Training on Energy Efficiency in Buildings of stakeholders in urban planning, construction and building

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SERA Sustainable Energy & Resources Availability

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Energy efficient buildings

Implementation of energy efficiency | key factors of success

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Overview of key aspects

What to consider during the building life cycle

Building life cycle	Key aspects for energy efficiency implementation	Possible solution to deal with key aspects
Step 1: Building arrangement	Take into account building related energy aspects when elaborating zoning plans	Collaboration of public bodies: urban planning and energy departments
Step 2: Building form / design	Integrated design meeting the energy requirements of the building legislation	Provide guidelines and tools; link with building permit and funding schemes
Step 3: Building construction	Commissioning and quality check before handing over	Provide guidelines and tools; Link with building use permit and with funding schemes
Step 4: Building operation	Inspections on a regular basis; recommendations on how to improve	Provide guidelines and tools; Link with financing schemes (ESCO; LCC-based contracts)

Building arrangement and energy efficiency

Key aspects | possible solutions

Building life cycle	Key aspects for energy efficiency	Possible solution to deal with it
Step 1: Building arrangement	Take into account building related energy aspects when elaborating zoning plans	Collaboration of public bodies: urban planning and energy departments

> Establish a co-ordination group consisting of representatives of the ministries in charge of energy and housing

> Usually urban development and zoning plans are dealt with in other ministries than energy. However, the ministry responsible for energy is confronted with the results of urban planning regarding energy supply.

> Define criteria for the development of master plans

> Call for tenders for master plan development contain energy related criteria such as orientation, control of wind flows, building density, green spaces, use of material with high albedo for infrastructure.

> Energy assessment of urban development plans and zoning plans

> Introduce a procedure in public administration which foresees the energy assessment of urban development plans and zoning plans.

aspects.

Building design and energy efficiency

Key aspects | possible solutions

Building life cycle	Key aspects for energy efficiency	Possible solution to deal with it
Step 2: Building form / design	Integrated design meeting the energy requirements of the building legislation	Provide guidelines and tools; link with building permit and funding schemes

> Provide energy guidelines and tools for professionals

> Guidelines and tools how to achieve an energy efficient building under the specific climatic conditions.

> Guidelines and tools how to provide the supporting documents to prove the energy efficiency according to the minimum energy requirements of the building legislation.

> Link the results of the energy efficiency documents to the building permit

> The building permit is only issued if supporting documents are presented and show that the minimum energy requirements are achieved.

> Link the results of the energy efficiency documents to funding schemes

> Funding schemes can be linked with the presentation of supporting documents if energy efficiency is better than required by law.

Building design and energy efficiency

Matrix of vernacular architecture | example

	Subtropical zone	Desert climate
Sunscreen	Shading required, often open gutters or grids, overhanging roofs.	Shading required, often open gutters or grids, overhanging roofs. Urban context helps to maximise shading.
Insulation	No insulation required, thermal mass is able to buffer. Buildings are as light as possible.	Insulation required; use thermal mass of material to lower the temperature peaks during the day.
Natural ventilation	Maximise natural ventilation; allows materials to dry fast during rain season.	Maximise natural ventilation, to gain maximum comfort by air velocity.
Heating	No heating	Sometimes needed in the night; can be solved by thermal mass temperature storage.
Cooling	Required, but mostly by using a good natural ventilation, use of adiabatic cooling.	Required, but mostly by using a good natural ventilation, use of adiabatic cooling, or use of thermal mass storage.
Orientation	Block direct sun, minimise solar gains.	Block direct sun, minimise solar gains.

Source: Principles of climate-adapted architecture http://librairie.immateriel.fr/fr/read_book/9789461860279/03 International Facades - CROFT, Climate Related Optimized Facade Technologies, Par Marcel Bilow, TU Delft Architecture (Auteur) TU Delft - 08/09/2012 Langue English

Building design and energy efficiency

Guidelines and tools on energy efficiency in buildings

There are many design guidelines available, for more information see some of the publicly available sources below:

Climate Responsive Building - Appropriate Building Construction in Tropical and Subtropical Regions http://collections.infocollections.org/ukedu/en/d/Jsk02ce/

Whole Building Design Guide http://www.wbdg.org/design/engage_process.php

Integrated Design Process Guideline http://www.iisbe.org/system/files/Task23_introduction.pdf

Expert Guide Part 1 Responsive Building Concepts, Expert Guide Part 2 Responsive Building Elements http://www.annex44.civil.aau.dk/ http://www.ecbcs.org/docs/Annex_44_Expert_Guide_RBC.pdf

There are many tools available, for more information see the following compilations of tools:

Overview of visualisation and simulation tools: State-of-the-art of digital tools used by architects for solar design
http://task41.iea-shc.org/data/sites/1/publications/IEA-T41_STB-DB1_SOA-DigitalTools.pdf

Database of tools: Building Energy Software Tools Directory
http://apps1.eere.energy.gov/buildings/tools_directory/
http://apps1.eere.energy.gov/buildings/tools_directory/tools_new.cfm

Building construction and energy efficiency

Key aspects | possible solutions

Building life cycle	Key aspects for energy efficiency	Possible solution to deal with it
Step 3: Building construction	Commissioning and quality check before handing over	Provide guidelines and tools; Link with building use permit and with funding schemes

> Provide energy guidelines and tools for professionals

> Guidelines and tools for carrying out commissioning and quality check to ensure that the building has been constructed as planned and will achieve the projected energy demand during building operation (provided that the actual use of the building corresponds with the planned one).

> Link the results of the commissioning to the building use permit

> After completion, a building use permit is required to actually occupy the building. The building use permit is only issued if commissioning documents are presented.

> Link the results of the quality check to funding schemes

> Pay the last installment of funding amount (e.g. 30%) only after successful quality check following the completion of the building.

Building construction and energy efficiency

Commissioning | IEA Annex 40 definition

IEA Annex 40 defined:

Commissioning is a “quality-oriented process for achieving, verifying and documenting whether the performance of a building’s systems and assemblies meet defined objectives and criteria.”

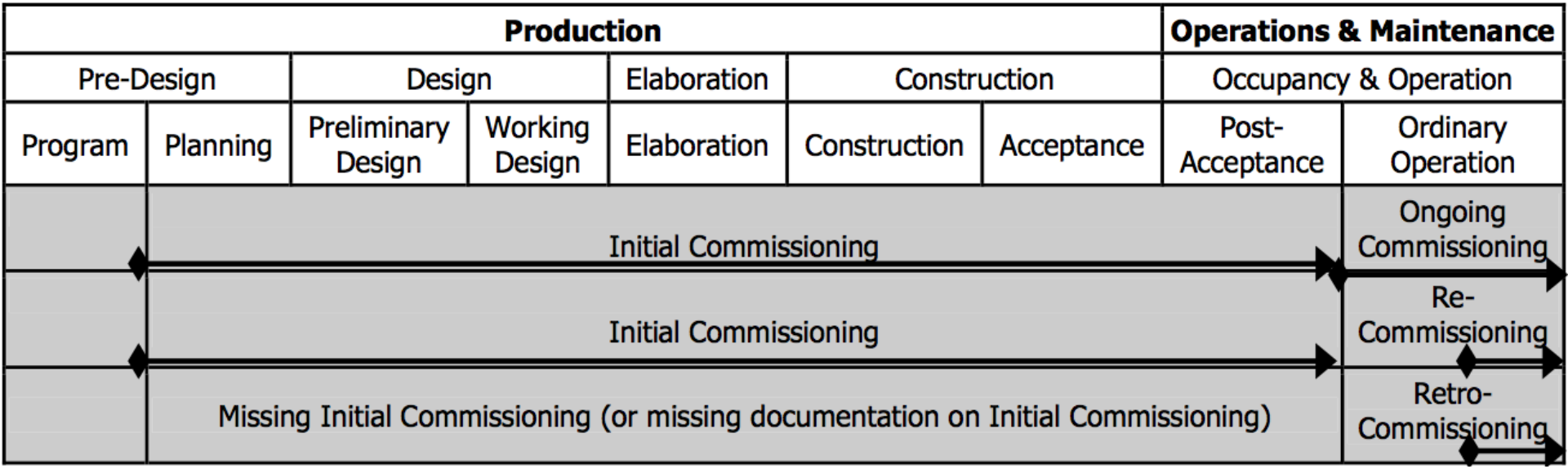
This internationally established definition is quite close to the definition used by ASHRAE (the American Society of Heating, Refrigerating, and Air Conditioning Engineers), that stipulates that Commissioning is “ the process of ensuring that systems are designed, installed, functionally tested and capable of being operated and maintained to perform in conformity with the design intent.”

Regarding energy efficiency commissioning takes place during the construction process at stages which are crucial concerning building energy efficiency performance.

Source: COMMISSIONING OVERVIEW (IEA ANNEX 47) - A Report of Cost-Effective Commissioning of Existing and Low Energy Buildings Annex 47 of the International Energy Agency Energy Conservation in Buildings and Community Systems Program. REPORT EDITORS: Chloé Legris (Natural Resources Canada) Natascha Milesi Ferretti (NIST, USA) Daniel Choinière (Natural Resources Canada), November 2010

Building construction and energy efficiency

Commissioning | IEA Annex 40 definition



In practice one can differentiate 4 types of commissioning which are describe below :
Initial commissioning begins during design and continues through construction and occupancy. It helps ensure that the performance of the new building or major retrofit meets owner's expectations
Retro-commissioning is the first time commissioning is implemented in an existing building in which a documented commissioning process was not previously implemented.
Re-commissioning occurs when a building that has already been commissioned undergoes another commissioning process.
Lifetime commissioning or on-going commissioning is a commissioning process conducted continually for the purposes of maintaining, improving and optimizing the performance of building systems initial or re/retro commissioning.

Building construction and energy efficiency

Avoiding damages due to improper design and execution

> How to avoid damages

> Design and construction / installation is carried out by qualified personnel.

> Qualified personnel has attended specific courses.

> Commissioning and quality check ensure that construction / installation has been carried out as planned.

Building operation and energy efficiency

Key aspects | possible solutions

Building life cycle	Key aspects for energy efficiency	Possible solution to deal with it
Step 4: Building operation	Inspections on a regular basis; recommendations on how to improve	Provide guidelines and tools; Link with financing schemes (ESCO; LCCbased contracts)

> Guidelines and tools for inspection and energy management

> Guidelines and tools for inspecting technical systems to check whether they work properly and whether energy efficiency can be improved.

> Guidelines and tools for introducing energy management in building operation (energy accounting and control).

> Link with financing schemes

> If energy savings pay for the energy efficiency measures it will be crucial to actually achieve the predicted energy demand; therefore the exact energy consumption must be measured.

> Meters must be in place and fraud must be prevented as a precondition for financing models based on the ESCO approach (Energy Services Company); the same applies to LCC-based contracts.

Specific aspects of implementing energy efficiency

Definition of minimum energy requirements | feasible options

> Cost optimality of minimum energy requirements

> Definition of minimum requirements: minimum energy requirements must be economically feasible (in terms of LCC); studies will be needed to determine the appropriate level of minimum energy requirements and the process of tightening them.

> Definition of proof of meeting minimum energy requirements: must result in supporting documents which can be easily produced, controlled and which allow for enforcement (e.g. a kind of Energy Certificate).

> Prescriptive and / or performance minimum energy requirements:

> *Prescriptive*: sets separate energy efficiency requirements for each building part and for each part of the equipment. Individual components must achieve compliance with their specific targets.

> *Performance*: based on a building's overall consumption of energy or fossil fuel or the building's implied emissions of greenhouse gas.

> First *prescriptive*, then also *performance*; for complex large office buildings immediately *performance*.

Specific aspects of implementing energy efficiency

Qualified personnel I training needs

> **Qualified personnel is needed in the design, construction and operation phase of the building**

- > Qualified personnel calculates and issues design and completion energy certificate.
- > Qualified workers are needed for building execution. Qualification is defined by training; for new building materials and for the installation of technical systems.
- > Qualified personnel is needed for inspection of air conditioning systems resulting in an inspection report.

Qualification is defined by education (e.g. architecture, engineering) and additional courses in energy efficiency.

Qualified personnel is listed in **the official public registry**; e.g. lists all experts allowed to do inspections.

Specific aspects of implementing energy efficiency

Monitoring and verification of energy efficiency in buildings

> Monitoring and verification of energy efficiency in buildings

- > Energy Certificates are collected and data are evaluated. This serves to refine policies and adjust targets.
- > The core-part is a central Energy Certificate database. The database provides administrative options (such as to link the Energy Certificate with the building permit procedure) and quality control options (e.g. automatic checks).
- > Example: http://epcadviser.direct.gov.uk/home.html

> Supporting compliance and control through data collection and assessment – examples of non-compliance

- > Building is not constructed as planned (e.g. no shading due to cost cutting) → energy consumption will be higher than calculated.
- > Building is constructed as planned, but workers are not qualified and technical systems are not installed properly resulting in inefficient operation → energy consumption will be higher than calculated.
- > Information provided is not correct (e.g. building without windows) → energy consumption indicator displayed in the energy certificate will be wrong.

Thank you for your attention!

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