and/or regulatory bodies? (Authorities, government etc.)

11. What is envisaged for the future?

12. What are your recommendations to improve accessibility to such technologies and increased market penetration?

13. What is the organisation's long-term vision vis-à-vis minimisation of environmental impact and improving the energy performance of its building?

14. What sorts of new policies or programs would make it easier for you to become more involved in incorporating sustainable building strategies into your privately-funded projects in the future?

Radisson Blu Resort & Spa, Golden Sands Malta

1. Does the organisation have an environmental policy?

2. What green measures have been taken so far? (Such as those pertaining to; Air-conditioning, Ventilation, Lighting, power generation, water heating, water conservation etc.)

3. What investment has been made in introducing green technologies? (financial terms)

4. What results have been achieved so far? Savings?

5. Has there been any system/s or technology/s which has not proved to be viable?

6. Has your organisation been rewarded for its achievements? (Awards etc.)

7. Are employees aware of the importance of such technologies and conscious about their impact on;
    a. The environment?
    b. General operating costs?

8. Do you think that the required expertise to introduce such technologies is available locally? If not, what other expertise were required?

9. What barriers have been encountered in introducing such measures?

10. Did you find the necessary support from local entities and/or regulatory bodies? (Authorities, government etc.)

11. What is envisaged for the future?

12. What are your recommendations to improve accessibility to such technologies and increased market penetration?

13. What is the organisation's long-term vision vis-à-vis minimisation of environmental impact and improving the energy performance of its building?

14. What sorts of new policies or programs would make it easier for you to become more involved in incorporating sustainable building strategies into your privately-funded projects in the future?

Pender Gardens

1. What guidelines / policies are you following in this development?

2. Can you provide examples of green initiatives?

3. Do you consider going green as an excessive cost? Is cost still the major hurdle to go green?

4. What results have been achieved so far?

5. Do you consider green technology as an investment? If yes, why?

6. Do you think that the public is aware of the benefits of green technologies?

7. Do you think that the local market is well equipped with green materials/ products?

8. Are we ensuring that the green technology which we are implementing is truly green? Are we ensuring that the solar panels we are installing on our roof tops for example are truly efficient and giving the true benefits?

9. Do you think that the local market has the required expertise / professionals who are versed on the subject? E.g. do you think that our building contractors have the required expertise?

10. Has there been any system/s or technology/s which has not proved to be viable?

11. What barriers have been encountered in introducing such measures?

12. What is your long-term vision vis-à-vis minimisation of environmental impact and improving the energy performance of the various building blocks?

Fort Cambridge

1. What guidelines / policies are you following in this development?

2. Can you provide examples of green initiatives?

3. Do you consider going green as an excessive cost? Is cost still the major hurdle to go green?

4. What results have been achieved so far?

5. Do you consider green technology as an investment? If yes, why?

6. Do you think that the public is aware of the benefits of green technologies?

7. Do you think that the local market is well equipped with green materials/ products?

8. Are we ensuring that the green technology which we are implementing is truly green? Are we ensuring that the solar panels we are installing on our roof tops for example are truly efficient and giving the true benefits?

9. Do you think that the local market has the required expertise / professionals who are versed on the subject? E.g. do you think that our building contractors have the required expertise?

10. Has there been any system/s or technology/s which has not proved to be viable?

11. What barriers have been encountered in introducing such measures?

12. What is your long-term vision vis-à-vis minimisation of environmental impact and improving the energy performance of the various building blocks?

New American Embassy Compound, Ta' Qali

1. What guidelines / policies are you following in the development of the New Embassy Building?

2. Can you provide examples of green initiatives?

3. Do you consider going green as an excessive cost? Is cost still the major hurdle to go green?

4. What results have been achieved so far?

5. Do you consider green technology as an investment? If yes, why?

6. Do you think that the public is aware of the benefits of green technologies?

7. Do you think that the local market is well equipped with green materials/ products?

8. Are we ensuring that the green technology which we are implementing is truly green? Are we ensuring that the solar panels we are installing on our roof tops for example are truly efficient and giving the true benefits?

9. Do you think that the local market has the required expertise / professionals who are versed on the subject? E.g. do you think that our building contractors have the required expertise?

10. Has there been any system/s or technology/s which has not proved to be viable?

11. What barriers have been encountered in introducing such measures?

12. What is your long-term vision vis-à-vis minimisation of environmental impact and improving the energy performance of the embassy building?

Smart City Malta

1. What guidelines / policies are you following in this development?

2. Can you provide examples of green initiatives?

3. Do you consider going green as an excessive cost? Is cost still the major hurdle to go green?

4. What results have been achieved so far?

5. Do you consider green technology as an investment? If yes, why?

6. Do you think that the public is aware of the benefits of green technologies?

7. Do you think that the local market is well equipped with green materials/ products?

8. Are we ensuring that the green technology which we are implementing is truly green? Are we ensuring that the solar panels we are installing on our roof tops for example are truly efficient and giving the true benefits?

9. Do you think that the local market has the required expertise / professionals who are versed on the subject? E.g. do you think that our building contractors have the required expertise?

10. Has there been any system/s or technology/s which has not proved to be viable?

11. What barriers have been encountered in introducing such measures?

12. What is your long-term vision vis-à-vis minimisation of environmental impact and improving the energy performance of the various building blocks?

Faculty for the Built Environment, University of Malta

1. How is the University of Malta preparing our future architects re: green buildings etc? Is the University of Malta stressing enough on the use of green technologies? Are students being provided with enough knowledge on the subject?

2. Do you think there is enough awareness amongst local Periti re: the use of green technologies etc?

3. Do you see an increase in the use of green concepts and design principles by local Periti?

4. Where do you see Malta in 5 years to 10 years re: green buildings etc?

5. Have any theses / projects on this subject been submitted?

6. Is the faculty collaborating with the local industry on this subject?

7. Is the faculty collaborating with some other foreign university / organisation re: this subject? If yes, how?