ESA building best practices

ESA's Sustainable Building Code for new and renovated constructions

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Agenda

- Background
- Environment and Energy context
- Why a Sustainable Building Code for ESA
- ESA's SBC
- NASA approach
- ESA's SBC : Possible following steps
- Conclusions

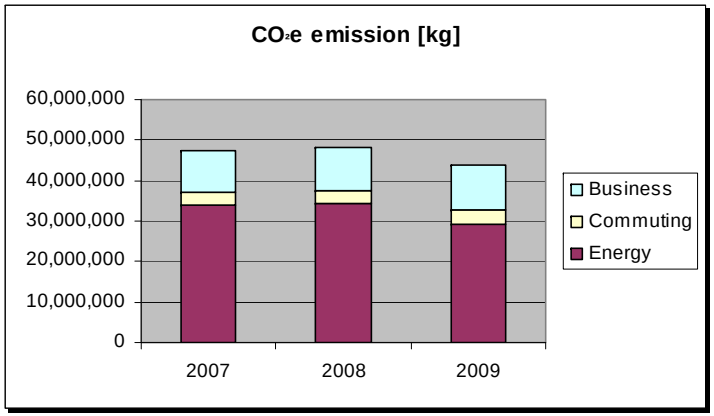
Background
Context

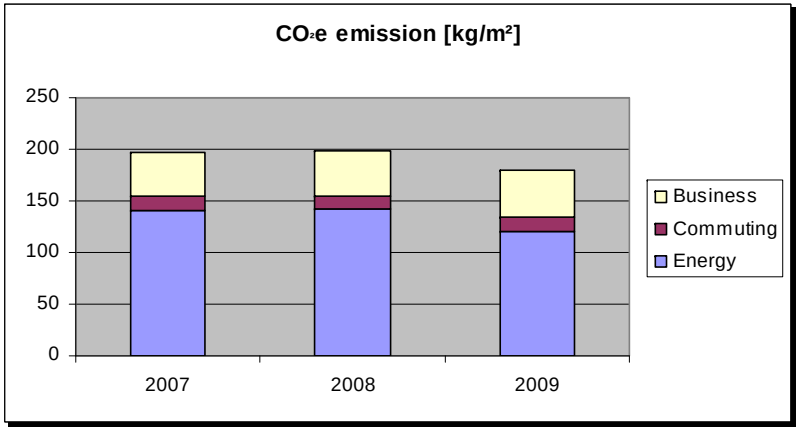
- Sustainability is moving rapidly up in the international political agenda (becoming a top priority). In particular the climate change issue, which already impacts the lives of millions of people on Earth.
- There is widespread recognition that our present rate of pollution and resource consumption is simply unsustainable and the environmental consequences of unconstrained development are increasingly evident.
- The European Space Agency, given its areas of competence, its activities and its influence over political decisions has a major responsibility with regard to this evolution.
- **The Agency and its Member States are taking steps**:
  - Creation of Coordination Office on SD in 2008
  - Mapping of all existing SD activities within ESA (environmental, social/societal and economic assessment)
  - Conducted in depth environmental survey on it's environmental & energy use. Defined a way forward and established SD KPIs and reports.
  - Framework of an ESA SD Policy (Environment & Energy, Programme Activities, and Governance and Ethics). One of the key target is the alignment to the EC 20-20-20 target.
  - Cooperation with external entities
- It the context of it's own activities, the Agency 's construction and operation of buildings gives rise to a substantial environmental impact.

E&E context at ESA

Agency's environmental GHG footprint

- In 2008 and 2009 the Agency has carried out environmental audits at each of its centres (GSP studies).
- During this process it became clear that the construction and operation of buildings gives rise to a substantial environmental impact (70%).
- While from 2007 to 2009 the energy consumption (and costs) raised by 6%, CO_2e were reduced by 7% due mainly to ESOC's procurement of green electricity.





E&E context at ESA

National and European Legislation

- EU's 20-20-20 objectives (by 2020 : 20% GHG reduction, 20% more efficiency, 20% renewable energy). These are minimal objectives at European level, some countries are setting more ambitious performance objectives (France 38% by 2020 and 75% by 2050 !).

- There will be (and there are already) a number of legal obligations for the :
  - construction of new building
  - renovation for the existing building
  - Building operation

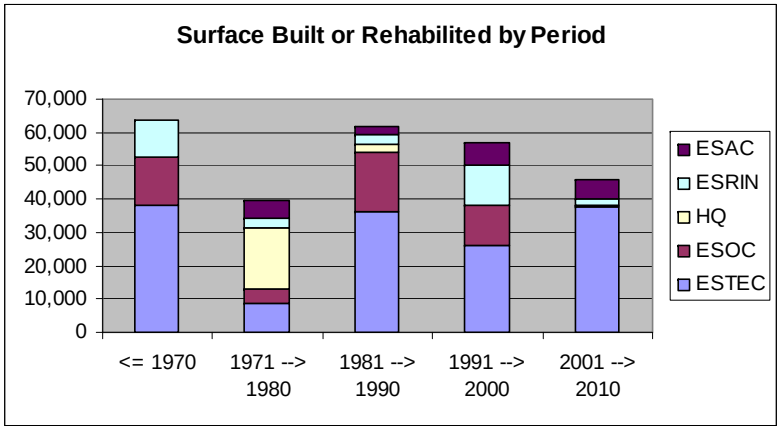
- EU and EU member states are setting up Building performance national schemes :

  BREEAM.NL (NL), DGNB (G), HQE (F), ITACA (I), VERDE (S), BREEAM (UK),…

E&E context at ESA

ESA's site infrastructure : Projects & Status

- While in the scope of the balance infrastructure review, the Agency is preparing major infrastructure projects : ESTEC2, ESOC2, ESRIN2, new HQ,….
- The current building infrastructure status indicates that :
  - About 40% of ESA's infrastructure is beyond normal life cycle (more than 30 years of utilisation)
  - Major investments should be soon considered for another 23% (more than 20 years)
- These investments will require to take also into consideration building envelope efficiency.
- Economical elements:
  - Infrastructure to respond to core (space) activity needs,
  - ROI on buildings investments,
  - Energy & running costs evolution,
  - austerity



<= 1970	1971 - 1980	1981 - 1990	1991 - 2000	2001 - 2010	
63,826	39,351	62,015	57,131	45,653	m2
24%	15%	23%	21%	17%	

A Sustainable Building Code for ESA ?

- The Agency has to comply with the national and European legislation.
- The Environmental footprint of the Agency is mainly coming from it's sites infrastructure (heating and cooling).
- Major investments are to be considered in the coming years (new projects and aging infrastructure).
- The needs to strike a balance between cost and environmental performance while setting of targets for sustainable construction.
- The EU 20-20-20 objectives, the legislation and the Agency's SD policy are giving the frame for future evolution of ESA's site infrastructure while:
  - responding to Agency Space programs requirements/needs,
  - making optimum use of resources.

➢ **To respond these challenges; guiding principles are needed for the sustainable construction, rehabilitation and maintenance (and operation) of ESA's building.**

A Sustainable Building Code for ESA – Principles for Sustainable Building

– **What are these guiding principles ?**

1. Provide a comfortable and healthy environment for employees.
2. Use sustainable materials, with the lowest embodied pollution and embodied energy.
3. Aim to build to the highest standards of energy efficiency
4. Provide the maximum amount of renewable energy on site, where viable.
5. Minimise the use of potable water.
6. Minimise the burden on the public drainage system to reduce flood risk.
7. Use the development process to enhance ecology and minimise impact.
8. Minimise waste and pollution both in construction and in operation.
9. Minimise the impact of new development upon the transport system.
10. Aim to achieve a positive impact on the local community.

A Sustainable Building Code for ESA – Principles for Sustainable Building

The set of guiding principles :

-are organised in 9 Categories with specific targets/recommendations.

-apply to three main domain of operation:

- Construction of new building
- Renovation for the existing building
- Building operation / Maintenance

A Sustainable Building Code for ESA – Principles for Sustainable Building

- **What is a Sustainable Building Code ?**
  - A set of guiding principles for Sustainable constructions
  - A useful tool (methodology) for all sites for improving the Sustainability of the Agency's building infrastructure investments and operations.
  - Reference to established Buildings performance targets for achievement of local sustainability codes (BREEAM.NL, DGNB, HQE, ITACA, VERDE) that reflects local concerns and legal requirements particular to each country.

- **What does it bring ?**
  - Improve the working conditions for employees and promote well-being and effectiveness.
  - A increased performance of the Agency sites' infrastructure and a reduction of the Environmental footprint (an also building asset value).
  - Reinforce the Agency's image and its credibility.
  - Achieve a reduction in running costs.
  - Improve consistency of the Agency sites' infrastructure, given a wide variety of building stock.
  - Allow the establishment of a basis for national (local) and international comparison of performance for ESA's sites. To allow benchmarks.
  - Legislation compliance.
  - Additional asset value of Agency's Buildings.

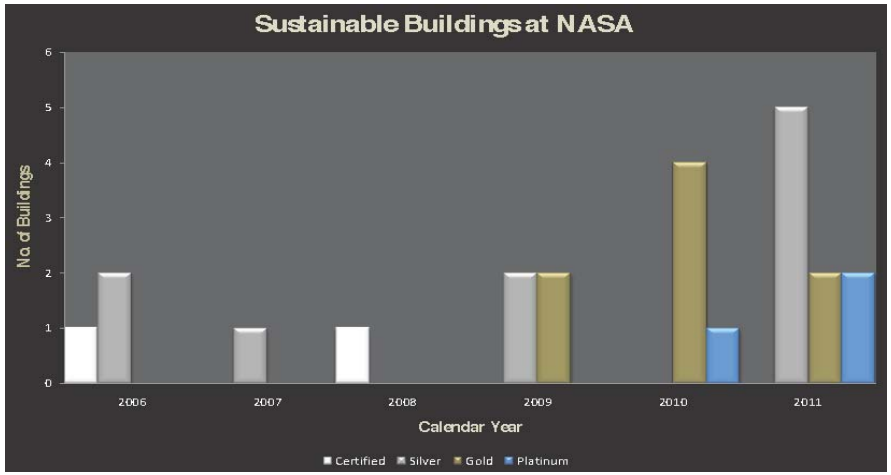
A Sustainable Building Code for ESA – Principles for Sustainable Building

- Reference to local and international standards:
  - Many countries are taking steps to define a measurement system (DGNB (G), HQE (F), ITACA (I), VERDE (S), BREEAM (UK)) or to adopt an existing one BREEAM.NL.
  - At international level two methodologies appears to be widely used : BREEAM and LEED.
  - Several examples exist were building receive two accreditations (ie HQE & BREEAM).

ESA's SBC Targets are:

- BREEAM Europe system is recommended for projects:
  - Refurbishment "very good".
  - new construction "excellent".
- BREEAM in use is recommended for maintenance & operation.

NASA's approach



NASA key figures and approach:

– 2,463 Buildings

– 45 Million Square Feet

– Since 2005 : a Federal Sustainable Policy
  - Executive Order : Guiding Principles for Federal Leadership in High Performance and Sustainable Buildings

–835,000 sf of buildings that are LEED® rated:
  - 2 Certified, 5 Gold, 6 Silver

–900,000 sf of buildings in construction or major rehab :
  - 11 Gold, 3 Silver, 3 Platinum

ESA’s SBC – Possible following steps

- QMS could be used for ESA’s SBC implementation.
- SBC shall be a *living document* as it will require updates as legislation and building technologies evolve.
- SBC could be further detailed in some key subjects (ie Energy).
- SBC could also further incorporate ESA’s space expertises in some specific fields, for instance water management (waste and treatment).

Conclusions

- National and European environmental legislation will require building owners to upgrade significantly their building infrastructure in the coming 10 years. The Agency will have to comply.
- Major investments are to be considered in the coming years (new projects and aging infrastructure).
- The EU 20-20-20 objectives, the legislation and the Agency's SD policy will give the frame for future evolution of ESA's site infrastructure.
- The ESA building code :
  - Shall be a reference tool for all sites (investments and operations).
  - Will contribute to enhance sites, reduce operation costs and build stronger links with local communities and contribute to the European economy.
  - Defines buildings performance targets at local and international levels (BREEAM Europe).
  - Allow internal and external comparison & benchmarking.
- As a high-profile international organisation, ESA is in a strong position to show leadership in this field. As its actions are visible to the communities in which its sites are located, it is also important that ESA can demonstrate that it takes the subject of sustainability seriously.
- Last but not least, Sustainable Buildings have a significant positive impact on the employee well being, motivation and efficiency at work. It would also greatly foster and support ESA's environmental commitment and awareness initiatives.

Additional slides

ESA's SBC : Health & Wellbeing

Provide a comfortable and healthy environment for employees.

- Maximise daylight and views from windows, minimise glare from natural light and flicker from artificial light, with appropriate, easy and accessible local control available.
- Provide adequate heating and ventilation with local control.
- Minimise pollutants such as VOCs to ensure optimal indoor air quality.
- Ensure that the risk of legionellosis is eliminated.
- Ensure that the acoustic performance is appropriate for the building purpose

ESA's SBC : Materials

Use sustainable materials, with the lowest embodied pollution and embodied energy.

- Use timber from sustainable sources
- Where possible, give preference to reused, reclaimed and recycled materials
- Use a risk prevention approach on materials selection (ie materials that in time could degrade/fall apart and liberate fibres or chemical vapour (gas) or fibres (that could be inhaled and therefore represents a health risk)
- Plan for deconstruction

Life cycle analysis should be used to compare the impact of materials

(where available)

ESA's SBC : Energy Efficiency

Aim to build to the best standards of energy efficiency

- Use passive solar design wherever possible
- Superinsulate building fabric and achieve excellent air tightness.
- Provide energy efficient systems:
  - Lighting
  - Heating
  - Ventilation
  - Air conditioning systems.
  - Refrigeration
  - IT
  - Lifts
- Recover waste heat for use in space heating
- Ensure that a BMS is operated and that sub-metering is provided for all major energy consuming items.

ESA’s SBC : Renewable Energy

Provide the maximum amount of renewable energy on site

Practically

Environmentally

Financially

} **Viable**

Make best use of locally available renewable energy resources including any district heating systems

ESA's SBC : Water Use

Minimise the use of potable water

- Use water efficient devices:
  - WCs
  - Urinals
  - Showers
  - White goods - washing machines and dishwashers.
- Introduce rainwater harvesting systems if safe and financially viable.
- Fit water leak detection systems, presence detection shut-off to sanitary areas and other controls as appropriate
- Ensure that water consumption is measured and monitored

ESA's SBC : Surface Water Drainage

Minimise the burden on the public drainage system to reduce flood risk

- Carry out a drainage impact assessment
- If land conditions are appropriate, use permeable surfacing materials
- Consider harvesting and attenuation methods
- Create an amenity where possible.
- Ensure that surface water run-off is free from contamination

ESA’s SBC : Ecology

Use the development process to enhance ecology and minimise impact

- Encourage the reuse of land that has been previously developed, or contaminated land.
- Carry out ecological survey using an accredited ecologist.
- Protect existing ecological assets, particularly trees, shrubs, watercourses and habitats on and near the site.
- Enhance the ecology of the site by means of the landscaping scheme and boundary treatment, using species which contribute to biodiversity.

ESA's SBC : Waste & Pollution

Minimise waste and pollution both in construction and in operation

- Use a site waste management plan to minimise waste during the (demolition and) construction phase.
- Design to minimise light and noise pollution from the building when in operation.
- Specify materials and processes in order to minimise pollution caused by chemicals emanating from the building when in operation.
- Avoid refrigerants which have a global warming potential and fit leak detection systems when refrigerants are used, together with automatic shut down.
- Provide dedicated storage facilities for the operational waste streams, to enable hygienic waste sorting and storage.

ESA's SBC : Transport

Minimise the impact of new development upon the transport system

- Ensure that sites selected for development are easily accessible by public transport for the majority of employees and visitors.
- Develop a travel plan and transport information points.
- Encourage car sharing.
- Provide facilities for pedestrians and cyclists including, secure covered bike parking, showers, lockers and safe pedestrian routes.
- Ensure that key facilities (food, cash machine) are available on or near site.

ESA's SBC : Management

Aim to achieve a positive impact on the local community

- Maximise the use of local suppliers and minimise disruption to local road networks. Minimise impact on neighbours from pollution from debris, dust and noise. Ensure adequate community consultation is undertaken at appropriate times.
- Ensure that contractors adopt agreed environmental and social objectives.
- Carry out comprehensive building services commissioning to ensure optimum performance under actual occupancy conditions.
- Encourage the provision of guidance for non-technical building users to enable them to understand and operate the building efficiently.