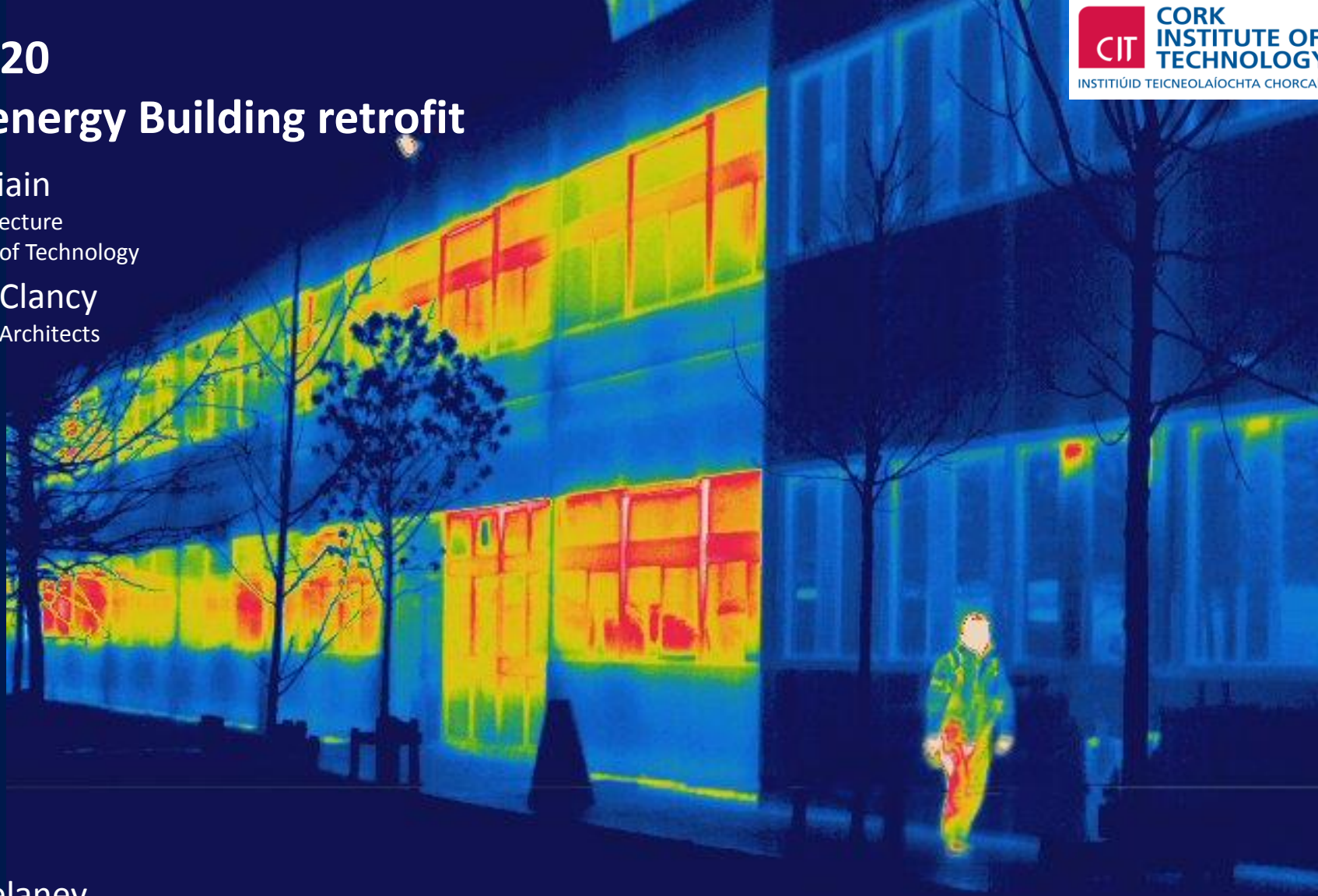
Zero2020
A low energy Building retrofit

Marc O Riain
Dept of Architecture
Cork Institute of Technology

Turlough Clancy
Henry J Lyons Architects



Fergus Delaney
Dept of Process, Energy, Transport Eng
School of Mechanical and Process Engineering

Paul O Sullivan
Dept of Process, Energy, Transport Eng
School of Mechanical and Process Engineering

http://www.zero2020energy.com

What is the zero2020?

The Regional Technical Colleges (RTC)

Design concept based on M&M building Birmingham

Designed by Scotts & Arup as a system build that could be rolled out

Precast contrete frame
Pre cast concrete elevation and roof panels
Blockwork infill
All to a strict 7.2m grid

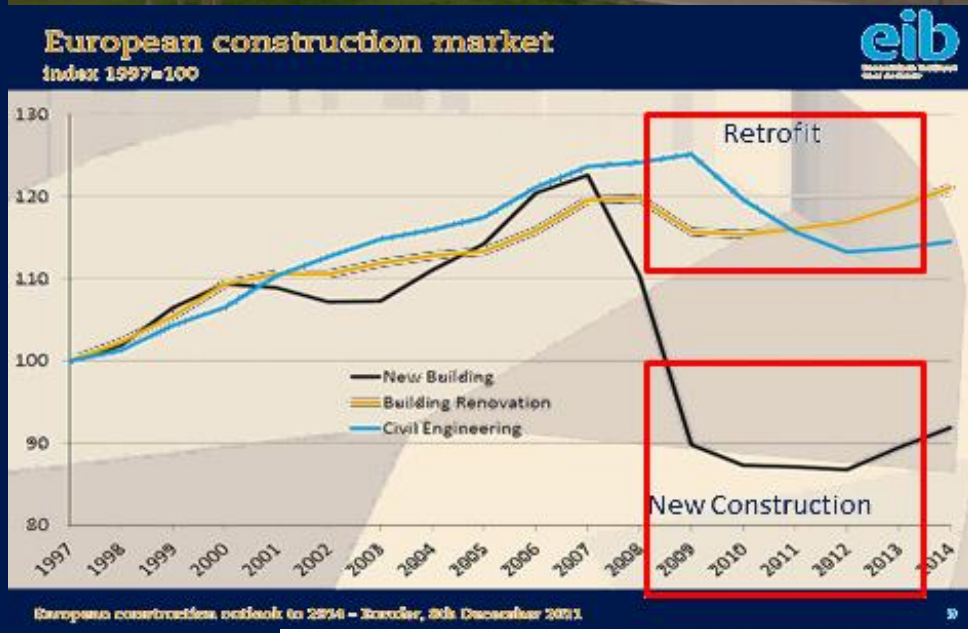
11 RTC's constructed around Ireland between 1970 & 1977Designed for a 20 year life

Coady Arup report in Feb 2011 for redevelopment.

Existing redevelopments at Leterkenny, Carlow, Waterford and Dundalk.

•A low energy retrofit targeting Net Zero energy building (site) performance over 3 stages.

•It's a pilot for a full building retrofit.



Existing Condition

Brief:

- A phased, modular, scalable, flexible, Durable
- Original structure
  poor thermal envelope performance
- poor thermal comfort conditions.

Envelope

- 100mm block leaf
- precast concrete aggregate panel
- well-ventilated cavity
- no insulation
- aluminium window frame
- 6mm single glazing

Roof

- 150mm two way waffle slab & beam
- 25mm thermally drifting Styrofoam and 25mm locally failing asphalt

Existing

No Temperature Control

Un-insulated fabric UA
2.4 W/m2K

High Air Permeability
14.77 $m^3/h/m^2$

Space Heat Demand
99 kWh/m2a

Poor Ventilation Control

Summer Overheating

No Energy Monitoring

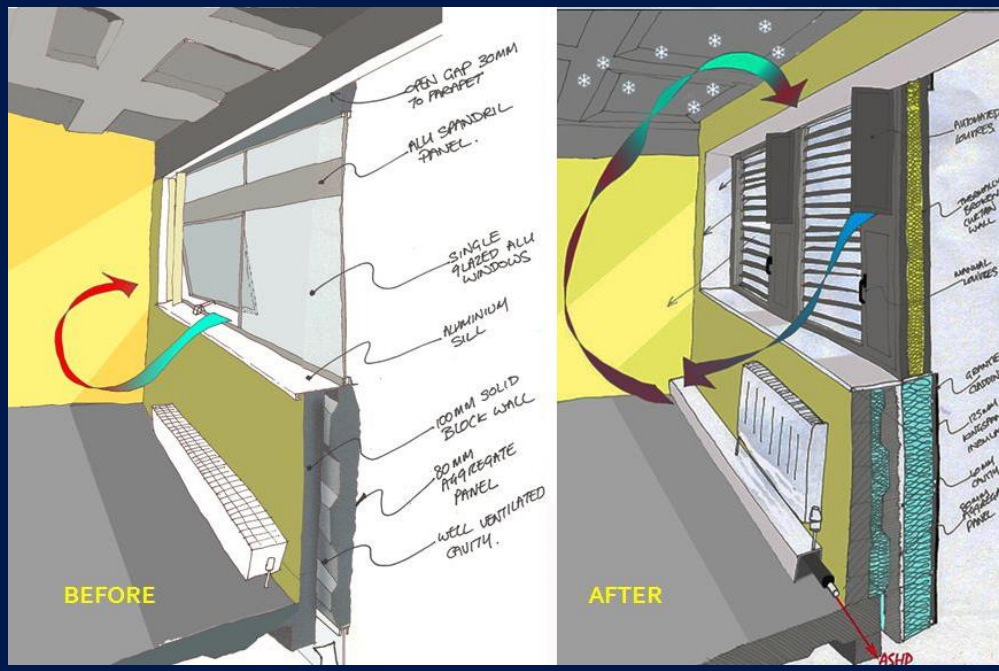
Recessed T5 manual

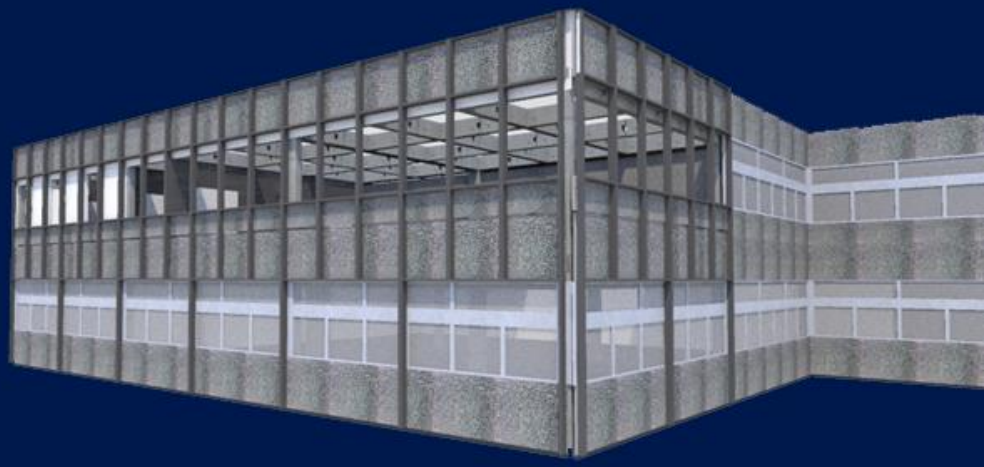
CORK INSTITUTE OF TECHNOLOGY
INSTITIÚID TEICNEOLAÍOCHTA CHORCA

HENRY LYONS ARCHITECTS

Design Solution/Research Team

- Overcladding solution
- locally developed products
- thermal bridging mitigation,
- vastly improved air tightness
- natural ventilation
- Scalable
- Modular
- no structural change
- Maximised material retention
- External granite aggregate panel
- reduced hygroscopic transfer
- highly ventilated cavity
- reduced summer heat transfer
- Interstitial shading



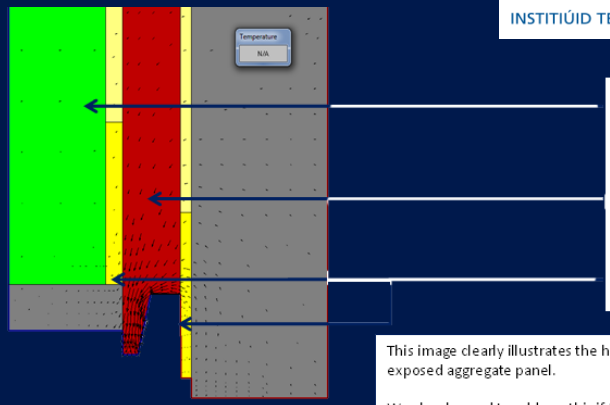


Design Team Appointment

- Initial ARUP-Engineering
- Later Henry J Lyons-Architecture

Research Simulation

- IES dynamic simulation modelling (ARUP 2011).
- Therm 5-thermal performance
- Heat-transfer analysis helped iterate
- Lowered thermal bridging
- Lowered condensation risk
- Indigenous Product Solutions
- Kingspan, AMS & Wesco
- Turnkey solution
- scalable solution



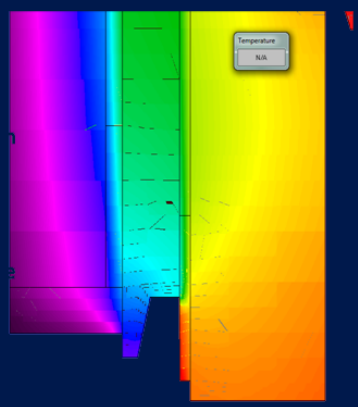
This image clearly illustrates the heat movement through the exposed aggregate panel.

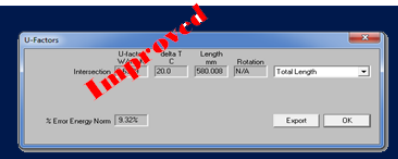
We clearly need to address this if the research project is to be achieved.

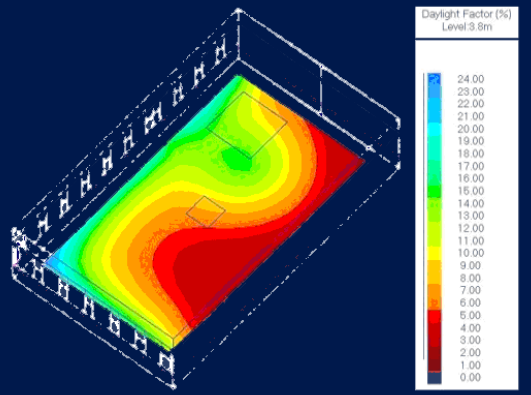
By taking 2 simple steps, a further 30% improvement in U value performance for this junction can be delivered.

1. Replace Rockwool with EPS insulation sandwiched between the new Kingspan panel and the aggregate panel.

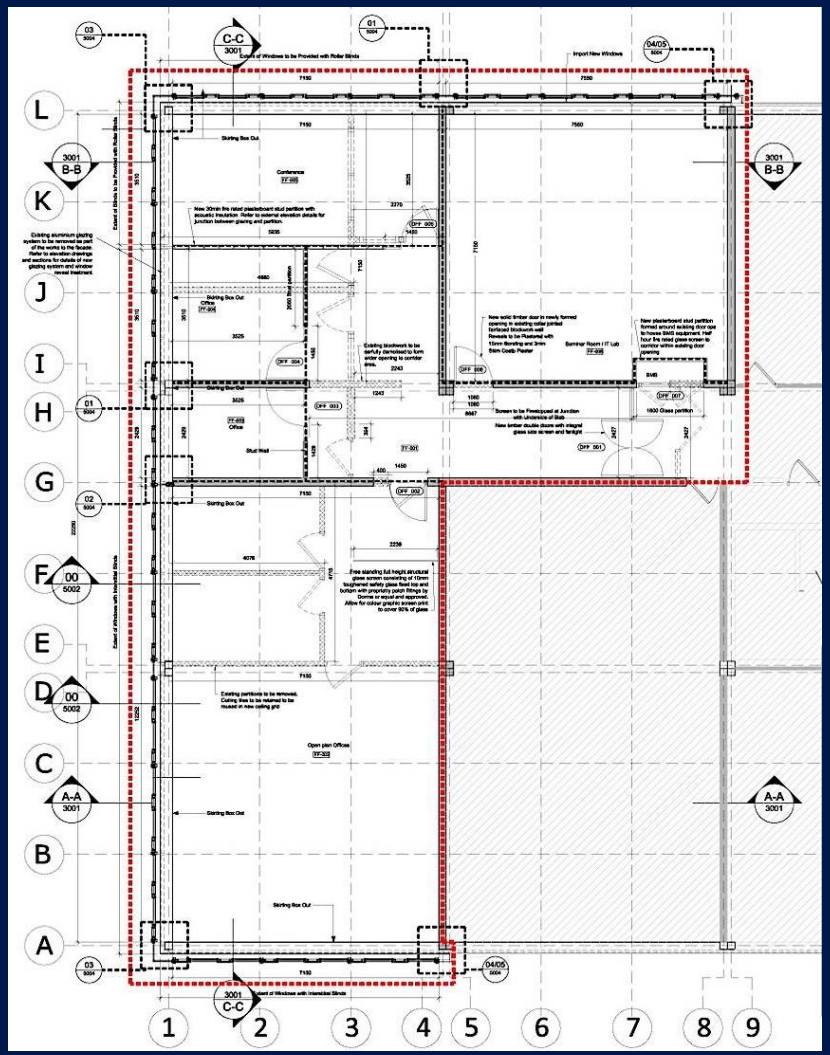
2. Phenolic injection foam into the interior cavity which would also help with air sealing. It has minimal shrinkage and non VOC.

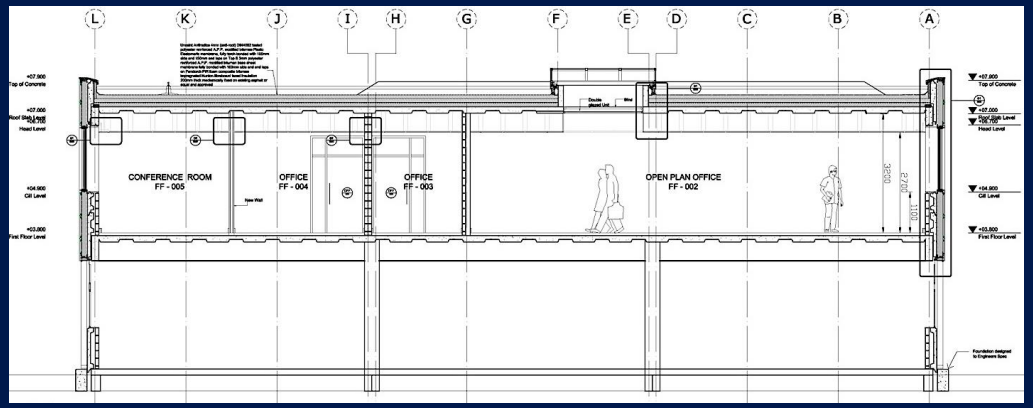


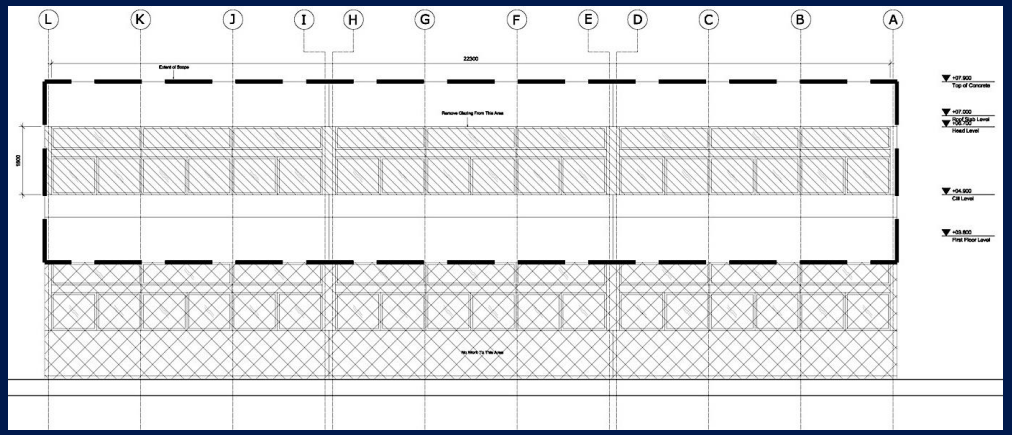




Project Area







Slide: Turlough Clancy
Henry J Lyons
http://www.zero2020energy.com

Principal elements

Roof Options

- Restricted by limitations of project extent
- Inverted roof system
- Cladding System

Wall Options

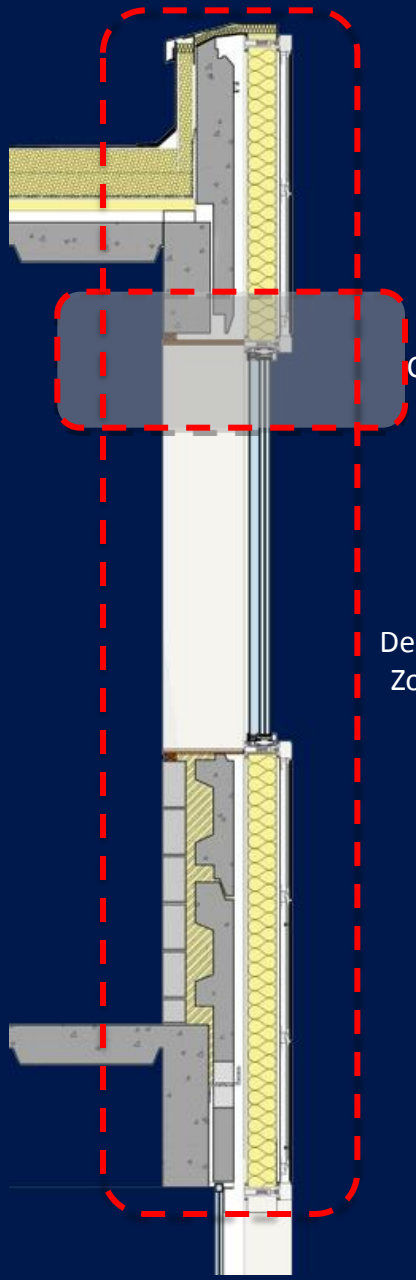
- Leave existing panels in place – quality?
- Insulated render system
- Insulated Cladding Panels
- Rainscreen System

Glazing Options

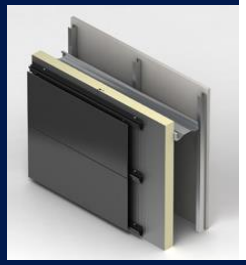
- uPVC
- Thermally Broken Aluminium
- Alu Clad

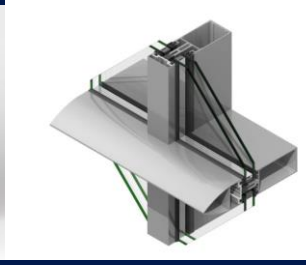
Design Considerations

- Junctions between three elemnets
- Airtightness
- Ventilation Strategy
- Cooling Strategy
- Glare
- Solar Gain



CORK INSTITUTE OF TECHNOLOGY
INSTITIÚID TEICNEOLAÍOCHTA CHORCA





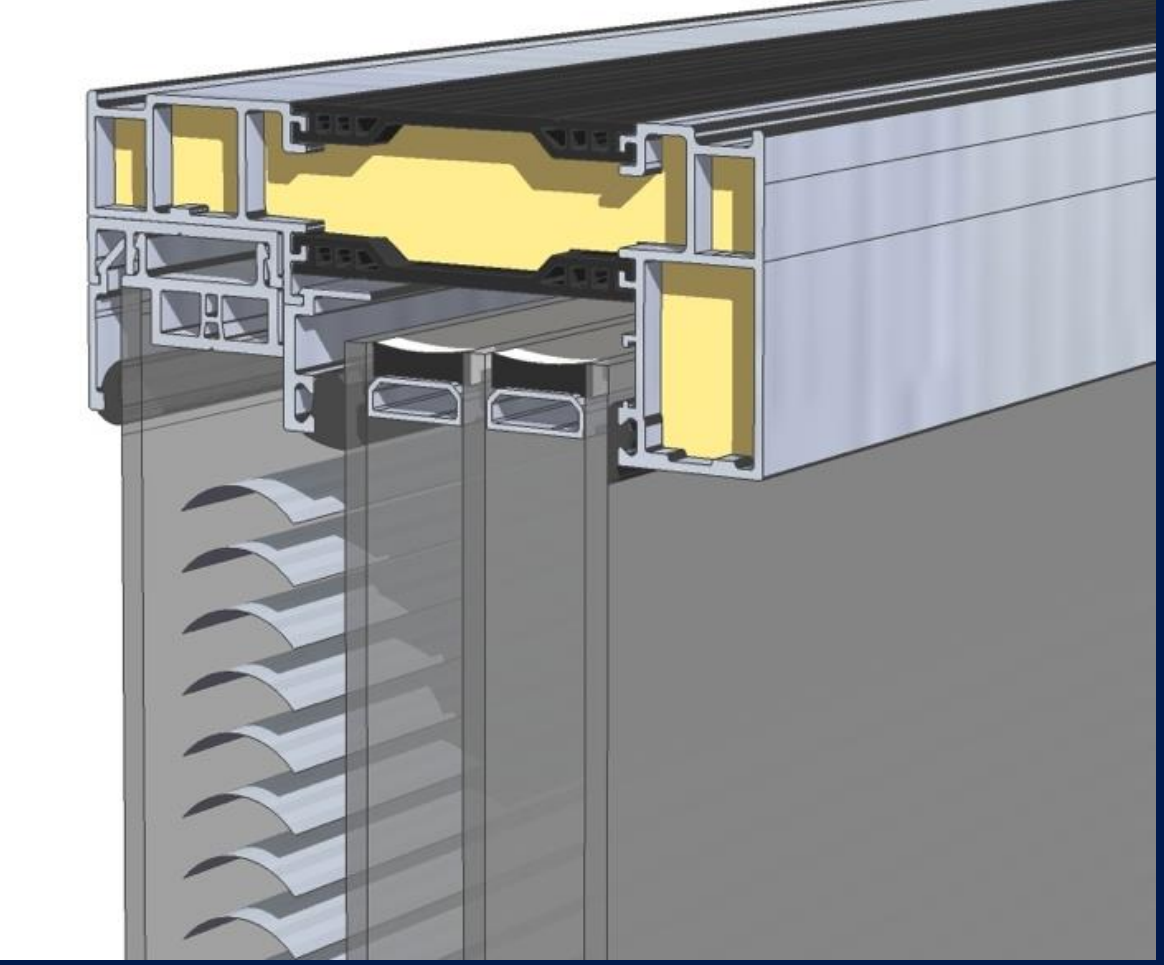
- Patented Thermal Break
- Profile design 'in house'
- On site testing rig
- On site aluminium extrusion line
- On site powdercoating
- On site fabrication
- Certified u-values
- Range of finishes including
- Zinc
- Cassette Panel
- Corten
- Timber
- Ceramic Granite
- CWCT tested
- "Dry System"
- Certified U-values

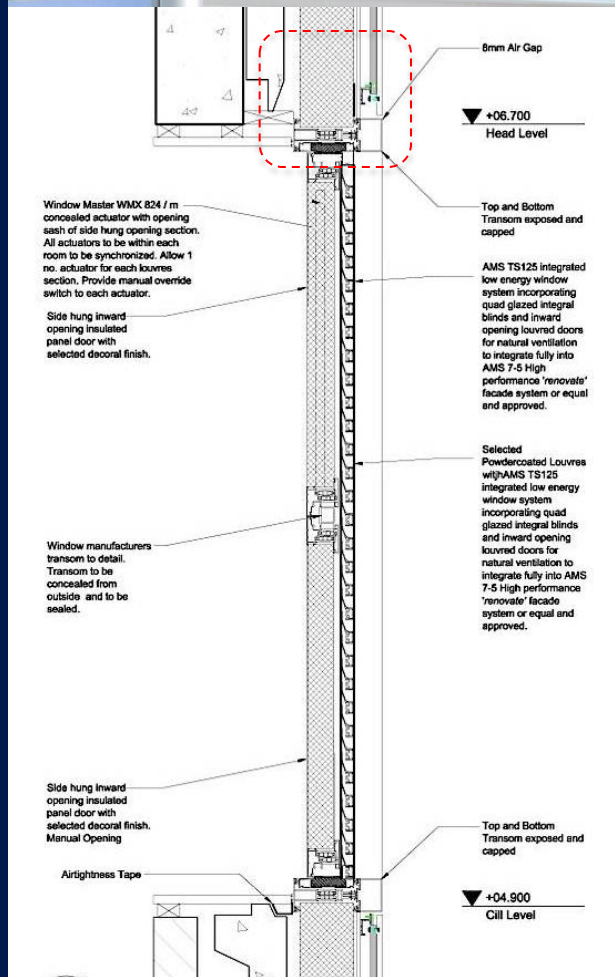
BENCHMARK
By Kingspa

AMS
ARCHITECTURAL & METAL SYSTEM

Slide: Turlough Clancy
Henry J Lyons
http://www.zero2020energy.com

HENRY J LYONS ARCHITECTS

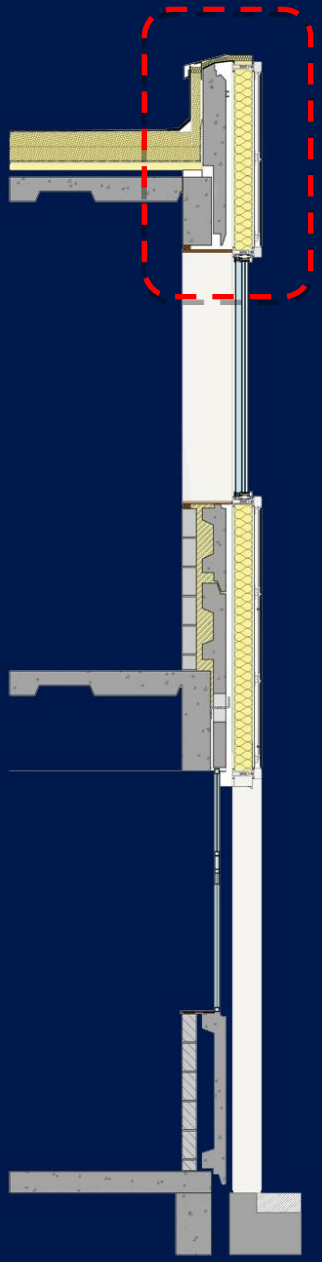


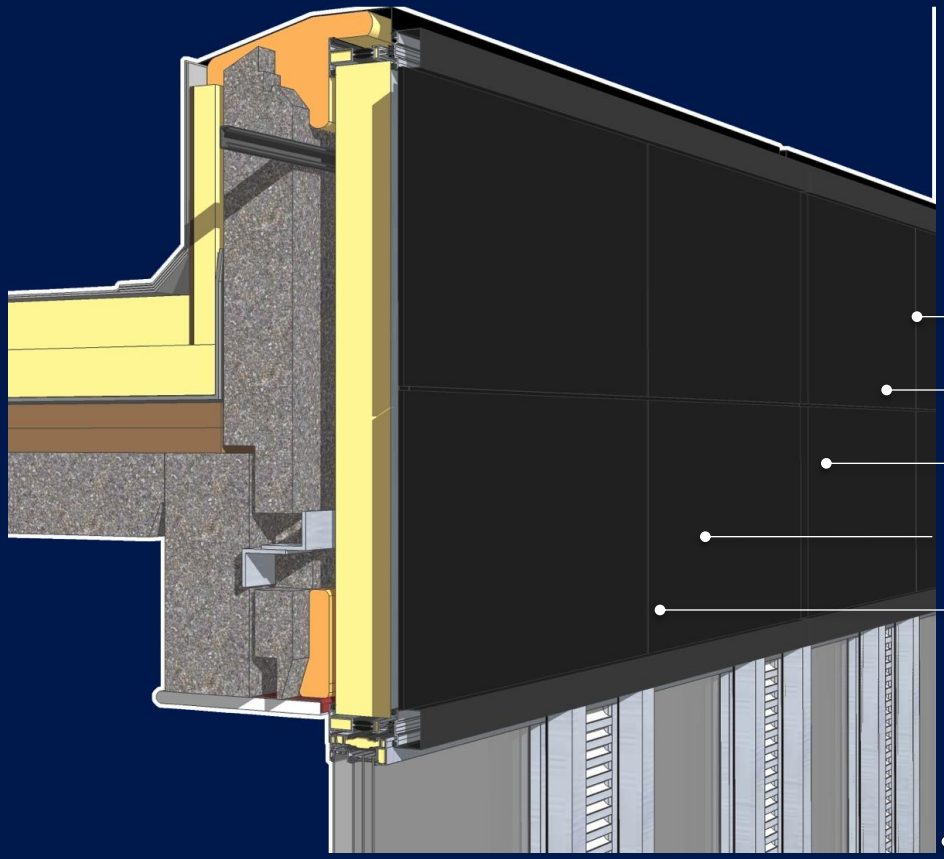


- Aluminium foam filled thermally broken curtain wall system
- 48mm triple glazed krypton filled sealed unit
- 24mm interstitial blinds behind 4th (removable) pane of 4mm clear float glass with thumb turn open/close operation
- Certified U-Value of
- High and Low inward opening vents (soild – insulated)

- Top opening vent has concealed motorised actuator linked to BMS
- Manual override button for motorised vents
- Fixed louvres to exterior

- All aluminium profiles designed & extruded in Cork – 14 no profiles
- Foam filling of aluminium by Munster Joinery





12mm Ceramic Granite Panel

130mm Insulated Carrier Panel

Carrier Rail

25mm Residual Cavity

Existing Concrete Panel

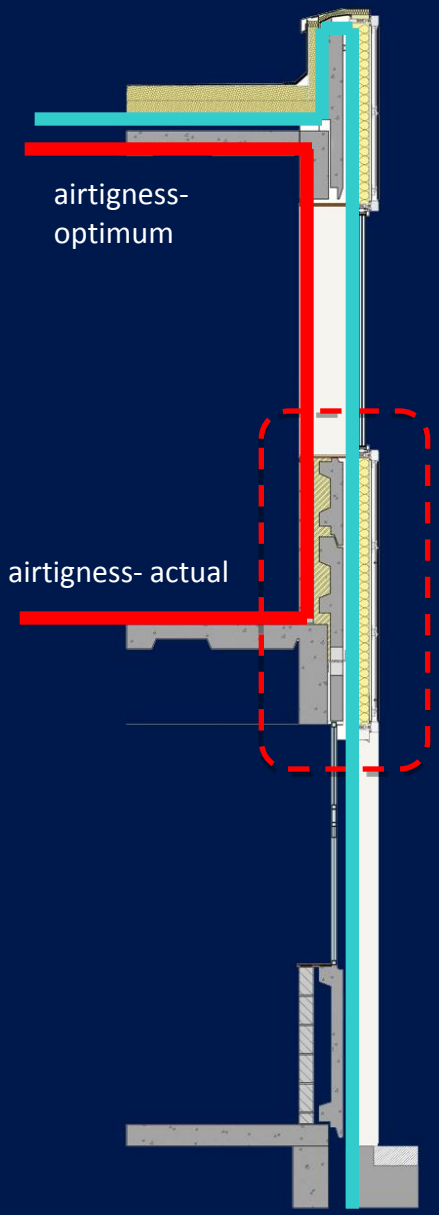
Carrier Rail

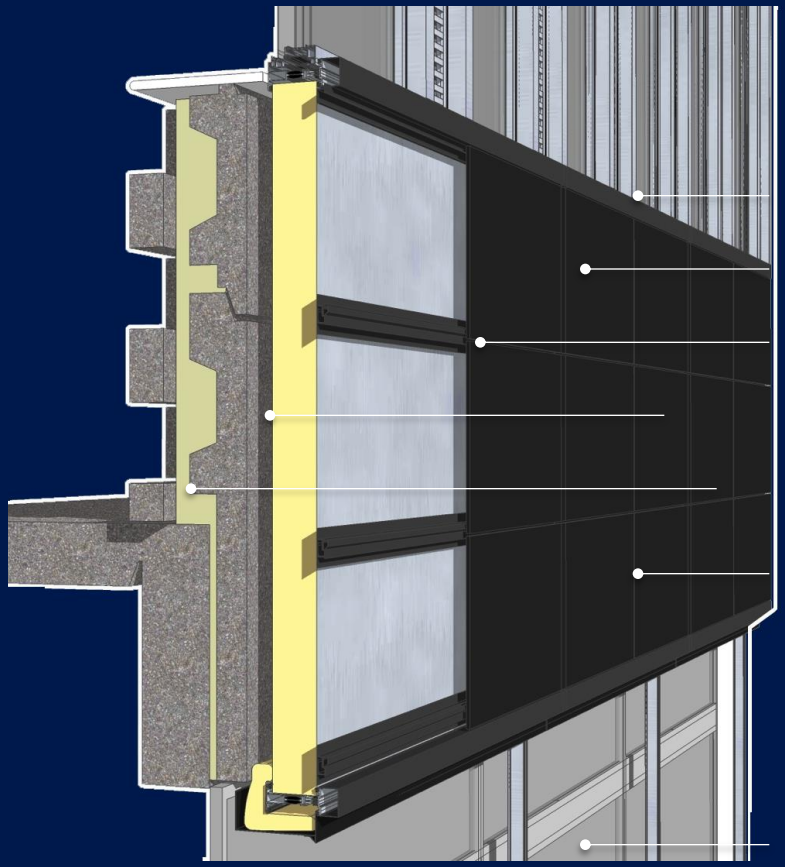
Cover Cap

48mm Sealed Triple Glazed Unit

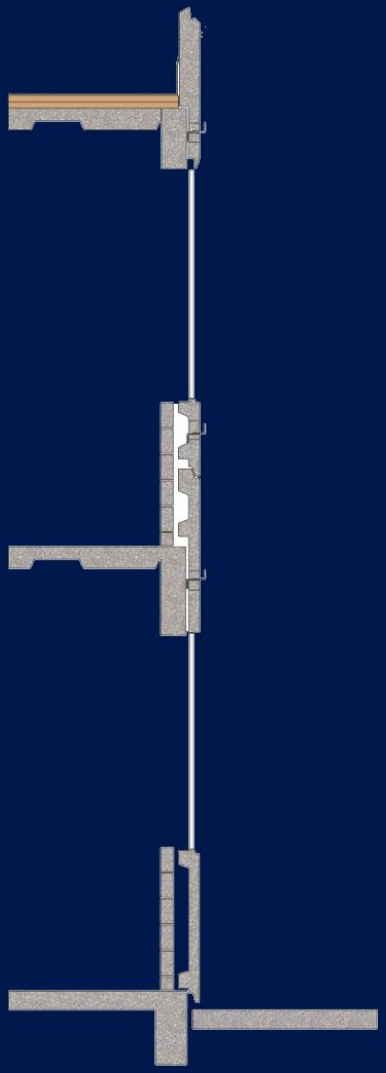
Slide: Turlough Clancy
Henry J Lyons
http://www.zero2020energy.com

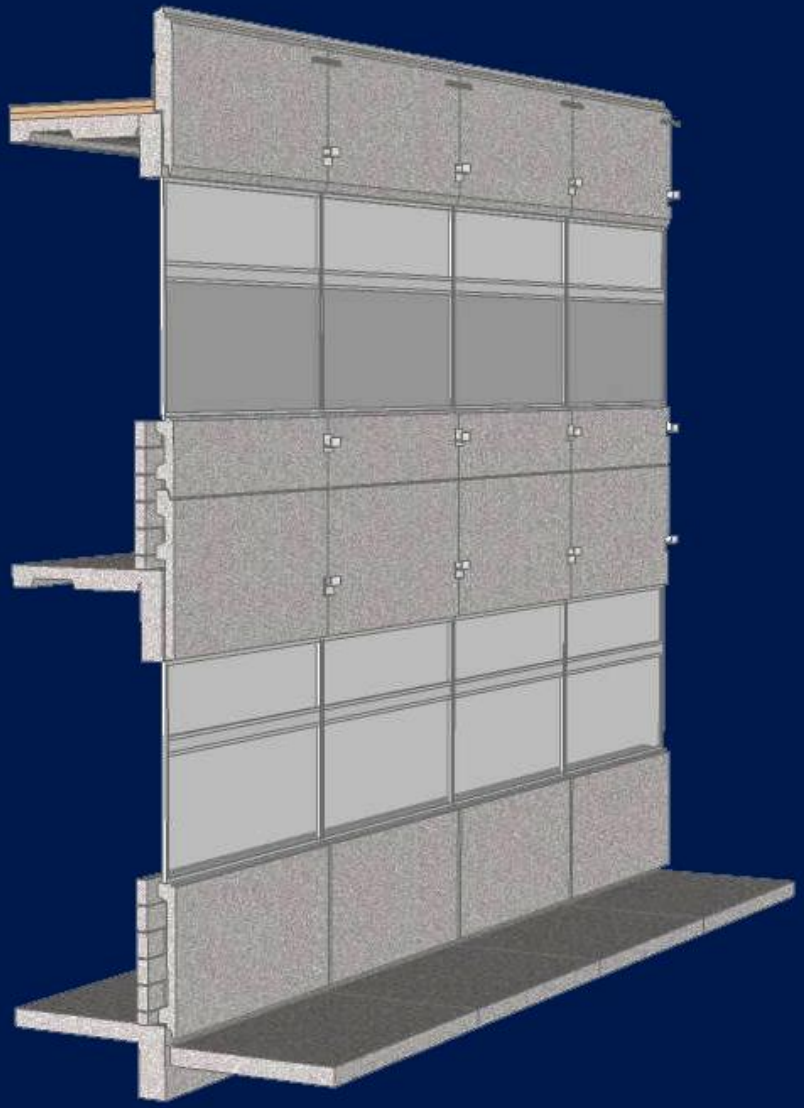
Architectural Slide



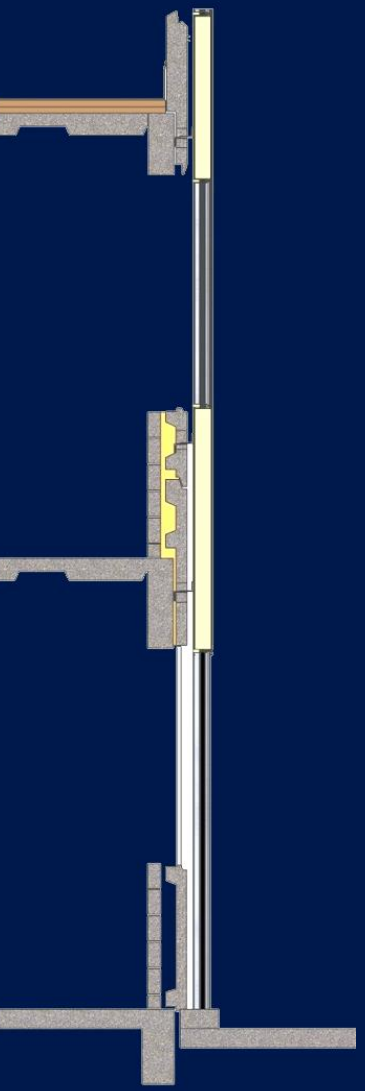


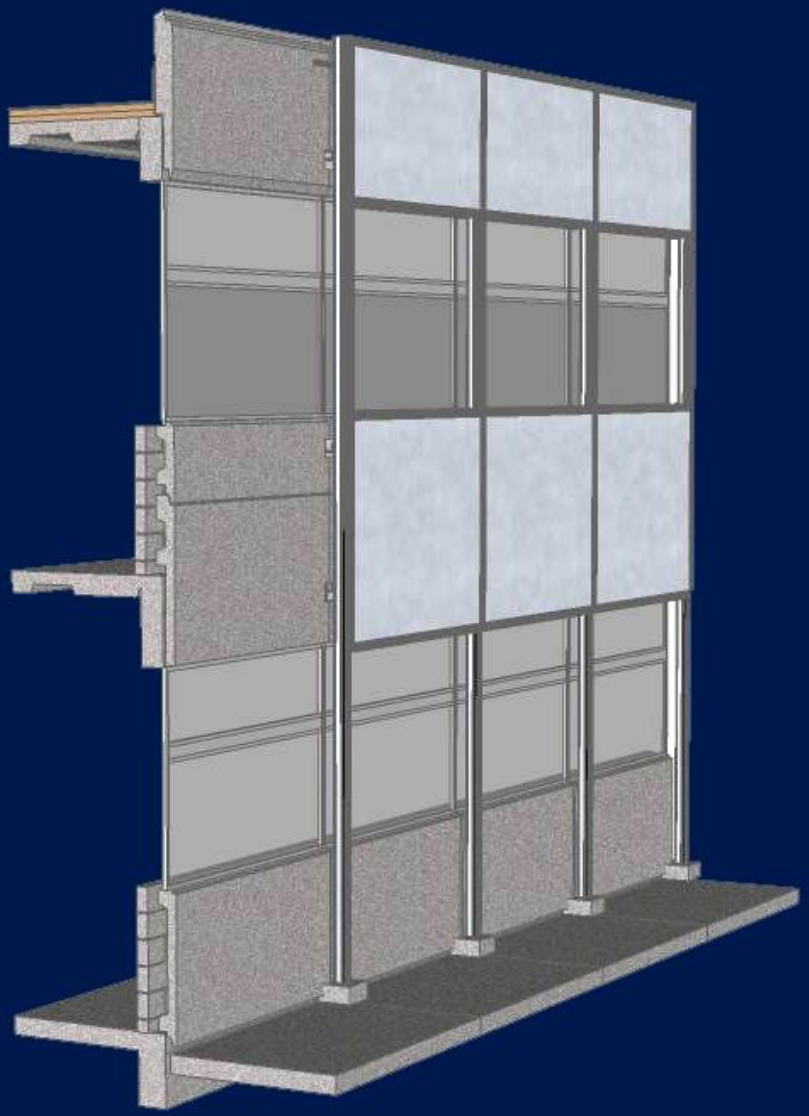
Architectural Slide

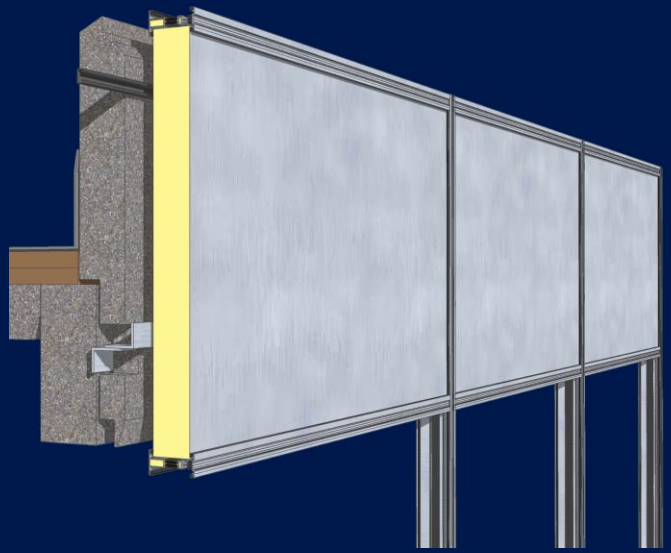


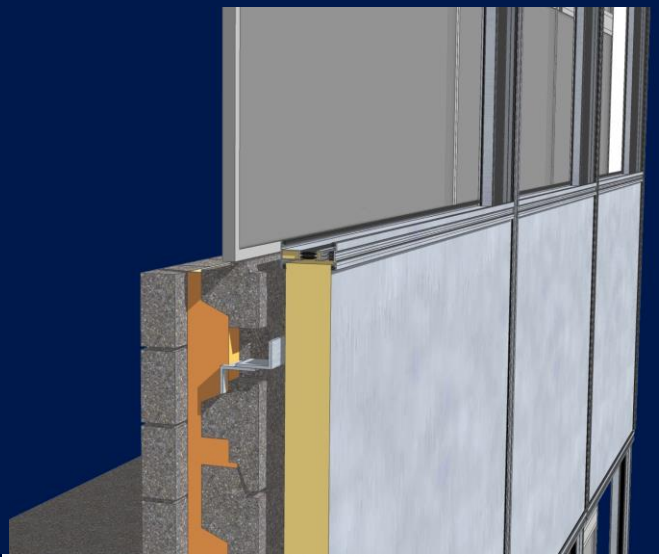


Slide: Turlough Clancy
Henry J Lyons
http://www.zero2020energy.com

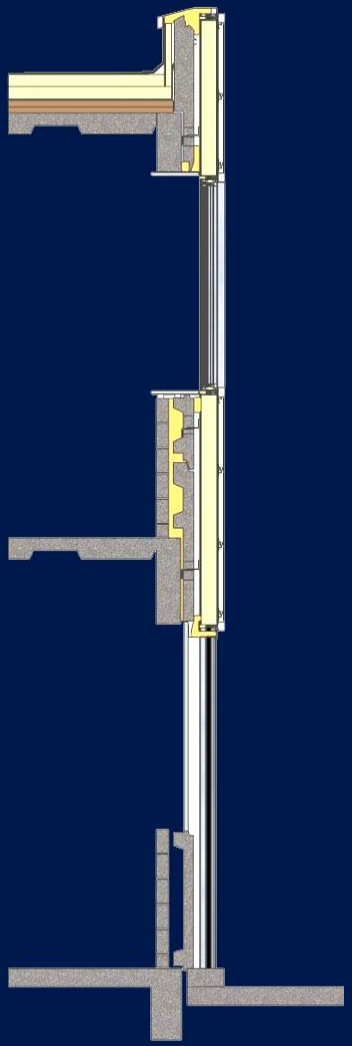


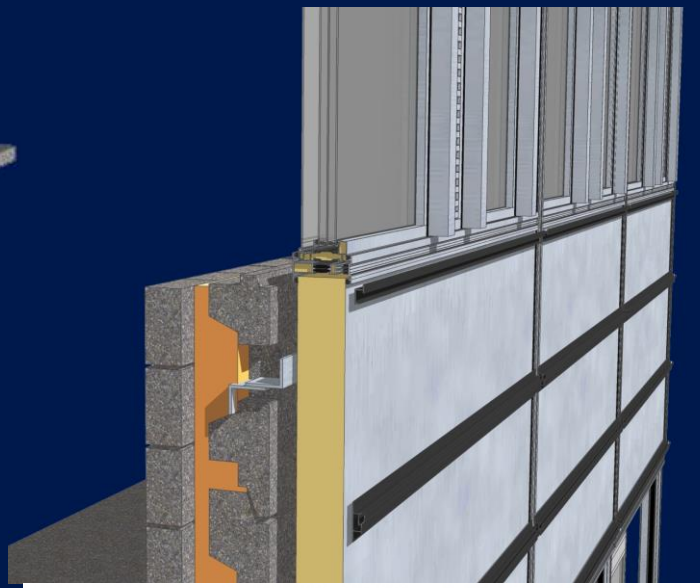




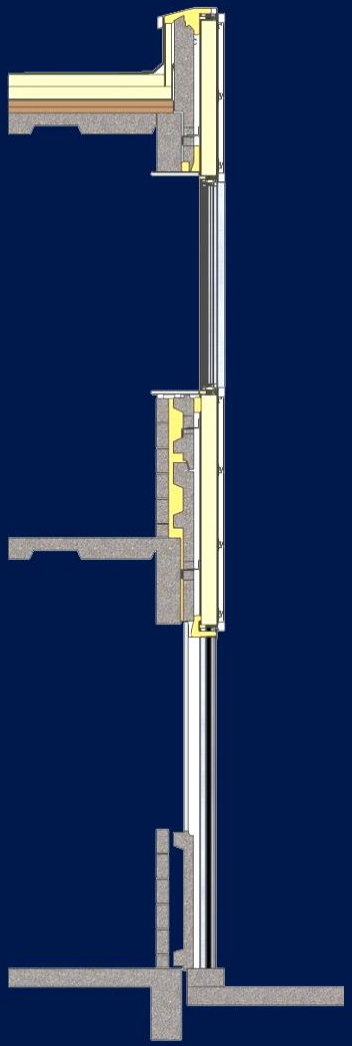


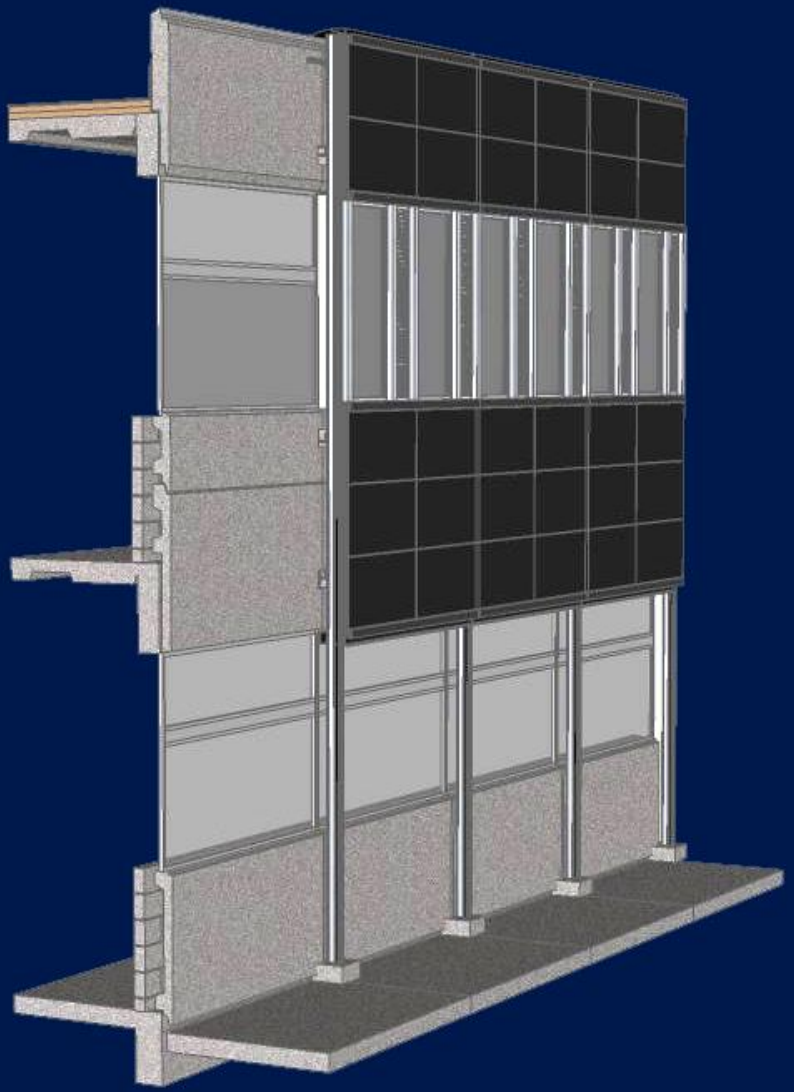
Slide: Turlough Clancy
Henry J Lyons
http://www.zero2020energy.com

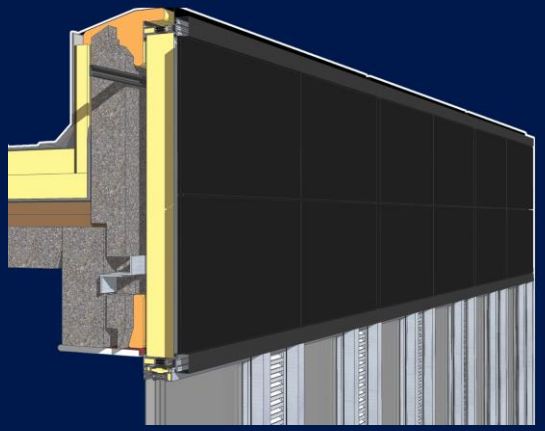


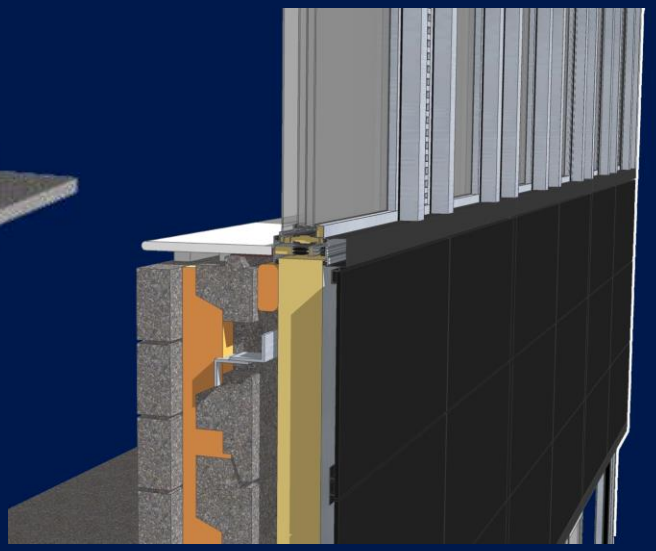


Slide: Turlough Clancy
Henry J Lyons
http://www.zero2020energy.com

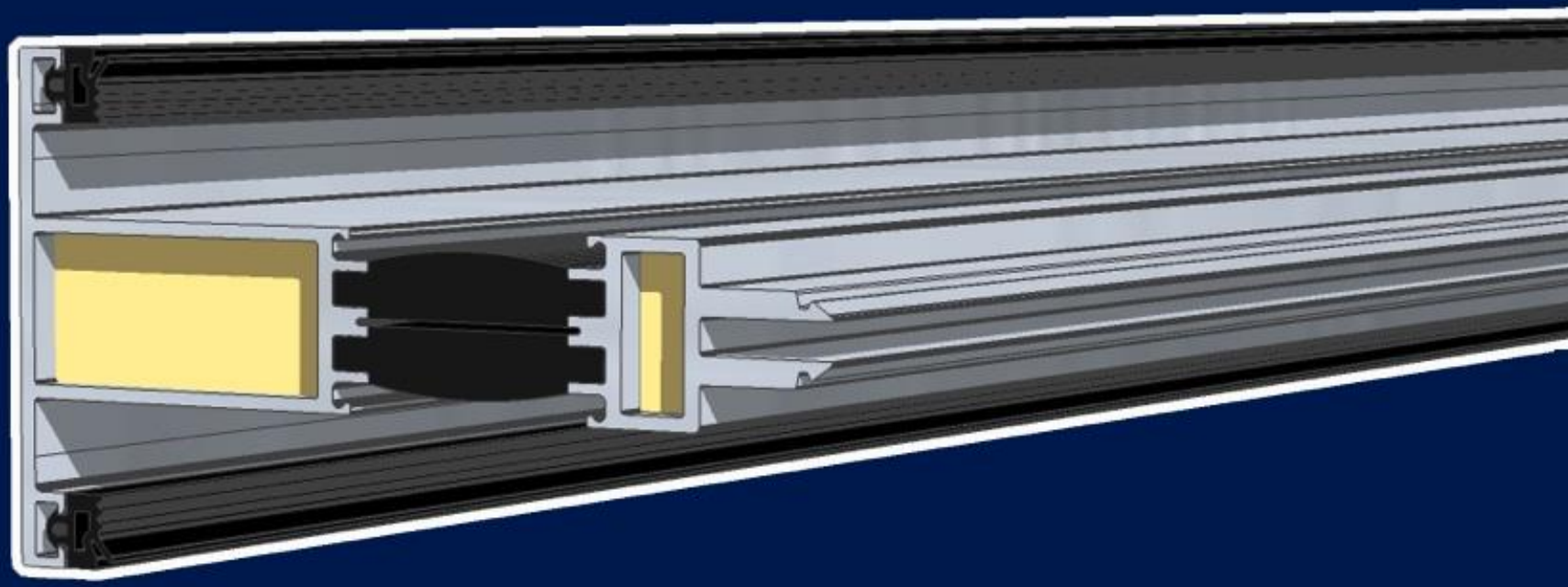








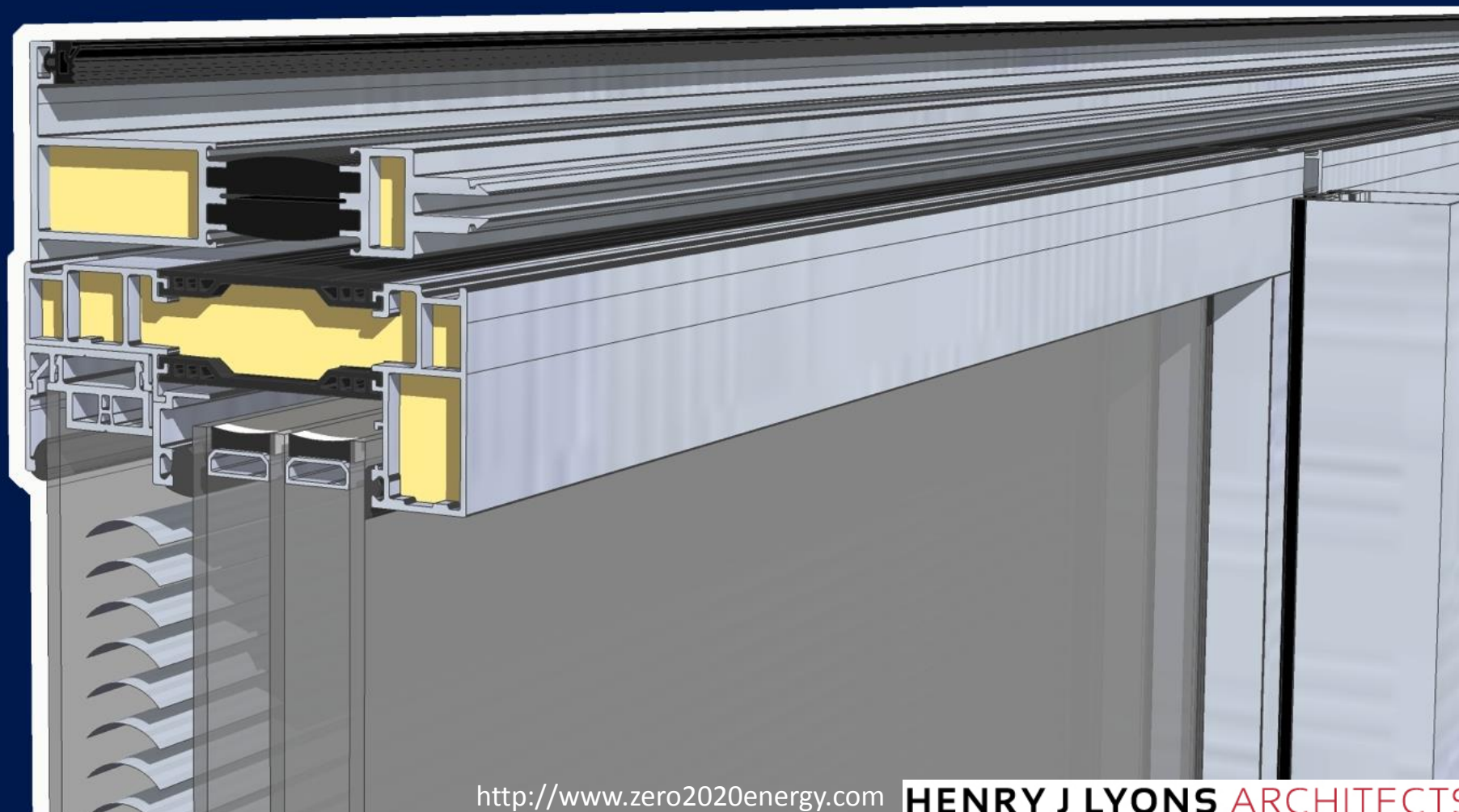
Slide: Turlough Clancy
Henry J Lyons
http://www.zero2020energy.com

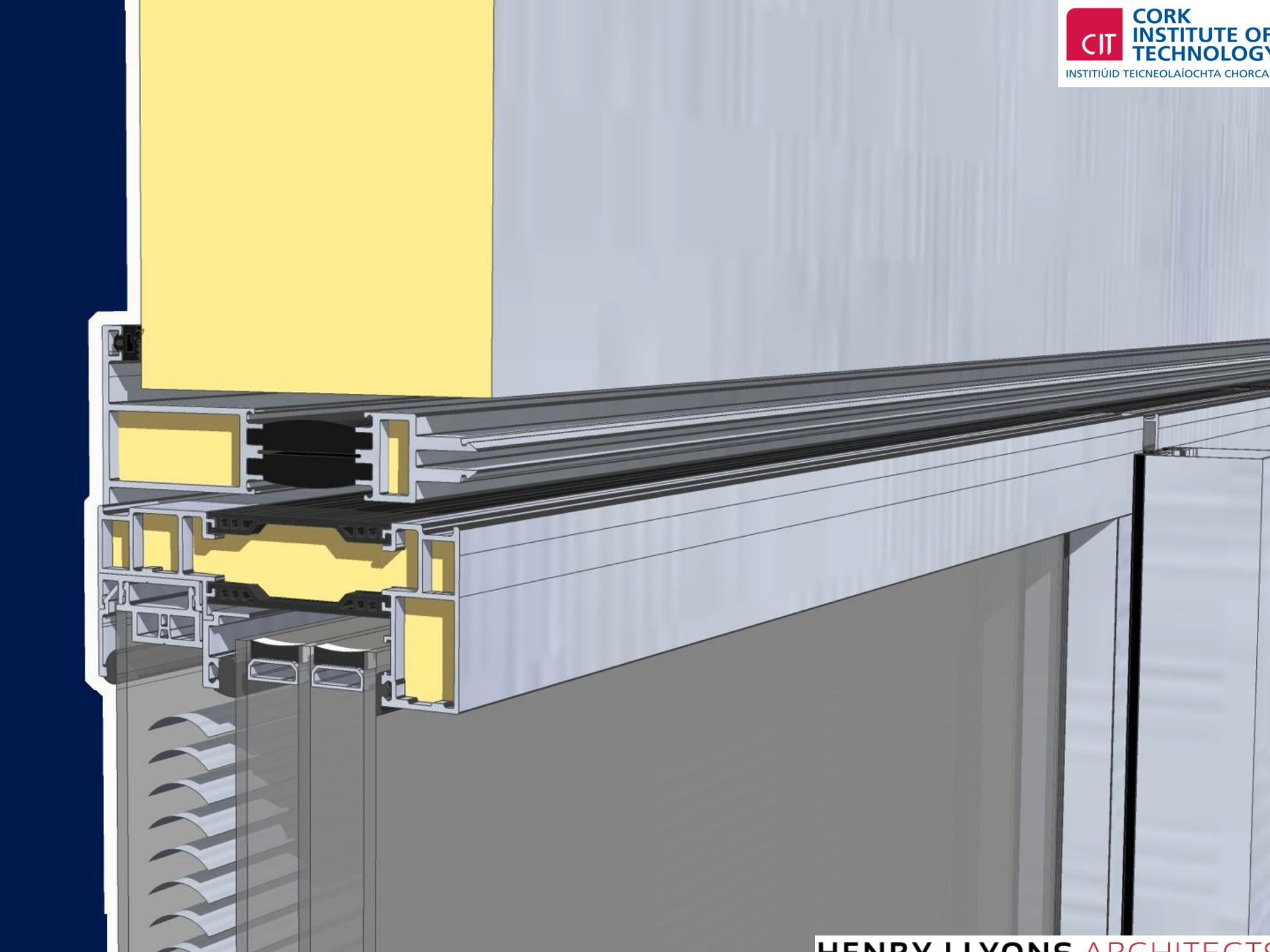


Slide: Turlough Clancy
Henry J Lyons
http://www.zero2020energy.com

Slide: Turlough Clancy
Henry J Lyons
http://www.zero2020energy.com

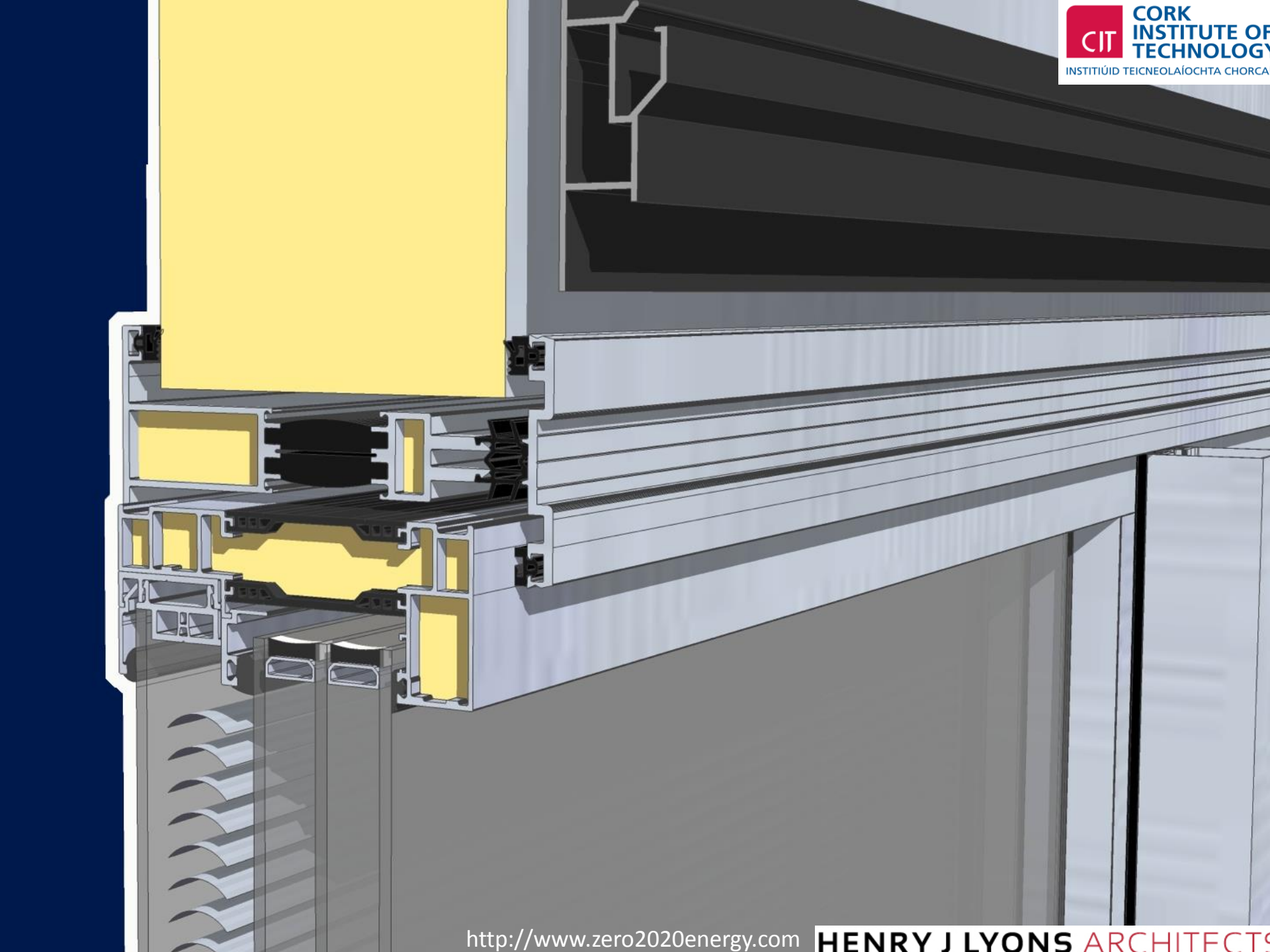
CORK INSTITUTE OF TECHNOLOGY
INSTITIÚID TEICNEOLAÍOCHTA CHORCA

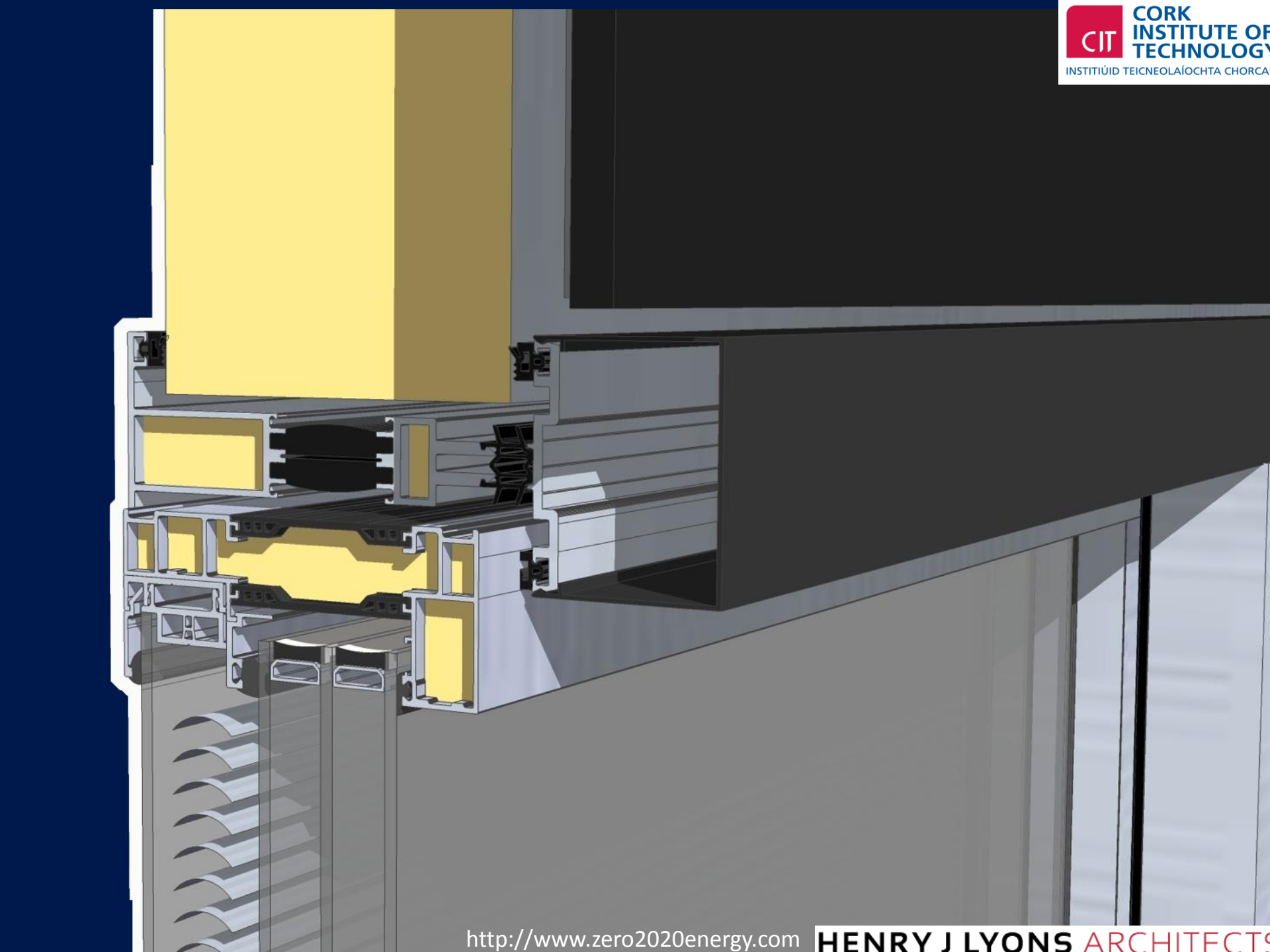




CORK INSTITUTE OF TECHNOLOGY
INSTITIÚID TEICNEOLAÍOCHTA CHORCA

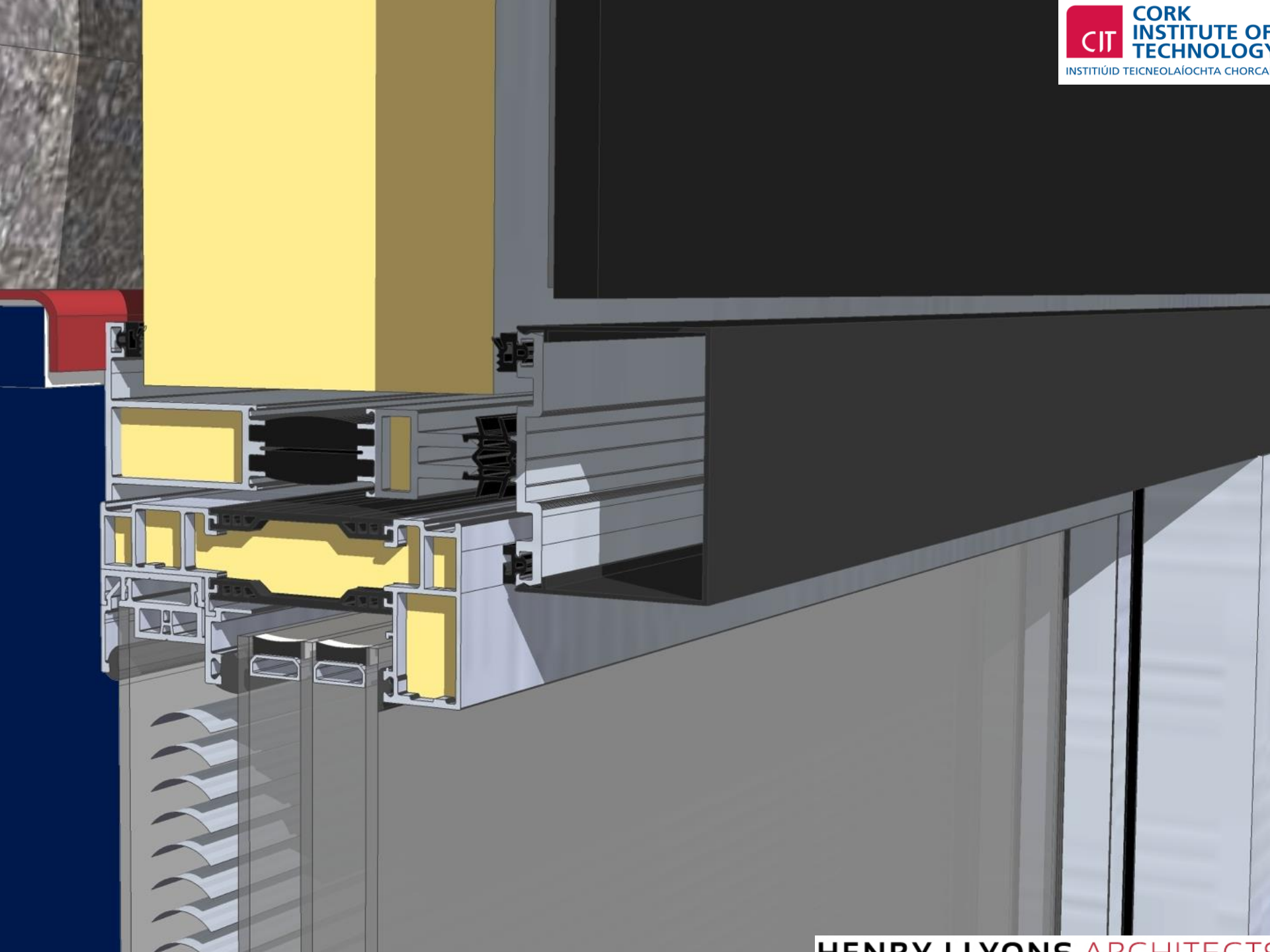
HENRY LYONS ARCHITECTS


CIT
CORK
INSTITUTE OF
TECHNOLOGY
INSTITIÚID TEICNEOLAÍOCHTA CHORCA
http://www.zero2020energy.com
HENRY J LYONS ARCHITECTS



CORK INSTITUTE OF TECHNOLOGY
INSTITIÚID TEICNEOLAÍOCHTA CHORCA

http://www.zero2020energy.com HENRY J LYONS ARCHITECTS


CIT
CORK
INSTITUTE OF
TECHNOLOGY
INSTITIÚID TEICNEOLAÍOCHTA CHORCA
HENRY LYONS ARCHITECTS

CORK INSTITUTE OF TECHNOLOGY
INSTITIÚID TEICNEOLAÍOCHTA CHORCA

HENRY LYONS ARCHITECTS

CORK INSTITUTE OF TECHNOLOGY
INSTITIÚID TEICNEOLAÍOCHTA CHORCA

Movie Slide

HENRY LYONS ARCHITECTS

Lessons Learned

Temperature fluctuations are highly moderated by thermal mass.

There is more scope in plug loads for savings. Watch out for Vampire loads

Thermal bridging detailing is more important than you think

Inter disciplinary communication can lead to poor performance decisions

Air tightness is critical to energy performance

Post Occupancy Evaluation is critical to continued professional development

More information on:
www.**zero2020energy.ie**