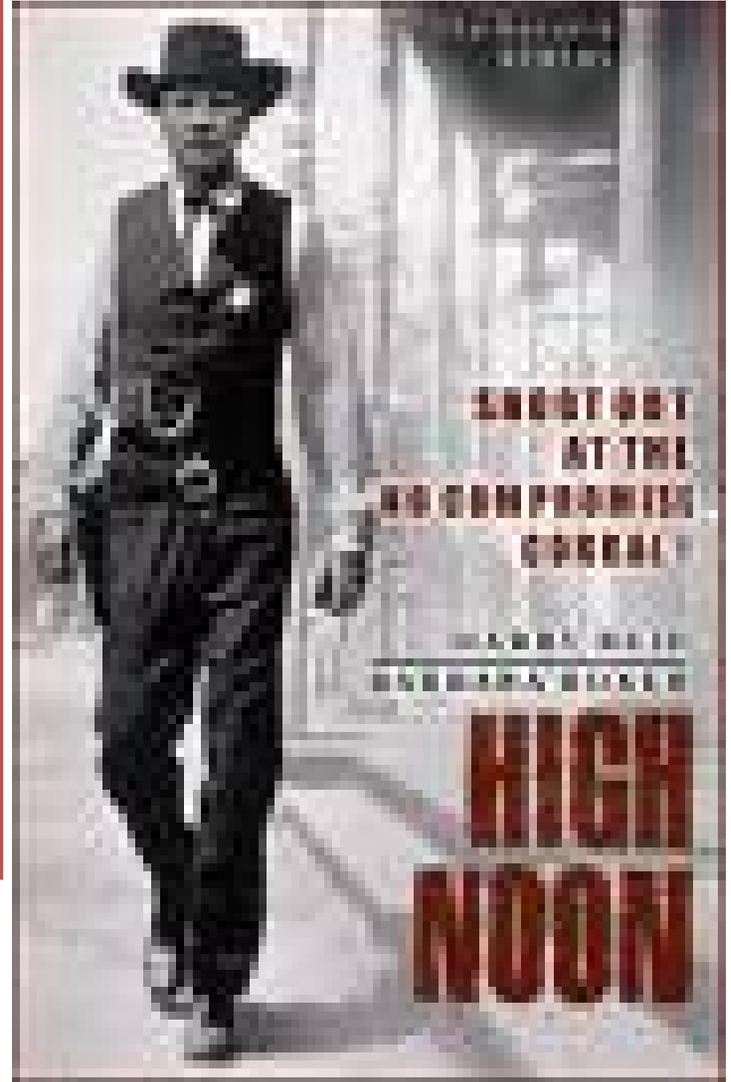


Time for
Energy
Independence
for Federal
Buildings?

It's already **High Noon**



Jack L Gosnell, PhD



Quality of Life Buildings, International



ARCHITECTURE | LANDSCAPE | URBAN DESIGN

MosArt

Wicklow, Ireland



University College

Dublin

Welcome to the Revolution!

In 1947, scientists at Bell Laboratories invented the transistor, a device that was, in comparison to vacuum tubes:

- More efficient
- Less expensive
- Instant acting
- Shake/shock resistant
- Much smaller, compact
- Longer lasting
- Better in every way except, initially, capacity, and even that characteristic improved

... and the Transistor allowed/led the Electronics/Communication Revolution

- Radios
- Televisions
- Telephones, including cellular
- Hand-held devices
- GPS
- Satellites
- All your children's toys – not everything is progress
- Computers – remember HAL, in *2001 – a Space Odyssey*? Occupied a huge room on the space ship. Now – or even by 2001 – would have been a desktop or smaller.

So what Revolution are We Plotting?

One perhaps as fundamental as the electronics/communications revolution....

Prediction: by 2020, the ways in which most of the buildings on earth are constructed will be as different from current conventional methods as transistors and chips are different from vacuum tubes....

You heard it here....

What are Two Signals for the Revolution?

- **LEED** – which, in America, is addressing the large part of the total set of environmental and energy issues in building and construction
- **Passive Standard** – which, in Europe, is rapidly becoming pan-European CODE

**You know a lot about
LEED**

**So, let's have a chat about
Passive Standard?**

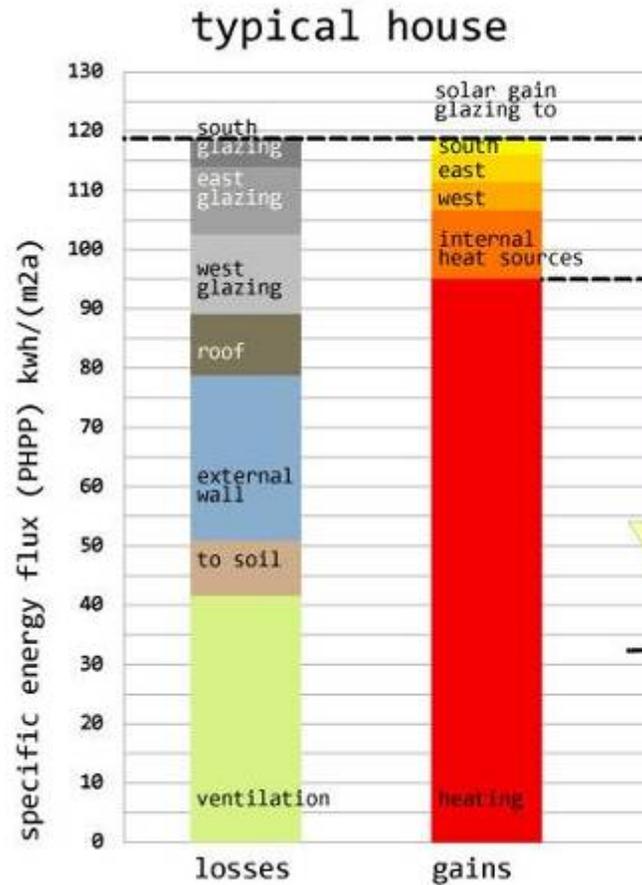
Europe's 'Passiv Haus' (P.H.) Standard



A Passive House is any building in which a comfortable interior climate can be maintained without active heating and cooling systems (Adamson, 1987, and Feist, 1988).

The building heats and cools itself, hence passive...

How does a Passive House Building work?



First Certified P.H. in Ireland

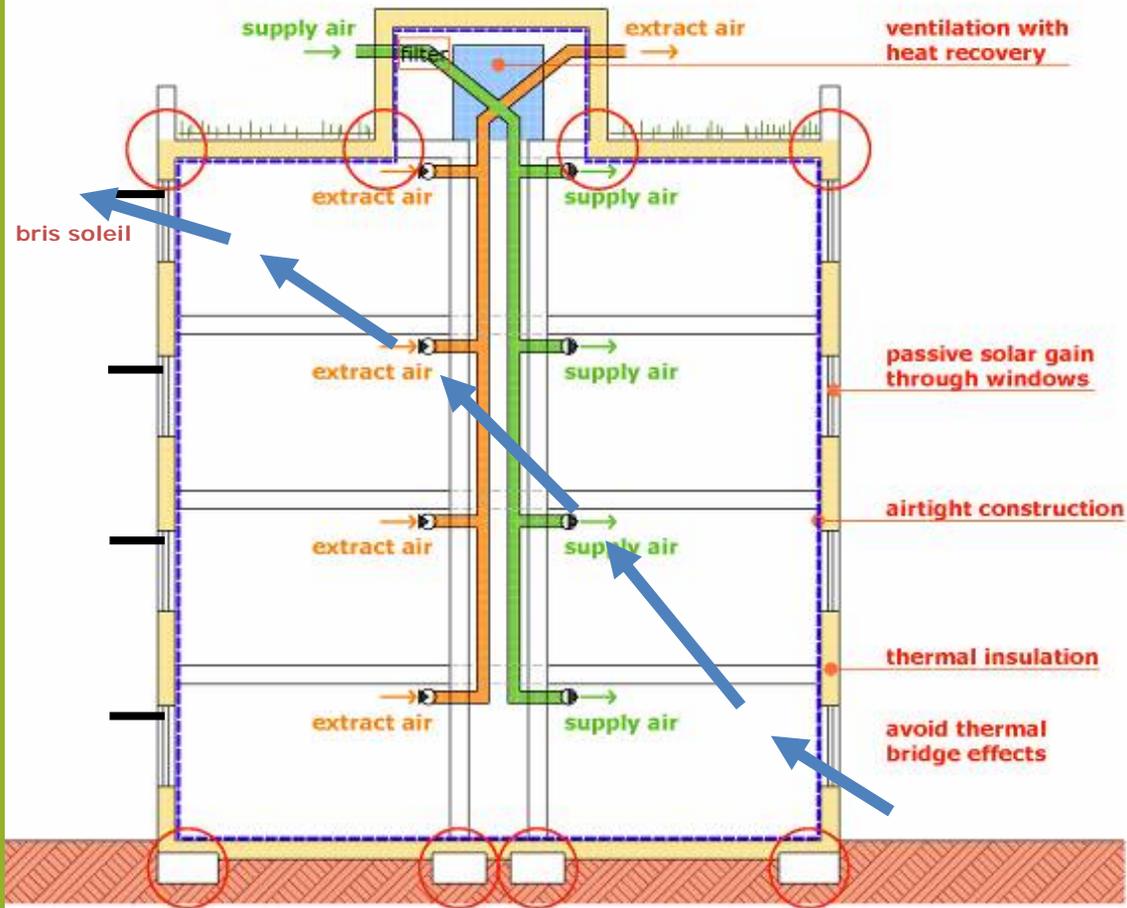
Please do drop by for a cup of tea sometime...



This one saves 87% on costs of conventional heating and domestic hot water

Strategies

dramatically to reduce energy consumption



**Term ‘*Passive House*’ sounds,
perhaps, on this side of the
Atlantic...**

...a little too passive!!

**What a P.H. really does
is provide highest
‘Quality of Life Buildings’
or ‘*qlb*’ for short**

At Symposia East,

One Federal Official urged we call
them

Power Houses

But...

**We strive for not just Low Energy...
but...**

'Energy Independence'

Advantages of 'Quality of Life Building' (QLB) standard

- **Running costs: very low (or even none!)**
- **Comfort: high**
- **Working/living environment: healthy**
- **Buildings: bright, airy**
- **Energy needs: future-proofed**
- **Building life: prolonged**
- **Sound proofing: excellent**
- **LEED Certification: excellent (Platinum Plus)**

P.H. Office Building



Sol4 Office Building, Mödling, Austria

The P.H. Church ...



that thinks it's a **powerplant**

Wels, Austria

Federal Environmental Symposia - June 2008

A light-filled...

...industrial building



Austria

A partially self-powered ...



... Community Center

Voralberg, Austria

Entirely- fresh-air School...



**extremely important for the
healths of our children**

Montessori School, Aufkirchen, Germany

Latest Development Trend:



Retrofitting to *P.H. Standard*

Retrofitting a school ...

A photograph of a classroom in Schwananstadt, Austria. A woman with glasses and a black sweater stands in the foreground, smiling. In the background, several children are seated at desks, some working on projects. The room has large windows with blinds and colorful educational posters on the wall.

**to healthy, low-energy
standard**

**without
closing
it down!**

Schwananstadt, Austria

Retrofitting

a Substantial Office Block to P.H. Standard



- **Projected Heating Costs for old building over 20 years = \$10 m**
- **for P.H. standard reduced to \$1.2 m for 20 years!**
- **renovation took one year and cost \$11m**
- **current operation costs \$0.30/ft²/yr**

Retrofitting Commercial Building to P.H. Standard



floor area 30,000 ft²

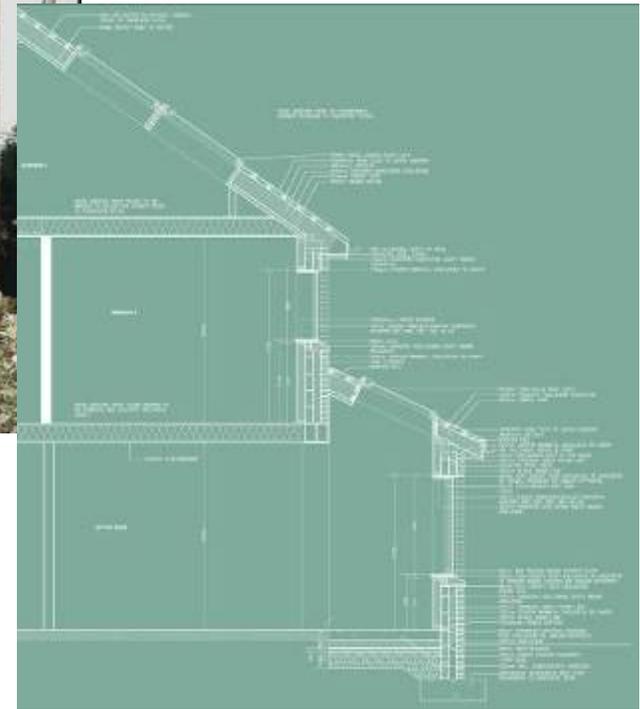
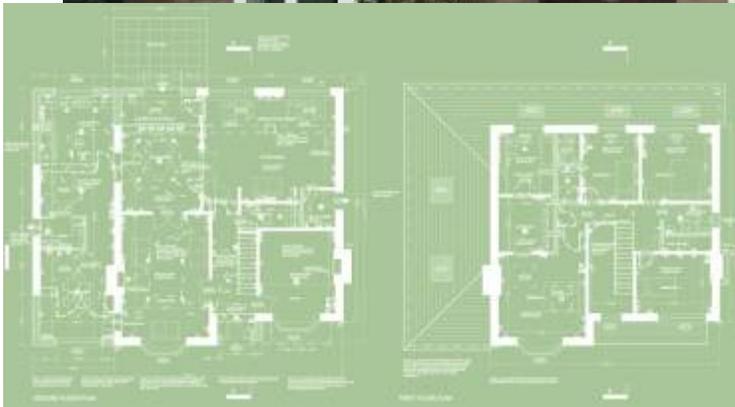
- **annual heating and hot water costs \$ 1,500/year**
- **extra over-renovation costs to P.H. Standard \$9,000**
- **payback = 1 year**

• **floor area 1,500 ft²**

- **annual heating and hot water costs \$ 2,250/year**

Retrofitting a Home...

...to P.H. Standard



Dublin, Ireland

by MosArt

Phoenix Centre

MosArt's Home



PV (photovoltaics) - **Wind** turbine - **Solar** water heating

Building completed 2008

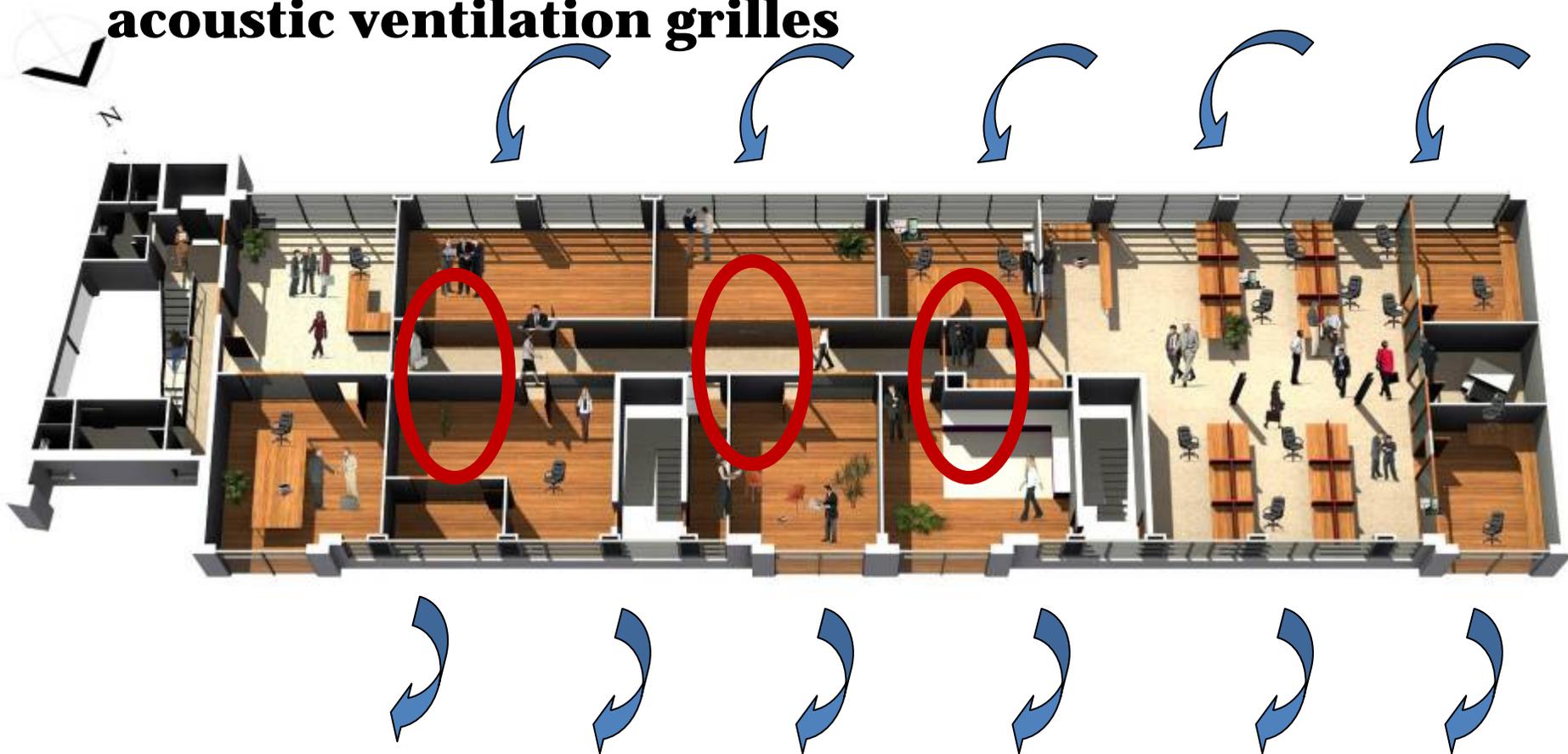
**upgrade of new-build office block required
- mid-fit-out!**



**Cooling load is almost twice the P.H.
Standard**

Cross Ventilation

acoustic ventilation grilles



Integrating Renewables ...



- **Wind turbine 1.5 kw => 2,000 kwh/yr (grid tied)**
- **Solar PV panels 1.47 kwp => 1,146 kwh/yr (grid tied)**
- **Solar thermal panels 4.5 m² => 3,400 kwh/yr**

On-site energy reduction of 6,546 kwh/yr
Approximate saving \$1,000 per year

**Our Bottom line (\$\$\$)...
... is the bottom line....**

**How Much does all this high-
spec build cost?**

&

**What happens to
Running Costs?**

**Following projections
pertain to
Costs of Building Green Offices
in Ireland...**

We express appreciation for the analysis work done by
Derry Scully FSCS FRICS, of Dublin

Costings Comparisons

Conventional *versus* Sustainable New-Build

	Conventional	Sustainable	Difference
Frame	48.28	53.82	11.46%
Envelope	83.65	101.27	21.06%
Roof	15.20	15.11	-0.58%
Walls/Doors	12.78	12.90	0.95%
Finishes	33.48	32.24	-3.70%
Services	92.18	86.64	-6.01%
Siteworks	7.04	7.02	-0.37%
Totals	292.62	309.00	5.60%

Figures, from European estimates, are \$/ft²

Energy Savings

Office Building Type	Energy
Conventional	25 KWH/ft ² /year
Sustainable	10 KWH/ft ² /year
Savings	15 KWH/ft²/year

For a Building Complex of 250,000 ft², that's

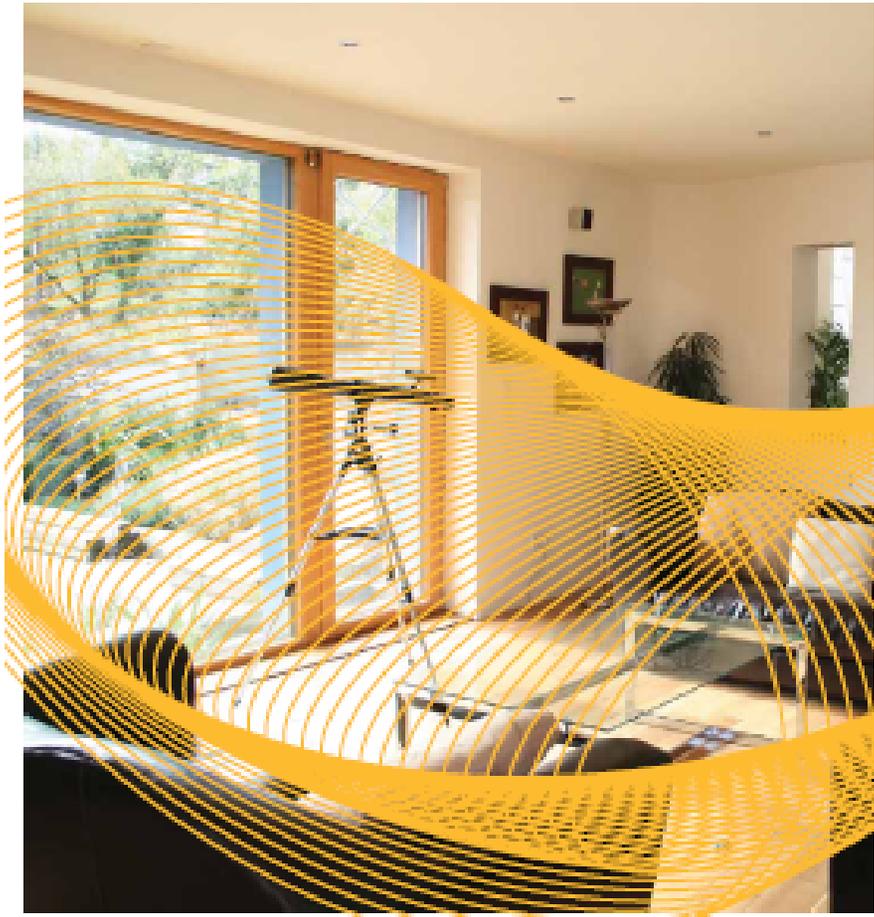
Savings of over \$300,000 per year

Ireland's National Best-Practice Guidelines



Passive homes

GUIDELINES FOR THE DESIGN AND CONSTRUCTION OF PASSIVE HOUSE DWELLINGS IN IRELAND



**Co-authored
by MosArt**

P.H. Training

- **Ireland, at national-government level, has asked MosArt to develop a special executive-education program for local government officials - from every one of Ireland's 32 counties**
- **Course is one (INTENSIVE) day, including a pre-course pop-quiz (on insulation, *etc*), and a post-course exam**
- **if you'd like more information, please contact us....**



COMMISSION OF THE EUROPEAN COMMUNITIES

Brussels, 19.10.2006
COM(2006)545 final

COMMUNICATION FROM THE COMMISSION

Action Plan for Energy Efficiency: Realising the Potential

{SEC(2006)1173}
{SEC(2006)1174}
{SEC(2006)1175}

**European Parliament resolution of
31 January 2008 on an Action Plan
for Energy Efficiency: A6-
0003/2008**

29. Calls on the Commission to propose a binding requirement that all new buildings needing to be heated and/or cooled be constructed to passive house or equivalent ~~non-residential~~ standards from 2011 onwards, and a requirement to use passive heating and cooling solutions from 2008;

It's official! The European Union has set Passive House Standard as the minimum performance standard across the all of Europe, from 2015 onwards

Calls from the EU parliament mean it may happen from 2011...

More European Legislation

- Implementation and amendment of the Energy Performance of Buildings Directive (2002/91/EC)
 - propose an expanded role for the public sector to demonstrate new technologies and methods (2009)
 - propose lowering significantly the threshold for minimum performance requirements for major renovations (2009)
 - propose minimum performance requirements (kWh/m²) for new and renovated buildings and some components with a target for new buildings to approach the level of passive houses⁴⁵ from 2015 (2009)
 - consider proposing binding requirements to install passive heating and cooling technologies (by the end of 2008)
 - propose measures for Member States to provide financing for highly cost-effective investments (2009)

We're in Montana, USA...

...so that's enough...

... about Europe....

When it's **High Noon** in American summers...



Clock from Film *High Noon*

Many of our cities have this **utterly-unenviable horror called**

“double-90’s”...

- Temperature > 90° F
- Humidity > 90%

Europe has no such honors (and asks that we NOT export them to Europe)...

Our American challenge is not to

heat, but to cool!!

Simple Physics:

it takes much more energy to deal with the water in the air than the actual cooling of it

Our Colleagues are developing Special Designs that deal with the moisture in “offset ways,” that minimize the significant extra energy requirements to cool air in moist climate conditions





National Institutes of Health (NIH)

Building 31

**A NIH-QLBI Case Study
in introducing innovative
retrofit proposals that
will both
increase comfort
&
reduce energy loss**



Issues in B-31's Offices Reasons

- Overheating in summer

**- Cold temperatures
in winter**

**- All Year: Freeze on
North, Roast on South**

- Poor air quality

- Large window areas

**- No shading devices, or shading
with only low efficiency**

- Inefficient cooling system

**- Large window areas, poor thermal
performance**

**- Huge thermal bridges through
concrete structure**

- Inefficient heating system

- Single Thermostat

- No fresh-air ventilation system



“Problem”

Large window areas, poor thermal performance

No shading devices or shading with low efficiency

Huge thermal bridges through concrete structure

Inefficient cooling and heating; no fresh-air-ventilation system

Potential Solutions

Reduce window areas, improve thermal performance, with triple-glazing

Put shading louvers on east, south and west facades of the building

Insulate thermal bridges

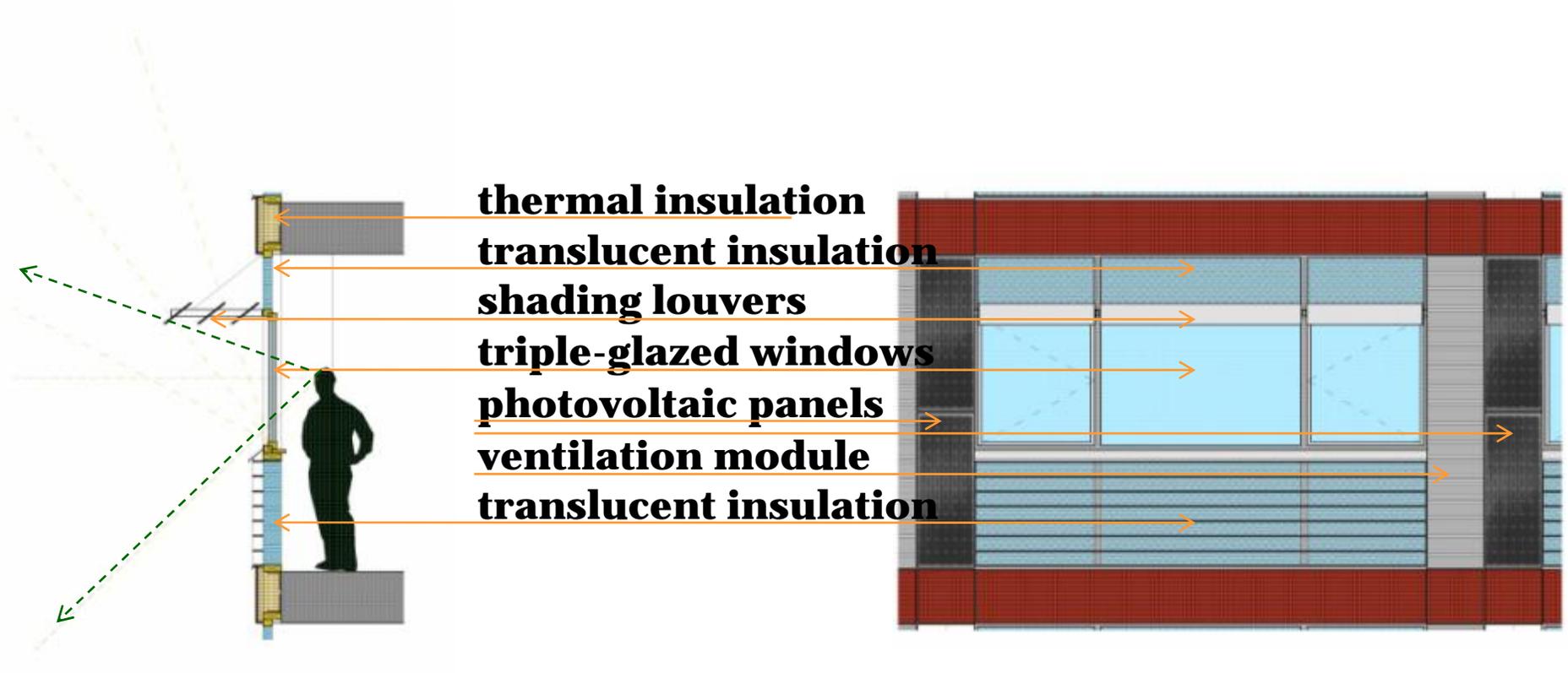
Change to efficient fresh-air-ventilation system to cool, heat and condition the air

***QLBI* Solution ...**

... is a prefabricated panel, especially designed for building 31, which includes:

- reduced and triple-glazed window areas combined with translucent thermal insulation**
- shading louvers on east, south and west facades of the building**
- thermal insulation**
- air ventilation module, which cools, heats and conditions the air**
- photovoltaic panels to generate electric power: CO₂-emission free**

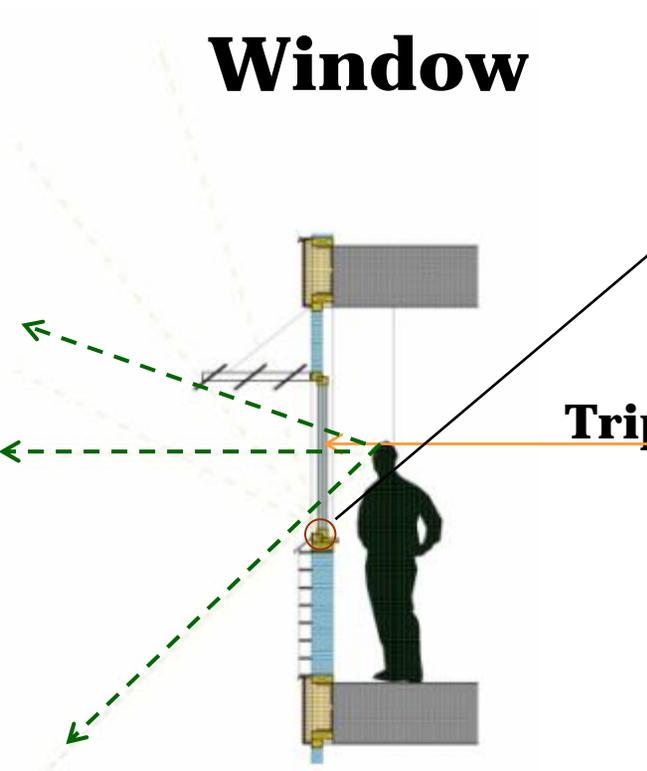
B-31 Panel



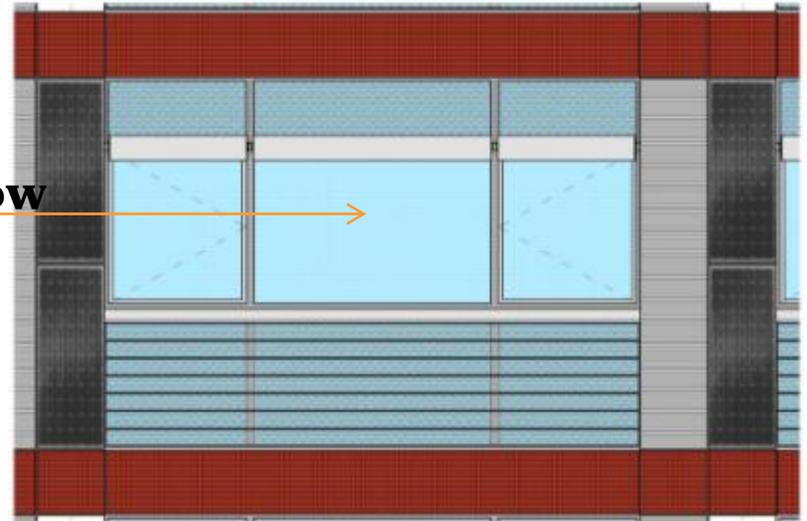
Panel Detail -1



Window



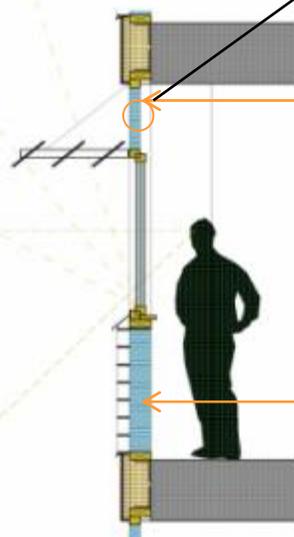
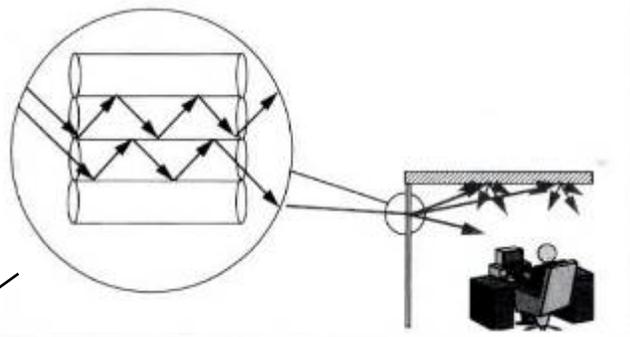
Triple-glazed window



- the triple-glazed window's thermal performance is far higher than that of the existing single glazing, so triple-glazed windows will reduce - probably eliminate - cold drafts near windows

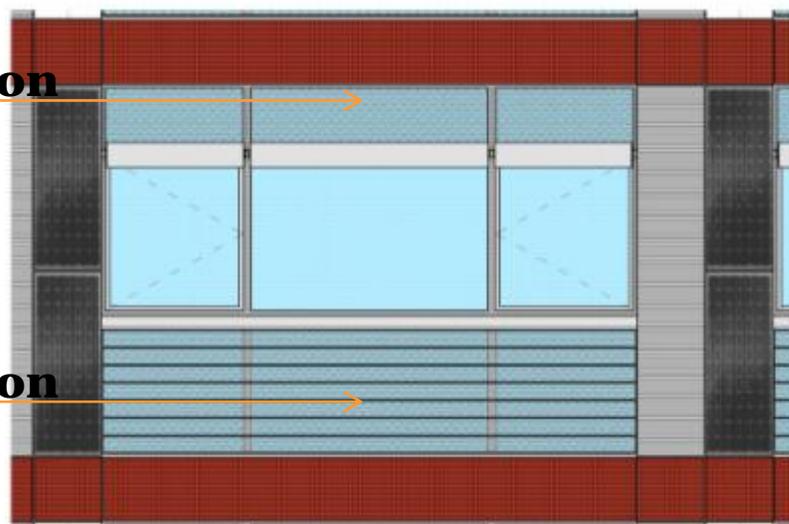
Panel Detail -2

**Translucent
Insulation**



translucent insulation

translucent insulation

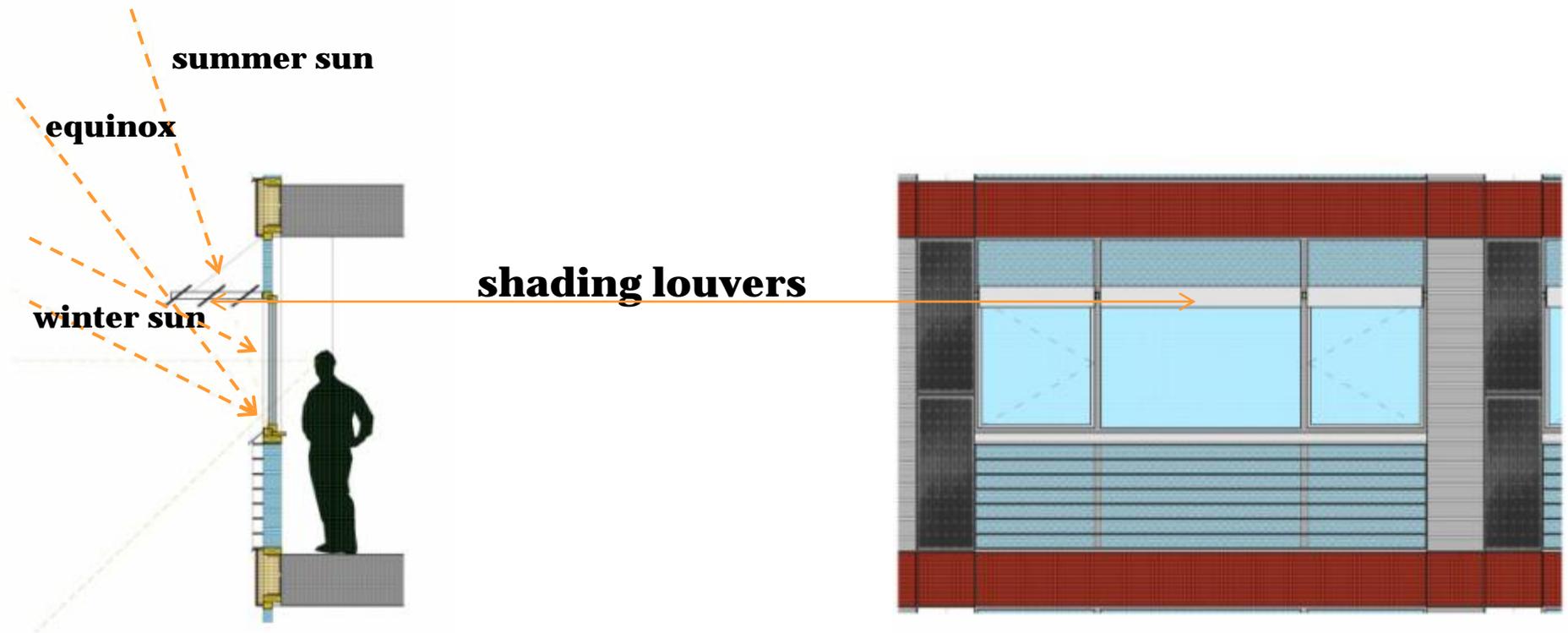


- even if the upper and lower panels are translucent, their thermal performance is much higher than the existing single glazing.

- translucent panels add more light, bringing diffused natural light deep into the offices without blinding glare

Panel Detail - 3

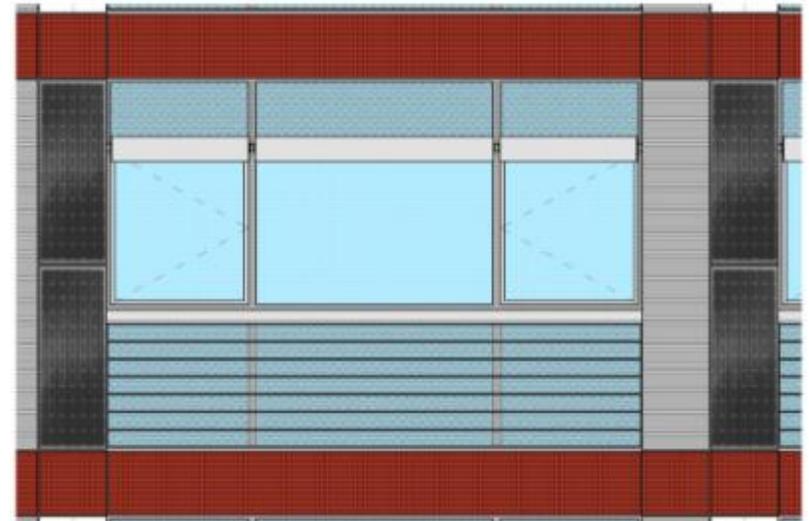
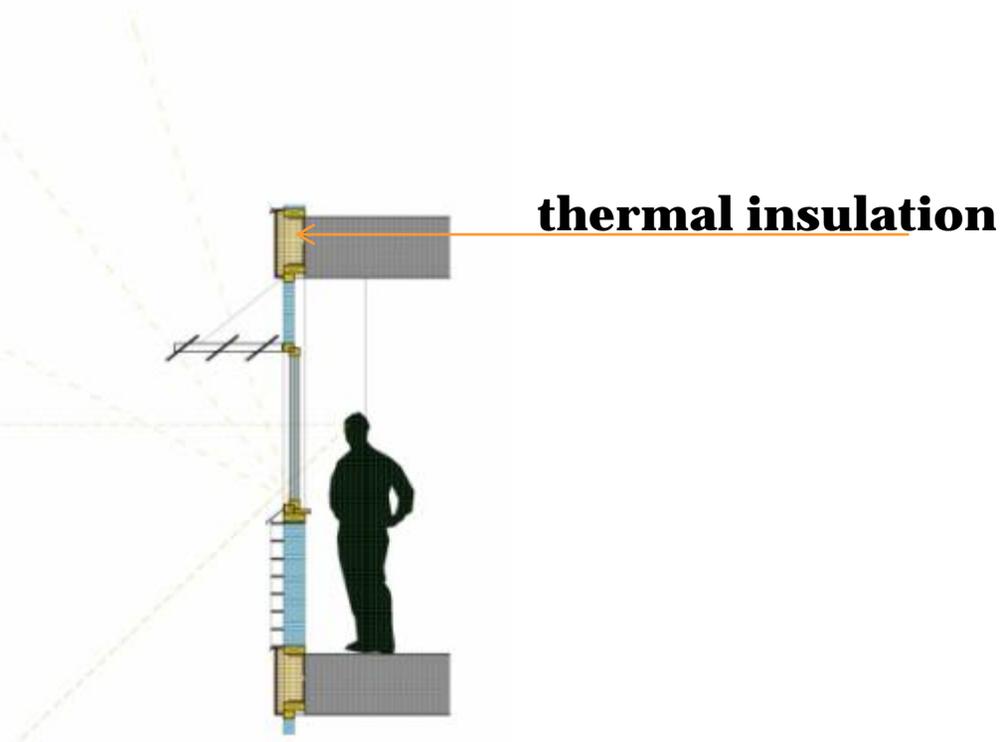
Shading Louvers



- the louvers screen the direct glare of the high summer sun to protect from overheating
- the louvers let in the low winter sun to maximise passive solar gain

Panel Detail - 4

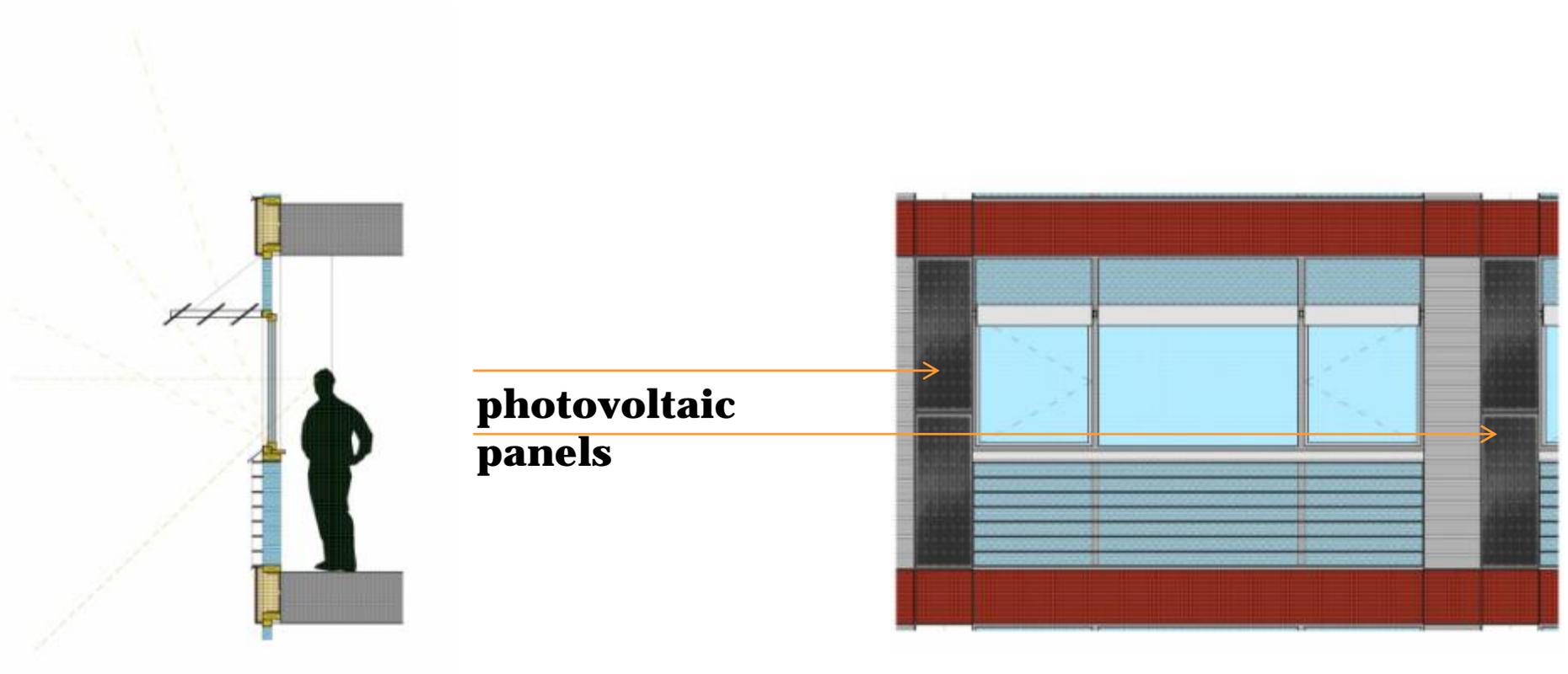
Thermal Insulation



- thermal insulation significantly reduces heat loss through thermal bridges

Panel Detail - 5

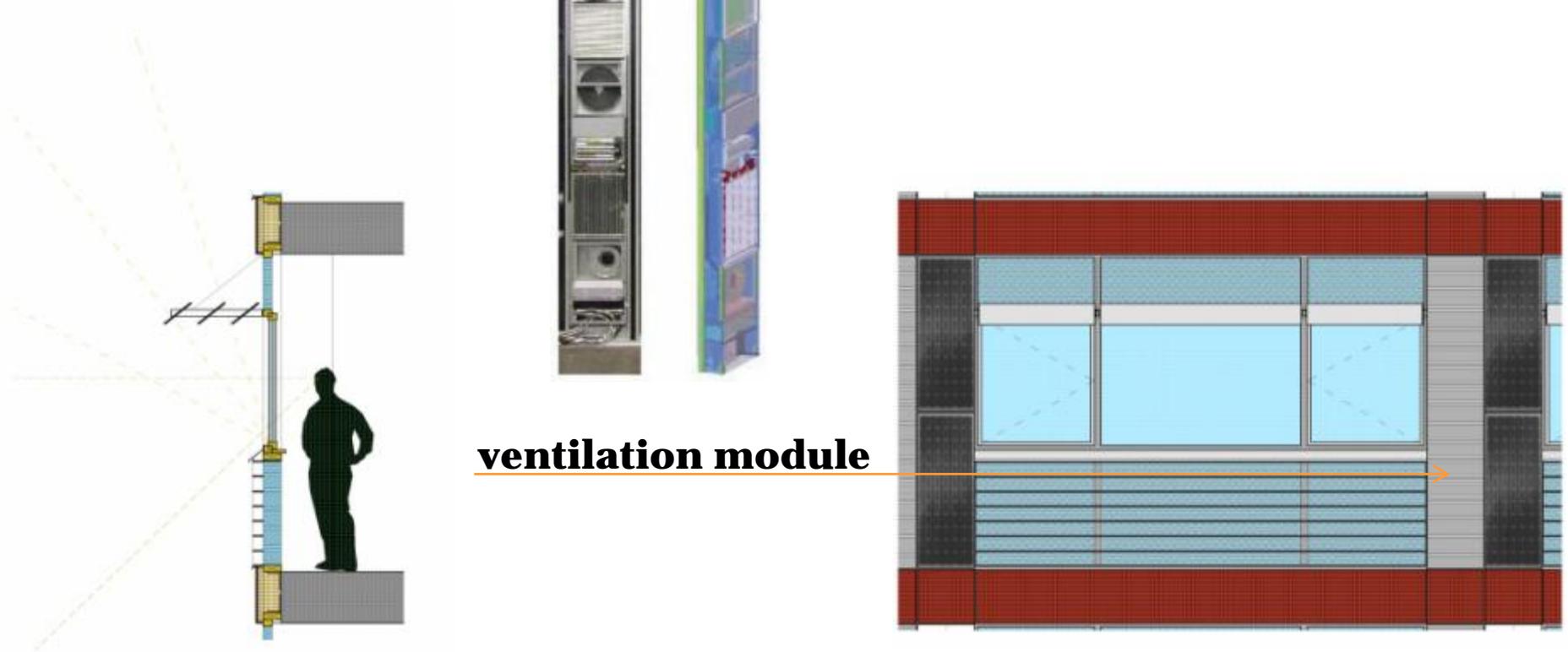
Photovoltaic Panels



- photovoltaic panels generate electric power

Panel Detail - 6

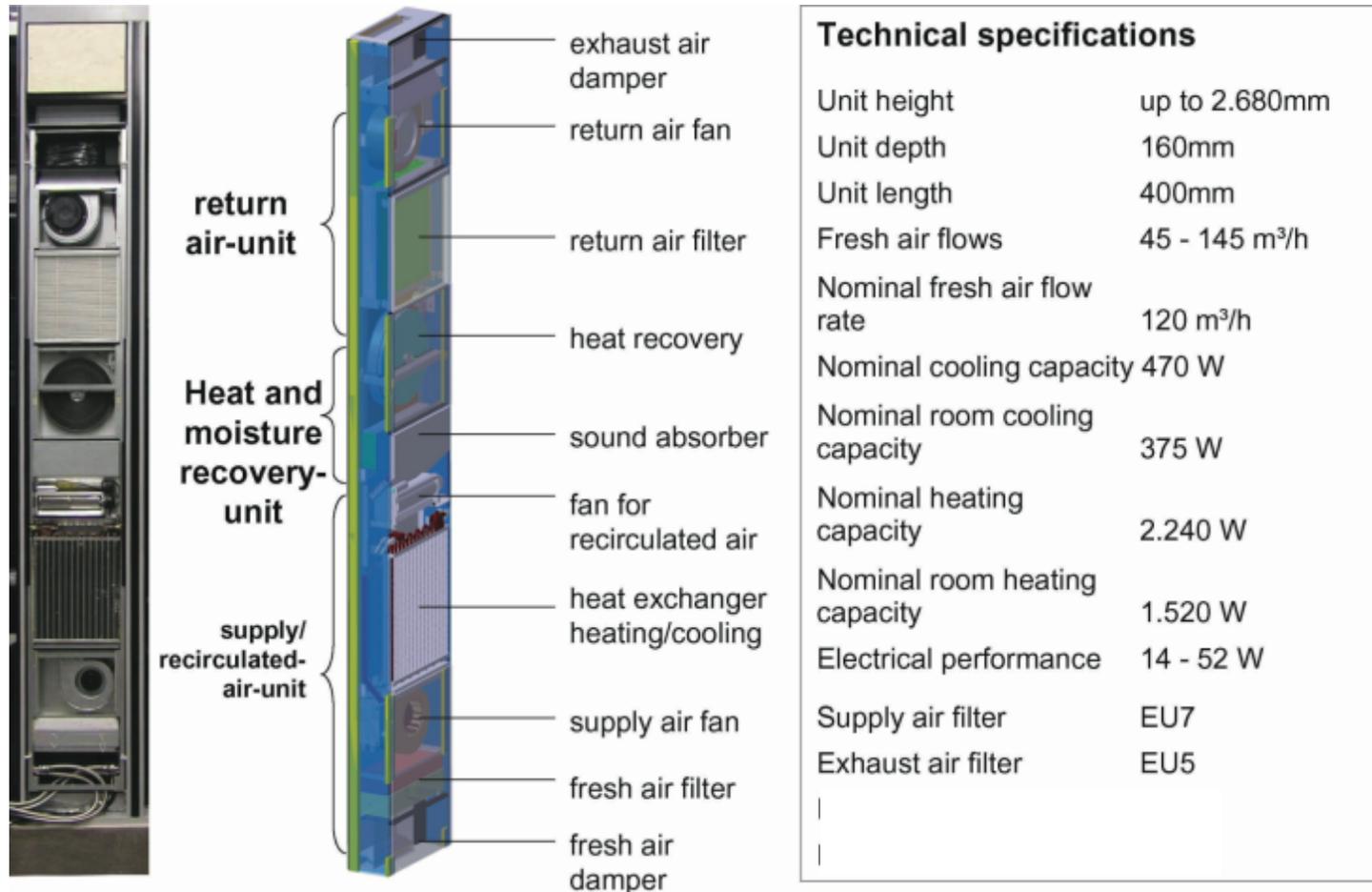
Ventilation Module



ventilation module

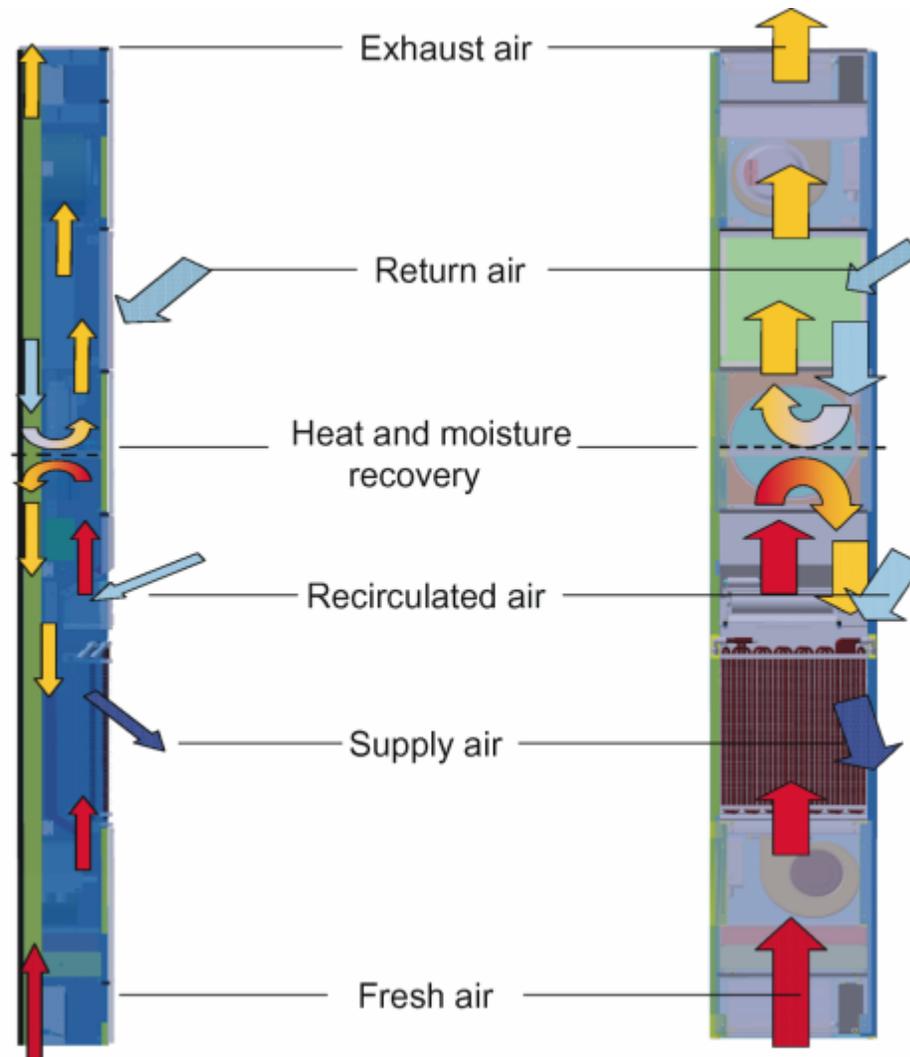
- decentralized air ventilation module, which cools, heats and conditions the air – with heat recovery, shown in detail on the next slides

Decentralized Air Ventilation Module - Detail



Note: Diagram shows an earlier, prototype model. Our current model has a different design, with far-greater heat/cool recovery and deals entirely with moisture from hot summer air

Decentralized Air Ventilation Module - Detail



Not just the panel is exciting... but the retrofit process is too!!

- Remove existing façade elements, grid by grid**
- Install panels grid by grid**

Grid-by-grid process dramatically reduces number of people/offices that would need to be vacated at any given time in the process....



Implications for key players... - 1

For Governmental Organisations:

- retrofit to *QLBI* standard makes most sense with older buildings which already need or could benefit markedly from retrofitting!
- retrofit building has an increased asset value ⇔ lifecycle; costs decrease
- accumulate valuable LEED points
- demonstrate top-level management response to Executive Orders on Sustainability

Implications for key players... - 2

for Designers

- **existing building may limit design possibilities**
- **value-engineering analysis becomes very important**

Implications for key players... - 3

For Occupants

- **More flexibility provided in some working environments**
- **Healthier work conditions**
- **Are premium super-cooled air-conditioned buildings really required?**

Benefits from the *QLBI* Standard

- **Total comfort and healthy conditions/air in all offices/areas of the entire complex**
- **Significant reductions of expenditures for energy**
- **Perhaps reduction or even elimination of the huge current, probably outmoded, central heating/cooling**
- **Ability to accomplish complete refurbishment by stages, minimizing employee/office displacements**
- **Reasonable costs for totally-positive retrofit**
- **Transforming a problematic building into a “model” of refurbishment**
- **Health, Comfort, Happiness of Employees/your Colleagues**

Be Clever & Smart:

**Aim for highest
quality of life in your
buildings!**

Jack L Gosnell, Phd

E-mail: JGosnell@Quilby.com

Phone: 703 842-1689

Fax: 703 439-2480



[http://www/Quilby.com](http://www.Quilby.com)



in Ireland:

<http://www/mosart.ie>



We are awaiting you...

If...

- These Federal Environmental Symposia help all participants share their ideas, and learn the ideas and successes of others, AND...
- The Europeans are also leading this revolution in energy and buildings – in some ways FAR ahead of us ...
- Shouldn't we be talking with/exchanging information with them and other nations?

If...

**You have thoughts, or suggestions, or ideas,
or even complaints about potential
internationalization of this Symposium...**

Please contact me directly at:

JGosnell@Quilby.com

Or 703 842-1689