

Passive House as a Part of Sustainable Building



СТРОИТЕЛСТВО В
ХАРМОНИЯ С ПРИРОДАТА

Presented by: Ward Miller
USGBC Board Chairman

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The Program

- What is sustainability & Why it matters?
- Key happenings in building (R)evolution
- Passive House & Sustainable Building
- Fundamentals, Barriers, Benefits, and Getting to where we want to go!



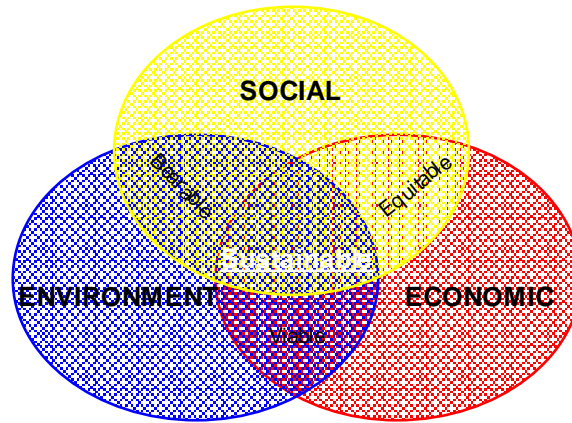
Sustainability in History

- What is sustainability?
- ~~We develop a building that meets the needs of the present without comprising the ability of future generations to meet their own needs"~~
- ~~The Great Law = Seventh Generation~~

Our experience



Building Blocks of Sustainability





1 planet to share!



Big Challenges

- Current economic model
- Climate change
- Resource depletion
- Biodiversity loss



Our experience



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Sustainable Building Global Newsflash

- A 'common carbon metric' developed by members of the World GBC leading sustainable building rating tool development
- Recognized by the UNEP Sustainable Building and Climate Initiative
- Will be highlighted before decision-makers at the COP15 conference in Copenhagen

Ground-breaking sustainable building agreement

Industry that is projected to contribute \$554 billion to the U.S. gross domestic product from 2009-2013.

making green building a source of significant economic and environmental opportunity. Greater building efficiency can meet 85% of future U.S. demand for energy, and a national commitment to green building has the potential to generate 2.5 million American jobs.



Europe on Energy Efficiency & Sustainability in Building

➤ Home to

- **BRE Environmental Assessment Method**
- **Passive House**
- **German Building Certificate**
- **More GBCs than any other continent**
- **World leading policy framework**



Energy Efficient Base Camp Climbing towards Sustainability

- 3 key policies in EU's energy efficiency
 - **Energy Efficiency Action Plan — EEAP (EC, 2006e)**
 - **Energy Performance of Buildings Directive – EPBD (EC, 2002c)**
 - **Energy End-Use Efficiency and Energy Services Directive – ESD (EC, 2006f)**

Integrated Product Policy (IPP); the Thematic Strategy on the Sustainable Use of Natural Resources; the Thematic Strategy on Waste Prevention and Recycling; the Eco-Management and Audit Scheme (EMAS), the Ecolabelling Scheme, the Environmental Technologies Action Plan (ETAP); Green Public Procurement (GPP); the Eco-design of Energy Using Products Directive (EuP) and the European Compliance Assistance Programme — Environment & SMEs.



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Key Criteria of Passive House

- **1st Passive House built in 1990:**
 - **Annual heating/cooling demand < 15 kWh/m²/year**
 - **Total primary energy < 120 kWh/m²/year**
 - **Air leakage < 0.6 times the house volume per hour**
 - **Recommended ~ Total site energy < 42 kWh/m²/year**

An average European household consumes 4,667 kWh, whereas a household in the US consumes 11,209 kWh

Gave averages: <http://www.greenpeace.org/canada/en/campaigns/climate-and-energy/solutions/energy-efficiency/12-steps>

Europe's residential sector responsible for 26.6 % of final energy consumption



Putting the Numbers in Context for Bulgaria

- Bulgaria has 3.76 million households
- Area of Bulgarian household = 63.89 m²
- European household consumes 4,667kWh
 - **4,667kWh / 63.89 m² = 73.04 kWh/m²/year**
 - **73% more than Passive House**
 - **116 mln kWh potential savings!**
 - » Equivalent energy needed to support 10,610 average American or 25,000 Bulgarian households

Stats from Bulgarian NSI, Greenpeace, and U.S. Dept. of Energy

The 73% more than passive house refers to the 42kWh total site energy
(73.04 kWh – 42 kWh) * 3.76 mln. Dwellings = 116 mln kWh savings

X = American, which average 11,000 kWh per year or equivalent of 25,000
European households

BG in 2.1 million res. Buildings (NSI Dec31,2008)



Key Building Blocks of Passive House

- Most Passive Houses include:
 - **Passive solar heat gain**
 - **Low-volume heat recovery ventilation system**
 - **High efficiency lighting and appliances**
 - **Advance window technology and super insulation**

super insulation (33.5 cm and 50 cm wall and roof for Sweden)



Key Criteria of Sustainable Building

- Sustainable Sites
- Water Efficiency
- Materials and Resources
- Indoor Environmental Quality
- Energy & Atmosphere
- Innovation in Design
- Regional Priority

Points

Construction Activity Pollution Prevention	Required	
Credit 1 Site Selection	1	
Credit 2 Development Density & Community Connectivity		5
Credit 3 Brownfield Redevelopment	1	
Credit 4.1 Alternative Transportation—Public Transportation Access		6
Credit 4.2 Alt. Transportation—Bicycle Storage & Changing Rooms		1
Credit 4.3 Alt. Transportation—Low-Emitting & Fuel-Efficient Vehicles	3	
Credit 4.4 Alternative Transportation—Parking Capacity		2
Credit 5.1 Site Development—Protect or Restore Habitat		1
Credit 5.2 Site Development—Maximize Open Space	1	
Credit 6.1 Stormwater Design—Quantity Control	1	
Credit 6.2 Stormwater Design—Quality Control	1	
Credit 7.1 Heat Island Effect—Non-roof	1	
Credit 7.2 Heat Island Effect—Roof	1	
<u>Credit 8 Light Pollution Reduction</u>	<u>1</u>	
Subtotal		

Points

Water Use Reduction	Required	
Credit 1 Water Efficient Landscaping	2-4	
Credit 2 Innovative Wastewater Technologies	2	
<u>Credit 3 Water Use Reduction</u>	<u>2-4</u>	
Subtotal		
Fundamental Commissioning of Building Energy Systems	Required	
Minimum Energy Performance	Required	
Fundamental Refrigerant Management	Required	
Credit 1 Optimize Energy Performance	1-19	
Credit 2 On-site Renewable Energy		



Understanding the Building Blocks of Sustainable Building

- Focus on holistic approach to design
- Cutting edge building technologies & design
- Rating tools are straightforward to use
- Graded range of thresholds

Points

Construction Activity Pollution Prevention	Required	
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Credit 2 Development Density & Community Connectivity		5
Credit 3 Brownfield Redevelopment	1	
Credit 4.1 Alternative Transportation—Public Transportation Access		6
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Points

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Credit 1 Water Efficient Landscaping	2-4
Credit 2 Innovative Wastewater Technologies	2
<u>Credit 3 Water Use Reduction</u>	<u>2-4</u>
Subtotal	

Fundamental Commissioning of Building Energy Systems	
Minimum Energy Performance	
Fundamental Refrigerant Management	
Credit 1 Optimize Energy Performance	1-19
Credit 2 On-site Renewable Energy	1-7
Credit 3 Enhanced Commissioning	



Understanding the Building Blocks of Sustainable Building

➤ Energy & Atmosphere

<u>Prerequisites</u>	<u>Points</u>
<ul style="list-style-type: none"> • Credit 1 Optimize Energy Performance • Credit 2 On-site Renewable Energy • Credit 3 Enhanced Commissioning • Credit 4 Enhanced Refrigerant Management • Credit 5 Measurement & Verification • Credit 6 Green Power 	<ul style="list-style-type: none"> 1-19 1-7 2 2 3 2

Points

Construction Activity Pollution Prevention
Required

Credit 1 Site Selection

1

Credit 2 Development Density & Community Connectivity

5

Credit 3 Brownfield Redevelopment
1

Credit 4.1 Alternative Transportation—Public Transportation Access

6

Credit 4.2 Alt. Transportation—Bicycle Storage & Changing Rooms

1

Credit 4.3 Alt. Transportation—Low-Emitting & Fuel-Efficient Vehicles

3

Credit 4.4 Alternative Transportation—Parking Capacity

2

Credit 5.1 Site Development—Protect or Restore Habitat

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Credit 5.2 Site Development—Maximize Open Space
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Credit 6.1 Stormwater Design—Quantity Control
1

Credit 6.2 Stormwater Design—Quality Control
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Credit 7.1 Heat Island Effect—Non-roof
1

Credit 7.2 Heat Island Effect—Roof
1

Credit 8 Light Pollution Reduction

1

Subtotal

Points

Water Use Reduction

Required

Credit 1 Water Efficient Landscaping

2-4

Credit 2 Innovative Wastewater Technologies

2

Credit 3 Water Use Reduction

2-4

Subtotal

Fundamental Commissioning of Building Energy Systems

Minimum Energy Performance

Fundamental Refrigerant Management

Credit 1 Optimize Energy Performance

1-19

Credit 2 On-site Renewable Energy

1-7

Credit 3 Enhanced Commissioning



There's little "unsustainable" about Passive House

- Stimulates innovation in design
- Cost parity has been achieved between Passive House & standard homes
- Sets the bar very high for energy efficiency, but other aspects need to be incorporated

A study carried out at the University College in Dublin [3] shows that seen in a 50 year life cycle perspective, the embodied energy of the materials used for the last kWh/m² reduction needed to achieve the passive house standard, actually increased the energy consumption for the building to such an extent, that the energy reduction achieved for operation was balanced out by the increase in embodied energy. In other words – the last kWh/m² energy savings for operation do not necessarily lead to an overall lower impact on the environment. Actually it might increase the impact considering the fact that the energy consumption for operation might be changed to a fuel with lower Carbon emission than today or if the fuel for the CHP plant already has a low carbon footprint.



There's little "Passive" about Sustainable Building

➤ Active approach to designing:

- Production of materials
- Materials procurement
- Water consumption
- Building user
- Waste handling
- Community interaction
- Site selection
- Lifecycle energy use



BSBC

BULGARIAN SUSTAINABLE
BUILDING COUNCIL

There's little "Passive" about Sustainable Building

- Has the current focus on limiting carbon emissions put social issues on the back burner?
- Universal approach to assessing carbon impacts from buildings – GOOD
- Adapting behavior to a sustainable built environment, must be closely tied to social issues



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Fundamentals of Energy Efficiency & Sustainability

- Requires upfront funding
- Fragmented benefits
- Low priority because of shared benefits
- Difficult to measure savings as opposed to consumption

Fragmented benefits - , renter in apt has little to no choice of EE of products he pays the bills for...(Just like distributed energy at the micro level is underutilized because the implementation strategy for a nation is by definition fragmented, so too are the opportunities for energy efficiency gains

Difficult to measure savings as opposed to consumption, reducing investor confidence



Barriers to Energy Efficiency & Sustainability

- Access to information
- Access to financing
 - **Retrofitting requires upfront investment that is paid for over the life of the upgrade**
- Access to skilled labor
- Underdeveloped market for EE products resulting in exorbitant prices

Access to information – property investors lack sufficient information on energy retrofits to make informed choices

Access to Financing – retrofits should have mechanisms to reduce investor risk in the high upfront cost

Access to skilled labor – presently insufficient knowledge and capacity of skilled technicians and entrepreneurs to expand EE retrofits on a national scale

Insufficient supply of EE options for consumers resulting in exorbitant prices

Access to skilled labor – presently insufficient knowledge and capacity of skilled technicians and entrepreneurs to expand EE retrofits on a national scale

Insufficient supply of EE options for consumers resulting in exorbitant prices



A few Benefits of Energy Efficiency & Sustainability

- Investing puts us on the path to real reductions in greenhouse gases while:
 - **CONTRIBUTING TO USER'S FINANCIAL SAVINGS**
 - **NATIONAL ECONOMIC GROWTH**
 - **STREAMLINING THE RETROFITTING PROCESS**
 - **LIMITING URBAN SPRAWL**
 - **PPP WILL LEVERAGE PRIVATE RESOURCES**



Facilitating Energy Efficiency & Sustainability

- **Decreasing affordability of energy**
opportunities in EE & sustainability:
 - Recognize EE as an energy resource in the transition to a high growth, low carbon economy
- **Energy security**
 - Coordinate public and private efforts at the national and municipal level
- **Increasing levels of Greenhouse gases**
 - Determine optimal financing model for Bulgaria
 - Optimize use of European policy framework by maximizing legislative actions on policies like EBPD, Integrated product policy, etc.

Solution: integrated analysis of EE opportunities linked to their barriers to clarify savings potential



Making it Happen!

- National awareness campaign about the benefits of sustainable building
- Adopt and adapt a sustainable building standard for Bulgaria
- Involve third parties: NGOs, business, utilities
- Further develop tax incentives
- Expand opportunities for energy efficient/sustainability mortgages
- These recommendations do not involve spending large sums of tax payer money!

Adopt SBS: A uniform set of national standards to qualify energy efficiency and retrofit workers and industry training providers will establish the foundation of consumer confidence that work will be completed correctly and produce the expected energy savings and benefits. high-level national standards will spur the utilization of qualified training providers that offer career-track programs for people of all skill levels, promote and expand green jobs opportunities, and facilitate the mobilization of a national home retrofit workforce

Expand opportunities for energy efficient/sustainability mortgages: ensures that retrofits are accurately valued in the appraisal process.

These recommendations do not involve spending large new sums of tax payer money in our fiscally-constrained environment. Rather, they focus on removing information barriers, transaction costs, Recovery Through Retrofit liquidity constraints, and other market failures that often prevent homeowners from making investments that have both private and social benefits.



БСУС

БЪЛГАРСКИ СЪВЕТ
ЗА УСТОЙЧИВО
СТРОИТЕЛСТВО

Mission:

To stimulate a rapid and thoughtful way
Bulgarian buildings and communities are designed,
constructed, operated & decommissioned - enabling
a sustainable built environment that is in harmony

with nature and culture, and promotes economic and
societal prosperity.

For more information about the contents of this presentation or the
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