

# **Solar Buildings :**

## **Main Players of Sustainable Campus**

**Prof. Dr Jean-Louis Scartezzini**  
**Solar Energy and Building Physics Laboratory**  
**Swiss Federal Institute of Technology in Lausanne**  
**1015 Lausanne, Switzerland**

# Hurricane Katrina (USA - 2005)



*Prof. M. Beniston, University of Geneva, 2005.*

# Water Floods & Heatwaves (Europe - 2007)

Greece – June 2007

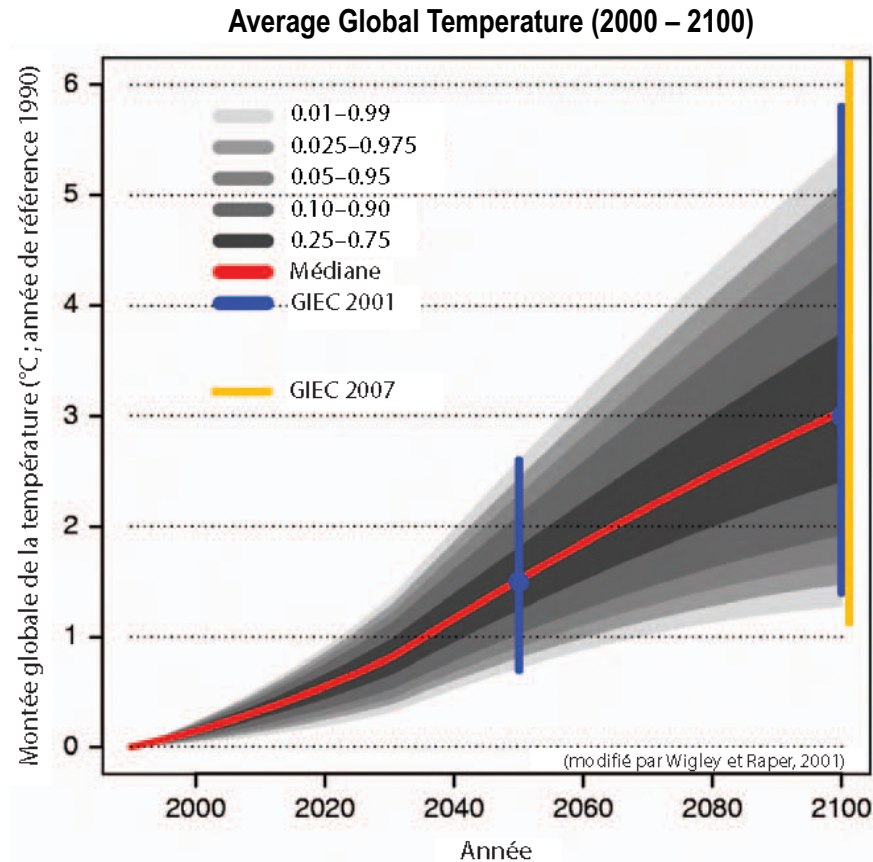


*The Telegraph, 2007.*

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- **Climate Changes : Outlook and Challenges**
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- **Future Development Perspectives**
- **Conclusion**

# Climate Changes – Perspectives CH2050



## Scenario for Switzerland (2050)

- 2 to 3°C Temperature Increase
- 10 to 20% Diminution of Rain Falls
- Higher Frequency of Extreme Events
- Acute Risk of Floods and Torrential Flows
- Increase of Droughts and Heatwaves Occurrence (Summertime)
- Decrease of Snow Falls Occurrence (Wintertime)

OcCC/ProClim, 2007.

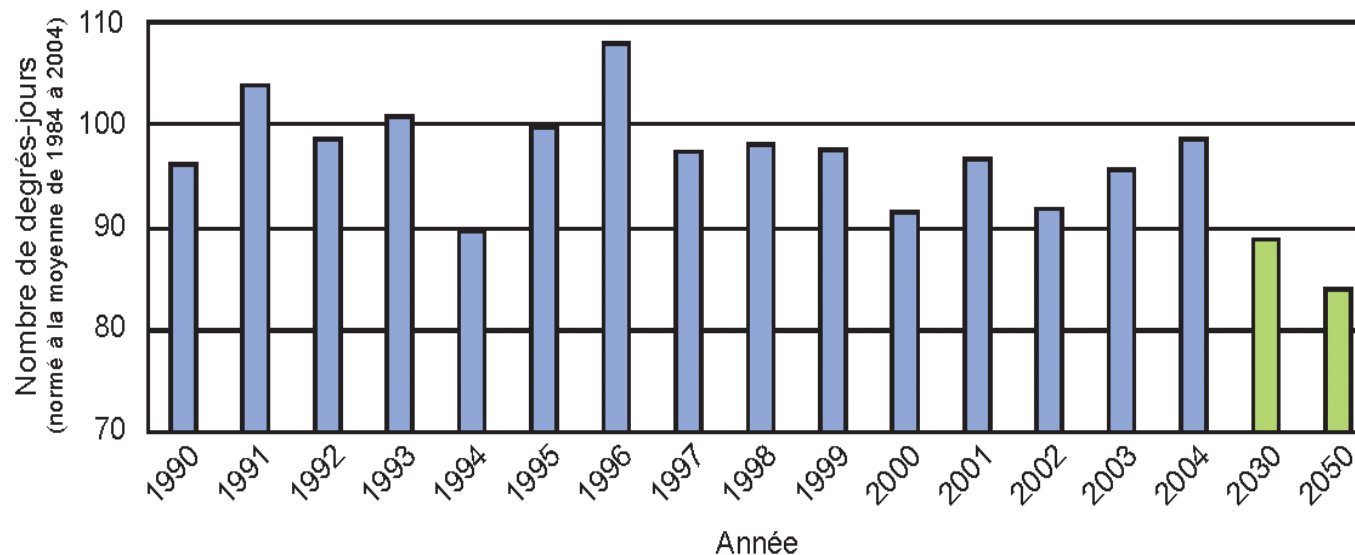
# Climate Changes – Status CH2000



OcCC/ProClim, 2007.

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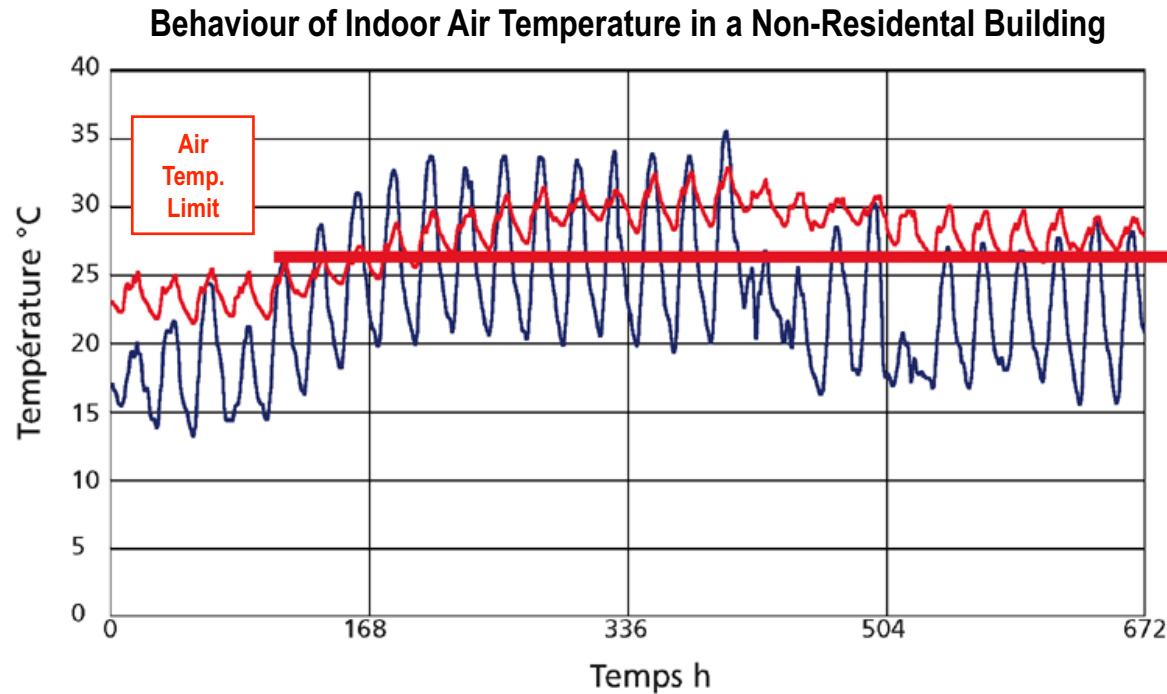
# Building Heating Loads – Perspectives CH2050



- -11% (2030) to -15% (2050) Mitigation of Building Heating Loads
- +100% (2030) to +150% (2050) Increase of Building Cooling Loads
  - Transfer from Heat toward Electricity Demand (+ 3200 GWh/a for Non-Residential Buildings)

OcCC/ProClim, 2007.

# Building Cooling Loads – Heatwave 2003

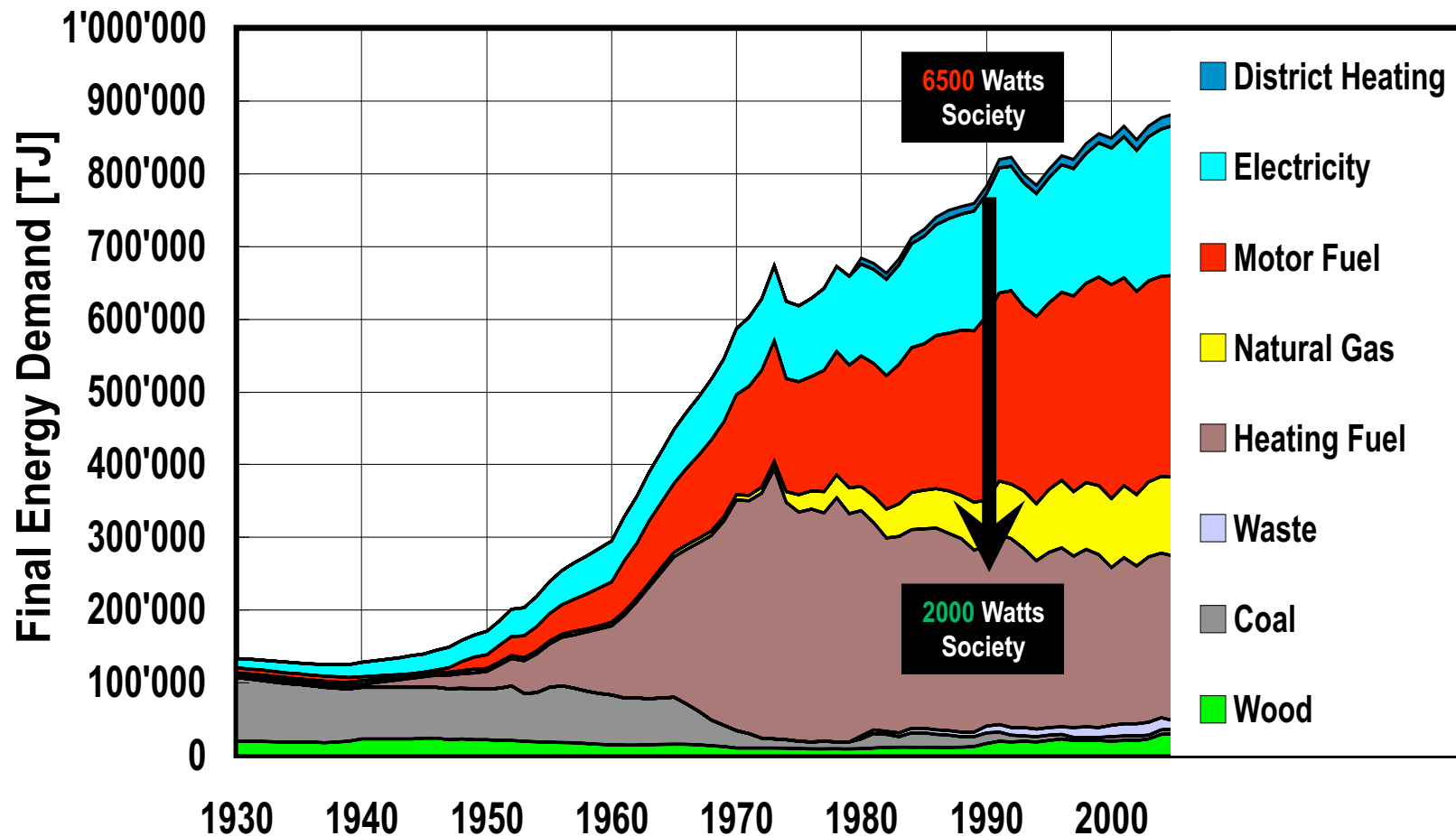


**Scorching Summer 2003 (Zürich)**  
**Highly Glazed Facade (80%), Solar Blinds (SHGC: 0.10)**  
**Moderate Free Gains (15 W/m<sup>2</sup>)**  
**Natural Ventilation (Night Cooling)**



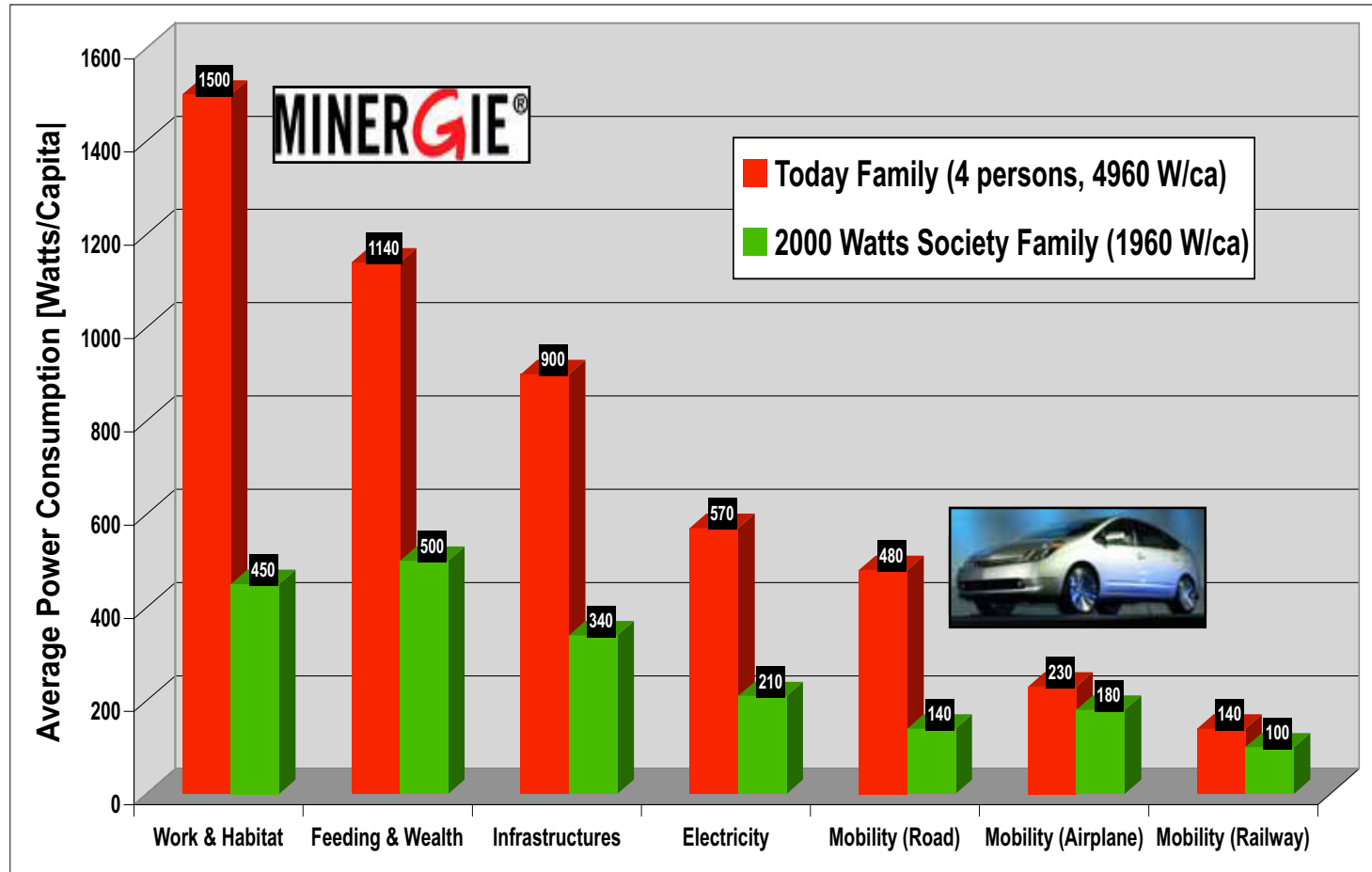
OcCC/ProClim, 2007.

# Swiss Energy Demand - Factor 4

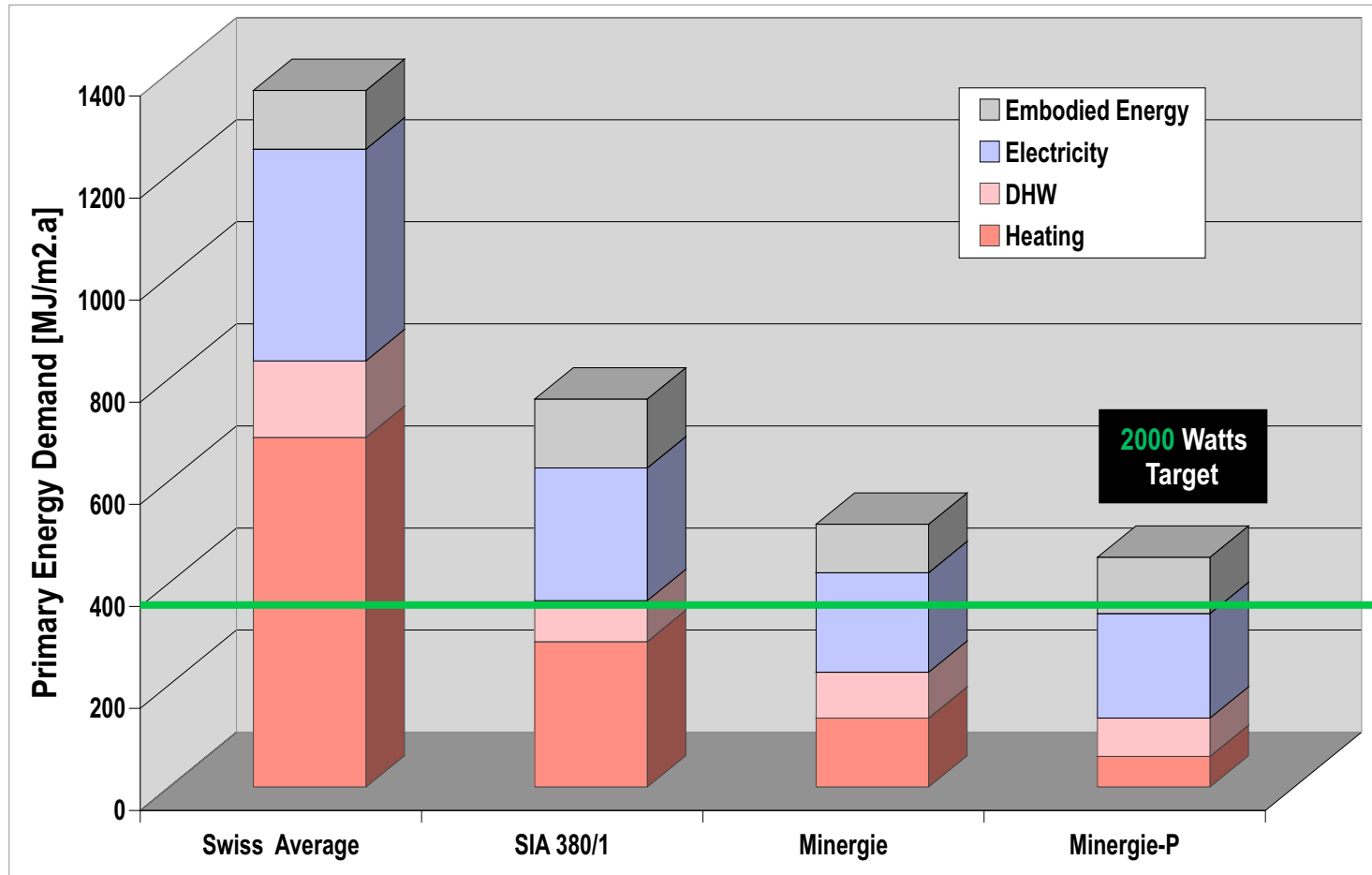


Swiss Federal Office of Energy, 2007.

# 2000 Watts Society - Factor 4



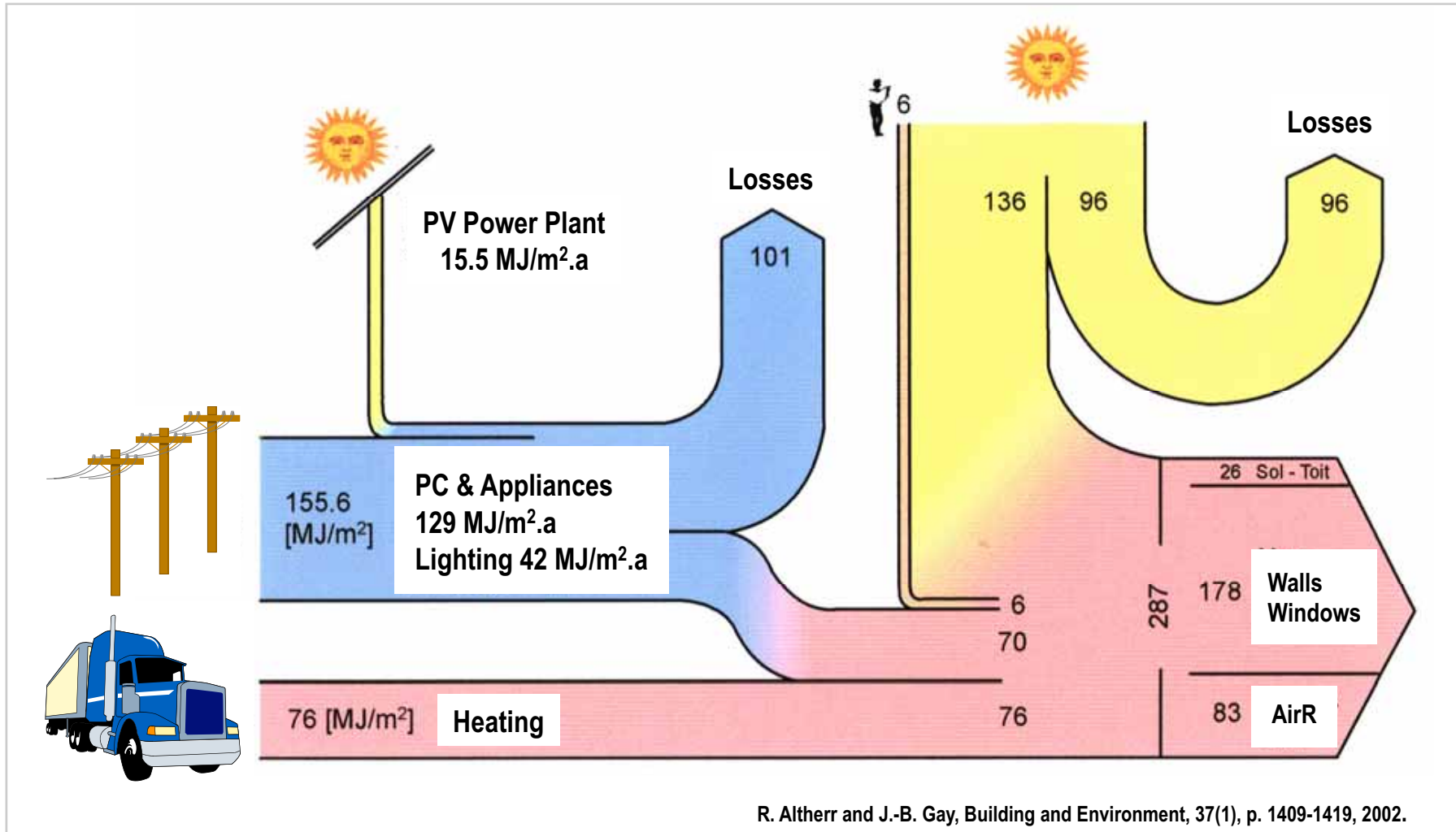
# Swiss Buildings Energy Standards



Competence Center Energy & Mobility, 2008.



# LESO Solar Building - 2000W Target



# EPFL Campus – Design & Planning 1975-2008

**1<sup>st</sup> Stage (1975 - 1985)**



**8 cm Thermal Insulation  
Triple Insulated Glazing  
Low Air Infiltration Rate  
Natural Ventilation**

**2<sup>nd</sup> Stage (1985 - 1999)**



**10 cm Thermal Insulation  
Double Insulated Glazing  
Passive Solar Design  
Cooling Load Extraction  
Natural Ventilation**

**3<sup>rd</sup> Stage (1999 - 2008)**

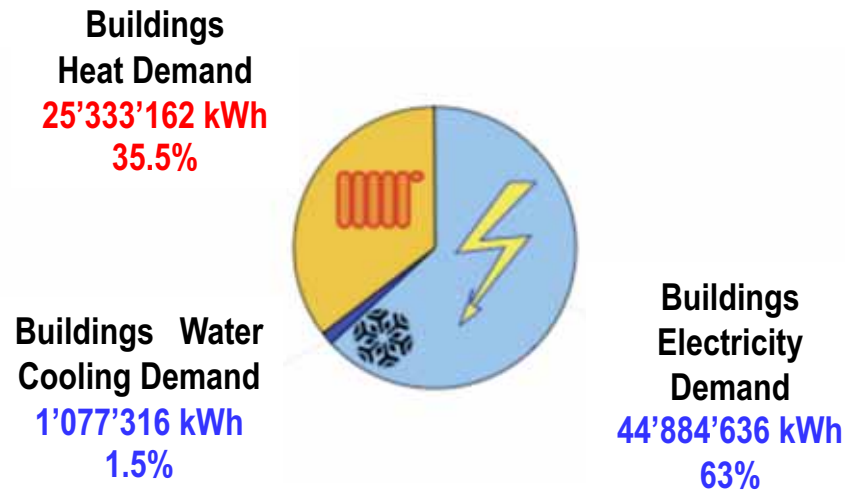


**10 cm Thermal Insulation  
Double Selective Glazing  
Cooling Load Extraction  
Natural Ventilation**

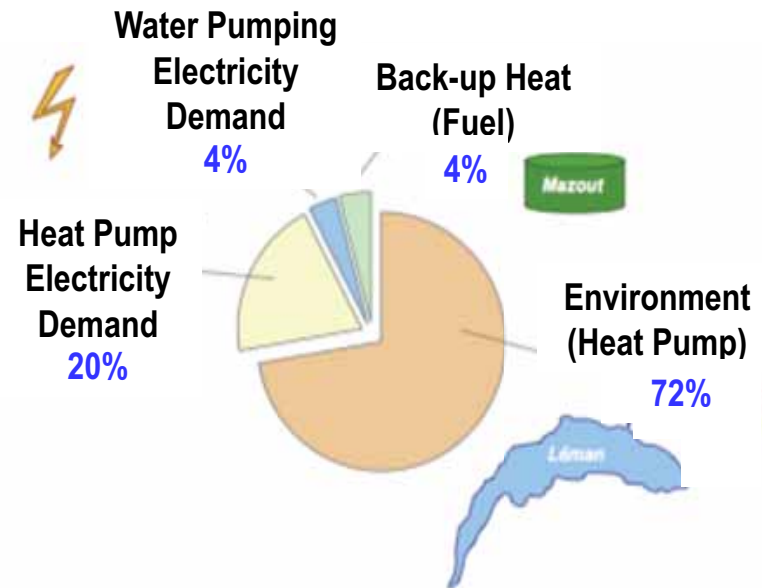


# EPFL Campus – Buildings Energy Performance

Heat & Electricity Demand (2007)



Energy Sources - Heat Demand (2007)



Mitigation of 250'000 Tons CO<sub>2</sub> over 25 years  
(22'000 Tons CO<sub>2</sub> per annum in 2007)

EPFL PL DII F. Vuille, 2007.

# Zero Energy Building – Forum Chriesbach



## Main Features

**Architects : Bob Gysin + Partners (Zürich)**  
**Contractor : Implen SA (Dietikon)**

**Volume (SIA 416) : 32'986 m<sup>3</sup>**  
**Building Area (SIA 416) : 5'012 m<sup>2</sup>**  
**Heated Floor Area (HFA) : 11'170 m<sup>2</sup>**

**External Shading (lamellae)**  
**Daylighting Technology (atrium)**  
**Free Cooling (canadian well)**  
**Active & Adaptive Facades**

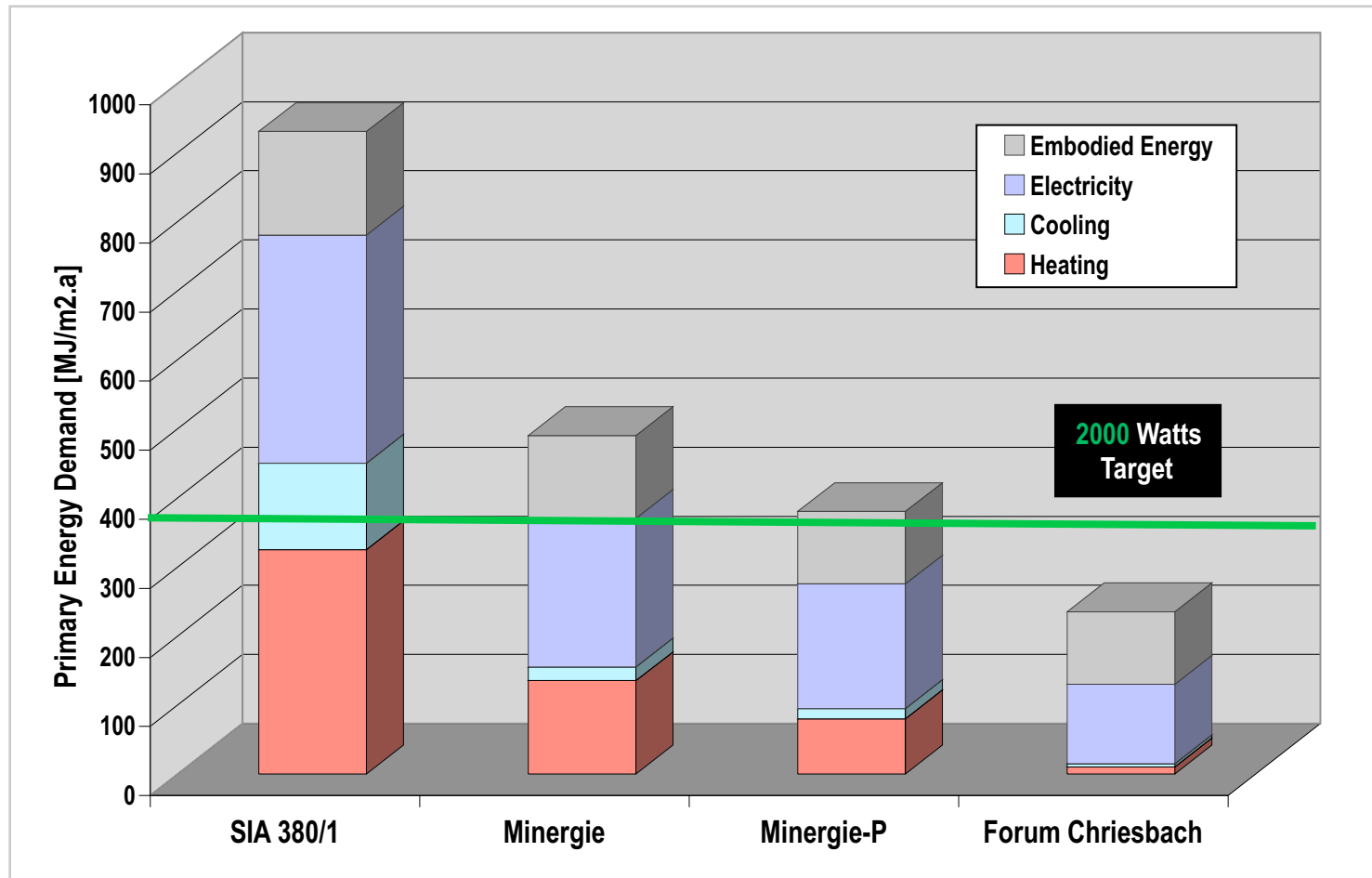
**PV Solar Panels (459 m<sup>2</sup>)**  
**Thermal Solar Collectors (50 m<sup>2</sup>)**  
**Rain Water Recovery (4 m<sup>3</sup>)**  
**Biological Toilets (Nomix)**

# Forum Chriesbach – Building Views



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# Forum Chriesbach – Building Performance



EAWAG Forum Chriesbach, 2006.

# EPFL Solar Energy Lab - R&D Focus



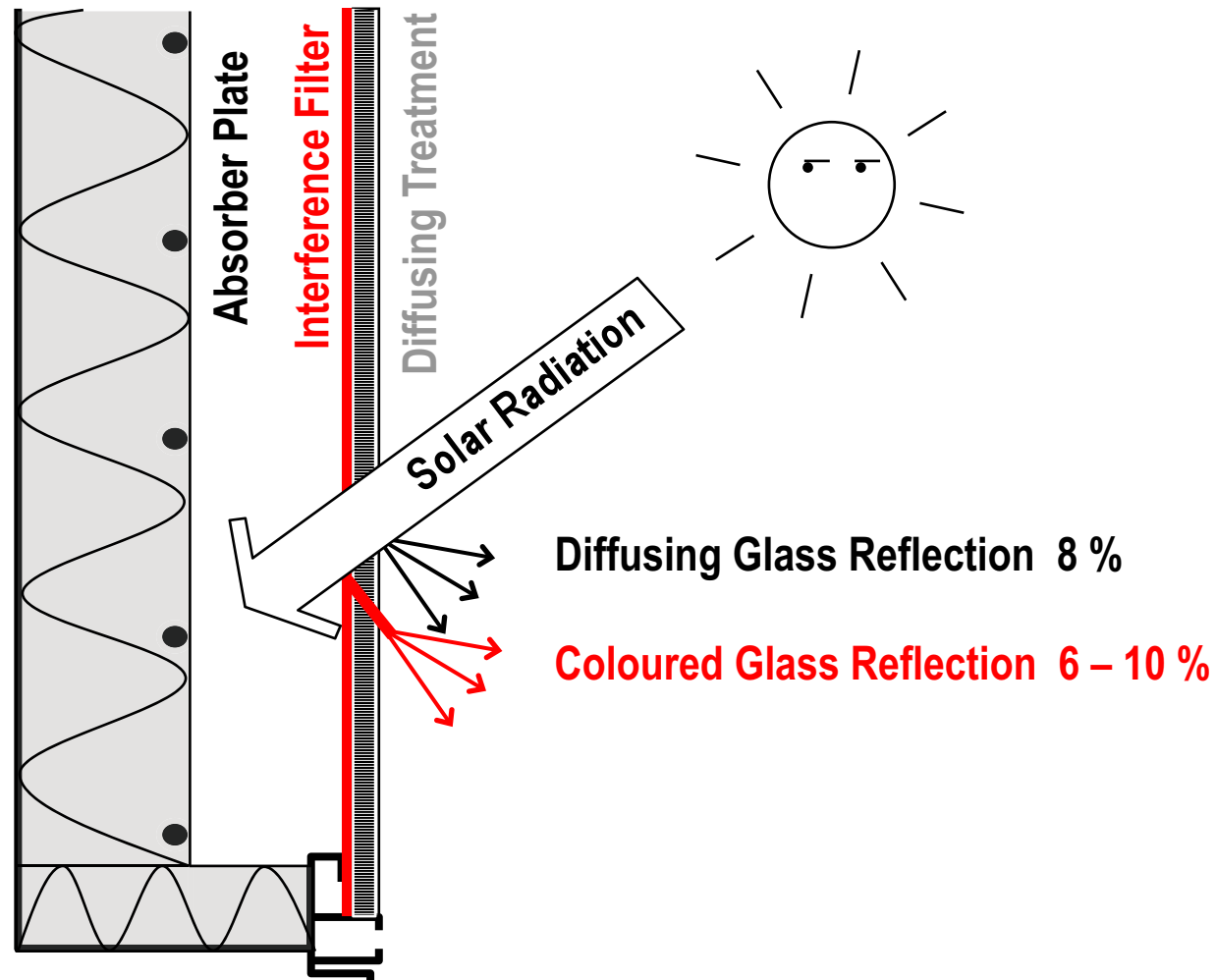
Urban Scale

Integration of REN Technology

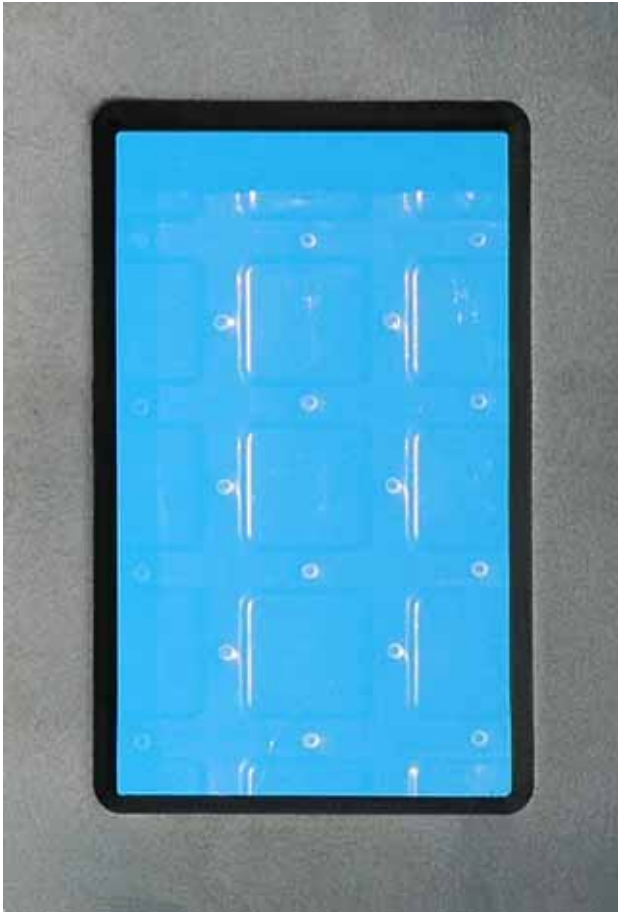
Nano Scale

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# Coloured Solar Collectors – Basic Principles



# Coloured Solar Collectors – Glass Treatment



M.-C. Munari Probst and C. Roecker, *Solar Energy*, 81(9), p. 1104-1116, 2007.

# Coloured Solar Collectors – Glass Samples



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# Coloured Solar Collectors – Case Study



Collège de Pully, Devanthery & Lamunière, 1999.



Computer Simulation, M-C Munari-Probst, 2009.

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# BIPV Solar Power Plant – EPFL 2009-2011



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# Conclusion

- **Solar Buildings are Main Players in the Mitigation of Climate Changes (IPCC RET Special Report)**
- **Substantial Scientific and Technological Progress was achieved in the last Decades (Zero & EnergyPlus Buildings)**
- **Focus on Refurbishment, Electricity Demand and Embodied Energy is required (Growing Concerns)**
- **Future Research Efforts must address the Integration of Solar Technologies in the Built Environment (Dissemination)**



**Any Questions ?**

**Thank you  
for  
your Attention**