Public presentation
“UNITED NATIONS ENVIRONMENTAL COUNCIL”
Graduation tracks Architecture + Building Technology
Student: Roy Wijte  1258257
Board of committee:
Henri van Bennekom, Bas Gremmen, Eric van den Ham, Frank Schnater, Peter Barendse
November 6th, 2012
- PROJECT DEFINITION
- URBAN ANALYSIS AND MASTERPLAN
- UNEC BUILDING DESIGN
  - BUILDING TECHNOLOGY RESEARCH
Google: ‘Global warming’ 20,000,000 hits
- Information is complex and often contradictory
- Interests lead to biased messages
- Lack of a leader on environmental issues
- Public concern is not sufficiently activated
UNEC – Worldwide organisation

UNITED NATIONS

- 193 COUNTRIES ORGANISATION
- SECURING WORLDWIDE HUMAN INTERESTS
UNECS - Organogram

UNITED NATIONS

International court of justice

The Hague

General Assembly

Security Council

Economic & Social Council

Secretariat

Manhattan, New York
UNITED NATIONS

International court of justice

General Assembly
Security Council
Economic & Social Council
Secretariat

The Hague

Environmental Council

Manhattan, New York

United Nations Environmental Council
UNEC – Current shop
UNEC – Mission

MISSION
COLLECT
PRODUCE
EXCHANGE
PROPAGATE

PROJECT DEFINITION  URBAN MASTERPLAN  UNEC BUILDING DESIGN  BUILDING TECHNOLOGY
MISSION

PROGRAM OF REQUIREMENTS

COLLECT: Library, Archive

PRODUCE

EXCHANGE

PROPAGATE
**MISSION** | **PROGRAM OF REQUIREMENTS**
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COLLECT | Library, Archive
PRODUCE | Offices, Facilities
EXCHANGE | 
PROPAGATE |
UNEC – Program of Requirements

MISSION

PROGRAM OF REQUIREMENTS

COLLECT

: Library, Archive

PRODUCE

: Offices, Facilities

EXCHANGE

: Auditoria, COUNCIL, Meeting rooms, LOBBY

PROPAGATE
UNEC – Program of Requirements

MISSION          PROGRAM OF REQUIREMENTS
COLLECT          : Library, Archive
PRODUCE          : Offices, Facilities
EXCHANGE         : Auditoria, COUNCIL, Meeting rooms, LOBBY
PROPAGATE        : Exposition, Product Space
UNEC – Program of Requirements

MISSION

PROGRAM OF REQUIREMENTS

COLLECT : Library, Archive

PRODUCE : Offices, Facilities

EXCHANGE : Auditoria, COUNCIL, Meeting rooms, LOBBY

PROPAGATE : Exposition, Product Space

OTHER : UN PUBLIC ENTRY, Restaurant

Total 15.500m²
UNEC – Use

- Press
- Visitors
- Employees/Businessmen
- Delegates

Venn Diagram:
- PUBLIC
- PRIVATE

Areas:
- Project Definition
- Urban Masterplan
- UNEC Building Design
- Building Technology
LOCATION
UNEC – Location

NEW JERSEY

MANHATTAN

QUEENS

BROOKLYN

BRONX

STATEN ISLAND

EAST RIVER

Image © 2012 DigitalGlobe
URBAN MASTERPLAN
UNEC – Masterplan concept
UNECC – Connection water vs. city
UN complex
UNEC – Significance in Manhattan

Manhattan photo heat-map by eric fischer
UNEC – Modernist icon
UNECE – International group of designers

OSCAR NIEMEYER – BRAZIL
WALLACE K. HARRISON – AMERICA
LE CORBUSIER – FRANCE
UNECD - Golden ratio

A : B = 1 : 1.618
UNECE – Golden ratio

\[ A : B = 1 : 1.618 \]
UNEC – Golden ratio
ONLY 25% OF PLOT WITH BUILD SURFACE
UNEC – Current Security Measurements
UNECD DESIGN CONCEPTS
UNEC – Current situation
UNECE – Adding UNEC
UNEC – Security and underground situation
- NO VISUAL OBSTRUCTIVE SECURITY MEASUREMENTS
UNECA – Representative volumes

PROJECT DEFINITION  URBAN MASTERPLAN  UNEC BUILDING DESIGN  BUILDING TECHNOLOGY
Representative programme translated in volumes introducing climate
UNEC – Aesthetic and functional connection
DESIGN – LAYOUT
POSITIONING FORUM
 POSITIONING PUBLIC ENTRANCE
UNECE – Functional connection
UNEC – Central axis
UNECE – Transition zone
EXISTING FDR-STRUCTURE
RE-USE OF SPACE, ADDING NEW STRUCTURE
DESIGN – CLIMATE Central axis and Forum
UNEC – First concept and fascination

SECTION
Using sunlight to:
- enlight;
- humidify;
- warm the entrance area

Active Smart Glass Facade
Electrochromic, structural glazing

Facade possible under inclination according to sunorientation

GREAT SPACE

PROJECT DEFINITION  URBAN MASTERPLAN  UNEC BUILDING DESIGN  BUILDING TECHNOLOGY
GOAL:
TO OBTAIN AN INSIGHT OF THE CONSEQUENCES AND EFFECTS OF WATERFEATURES WITH EVAPORATIVE COOLING PURPOSES IN BUILDINGS.
MECHANICAL CLIMATE VS. NATURAL CLIMATE

CONSTANT TEMPERATURE 22–24°C

COMFORT TEMPERATURE DEPENDING ON OUTDOOR CLIMATE

*secretariat building one of first with personal airconditioning units
UNECE – Natural vs. Mechanical ventilation

- Outdoor temperature
- ACM upper 80%
- ACM lower 80%
UNEQ – Standard building
Evaporative cooling

allows the cooling of air (incoming or exiting air) or of thermal masses (roofs, walls, ceilings). It uses the natural effect of evaporation to remove heat from the air. Sensible heat from the air is absorbed as latent heat necessary to evaporate water: arm dry air is changed to cool moist air.
UNECA – Climatic schematisation model

- MOISTURE- AND HEAT-BALANCE TO BE ZERO
### Input

<table>
<thead>
<tr>
<th>Simulation name</th>
<th>Climate data location</th>
</tr>
</thead>
<tbody>
<tr>
<td>Atrium</td>
<td>New York Central Prk Obs Belv USA</td>
</tr>
</tbody>
</table>

#### Properties of the building or space

**SPACE PROPERTIES:**
- Size: Lenght 10 m, Width 10 m, height 8 m
- Volume: V 800 m³
- net floor area: A 100 m²
- ventilation rate: n 10 h⁻¹

**FACADE PROPERTIES:**
- Glass surface: A₅ 100 m²
- G-value glass: G 0.7
- U-value glass: U 3 W/m².K
- Shading factor: z 0.7

**INTERIOR FACADE PROPERTIES:**
- Surface: Aᵢ 320 m²
- U-value: Uᵢ 0.6 W/m².K

**INTERNAL HEAT AND MOISTURE LOAD**
- People, appliances, lighting fixtures: 0 kg/h
- Number of people: 0 kg/h

#### Properties of the used system

**Pond**
- Size: Lenght 6 m, width 5 m, depth 1 m
- Surface area: Aₚ 30 m²
- Volume: Vₚ 30 m³
- Mass: mₚ 300000 kg
- Evaporation energy: Qₑ 4.5 W/m²
- Evaporation rate: Eₑ 0.3 kg/h

#### PMV properties
- Activity: 80 W
- Cloting level: 0.11 clo
- Indoor airspeed: V 0.2 m/s
- External labour: W 0.1 W

### Results

#### Outcome with the used pond system - Yearly averages

<table>
<thead>
<tr>
<th>With system</th>
<th>Without system</th>
<th>Gain/loss</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ambient temperature T_a</td>
<td>16.5 °C</td>
<td>16.9 °C</td>
</tr>
<tr>
<td>Relative Humidity</td>
<td>66.0 %</td>
<td>64.8 %</td>
</tr>
<tr>
<td>Evaporation rate Eₑ</td>
<td>5.80 gr/m².h</td>
<td></td>
</tr>
<tr>
<td>PMV</td>
<td>1.1</td>
<td>1.2</td>
</tr>
<tr>
<td>PPD</td>
<td>65.6</td>
<td>67.8</td>
</tr>
</tbody>
</table>

### Diagrams

1. [New York Central Prk Obs Belv](#)
2. [Evaporation rate (kg/h)](#)

**PROJECT DEFINITION**

**URBAN MASTERPLAN**

**UNEC BUILDING DESIGN**

**BUILDING TECHNOLOGY**
**UNEC – Simulation as parameter**

1. INSIGHT IN COOLING DEMAND BUILDING

2. INSIGHT IN COOLING CAPACITY WATERFEATURE

```
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</thead>
<tbody>
<tr>
<td>Ambient temperature $T_a$</td>
<td>19.7 °C</td>
<td>22.7 °C</td>
<td>-3.0 °C</td>
</tr>
<tr>
<td>Relative Humidity</td>
<td>75.7 %</td>
<td>64.8 %</td>
<td>10.9 %</td>
</tr>
<tr>
<td>Evaporation rate $E_{evap}$</td>
<td>63.2 gr/m².h</td>
<td></td>
<td></td>
</tr>
<tr>
<td>PMV</td>
<td>-0.4 %</td>
<td>0.1 %</td>
<td>-0.5 %</td>
</tr>
<tr>
<td>PPD</td>
<td>51.8 %</td>
<td>56.4 %</td>
<td>-4.6 %</td>
</tr>
<tr>
<td>Cooling Capacity</td>
<td>39.7 W/m²</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
```

**PROJECT DEFINITION**

**URBAN MASTERPLAN**

**UNEC BUILDING DESIGN**

**BUILDING TECHNOLOGY**
UNECE – Forum vs. Manhattan glass skyscraper
UNEC – Outcome cooling demand

<p>| Outcome with the used pond system - Yearly averages |
|---------------------------------|-------|--------|</p>
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<td>19,7</td>
<td>22,7</td>
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<tr>
<td>Relative Humidity</td>
<td>75,7</td>
<td>64,8</td>
</tr>
<tr>
<td>Evaporation rate $E_{e\text{vap}}$</td>
<td>63,2 g/m².h</td>
<td></td>
</tr>
<tr>
<td>PMV</td>
<td>-0,4</td>
<td>0,1</td>
</tr>
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MAXIMUM COOLING DEMAND REACHED AT 0,1L. PER SECOND
UNECA – Climate concept

**Scenario 1**

- Air $T_{air} = 20^\circ C$
- $T_{max} = 33^\circ C$

**Rainwater**

- Theoretical buffer temperature
- Adiabatic heating

**Summer**

- Air $T_{air} = 20^\circ C$
- $T_{max} = 33^\circ C$

- Riverwater (brickish) $T_{water} = 25^\circ C$

- Constant ground temperature $T_{g} = 12^\circ C$
**outside air**

- $T_{av} = 25^\circ C$
- $T_{max} = 35^\circ C$
- $RH = 58\%$

**UNEC Forum + Axis**

- Volume: $84,000 m^3$
- Ventilation rate: 1.5

**Air inlet**

- Surface: $20 m^2$
- $v = 1.7 m/s$
- $T_{av} = 18^\circ C$
- $T_{max} = 25^\circ C$
- $RH = 75\%$

**Rainwater storage**

- $20,000 m^3$

**Cooling Tower**

- Water surface: $600 mm$
- Annual precipitation: $1270 mm$
- Pan-evaporation: yearly $1055 mm$
- $T_{fluctuation} = \pm 5 - 10^\circ C$

**Sun**

- Av. $450 W/m^2$
- Max. $600 W/m^2$

**Audience**

- $130 W/pp.$
- $110 gr. moisture pp. hour$

**Air outlet**

- Surface: $16 \times 7.4 = 117 m^2$
- $v = 0.3 m/s$

**Rainwater storage**

- $2250 m^3$

**Heat (water) storage**

- $2250 m^3$

**Constant ground temperature**

- $T = 12^\circ C$

**indoor pond**

- $745 m^2$

**Column water walls**

- $425 m^2$

**Heat extraction**

- via heat exchanger

**PROJECT DEFINITION** **URBAN MASTERPLAN** **UNEC BUILDING DESIGN** **BUILDING TECHNOLOGY**
Outside air
- $T_{av} = 25^\circ C$
- $T_{max} = 35^\circ C$
- $RH = 58\%$

Ventilation rate: 1.5

Air inlet
- Surface: 20 m$^2$
- $v = 1.7$ m/s
- $T_{av} = 18^\circ C$
- $T_{max} = 25^\circ C$
- $RH = 75\%$

Audience
- 130 W/pp.
- 110 gr. moisture pp. hour

Heat extraction via heat exchanger

Rainwater storage
- 20,0 m$^3$
- Wind depending louveres
- Opening variable, max. 55 m$^2$

Rainwater storage
- 2250 m$^3$

Heat (water) storage
- 2250 m$^3$

Cooling Tower
- Evaporation 0.1 L/sec.
- Water surface 600 mm
- Annual precipitation: 1270 mm
- Pan-evaporation: yearly 1055 mm
- $T_{fluctuation} = \pm 5 - 10^\circ C$

Wind depending louvers
Opening variable, max. 55 m$^2$

Air outlet
- Surface: 16 * 7.4 = 117 m$^2$
- $v = 0.3$ m/s

UNEC Forum + Axis
- Volume: 84,000 m$^3$
- Ventilation rate 1.5

Appliances
- 5 W/m$^2$. 

Rainwater storage
- 2250 m$^3$
UNC – Cooling tower in axis
UNECE – Hybrid cooling

**STATIC**

- $F = 0.7$
- $F = 1$

**DYNAMIC**

- $F = 1.2$
- $F = 1 - 10$
## Results

### Outcome with the used pond system - Yearly averages

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<tr>
<td>Ambient temperature $T_a$</td>
<td>20.8</td>
<td>22.8</td>
<td>-2.0</td>
</tr>
<tr>
<td>Relative Humidity</td>
<td>71.9</td>
<td>64.8</td>
<td>7.1</td>
</tr>
<tr>
<td>Evaporation rate $E_{\text{evap}}$</td>
<td>69.7 gr/m$^2$·h</td>
<td></td>
<td></td>
</tr>
<tr>
<td>PMV</td>
<td>-0.1</td>
<td>0.2</td>
<td>-0.3</td>
</tr>
<tr>
<td>PPD</td>
<td>52.6</td>
<td>56.6</td>
<td>-4.0</td>
</tr>
<tr>
<td>Cooling Capacity</td>
<td>43.7 W/m$^2$</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### UNEC Forum

- **Indoor temperature**
- **Outdoor temperature**
- **Indoor without**
- **ACM upper 80%**
- **ACM lower 80%**

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**PROJECT DEFINITION**  **URBAN MASTERPLAN**  **UNEC BUILDING DESIGN**  **BUILDING TECHNOLOGY**
UNEC – Climatic concept winter

**Outside air**
- $T_{av} = 5\,^\circ C$
- $T_{min} = -15\,^\circ C$
- $RH = 61\%$

**UNEC Forum + Axis**
- Volume: $84,000\,m^3$
- Ventilation rate: $1.0$

**Air inlet**
- Surface: $20\,m^2$
- $v = 1.2\,m/s$
- $T_{av} = 18\,^\circ C$
- $T_{max} = 25\,^\circ C$
- $RH = 70\%$

**Audience**
- $130\,W/pp.$
- $110\,gr.\,moisture\,pp.\,hour$

**Air outlet**
- Surface: $16 \times 7.4 = 117\,m^2$
- $v = 0.2\,m/s$

**Rainwater storage**
- $20,000\,m^3$

**Sun**
- Av. $300\,W/m^2$
- Max. $500\,W/m^2$

**Water surface**
- $600\,mm$
- Annual precipitation: $1270\,mm$.
- Pan-evaporation: yearly $1055\,mm$.
- $T_{fluctuation} = +/- 5 - 10\,^\circ C$

**Wind depending louvres**
- Opening variable, max. $55\,m^2$

**Appliances**
- $5W/m^2$. 

**Constant ground temperature**
- $T = 12\,^\circ C$

**Indoor pond**
- $745\,m^2$

**Heat (water) storage**
- $2250\,m^3$

**PROJECT DEFINITION URBAN MASTERPLAN UNEC BUILDING DESIGN BUILDING TECHNOLOGY**
DESIGN – Forum
UNEC – South facade
UNECD – South facade
UNEC – Precast concrete elements
The UNEC design is:

- architectonic and functional affinity with existing complex;
- secure and sustainable by underground situation;
- underground passive daylight and ventilation solutions.