D.H. CAMILLERI Eur. Ing, A. & C.E.
B.Sc., (Eng)., B.A. (Arch.)., C. Eng., A.C.I.Arb., M.I. Struct. E., F.I.C.E.
Architect and Civil Engineer
Structural & Property Investments Consultant

5, (1st Floor), Europa Centre, Floriana VLT 15, Malta.
Fax/Tel: --356-21233376
E-mail: dhcamill@maltanet.net

Your Ref:. **Our Ref**: **Date**: 15/06/03

Sustainable Development Property Facts

Denis H. Camilleri BICC CPD Co-ordinator.

The concept of sustainability refers to the statement, "*treat the earth well, it was not given to by your parents, it was lent to you by your children*." This may be explained by referring to life styles 100 years ago, when a farmer ran his own holding, recycling everything, using manure from his animals to fertilize his fields and eating the produce of the land, and doing no harm to the environment. When he closed down, he left everything as he had found it – an environmentally neutral activity. The idea of growth and social welfare has to be balanced by the conservation of environmental resources by the present generation for the benefit of future generations. Nowadays instead of being at loggerheads, 3 dimensions co-exist, mainly *economic growth, sustainability and social adhesion.*

In 20 to 30 years time it will be too expensive to extract fossil fuels, which are only 25% efficient. There however, does not appear to be any hurry to change over to renewable energy sources, which in Europe presently stands at around a meagre 6%. Malta intends to have 5% of its electricity consumption coming from renewable sources by 2010, primarily through the installation of more domestic solar water-heaters. Consider the following, if an area in the Libyan Sahara Desert, 750km by 750km is covered up in photovoltaic panels, presently only 12% efficient, this would supply the global energy requirements.

To reduce reliance on fossil fuels, *EU Directive 2001/77/EC states that by 2010, the emission of CO_2 is to be reduced by 20%.* In Malta, energy requirements are mostly totally reliant on imported fossil fuels, of which 60% is utilised for electrical generation and 30% for transport. The feasibility of importing natural gas by pipeline for use in power generation is being considered, which should lead to improvements in power efficiency and air quality. Environmental benefits of shifting from one fuel system to another may be gauged from the CO_2 emissions for the various fuels. This works out at 0.31kgCO_2/kWh for coal, 0.29kgCO_2/kWh for oil and 0.21kgCO_2/kWh for natural gas. A typical UK electrical generation mix stands at 0.72kgCO_2/kWh.

Construction Development

Any one development has a much larger environmental impact than is immediately apparent. At first sight the imprint may appear small, just the impact on the site on which the development sits. But, when the environmental capital inherent in the construction of

that development is considered – the energy and resources expended in the manufacture and transport of materials, the energy required to prepare the site and construct the development, a hidden but much larger environmental impact is apparent. Subsequently when the development is in occupation, the ongoing energy and resources expand to sustain the development – the maintenance requirements, the energy requirements of the development – heat, light, electricity, etc., the waste disposal requirements, and the travel requirements, of the occupants – the impact extends even further. Thus, even in a very efficient building, ongoing energy use over the lifetime of the building will represent 4 times that of the embodied energy used in the construction process. However, the proportion of energy that is embodied or operational, varies between types. The extremes are a bridge, with high embodied energy and low operational requirements and a hospital where the operational energy is high. Finally, when the building reaches the end of its life, the energy required to alter or demolish the development and to deal with the resulting site and materials completes the lifetime environmental costs of that development.

Our Common Future (1987) stated "Humanity has the ability to make development sustainable – to ensure that it meets the needs of the present without compromising the ability of future generations to meet their own needs". This entails an understandable and holistic design by architects, engineers, planners, developers, contractors, users and manufacturers.

However, developers will adopt 'sustainability' criteria in their developments when the market gives them a positive motive for doing so – when occupiers, buyers and users show that they will pay the best rents and prices for more sustainable buildings, together with the attitude of lenders and investors to such developments. Further, developers would be much more highly motivated if they had to demonstrate the 'greenness' of their projects at planning application stage and could make an environmental case as part of their bid for planning permission.

Energy certificates compulsory for new and existing buildings – what next!
More than 40% of energy consumption takes place in buildings. As part of the EU's sustainable development strategy and its Kyoto commitment to reduce greenhouse gas emissions by 2010, the EU proposed **a draft Directive to improve the energy performance not just of new buildings but also of existing buildings**. Member states have until 4th January 2006 to implement this directive into their national law. Those counties who can justify their lack of qualified/accredited experts may have an additional 3 years.

The directive which is based on the reduction of energy consumption, has 4 key elements.

1/- energy certificates are required each time a new or existing building is to be sold or let. A performance certificate not more than 10 year old is to be shown to prospective purchaser.

2/- new buildings need to meet minimum energy performance requirements. The design of new buildings with a total useful floor area over 1000m^2, must take into account the technical, environmental and economic feasibility of alternative systems for on-site generation from renewable sources and the use of other low carbon technologies.

3/- major renovation for buildings with a total useful floor area of over 1000m^2 must have their energy performance upgraded to meet minimum requirements where it is technically and economically feasible.

4/- boilers/air-conditioning burning fossil fuel must be regularly inspected.

The member states are to set minimum energy requirements for buildings – to take account of general indoor climate, as well as local conditions and the designated function and age of the building. Member states may decide to exempt the following buildings.

- buildings and monuments designated as protected
- places of worship
- temporary buildings with a planned time of use of 2 years and less
- industrial sites
- workshops
- non-residential agricultural buildings
- residential buildings intended to be used less than 4 months a year
- stand-alone buildings with a total useful area of less than 40m^2.

Most of the following data relies heavily on a Conference organised by the Kamra tal-Periti in collaboration with the Parliamentary Secretary for Planning & the Environment & The Building Industry Consultative Council (BICC) during November 2002 on 'The Culture of Sustainability –Sustainability as a Culture'.

This Conference had helped create an awareness for Periti to consider sustainable criteria which create healthy spaces, economically viable and sensitive to social needs. The location of this Conference at the old University Hall, the Aula Magna was testimony to the above.

Prof. Gunnel Aldercreutz from Finland, dwelt on **"Sustainability – the development of a culture in Northern Europe."** The Professor is also director general of the Finnish Building Information Foundation RTS www.rts.fi

As an introduction, it was shown how Finland's austere environment helps shape its surrounding. The urban fabric, streetscape, colours all tell us something. The principle adopted is that the whole is more important than its parts. How relevant for Malta where homeowners try to outshine their neighbours!

The quality of the works involves not only the technical aspect, but the environmental and architectural are to be holistically considered. Practical works are to be durable, they have to be seen tomorrow.

Vitruvius maxims were quoted – practicality, durability and beauty. Small nations have the advantage of functioning better than larger nations in adopting these principles, as uniformity is achieved more easily.

Beauty being difficult to measure is not a luxury but a human right. The concepts of cost, price and value have different meanings. Low Cost is not sustainable as it may not be enjoyed

tomorrow. The beautiful and pleasant surroundings are what give added Value. Constructions cost are to be covered by life-cycle costing (LCC) and life-cycle analysis (LCA).

Sustainability implies recognising quality, achieving quality and maintaining quality which in turn requires 'taking a broad and long term view of the cost and benefits of any change.' A sustainable approach is not merely 'an engineering problem' but requires further designing to meet societal needs, understanding what makes towns and cities sustainable. The political economic systems are generally of a short term nature, rarely reflecting the true costs of a sustainable development based on a long-term investment

The design process is not to be subjected to fee tendering procedures, due to the creative nature of design. A greater input in design is necessary to achieve environmental savings. In Finland young architects are being given the jobs and this has worked well since the 80's. Quality is achieved via the Authorities and well trained personnel, thus putting the onus on the Universities.

Who can influence – not only architects!
Citizens
Local Councils
Parliament
State Institutions
Ministries & Government.

Competition focuses on quality, with pride in work giving a better result than watchdog rules.

A science park was then outlined, presently being constructed on ecological principles, being 8km away from Helsinki, close by to a natural reserve. A mixed use development consisting of private, rented and subsidized housing is being created from State-owned land. Its location depends on Public Transport. Wood is being used in the apartment construction, not producing so much waste on site. Cooling efficiency, solar heating, waste water systems, solar heating, ventilation principle have all been incorporated in the design. It is being built for the future for families with small children in mind.

Architect Varis Bokalders from Sweden, winner of several national and international awards, dwelt on **"Definition on examples of sustainable buildings."**

The following useful data on the building sector was supplied.
40% of energy is used in the building sector
40% of all materials are used in the building sector
25% of water is used by the building sector
25% of timber is used in the building sector (applies for Scandinavian countries)

Useful data on conservation of resources
Build cities requiring less heat
Electricity - use more efficient lighting, refrigerants
Water flushing systems originally used 12l/flush, then went down to 9l/flush, even 6l/flush and now even to 4l/ flush. A vacuum system now only requires 0.5l/flush. In the US a flush takes 25l.
Separation of garbage outlined. *Garbage is just material at the wrong place at the wrong time.*

To create Eco-cycles the following is required
Renewable energy such as solar panels
Renewable power such as wind power
Sewage systems with separate systems for traffic and rain water
Vegetation

Adjustment to the place,
Nature – geology, plants, trees
Infrastructure – too many cars, cycle tracks, public transport, boat transport
Existing buildings – poisonous materials such as asbestos are out, healthy buildings help reduce sick leave.

Healthy Buildings
As a general rule, natural building materials are also healthy ones. Traditional materials, some neglected because of fashion or poor performance are being revived as a result of their undoubted healthiness. Organic materials require better detailing than modern materials, due to damp penetration etc.
Do not use heavy metals, poisonous materials. **Use** materials that utilise less resources.
Do use cellulose fibre for insulation, **do use** foam glass, old newspapers with boric acid, seaweed. **Do use** light weight concrete, glass fibre reinforced instead of reinforcing steel bars. **Do use** PVC pipes **do not use** steel. **Do use** halogen free cables **do not use** PVC. **Do use** water paint instead of oil or plastic paint, as they are less toxic, reducing the risk of lung cancer.
The main organic materials are earth products ranging from earth blocks, sun baked bricks, clay mortars and earth-based plasters, together with stone, timber and lime mortar.

The above treatise on the choice of adapting sustainable materials raises a dilemma. If our constructions are to be insulated, to keep the heat in winter and reduce the heat gain in summer, does this necessitate the use of unsustainable materials to infill the wall cavities such as urea-formaldehyde systems, when then most households decide to keep their external aperatures open for most of the year.

A flow chart demonstrated how *Building Ecology* has to be treated in a holistic approach including *health, conservation, eco-cycles and the place*.

This approach was then demonstrated from the various projects referred to. The pioneers of the eco-village were young married couples with children. Roads were paved solely in gravel not in asphalt for the water to return to the earth. Heating was achieved from pellets collected from carpenters' left-overs. WC's have separators to separate the urine from the foeces, as urine has a high fertilizing content. Efficient kitchen appliances are purchased having a higher initial cost, but with a 9 year payback period. The right choice of paints adopted with a low toxic value. Hot water is achieved from solar energy, with no heating bills for housing, although a low internal temperature achieved hovering around 14C after a lengthy holiday period.
Earth-soil covered buildings were also shown in clay/timber interiors outlying the above principles for material selection.

The ***Hon. Dr. Francis Zammit Dimech***, former Minister for Resources & Infrastructure addressed "**Proper use of Natural Resources & Energy Efficiency in Building Design."**

Maltese stone was discussed, referring to a limit on quarrying. The current quarrying stocks are estimated to last for a further 35 years. So why is it that unsustainable solutions were adopted in the hospital and other large projects where good quality excavated franka building material was dumped instead of producing building blocks. It would be interesting to identify how much of this excavation waste is due to the unsustainable provision of the car parking spaces, for the issue of building permits.

82% of the national waste is due to demolition and construction waste, comparing unfavourably to the normal 40% for quarrying, mining, demolition and construction waste. 11% is then due to municipal waste and 7 % to industrial. Solid waste at public disposal sites totals 1.4 million tons annually, with domestic waste totalling 1.3 tons/household annually, with plastic containers and film accounting for 10% of domestic waste. The countries of the EU generate about 2 billion tons of waste annually, and between 1993 and 1999, the amount generated increased by 10% pa. 8 EU member states had been sent a 2nd warning by the EU commission for their failure to comply on landfill legislation. The directive bans certain types of waste from landfill sites, eg used tyres, and requires Member States to reduce the amount of biodegradable waste to 35% of 1995 levels. This measure will help to reduce the negative impacts of landfilling and promote the recovery of waste, a study on which is to be presented towards the end of 2003. The evolution of the waste policy discourse has been manifested in a move away from 'filling holes in the ground' towards adopting the 'waste hierarchy'. The predominance of landfill in current waste management practices reflects the fact that landfill is the most adaptive and least expensive waste management option in most countries, with landfill accounting to 85%, incineration 7% and recyled/re-use at 8%. The planning system is set to face one of its greatest environmental and political challenges in the coming 21st century.

The Solid Waste Management is to help create an awareness via a BICC working group on recycled materials, identifying the materials to recycle for which application, together with the disposal of rock into the sea for reclamation purposes being studied. The aims are to recover and recycle materials from excavation, demolition and construction.

Reference was made to the BICC Education & Research handbook on "Energy Efficiency in Building Design", prepared by Dr. V. Buhagiar A&CE. The historical outlook was gone into with basements being previously used as a buffer for damp proof effects and the current form of air-conditioning works installed in all construction uses. Achieving energy conservation in buildings, which consume ½ of the nation's energy supply, is a sustainable measure. To be noted that energy losses occur at 35% from walls, 25% from roofs, 15% from floors, 15% in draughts and 10% from windows.

Architect Livia Tirone, dwelt on "**Architecture, a Mediator for a Sustainable Built Environment."** She presently chairs the task force of the Architects Council of Europe on Environment and Sustainable Architecture.

Our island being 25% built up with a favourable climate requires solutions *adapting not adopting* to the local context. A glass high rise building using as much energy as a whole town is not a sustainable solution for Malta. Local materials require the use of thermal mass to average out temperature variations, so timber is not appropriate for the Mediterranean region. The West façade requires a closed gable wall, whilst the South wall should take advantage of the low winter sun for lighting and shading is to be provided for the high summer sun. Orientation with natural ventilation principles can reduce the energy intake by 30%. It is possible to achieve

thermal comfort by passive means not involving the use of energy. The utilization of basements as a passive form of cooling to the upper floors, is virtually unknown. The internal yard concept although appreciated has lost its planning appeal. A residence requiring air conditioning for its comfort may be considered a design disaster A good climatic orientation taking ventilation advantage of light breezes, a light coloured roof top, not as is the norm, covered up in dark textured membranes, the provision of ceiling fans, together with humidity reduction with the help of a dehumidifier should create a comfortable environment for most days of the year. If air conditioning has to be installed the provision of ceiling fans would reduce the demand by $5^{o}C$. Besides the initial capital expenditure, there needs to be more education on the energy efficiency ratio (EER) Number of a unit, together with choosing units, such as VRF that are more environmentally friendly.

Most Mediterranean countries are late in adopting sustainable measures, but late means not repeating previous mistakes. A Directive of Energy Buildings in Mediterranean Countries is being completed, together with Public Procurement documents including construction, maintenance and life cycle costing.

Urban Design Measures are to include
Construction costs quality as affecting market value over time, with possible future refurbishment considered.
Mixed development
Working from home – home-tasking
Durability of the built environment.

Sustainable measures are to include
The 7 R's
Reduce weight by going for light weight
Classify materials as per load cycle analysis LCA, taking into consideration toxicity, diseases, future loss of work.
Reduce site waste
Reduce water consumption – a launderette was mentioned that does not consume water due to a recycling investment with a 9 year payback period.

The previous Parliamentary Secretary for the Ministry for Planning & the Environment, the ***Hon Perit George Pullicino*** discussed, **"Malta at Johannesburg."**

Malta prior to Conference published a stocktaking report since Rio with The Minister thanking Dr. M. Camilleri for preparing the sustainability indicators for Small Islands States.

The sustainable development for a small island state includes

1- The Rehabilation of Valletta, noting that its population of 24,000 inhabitants had decreased to 8,000 in 1985, together with decay of building fabric, social, environmental and its underutilisation of tourism potential. The potential of a bed and breakfast type of accommodation should be looked into. The 1^{st} phase by 2007 is to include a park and ride system, gardens upgrading and reduction of pollution. The 2^{nd} phase by 2012 is to include the upgrading of City Gate, Bus Terminus and Opera Site, upgrading of the underground system, lighting and stabilizing the residential vacancy rate.

2- Waste Management. The present landfill is the hottest issue, with 1.5 million tons of waste produced annually. It is aimed by 2007 to establish introductory standards, monitoring, enforcement, recovery, recycling of waste, waste charges. Landfill is to be closed by 2007 and rehabilitated over the next 10 years.
3- Coastal Zone Management. Due to expanding population, industrial, aquaculture demands better standards are to be obtained via Integrated Management. By 2007 to upgrade 1 coastal area to blue EU designated area. By 2012 to upgrade to blue EU standard the NW areas with integrated coastal management applied to rest of Malta.
4- Transport Management. The 1990's saw an alarming increase in the number of new vehicles at 510cars pa. The public bus service lost 1 million passengers pa, with increased congestion , noise and more pollution problems. To shift the balance of modes of transport the following are to be provided, accessible buses, fiscal measures for low energy cars, 16% customs duty, instead of 60%, limiting the number of car parking spaces together with better urban and land use planning.

Malta's national report on sustainable development presented to Johannesburg 2002, notes that *the main transport issues affecting Malta are the impacts of cars on society, health, and the environment. Congestion, noise pollution, air pollution, road accidents as well as economic costs point to a need to reduce the dependency on private cars.*

Road traffic also leads to atmospheric pollution by lead particulates and volatile organic compounds such as benzene. A recent study by prof A. Vella notes that, not only are our urban areas amongst the worst in Europe due to benzene air pollution, but the quality of air in the Maltese countryside is worse than that of the Swedish urban areas. This is due to wind action, which disperses the pollutants not eliminates them, against the common thinking.

The private motorcar however, is presently implicitly being given the greatest attention and priority, as planning permission is dependent on providing a number of car spaces for a development. Whilst the modernist visions clearly saw transport as part of the urban solution, today sustainability justifies a turnaround in approaches to the planning of transport systems. Poor availability for residential car parking may discourage car ownership, whilst people make more trips on foot, not to lose their parking space. A good rule of thumb is that at a density of 100 persons per hectare, a good bus service may be maintained. Note that the population for Malta is on the low side, averaging 65 persons per hectare. Towns with the higher density are Zabbar, Pieta', B'kara, Sta. Lucija, Paola, Fgura, with Senglea topping the range at 220 persons per hectare. Also distances must be walkable: the maximum distance people are prepared to walk is taken at 2000m, with an optimum of 800m, a comfortable 10 minute walk. Shopping developers use 400m as the maximum with shopping.

It is clear from the above that Malta's transport system has to be more sustainable, by boosting green travel. 'Feet first', 'two wheels good' and 'four wheels bad' encapsulate this green approach. Typically pedestrians and cyclists come first, followed by public transport and private transport comes last in priority. Unlike, motorised travel, walking and cycling are non-polluting, indeed they are healthy activities in the form of an exercise. Together, public transport with walking or cycling can offer the range and speed of motorised transport with the door-to-door penetration of individual transport.

Regarding enticing the 1 million annual passengers back to the public transport, can this be run on a free basis, obtaining its part funding from increased advertising? For a sustainable Public

Transport solution, the way forward is, unlike in the housing field, to have air conditioning installed on buses.

Prof. Manfred Hegger from Germany, dwelt on, **"Elements of Sustainable Architecture".** He is presently director on the UIA working programe on "Architecture for the Future."

20 years ago nobody believed in ecology, it is the clients who moved the concept forward. An improved quality of life has asked for healthier buildings, which utilize low primary energy, together with reduced CO_2 & SO_2 emissions. The improved air quality helps reduce sick leave by a 1/2. The quality of buildings has since doubled, however the resources have been halved, thus achieving an improvement to the factor of 4.

For ecological buildings the services engineer is to be engaged in partnership from the onset, for a healthy building to evolve. Not all spaces are to be heated or cooled uniformly, it is good for the body to be subjected for varying climatic conditions.

Various projects were then shown highlighting above projects. Demolition of an existing building was demonstrated, where the premises were left open. After some time , the people took that which was necessary, leaving very little to demolish. A project was shown with buildings never completed, giving open ended buildings. Used bricks was shown as being the best solution for walling.

An 11,000m^2 building within a building was finally shown. The outer skin was constructed in timber and glazing. The trees were moved around in the first years to find their best location. The photoelectric elements installed producing 1MW, besides producing 2 ½ times the amount of energy it actually uses, also creating pleasant unexpected coloured shading effects. The rectangular shaped building had no sloping faces for a more effective photoelectric collection, as aesthetics prevailed. Methane gas from the earth was also tapped and connected to the main electrical grid, lighting up a whole city. This ecological monumental building is thus partly self-financing.

As costs are to be added to the constructions, this would further affect their affordability, although green buildings have been quoted as being more affordable, as they can cut down on heating/cooling costs. It is commendable that the Housing Authority has taken the initiative in constructing an energy efficient block. However, it may be contentious, as less is then left of its budget due to the higher construction costs. It is thus left with less revenue, thus being able to construct less units, which in turn causes the property market to act in a less affordable manner.

Concluding Remarks
If Northern Countries collect and save water, even use solar energy, why is there this resistance in Mediterranean countries? Why is the recycling of "grey water" –e.g. water already used for washing, or the specification of low flush sanitary fittings and water-saving devices, on especially large development not enforced, together with the provision of more sewage treatment plants? The above has further to take into consideration the high proportion of our electrical supply, going towards the production of drinking water, via the reserve osmosis plants. Although renewables should be encouraged, however with offshore wind energy and solar

energy at the best supplying less than 10% of the power required, presently Malta's main aim should be energy saving.

Quarrying & Waste
With Malta's quarries and the high thermal capacity of franka, stone is an obvious building material. As stone occurs naturally, it is healthy, enduring and attractive. Although health problems can occur in quarrying and site cutting, however generally stone poses little pollution risk. Quarrying is however, visually and ecologically damaging, with large transportation energy costs involved. Ideally materials should be made on site or sourced within a radius of 10km. Our stone buildings can be more sustainable if particular emphasis is given on the mode of quarrying/transporting the material to site with reduced dust production, together with greater importance being given to its re-use.

Malta's national report on sustainable development presented to Johannesburg 2002, notes that '*the construction industry should be directed to improve design for thermal efficiency and to adopt energy saving measures prior to being granted development permission. In this regard, there is the need to step up funding for research to improve knowledge on local materials and conditions'*

However, as costs are to be added to the constructions, this would further affect their affordability, although green buildings have been quoted as being more affordable, as they can cut down on heating/cooling costs. It is commendable that the Housing Authority has taken the initiative in constructing an energy efficient block. However, it may be contentious, as less is then left of its budget due to the higher construction costs. It is thus left with less revenue, thus being able to construct less units, which in turn causes the property market to act in a less affordable manner. The economics of sustainable construction in Malta is still to be delved into. New sustainable forms of construction are to be introduced which are shown to be cheaper than the existing methods. An example could be for the unsustainable reinforced concrete floor slabs in construction for the past 50/60 years.

The resistance of building services engineers towards sustainable measures is to be overcome with the duty of the engineer to become more involved in the development and research of sustainable technology, as outlined in the recent Chamber of Engineers conference on 'Engineering the Environment.' Architects could also provide a greater awareness if further building services tutoring was introduced in the study curriculum.

In the proposed classification of contractors, environmentally friendly contractors are to be given their due weighting. It is presently far easier to dump disused material than to stockpile it for future use in the project.