NZEB

NATIONAL SKILLS SPECIFICATION
NEARLY ZERO ENERGY BUILDING
FUNDAMENTAL AWARENESS

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NZEB

Foreword for the

National Skills Specification for Nearly Zero Energy Buildings,

Waterford and Wexford Educational Training Board (WWETB)

by

Mr. Damien English, T.D.

Minister for State - Housing and Urban Renewal.

As a Government we are committed to responding to climate change through our policies and legislation. The implementation of Nearly Zero Energy Buildings (NZEB) is a key action for the built environment in contributing to Ireland's Low Carbon Transition and Mitigation Plan. This requires a change in how we live. In Ireland, approximately 40% of total energy produced is used in the building sector. Whilst we are a small country we can play a leadership role and one significant area we are doing this in is NZEB.

Having advanced our performance standards for new dwellings over the last 10 years for which we have received international recognition, we are now addressing the significant challenge to improve existing dwellings by introducing a minimum standard for major renovations i.e. cost optimal level. To turn these high performance standards into reality on site we need a highly skilled construction workforce with a good understanding of the principles of energy efficiency, and the roles and responsibilities of interacting trades.

The delivery of our housing and climate action targets is dependent on having a properly trained workforce with the right skills and training in place. Thanks to Waterford and Wexford Education and Training Board (WWETB), in partnership with key stakeholders, a programme to deliver Nearly Zero Energy Building Construction skills to existing tradespersons and professionals in the construction sector has been developed. Key stakeholders in this highly collaborative initiative have included the Department of Education and Skills, Department of Housing, Planning and Local Government, the Department of Communication, Climate Action and Environment, the Sustainable Energy Authority of Ireland , SOLAS, the National Standards Authority of Ireland, the Irish Green Building Council, the Construction Industry Federation, Connect Trade Union, Limerick Institute of Technology, Carlow Institute of Technology and Waterford Institute of Technology.

These courses come at a time when skills are becoming an important resource in Ireland's ability to deliver housing. There will be a significant demand for these NZEB skills, given that all new buildings in Europe must be NZEB by the 31st Dec 2020. In Ireland, all new buildings which start construction in 2019 are required to meet the NZEB standards as set down in Part L of the Building Regulations. This is also a key measure in Ireland's Climate Action Plan and is identified in Action 50 of the plan to skill-up current contractors/other industry players in deep retrofit, NZEB and new technology installations.

Ireland is committed to Climate Action and is showing international leadership in the area of new Nearly Zero Energy Buildings. The United Nations Economic Commission for Europe are supportive of the development of this programme and Ireland looks forward to cooperation with the UNECE on this programme and in other areas related to the sharing of information in the development of Nearly Zero Energy Buildings at an international level.

This collaboration with UNECE will enable Ireland to show leadership internationally in addressing climate change and to share the lessons and skills we are learning with both the developed and developing world. This initiative will support Ireland's contribution to the UN Sustainable Development Goals by training people and supporting a skilled workforce.

I wish Waterford and Wexford Education and Training Board well with this first of its kind initiative and look forward to meeting the craft workers who avail of this training across all of the trades covered. This will make a valuable contribution to the delivery of sustainable and quality housing in Ireland. It is a key action for the Built Environment in contributing to Ireland's role in addressing Climate Change and supports the implementation of Action 50 of the Climate Action Plan to Skill-up current contractors/other industry players in deep retrofit, NZEB and new technology installations. To those who are taking part in this training, I wish you all well and I'm sure it will be of great benefit to you in your future careers in the construction industry.

Damien English, T.D.
Minister for State,
Department of Housing and Urban Renewal

Foreword for the

National Skills Specification for Nearly Zero Energy Buildings,

Waterford and Wexford Educational Training Board (WWETB)

by

Mr. John Halligan, T.D

Minister of State for Training, Skills, Innovation, Research and Development

The National Skills Strategy set a clear direction for lifelong skills development and for a workforce that is flexible, adaptable and capable of dealing with the challenges and opportunities posed by the major forces influencing the world of work. The challenge of tackling climate change, growing the use of renewable energy and improving the energy efficiency of homes, businesses and public services are having a significant influence in workplaces and working lives across sectors and regions.

Thanks to a highly collaborative project led by WWETB and supported by a broad range of stakeholders including; the Department of Education and Skills, Department of Housing, Planning and Local Government, the Department of Communication, Climate Action and Environment, the Sustainable Energy Authority of Ireland, SOLAS, the National Standards Authority of Ireland, the Irish Green Building Council, the Construction Industry Federation, Connect Trade Union, Limerick Institute of Technology, Carlow Institute of Technology and Waterford Institute of Technology, the first NZEB skills specifications have been produced - one of the first internationally for crafts persons in the construction sector. These courses come at a time when skills are becoming an important resource in Ireland's ability to deliver housing.

Not only will there be interest in these NZEB skills specifications nationally, I understand there is also international interest and many other countries wish to learn from Ireland's experience in this area. The United Nations Economic Commission for Europe (UNECE) is committed to working with the relevant authorities and stakeholders to develop an International Centre of Excellence in High Performing Buildings in Wexford. This national skills specification will form a cornerstone of that collaborative project at both a national and international level."

Education and training institutions have a long track record of working with the construction industry, both in training those entering the sector at the start of their working lives and, increasingly, in supporting skills development within the construction workforce. As the sector adapts to meet the challenges and the significant opportunities of providing high performing homes and buildings and improving the energy performance of our existing building stock, the education and training sector are there to support them. The development of this programme also supports Ireland's Climate Action targets and is key measure in Action 50 of the Climate Action Plan. Consistency in training delivery and the framing of training standards will underpin our success in this area.

I would like to congratulate Waterford and Wexford Education and Training Board and their partners in the development of this training programme which is being delivered at a critical time to meet Ireland's housing needs and climate action challenge.

Mr. John Halligan, T.D

Minister of State for Training, Skills, Innovation, Research and Development

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FUNDAMENTAL AWARENESS

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1. INTRODUCTION

On behalf of Waterford and Wexford Education and Training Board (WWETB), I am very pleased that we are playing our part in enhancing the skill-set of the national construction workforce in relation to Nearly Zero Energy Buildings (NZEB). WWETB Training Services have a proud and well-recognised tradition of being to the fore nationally in training craft apprentices and Wexford County Council has been exemplary in developing high performance energy efficient housing. It was from this initial partnership that the momentum for NZEB Skills Training emerged and this was heightened by the national imperative to develop National Skills Training response to meet the upcoming challenges. In addition, the WWETB Strategy Statement 2018-2022 prioritises collaborations and innovative training developments such as NZEB.

Minister for State for Housing and Urban Renewal, Mr. Damien English, T.D., in his foreword to this document has listed the wide range of participants who worked together with WWETB to produce the first National NZEB Skills Specifications in Ireland and we cannot thank them enough for their commitment and enthusiasm for the project. In addition, I wish to thank SOLAS who financially supported us, and without whose help this project could not have progressed to this stage. I would like to, also, acknowledge the Department of Education and Skills for their on-going support of WWETB. We are very proud to have played a leadership role in this development and we will now proceed to ensure the widest possible access to this learning is available to upskill the construction industry in NZEB. It is very gratifying that the United Nations Economic Commission for Europe (UNECE) have shown such interest in the project and we will continue to work with them in the potential development of a National Centre of Excellence in High Performance Buildings in Co. Wexford

These developed documents have now been converted to the curriculum to meet the requirement of the NZEB Skills Specifications and the process will continue to develop and adapt appropriate training programmes and manuals. This will enable training to commence at the WWETB National NZEB Training Centre in Enniscorthy. It is our hope that these National Skills Specifications and subsequent training programmes will ensure that the construction industry is well prepared to meet the legislative requirement whereby 31st of December 2020 all new buildings must meet the Nearly Zero Energy Building standard.

The National Skill Specifications have been developed in the following areas: NZEB Fundamentals, NZEB for Electricians, Bricklayers, Plasterers, Carpenters, Plumbers, and Site Supervisors, This broad range of training opportunities will enable all involved in the construction industry to continue to be at the cutting edge in supporting Ireland's Low Carbon Transition and Mitigation Plan. We, in WWETB, look forward to working with the construction industry and all our other partners in this area to ensure the provision of these most relevant training opportunities in NZEB available anywhere globally.

Kevin Lewis
Chief Executive
Waterford and Wexford Education and Training Board (WWETB)

2. NZEB PRINCIPLES

Understand the Principles relevant to NZEB, Building Regulations and Product Standards.

KNOWLEDGE

- Explain why it is important to reduce the energy demand and consumption in buildings.
- Define the acronym 'NZEB'.
- Briefly outline the EPBD and EED drivers relevant to building regulations and NZEB.
- Explain the importance for energy efficiency combined with the need of the production and use of renewable energy.
- Define the timeframe deadlines that all new/existing dwellings are to comply with the NZEB standard.
- Describe how the NZEB standard relates to existing buildings, extensions, change of use and major renovations which affect more than 25% of the surface area of the building (deep retrofitting).
- Explain the importance of minimising heat loss through the building envelope.
- Describe the key renewable energy technologies most relevant to NZEB in Ireland.
- Explain the importance to building occupants in achieving adequate levels of ventilation, lighting and thermal comfort.
- Describe the key roles of adequate ventilation in meeting the fresh air needs for the occupants of the building, as well as preventing excessive levels of relative humidity and the associated risks of mould and condensation.
- Describe the key information presented in the acceptable construction details (ACDs), namely insulation placement, airtightness detailing and avoiding thermal bridging.

3. BUILDING PHYSICS

Understand Building Physics – Key energy terms and units

KNOWLEDGE

- Describe the different means by which heat flow occurs in a building.
- Describe the terms "U-value" and "R-value", including their units, and explain their practical relevance, with regards to the energy efficiency of dwellings and achieving NZEB compliance.
- Describe the consequences of poorly insulated dwellings.
- Describe the term "thermal bridging".
- Describe the practical relevance of thermal bridging with respect to energy efficiency and NZEB compliance for dwellings.
- Describe the consequences of having poor thermal bridge detailing in dwellings.
- Describe the term "air-permeability" and explain its practical relevance with regards to the energy efficiency of dwellings.
- Describe the consequences of having high air permeability in dwellings.

- Describe the potential adverse effects arising from penetrations in the building envelope considering both thermal and moisture movement.
- Explain the importance of minimising heat loss through the building envelope
- Outline the benefit of maximising heat gains in buildings through the windows whilst ensuring that buildings do not overheat.
- Describe key factors that affect occupant comfort in a building, including temperature, relative humidity, air speed and indoor air quality.

4. BUILDING FABRIC

Understand Building Fabric: Continuous Insulation / Thermal Bridging / Air Permeability and Windows and Doors.

4.1 CONTINUOUS INSULATION

KNOWLEDGE

- Describe the importance of creating a continuously insulated thermal envelope in order to reduce heat loss through the building fabric.
- Describe the risks associated with poor workmanship relating to continuity of the insulation layer by considering reducing the number and size of service penetrations.
- List those parts of the building envelope where special attention must be directed towards ensuring unbroken continuity of insulation.
- Identify and label the key insulation related measures presented on the acceptable construction details (ACDs) for cavity walls and timber frame.
- Describe the most commonly used interventions to prevent or reduce thermal bridging.
- Identify thermal bridging in thermographic images.

4.2 THERMAL BRIDGING

KNOWLEDGE

- Identify where thermal bridges are commonly found in dwellings.
- Explain why thermal bridging typically occurs at such locations.
- Describe the potential risks associated with poor workmanship relating to thermal bridging,
- Describe the potential adverse structural impacts to the building when thermal bridging occurs, with regards to risk of mould and condensation.
- Describe the potential adverse health impacts to occupants of the building when thermal bridging occurs, with regards to risk of mould and condensation.

4.3 AIR PERMEABILITY

KNOWLEDGE

- Describe how the air permeability of a building has an influence on heat loss.
- Describe the multiplicity of benefits that airtightness brings to dwellings.
- Describe the multiplicity of benefits that wind-tightness brings to dwellings.
- List common leakage points in both masonry and timber frame construction types.
- Describe the key concept of “unbroken continuity” as it relates to the formation of an airtight building.
- State the maximum level of air-permeability allowed in Part L of the Building Regulations for compliance with NZEB, including its units.
- State the level of air permeability below which mechanical ventilation is required.
- Describe the techniques and types of materials that are commonly used to create the airtight layer.
- Describe the most critical locations (including junctions) where meeting the airtightness target presents the greatest challenge.
- Explain the importance of not reducing the effectiveness of the installed airtightness and vapour control layer though removal or damage.
- Describe the risks associated with poor workmanship relating to airtightness.
- Describe the importance of the sequence of tasks that should be followed in an airtightness strategy in order to ensure that the most optimal result is obtained.
- Describe the benefit of completing an early initial airtightness test.
- Explain the importance of providing adequate ventilation to a dwelling with increased levels of airtightness.

4.4 WINDOWS & DOORS

KNOWLEDGE

- Describe the energy efficiency and comfort related function of windows, highlighting their role in relation to thermal protection, solar gains and ventilation.
- Describe the importance of connecting the windows and doors to the insulation layer and the airtight layer.

5. BUILDING SERVICES

Understand Building Services: Space Heating and Domestic Hot Water, Controlled Ventilation, Lighting ICT and Smart Technology.

5.1 SPACE HEATING & DOMESTIC HOT WATER

KNOWLEDGE

- Explain in outline why space heating and domestic hot water provision is typically one of the highest sources of carbon emissions from a dwelling.
- Explain in outline why all hot water storage vessels, pipes and ducts associated with the provision of heating and hot water should be fully insulated.

5.2 CONTROLLED VENTILATION

KNOWLEDGE

- Describe in outline the differences between natural/background/combined/ mechanical ventilation.
- Explain why the importance of controlled ventilation increases with decreasing air permeability.
- Describe the different kinds of controlled ventilation systems that can be used for different types of dwellings (continuous, intermittent, whole-house individual room, with and without heat recovery, demand controlled and others).
- Explain the importance of having a ventilation system designed, installed, balanced and commissioned by competent installers.
- Explain the importance of regularly changing the filters on an MVHR system.

5.3 LIGHTING, ICT & SMART TECHNOLOGY

KNOWLEDGE

- Explain in outline why lighting constitutes significant regulated electrical loads in dwellings.
- Describe the energy labelling used for light bulbs and appliances.

6. RENEWABLE ENERGY, PHOTO-VOLTAICS, SMART METERING & ELECTRIC VEHICLES

Understand Renewable Energy, Photo-Voltaics, Smart Metering and Electric Vehicles.

KNOWLEDGE

- Define the minimum level of energy provision required from renewable energy technologies to comply with NZEB requirements.
- Describe in outline “renewable energy technologies” and cite examples of the different types of technology that qualify as providing renewable energy.

7. COMMUNICATION & USER INFORMATION

Understand communication and user information.

KNOWLEDGE

- Explain the importance of ensuring good communication between all trades on the site as part of an overall ‘system-thinking’ approach to achieve NZEB compliant dwellings. In particular, communication with those trades which regularly make penetrations through the airtight and insulation layers (including electricians and plumbers) is especially critical.
- Apply collaborative teamwork and “system thinking” on-site with all trades.
- List key aspects that require excellent communication on-site, especially the strategies being used for airtightness, vapour control, continuous insulation and thermal bridging to achieve NZEB compliant dwellings.
- Outline the key sequences that must be followed in order to meet the airtightness targets and communicate these to the site/supervisor and all relevant trades.
- Understand the details specified in construction drawings with respect to thermal bridging, air tightness and window positioning and how not to reduce their effectiveness.
- Describe what information needs to be provided to the homeowner to ensure that the building is operated and maintained to its optimum, including special emphasis on energy efficiency.
- Explain the importance of continuing professional development CPD, (continuous training) and association with relevant national quality assurance standards.
- Understand where CPD and future accredited training can be obtained in relation to the NZEB standards.

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