Emirates Green Building Council
~
Technical Workshops
2013 Briefs

EmiratesGBC Technical Workshops are intended to gather EGBC members and partners on a monthly basis to discuss specific topics that are relevant and beneficial to the green building industry. As a knowledge-sharing platform, they are meant to allow EGBC members to highlight problems and solutions in their specific areas of work, and to exchange with professionals from other companies, sectors, areas of the green building industry. They also support the EGBC objectives to be an active and pro-active knowledge center to its members.

The present compilation includes briefs for the following workshops which took place in 2013:

- June: “Natural lighting and ventilation in Industrial Buildings”
- August: “Sustainable lighting design”
- September: “Volatile Organic Compounds (VOCs) and building materials”
- December: “Aligning integrated management systems in projects seeking green building certifications”

if you wish to take part in the 2014 Technical Workshops and/or help facilitate one, refer to the EmiratesGBC website to see the topics that will be addressed, and contact us at any time!

The Emirates Green Building Council was formed in 2006 with the goal of advancing green building principles for protecting environment and ensuring sustainability in the United Arab Emirates.

Address: PO Box 121838, Dubai, U.A.E.

Tel: +971 4 346 8244

Fax: +71 4 346 8248

E-mail: info@emiratesgbc.org

Website: www.emiratesgbc.org

EmiratesGBC
مجلس الامارات للابنية الخضراء
Emirates Green Building Council

EGBC Technical Workshop #2013-3:
"Natural lighting and ventilation in Industrial Buildings"

2 July 2013

Facilitators:

Barrie Harmsworth, Green Energy Solutions

Marie-Helene Westholm-Knebel, EGBC

Venue: EGBC Office

Keywords: lighting, ventilation, industry, regulations, climate

An introduction on natural lighting and ventilation

Climatic conditions in the Gulf Region have an obvious impact on the working conditions in industrial premises. This is particularly the case during the summer when high temperatures can dramatically affect the overall productivity, but also raise clear concerns regarding health and safety aspects.

Despite the existing regulations and standards in Dubai and Abu Dhabi, it appears that **short-term financial motivations still direct the decisions for manufacturers not to engage in improving their facilities**, by taking advantage of the obvious loopholes and the lack of concrete implementation of the measures in these regulations. Growing awareness on benefits from green buildings (energy savings, health and safety, comfort...), possible market pressures (competitiveness, product prices, returns of investment...) and stronger commitments from the local authorities might however change the positions in the coming future.

Raising the case for stronger commitments and education

The limitations of current standards and regulations

The review of existing standards and regulations in the region has raised concerns on their relevance and applicability, amongst others:

- **Specifications mainly apply to office/residential premises** and do not address industrial activities sufficiently;

- Ratings, requirements and thresholds are often **based on Western standards** that are not relevant or applicable to local climatic conditions (heat, humidity, sandstorms...) and market structures;
- Government directives are often perceived as **too generic** to address the specific needs of a certain industry or market segment, leading to possible misunderstandings and misuse.
- The enforcement of stricter regulations would require the local authorities to engage in **systematic building audits and controls** which does not seem feasible easily.
- Emphasis was put on the **incompatibility between regulations, codes and practices** (such as property loss prevention) c**onflicting with natural ventilation demands for occupational health and productivity.**

These concerns reinforce the perceptions that as such, **existing regulations do not provide enough detailed guidelines that would help professionals decide on measures to implement in their area of activity**. They leave instead the choice to owners/operators/managers to take advantage of the definitions' loopholes and decide on which measures they want to apply in view of their economic constraints.

Engaging internal forces to trigger change

Strengthening the dialogue between the stakeholders dealing with these regulations is considered a key solution to tackling the above-mentioned limits, despite a certain amount of predictable challenges:

- **Engineers and architects** should be given a higher role in the process by integrating in their design natural lighting and natural ventilation equipments to enhance working conditions, generate energy savings and thus generally support the green building cause. **Financial constraints** (namely returns on investments) and **the lack of comparative data between natural and conventional equipments** however give owners/managers reasons to disregard green alternatives.

- **EGBC members should identify "champions"** in their respective parts of the industry who are eager to advocate green innovation and contribute further to the education of owners/operators/managers/clients. Their greatest challenge will however consist in **tackling the lack of awareness and visible benefits** one can get from green buildings and the use of environmentally-friendly equipments.

- **Local authorities in Dubai and Abu Dhabi** are perceived as eager to receive feedback on such issues. Obvious progresses have been made in the past decade, opening the way for a greater dialogue on working conditions, health and safety concerns and sustainability considerations.

As such, **the EGBC was identified as the relevant knowledge-sharing platform** to take the lead in linking its members with the authorities. Technical workshops and other informative events could be used to support the existing initiatives and respond to the needs of each stakeholder looking for improvements.

Considering alternative equipments and designs

Alternative equipments to conventional lighting and ventilation systems have been emphasized as possible solutions to deal with the economic constraints on the one hand, and the climatic conditions on the other hand. Even though their production and distribution costs are more expensive, these innovations however lead to **substantial financial savings** (reduced energy consumption, lower maintenance costs) that need to be showcased.

Amongst others the following innovations have been discussed:

- **Fire-retarding materials** to limit the spread from fire breaking out in industrial facilities. Combined with a reinforcement of safety rules and awareness, these procedures can become an alternative when natural ventilation is actually considered to enhance the risks.

Lighting system alternatives (for instance LED and CFL lights) are easily available in the market. **Natural light remains however the best source**, particularly as it is widely available in the region and is not affected by the seasons. If occupancy sensors, zonal lightings and “solar tubes” can be installed via retrofit programs (see article on The Change Initiative in Reference section), architects and engineers recommend that **integration of natural light is planned during the design stage** to prevent costing modifications of the building during its operational phase.

Conclusion: Future prospects in the region

The Technical Workshop was perceived as a strong opportunity for members to discuss the topic and express their concerns with regard to the existing regulations and technical and financial constraints. Participants were **aware of the potential for change in their**

respective sectors and foresee positive impacts from stronger educational and regulatory commitments.

Educating the market

The concept of education often arises forward during the Technical Workshop and can be considered a **solid potential solution to all challenges** mentioned previously. Participants have expressed the following points:

- The dialogue with clients and local authorities should be **supported by success stories, factual data and comparative studies**. Without understanding obvious financial benefits clients will not be motivated to engage in improving their facilities.
- **University departments should be approached to engage in research projects** and produce tangible figures and analysis on topics such as: the most suitable ratings for light and ventilation in industrial buildings specifically in the GCC/UAE region; the types and advantages of natural lighting and ventilation equipments; the impact on high humidity rates on productivity, health and safety.
- Eventually, and in view of the mandatory implementation of the Dubai Municipality codes by January 1st, 2014 consultants and professionals will have to engage in **training efforts and seminars** that will support good practices.
- If clients are educated through knowledge-sharing events and awareness campaigns, **market forces** can make green equipment alternatives economically more viable, and place the committed industries in a position of **competitive advantage**.

Reinforcing regulations

Following their interest in a stronger dialogue among the different stakeholder groups, the participants have emphasized the **need for a stronger commitment from the local authorities**:

- **Regulations and standards should be addressed in more details**. More practical guidelines should be made available to answer the specific needs of the different industries;

- Without the support of local authorities, forums such as the EGBC will experience difficulties when disseminating knowledge. **Authorities should be making the link between short-term economic priorities and long-term sustainability ones**.

References, tools and products

Rules, Regulations and standards

- ASHRAE Standards and Guidelines
- Dubai Municipality Green Building Regulations and Specifications
- Estidama Pearl Rating System
- The Chartered Institution of Building Services Engineers guidelines and technical resources
- Air Infiltration and Ventilation Centre papers and recommendations
- Directive 2010/31/EU of the European Parliament and of the Council of 19 May 2010 on the energy performance of buildings

Relevant reports and press articles

- The Change Initiative, Dubai. "World's most sustainable building can now be found in Dubai", Gulf News, 16 June 2013
- "Heat Stress Control and Heat casualty Management", US Army, Headquarters, Department of the Army and Air Force, 7 March 2003
- "Heat Stress and Strain", American Conference of Governmental Industrial Hygienists (ACGIH), 7th Edition

Outline of Technical Workshop #2013-3

"Natural lighting and ventilation to Industrial Buildings": Frequently natural lighting and ventilation is provided to industrial buildings in a random if not haphazard manner. For most industries, air conditioning is not an option, and the processes inside industrial buildings are often heat producing with VOC's or other irritant emissions. Plainly, visibility and comfort are essential to productivity but little attention is paid to installing efficient and effective systems. The technical workshop will investigate these challenges by looking at the following:

1. *The effect of light and ventilation rates - Are they productive? Suggested levels?*
2. *Government and Municipality regulations - Are they in place? Are they effective?*

3. *Types of natural lighting and natural ventilation equipment*
4. *Evaluation procedures - Are simple accounting techniques relevant to these systems?*
5. *Fire risk management: Conflicts between desirable levels of natural lighting and ventilation and fire risk management policies*
6. *Possible future innovations in both natural lighting and ventilation equipment*

EGBC Technical Workshop #2013-4:
"Sustainable lighting design"
14 August 2013

Facilitators:

Michael Nyuttens, ETAP

Marie-Helene Westholm-Knebel, EGBC

Venue: EGBC

Keywords: lighting, sustainability, design, LED, fluorescent, parameters

Introduction

As lighting is generally accountable for 20 up to 40% of a building's energy consumption (Swedish Energy Agency), **designing a sustainable lighting installation** is a key factor not only to successfully reduce energy use and its related costs; such a design also takes into account inputs from the building's occupants (i.e. their specific needs and activities) as well natural factors (building's location and access to direct sun light). In this context, a strong understanding of various factors and parameters is necessary so that the design answers the project's requirements and technical components.

Defining Sustainability lighting and design

Back to basics: sustainable development

To properly understand the concept of "sustainable lighting design", one is invited to refer to the widely-accepted **definition of sustainable development** as per the UN Report of the World Commission on Environment and Development of 1987 - also known as *Our Common Future* or *Brundtland Report*:

*"Sustainable development is **development that meets the needs of the present without compromising the ability of future generations to meet their own needs**. It contains within it two key concepts:*

- *the concept of **needs**, in particular the essential needs of the world's poor, to which overriding priority should be given; and*
- *the idea of **limitations** imposed by the state of technology and social organization on*

the environment's ability to meet present and future needs."

The 5 P's

The Brundtland definition reaffirms the need for sustainable design to respect and connect three central pillars (environmental, social and economic) to reach specific long-term objectives. During the Technical Workshop, the following "**sustainability 5 P's**"[1] have been discussed to strengthen the definition:

- *People*: includes aspects such as tasks and purposes, comfort, health, colour/light temperature, natural light, lux level…
- *Planet*: refers to the environmental impact of products and processes: materials and components, life cycle, disposal/waste management, light pollution…
- *Profit* (sometimes called *Prosperity*): refers to the value-added of the installation to the users, including energy and financial savings, long-term profitability …
- *Product*: refers to the item's design and its abilities to be used, deployed and maintained easily.
- *Process*: refers to the product's compliance with local norms, regulations, codes…

Applying sustainable principles to lighting design

Based on the above-mentioned concepts, sustainable lighting has been defined as ***luminaires and lighting products that are fit for the tasks they have been assigned for while respecting long-term economic, social and environmental objectives*.**

During the workshop, the following **concepts and keywords** have been associated to this definition:

Holistic approach	Education - Awareness	Maintenance
Measurable – metering and control systems	Sustainability integrated project development	Different purposes for different users
Benchmarks and accreditations	Power consumption and efficiency	Economic growth and long-term profits
Lux levels and parameters	Energy production-energy sources	End-users and operators' behaviours

[1] *Other "P's" include also "Place" (work environment in relation to CSR activities)*

Local norms, regulations and codes | Intelligent systems – sensors | Natural light

Understanding the context for a relevant design

Context and factors

Applying sustainability concepts to lighting design needs to be supported by **a thorough understanding of the context** in which the installation will be set up:

End product = choice of installations and luminaires type that takes into account:

↪ the **architecture** of the room/building and its technical component ⟶ inputs of natural light, absorption level of indoor materials, impacts of architectural structure...

↪ the **function and operations** to take place in this room/building ⟶ need for direct/non-direct light, temperature factor, reflexion and flare...

↪ the **existing technologies** on the market and their performance (available in the products' Technical Data Sheet)

Embedded Objectives:

Minimize connected load

⇩

Manage your energy consumption

Sustainability evaluation

Based on the above-mentioned process, various methods and factors have been highlighted to allow a **proper evaluation of the products/installation's sustainability performance**:

- The use of metering/sub-metering and the comparison of the energy consumption and performance against baselines, benchmarks and KPIs;
- The replacement frequency and maintenance needs;
- The life-cycle of a product/installation and the environmental impact of its components;
- The long-term compliance with local codes and regulations;
- The economic evaluation of the product/installation (cost savings, energy savings) and its social impacts (end-users' satisfaction and well-being, health); and
- The end-users/occupants' feedback on their work environment (via follow-up questionnaires).

Know your technical terminology

Being familiar with the technical parameters will allow you to get a better opinion about which lighting installation suits your needs better:

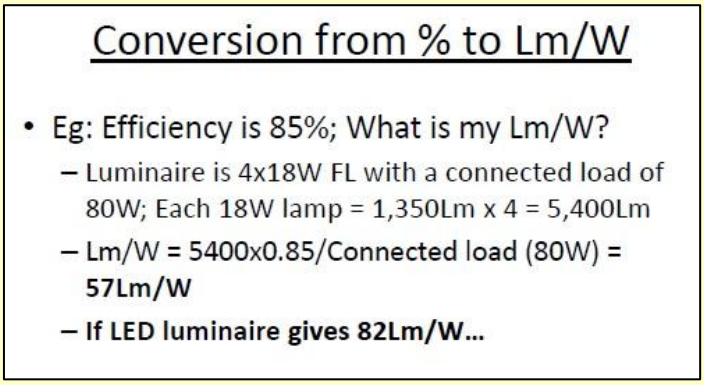
- Colour temperature: *measured in degrees of kelvins (°K), to be considered in relation to the usage of the room and tasks to be accomplished; warmer/lower colour temperature generally refers to more "relaxed" areas while cooler/higher temperature seems to enhance concentration.*
- Efficiency (FL): *expresses in % how efficient a luminaire deals with a given amount of light = Lumen output of the luminaire divided by total lumen output of the FL lamps.*
- Illuminance (lux, lx): *light level, amount of light over area (uniformity > 0.7).*
- Luminous Efficacy (LED): *Lm/W = Lumen output / unit of power. Generally provided by the supplier as part of the Technical Data Sheet*.
- Maintenance factor: *Factor with which pollution, ageing and lower light output of light sources are taken into account in light calculations. Generally provided by the supplier as part of the Technical Data Sheet*. *See page 6 for more details.*
- Photobiological safety: *risk management and regulatory standards applied to certain type of lights to prevent physical harm of human health from direct/indirect exposure.*
- Photometry/Photometrics: *all optic-related terms associated with the perceived brightness of light to the human eyes. See References for more details.*
- Reflection factors: *expressed in %, designates the ability of a material/surface to reflect light. Building materials and paints/coating have different reflection.*
- Reflector design: *tools/installations/lamp positioning/luminaire technology that will enhance/tailor the luminance flux as per the end-users' needs.*
- W/m2: *installed electrical power for lighting per m2.*

Fluorescent vs. LED lighting

Comparing parameters

Fluorescent and LED lighting technologies are often considered the most sustainable options on the market at the current stage of research. However their internal components and technical characteristics need to be addressed to decide which technology is the most suitable in a specific context:

- The **level of mercury and other toxic components in the Fluorescent lamps** raises concerns regarding their impact on human health and on the products' disposal. It is therefore important to take into account in the design phase the materials' life-cycle, the cost associated to their purchase, maintenance and disposal, and the availability of appropriate waste facilities.
- **Efficiency of Fluorescent luminaires vs. Luminous efficacy of LED luminaires** : the differences in terminology and technical characteristics of fluorescent and LED technologies often make it difficult to compare their sustainability and energy efficiency against each other. It is therefore useful to convert the efficiency percentage into luminous efficacy to decide based on comparable factors:



New technologies

Understanding the architectural context, the technical parameters of the products, and the operational needs from the end-users should be complemented with a thorough research on the existing technologies in the market. New sensors, reflectors and reflecting materials, bulb shapes...might give you options that fit your purposes and respond your energy requirements better.

Conclusion

Designing a lighting installation with sustainability as a central objective should not imply a systematic opposition between fluorescent and LED lights; the technical parameters of both technologies should be thoroughly considered rather than opposed, and a clear understanding of the installation's purposes should be combined with a proper education of end-users and operators.

Some more on the Maintenance Factor...

Technical Definition: Factor with which pollution, ageing and lower light output of light sources are taken into account in light calculations

Maintenance Factor (MF) *= LLMF x RSMF x LSF x LMF*

Whereas:

LLMF = Lamp Lumen Maintenance Factor = the **decrease** in the lamp's initial luminous flux

RSMF = Room Surface Maintenance Factor (pollution of the room or space)

LSF = Lamp Survival Factor = Frequency of lamp **defects** without immediate replacement

LMF = Luminaire Maintenance Factor = **decrease** in luminaires' output due to pollution

The Maintenance Factor is critical for an accurate designed lighting installation as only correct calculations will enhance sustainable lighting design. When comparing LED and FL luminaires, we can state that the RSMF, LSF and LMF will be practically identical. The main differences are manifested in the LLMF:

- For Fluorescent lamps: the LLMF factor is given by the manufacturers and remains standard (e.g. for T5 Fluorescent lamps, LLMF = 0.9)
- For LEDs: the LLMF is not standard as the behavior of the LED varies in time according to the design of the luminaire (for instance the heat evacuation management, amongst others). Therefore, the LED LLMF can vary much (i.e. with of 0.98 or 0.7).

Time (whether it is 20,000hrs or 50,000hrs) is also a critical factor to take into consideration as the design is always calculated at the end of the product's lifetime. 2 examples:

- If MF = 0.85: in case a 500Lx environment is required, the first day of the installation will be giving 500lx/0.85 = 588Lx, and 500lx at the end of its lifetime.
- If MF = 0.63: for the same required environment, the first day of the installation will give 500Lx/0.63 = 793Lx, and 500lx at the end of its lifetime. The number of luminaires and connected load will therefore be 20-30% higher, pushing us far away from a sustainable design.

References, tools and products

- Our Common Future, United Nations Report of the World Commission on Environment and Development, also known as the Brundtland Report, 1987.
- How to read Photometrics: definition of main concepts associated with Photometrics information
- Comparison chart between LEDs, incandescent light bulbs and compact Fluorescents (CFLs) – generic information
- Energy Efficiency Lighting: a comparison between LED and Fluorescent lighting by Earth Easy – Solutions for Sustainable Living: benefits, limitations, existing technologies, terminology.
- Maintenance factor of LED products, CIE97: Publication for Interior Lighting, ETAP
- Swedish Energy Agency – SEA, Energy statistics for offices, 2007.

Outline of Technical Workshop #2013-4

Topic: ***"Sustainable lighting and design"***

Complementing July technical workshop on natural lighting and ventilation, August session will concentrate on ***sustainable lighting design*** *and its related challenges. Approaching the concept of "sustainable lighting" differs among the various segments of the building industry: new technologies are often considered "sustainable" despite a clear lack of understanding of parameters and calculations involved in the decision process, and stakeholders' engagement generally stops after the building's design stage.*

To bridge the existing gaps, the workshop aims at the following:

- *Understanding what sustainable lighting design and installation are*
- *Addressing the concepts and knowledge gap in the industry: efficiency calculations, parameters, photometrics*
- *Comparing the equipments' efficiency and assessment methods: LED and fluorescent lamps*

Agenda and questions to be addressed by the groups:

1- *How do the participants define "sustainable lighting"?*
2- *How to come to a sustainable lighting design and installation?*
3- *Once design how can we evaluate its sustainability?*
4- *What elements should be mastered/available to make a motivated choice between FL or LED?*

EGBC Technical Workshop #2013-5:

"Volatile Organic Compounds (VOCs) and building materials"

25 September 2013

Facilitators:

Brown Joseph, DOW

Marie-Helene Westholm-Knebel, EGBC

Venue: EGBC

Keywords: VOCs, regulations, building materials

Introduction

Volatile Organic Compounds, or VOCs, are generally associated with the way indoor air quality is impacted by the building's construction materials, paint and other daily products that release chemical compounds in the atmosphere. The green building industry has for long notified the risks of VOCs on human health, and limits of VOC contents in construction products have become more stringent to suppliers, manufacturers and contractors.

In October, the workshop's participants have been invited to **share their understanding of the current trends regarding VOCs for the UAE industry and discuss the impacts of the current regulations and green building standards on their respective professional areas**.

Identifying the impacts of VOCs

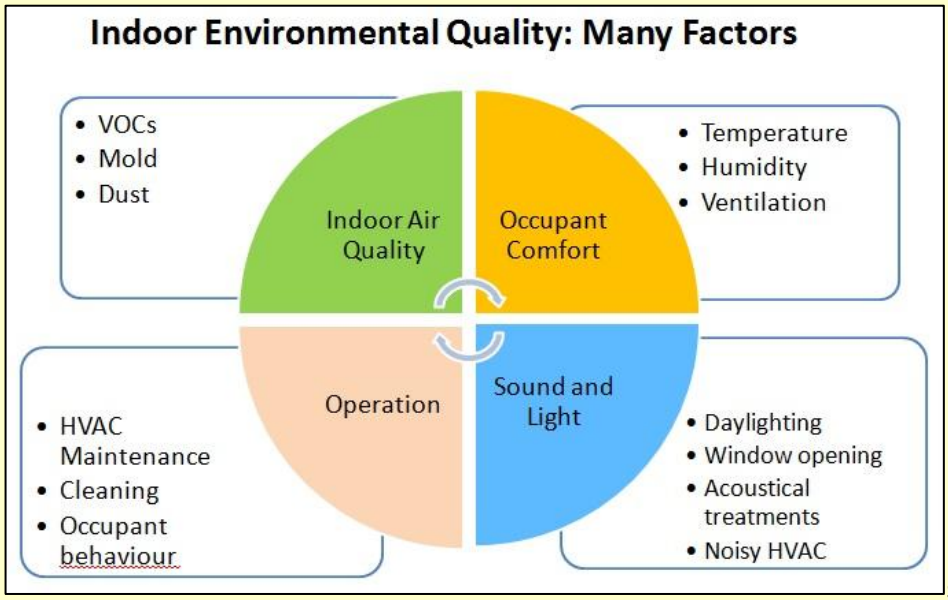
Back to the basics

Volatile organic compounds can generally be defined as **organic chemical compounds whose composition makes it possible for them to evaporate under normal indoor atmospheric conditions of temperature and pressure**. If they are known to be components of paints, coatings or solvents, VOCs can also be found in insulation materials, in interior furnishing (carpets, furniture, home and office appliance), in cleaning products and in natural/biological sources.

In terms of their chemical characteristics, the definition varies **depending on regulations set on the national level**. The European Union for instance defines VOCs as organic having an "initial boiling point less than or equal to 250° C measured at a standard atmospheric pressure of 101.3 kPa", while Canadian health authorities address the definition of VOCs through their impact on the air quality and human health.

Indoor air quality and impacts on human health

The risks and consequences of a direct exposure to VOCs and other chemicals on health, safety and the environment have been scientifically researched and identified, leading to the **acknowledgement of a "sick building syndrome"** highlighting their long-term negative impacts on human health and comfort. Even though indoor environmental quality now takes into account other factors than VOCs only, such as the overall composition of building materials or the operations and occupancy exposure, awareness in the UAE has remained fairly low in view of the existing trends and standards aiming at low-VOC contents.



s

Limitations associated to current trends and regulations

Green building standards and eco-certifications

To minimize these risks and reduce the negative impacts on human health, regulations and green building standards in the world have set limits to the VOC concentration in construction products and materials. **These limits however differ depending on the countries where these regulations and standards have been enacted**.

To build their own regulations and building standards, the UAE authorities have been inspired by these international frameworks (LEED-US, ASHRAE-US, International Green Construction Code-US…) to set their own concentration limits, with Estidama Pearl in Abu Dhabi and Dubai Municipality "Green Building Regulations and Specifications" providing the most stringent local frameworks.

Green certifications and eco-labels (mainly US and EU based) are also used worldwide as technical guidelines and visibility tools to ensure that materials and products are low-emitters of VOCs. Often very specialized, they allow consumers to compare and purchase products and apply in their everyday purchasing choices what they consider eco-principles.

Challenges to the industry

On the producers' and suppliers' perspective however, the current trends to reduce VOCs concentration via regulations and eco-certifications has raised **clear concerns regarding their relevance and application in the UAE**:

- Too many inspiration sources but no common understanding: Because the construction market in the UAE gets mainly inspired from international standards, and thus until regulations such as the Dubai Municipality "Green Building Regulations and Specifications" become mandatory in 2014, manufacturers and contractors can benefit (or suffer, based on their respective perspective) from obvious loopholes, allowing them to "work around" chemical values and products' qualifications.
- Market forces against green progresses: Complementing the precedent point, the lack of education regarding "green" concepts make market-related interests and forces (cheap prices and low production costs remaining competitive factors) much more attractive than environmental and sustainable factors.
- Too many eco-certifications and no clear transparency: The development of numerous eco-certifications and labels has been counter-productive as they make the market more confused. The diffusion of information does not allowed producers, contractors and end-users to make relevant "green choices", and it remains hard to see how stringent and relevant these certifications are.
- Local authorities enacting procedures stringent while lacking on controls and verifications*:* By setting constraining procedures that are costly and time-consuming in order for manufacturers to have their products and materials tested and certified

(and thus only over a one-year period), local authorities prevent the UAE market from becoming creative and innovative. As such, only large industries, already based locally, can afford to have their products certified, while smaller-scale companies cannot afford to move their business in the UAE.

Educating the market

During the workshop, the following aspects have been identified as possible solutions to make the UAE market and the local green building industry eco-responsible:

- Improving education and raising awareness: In comparison with the countries where regulations and green building standards have originally been developed, the UAE market has not reached its maturity in terms of understanding and applying sustainability. **Education** has been mentioned as a key factor:
    - To inform **suppliers and contractors** on the positive impacts to human health of low-emitting products and materials, and make them aware that these products can make their market visibility more competitive;
    - To empower **engineers, architects and designers** in providing sustainable alternatives for the products and projects they are managing;
    - To make **end-users** conscious of long-term benefits of eco-friendly materials in terms of health but also in terms of financial investments;
    - To have the **young generations** understand from an early age the critical need for sustainable principles and empower them in school and at home to apply these principles on a daily basis.
- Standardizing and optimizing processes: educating suppliers and contractors goes together with the **need to simplify the products' certification processes**, while teaching them about the VOCs limits to be included into the supplier sustainability questionnaires. These stakeholders, on the upstream on the supply chain, need to understand the risks associated with their products' chemical qualifications; they should be able to suggest greener solutions and understand the benefits long-term sustainability in opposition with short-term financial profits.
- Engaging the local authorities: to enact regulations that clearly set VOC limits relevant to the industry while being constraining enough to promote low-

emitting/VOC-free materials, local authorities should **engage in deeper dialogues with stakeholders** from the industry to understand their respective priorities and challenges.

Conclusion

On the same level as other challenges related to sustainability in the UAE, solutions often lay in educating stakeholders and engaging the local authorities to design regulations that are relevant to the industry. Discussions and ongoing trends towards the reduction of VOCs to low or null levels however show that awareness for better/healthier indoor air quality has reached out the market properly.

Some VOC limits as per USGBC LEED and Green Seal standards

IEQc4.2: LOW-EMITTING MATERIALS—PAINTS AND COATINGS REQUIREMENTS		
Architectural paints, coatings and primers applied to interior walls and ceilings: Do not exceed the VOC content limits established in Green Seal Standard GS-11, Paints, First Edition, May 20, 1993.		
Flats		50 g/L
Non-flats		150 g/L
Anti-corrosive and anti-rust paints applied to interior ferrous metal substrates: Do not exceed the VOC content limit of 250 g/L established in Green Seal Standard GC-03, Anti-Corrosive Paints, Second Edition, January 7, 1997.		
Clear wood finishes, floor coatings, stains, sealers, and shellacs applied to interior elements: Do not exceed the VOC content limits established in South Coast Air Quality Management District (SCAQMD) Rule 1113, Architectural Coatings, rules in effect on January 1, 2004.		
Clear wood finishes	Varnish	350 g/L
	Lacquer	550 g/L
Floor Coatings		100 g/L
Sealers	Waterproofing Sealers	250 g/L
	Sanding Sealers	275 g/L
	All other sealers	200 g/L
Shellac	Clear	730 g/L
	Pigmented	550 g/L
Stains		250 g/L

IEQc4.1 LOW-EMITTING MATERIALS—ADHESIVES AND SEALANTS REQUIREMENTS All adhesives and sealants must comply with South Coast Air Quality Management District (SCAQMD) Rule #1168 limits for volatile organic compounds (VOCs) limits, as listed below.	
Architectural Applications	**VOC Limit (g/L less water)**
Indoor carpet adhesives	50
Carpet pad adhesives	50
Wood flooring adhesives	100
Rubber floor adhesives	60
Subfloor adhesives	50
Ceramic tile adhesives	65
VCT & asphalt adhesives	50
Drywall and panel adhesives	50
Cove base adhesives	50
Multipurpose construction adhesives	70
Structural glazing adhesives	100
Specialty Applications	
PVC welding	510
CPVC welding	490
ABS welding	325
Plastic cement welding	250
Adhesive primer for plastic	550
Contact adhesive	80
Special purpose contact adhesive	250
Structural wood member adhesive	140
Sheet applied rubber lining operations	850
Top and trim adhesive	250
Substrate-Specific Applications	
Metal to metal	30
Plastic forms	50
Porous material (except wood)	50
Wood	30
Fiberglass	80
Sealants	
Architectural	250
Nonmembrane roof	300
Roadway	250
Single-ply roof membrane	450
Other	420
Sealant Primers	
Architectural non-porous	250
Architectural porous	775
Other	750
Aerosol Adhesives must comply with Green Seal Standard for Commercial Adhesives GS-36 requirements in effect on October 19, 2000.	
Aerosol Adhesives	**VOC Limit**
General purpose mist spray	65% VOCs by weight
General purpose web spray	55% VOCs by weight
Special purpose aerosol adhesives (all types)	70% VOCs by weight

References, tools and products

Articles and News

- Abu Dhabi Quality and Conformity Council, "QCC Launches Conformity Scheme to Reduce Effects of Toxic Paint on Health and Environment", 22 July 2013
- Directorate General for Health and Consumers as part of the EU health programme, Executive Agency for Health and Consumers, Promoting actions for healthy indoor air (IAIAQ), 2011
- Landman L., How to Select Less-Toxic, Low-VOC Paints, Primers, Stains, and Coatings,
- US Environmental Protection Agency: Indoor Air - Glossary of Terms - Health Effect of exposure to VOCs – Factsheet on the Sick Building Syndrome

Green Building Standards, Norms and Authorities

North America and Europe

- ASHRAE Standard for the Design of High-Performance, Green Buildings Except Low-Rise Buildings (ASHRAE 189.1)
- BREEAM, Hea 02 in Indoor air quality
- ICC-700 National Green Building Standard (Residential Construction)
- ISO 16000 on Indoor Air
- Ozone Transport Commission (OTC)
- US GBC Leadership in Energy And Environmental Design (LEED) (see powerpoint presentation for details on VOCs components and limits)
- WHO, Guidelines for Indoor Air Quality - Selected Pollutants, 2010.

U.A.E.

- Abu Dhabi Quality and Conformity Council, Standards Development
- Dubai Central Laboratory, Government of Dubai: Laws and Legislations, Inspection certification, engineering and consumer sections...
- Emirates Standards and Metrology Authority
- Estidama Pearl Rating System

Green certifications

- Green Seal and Green Seal certified products and services

- EMICODE: test requirements, product categories, classification criteria
- UL Environment and its Sustainable Products Database. Greenguard Certification affiliated to UL Environment.

Outline of Technical Workshop #2013-5

In its Green Building Regulations and Specifications, Dubai Municipality sets specific indoor air quality standards for new and existing buildings with regard to the concentration of ***Volatile Organic Compounds (VOCs)*** *and other air contaminants.* ***In September, the EGBC Technical Workshop will focus the VOCs components in the building materials*** *in view of the existing regulations and current practices in the building industry in the UAE and in the world.*

The following aspects will be discussed:

- *Current trends in building materials in the UAE and globally*
- *Local regulations, standards and international green building certifications*
- *Linking VOCs in building materials with health, safety and environment standards*

Agenda and questions to be addressed by the groups:

- *What are the coming trends in building materials in the UAE and globally?*
- *Can the various building industry stakeholders influence the materials' type and content to ensure that green/sustainable standards are reached?*
- *Are the existing certification schemes and tools such as the Abu Dhabi Certification Scheme for Exterior and Interior Paints or the information provided by the Dubai Central Laboratory relevant/useful/sufficient to influence the industry?*

EGBC Technical Workshop #2013-6: "Aligning integrated management systems in projects seeking green building certifications"

17 December 2013

Facilitators:

Stephen Smith, Brookfield Multiplex

Marie-Helene Westholm-Knebel, EGBC

Venue: EGBC

Keywords: Management systems, ISO, integrated design, EMS

Introduction

As new green rating systems and building standards make their way through the UAE market, the need to assess and adapt management systems within organizations and projects against these standards remains a critical factor. In December, the EGBC Technical Workshop addressed Integrated Management Systems (IMS) in the context of aligning internal processes with existing green certifications.

Understanding green requirements and chains of responsibilities

Connecting the dots: who is in charge?

The introduction of new green systems, certifications and regulations in the U.A.E., generally based on Western standards and market characteristics, **have impacted not only the different stages of a project's lifecycle but also all professionals involved during each of these stages.** Through a "connector game", the workshop participants were asked to consider a few Estidama articles and identify within a project team who should actually be responsible of ensuring that all aspects are met during the design and construction phases to comply with this article.

Early cooperation across the organization

The discussions highlighted a few points that seem to be often disregarded in project's conduction:

- To finalize the project in accordance with the agreed deadline and technical requirements and achieve the necessary level of constrction to comply with green standards, **applying a** collaborative approach with all departments/professionals is a key factor for success. It is especially critical to encourage and develop team efforts from the earliest stage of the project.
- An **integrated design approach** will allow the project leaders to identify and take advantage of the various links that connect units and professionals.
- Even though architects, engineers and contractors are generally aware of a project's characteristics and specifications, all stakeholders should actively take part in each of the lifecycle stages.
- **Clients, end-users and/or facility managers should also be involved in the process, particularly towards the project's finalization and certainly at commissioning stage**. Whether they should be involved earlier, i.e. from the design stage, mainly depends on their level of expertise and awareness of project management and environmental/technical requirements. This is especially relevant with regard to energy efficiency and energy management.

Understanding what "green" is

As all stakeholders try to fulfil their duties based on new green standards in the region, delivering projects at the lowest costs while maximizing performance remains a challenge for the industry. Achieving green building standards in construction and continuously apply green building philosophy on the site, thus from the very beginning, often requires for the project team to **compromise between financial interest and quality against green specifications**. The right level of environmental and technical education is required to ensure a proper understanding of the project's objectives and impacts.

Market trends also see a change in project management and delivery mechanisms where risks are being shifted from big clients onto contractors who appear to provide better integrated designs. Joint ventures between contractors and consultants already take place in such projects as oil and gas, and **Front End Engineering and Design (FEED)** reflect that the specific requirements agreed upon during the design stage are respected and fulfilled, while avoiding significant changes during the execution phase. As such the compliance of project stages with green standards could be guaranteed.

Management systems and green standards

Existing systems and limitations

Certain management systems have gained international recognition and been commonly applied to projects and organizations on the U.A.E. The workshop participants were asked to discuss the following standards in view of their respective areas of activities and experience:

- ISO 9001 – Quality Management Systems
- ISO 14001 – Environmental Management Systems
- ISO 18001 – OH&S Management Systems
- ADEHMS – Abu Dhabi Integrated Environmental Health & Safety Management System

Based on British standards and contexts, the ISO series was originally considered a marketing tool by the time of its creation, while it is now accepted as **a seal of approval for projects and the guarantee for these to be continuously assessed and improved**.

The **ISO 9001 "process approach"** for continuous improvement in the quality management system and the **ISO 14001 "PDCA"** (plan-do-check-act) were compared against project management needs and requirements. Initiating an Environmental Management System to a project involves applying the following steps:

1. generate policy to set the project's basis, structure, stages and chains of responsibilities
2. set the project's objectives
3. implement the project phases
4. monitor processes and results
5. facilitate continuous improvement by reviewing results and engage in a feedback system bringing you back to step 1.

A few challenges directly related to the implementation of such management systems onto the construction/building industry have been identified during the discussions:

- As the PDCA process is not linear but is shaped as a loop/feedback system instead, the overall process can be impacted as the correction applied to one stage will affect the others. **Decisions to change should therefore be applied carefully**.

- Depending on the project's complexity and size, maintaining standards can become challenging, especially when team, objectives, offices and context change during the construction cycle. Technical knowledge and organizational/logistical support can get lost during the transition phases, with the risks to be obliged again to bring all stakeholders together and re-set priorities. A **strong and continuous commitment** from the project top managers and leaders, in this case, is,required to maintain standards across the company and throughout the project.
- ISO processes are **not sufficiently flexible for SME** (compared with large corporate groups) this prevents them applying the feedback collected during the assessment phase.

Can management systems embed sustainability in projects?

Aligning existing management systems with sustainability and environmental standards is feasible but needs to keep the following in mind at all stages:

- **integrated design and corporate engagement**: as mentioned in the first section, involving all parties already from the design phase can improve the project's quality and reduce the change of future discrepancies between the design and actual results. A matrix of responsibilities should be prepared and agreed upon, and efforts should be made to place sustainability/green at the core of the corporate culture.
- **education and commitment towards sustainability**: as there is an obvious need for all parties to understand the definitions and objectives of green standards and relevant articles, education is a core aspect of a successful implementation. It is therefore advised to teach and pass relevant information to all units on all levels (from project managers to workers) as well as encourage continuous professional development.
- **procurement and process review**: beyond the general compliance with green standards and regulations, sustainability can be applied by adding complementary review steps of materials and processes to the existing ones. The matrix of responsibilities mentioned above should clearly state which position would be responsible to conduct and report on these review steps.

Conclusion

A poor level of education and understanding of all parties involved during the project lifecycle can easily jeopardize the project's compliance. However management systems such as the ISO series and processes can easily be implemented and applied to green building projects: as they are built for compliance assessment they can provide a good "back bone" to prepare for a green rating application.

Credit	Design Phase	Construction Phase
LBi-2.1: Materials Emissions – Adhesives & Sealants	Architect	Contractor – Design Manager
IDP-3: Construction Environmental Management	??? PQP/PMC	Contractor – Env. Coordinator
LBi-1: Ventilation Quality	Mechanical Engineer	MEP S/C
SM-13: Improved Construction Waste Management	PQP/PMC	Contractor – Env. Coordinator
NS-3: Ecological Enhancement	Ecologist / Landscape architect	Landscaping S/C
PW-4: Stormwater Management	Civil Engineer	MEP or Civil S/C
RE-1: Improved Energy Performance	Energy Modeler	Energy Modeler

"Connector Game": Designing the responsible role/team in charge of the compliance to a specific Estidama credit

References, tools and products

Norms and Standards

- International Network for Environmental Management: provides toolkits and guidance to implement environmental/sustainability management, ISO and EMAS standards. Best practices for industries and small and medium-sized companies.
- Environmental Management, the ISO 14000family of International Standards, ISO
- GHG schemes addressing climate change, How ISO standards help, ISO, 2010
- The European Eco-Management and Audit Scheme
- Integrating Management System Standards

Research and Academic Papers

- Assessing Environmental Performance in the Construction Industry, Vivian WY Tam and Khoa N Le, *Surveying and Built Environment* Vol 18 (2), 59-72 December 2007.
- ISO 14001 Implementation practices in the construction industry: the cases in the United Kingdom and Hong Kong, Cheuk Yan Chan, Master Thesis for the School of Environmental Sciences, University of East Anglia (UK), August 2011.
- The Integrated Design Process, Nils Larsson, International Initiative for a Sustainable Built Environment (iiSBE), 2004.

Articles, Examples and Case studies

- Environmental Management System Programs Manual, US Department of Energy, Legacy Management, January 2012: examples of EMS programs, scopes, training…
- **"***How to up the EMS ante***",** LBurden MEnvMan BSc*, WME Magazine,* November 2010.

Outline of Technical Workshop #2013-6

Topic: ***"Aligning integrated management systems in projects seeking green building certifications"***

Whether one considers a construction project from the perspective of the designer, of the contractor or of the overall project manager, the clear separation between tasks and responsibilities of the involved parties remains a challenge: ***the lack of consultation and integration*** *from the very beginning raises misunderstandings and possibly affects the quality of the final product as well as the implementation time and costs.*

Management systems such as ISO 9001 provide a step-by-step approach to integrate all stakeholders in a well-structured (step-by-step) process that facilitates the project conduction and improve results. In December, the EGBC Technical Workshop will focus on these

management systems and standards such as ISO 9001 and the benefits to engage all parties in an integrated project plan*.*

The following aspects will be discussed:

- *Integrated design and project management: how to include all necessary stakeholders to design and implement a project efficiently.*
- *ISO 9001 and quality management: definition, systems and processes, chain of responsibilities...*
- *Combining management systems with environmental concerns, green building rating systems and certifications.*