



# Knowledge, Training & Understanding Deep Energy Renovations of Traditional Buildings.

Peter Cox

*Managing Director of Carrig Conservation International*



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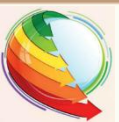
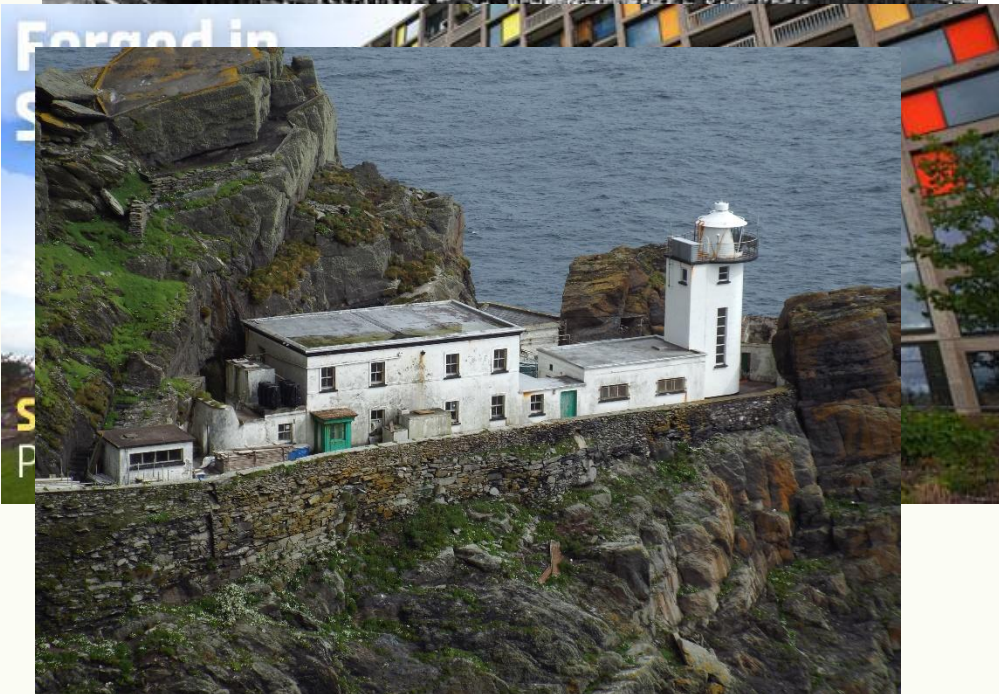
CARRIG | Energy  
conservation international Conservation

Peter Cox, Managing Director  
Dr Caroline Engel Purcell, Head of Research

CARRIG  
conservation international



# Some Carrig Projects



# Introduction

## **We have been involved in the following studies**

- Fraunhofer Institute of Building Physics
- CEN Technical Committee 346 – WG 8 which delivered EN16883:2017
- 2010 Climate Change and it's Effect on Heritage
- Vulnerability Atlas for Heritage Sites in Wexford
- Gap Analysis of Deep Energy Retrofit Skills & Training
- 10 Module CPD Course on the above
- Understanding Carbon in the Built Environment
- Future of our Past

## What I will cover in my talk:

- A Short Background
- Our Experience
- Gap Analysis in Deep Retro Fit Skills & Knowledge
- New CPD Course
- Understanding Carbon in the Built Environment
- Worst Case Scenario





## Location: Monastery Benediktbeuern



# Benediktbeuern



## The Building: Alte Schäferei / *Old Cooperage*



Front view of the building before renovation.

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## Fraunhofer-Zentrum für energetische Altbausanierung und Denkmalpflege Benediktbeuern



Kopfbau der Alten Schäferei

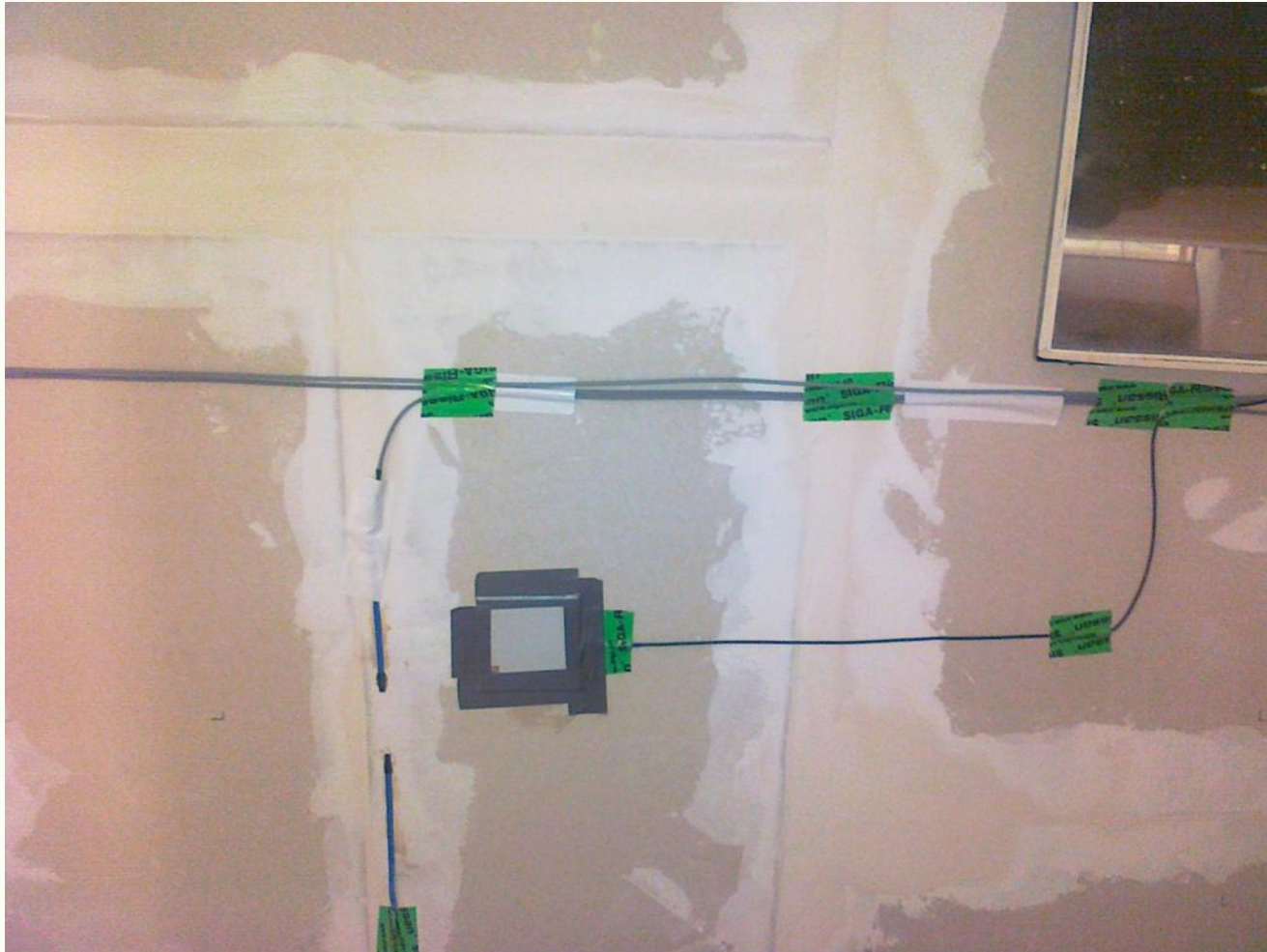
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# *Benediktbeuern*

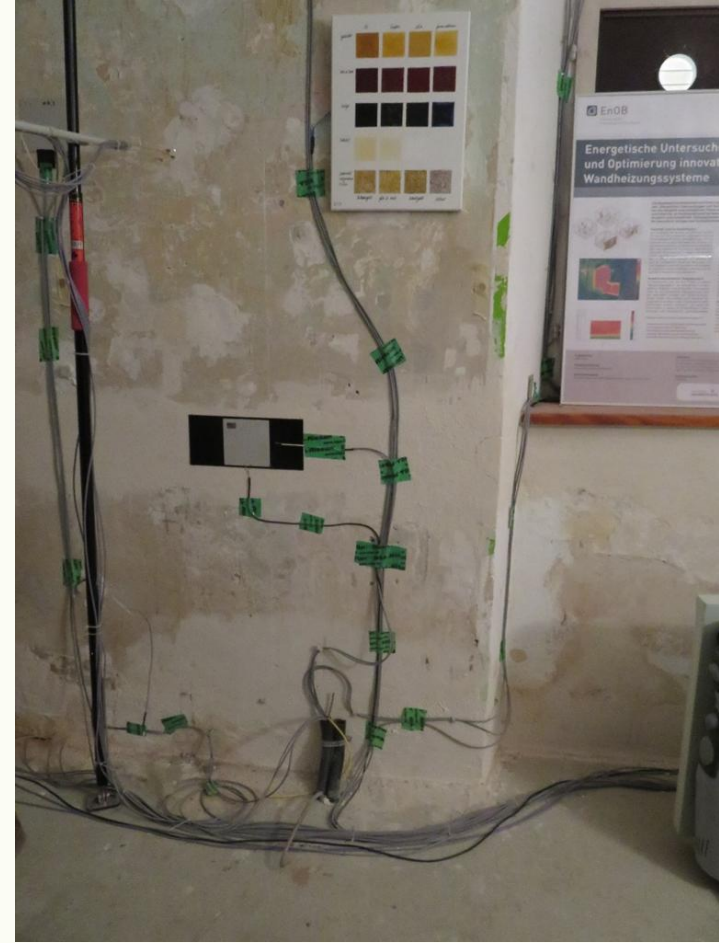


# Benediktbeuern





# Benediktbeuern



# Building Typologies







# Deep Energy Renovation of Traditional Buildings

Addressing knowledge  
gaps and skills training  
in Ireland



# Deep Energy Renovation of Traditional Buildings

*Addressing Knowledge Gaps and Skills Training in Ireland*

Navigating  
Gaps in Research  
Practice

The Sustainable Energy Authority of Ireland

The Heritage Council

Carrig Conservation International, Ltd.

ICOMOS Ireland National Scientific Committee on  
Energy, Sustainability and Climate Change (NSCES+CC)

## Author

**Caroline Engel Purcell**, PhD Arch, MSc Arch Cons, BA Arch

## NSCES+CC Steering Committee

**Colm Murray**, The Heritage Council; **Peter Cox**, ICOMOS International Scientific Committee on Energy, Sustainability and Climate Change and Carrig Conservation International Ltd; **Leila Budd**, Carrig Conservation International Ltd.; **Deirdre McDermott**, Vice President of ICOMOS Ireland.

**March 2018**



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## 2.4 Understanding Traditional Buildings

### 2.4.1 Building Physics and Hygrothermal Behaviour

Nearly all buildings constructed in Ireland from medieval times up until 1940 were constructed using traditional methods<sup>94</sup>, but what is a 'traditional' building? According to the 2010 DEHLG Advice Series publication *Energy Efficiency in Traditional Buildings*, traditional buildings in Ireland primarily consists of those built with solid masonry walls of brick or stone, often originally finished with a lime-based render, single-glazed timber or metal windows, and a timber-framed roof clad in slate, tiles, copper or lead. Solid masonry walls do not contain an air-filled cavity but were instead often filled with small stones or lime mortar. Brick walls were finished internally with a lime-based plaster while rubble walls were finished both internally and externally with a breathable lime-based plaster that allowed internal moisture to escape through the walls.

Traditional buildings require sufficiently thick external walls to ensure that drying cycles occur before atmospheric moisture reaches the internal wall face. It is essential that all materials and finishes, including mortars<sup>95</sup> and renders<sup>96</sup>, used on traditional walls are porous to allow this natural transfer of moisture to occur. Basic guidance on the detriment of non-porous materials like cement is provided in the HES Inform Guide *Lime and Cement Mortars in Traditional Buildings*<sup>97</sup>.

The 2007 Conservation Advice Series publication *Maintenance: A Guide to the Care of Older Buildings* also provides a brief overview for homeowners on how old buildings work and how to deal with three common types of damp: rising, penetrating and condensation.<sup>98</sup>

Under the Intelligent Energy Europe TABULA Project (2009-2012), a study of common Irish residential building typologies and their typical energy and thermal properties was developed into an

[Advice Series: Energy Efficiency in Traditional Buildings \(2010\)](#)

[Advice Series: Maintenance - A Guide to the Care of Older Buildings \(2007\)](#)

[HES Technical Advice Note 15: External Lime Coatings on Traditional Buildings \(2001\)](#)

[HES Short Guide 6: Lime Mortars in Traditional Buildings \(2014\)](#)

[HES INFORM Guide: Lime and Cement Mortars in Traditional Buildings \(2016\)](#)

<sup>94</sup> *Advice Series: Energy Efficiency in Traditional Buildings* (2010), Dublin: Department of the Environment, Heritage and Local Government. Available at: <https://www.chg.gov.ie/heritage/built-heritage/architectural-heritage-advisory-service/advice-for-owners/> p 5.

<sup>95</sup> Snow, J. and Torney, C. (2014) *Short Guide 6: Lime Mortars in Traditional Buildings*. Edinburgh: Historic Environment Scotland.

<sup>96</sup> Newsom, S., Gibbons, P. and Brown, S. (2001) *Technical Advice Note 15: External Lime Coatings on Traditional Buildings*, Edinburgh: Historic Environment Scotland. Available at: <https://www.historicenvironment.scot/archives-and-research/publications/publication/?publicationId=33c274be-9e98-49d5-9b24-a5c2009c7bb>.

<sup>97</sup> Mitchell, D. D. and Torney, D. C. (2016) *INFORM Guide: Lime and Cement Mortars in Traditional Buildings*, Edinburgh: Historic Environment Scotland. Available at: <https://www.historicenvironment.scot/archives-and-research/publications/publication/?publicationId=9410b4db-0fbb-41e4-ba8d-a59500f5618d>.

<sup>98</sup> Donnelly, J. (2007) *Advice Series: Maintenance - A Guide to the Care of Older Buildings*, Dublin: Department of Culture, Heritage and the Gaeltacht. Available at: <https://www.chg.gov.ie/heritage/built-heritage/architectural-heritage-advisory-service/advice-for-owners/>.



# ENERGY RENOVATION & MOISTURE- RELATED RISKS

- **Reputable Information Sources**
- UK Centre for Moisture in Buildings (UKCMB)
- Building Research Establishment (BRE)
- Sustainable Traditional Building Alliance (STBA)
- Society for the Protection of Ancient Buildings (SPAB)
- Historic Environment Scotland (HES)
- Historic England (HE)



## UK CENTRE FOR MOISTURE IN BUILDINGS

[Home](#)  
[Welcome to the UKCMB](#)  
[Two new projects within the UKCMB](#)  
[UKCMB launches blog with first post: 'Mould: is it really an unbeatable monster?' by Yasemin Aktas](#)  
[UKCMB's Knowledge Transfer Partnership \(KTP\) to investigate dampness in buildings](#)  
[Neil May's White Paper on moisture mentioned in the long-awaited Bonfield Review](#)  
[Dr Marcella Ucci presents UKCMB findings at the Bartlett Research Exchange](#)  
[UKCMB Director Neil May awarded MBE in the Queen's Birthday Honours List](#)  
[UKCMB re-launch event](#)  
[Hygrothermal Risk Evaluation for the Retrofit of a Typical Solid-walled Dwelling](#)  
[Avoidance and diagnosis of problems associated with internal wall insulation](#)  
[Outputs from the UKCMB re-launch event](#)  
[UKCMB launches a report on the health impact of buildings which are too dry or too damp](#)  
[UKCMB launches a new video on moisture guidance for existing homeowners](#)  
[Vacancy: Research Associate - Hygrothermal Modeller at Loughborough University](#)  
[Feedback from the UKCMB re-launch conference \(October 20th 2017\)](#)  
[An update on standards and policy work](#)  
[UKCMB launches a public report on mould testing and benchmarking](#)  
[An update on our training programme](#)  
[New UKCMB management team members](#)

UKCMB launches a new video on moisture guidance for existing homeowners

2 November 2017

The video aims to provide guidance to homeowners on how to avoid moisture problems in existing homes. It provides an introduction to moisture in buildings, explaining in simple terms and images what damp means, where moisture in buildings comes from, as well as, introduce the notion of balance and how this can be achieved.



Watch later Share

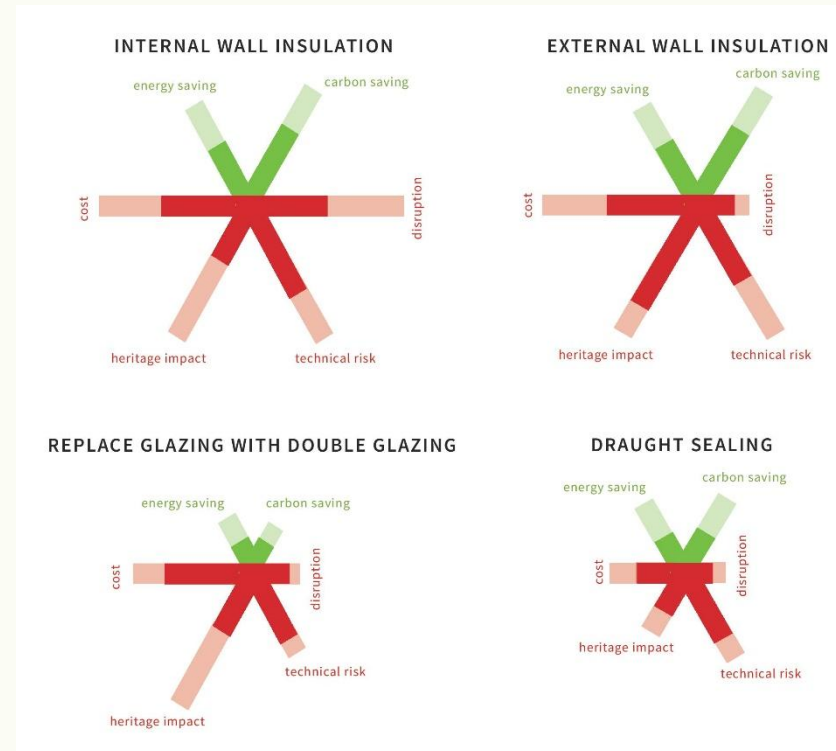
The UKCMB team are also developing an interactive web-based tool which shows how different measures or problems can push a building out of balance in a particular way and how we can start to restore balance. A highly-visual interface will collect information from the user and will provide summary advice for particular problems and where to go for more information.

[Click here to learn more about the research project](#)

<http://www.ukcmb.org/resources/Outputs>

# Reputable Information Sources

- **Historic Environment Scotland (HES)**
  - Technical Reports, Technical Advice Series & Refurbishment Case Studies
  - Little, J., Ferraro, C. and Arregi, B. (2015) [\*HES Technical Paper 15: Assessing Risks in Insulation Retrofits using Hygrothermal Software Tools - Heat and Moisture Transport in Internally Insulated Stone Walls\*](#)
- **Historic England (HE)**
  - Energy Efficiency and Historic Buildings series:
    - [\*How to Improve Energy Efficiency\*](#) (2018)
    - [\*Insulating Solid Walls\*](#) (2016)
  - Research Report Series:
    - [\*Hygrothermal Modelling of Shrewsbury Flax Mill Maltings\*](#)
    - [\*External Wall Insulation in Traditional Buildings - Case Studies of Three Large-scale Projects in the North of England\*](#)
- **Sustainable Traditional Building Alliance (STBA)**
  - May, N. and Sanders, C. (2017) [\*Moisture in Buildings: An Integrated Approach to Risk Assessment and Guidance\*](#)
  - [\*STBA Responsible Retrofit Wheel\*](#) (2017; adapted for France 2018)



Measuring risk vs benefit of energy renovation options  
(Historic England, *How to Improve Energy Efficiency*, 2018)

# STBA

SUSTAINABLE TRADITIONAL  
BUILDINGS ALLIANCE

WELCOME TO THE RESPONSIBLE RETROFIT KNOWLEDGE CENTRE

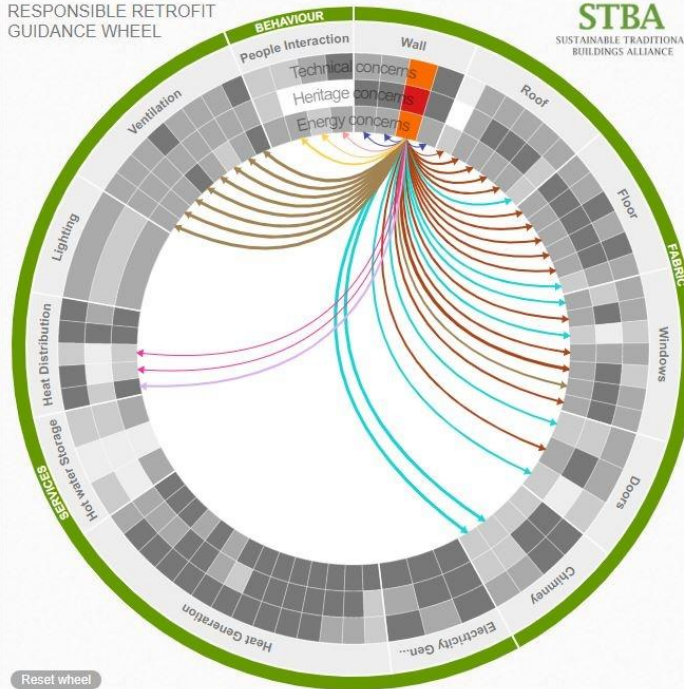
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All Categories



## RESPONSIBLE RETROFIT GUIDANCE WHEEL



STBA  
SUSTAINABLE TRADITIONAL  
BUILDINGS ALLIANCE

GETTING STARTED ABOUT GLOSSARY REPORT

### Colour key

#### Building context

Please select the context of your building here:

##### Heritage

What is the heritage value of the building?

Listed - Important (Listed - Grade 2 in E&W, C ▼)

##### Condition/State of repair

What is the condition/state of repair of the building?

Fair (Acceptable condition, likely to need some ▼)

##### Exposure

What is the exposure of the building to wind driven rain? (see B.Regs AD C diagram 12 shows map for UK zones). Apply correction factors if known and as described in BS 8104:1992

Moderate (Wind driven rain (in l/m2 per spell) ▼)

##### Energy User Type

How does the energy user compares with others in terms to energy use as assessed in the Green Deal Occupancy assessment?

Medium (Typical) Energy Use (Within 20% eitt ▼)

##### User interest and involvement In Operation

What is the user's level of motivation and knowledge when operating the building?

Uninterested User ▼

##### Number of exposed sides

How many sides of the building are exposed to wind for ventilation?

Single (Dwelling has a single exposed side) ▼

##### Wall

Internal Wall insulation

## Deep Energy Renovation of Traditional Buildings Addressing Knowledge Gaps and Skills Training in Ireland

Contracting Authority: Sustainable Energy Authority of Ireland (SEAI)  
Partner: The Heritage Council



## Deep Energy Renovation of Traditional Buildings

*Addressing Knowledge Gaps and Skills Training in Ireland*

The Sustainable Energy Authority of Ireland

The Heritage Council

Carrig Conservation International, Ltd.

ICOMOS Ireland National Scientific Committee on  
Energy, Sustainability and Climate Change (NSCES+CC)

### Author

Caroline Engel Purcell, PhD Arch, MSc Arch Cons, BA Arch

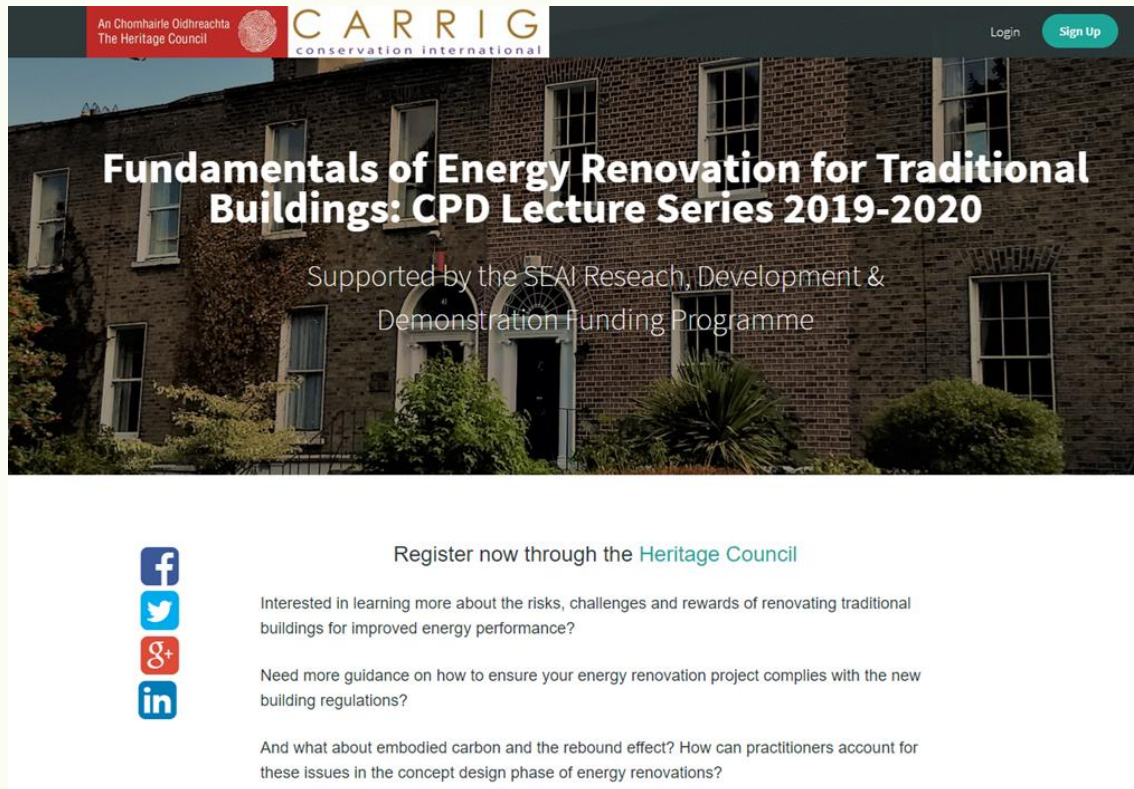
### NSCES+CC Steering Committee

Colm Murray, The Heritage Council; Peter Cox, ICOMOS International Scientific Committee on Energy, Sustainability and Climate Change and Carrig Conservation International Ltd; Leila Budd, Carrig Conservation International Ltd.; Deirdre McDermott, Vice President of ICOMOS Ireland.

March 2018



# Fundamentals of Energy Renovation for Traditional Buildings: CPD Course



The screenshot shows the Carrig Conservation International website. At the top, there is a header with the Carrig logo and the text 'An Chomhairle Oidhreachta The Heritage Council'. Below the header is a large image of a traditional brick building. Overlaid on the image is the title 'Fundamentals of Energy Renovation for Traditional Buildings: CPD Lecture Series 2019-2020' and the text 'Supported by the SEAI Research, Development & Demonstration Funding Programme'. Below the image, there are social media icons for Facebook, Twitter, Google+, and LinkedIn. To the right of the icons, there is a registration link 'Register now through the Heritage Council' and three paragraphs of text describing the course.

**Fundamentals of Energy Renovation for Traditional Buildings: CPD Lecture Series 2019-2020**

Supported by the SEAI Research, Development & Demonstration Funding Programme

Register now through the [Heritage Council](#)

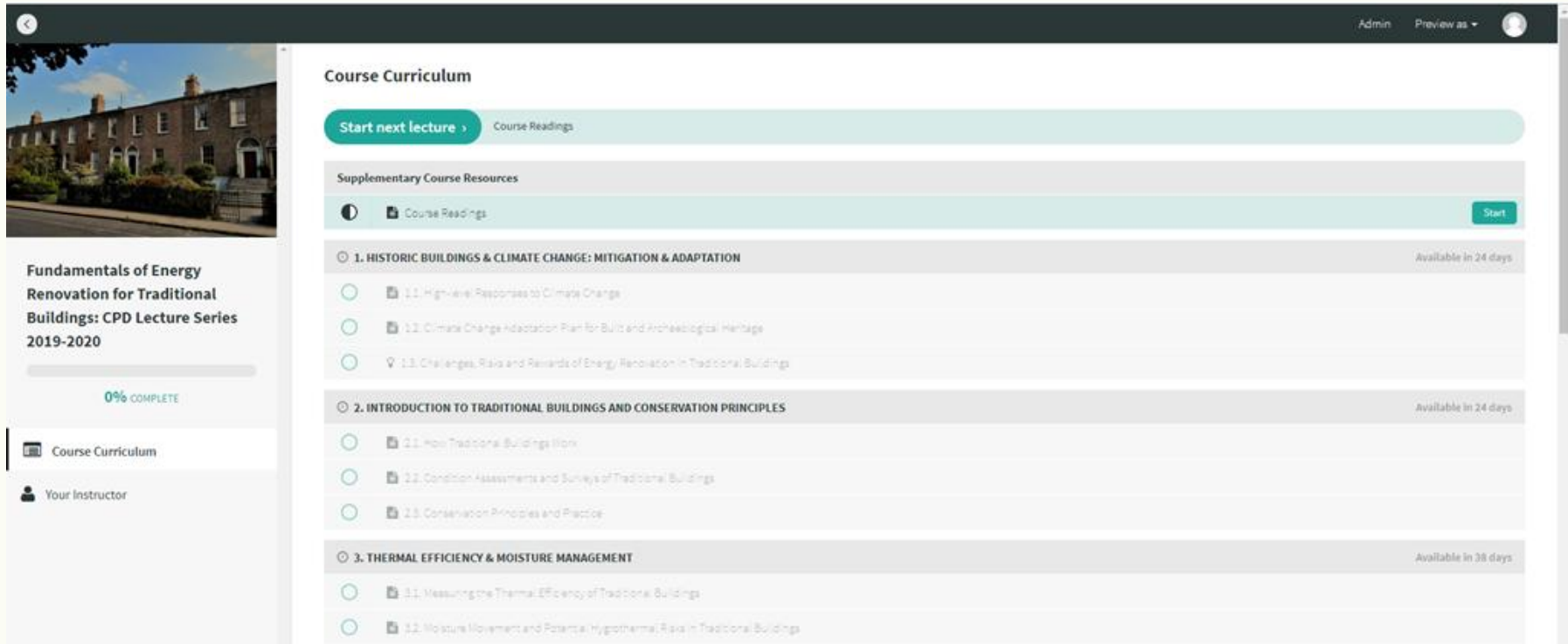
Interested in learning more about the risks, challenges and rewards of renovating traditional buildings for improved energy performance?

Need more guidance on how to ensure your energy renovation project complies with the new building regulations?

And what about embodied carbon and the rebound effect? How can practitioners account for these issues in the concept design phase of energy renovations?

- Developed in conjunction with the Heritage Council
- Attendance fees subsidised by SEAI
- 5 lecture days from November 1<sup>st</sup> 2019 to January 31<sup>st</sup> 2020
- Continuing Professional Development (CPD) credits provided by Royal Institute of the Architects of Ireland (RIAI) and Engineers Ireland (EI)

# Fundamentals of Energy Renovation for Traditional Buildings: CPD Course



The screenshot displays a web-based course interface. On the left, a sidebar features a photograph of a row of traditional brick houses, the course title 'Fundamentals of Energy Renovation for Traditional Buildings: CPD Lecture Series 2019-2020', a progress bar at 0% complete, and navigation links for 'Course Curriculum' and 'Your Instructor'. The main content area is titled 'Course Curriculum' and includes a 'Start next lecture' button and a 'Course Readings' link. Below this, a section titled 'Supplementary Course Resources' contains a 'Course Readings' link with a 'Start' button. The curriculum is organized into three numbered sections, each with a list of topics and a 'Start' button:

- 1. HISTORIC BUILDINGS & CLIMATE CHANGE: MITIGATION & ADAPTATION** (Available in 24 days)
  - 1.1 High-level Responses to Climate Change
  - 1.2 Climate Change Adaptation Plan for Built and Archaeological Heritage
  - 1.3 Challenges, Risks and Rewards of Energy Renovation in Traditional Buildings
- 2. INTRODUCTION TO TRADITIONAL BUILDINGS AND CONSERVATION PRINCIPLES** (Available in 24 days)
  - 2.1 How Traditional Buildings Work
  - 2.2 Condition Assessments and Surveys of Traditional Buildings
  - 2.3 Conservation Principles and Practice
- 3. THERMAL EFFICIENCY & MOISTURE MANAGEMENT** (Available in 38 days)
  - 3.1 Measuring the Thermal Efficiency of Traditional Buildings
  - 3.2 Moisture Movement and Potential Hygrothermal Risks in Traditional Buildings

Attendees will be supported by an online resource with suggested readings, speaker presentations and practice quizzes to test knowledge and comprehension.

## *Modules (2 per day):*

1. HISTORIC BUILDINGS & CLIMATE CHANGE: MITIGATION & ADAPTATION
2. INTRODUCTION TO TRADITIONAL BUILDINGS AND CONSERVATION PRINCIPLES
3. THERMAL EFFICIENCY & MOISTURE MANAGEMENT
4. UPGRADING BUILDING SERVICES & INTEGRATING RENEWABLE ENERGY SOURCES
5. LOW-RISK, HIGH-IMPACT ENERGY RENOVATION WORKS
6. SOLID WALL INSULATION
7. COMPLYING WITH BUILDING REGULATIONS & TAKING A BALANCED APPROACH TO RENOVATION
8. PROJECT COORDINATION AND RISK MANAGEMENT
9. REDUCING THE ENERGY PERFORMANCE GAP
10. DEALING WITH KNOWLEDGE GAPS AND UNCERTAINTIES IN PRACTICE

# Fundamentals of Energy Renovation for Traditional Buildings: CPD Course



## ***Fundamentals of Energy Renovation for Traditional Buildings: CPD Lecture Series 2019-2020***

### **Lecture Topics**

The following 10 modules will be delivered over the 5 days of the lecture series (2 modules per day).

#### **1. HISTORIC BUILDINGS & CLIMATE CHANGE: MITIGATION & ADAPTATION**

- 1.1. High-level responses to climate change – *Peter Cox, Carrig Conservation International Ltd.*
- 1.2. Climate Change Adaptation Plan for Built & Archaeological Heritage – *Dr Cathy Daly, University of Lincoln*
- 1.3. Challenges, risks and rewards of energy renovation – *Chris Morgan, Scottish Ecological Design Association*

#### **2. INTRODUCTION TO TRADITIONAL BUILDINGS AND CONSERVATION PRINCIPLES**

- 2.1. How traditional buildings work – *Carl Raftery, Dublin City Council*
- 2.2. Condition assessments and surveys of traditional buildings – *Frank Keohane, Chartered Building Surveyor*
- 2.3. Conservation principles and practice – *Jacqui Donnelly, Dept of Culture, Heritage & the Gaeltacht*

#### **3. THERMAL EFFICIENCY & MOISTURE MANAGEMENT**

- 3.1. Measuring the thermal efficiency of traditional buildings – *Joseph Little, Technical University Dublin*
- 3.2. Moisture movement and potential hygrothermal risks – *Colin King, UK Centre for Moisture in Buildings*
- 3.3. Case Study: New Court, Trinity College, Cambridge – *Dr Caroline Rye, Archimetrix Ltd.*

#### **4. UPGRADING BUILDING SERVICES & INTEGRATING RENEWABLE ENERGY SOURCES**

- 4.1. Introduction to low carbon energy sources and heating solutions – *Lis O'Brien, Limerick Institute of Technology*
- 4.2. Managing the design of mechanical and electrical installations – *Edith Blennerhassett, ARUP*
- 4.3. Case Study: Decarbonising National Trust Properties – *Keith Jones, UK National Trust*

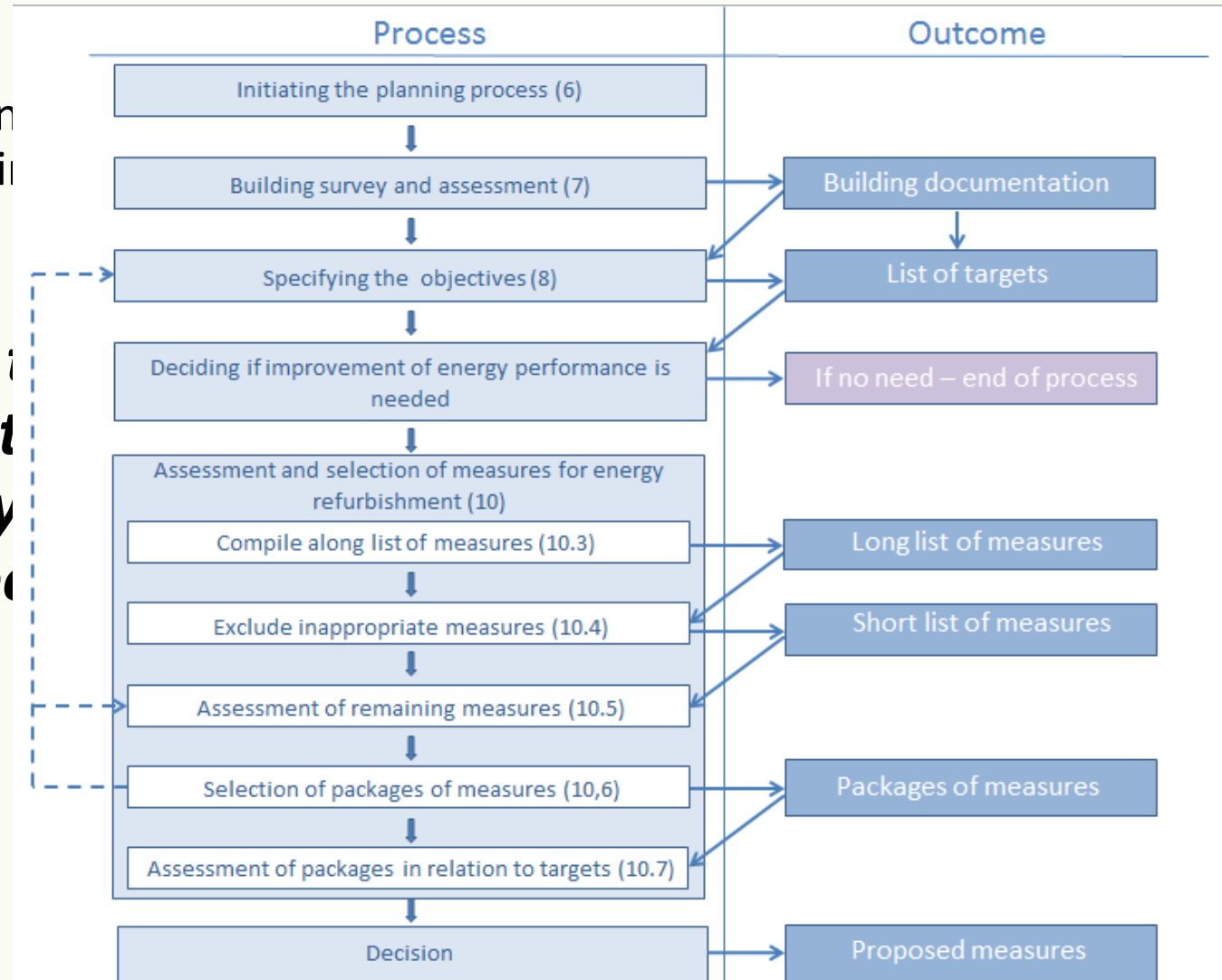
Speakers from Ireland, UK and Europe:

- *Dr. Cathy Daly*
- *Chris Morgan*
- *Keith Jones*
- *more examples...*



This is a little known  
Standard or Guideline

# ***Guidelines for the Retrofit of Historic Architecturally Culturally Important Buildings.***



# Deep Energy Renovation Of Traditional Buildings

## Social Housing in Preston, UK



 alamy stock photo

BJGM0Y  
www.alamy.com

# Deep Energy Renovation Of Traditional Buildings

## What not to do





# Deep Energy Renovation Of Traditional Buildings





# Deep Energy Renovation Of Traditional Buildings

## Internal Conditions within 7 Years



# Deep Energy Renovation Of Traditional Buildings

## Closer to Home



# Sustainable Development Goals





# We Need to Stop This.



We Hope to Get to This.





*Thar*



*tion.*