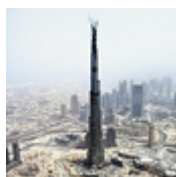


## Trends in intelligent buildings

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This paper presents trends in intelligent buildings - definition, energy demands and control requirements. Presented explanation of the building “intelligence” emphasizes the fact that inappropriate (architecturally and technologically) designed building with superb control technology will still be a poor building with excellent control.

Creating intelligent source-efficient building in all its subsystems determines the path of sustainable living on earth.

We spend up to ninety percent of our life inside the buildings; therefore, we can't omit the fact that the building affects our physical and mental well being. Low light can trigger depression; poor air exchange causes the formation and breeding of allergenic and irritant substances, causing breathing problems. Relationship to our housing reflects our relationship to oneself and the relationship to nature because buildings are responsible almost for one half consumption of primary energy sources, one-third of global CO<sub>2</sub> production and one half of all consumed raw materials. The buildings are producing hundreds millions tones of waste (BEDB). The trend of the building use of the so-called “polluted” 21st century, determines the direction of human society from the perspective of the sustainability of life on the Earth.

### Introduction

The concept of intelligent buildings is relatively widespread, although the precise definition of intelligent building still doesn't exists and probably will not exist. This follows from the fact that the intelligence in humans is very vague and subjective. Generally intelligence is defined as

Intelligence is a set of cognitive skills, ability to solve problems under circumstances accompanied by uncertainty. The word “intelligence” also means the ability to extract relevant information from a variety of observations that ensure survival

In human society we often share an opinion that the intelligence (civilization) lies in the extent of the use of technology, i.e. rate of technocracy. However during the last two centuries this technocratic society devastated the planet to the point, when our parents and grandparents telling stories about clean air and rivers seems like science

fiction. In accordance with the global philosophic authority (i.e. A. Bates, V. Sinelnikov) the previous definition of intelligence “to ensure the survival” can be changed to

“Intelligence is determined by the individual’s relationship to the surrounding environment during or for the satisfaction of his living needs”

### **Intelligence of buildings**

There are two basic manners how to solve “smart” / “intelligent” buildings. The first approach “active intelligence” represents the “doping” the building with technology and electronics, which are controlled by “sophisticated” information system. This system enable control and management of all processes associated with the use of the building (from air conditioning, heating to automatic lawn watering). The second option is “intelligent” design of the building - “passive intelligence”. The building is well designed, therefore it need a minimum of techniques (monitoring, control, etc.) in order to achieve the characteristics of buildings (indoor environment quality, comfort, energy consumption, etc.). During the proposals of intelligent buildings - in the 80’s of the 20<sup>th</sup> Century, emphasis were variably greater on energy savings and creation of an optimal internal environment.

### **Comfort versus savings**

We feel subconsciously that the higher comfort demands higher energy consumption, which in itself is not clean and also raise many questions: “Is all of this necessary?” Must I have it all and will I use it? “On the other hand, we would like to live comfortably and enjoyed at home peace and comfort in today’s busy and stressful world. Everyone has free choice to decide how much money to invest and how many comforts in ecology will the cost of the building accept. But are we thinking during the construction of our own housing of our self or also of the others? The real world around us gives us the answer to this question.

### **Intelligent green building**

If we want to stop the planet devastation will be - “an intelligent building” seen as a building, which ensures a reasonable standard of the building using the quality of indoor environment and services in order to minimize the impact on the environment. Integrating green building features into smart buildings appears to be inevitable and necessary. This fact confirms the Energy Performance of Building Directive (2002/91/EC), which was issued due to the high negative impact of buildings on the environment. A green building therefore represents the structures and processes that are environmentally friendly and are resource-efficient throughout the building lifecycle: from excavation, construction, production, operation, maintenance, reconstruction and demolitions.

### **Source-efficient solutions**

Consider the eco heating system, which saves 100 euros per one year to a classical heating system. For the production of the eco system we consumed 2 tons of raw

materials, is this system “smart” (green) if its price (production) and deployment costs 20 000 euros, and its lifespan is 30 years? Is this system smart (green) if the processing of materials and the consumption of energy for the system manufacturing is higher than the possible energy savings? Is this system smart (green) if the development contribution of 20 people for several months, the resources to run their offices and other overheads are higher than the savings that the smart green system saved in cost? Etc. etc. ... It is obvious that to assess the effectiveness of some solutions is not sufficient to determine the price and benefits (savings, increased comfort, etc.), but we must carefully consider the entire life cycle.

### **Grey power**

it represents a methodology that aims to find a summary of the energy needed for the entire product life cycle. This includes raw material extraction, transportation, manufacturing, assembly, installation, dismantling and deconstruction or disassembly. Let us look at simple example in water system distribution - bottling of water and municipal water distribution. Each water system needs energy for its “muscle pumps” to distribute to the taps of households or buildings and to fill the bottles. In the second case each bottle must be manufactured, packed and shipped to store shelves. It is important to know that the energy required in the second case is 1000 times higher than in the first case (Adzem E. et al.).

This example illustrates the need to assess the energy performance of buildings, not only from the time of use, but since the establishment of the project itself (till the lifetime of the building - demolition). When we use life cycle assessment to analyze the buildings of our ancestors (eg Orava’s timber) in view of CO2 emissions or energy consumption we will find that often today’s “zero” or “green” buildings have much worse impact on the environment. At present, therefore, the designation “eco” appears in many cases only as a pure marketing illusion.

### **Intelligent, source and energy efficient building**

Detailed analysis of housing in terms of source and energy efficiency comes to the conclusion that the most effective is “live in the forest” or “dugout” It is interesting that dugout provides the highest quality of internal environment conditions with minimum energy requirements. But is obvious that living in dugout is impossible for “developed” countries and would bring more harm than good. Dugout represents the second approach - living with minimum requirements of energy. The intelligent energy and source building lies somewhere in the middle of the interval defined by dugout and luxury and source demanding villa.

The building as a productive and cost effective environment must therefore reflect the resource and energy efficiency in the whole and also in it’s parts of the building construction, technical equipment, services, management and their inter-relationships. Optimal design of the building must include requirements in the areas of electrical engineering, computer science, engineering, building services, psychology, sociology, architecture, ergonomics, and many other disciplines. This proposal therefore represents a very difficult optimization problem however, the most optimal proposal is apparent in the energy requirements of buildings and its impact on the environment.

Therefore the most important thing is to realize the fact that inappropriate (architecturally and technologically) designed building with superb control technology will still be a poor building with excellent control.

### **The future of intelligent buildings.**

Animal structures in nature (termitary etc.) are characterized by tremendous ingenuity and optimality, effectively using all the elements of its surroundings. None of the higher animals are devastating environment in which they live. Man did not invent anything new, which would have existed in nature. Intelligent buildings therefore necessarily find an analogy in nature, i.e. intelligent building construction will be a minimum load of the environment that will use just passive elements (activities) of the environment.

Creating intelligent source-efficient building in all its subsystems determines the path of sustainable living on earth. Above all technical proposals (solutions) are always a man as his creator and user. Savings, efficiency and friendly approach to the environment will always depend on awareness of needs and of itself, its relationship to its surroundings. Each of us can always decide which way to choose to live. Either build a building in harmony with nature, according to their natural needs or house with a lot of unused potential, and areas which contribute to waste of resources and destruction of our nature.





*Fig.1 : Tallest building in the world (termitary - left, Burj Khalifa - right)*

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