









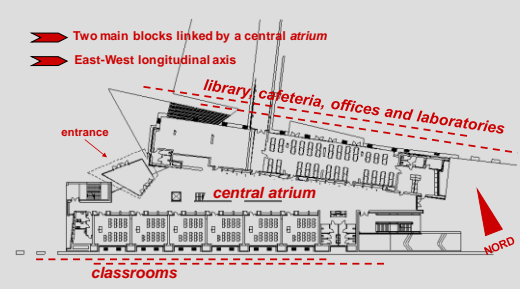

A ventilative cooling system in a School Building, Imola, Italy

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Building layout



Two main blocks linked by a central atrium
 East-West longitudinal axis
 entrance
 library, cafeteria, offices and laboratories
 central atrium
 classrooms
 NORTH


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Estimate of energy needs

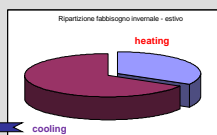
PRELIMINARY - PHASE 1
 Focussed simulations of energy strategies and comparison to a benchmark configuration
 Calculation of annual energy needs using simplified tools

Ripartizione del fabbisogno di riscaldamento



Data related to the South-West block





Ripartizione fabbisogno invernale - estivo



Data related to the South-West block for an occupation period from September to July

attention to ventilation load
 need to high-performance glazing
 priority to application of passive cooling systems

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Estimate of energy needs

PRELIMINARY - PHASE 2
 Evaluation of energy-saving benefit related to alternative strategies

		Fabbisogno di energia (kWh/m²-anno)	
		RISCALDAMENTO	RAFFRESCAMENTO
A	ISOLAZIONE - A		
	ventilazione naturale	13,6	-8,7
	ventilazione meccanica		
	ventilazione mista		
B	ISOLAZIONE - B		
	ventilazione naturale	13,6	-9,9
	ventilazione meccanica		
	ventilazione mista		
C	ISOLAZIONE - C		
	ventilazione naturale	21,1	-11,4
	ventilazione meccanica		
	ventilazione mista		
D	ISOLAZIONE - D		
	ventilazione naturale	21,1	-8,8
	ventilazione meccanica		
	ventilazione mista		

SOLUTION D

to optimise yearly energy balance

TECHNOLOGICAL OPTIONS FOR INDOOR CLIMATE CONTROL SYSTEMS

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Architecture



South view of the School Building

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Architecture



North view of the School Building

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Ventilation system

- Hybrid system (controlled natural/mechanical system)
- Controlled natural ventilation (CNV): motorised sensor-driven openings related to IAQ and thermal comfort





Atrium:
 Winter - mechanical
 Summer - mech. + CNV

Cafeteria and discontinuous-use spaces:
 Winter - mechanical
 Summer - mechanical

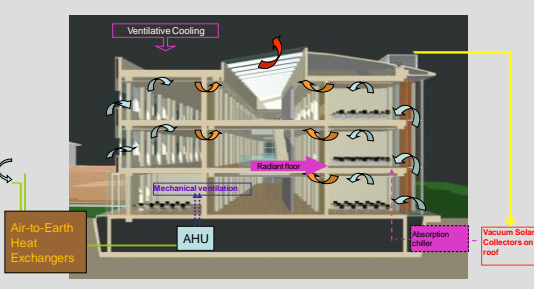
Classrooms:
 Winter - mechanical
 Summer - mech. (during occupation) + CNV







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Cooling systems



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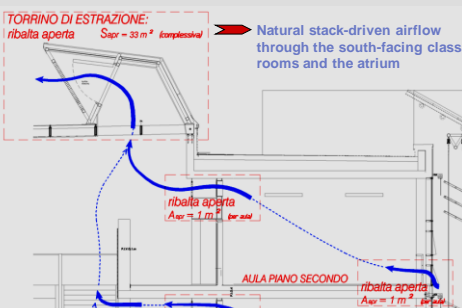





Ventilative cooling

TORRINO DI ESTRAZIONE:
 ribalta aperta $S_{ext} = 33 \text{ m}^2$ *imprescindibile* ➤ Natural stack-driven airflow through the south-facing class rooms and the atrium

ribalta aperta $A_{ext} = 1 \text{ m}^2$ *per aula*

AULA PIANO SECONDO:
 ribalta aperta $A_{ext} = 1 \text{ m}^2$ *per aula*



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Ventilative cooling



internal view of the atrium

vented clerestory on the atrium glazed roof

south glazed wall with hopper window openings

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Isolated suspended-ceiling element integrating lighting, sound adsorption, and air diffusion



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Isolated suspended-ceiling element integrating lighting, sound adsorption, and air diffusion: laboratory testing of air downdraft distribution



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