

1.11 - ENERGY EFFICIENT DESIGN (EED) And NET CARBON ZERO DESIGN PROCESS GUIDANCE

For

Design Teams & Design Stage Report Template

As part of

Technical Requirements & Scope of Services - All Framework Lots
and all Projects > €1.0million

For	Design Team Services.
For	<i>HSE National Design Team Services Frameworks 2024.</i>
For	Health Service Executive (HSE) or other tendering body as defined as HSE Group or Tusla.
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EED PROCESS for use for All Framework Lots and all Projects > €1.0million

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SECTION 1: GUIDANCE

1.1 Introduction – Objective:

Organisation, processes, guiding principles and control measures to be implemented in design projects for the purpose of reducing the lifecycle energy consumption and GHG emissions of the building in use and achieving a building that is Carbon Zero Ready (i.e. will be carbon zero when the electrical grid decarbonises)

Set out the project-specific EED and Carbon Zero Ready objectives. The EED process shall:

Be applied to all projects with a value greater than €1.00M.

Be measured, communicated and updated by means of the EED Report in the standard format set out in this guidance and the EED Report must be prepared for each design stage and signed off by the HSE project Manager/EED Owner.

1.2 EED Facilitator Duties:

The EED Facilitator is responsible for coordinating the EED process, organising meetings with the EED Owner and DT in order to challenge the design and design assumptions in line with the IS399 process. This is to ensure that the Client ends up with the most energy efficient building possible which is also Net Carbon Zero Ready.

The EED Facilitator is responsible for the day-to-day execution, coordination and management of the EED process and activities during the project lifecycle. They shall carry out the functions outlined below from Stage (i) Concept Design to Stage (v) Handover of the project.

1.2.1 Implementation Plan:

The EED Facilitator will issue an Implementation Plan **within 1 month** of appointment as EED Facilitator.

Aligned with IS 399, the Implementation Plan shall include the following:

- A description of scope and boundaries and the baseline design that represents the starting point of the EED project.
- A list of EED project objectives.
- Overall project timelines.
- An appropriate schedule of EED design reviews and required participants.
- Requirements for energy measurement, monitoring and reporting.
- Communication requirements between the EED owner, EED facilitator and the project design team.
- Varying operating conditions that the asset is likely to experience when operating.
- Criteria by which significant energy uses are determined.
- The criteria for selecting energy performance opportunities for implementation.
- Criteria for measurement and verification (M&V) of the energy performance of implemented opportunities.
- The requirement to verify the design energy performance of significant energy using equipment installed.
- The procurement and contracting strategy where it can impact on EED.
- The risks and opportunities identified.
- Consideration of any national policies or other mechanisms that could support the viability of energy performance opportunities.

1.2.2 EED Project Stage Report

Aligned with IS399 process, the EED facilitator shall be responsible for preparing an EED project stage report. This report shall include:

- An assessment of the extent to which the EED objectives were achieved.
- Outputs of the design for energy performance process.
- Outputs of the design for efficiency in operation process.
- Description of any co-benefits arising. e.g. environmental, patient/staff well-being, production, quality, and health and safety benefits.
- Financial implications including capital expenditure (Cap-Ex), Op-Ex and associated return on investment;
- All documented opportunities, including their final status in the context of the project.
- Energy performance in operation training delivered to operations personnel.
- Lessons learnt.
- The outputs of energy performance verification.

NB: The EED Report, throughout all stages, shall track the level of savings (kWh/tCO₂/€) achieved through the EED process. The baseline shall be the TGD Part L compliant version of the building in question without the use of fossil fuels and for retrofit projects, the baseline shall be the existing building energy consumption profile. This shall be the baseline from which savings will be compared and LCC etc. analysis is based on. Variances in the kWh, CO₂ and € shall be documented and explained between the various EED Stage Reports. Co-benefits or intangible/unquantifiable benefits must also be documented in the EED report.

For major renovation/retrofit projects, the baseline shall be the existing building energy consumption profile.

The EED project summary report shall be reviewed and approved by the EED owner (Client Project Manager). The EED Facilitator will issue 3 Nr. detailed EED Project Summary Reports for each of the Design Process Stages (Stage (i), Stage (ii)a + Stage (ii)b) as well as an EED Stage (v) Summary Report in line with the Project Programme.

The EED Facilitator as part of their core duties is also required to review and improve on the design proposals required to comply with the Government's Climate Action Plan (including Appendices and Annex and Amendments).

Compliance with the TGD Part L falls into two distinct categories (1) new builds and (2) refurbishment of existing facilities. The performance requirements are as follows:

New Building

Compliance with TGD Part L (NZEB)

Ensure design provides and will facilitate a clear roadmap to net zero carbon in accordance with the HSE obligations for 2030 and 2050 i.e., 51% absolute carbon reduction and net zero carbon respectively.

Existing Buildings must achieve

- a minimum 50% improvement in energy efficiency against baseline carbon emissions
- a minimum 51% reduction in Scope 1 & 2 carbon emissions against baseline carbon emissions
- Ensure design provides and will facilitate a clear roadmap to net zero carbon in accordance with the HSE obligations for 2030 and 2050
- Baseline energy and carbon emissions is the annual average consumption data for the years 2016 – 2018 inclusive.

It is noted that public bodies can no longer install fossil fuel systems or replace old fossil fuel systems unless one of the following criteria is satisfied:

- The fossil fuel use is only through the use of electricity from the grid
- There is no technically viable non-fossil alternative (generally only related to applications for a purpose other than space heating)
- Where the installation of a renewable space heating system would increase the final energy consumption or CO2 emissions. The fossil fuel use is provided for backup, peaking, or operational purposes (and makes up less than 10% of annual heating energy). If fossil fuels are used for back-up/peaking, then verification that its use is less than 10% of the thermal demand of the building energy will need to be carried out at stage 5 prior to project sign-off.
- The fossil fuel is part of a credible phased pathway to net zero emissions (e.g. to allow the building to be connected to a planned district heating system)

The Design Team and EED Facilitator shall fully understand and take account of any benefits achieved (and projected) from de-carbonisation of the different utility infrastructures in completing the designs and reports for net zero carbon buildings. **This must include consideration for the shadow cost of carbon.**

The DT will provide an update as part of their contractual obligations on CAP compliance at Stage (i), Stage (ii)A, Stage (ii)B and Stage (ii)C for the EED Facilitator to review.

1.2.3 Design Stages:

The EED Facilitator will issue 3 Nr. detailed EED Reports for each of the Design Process Stages (Stage (i), Stage (ii)A and Stage (ii)B) as well as an EED Stage (v) Summary Report in line with the Project Programme.

Each of the design stage EED reports should include the following headings as a minimum:

1. Introduction and Project-Specific EED Objectives
2. Part L Compliance Declaration:
 - a. Provisional BER.
3. Energy Data.
4. Create an Energy Balance Report.
 - a. System (lighting, heating, ventilation, process energy etc).
 - b. Energy source (gas, elect etc).
 - c. Annual kWh, € and CO2.
5. Design for efficiency in operation
6. Planning for energy performance verification
7. Overheating Analysis
8. Challenge & Analyse

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9. Develop a Register of Opportunities:
 - a. Assess & Evaluate Opportunities:
 - (i) Capital Cost.
 - (ii) Energy Saving kWh.
 - (iii) Cost Saving kWh.
 - (iv) Life Cycle Cost Analysis
 - (v) ROI.
 - b. Provide recommendations based on review.
 - c. Description of any co-benefits arising. e.g. environmental, production, quality, and health and safety benefits.
10. An assessment of the extent to which the EED objectives were achieved.
11. Agree Targets for the next phase of the Project (if applicable).
12. Lessons learnt.

1.2.4 Construction Stage:

The duties of the various project team members in relation to the EED process during the construction phase are as follows:

The DT must review all technical submissions issued by the Contractor and issue a report on project design compliance.

- The EED Facilitator will undertake an independent review of the report.
- This will be on-going throughout the Construction Stage.
- **Approval of technical submittals will remain the responsibility of the DT members.**

Handover Stage:

The EED Facilitator will review handover documentation (commissioning certs, O&M's, safety file) and provide an independent report and analysis of the Energy Management protocol and submit a final EED Project Summary Report.

1.3 Alignment of Energy Efficient Design (EED) Process with HSE Capital Project Design Process:

The table below summarises the symmetry between the processes.

HSE Capital Project Design Process	EED Process
Stage (i) – Preliminary Design	Implementation Plan
	EED Stage (i) Report
Stage (ii) a – Scheme Design	EED Stage (ii)(a) Report
Stage (ii) b - Developed Design	EED Stage (ii)(b) Report
Stage (ii) c – Detailed Design/ Tender Documents	Review EED Elements of Tender Documents (checklist from Stage (ii)(b) report)
Stage (iii) Tender Action	
Stage (iv) Construction Start/End date	EED Facilitator will occasionally attend site meetings as required
Stage (v) Commissioning & Handover	EED Stage (v) Summary Report

[End – Section 1: Guidance]

SECTION 2: EED REPORT TEMPLATE

Energy Efficient Design (EED) Guidance & Template

2.1 EED Report Template:

The headings outlined in Section 1.2.3 above are to be included in the EED Report as a minimum.

** All text highlighted in yellow is for information purposes only and is not required to be included in the version of the report issued to HSE.*

The author can expand on any of the tables included in the report. In the case where a Section is not applicable, it should not be deleted, and N/A should be inserted under the Section heading

2.1.1 Introduction and Project-Specific EED Objectives

Introduction and overview of project focusing on main aspects related to EED. Agree the **project-specific** EED Objectives with the EED Owner and wider project team. The EED objectives shall:

Be appropriate to the size, nature and complexity of the investment.

- Be compatible with the strategic direction of the organization.
- Be measurable (if practicable).
- Be communicated; and
- Be updated as appropriate throughout the project.

Below also are some sample EED objectives:

- To use the least carbon intensive construction materials available
- To achieve a minimum of A2 or A1 BER rating
- To achieve a CPC (Carbon Performance Coefficient) of less than 1 or other value
- To achieve a RER (Renewable Energy Ratio) of 0.25 or xxx excluding the heat pump contribution
- For a refurb it could be to reduce CO2 emissions by more than 51% of current emissions
- To maximise PV technology e.g. PV carports, flat roofs etc.
- To use geothermal heat pumps if deemed feasible after ground tests.
- To maximise rainwater harvesting.
- To achieve a maximum construction material waste of xx%

2.1.2 Part L Compliance Declaration:

The Design team must confirm that all elements of the design comply with TGD Part L. If applicable, they shall identify any elements that do not comply, together with the reasons for non-compliance and the associated consequences/risks. The compliance declaration must include the Primary Energy Equivalent (PEE).

2.1.3 Energy Data

Provide an overview of the energy data as it relates to the project. The accuracy of this data will depend on the project stage but can be developed and examined as the design develops. The EED Facilitator must provide commentary and insight into the data to unlock potential opportunities.

2.1.4 Create an Energy Balance Report.

An energy balance study of the baseline design shall be undertaken at the earliest possible stage and include:

- Areas where opportunities for energy performance improvement may exist.
- All energy uses and proposed energy sources.
- An annual energy-consumption profile including assumptions.
- An estimate of the annual energy-consumption costs including assumptions.

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- Identification of significant energy uses; and
- A description of the appropriateness of the baseline design.

The energy balance must also consider carbon emissions and/or primary energy sources. The energy balance must also break down usage into systems, energy source (gas, elect etc), annual kWh/€/CO₂ etc.

NB: The EED Report, throughout all stages, shall track the level of savings (kWh/tCO₂/€) achieved through the EED process. The baseline shall be the TGD Part L compliant version of the building in question without the use of fossil fuels and for retrofit projects, the baseline shall be the existing building energy consumption profile. This shall be the baseline from which savings will be compared and LCC etc. analysis is based on. Variances in the kWh, CO₂ and € shall be documented and explained between the various EED Stage Reports. Co-benefits or intangible/unquantifiable benefits must also be documented in the EED report.

For major renovation/retrofit projects, the baseline shall be the existing building energy consumption profile.

2.1.5 Design for efficiency in operation

The design for efficiency in operation shall evaluate all significant energy consuming equipment, processes or systems and include:

- Consideration of operating and maintenance control.
- Operational energy performance under planned and unplanned variability across a typical range of operating conditions.
- Identification and review of the impact of potentially relevant variables on energy performance.
- A review of the potential for deterioration in energy performance during operation; and
- A measurement and data collection plan considering the above in relation to energy consumption, relevant variables and operating parameters. **For example, all heat pumps must include metering to measure electric energy in, thermal energy out so that COP can be monitored post-handover.**

The design should avoid any unnecessary impediments for operation or maintenance. Where appropriate, outputs of the design for efficiency in operation may be incorporated into the operational planning and control of an energy management system as described in I.S. EN ISO 50001.

2.1.6 Planning for energy performance verification

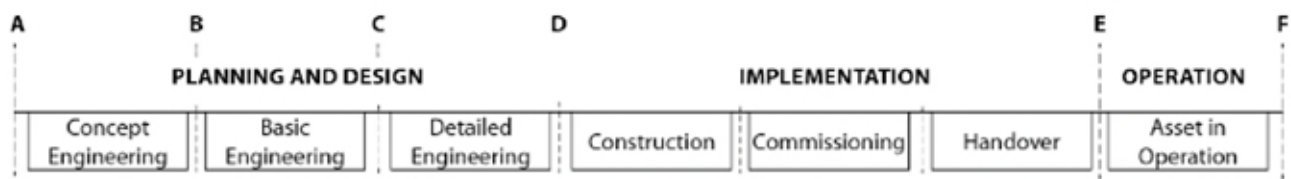
An energy performance verification plan shall be prepared to include:

- The project verification requirements, which will include as a minimum the verification of the design energy performance of the significant energy consuming equipment, processes or systems.
- The planned M&V method(s), including justification
- The measurement and data collection requirements.
- The minimum M&V requirements include verifying the project at handover (E) as illustrated below against the baseline design(s) (A, B or C) or final design (D).

The following options for energy performance verification should be considered in operation (F) against:

1. Handover (E).
2. The final design (D/Stage (ii)b).
3. Building regulations or corporate standards; and
4. An existing similar asset.

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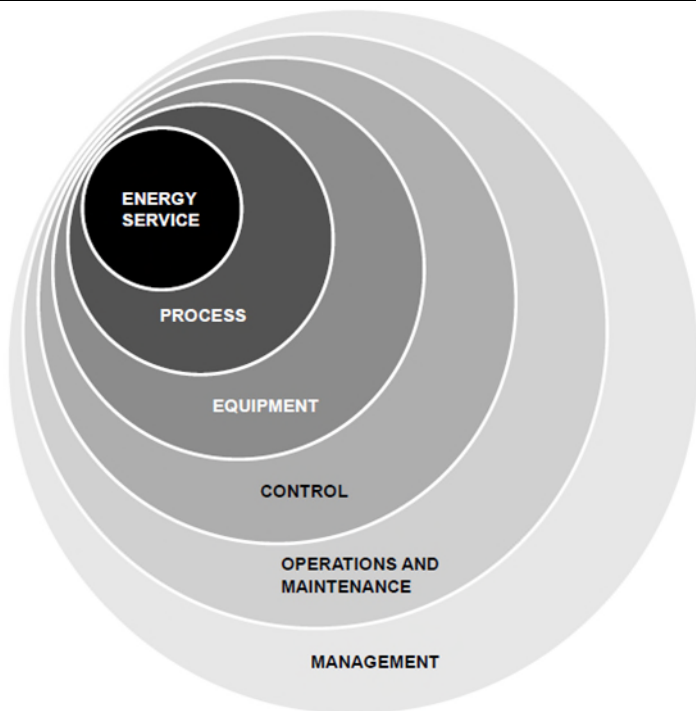
2.1.7 Overheating Analysis

The overheating analysis itself is the responsibility of the Design Team. The design team must demonstrate as part of the overheating analysis that the measures adopted do not introduce an unacceptable risk of overheating. **The DT must also demonstrate that all possible passive measures have been exhausted before any mechanical ventilation or cooling is considered. It is expected that the EED Facilitator shall challenge the DT assumptions such as internal gains, the use of blinds, etc.**

This section in the EED Report should be used to discuss any overheating issues along with possible solutions and updated as the design progresses.

2.1.8 Challenge & Analyse

The Energy Venn Diagram (Figure A.3) helps us understand factors influencing energy consumption. The central part, called the "energy service," has the most impact on energy needs, while elements outside it have a smaller effect. Refer to IS 399 Table A.1 which defines each layer with examples. In the design stage, focus on identifying major energy users, understanding their energy service, and then challenging and analysing it, moving outward through the diagram layers. This systematic approach ensures all opportunities to reduce energy consumption are considered during design, followed a robust challenge and analyse methodology. Other approaches aligned with the Energy Venn Diagram can also be used for comprehensive consideration.



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The table below shall be used and outlines the design team's responses to the various different design elements both passive & active to be considered under Challenge & Analyse as part of this project.

It is expected that the EED Facilitator is competent and knows that the challenge and analyse stage addresses energy service, process, equipment, controls, operation and maintenance and management.

<u>Energy Service</u>	<u>Process</u>	<u>Equipment</u>	<u>Control</u>	<u>Operation & Maintenance</u>	<u>Management</u>
e.g. Lighting	Natural or artificial lighting	LED Lighting	Occupancy control Appropriate type of sensor to deliver good energy performance for the application e.g., infra-red, sonic, ultrasonic. Dimming based on space lighting levels and natural light-level available;	Placement of fittings to allow for maintenance e.g. for use of uplighters and ceiling reflectors it may be most effective to avoid placing fittings at high (difficult to access) positions. Recommended maintenance practice including optimal replacement of lamps if applicable. If fittings can be easily cleaned. If roof lights/windows can be easily cleaned. Potential for roof lights to remain transparent over time. Alignment of lighting and controls to evolving occupancy patterns; and If training or guidance for operators and/or maintenance personnel should be included in handover process.	Items to consider could include: development of lighting EnPI(s). guidance on night-time lights on checks for security or cleaning personnel; and highlighting elements of lighting use that people can change or control as input for awareness campaigns.

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Project Design Considerations Summary:

General Design Considerations	Min Requirement for Stage	EED Facilitator Comments	Design Team Response
Challenge Schedule of Accommodation and layout efficiency.	Stage 1		
Building Orientation: (Add notes/guides).	Stage 1		
Fabric Thermal Performance.	Stage 1/2a		
Glazing: (u-values, g-values etc., wall/glass ratio).	Stage 1/2a		
Air Tightness.	Stage 1/2a		
Thermal Bridging.	Stage 1/2a/2b		
Daylight Availability (including sun-cast study).	Stage 1/2a/2b (Report issued by DT)		
Glare Consideration.	Stage 1/2a		
Solar Gain Implications.	Stage 1/2a		
Purge ventilation implications.	Stage 1/2a		
Natural Ventilation Analysis (% of areas to be naturally ventilated, overheating etc.).	Stage 1/2a/2b (Report issued by DT)		
Water Conservation Measures e.g. low water use appliances, rainwater harvesting, etc.	Stage 2a/2b		
Other.			
Active Design Element Considerations			
System Selection – HVAC & Domestic HW (Refer to Heating System Selection Matrix).	Stage 1/2a		
Ventilation Requirements (e.g. optimisation of ACH).	Stage 1/2a		
Lighting Strategy (e.g. lighting levels, lighting load etc.).	Stage 1/2a/2b		
Controls Strategy – Text Narrative describing controls functional content (e.g. Demand response, temperature optimisation, maximising free cooling, opportunities to smooth the peak load, ease of operation of controls, Information provision and labelling strategy, Fail safe design)			
Energy Metering Strategy, Water metering and sub-metering.	Stage 2a/2b		
Renewables			
Renewable energy design (e.g. viability of proposals etc.).	Stage 1/2a/2b		Include in system selection above (percentage of renewables and kW/m ²)
Systems considered e.g. heat pumps, geothermal heating and cooling, biomass, biofuel, district heating, PV etc.			
Water Conservation			
Rainwater harvesting	Stage 1/2a/2b		Include capacity, location, treatment (if any) and what it will serve. Include annual litres of water saved etc.
Waterless urinals, low flow taps/shower heads/Other			

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2.1.9 Register of Opportunities – Initial Register of Opportunities:

NB: The criteria for selection of energy performance opportunities for implementation are set out below. It is important that the criteria are clearly set in order to avoid implementing opportunities which will not benefit the project. The below **must** be supported with analysis/calculations/documentation etc.

- Simple Payback.
- Net Present Value Calculation – must include shadow cost of carbon.
- Lifecycle Costing Calculation – must include shadow cost of carbon.
- Investment Matrix which considers Cost, Savings & Ease of Implementation.
- Avoided CO2 emissions (tonnes) – based on PEE.

As there may be a requirement to perform detailed costings in order to determine if some opportunities are feasible, it is possible to carry this process out as a two-stage process. This would include:

- Reviewing the feasibility of each opportunity with the project team
- Performing calculations on those opportunities which are deemed feasible in order to ensure that they meet the additional criteria as set out.

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For major renovation/retrofit projects, the baseline shall be the existing building energy consumption profile.

Ref	Category	Fuel	Opportunity	kWh Savings	CO ² savings	€ Savings	SPB (years)	Status	Comments (incl. co-benefits)
1	Space Heating	Electricity						Rejected.	
2	Hot Water	Gas						Under Consideration.	
3	Lighting	Electricity	e.g. daylight sensors	20,000	8.72	€2,400	4	Approved.	
*Savings and other values above (SPB, NPV etc.) are to be calculated based on savings achieved when compared to compliant alternatives									

2.1.10 Register of Opportunities – Analysis of Opportunities:

Include any supplementary info to support the Register of Opportunities as necessary.

2.1.11 Next Steps – Design Stage Reports:

At the end of each design stage, the EED Facilitator shall outline design elements to be expanded on in preparation for the next Stage EED report e.g. SFP, lux levels etc. (lead into next stage).

2.1.12 Next Steps – Construction Stage:

At the end of the design stage, the EED Facilitator shall outline the project construction milestones which require EED Facilitator involvement. This may include a checklist table for them to audit at each milestone.

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2.1.13 Summary of Outcomes:

Outline the outcomes from the EED process.

Avoided Energy	
Avoided CO2	
Building Performance above benchmark	
Design decisions made that require a compromise on energy performance	
Lessons learnt from process	
EED related CAPEX savings	
Co-benefits e.g. H&S, environmental, lean etc.	

2.1.14 Commentary on lessons learned to date

An assessment of the extent to which the EED objectives were achieved. Agree targets for the next phase of the Project.

[End – Section 2: Report Template]