

# IRISH GPP CRITERIA: **HEATING EQUIPMENT**



# IRISH GPP CRITERIA: HEATING EQUIPMENT



This document sets out the core and comprehensive GPP criteria for the purchase of heating equipment by Irish public bodies. The criteria cover the procurement of:

- Gas, electric, liquid and solid fuel boilers, including biomass boilers and cogeneration equipment
- Water heaters
- Electric and fuel-driven heat pumps
- Steam systems
- Solar thermal collectors

Note that the following items within these criteria are included in the SEAI Triple E Register, meaning that it is a requirement under Irish law<sup>1</sup> that public bodies only purchase products which meet the Triple E Register criteria (which are incorporated in these GPP criteria):

- Boilers and Hot Water Heaters
- Boiler Controls
- Condensate Recovery Systems
- Biomass Boilers
- Cogeneration equipment
- Heat pumps
- Steam Systems
- Localised Steam Generators
- Solar Thermal Collectors

The criteria are divided into core and comprehensive versions. The core criteria are expected to have minimal effect on costs or verification effort. The comprehensive criteria go beyond the core requirements to target enhanced environmental performance, and may imply some additional costs or verification effort.

The criteria have been developed based on the *EU GPP Criteria for Water-based Heaters*, the *SEAI Triple E Register criteria*, relevant Irish and European legislation and a consultation with Irish public bodies and suppliers. Further context for the development of the criteria, and advice on how they can be applied and verified within tender procedures, is given in the accompanying EPA guidance document. Information on Life-cycle costing for this product group is included in *Section 4*.

<sup>1</sup> Under S.I. No. *151/2011* and S.I. No. *426/2014* as amended by S.I. No. *646/2016*. To ensure adequate competition, there is an exception to the requirement to purchase items meeting these criteria where, in the opinion of the public body concerned, there is, or is likely to be, an insufficient amount of equipment which meets the criteria.

## WHAT DO THE CRITERIA COVER?

The following table summarises the core and comprehensive GPP criteria for Heating Equipment. A merged cell indicates that the same criteria apply at core and comprehensive levels.

TOPIC	CORE GPP CRITERIA	COMPREHENSIVE GPP CRITERIA
<b>A. BOILERS (INCLUDING BIOMASS BOILERS, COGENERATION AND TRIGENERATION)</b>	SC1. Technical Capacity	
	TS1. CE marking, Ecodesign and Energy Label	
	TS2. Standing heat losses	
	TS3. Minimum energy efficiency	TS3. Minimum energy efficiency
	TS4. Boiler controls	
	TS5. Product longevity and warranty	TS5. Product longevity and warranty
	TS6. Installation instructions and user information	
	TS7. Additional requirements for biomass boilers	
	TS8. Additional requirements for combined heat and power	
	TS9. Additional requirements for trigeneration	
	AC1. Life-cycle costs	
	AC2. Extended warranty	
	CPC1. Environmental performance	
<b>B. WATER HEATERS</b>	SC1. Technical capacity	
	TS1. CE marking, Ecodesign and Energy Label	
	TS2. Product longevity and warranty	TS2. Product longevity and warranty

TOPIC	CORE GPP CRITERIA	COMPREHENSIVE GPP CRITERIA	
<b>B. WATER HEATERS</b>	TS3. Condensate recovery system		
	TS4. Minimum energy efficiency		
	TS5. Gas condensing water heaters		
	TS6. Modulating output		
	TS7. Balanced flue		
	AC1. Life-cycle costs		
	AC2. Extended warranty		
			AC3. Emissions
			AC4. Design for disassembly
			AC5. Noise emission limits
	CPC1. Environmental performance		
<b>C. HEAT PUMPS</b>	SC1. Technical capacity		
	TS1. CE marking, Ecodesign and Energy Label		
	TS2. Product longevity and warranty	TS2. Product longevity and warranty	
	TS3. Design for permanent installation		
	TS4. Requirements for air source and water source heat pumps		
	TS5. Requirements for ground source heat pumps		
	TS6. Requirements for heat pump dehumidifiers		
			TS7. Primary and secondary refrigerants
	AC1. Life-cycle costs		
	AC2. Extended warranty		
	CPC1. Environmental performance		

TOPIC	CORE GPP CRITERIA	COMPREHENSIVE GPP CRITERIA
<b>D. STEAM SYSTEMS</b>	TS1. CE marking, Ecodesign and Energy Label	
	TS2. Product longevity and warranty	TS2. Product longevity and warranty
	TS3. Condensate recovery system	
	TS4. Requirements for economisers	
	TS5. Requirements for boiler blow-down controls	
	TS6. Requirements for flue gas shut-off dampers	
	TS7. Requirements for localised steam generators	
	AC1. Life-cycle costs	
	AC2. Extended warranty	
	CPC1. Environmental performance	
	<b>E. SOLAR THERMAL COLLECTORS</b>	TS1. CE marking, Ecodesign and Energy Label
TS2. Product longevity and warranty		TS2. Product longevity and warranty
TS3. Compliance with standards and performance parameters		
TS4. Operating and Maintenance Manuals		
AC1. Life-cycle costs		
AC2. Extended warranty		
CPC1. Environmental performance		

## IRISH GPP CRITERIA - HOW TO READ THE TEMPLATE

<b>Scope</b>	Defines the products and services to which the criteria apply.
<b>Exclusions</b>	Identifies any related products or services which are not covered by the criteria.
<b>References</b>	The primary sources consulted to develop the Irish GPP criteria.
<b>Eco-labels</b>	Type I eco-labels and other labels which address relevant environmental characteristics of the products or services and may be used either to define GPP criteria, verify compliance or both. Labels with equivalent criteria must also be accepted.
<b>Legislation and Standards</b>	Relevant EU and Irish legislation which applies within the sector and International, European or Irish standards which may be referenced in technical specifications (accompanied by the words 'or equivalent').
<b>Notes</b>	Practical tips and advice on applying the criteria, and explanations of the environmental impacts being addressed.
<b>Core Criteria</b>	Criteria which can be applied by any Irish public body and which are expected to have minimal effect on costs or verification effort.
<b>Comprehensive Criteria</b>	Criteria which go beyond the core requirements to target enhanced environmental performance and may imply some additional costs or verification effort.
<b>Selection Criteria</b>	Criteria which operators must meet in order to be eligible for tender submission (in a two-stage procedure) or award (in an open procedure).
<b>Specification</b>	Minimum requirements which all tenders must meet. Where multiple specifications are included in the criteria, these may be used together (recommended) or separately.
<b>Specification - Variant</b>	An optional alternative to the specification, which allows alternative solutions to be considered.
<b>Award Criteria</b>	Criteria which target environmental performance beyond the minimum requirements of the specification. These may be qualitative or quantitative in nature and must be weighted for evaluation. Suggested ranges for weighting of award criteria are included in <b>[blue brackets]</b> however it is up to the contracting authority to determine an appropriate weighting based on its priorities and the totality of criteria which it is applying in a specific tender.
<b>Contract Management</b>	Clauses which can be inserted into contracts in order to manage environmental aspects and promote progressive improvements in delivery.

**SCOPE, REFERENCES, LEGISLATION AND CERTIFICATIONS/LABELS**

<b>IN SCOPE</b>	<p>Products that are used to generate heat as part of a water-based central heating system, where the heated water is distributed by means of circulators and heat emitters in order to reach and maintain the indoor temperature of an enclosed space such as a building, a dwelling, or a room, at a desired level. The operation of the heat generator can be based on a number of processes and technologies, such as:</p> <ul style="list-style-type: none"> <li>• Combustion of gaseous, liquid or solid fossil fuels</li> <li>• Combustion of gaseous, liquid or solid biomass (minimum 50 kW output)</li> <li>• Use of the Joule effect in electric resistance heating elements</li> <li>• Capture of ambient heat from air, water or ground source, and/or waste heat</li> <li>• Cogeneration (the simultaneous generation in one process of heat and electricity)</li> <li>• Solar (auxiliary)</li> </ul> <p>The maximum output power of the water-based heaters covered by these criteria is 400 kW. Combination heaters are included in the scope of this product group, provided that their primary function is to provide ambient heat. Circulators are included where these are an integral part of the heater. Water heaters based on any of the above technologies are also included.</p>
<b>NOT IN SCOPE</b>	<p>The following products fall outside of the scope of these criteria:</p> <ul style="list-style-type: none"> <li>• Biomass boilers with an output less than 50 kW;</li> <li>• Heaters for heating and distributing gaseous heat transfer media such as vapour or air;</li> <li>• Space heaters that combine both indirect heating, using water-based central heating system, and direct heating, by direct emission of heat into the room or space the appliance is installed.</li> <li>• Circulators which are supplied separately (e.g. for larger heaters)</li> </ul> <p><b>NOTE:</b> Air conditioning units (which may also include heating functionality) and ventilation units are covered by the Irish GPP criteria for Energy-related products, which reflect Ecodesign requirements, the EU Energy Label and the Triple E Register criteria.</p>
<b>ECOLABELS</b>	<ul style="list-style-type: none"> <li>• EU Energy Label for <i>Space and Water Heaters, Local Space Heaters and Solid Fuel Boilers</i></li> <li>• <i>Nordic Ecolabel for Solid Biofuel Boilers</i></li> <li>• <i>Blue Angel Ecolabel for Solar Collectors</i></li> </ul>
<b>REFERENCE DOCUMENTS</b>	<ol style="list-style-type: none"> <li>1. European Commission Joint Research Centre (2014) <i>EU GPP Criteria for Water-Based Heaters and Technical Background Report</i></li> <li>2. Sustainable Energy Authority of Ireland (various dates), <i>Eligibility Criteria for Triple E Register</i></li> <li>3. Sustainable Energy Authority of Ireland (2019) <i>Biomass Boilers Implementation Guide</i></li> <li>4. European Commission (2018) <i>Guidelines accompanying Regulations 811, 812, 813 and 814/2013 and Regulations 2015/1187 and 1189</i></li> <li>5. European Commission (2013) <i>Staff Working Document on Implementation of EED Article 6: Purchasing by public bodies</i></li> </ol>

**SCOPE, REFERENCES, LEGISLATION AND CERTIFICATIONS/LABELS**

<b>LEGISLATION AND STANDARDS</b>	<ul style="list-style-type: none"> <li>• <i>S.I. 151/2011 European Union (Energy Efficient Public Procurement) Regulations 2011</i></li> <li>• <i>S.I. 366 of 2011 European Union (Energy Labelling) Regulations, as amended by S.I. 351 of 2014</i></li> <li>• <i>S.I. 454 of 2013 European Union (Ecodesign Requirements for certain energy related products) Regulations, as amended by S.I. 96/2021</i></li> <li>• <i>S.I. No. 426/2014 - European Union (Energy Efficiency) Regulations 2014, as amended by S.I. No. 646/2016</i></li> <li>• <i>Directive 2009/125/EC establishing a framework for the setting of ecodesign requirements for energy-related products</i></li> <li>• <i>Directive 2012/27/EU on energy efficiency, as amended by Directive 2018/2002</i></li> <li>• <i>Regulation (EU) 2017/1369 setting a framework for energy labelling</i></li> <li>• <i>Regulation (EU) 811/2013 on energy labelling of space heaters, combination heaters, packages of space heater, temperature control and solar device and packages of combination heater, temperature control and solar device</i></li> <li>• <i>Regulation (EU) 812/2013 on energy labelling for water heaters and hot water storage tanks</i></li> <li>• <i>Regulation (EU) 813/2013 on ecodesign requirements for space heaters and combination heaters</i></li> <li>• <i>Regulation (EU) 814/2013 on ecodesign requirements for water heaters and hot water storage tanks</i></li> <li>• <i>Regulation (EU) 2015/1187 on energy labelling of solid fuel boilers and packages of a solid fuel boiler, supplementary heaters, temperature controls and solar devices</i></li> <li>• <i>Regulation (EU) 2015/1189 on ecodesign requirements for solid fuel boilers</i></li> <li>• <i>Directive 2012/19/EU on waste electrical and electronic equipment (WEEE Directive)</i></li> <li>• <i>Directive 2002/49/EC relating to the assessment and management of environmental noise</i></li> </ul>
<b>NOTES</b>	<p><b>EU Energy Label:</b> A new space or water heater or solid fuel boiler (up to 70 kW) comes with an energy label showing its energy efficiency class. As of 1 January 2019, suppliers (manufacturers, importers or authorised representatives) need to register products requiring an energy label in the <i>European Product Database for Energy Labelling</i> (EPREL). For individual products, ratings may range from G (least efficient) to A+++ (most efficient). It is also possible to buy a combination of technologies, such as a boiler with a solar hot water storage tank, in order to reach an A+++ energy efficiency rating. <b>Under the Energy Efficiency Directive, public bodies should purchase products in the highest available energy class, unless this would lead to insufficient competition.</b></p> <p>The <b>Ecodesign regulations</b> set requirements for energy efficiency, nitrogen oxide emission levels, volume for storage water heaters, heat losses from hot water storage tanks, and a range of other criteria. From September 2018 space heater and combination heaters must meet all of the requirements set out in Regulation (EU) 813/2013 and water heaters must meet all of the requirements set out in Regulation (EU) 814/2013. From 1 January 2020 all solid fuel boilers must meet the requirements of Regulation (EU) 2015/1189.</p> <p>The criteria for boilers are <b>technology-neutral</b>, so that they can be used in tenders for gas, liquid or solid (including biomass) fuel boilers. In some cases, contracting authorities may wish to allow bidders to propose different technologies. Specific requirements apply for biomass boilers, cogeneration and trigeneration based on the Triple E criteria, and these are included in the Technical Specifications. <b>Action 60 of the CAP provides for the effective banning of the installation of oil boilers in dwellings from 2022 and gas boilers from 2025. Both the GPP criteria and Triple E Register criteria will be updated to reflect this requirement in line with the Building Regulations. Under the 2018 EU Renewable Energy Directive, palm oil is considered unsustainable and will be phased out as a fuel by 2030, beginning in 2023.</b></p>



## HOW CAN THE CRITERIA BE APPLIED AND VERIFIED?

Information about how each of the criteria can be verified is included. The verification methods form an essential part of the criteria and must be included in tender documents to ensure that suppliers are aware of how compliance with the criteria will be assessed. The forms of verification referred to in the criteria include:

- The product Certificate of Conformity or Product Information Sheet
- A valid Energy Label and evidence of the product's registration on the EPREL database
- Where the criteria are based on the SEAI Triple E Register criteria, inclusion of a specific product on this Register can verify compliance. Alternatively, technical documentation and/or test results which demonstrate compliance with the criteria should be accepted
- Provision of test results based on the specified EN standards for each product type listed in Annex 1, or equivalent standards
- Provision of a relevant Type 1 Ecolabel which addresses the specific criteria, e.g. the EU Ecolabel

There should be a clear link between all supporting documentation supplied and the product being submitted. This will typically take the form of a product code or product name that can be cross referenced between the submitted product and relevant supporting documentation. If product codes/names have been changed since publication of the supporting documentation, then a record of this must be provided with the supporting documentation supplied. Any deviation from these requirements should result in the supporting documentation not being considered adequate for the purposes of demonstrating compliance with the criteria.

### Test Reports

A test report must include the following elements: An outline of the complete test including introduction, details on test conditions and standards applied, the specific model details of the product tested, the steps taken in the test, the results, graphical representations, and a conclusion. All documents should be on headed paper and the document should be officially signed off. All documentation must be in English, or include an adequate translation.

### Certification

Where certificates are provided, all tests must be carried out by an organisation that is accredited by a national accreditation body recognised via the European Cooperation for Accreditation or the International Accreditation Forum. All documentation must be in English, or include an adequate translation.

### Equivalence

Some criteria conditions allow for scientifically equivalent tests and/or standards to be used. In the event that a product has not been designed, manufactured or tested to the specific standard named, then documentation relating to an equivalent internationally recognised standard may be used. In such cases, the onus is on the tenderer to demonstrate satisfactory equivalence of the standards.

According to Article 44(2) of Directive 2014/24/EU, other appropriate means of proof may be accepted where the bidder concerned had no access to test reports, ecolabels, certificates etc. or no possibility of obtaining them within the relevant time limits for reasons which are not attributable to the economic operator. This could include, for example, a technical dossier from the manufacturer. In this case, the bidder must prove that the works, supplies or services it provided meet the requirements or criteria set out in the technical specifications, the award criteria or the contract performance conditions.

Some simple market research in advance of tendering should be sufficient to confirm that suppliers, products and services are available which meet the criteria and verification requirements. One particularly useful source is the *Topten EU website* which lists the most energy-efficient products available in a number of categories (including solid fuel boilers, heat pumps, local space heaters and electric water heaters).<sup>2</sup> From 2021, it will also be possible to consult the *EU EPREL* database to find products based on their energy rating. Further information on techniques for market engagement linked to GPP, including legal and practical considerations, is available in *Module 6 of the GPP Training Toolkit*.

<sup>2</sup> Topten is strictly neutral and independent from manufacturers and retailers, its selection criteria are always published online.

## KEY ENVIRONMENTAL IMPACTS – HEATING EQUIPMENT

The key environmental impacts from water-based heaters are associated with their use phase and linked mainly to the fuel source and energy efficiency of the product and related greenhouse gas (GHG) emissions. Greenhouse gas emissions are mainly due to the emission of CO<sub>2</sub> from combustion and potentially – to a lesser extent – refrigerant leakage (for certain types of heating technologies such as heat pumps). Provision of installation instructions and user information has been identified as one of the most important criteria to guarantee optimum environmental performance of water-based heating equipment.

### KEY ENVIRONMENTAL IMPACTS

- Energy consumption in use phase
- Emissions of greenhouse gases, NO<sub>x</sub>, OGC, CO and PM in use-phase, due to fossil fuel combustion or heat pump refrigerant leakage
- Suboptimal performance due to incorrect usage or maintenance
- Air emissions of in use-phase
- Noise in use phase



### GPP APPROACH

- Specify minimum energy efficiency levels, ensure compliance with ecodesign principles and correct installation and commissioning
- Award marks for products with lower GHG and pollutant emissions and use of refrigerants with lower global warming potential
- Require comprehensive user instructions to be provided with products and contract clauses to ensure contractor is responsible for ongoing environmental performance
- Award marks for products with noise emissions below set limits

*Please note that the order of environmental impacts above does not necessarily correspond to their importance.*

## DEFINITION OF TERMS USED IN THE GPP CRITERIA

- **'biomass'** means the biodegradable fraction of products, waste and residues from biological origin from agriculture (including vegetal and animal substances), forestry and related industries including fisheries and aquaculture, as well as the biodegradable fraction of industrial and municipal waste
- **'boiler heater'** means a space heater or combination heater equipped with one or more heat generators using the combustion of gaseous, liquid or solid fuels of fossil origin or from biomass
- **'cogeneration heater'** means a space heater simultaneously generating heat and electricity in a single process
- **'combination heater'** means a water-based space heater that is designed to also provide heat to deliver hot drinking or sanitary water at given temperature levels, quantities and flow rates during given intervals, and is connected to an external supply of drinking or sanitary water
- **'electrically-driven heat pump heater'** means a heat pump heater equipped with one or more heat generators using electricity as a fuel
- **'electric heater'** means a space heater or combination heater equipped with one or more heat generators using electricity as a fuel
- **'electric boiler heater'** means a boiler heater equipped with one or more heat generators using the Joule effect in electric resistance heating elements only
- **'fuel-driven heat pump heater'** means a heat pump heater equipped with one or more heat generators fuelled with gas or liquid fuel of fossil origin or from biomass
- **'gas boiler heater'** means a boiler heater equipped with one or more heat generators using the combustion of gaseous fuels of fossil origin or from biomass
- **'gas heater'** means a space heater or combination heater equipped with one or more heat generators fuelled with gaseous fuels of fossil origin or from biomass
- **'global warming potential'** means global warming potential as defined in Article 2(4) of Regulation (EC) No 842/2006
- **'heat pump heater'** means a space heater or combination heater equipped with one or more heat generators using ambient heat from an air, water or ground source, and/or waste heat for heat generation
- **'heater'** means a space heater or combination heater
- **'heater equipped with external combustion'** means a category of heaters comprising boilers, a-sorption heat pumps and heaters equipped with external combustion engine
- **'heat generator'** means the part of a heater that generates the heat using one or more of the following processes:
  - combustion of fossil fuels and/or biomass fuels
  - use of the Joule effect in electric resistance heating elements
  - capture of ambient heat from an air source, water source or ground source, and/or waste heat
- **'liquid fuel boiler heater'** means a boiler heater equipped with one or more heat generators using the combustion of liquid fuels of fossil origin or from biomass
- **'liquid fuel heater'** means a space heater or combination heater equipped with one or more heat generators fuelled with liquid fuels of fossil origin or from biomass;

- **'Nm<sup>3</sup>'** means normal cubic metre (at 101.325 kPa, 273.15 K)
- **'package of space heater, temperature control and solar device'** means a package offered to the end-user containing one or more space heaters combined with one or more temperature controls and/or one or more solar devices
- **'package of combination heater, temperature control and solar device'** means a package offered to the end-user containing one or more combination heaters combined with one or more temperature controls, and/or one or more solar devices
- **'rated heat output'** means the declared heat output of a heater when providing space heating and, if applicable, water heating at standard rating conditions, expressed in kW; for heat pump space heaters and heat pump combination heaters the standard rating conditions for establishing the rated heat output are the reference design conditions, as set out in Regulation (EU) No 813/2013 implementing Directive 2009/125/EC with regard to ecodesign requirements for space heaters and combination heaters
- **'seasonal space heating energy efficiency'** ( $\eta_s$ ) means the ratio between the space heating demand for a designated heating season, supplied by a space heater, a combination heater or a hybrid heater, including temperature control, and the annual energy consumption required to meet this demand, expressed in %
- **'seasonal space heating emissions'** means:
  - for automatically stoked solid fuel boilers, a weighted average of the emissions at rated heat output and the emissions at 30 % of the rated heat output, expressed in mg/m<sup>3</sup>
  - for manually stoked solid fuel boilers that can be operated at 50% of the rated heat output in continuous mode, a weighted average of the emissions at rated heat output and the emissions at 50 % of the rated heat output, expressed in mg/m<sup>3</sup>
  - for manually stoked solid fuel boilers that cannot be operated at 50% or less of the rated heat output in continuous mode, the emissions at rated heat output, expressed in mg/m<sup>3</sup>
  - for solid fuel cogeneration boilers, the emissions at rated heat output, expressed in mg/m<sup>3</sup>
- **'solar device'** means a solar-only system, a solar collector, a solar hot water storage tank or a pump in the collector loop, which are placed on the market separately
- **'solid fuel heater'** means a space heater or combination heater equipped with one or more heat generators fuelled with solid fuels of fossil origin or from biomass
- **'solid fuel boiler heater'** means a boiler heater equipped with one or more heat generators using the combustion of solid fuels of fossil origin or from biomass
- **'solid biomass boiler heater'** means a boiler heater equipped with one or more heat generators using the combustion of solid fuels from biomass
- **'space heater'** means a device that
  - provides heat to a water-based central heating system in order to reach and maintain at a desired level the indoor temperature of an enclosed space such as a building, a dwelling or a room; and
  - is equipped with one or more heat generators
- **'standard rating conditions'** means the operating conditions of heaters under average climate conditions for establishing the rated heat output, seasonal space heating energy efficiency, water heating energy efficiency, sound power level, nitrogen oxide (NO<sub>x</sub>) emissions, carbon monoxide (CO) emissions, organic gaseous carbon (OGC) emissions and particulate matter

- **'temperature control'** means equipment that interfaces with the end-user regarding the values and timing of the desired indoor temperature, and communicates relevant data, such as actual indoor and/or outdoor temperature(s), to an interface of the heater such as a central processing unit, thus helping to regulate the indoor temperature(s)
- **'water-based central heating system'** means a system using water as a heat transfer medium to distribute centrally generated heat to heat emitters for the space heating of buildings, or parts thereof

## DEFINITION OF PRODUCTS INCLUDED IN THE SEAI TRIPLE E REGISTER

- **Biomass boilers** provide an efficient, automatic method of generating hot water, steam or other heat-transporting fluids, using carbon-neutral biomass as the fuel source. Biomass boilers are considered to incorporate ancillary equipment such as control systems, fuel-feed systems, fans and grit arrestors.
- **Boilers** combust fuel to provide heating through a closed loop hot water system delivery medium. Boilers can also indirectly heat water for on-site use. The equipment consists of the boiler and/or burner.
- **Boiler Controls** are defined as specifically designed equipment that maximise the energy efficiency of new and/or existing boiler and burner plant.
- **Co-generation** is defined as highly energy efficient equipment which can simultaneously generate a combination of heat, cooling energy and usable electrical power in a single thermodynamic process and which is intended primarily for on-site use.
- **Condensing boilers** are boilers fitted with condensate recovery systems.
- **Condensate recovery systems** are defined as equipment which is specifically designed to efficiently recover condensate from steam installations in order to maximise their overall energy efficiency.
- **Heat pumps** are defined as equipment that is designed to transfer heat from a heat source (such as ground, water or ambient air) to a heat sink (such as indoor air or a water-based heating system) using a refrigeration system.
- **Instantaneous gas fired water heaters** combust fuel to provide hot water on demand, whereby the water used is heated directly by the unit. They also have the facility to recover heat from the flue gases to maximise the heat output.
- **Localised Steam Generators** are defined as equipment that rapidly and efficiently produces pressurised steam on demand primarily for on-site use, by use of a cold-water feed through the combustion of fuel in a burner.
- **Solar thermal collectors** are defined as renewable energy equipment which transforms solar radiation directly into thermal energy.



- **Steam systems** are defined as equipment specifically designed to maximise the energy efficiency of a boiler and/ or a heating system as a whole.
- **Oxygen trim controls** are controls which automatically monitor the oxygen or carbon monoxide concentration in boiler flue gases and vary the air and fuel supply to the burner to limit excess or low oxygen concentrations in the fuel/air mix.
- **Burner systems** are designed to provide boiler modulation and combustion control through the use of digital microprocessor-based systems with the aim of optimising energy use. They include new burners with controls and retrofit burner control systems.
- **Sequencers** are boiler controls which optimise fuel usage by managing the firing sequence of different boilers to ensure that the most efficient boiler(s) are selected to match the prevailing load conditions.
- **Energy meters** are meters which can track boiler performance and report boiler system efficiency to the user.

# GPP CRITERIA FOR HEATING EQUIPMENT

## SUBJECT MATTER

Supply of heating equipment with low environmental impact

## A BOILERS (INCLUDING BIOMASS BOILERS AND COGENERATION)

### CORE CRITERIA

### COMPREHENSIVE CRITERIA

#### SELECTION CRITERIA

#### SC1. **Technical Capacity** *[where installation is included in the contract]*

Candidates must demonstrate that suitably qualified and experienced personnel will undertake the installation of the equipment and any ancillary works.

Fitters and service personnel must be fully trained and qualified. Training should comprise the following elements *[select all which are relevant]*:

- Assembly, installation and commissioning of the specific products covered by the contract
- Pressure testing of components
- Electrical testing of equipment
- Testing controls and meters
- Ensuring safety devices are correctly installed and working
- Operational testing of individual components of the system (e.g. boiler, fluid transfer pumps, distribution system)
- Testing the whole system under a range of normal operating conditions
- Adjustment of the equipment to energy-efficient settings
- Air emission measurement techniques
- Technical and legal documentation for the products (certificate of conformity, commissioning and test reports).

**Verification:** Candidates must submit evidence that the personnel directly responsible for installation and any ancillary works have relevant experience, qualifications and training in relation to each of the above aspects. This may be in the form of a list of relevant contracts carried out over the previous three years, references, CVs, training records and/or other evidence of qualifications and experience.



## CORE CRITERIA

## COMPREHENSIVE CRITERIA

## TECHNICAL SPECIFICATIONS

**TS1. CE marking, Ecodesign and Energy Label**

All equipment and/or components must be CE marked as required by the applicable EU directive(s) and/or regulations.<sup>3</sup> They must also comply with the applicable Ecodesign and EU Energy Label Regulations.<sup>4</sup>

**Verification:** Tenderers must provide the product Declaration of Conformity and Energy Label confirming compliance with the above requirements. Evidence of the product's entry in the EPREL database should be provided.

**TS2. Standing heat losses**

Standing heat losses must not exceed 2% of the rated boiler output.

**Verification:** Products which are included on the *Triple E Register* will be deemed to comply. Alternatively, technical documentation and diagrams which confirm compliance with the above requirements must be provided.

**TS3. Minimum energy efficiency**
**4.1 Gas, dual fuel, and oil-fired boilers**

The boiler must meet the performance criteria set out in the below table:

Fuel Type	Turndown Ratio	Test Point (% of Maximum Nominal Input)	Net Thermal Efficiency %
Gas fired or dual fuelled	≥4.0:1	30	≥108.0%
		100	≥97.0%
Oil fired	≥3.33:1	30	≥101.0%
		100	≥95.0%

**TS3. Minimum energy efficiency**

The seasonal space heating energy efficiency ( $\eta_s$ ) of the boiler shall not fall below the limit values set out as follows:

Heat generator technology	Minimum seasonal space heating energy efficiency
All boilers except solid biomass	$\eta_s \geq 96\%$
Solid biomass boilers > 20 kW	$\eta_s \geq 77\%$ <sup>5</sup>

<sup>3</sup> For example, *Regulation (EU) 2016/426 on appliances burning gaseous fuels*. Further information on CE marking is available [here](#).

<sup>4</sup> For example, *Regulation (EU) 813/2013 on ecodesign requirements for space heaters and combination heaters* and *Regulation (EU) 811/2013 on energy labelling of space heaters, combination heaters, packages of space heaters*. Note that space heaters between 70 and 400 kW must fulfil Ecodesign requirements even though they are not covered by the energy labelling regulation.

<sup>5</sup> The requirements for solid fuel biomass boilers are based on *Ecodesign Regulation 2015/1189*. These requirements are mandatory from 1 January 2020.

## CORE CRITERIA

## COMPREHENSIVE CRITERIA

## TECHNICAL SPECIFICATIONS

 TS3. **Minimum energy efficiency** (continued)

Net thermal efficiency test data must be presented to 1 decimal place. A condensing oil boiler with a net thermal efficiency of 94.5% at 100% of its maximum rated output would be deemed to fail.

**Verification:** Products which are included on the *Triple E Register* will be deemed to comply. Alternatively, technical documentation which confirms compliance with the above requirements must be provided.

**4.2 Biomass boilers**

Biomass boilers burning wood chips or wood pellets must achieve the thermal efficiency levels set out in the below table:

Boiler rating	Thermal efficiency	
	Chips	Pellets
50-150 kW	≥85%	90%
>150-500 kW	≥86%	91%
>500 kW	≥87%	92%

**Verification:** Products which are included on the *Triple E Register* will be deemed to comply. Alternatively, technical documentation which confirms compliance with the above requirements must be provided.

**NOTE:** At time of publication, the *Triple E Register* criteria are based on net thermal efficiency whereas the Ecodesign and EU GPP criteria are based on seasonal space heating efficiency. Due to the additional verification burden associated with demonstrating compliance where the *Triple E Register* cannot be used, the core criteria here are based on thermal efficiency. It is proposed to align the core criteria with the seasonal space heating approach as and when the *Triple E Register* criteria are updated. This note is also applicable to the award criterion on improved energy efficiency.

 TS3. **Minimum energy efficiency** (continued)

The seasonal space heating energy efficiency shall be calculated in accordance with

1. the procedures set out in Annex III of the Ecodesign Regulation for space heaters and combination heaters;<sup>6</sup> and
2. the harmonised standards and the transitional methods of measurement and calculation for the implementation of the Ecodesign and Energy Labelling Regulations within *Commission Communication 2014/C 207/028*.

In addition to the procedures 1. and 2., the procedures set out in Annex VII to the Energy Labelling Regulation for space heaters, combination heaters and packages of space heaters<sup>7</sup> shall apply to packages which include space heaters.

For solid fuel boiler heaters,  $\eta_s$  shall be calculated according to the aforementioned procedures, taking into account the following provisions:

- a. the calculation of  $\eta_s$  shall be based on the gross calorific value of the wet fuel (as received)  $GC_{VAR}$ , which corrects for the moisture content in the fuel and includes the latent heat energy stored in hydrogen that is oxidised to water in the combustion process. The principles laid down in Standard EN 303-5 or equivalent shall apply to estimate  $\eta_s$ , while  $GC_{VAR}$  shall be used for the calculation of  $\eta_s$ , instead of the net calorific value of the wet fuel (as received),  $NC_{VAR}$ .
- b. for determining the gross calorific value of the wet fuel (as received)  $GC_{VAR}$ , the principles laid down in Standard EN 14918 or equivalent shall apply.

**Verification:** Products holding a relevant Type 1 Eco-label fulfilling the listed requirements will be deemed to comply. Other appropriate means of proof will also be accepted, e.g. a declaration of compliance with this criterion, together with test results based on procedures in applicable EN standards or equivalent standards for the specific product (see *Annex 1*).

<sup>6</sup> Regulation (EU) 813/2013 on *ecodesign requirements for space heaters and combination heaters*

<sup>7</sup> Regulation (EU) 811/2013 on *energy labelling of space heaters, combination heaters, packages of space heater, temperature control and solar device and packages of combination heater, temperature control and solar device*.

**CORE CRITERIA**
**COMPREHENSIVE CRITERIA**
**TECHNICAL SPECIFICATIONS**
**TS4. Boiler controls**

*[Note – the applicable control criteria will depend upon the type of system specified/proposed]*

**4.1 Oxygen Trim Controls**

**4.1.1** Equipment must contain the following elements:

- Electronic Oxygen (or Carbon Monoxide) sensor designed for fitting in the boiler flue near the boiler
- Boiler temperature or pressure sensor
- Actuated air supply control damper
- Actuated valve on fuel supply
- Control panel which takes a reading from the sensor and adjusts the air supply damper and fuel supply accordingly.

**4.1.2** Overall equipment must be accurate to minimum accuracy of  $\pm 1\%$  excess oxygen (“overall” refers to the “sum of errors” across the system)

**4.1.3** Controls must permit integration with burner management systems.

**4.1.4** There must be the capability to output to BMS or other equivalent control system.

**4.2 Burner systems**

**4.2.1** Burners must have microprocessor-based controls that are capable of continuously modulating burner output in response to measured temperature or pressure values over a turn-down ratio as appropriate below:

- Gas ( $\geq 1,200\text{kW}$ ):  $\geq 4$  to 1
- Oil ( $\geq 1,200\text{kW}$ ):  $\geq 2.5$  to 1
- Gas or dual fuel ( $< 1,200\text{kW}$ ):  $\geq 3$  to 1
- Oil ( $< 1,200\text{kW}$ ):  $\geq 2$  to 1

**NOTE:** *Turn-down ratio is a measure of the range within which the burner can be adjusted. Turn down of 4 to 1 indicates adjustment in the range 25% to 100%.*

**4.2.2** The microprocessor must control the air/fuel ratio to limit Oxygen levels in exhaust gasses to the following levels:

- 3% O<sub>2</sub> at 100% rated boiler output
- 4% O<sub>2</sub> at 50% rated boiler output

**CORE CRITERIA**
**COMPREHENSIVE CRITERIA**
**TECHNICAL SPECIFICATIONS**
**TS4. Boiler controls (continued)**

- 4.2.3** 4.2.3 CO levels in the exhaust gases must be less than 20 ppmv for all boilers over all turn-down ratios.
- 4.2.4** All valves and dampers must be fitted with precision servomotors.
- 4.2.5** The burner must be fitted with an air damper which is fully closed on burner shutdown.
- 4.2.6** All burner fans must be fitted with VSD control on the fan motor.
- 4.2.7** Oil fired burners must comply with the performance criteria set out in IS EN 267, or scientific equivalent.
- 4.2.8** Gas fired burners must comply with the performance criteria set out in IS EN 676, or scientific equivalent.

**4.3 Sequencers**

- 4.3.1** The sequencer must be microprocessor based and use sensors to measure heating system flow and return temperatures.
- 4.3.2** The sequencer must be able to control and isolate a minimum of two boilers. It must have the capability of storing and consulting individual control parameters for each connected boiler. It must select the appropriate boiler(s) based on the optimum efficiency of the whole system.

**Verification:** Products which are included on the *Triple E Register* will be deemed to comply. Alternatively, technical documentation and diagrams which confirm compliance with the above requirements must be provided.

**TS5. Product longevity and warranty**

Repair or replacement of the boiler and each of its components must be covered by the warranty terms for a minimum of **four years** from the date of commissioning. The tenderer must confirm that genuine or equivalent spare parts will be available for at least **ten years** from the date of purchase. Where repair work is undertaken the maximum time period from notification of the fault through to its resolution must be stated together with the provision which will be made for temporary alternative heat sources where required.

**Verification:** Tenderers must provide a copy of the warranty terms which includes the above requirements.

**TS5. Product longevity and warranty**

Repair or replacement of the boiler and each of its components must be covered by the warranty terms for a minimum of **five years** from the date of commissioning. The tenderer must confirm that genuine or equivalent spare parts will be available for at least **ten years** from the date of purchase. Where repair work is undertaken the maximum time period from notification of the fault through to its resolution must be stated together with the provision which will be made for temporary alternative heat sources where required.

**Verification:** Tenderers must provide a copy of the warranty terms which includes the above requirements.

**CORE CRITERIA**
**COMPREHENSIVE CRITERIA**
**TECHNICAL SPECIFICATIONS**
**TS6. Installation instructions and user information**

The equipment must be supplied with installation instructions and user information in printed (on the packaging and/or on documentation accompanying the product) and/or in electronic format, which include the following:

- a. Information on the energy consumption of the boiler
- b. Full installation instructions, including:
  - i. instructions specifying that the heater shall be installed by fully trained fitters;
  - ii. any specific precautions that shall be taken when the boiler is assembled or installed;
  - iii. instructions specifying that the control settings of the boiler ('heating curve') shall be adjusted properly after installation;
  - iv. if applicable, details on the emission values of the flue gas during the operating phase and how the boiler should be adjusted to minimise them. In particular, the recommendations should mention that:
    - the boiler shall be adjusted with the aid of gauges for measuring CO, O<sub>2</sub> or CO<sub>2</sub>, NO<sub>x</sub>, temperature and soot to ensure that none of the threshold values provided for in the specifications are exceeded;
    - holes shall be made for measuring gauges in the same location as used in laboratory testing;
    - measurement results shall be recorded in a form or diagram, one copy of which is retained by the end user;
  - v. for boilers with low flue gas temperature, instructions specifying that the system shall be equipped with corrosion retarding technology;
  - vi. for condensing boiler technology, instructions specifying that the chimney shall be protected against condensate with low pH;
  - vii. information on who the fitter can approach for guidance on installation;
- d. operating instructions for service personnel;
- e. user information, including:
  - i. references to competent installers and service personnel;
  - ii. recommendations on the proper use and maintenance of the boiler, including the correct fuels to be used and their appropriate storage for optimum combustion and the regular maintenance schedule to keep;
  - iii. advice on how users can minimise the environmental impact of the boiler, in particular information on use to minimise energy consumption;
  - iv. if applicable, information on how the measurement results should be interpreted and how they can be improved.
  - v. information about which spare parts can be replaced;
- f. recommendations on appropriate disposal at the product's end-of-life.

**Verification:** A copy of the installation instructions and user information which will be supplied with the equipment must be provided in electronic format as part of the tender.

**CORE CRITERIA**
**COMPREHENSIVE CRITERIA**
**TECHNICAL SPECIFICATIONS**
**TS7. Additional requirements for Biomass Boilers**

In addition to the applicable requirements under the Ecodesign regulations and other technical specifications, the following technical requirements apply:

**7.1** Minimum output of 50kW

**7.2** Must be equipped for automatic operation without the need for permanent supervision. This shall include:

- Automatic start-up and shut-down
- Ability to operate in slumber mode and restarting when the heating load demands
- Automatic fuel loading commensurate with the heat/steam demand
- Automatic ash removal
- Automatic control of the burning rate commensurate with the heating demand.

**7.3** Must incorporate a system to automatically prevent burn-back through the fuel-feed system

**7.4** Must incorporate a fault-reporting system which should be capable of remotely communicating a fault. The parameters to be monitored shall include:

- Fuel shortage or blockage
- Boiler shut-down
- Boiler hot water/thermal fluid outlet temperature or steam pressure
- Flue gas temperature

**7.5** To facilitate automatic tube-cleaning, the boiler must incorporate a mechanical or pneumatic system for heat-exchanger cleaning on the gas side.

**7.6** Must incorporate an automatic system to 'trim' the combustion air commensurate with the oxygen content of the flue gases so as to minimise 'stack' losses caused by excess air.

**7.7** Must incorporate a system to prevent over-heating of the water in the boiler in the event of a mains electricity failure.

**Verification:** Products which are included on the *Triple E Register* will be deemed to comply. Alternatively, technical documentation and diagrams which confirm compliance with the above requirements must be provided.

**CORE CRITERIA**
**COMPREHENSIVE CRITERIA**
**TECHNICAL SPECIFICATIONS**
**TS8. Additional requirements for Combined Heat and Power (CHP)**

In addition to the applicable requirements under the Ecodesign regulations and other technical specifications, the following technical requirements apply:

- 9.1** The CHP unit must be a packaged unit with the power generation section and heat recovery section contained within a single enclosure, and should consist of a single prime mover.
- 9.2** Units must have a minimum overall efficiency (thermal + electricity) greater than or equal to 78%, calculated on a gross calorific value or HHV basis, when the unit is operating at 100% output (electrical).
- 9.3** The unit must have installed software to record levels of electricity and heat generated over a running period.
- 9.4** The CHP Unit must include one main heat output system i.e. a system recovering heat from the prime mover and the exhaust gasses, and must have no inbuilt, or integral, facility to dump high grade heat.

**Verification:** Products which are included on the *Triple E Register* will be deemed to comply. Alternatively, technical documentation and diagrams which confirm compliance with the above requirements must be provided.

**TS9. Additional requirements for Trigeneration**

In addition to the applicable requirements under the Ecodesign regulations and other technical specifications, the following technical requirements apply:

- 10.1** The heat and power element of the trigeneration system must comply with the criteria for CHP units set out in TS8.
- 10.2** The absorption chiller must use the CHP heat source as its primary energy input and should be an “indirect fired” absorption chiller.
- 10.3** The absorption chiller must have a minimum coefficient of performance (COP) of 0.7
- 10.4** The units must have installed software to record levels of cooling achieved.

**Verification:** Products which are included on the *Triple E Register* will be deemed to comply. Alternatively, technical documentation and diagrams which confirm compliance with the above requirements must be provided.

**CORE CRITERIA**
**COMPREHENSIVE CRITERIA**
**AWARD CRITERIA**
**AC1. Life-cycle costs**

The cost of each valid and responsive tender will be evaluated on the basis of total life-cycle costs (LCC). Tenderers are required to complete the spreadsheet included in the tender documents with the requested data regarding their products. This information will be used to calculate LCC and the tender with the lowest life-cycle cost will be awarded [X] marks, with other tenders being scored according to the following formula:

$$\text{Score Tender A} = [X] * \frac{\text{Lowest LCC}}{\text{LCC}_{\text{TENDER A}}}$$

**Verification:** The completed spreadsheet must be submitted with the tender and where indicated, supporting documentation verifying the data must be provided. The data entered in the spreadsheet regarding costs, energy consumption, time to replacement and other parameters will become binding under the contract with the successful tenderer.

**NOTE:** Contracting authorities may choose to evaluate LCC using an existing template such as the *SMART-SPP LCC Tool*, or based on their own bespoke template. In either case, certain information such as the evaluation period, energy costs and cost of maintenance/replacement (if not included in the tender) will need to be completed by the contracting authority. See Section 4 for further information.

**AC2. Extended warranty**

Up to [X] marks will be awarded to tenders offering a product warranty in excess of the minimum period required under TS5. Full marks will be awarded to the tender offering the longest warranty period, with other offers being scored proportionately.

**Verification:** Tenderers must provide a copy of the warranty terms offered for the product. Where the extended warranty has an additional cost this must be clearly indicated within the pricing schedule.

**AC3. Emissions**

**NOTE:** The Ecodesign regulations set maximum emission levels. This award criterion targets improved emissions performance beyond the legal requirements. **NB if emissions are monetized for inclusion in life-cycle costing under AC1 this criterion should not be applied.**



CORE CRITERIA	COMPREHENSIVE CRITERIA
<b>AWARD CRITERIA</b>	
	<p>AC3. <b>Emissions (continued)</b></p> <p>Up to [X] marks will be awarded based on the verified level of emissions of greenhouse gases, particulate matter, nitrogen oxides, organic gaseous compounds and carbon monoxide. For each of these emissions categories which is relevant based on the fuel type, full marks will be awarded to the tender offering the lowest emissions in that category, with other offers being marked proportionately. The maximum number of marks available for each category will depend upon the number of relevant categories for that fuel type, with the total available marks being divided evenly amongst the relevant categories.<sup>8</sup></p> <p><b>Verification:</b> Tenders must state the emissions for each of the relevant categories based on the fuel type of their product, calculated in accordance with the methodologies set out in Annex 2. Test results demonstrating that these levels have been attained must also be provided, based on the applicable EN standard for the product type as set out in Annex 1, or an equivalent standard.</p>
	<p>AC4. <b>Design for Disassembly</b></p> <p>Up to [X] marks will be awarded for boilers which are easy to dismantle by professionally trained personnel using commonly available tools, for the purpose of repairs and replacements of worn-out parts, upgrading older or obsolete parts, and separating parts and materials, ultimately for reuse or recycling.</p> <p><b>Verification:</b> Products holding a relevant Type 1 Eco-label fulfilling the listed requirements will receive the points. Other appropriate means of proof will also be accepted, e.g. a declaration of compliance with this criterion, together with a technical report from the manufacturer showing the dismantling of the product with an exploded diagram labelling the main components as well as identifying any hazardous substances in these components as specified in Annex 2 to Directive 2002/96/EC (WEEE Directive). Information regarding hazardous substances must be provided in the form of a list of materials identifying material type, quantity used and position. The diagram and information must also be available online.</p>

<sup>8</sup> If the fuel type is specified in the tender documents, then the contracting authority should state the relevant categories here and the marks available for each. Note that PM emissions are only relevant for solid fuel boilers (including biomass boilers).

**CORE CRITERIA**
**COMPREHENSIVE CRITERIA**
**AWARD CRITERIA**
**AC5. Noise emission limits**

**NOTE:** The Ecodesign regulations set maximum noise emission levels. This award criterion targets improved performance beyond the legal requirements. This award criterion is recommended to be applied in the procurement of boilers that are to be installed in noise-sensitive buildings, e.g. hospitals and schools, according to the scope of Directive 2002/49/EC relating to the assessment and management of environmental noise.

Up to [X] marks will be awarded based on the noise emissions of the boiler. The unit of measurement shall be given in dB(A) or dB(C), as appropriate. The tests shall be conducted according to the relevant standards or equivalent included in Annex 1, at standard rating conditions and rated heat output. Full marks will be awarded to the tender offering the lowest noise emissions, with other offers being marked proportionately.

No marks will be awarded if the noise emissions of the equipment exceed the limit values set out as follows:

Heat generator technology	Measurement	Noise emission limit
All boilers except cogeneration and heat pumps equipped with internal combustion engine	A-weighted sound power level limit value ( $L_{WAd, lim}$ )	$17 + 36 \times \log(PN + 10)$ dB(A)
Cogeneration boilers and heat pumps equipped with internal combustion engine	A-weighted sound power level limit value ( $L_{PAd, lim}$ )	$30 + 20 \times \log(PE + 15)$ dB(A)
	C-weighted sound power level limit value ( $L_{PCd, lim}$ )	$L_{PAd, lim} + 20$ dB(C)

**NOTE:** PN means the nominal (full load) heat output; PE means the electricity output.

**Verification:** Tenderers must state the noise emissions of the product and provide test results demonstrating the A-weighted sound power level limit value and, where applicable, C-weighted sound power level limit value.

**CORE CRITERIA**
**COMPREHENSIVE CRITERIA**
**CONTRACT PERFORMANCE CLAUSES**
**CPC1. Environmental performance**

*This clause should be adapted to the specific nature of the contract and the scope of any maintenance/repair/warranty commitments. It is important that it includes a specific requirement to test environmental performance at regular intervals and assigns responsibility for this activity.*

The contractor is responsible for ensuring that the levels of environmental performance, including energy efficiency, indicated in its tender are met both at the point of installation/commissioning and during the *[entire operating lifetime of the boiler]/[warranty period]*. Where this is dependent upon specific usage instructions and maintenance activities these must have been clearly highlighted in the tender. Regular inspections and testing of the equipment to ensure compliance will be carried out *[specify the schedule for these and whether the contractor is responsible for the cost]*.

Where the inspections or tests indicate that the designated levels of environmental performance are not being achieved, the contractor is responsible for *[repairing and/or replacing the equipment and any components]/[the costs of such work carried out by the contracting authority's nominated agent]*. The maximum time period for remedying any default in environmental performance shall be *[7 working days]* from the date on which the fault is identified. Where required by the contracting authority, the contractor must provide suitable alternative heat sources during the repair period.

## B WATER HEATERS

### CORE CRITERIA

### COMPREHENSIVE CRITERIA

#### SELECTION CRITERIA

##### SC1. **Technical Capacity** *[where installation is included in the contract]*

Candidates must demonstrate that suitably qualified and experienced personnel will undertake the installation of the equipment and any ancillary works.

Fitters and service personnel must be fully trained and qualified. Training should comprise the following elements *[select all which are relevant]*:

- Assembly, installation and commissioning of the specific products covered by the contract
- Pressure testing of components
- Electrical testing of equipment
- Testing controls and meters
- Ensuring safety devices are correctly installed and working
- Operational testing of individual components of the system (e.g. boiler, fluid transfer pumps, distribution system)
- Testing the whole system under a range of normal operating conditions
- Adjustment of the equipment to energy-efficient settings
- Air emission measurement techniques
- Technical and legal documentation for the products (certificate of conformity, commissioning and test reports).

**Verification:** Candidates must submit evidence that the personnel directly responsible for installation and any ancillary works have relevant experience, qualifications and training in relation to each of the above aspects. This may be in the form of a list of relevant contracts carried out over the previous three years, references, CVs, training records and/or other evidence of qualifications and experience.

#### TECHNICAL SPECIFICATIONS

##### TS1. **CE marking, Ecodesign and Energy Label**

All equipment and/or components must be CE marked as required by the applicable EU directive(s) and/or regulations.<sup>9</sup> They must also comply with the applicable Ecodesign and EU Energy Label Regulations.<sup>10</sup>

**Verification:** Tenderers must provide the product Declaration of Conformity and Energy Label confirming compliance with the above requirements. Evidence of the product's entry in the EPREL database should be provided.

<sup>9</sup> For example, *Regulation (EU) 2016/426 on appliances burning gaseous fuels*. Further information on CE marking is available [here](#).

<sup>10</sup> For example, *Regulation (EU) 811/2013 on energy labelling of space heaters, combination heaters, packages of space heater, temperature control and solar device and packages of combination heater, temperature control and solar device* and Regulation (EU) 813/2013 on *ecodesign requirements for space heaters and combination heaters*

CORE CRITERIA	COMPREHENSIVE CRITERIA
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**TECHNICAL SPECIFICATIONS**
**TS2. Product longevity and warranty**

Repair or replacement of the water heater and each of its components must be covered by the warranty terms for a minimum of **four years** from the date of commissioning. The tenderer must confirm that genuine or equivalent spare parts will be available for at least **ten years** from the date of purchase. Where repair work is undertaken the maximum time period from notification of the fault through to its resolution must be stated together with the provision which will be made for temporary alternative heat sources where required.

**Verification:** Tenderers must provide a copy of the warranty terms which includes the above requirements.

**TS2. Product longevity and warranty**

Repair or replacement of the water heater and each of its components must be covered by the warranty terms for a minimum of **five years** from the date of commissioning. The tenderer must confirm that genuine or equivalent spare parts will be available for at least **ten years** from the date of purchase. Where repair work is undertaken the maximum time period from notification of the fault through to its resolution must be stated together with the provision which will be made for temporary alternative heat sources where required.

**Verification:** Tenderers must provide a copy of the warranty terms which includes the above requirements.

**TS3. Condensate recovery system**

Hot water heaters must be fitted with a condensate recovery system which meets the following requirements:

Component	Requirements
Steam Traps	The steam trap must be one of those defined in EN 26704 Classification of automatic steam traps, or scientific equivalent.
	Steam traps must be designed and manufactured in accordance with IS/EN 26948 Production and performance characteristic tests for automatic steam traps, or scientific equivalent.
	Steam traps must include the Failure Monitoring measures: <ul style="list-style-type: none"> <li>• Failure sensor located in the steam trap or in suitable device adjacent to it</li> <li>• Output from sensor either to an intermediate device which communicates with a control system or directly to control system</li> <li>• Output to BMS, DCS, Delta V or other equivalent control system</li> </ul>
Deaeration Tanks	Equipment must be capable of achieving a minimum dissolved oxygen concentration of 5 ppb by weight or less
	Equipment must be rated for total removal of dissolved carbon dioxide.
	Low vent losses must be less than or equal to 22.4 kg/h of steam/air mixture per 1 000 kg/h of deaerator capacity
	Equipment must allow rapid load changes of boiler for which designed – minimum of 5% of boiler rating in 30 seconds.

**Verification:** Products which are included on the *Triple E Register* will be deemed to comply. Alternatively, technical documentation and diagrams which confirm compliance with the above requirements must be provided.

CORE CRITERIA	COMPREHENSIVE CRITERIA
<b>TECHNICAL SPECIFICATIONS</b>	
<p>TS4. <b>Minimum energy efficiency</b>            The Net Thermal Efficiency tested at full load must meet or exceed the following levels:            Storage and non-storage instantaneous water heaters: <math>\geq 102\%</math>            Non-storage circulator water heaters: <math>\geq 93\%</math>  <b>Verification:</b> Products which are included on the <i>Triple E Register</i> will be deemed to comply. Alternatively, technical documentation which confirms compliance with the above requirements must be provided.</p>	
<p>TS5. <b>Gas condensing water heaters</b>  <b>4.1</b> Gas condensing water heaters must comply with all the requirements in the standard EN 89 “Gas-fired storage water heaters for the production of domestic hot water”, or scientific equivalent.  <b>4.2</b> Gas condensing water heaters with atmospheric burners must comply with EN 26/A1 “Gas-fired instantaneous water heaters for sanitary uses production, fitted with atmospheric burners (Including Corrigendum 1998)”, or scientific equivalent.  <b>Verification:</b> Products which are included on the <i>Triple E Register</i> will be deemed to comply. Alternatively, technical documentation which confirms compliance with the above requirements must be provided.</p>	
<p>TS6. <b>Modulating output</b>            Non-storage water heaters must have the capability to vary their hot water output in response to changes in water demand, without initiating a purge cycle.  <b>Verification:</b> Products which are included on the <i>Triple E Register</i> will be deemed to comply. Alternatively, technical documentation which confirms compliance with the above requirements must be provided.</p>	
<p>TS7. <b>Balanced flue</b>            Units with a rated output less than 70kW must have a balanced flue.  <b>Verification:</b> Products which are included on the <i>Triple E Register</i> will be deemed to comply. Alternatively, technical documentation which confirms compliance with the above requirements must be provided.</p>	

**CORE CRITERIA**
**COMPREHENSIVE CRITERIA**
**AWARD CRITERIA**
**AC1. Life-cycle costs**

The cost of each valid and responsive tender will be evaluated on the basis of total life-cycle costs (LCC). Tenderers are required to complete the spreadsheet included in the tender documents with the requested data regarding their products. This information will be used to calculate LCC and the tender with the lowest life-cycle cost will be awarded [X] marks, with other tenders being scored according to the following formula:

$$\text{Score Tender A} = [X] * \frac{\text{Lowest LCC}}{\text{LCC}_{\text{TENDER A}}}$$

**Verification:** The completed spreadsheet must be submitted with the tender and where indicated, supporting documentation verifying the data must be provided. The data entered in the spreadsheet regarding costs, energy consumption, time to replacement and other parameters will become binding under the contract with the successful tenderer.

**NOTE:** Contracting authorities may choose to evaluate LCC using an existing template such as the *SMART-SPP LCC Tool*, or based on their own bespoke template. In either case, certain information such as the evaluation period, energy costs and cost of maintenance/replacement (if not included in the tender) will need to be completed by the contracting authority. See Section 4 for further information.

**AC2. Extended warranty**

Up to [X] marks will be awarded to tenders offering a product warranty in excess of the minimum period required under TS2. Full marks will be awarded to the tender offering the longest warranty period, with other offers being scored proportionately.

**Verification:** Tenderers must provide a copy of the warranty terms offered for the product. Where the extended warranty has an additional cost this must be clearly indicated within the pricing schedule.

**AC3. Emissions**

**NOTE:** The Ecodesign regulations set maximum emission limits. This criterion targets improved emissions performance beyond the legal requirements. **NB If emissions are monetised for inclusion in life-cycle costing under AC1 this criterion should not be used.**

CORE CRITERIA	COMPREHENSIVE CRITERIA
<b>AWARD CRITERIA</b>	
	<p>AC3. <b>Emissions (continued)</b></p> <p>Up to [X] marks will be awarded based on the verified level of emissions of greenhouse gases, particulate matter, nitrogen oxides, organic gaseous compounds and carbon monoxide. For each of these emissions categories which is relevant based on the fuel type, full marks will be awarded to the tender offering the lowest emissions in that category, with other offers being marked proportionately. The maximum number of marks available for each category will depend upon the number of relevant categories for that fuel type, with the total available marks being divided evenly amongst the relevant categories.<sup>11</sup></p> <p><b>Verification:</b> Tenders must state the emissions for each of the relevant categories based on the fuel type of their product, calculated in accordance with the methodologies set out in Annex 2. Test results demonstrating that these levels have been attained must also be provided, based on the applicable EN standard for the product type as set out in Annex 1, or an equivalent standard.</p>
	<p>AC4. <b>Design for Disassembly</b></p> <p>Up to [X] marks will be awarded for water heaters which are easy to dismantle by professionally trained personnel using commonly available tools, for the purpose of repairs and replacements of worn-out parts, upgrading older or obsolete parts, and separating parts and materials, ultimately for reuse or recycling.</p> <p><b>Verification:</b> Products holding a relevant Type 1 Eco-label fulfilling the listed requirements will receive the points. Other appropriate means of proof will also be accepted, e.g. a declaration of compliance with this criterion, together with a technical report from the manufacturer showing the dismantling of the product with an exploded diagram labelling the main components as well as identifying any hazardous substances in these components as specified in Annex 2 to Directive 2002/96/EC (WEEE Directive). Information regarding hazardous substances must be provided in the form of a list of materials identifying material type, quantity used and position. The diagram and information must also be available online.</p>

<sup>11</sup> If the fuel type is specified in the tender documents, then the contracting authority should state the relevant categories here and the marks available for each. Note that PM emissions are only relevant for solid fuel boilers (including biomass boilers).



## CORE CRITERIA

## COMPREHENSIVE CRITERIA

## AWARD CRITERIA

**AC5. Noise emission limits**

**NOTE:** The Ecodesign regulations set noise emission limits. This criterion targets improved noise performance beyond the legal requirements. This award criterion is recommended to be applied in the procurement of water heaters that are to be installed in noise-sensitive buildings, e.g. hospitals and schools, according to the scope of Directive 2002/49/EC relating to the assessment and management of environmental noise.

Up to [X] marks will be awarded based on the noise emissions of the boiler. The unit of measurement shall be given in dB(A) or dB(C), as appropriate. The tests shall be conducted according to the relevant standards or equivalent included in Annex 1, at standard rating conditions and rated heat output. Full marks will be awarded to the tender offering the lowest noise emissions, with other offers being marked proportionately.

No marks will be awarded if the noise emissions of the equipment exceed the limit values set out as follows:

Heat generator technology	Measurement	Noise emission limit
All heaters except cogeneration and heat pumps equipped with internal combustion engine	A-weighted sound power level limit value ( $L_{WAd, lim}$ )	$17 + 36 \times \log(PN + 10)$ dB(A)
Cogeneration heaters and heat pumps equipped with internal combustion engine	A-weighted sound power level limit value ( $L_{PAd, lim}$ )	$30 + 20 \times \log(PE + 15)$ dB(A)
	C-weighted sound power level limit value ( $L_{PCd, lim}$ )	$L_{PAd, lim} + 20$ dB(C)

**NOTE:** PN means the nominal (full load) heat output; PE means the electricity output.

**Verification:** Tenderers must state the noise emissions of the product and provide test results demonstrating the A-weighted sound power level limit value and, where applicable, C-weighted sound power level limit value.

**CORE CRITERIA**
**COMPREHENSIVE CRITERIA**
**CONTRACT PERFORMANCE CLAUSES**
**CPC1. Environmental performance**

*This clause should be adapted to the specific nature of the contract and the scope of any maintenance/repair/warranty commitments. It is important that it includes a specific requirement to test environmental performance at regular intervals and assigns responsibility for this activity.*

The contractor is responsible for ensuring that the levels of environmental performance, including energy efficiency, indicated in its tender are met both at the point of installation/commissioning and during the *[entire operating lifetime of the boiler]/[warranty period]*. Where this is dependent upon specific usage instructions and maintenance activities these must have been clearly highlighted in the tender. Regular inspections and testing of the equipment to ensure compliance will be carried out *[specify the schedule for these and whether the contractor is responsible for the cost]*.

Where the inspections or tests indicate that the designated levels of environmental performance are not being achieved, the contractor is responsible for *[repairing and/or replacing the equipment and any components]/[the costs of such work carried out by the contracting authority's nominated agent]*. The maximum time period for remedying any default in environmental performance shall be *[7 working days]* from the date on which the fault is identified. Where required by the contracting authority, the contractor must provide suitable alternative heat sources during the repair period.

## C HEAT PUMPS

### CORE CRITERIA

### COMPREHENSIVE CRITERIA

#### SELECTION CRITERIA

##### SC1. **Technical Capacity** *[where installation is included in the contract]*

Candidates must demonstrate that suitably qualified and experienced personnel will undertake the installation of the equipment and any ancillary works.

Fitters and service personnel shall be fully trained and qualified. Training should comprise the following elements *[select all which are relevant]*:

- Assembly, installation and commissioning of the specific products covered by the contract
- Pressure testing of components
- Electrical testing of equipment
- Testing controls and meters
- Ensuring safety devices are correctly installed and working
- Operational testing of individual components of the system (e.g. boiler, fluid transfer pumps, distribution system)
- Testing the whole system under a range of normal operating conditions
- Adjustment of the equipment to energy-efficient settings
- Air emission measurement techniques
- Technical and legal documentation for the products (certificate of conformity, commissioning and test reports).

**Verification:** Candidates must submit evidence that the personnel directly responsible for installation and any ancillary works have relevant experience, qualifications and training in relation to each of the above aspects. This may be in the form of a list of relevant contracts carried out over the previous three years, references, CVs, training records and/or other evidence of qualifications and experience.

CORE CRITERIA	COMPREHENSIVE CRITERIA
<b>TECHNICAL SPECIFICATIONS</b>	
<p><b>TS1. CE marking, Ecodesign and Energy Label</b></p> <p>All equipment and/or components must be CE marked as required by the applicable EU directive(s) and/or regulations. They must also comply with the applicable Ecodesign and EU Energy Label Regulations.<sup>12</sup></p> <p><b>Verification:</b> Tenderers must provide the product Declaration of Conformity and Energy Label confirming compliance with the above requirements. Evidence of the product's entry in the EPREL database should be provided.</p>	
<p><b>TS2. Product longevity and warranty</b></p> <p>Repair or replacement of the heat pump and each of its components must be covered by the warranty terms for a minimum of <b>four years</b> from the date of commissioning. The tenderer must confirm that genuine or equivalent spare parts will be available for at least <b>ten years</b> from the date of purchase. Where repair work is undertaken the maximum time period from notification of the fault through to its resolution must be stated together with the provision which will be made for temporary alternative heat sources where required.</p> <p><b>Verification:</b> Tenderers must provide a copy of the warranty terms which includes the above requirements.</p>	<p><b>TS2. Product longevity and warranty</b></p> <p>Repair or replacement of the heat pump and each of its components must be covered by the warranty terms for a minimum of <b>five years</b> from the date of commissioning. The tenderer must confirm that genuine or equivalent spare parts will be available for at least <b>ten years</b> from the date of purchase. Where repair work is undertaken the maximum time period from notification of the fault through to its resolution must be stated together with the provision which will be made for temporary alternative heat sources where required.</p> <p><b>Verification:</b> Tenderers must provide a copy of the warranty terms which includes the above requirements.</p>
<p><b>TS3. Design for permanent installation</b></p> <p>All heat pumps must be designed for and include fittings for permanent installation.</p> <p><b>Verification:</b> Products which are included on the <i>Triple E Register</i> will be deemed to comply. Alternatively, technical documentation and diagrams which confirm compliance with the above requirements must be provided.</p>	
<p><b>TS4. Requirements for air source and water source heat pumps</b></p> <p><b>3.1</b> The heat pump must incorporate an electrical or gas-fired internal combustion engine refrigeration system.</p> <p><b>3.2</b> The heat pump must meet the performance criteria set out in Table 1 below for:</p> <ul style="list-style-type: none"> <li>• Coefficient of performance (COP) across the range of connected capacities and including 100% (full load) in heating mode</li> <li>• Energy efficiency ratio (EER) across the range of connected capacities and including 100% (full load) in cooling mode, where the product is designed to provide cooling</li> </ul> <p><b>Verification:</b> Products which are included on the <i>Triple E Register</i> will be deemed to comply. Alternatively, technical documentation and diagrams which confirm compliance with the above requirements must be provided.</p>	

<sup>12</sup> For heat pumps: *Regulation (EU) 811/2013 on energy labelling of space heaters, combination heaters, packages of space heater, temperature control and solar device and packages of combination heater, temperature control and solar device* and *Regulation (EU) 813/2013 on ecodesign requirements for space heaters and combination heaters*

CORE CRITERIA	COMPREHENSIVE CRITERIA
<b>TECHNICAL SPECIFICATIONS</b>	
<p><b>TS5. Requirements for ground source heat pumps</b></p> <p><b>4.1</b> The heat pump must incorporate an electrical or gas-fired internal combustion engine refrigeration system.</p> <p><b>4.2</b> The heat pump must be designed to use an indirect, closed-loop ground heat exchanger.</p> <p><b>4.3</b> The heat pump must meet the performance criteria set out in Table 1 below for:</p> <ul style="list-style-type: none"> <li>• Coefficient of performance (COP) across the range of connected capacities and including 100% (full load) in heating mode</li> <li>• Energy efficiency ratio (EER) across the range of connected capacities and including 100% (full load) in cooling mode, where the product is designed to provide cooling</li> </ul> <p><b>Verification:</b> Products which are included on the <i>Triple E Register</i> will be deemed to comply. Alternatively, technical documentation and diagrams which confirm compliance with the above requirements must be provided.</p>	
<p><b>TS6. Requirements for heat pump dehumidifiers</b></p> <p>Dehumidifiers must:</p> <p><b>4.3</b> Incorporate an electrically driven refrigeration system that is designed to remove water vapour from the surrounding atmosphere, as the air is recirculated through the product.</p> <p><b>4.4</b> Recover both sensible heat and latent heat released during dehumidification, and use it to heat the air as it leaves the product and or for other useful purposes (such as water heating).</p> <p><b>4.5</b> Incorporate a control system that monitors the relative humidity of the surrounding atmosphere, and automatically switches off dehumidification, or modulates the rate of dehumidification, when the relative humidity falls below a preset value.</p> <p><b>4.6</b> Have a dehumidification capacity that is greater than or equal to 0.625 litres per hour.</p> <p><b>4.7</b> Not be designed to be connected to compressed air systems.</p> <p><b>4.8</b> Have a dehumidification efficiency rate (DER) equal to or greater than the thresholds set out in Table 2 below, which depend on the dehumidification capacity (C) of the product.</p> <p><b>Verification:</b> Products which are included on the <i>Triple E Register</i> will be deemed to comply. Alternatively, technical documentation and diagrams which confirm compliance with the above requirements must be provided.</p>	

CORE CRITERIA

COMPREHENSIVE CRITERIA

TECHNICAL SPECIFICATIONS

Tables and Notes

Product Category	Heating mode (COP)	Cooling mode (EER)
<b>Air Source</b>		
Air-to-water	> 4.00	> 3.10
Air-to-Air packaged	> 3.20	> 2.80
Air-to-Air split and multi-split	> 3.70	> 3.30
Air-to-Air gas engine driven (GED)	> 1.30	> 1.10
<b>Ground Source</b>		
Brine-to-water heat pumps	> 4.00	> 3.20
<b>Water Source</b>		
Split and multi-split heat pumps	> 4.10	> 3.50

Table 1 – Performance thresholds for heat pumps

Dehumidification capacity (C) (Litres/hour)	Dehumidification efficiency ratio (DER) (Litres/kWh)
≥0.625 < 1.5	≥1.40
≥1.5 and <2.3	≥1.80
≥2.3	≥2.30

Table 2 – Performance test points for heat pump dehumidifiers

**CORE CRITERIA**
**COMPREHENSIVE CRITERIA**
**TECHNICAL SPECIFICATIONS**
**Tables and Notes**

**NOTES:** Energy Efficiency Ratio (EER) in the context of heat pumps is an index used to indicate the efficiency of the equipment in cooling mode and is calculated as follows:

$$\text{EER} = \frac{\text{Net Cooling Capacity (kW)}}{\text{Effective Power Input (kW)}}$$

Coefficient of Performance (COP) in the context of heat pumps is an index used to indicate the efficiency of the equipment in heating mode and is calculated as follows:

$$\text{COP} = \frac{\text{Net Heating Capacity (kW)}}{\text{Effective Power Input (kW)}}$$

For the avoidance of doubt test data should be presented to two decimal places. As an example, in Table 1 an Air-to-water heat pump with a heating mode COP of 4.00 would be deemed to fail.

**TS7. Primary and secondary refrigerants**
**Primary refrigerant**

The global warming potential over a 100-year period (GWP100) of the primary refrigerant shall not exceed a value of 2000. GWP100 values are those set out in Annex I to Regulation (EC) No 517/2014. The GWP100 values of refrigerants shall be calculated in terms of the 100-year warming potential of one kilogram of a gas relative to one kilogram of CO<sub>2</sub>. For those refrigerants that are not covered by the Regulation (EC) No 517/2014, sources of references for the GWP100 values should be those defined in Annex 1.1(7) to Regulation (EU) No 206/2012/14.

**Secondary refrigerant**

In the case of space heaters using a secondary refrigerant, the design of these heaters shall not be based on secondary refrigerant, brine or additives classified as environmentally hazardous or constituting a health hazard within the meaning of Regulation (EC) No 1272/2008 and Council Directive 67/548/EEC, and installation instructions shall clearly indicate that substances classified as environmentally hazardous or constituting a health hazard shall not be used as a secondary refrigerant.

CORE CRITERIA	COMPREHENSIVE CRITERIA
<b>TECHNICAL SPECIFICATIONS</b>	
	<p>TS7. <b>Primary and secondary refrigerants</b> (continued)</p> <p><b>Verification:</b> Products holding a relevant Type 1 Eco-label fulfilling the listed requirements will be deemed to comply. Other appropriate means of proof will also be accepted, e.g. a declaration of compliance with this criterion, together with providing the names of refrigerant(s) used in the product along with their GWP100 values.</p>
<b>AWARD CRITERIA</b>	
<p>AC1. <b>Life-cycle costs</b></p> <p>The cost of each valid and responsive tender will be evaluated on the basis of total life-cycle costs (LCC). Tenderers are required to complete the spreadsheet included in the tender documents with the requested data regarding their products. This information will be used to calculate LCC and the tender with the lowest life-cycle cost will be awarded [X] marks, with other tenders being scored according to the following formula:</p> <div style="border: 1px solid black; padding: 10px; margin: 10px 0; width: fit-content;"> <math display="block">\text{Score Tender A} = [X] * \frac{\text{Lowest LCC}}{\text{LCC}_{\text{TENDER A}}}</math> </div> <p><b>Verification:</b> The completed spreadsheet must be submitted with the tender and where indicated, supporting documentation verifying the data must be provided. The data entered in the spreadsheet regarding costs, energy consumption, time to replacement and other parameters will become binding under the contract with the successful tenderer.</p> <p><b>NOTE:</b> Contracting authorities may choose to evaluate LCC using an existing template such as the <i>SMART-SPP LCC Tool</i>, or based on their own bespoke template. In either case, certain information such as the evaluation period, energy costs and cost of maintenance/replacement (if not included in the tender) will need to be completed by the contracting authority. See Section 4 for further information.</p>	



**CORE CRITERIA**
**COMPREHENSIVE CRITERIA**
**AWARD CRITERIA**
**AC2. Extended warranty**

Up to **[X]** marks will be awarded to tenders offering a product warranty in excess of the minimum period required under TS2. Full marks will be awarded to the tender offering the longest warranty period, with other offers being scored proportionately.

**Verification:** Tenderers must provide a copy of the warranty terms offered for the product. Where the extended warranty has an additional cost this must be clearly indicated within the pricing schedule.

**CONTRACT PERFORMANCE CLAUSES**
**CPC1. Environmental performance**

*This clause should be adapted to the specific nature of the contract and the scope of any maintenance/repair/warranty commitments. It is important that it includes a specific requirement to test environmental performance at regular intervals and assigns responsibility for this activity.*

The contractor is responsible for ensuring that the levels of environmental performance, including energy efficiency, indicated in its tender are met both at the point of installation/commissioning and during the *[entire operating lifetime of the boiler]/[warranty period]*. Where this is dependent upon specific usage instructions and maintenance activities these must have been clearly highlighted in the tender. Regular inspections and testing of the equipment to ensure compliance will be carried out *[specify the schedule for these and whether the contractor is responsible for the cost]*.

Where the inspections or tests indicate that the designated levels of environmental performance are not being achieved, the contractor is responsible for *[repairing and/or replacing the equipment and any components]/[the costs of such work carried out by the contracting authority's nominated agent]*. The maximum time period for remedying any default in environmental performance shall be *[7 working days]* from the date on which the fault is identified. Where required by the contracting authority, the contractor must provide suitable alternative heat sources during the repair period.

## D STEAM SYSTEMS

### CORE CRITERIA

### COMPREHENSIVE CRITERIA

#### TECHNICAL SPECIFICATIONS

##### TS1. **CE marking, Ecodesign and Energy Label**

All equipment and/or components must be CE marked as required by the applicable EU directive(s) and/or regulations. They must also comply with the applicable Ecodesign and EU Energy Label Regulations.

**Verification:** Tenderers must provide the product Declaration of Conformity and Energy Label confirming compliance with the above requirements. Evidence of the product's entry in the EPREL database should be provided.

##### TS2. **Product longevity and warranty**

Repair or replacement of the equipment and each of its components must be covered by the warranty terms for a minimum of **four years** from the date of commissioning. The tenderer must confirm that genuine or equivalent spare parts will be available for at least **ten years** from the date of purchase. Where repair work is undertaken the maximum time period from notification of the fault through to its resolution must be stated together with the provision which will be made for temporary alternative heat sources where required.

**Verification:** Tenderers must provide a copy of the warranty terms which includes the above requirements.

##### TS2. **Product longevity and warranty**

Repair or replacement of the equipment and each of its components must be covered by the warranty terms for a minimum of **five years** from the date of commissioning. The tenderer must confirm that genuine or equivalent spare parts will be available for at least **ten years** from the date of purchase. Where repair work is undertaken the maximum time period from notification of the fault through to its resolution must be stated together with the provision which will be made for temporary alternative heat sources where required.

**Verification:** Tenderers must provide a copy of the warranty terms which includes the above requirements.

CORE CRITERIA

COMPREHENSIVE CRITERIA

TECHNICAL SPECIFICATIONS

TS3. **Condensate recovery system**

Boilers must be fitted with a condensate recovery system which meets the following requirements:

Component	Requirements
Steam Traps	The steam trap must be one of those defined in EN 26704 <i>Classification of automatic steam traps, or scientific equivalent</i> .
	Steam traps must be designed and manufactured in accordance with IS/EN 26948 Production and performance characteristic tests for automatic steam traps, or scientific equivalent.
	Steam traps must include the Failure Monitoring measures: <ul style="list-style-type: none"> <li>• Failure sensor located in the steam trap or in suitable device adjacent to it;</li> <li>• Output from sensor either to an intermediate device which communicates with a control system or directly to control system;</li> <li>• Output to BMS, DCS, Delta V or other equivalent control system.</li> </ul>
Deaeration Tanks	Equipment must be capable of achieving a minimum dissolved oxygen concentration of 5 ppb by weight or less.
	Equipment must be rated for total removal of dissolved carbon dioxide.
	Low vent losses must be less than or equal to 22.4 kg/h of steam/air mixture per 1 000 kg/h of deaerator capacity.
	Equipment must allow rapid load changes of boiler for which designed – minimum of 5% of boiler rating in 30 seconds.

**Verification:** Products which are included on the *Triple E Register* will be deemed to comply. Alternatively, technical documentation and diagrams which confirm compliance with the above requirements must be provided.

TS4. **Requirements for Economisers**

2.1 Thermal Efficiency

- Condensing: Minimum of 9% increase in the net boiler thermal efficiency for which it is designed
- Non-condensing: Minimum of 3% increase in the net boiler thermal efficiency for which it is designed

2.2 Economiser performance must be measured using EN 308 “Heat exchangers – Test procedures for establishing performance of air to air and flue gases heat recovery devices”, or scientific equivalent.

2.3 It must be declared what boiler fuel the economiser is suitable for use with.

**Verification:** Products which are included on the *Triple E Register* will be deemed to comply. Alternatively, technical documentation and diagrams which confirm compliance with the above requirements must be provided.

CORE CRITERIA	COMPREHENSIVE CRITERIA
<b>TECHNICAL SPECIFICATIONS</b>	
<p>TS5. <b>Requirements for Boiler Blow-down Controls</b></p> <p><b>3.1</b> The device must include automatic control of boiler base blow-down valve in addition to manual bottom blow-down valve.</p> <p><b>3.2</b> It must continuously monitor the % TDS level in boiler water at steam level.</p> <p><b>3.3</b> It must only allow blowdown when TDS concentration exceeds a minimum allowable level to maintain the TDS level below a set limit.</p> <p><b>Verification:</b> Products which are included on the <i>Triple E Register</i> will be deemed to comply. Alternatively, technical documentation and diagrams which confirm compliance with the above requirements must be provided.</p>	
<p>TS6. <b>Requirements for Flue Gas Shut-off Dampers</b></p> <p><b>4.1</b> The damper must have automatic control and operation. Damper to close after post combustion purge operation.</p> <p><b>4.2</b> Damper to be to gas tight in accordance with DIN 25 414 or scientific equivalent.</p> <p><b>4.3</b> Safety interlocks to be included to prevent boiler firing when damper is closed.</p> <p><b>Verification:</b> Products which are included on the <i>Triple E Register</i> will be deemed to comply. Alternatively, technical documentation and diagrams which confirm compliance with the above requirements must be provided.</p>	
<p>TS7. <b>Requirements for Localised Steam Generators</b></p> <p><b>5.1</b> Minimum Net Thermal Efficiency of 90% at full load in accordance with BS 845: Part 1: 'Methods for assessing thermal performance of boilers for steam, hot water and high temperature heat transfer fluids – Part 1 Concise Procedure', or scientific equivalent.</p> <p><b>5.2</b> Localised rapid steam generators must comply with the acceptance tests set out in I.S. EN 12952-15 "Water-tube boilers and auxiliary installations. Acceptance tests", or scientific equivalent.</p> <p><b>5.3</b> Standing losses – 2% or less of boiler rated output.</p> <p><b>5.4</b> Steam generation time (steaming rate) – maximum 8 minutes.</p> <p><b>5.5</b> Incorporated burners must comply with the relevant <i>Triple E Register criteria for Boiler Controls</i>.</p> <p><b>Verification:</b> Products which are included on the <i>Triple E Register</i> will be deemed to comply. Alternatively, technical documentation and diagrams which confirm compliance with the above requirements must be provided.</p>	

**CORE CRITERIA**
**COMPREHENSIVE CRITERIA**
**AWARD CRITERIA**
**AC1. Life-cycle costs**

The cost of each valid and responsive tender will be evaluated on the basis of total life-cycle costs (LCC). Tenderers are required to complete the spreadsheet included in the tender documents with the requested data regarding their products. This information will be used to calculate LCC and the tender with the lowest life-cycle cost will be awarded [X] marks, with other tenders being scored according to the following formula:

$$\text{Score Tender A} = [X] * \frac{\text{Lowest LCC}}{\text{LCC}_{\text{TENDER A}}}$$

**Verification:** The completed spreadsheet must be submitted with the tender and where indicated, supporting documentation verifying the data must be provided. The data entered in the spreadsheet regarding costs, energy consumption, time to replacement and other parameters will become binding under the contract with the successful tenderer.

**NOTE:** Contracting authorities may choose to evaluate LCC using an existing template such as the *SMART-SPP LCC Tool*, or based on their own bespoke template. In either case, certain information such as the evaluation period, energy costs and cost of maintenance/replacement (if not included in the tender) will need to be completed by the contracting authority. See Section 4 for further information.

**AC2. Extended warranty**

Up to [X] marks will be awarded to tenders offering a product warranty in excess of the minimum period required under TS2. Full marks will be awarded to the tender offering the longest warranty period, with other offers being scored proportionately.

**Verification:** Tenderers must provide a copy of the warranty terms offered for the product. Where the extended warranty has an additional cost this must be clearly indicated within the pricing schedule.

**CORE CRITERIA**
**COMPREHENSIVE CRITERIA**
**CONTRACT PERFORMANCE CLAUSES**
**CPC1. Environmental performance**

*This clause should be adapted to the specific nature of the contract and the scope of any maintenance/repair/warranty commitments. It is important that it includes a specific requirement to test environmental performance at regular intervals and assigns responsibility for this activity.*

The contractor is responsible for ensuring that the levels of environmental performance, including energy efficiency, indicated in its tender are met both at the point of installation/commissioning and during the *[entire operating lifetime of the boiler]/[warranty period]*. Where this is dependent upon specific usage instructions and maintenance activities these must have been clearly highlighted in the tender. Regular inspections and testing of the equipment to ensure compliance will be carried out *[specify the schedule for these and whether the contractor is responsible for the cost]*.

Where the inspections or tests indicate that the designated levels of environmental performance are not being achieved, the contractor is responsible for *[repairing and/or replacing the equipment and any components]/[the costs of such work carried out by the contracting authority's nominated agent]*. The maximum time period for remedying any default in environmental performance shall be *[7 working days]* from the date on which the fault is identified. Where required by the contracting authority, the contractor must provide suitable alternative heat sources during the repair period.

## E SOLAR THERMAL COLLECTORS

### CORE CRITERIA

*This product category includes the following:*

**Flat Plate Collectors:** A solar thermal collector which has its absorber laid in a box, insulated at the rear and sides, and with a transparent cover on top. The heat transfer media can be water (with or without antifreeze) or air.

**Evacuated Tube Collectors:** A solar thermal collector comprising a series of tubes that contain an absorber area and into which vacuum is created to provide insulation. The heat transfer media is typically water (with or without antifreeze).

### COMPREHENSIVE CRITERIA

### TECHNICAL SPECIFICATIONS

#### TS1. CE marking, Ecodesign and Energy Label

All equipment and/or components must be CE marked as required by the applicable EU directive(s) and/or regulations. They must also comply with the applicable Ecodesign and EU Energy Label Regulations.

**Verification:** Tenderers must provide the product Declaration of Conformity and Energy Label confirming compliance with the above requirements. Evidence of the product's entry in the EPREL database should be provided.

#### TS2. Product longevity and warranty

Repair or replacement of the equipment and each of its components must be covered by the warranty terms for a minimum of **four years** from the date of commissioning. The tenderer must confirm that genuine or equivalent spare parts will be available for at least **ten years** from the date of purchase. Where repair work is undertaken the maximum time period from notification of the fault through to its resolution must be stated together with the provision which will be made for temporary alternative heat sources where required.

**Verification:** Tenderers must provide a copy of the warranty terms which includes the above requirements.

#### TS2. Product longevity and warranty

Repair or replacement of the equipment and each of its components must be covered by the warranty terms for a minimum of **five years** from the date of commissioning. The tenderer must confirm that genuine or equivalent spare parts will be available for at least **ten years** from the date of purchase. Where repair work is undertaken the maximum time period from notification of the fault through to its resolution must be stated together with the provision which will be made for temporary alternative heat sources where required.

**Verification:** Tenderers must provide a copy of the warranty terms which includes the above requirements.

**CORE CRITERIA**
**COMPREHENSIVE CRITERIA**
**TECHNICAL SPECIFICATIONS**
**TS3. Compliance with standards and performance parameters**

**2.1.** The solar thermal collector must be tested to one of the following European standards, or scientific equivalent:

**Solar Collectors**

EN 12975-1 (Part 1 General Requirements) AND EN 12975-2 (Part 2 Test Methods)

OR

**Factory Made Systems**

EN 12976-1 (Part 1 General Requirements) AND EN 12976-2 (Part 2 Test Methods)

**2.2** Tenderers must state the thermal collector performance parameters including optical efficiency ( $n_0$ ), first order heat loss coefficient ( $a_1$ ) and second order heat loss ( $a_2$ ) which allow the annual power output to be calculated according to the following formula:

$$\text{Power output (q)} = A \cdot (n_0 \cdot G - a_1 \cdot dT - a_2 \cdot dT^2) \text{ [W]}$$

with the operation conditions:

- G: Solar irradiance on collector plane [ $\text{W}/\text{m}^2$ ]
- dT: Temperature difference between collector mean fluid temperature and ambient air temperature [K] (Kelvin)

And the collector performance parameters:

- $n_0$ , optical efficiency (combined efficiency of the transparent cover and the absorber) [-]
- $a_1$ , First order heat loss coefficient (heat loss coefficient at collector fluid temperature equal to ambient temperature [ $\text{W}/\text{K}$ ])
- $a_2$ , Second order heat loss coefficient (temperature dependent term of heat loss coefficient) [ $\text{W}/\text{K}^2$ ]

And the collector area:

- A: Collector area corresponding to the performance parameters – in this case, the aperture area is used as the reference area.

**NOTE:** to facilitate comparisons with other products the following standard values will be used:

G:  $900 \text{ W}/\text{m}^2$  dT:  $50 \text{ K}$  A:  $1 \text{ m}^2$

**Verification:** Products which are included on the *Triple E Register* will be deemed to comply. Alternatively, technical documentation and test results/certification which confirm compliance with the above requirements must be provided.



**CORE CRITERIA**
**COMPREHENSIVE CRITERIA**
**TECHNICAL SPECIFICATIONS**
**TS4. Operating and maintenance manuals**

Appropriate operating and maintenance manuals must be provided with the product and available online in order to optimise the achievement of energy efficiency gains. These must contain full details of installation, operation and maintenance to achieve the stated performance levels.

**Verification:** A copy of the relevant manual(s) and URL for online access must be provided as part of the tender.

**AWARD CRITERIA**
**AC1. Life-cycle costs**

The cost of each valid and responsive tender will be evaluated on the basis of total life-cycle costs (LCC). Tenderers are required to complete the spreadsheet included in the tender documents with the requested data regarding their products. This information will be used to calculate LCC and the tender with the lowest life-cycle cost will be awarded **[X]** marks, with other tenders being scored according to the following formula:

$$\text{Score Tender A} = \mathbf{[X]} * \frac{\text{Lowest LCC}}{\text{LCC}_{\text{TENDER A}}}$$

**Verification:** The completed spreadsheet must be submitted with the tender and where indicated, supporting documentation verifying the data must be provided. The data entered in the spreadsheet regarding costs, energy consumption, time to replacement and other parameters will become binding under the contract with the successful tenderer.

**NOTE:** Contracting authorities may choose to evaluate LCC using an existing template such as the *SMART-SPP LCC Tool*, or based on their own bespoke template. In either case, certain information such as the evaluation period, energy costs and cost of maintenance/replacement (if not included in the tender) will need to be completed by the contracting authority. See Section 4 for further information.

**AC2. Extended warranty**

Up to **[X]** marks will be awarded to tenders offering a product warranty in excess of the minimum period required under TS2. Full marks will be awarded to the tender offering the longest warranty period, with other offers being scored proportionately.

**Verification:** Tenderers must provide a copy of the warranty terms offered for the product. Where the extended warranty has an additional cost this must be clearly indicated within the pricing schedule.

**CORE CRITERIA**
**COMPREHENSIVE CRITERIA**
**CONTRACT PERFORMANCE CLAUSES**
**CPC1. Environmental performance**

*This clause should be adapted to the specific nature of the contract and the scope of any maintenance/repair/warranty commitments. It is important that it includes a specific requirement to test environmental performance at regular intervals and assigns responsibility for this activity.*

The contractor is responsible for ensuring that the levels of environmental performance, including energy efficiency, indicated in its tender are met both at the point of installation/commissioning and during the *[entire operating lifetime of the boiler]/[warranty period]*. Where this is dependent upon specific usage instructions and maintenance activities these must have been clearly highlighted in the tender. Regular inspections and testing of the equipment to ensure compliance will be carried out *[specify the schedule for these and whether the contractor is responsible for the cost]*.

Where the inspections or tests indicate that the designated levels of environmental performance are not being achieved, the contractor is responsible for *[repairing and/or replacing the equipment and any components]/[the costs of such work carried out by the contracting authority's nominated agent]*. The maximum time period for remedying any default in environmental performance shall be *[7 working days]* from the date on which the fault is identified. Where required by the contracting authority, the contractor must provide suitable alternative heat sources during the repair period.

## 4. LIFE CYCLE COSTING

Life cycle costing (LCC) is a technique that can be used to estimate the total cost of ownership for heating equipment, as well as environmental externalities such as CO<sub>2</sub> emissions.<sup>13</sup> It is a method for making effective, long-term investment decisions since some cost aspects may not be immediately apparent to the decision maker, e.g., a higher initial investment may be required to achieve lower life-cycle costs, based on lower energy costs and improved durability with associated longer lifespans and lower repair costs. When externalities are taken into consideration, LCC is particularly relevant to achieving an improved environmental performance.

In addition to applying the GPP criteria set out in this document, it is recommended that contracting authorities carry out a comparison of life-cycle costs for the different heating equipment options either prior to or during the tender process. LCC can be included as part of award criteria under Article 68 of Directive 2014/24/EU. Further information on how to conduct LCC comparisons can be found in the EPA guidance document and on the *EU GPP website*.

For heating equipment, life-cycle impacts depend most on the use phase, particularly energy consumption in use. Purchase costs account for a comparatively small part of the total life-cycle cost of the products. A number of available studies on cost considerations in GPP have concluded that

higher purchasing prices are usually compensated for by lower operating costs for products where energy consumption is a major cost factor. A typical example is found in high-efficiency heating installations. During the whole life cycle of the heating installation, one study<sup>14</sup> found that approximately 95% of the total costs were determined by operating costs. Public procurement decisions based only on the purchase price will likely lead to mis-investment. The technical background report associated with the EU GPP criteria<sup>15</sup> presents a detailed life-cycle cost analysis of water-based heaters. The data analysed indicate life-cycle cost savings of up to 16% for the smaller boiler size classes and 34-46% for the largest sizes. As this study was carried out in 2011, it is expected that additional life-cycle cost savings are available with the best available technologies currently on the market.

The choice of fuel type will have a strong influence on the overall life-cycle costs of heating equipment. The SEAI regularly publishes cost comparisons for different fuel types in Ireland and this information will be useful for LCC calculations.<sup>16</sup> The SEAI has also created a *Cost Indicator for Biomass Boilers in Business* and *Energy Savings Calculator for Boiler Replacement Projects* which are useful tools to assist with LCC at the planning stages.

<sup>13</sup> Further information on LCC, including the possibility to account for externalities, is included in the EPA guidance document accompanying these criteria.

<sup>14</sup> "Costs and Benefits of Green Public Procurement in Europe", Öko-Institut e.V. and ICLEI, 2007

<sup>15</sup> Joint Research Centre (2011) *Development of European Ecolabel and Green Public Procurement Criteria for Water-based Central Heating Generators. Draft Report. Product definition, market analysis and technical analysis*. Available at: <http://susproc.jrc.ec.europa.eu/heating/stakeholders.htm>

<sup>16</sup> For example, see <https://www.seai.ie/publications/Commercial-Fuel-Cost-Comparison.pdf>

## ANNEX 1: STANDARDS FOR TEST METHODS

Test methods for each criterion, unless specified otherwise, shall be those described in the relevant Standards as indicated in Table 1. Where appropriate, test methods other than those indicated for each criterion may be used if they can be considered as equivalent.

Table 1. Relevant standards for test methods

Number	Title
Gas boiler heaters	
EN 676	Automatic Forced draught burners for gaseous fuels
EN 15502-1	Gas-fired heating boilers – Part 1: General requirements and tests
Liquid fuel boiler heaters	
EN 267	Automatic forced draught burners for liquid fuels
EN 303-1	Heating boilers - Part 1: Heating boilers with forced draught burners - Terminology, general requirements, testing and marking
EN 303-2	Heating boilers – Part 2: Heating boilers with forced draught burners – Special requirements for boilers with atomizing oil burners
EN 303-4	Heating boilers - Part 4: Heating boilers with forced draught burners - Special requirements for boilers with forced draught oil burners with outputs up to 70 kW and a maximum operating pressure of 3 bar - Terminology, special requirements, testing and marking
EN 304	Heating boilers – Test code for heating boilers for atomizing oil burners
Solid fuel boiler heaters	
EN 303-5	Heating boilers – Part 5: Heating boilers for solid fuels, manually and automatically stoked, nominal heat output of up to 500 kW – Terminology, requirements, testing and marking
EN 14918	Solid biofuels - Determination of calorific value
Electric boiler heaters	
EN 60335-2-35	Household and similar electrical appliances – Safety – Part 2-35: Particular requirements for instantaneous water heaters
Fuel-driven heat pump heaters	
EN 12309 SERIES	Gas-fired absorption and adsorption air-conditioning and/or heat pump appliances with a net heat input not exceeding 70 kW
DIN 4702, PART 8	Central heating boiler; determination of the standard efficiency and the standard emissivity

Number	Title
Electrically-driven heat pump heaters	
<b>EN 14511 SERIES</b>	Air conditioners, liquid chilling packages and heat pumps with electrically driven compressors for space heating and cooling
<b>EN 14825</b>	Air conditioners, liquid chilling packages and heat pumps, with electrically driven compressors, for space heating and cooling – Testing and rating at part load conditions and calculation of seasonal performance
Cogeneration heaters	
<b>EN 50465</b>	Gas appliances. Combined heat and power appliance of nominal heat input inferior or equal to 70 kW
<b>ISO 3046-1</b>	Reciprocating internal combustion engines – Performance – Part 1: Declarations of power, fuel and lubricating oil consumptions, and test methods – Additional requirements for engines for general use
Nitrogen oxide emissions	
<b>EN 14792</b>	Stationary source emissions – Determination of mass concentration of nitrogen oxides (NOx) – Reference method: Chemiluminescence
Carbon monoxide emissions	
<b>EN 15058</b>	Stationary source emissions – Determination of the mass concentration of carbon monoxide (CO) – Reference method: Non-dispersive infrared spectrometry
Organic gaseous carbon emissions	
<b>EN 12619</b>	Stationary source emissions – Determination of the mass concentration of total gaseous organic carbon at low concentrations in flue gases – Continuous flame ionisation detector method
Particulate matter emissions	
<b>EN 13284-1</b>	Stationary source emissions – Determination of low range mass concentration of dust – Part 1: Manual gravimetric method
Noise emissions	
<b>EN 15036</b>	Heating boilers - Test regulations for airborne noise emissions from heat generators
<b>ISO EN 3743</b>	Acoustics - Determination of sound power levels of noise sources - Engineering methods for small, movable sources in reverberant fields
<b>EN ISO 3744</b>	Acoustics - Determination of sound power levels and sound energy levels of noise sources using sound pressure - Engineering methods for an essentially free field over a reflecting plane
<b>EN ISO 3746</b>	Acoustics - Determination of sound power levels and sound energy levels of noise sources using sound pressure - Survey method using an enveloping measurement surface over a reflecting plane
<b>EN 12102</b>	Air conditioners, liquid chilling packages, heat pumps and dehumidifiers with electrically driven compressors for space heating and cooling - Measurement of airborne noise - Determination of the sound power level

## ANNEX 2: METHODS FOR CALCULATING EMISSIONS

1. Seasonal space heating emissions shall be calculated as follows:

Table 2. Calculation of seasonal space heating efficiency

Type of solid fuel boiler	Formula
Manually stoked solid fuel boilers that can be operated at 50% of the rated heat output in continuous mode, and automatically stoked solid fuel boilers	$E_s = 0.85 \times E_{s,p} + 0.15 \times E_{s,r}$
Manually stoked solid fuel boilers that cannot be operated at 50% or less of the rated heat output in continuous mode, and solid fuel cogeneration boilers	$E_s = E_{s,r}$

Where

- $E_s$  are the seasonal space heating emissions.
- $E_{s,p}$  are the emissions of respectively particulate matter, organic gaseous compounds, carbon monoxide and nitrogen oxides measured at 30% or 50% of rated heat output, as applicable.
- $E_{s,r}$  are the emissions of respectively particulate matter, organic gaseous compounds, carbon monoxide and nitrogen oxides measured at rated heat output.

2. GHG emissions shall be calculated following the TEWI formulae as set out in *Table 3* (the formula depends on the heat generator technology). Each TEWI formula may consist of two parts, one depending solely on the heater efficiency (expressed in terms of the seasonal space heating energy efficiency,  $\eta_s$ ) and the fuel carbon intensity (represented by the  $\beta$  parameter), and the second part (only applicable to heat pump heaters) depending on the greenhouse gas emissions due to refrigerant leakage. The GHG emissions from the refrigerant leakage depend on the global warming potential (GWP100) of the refrigerant and the refrigerant leakage during the use phase (expressed as an annual leakage rate, ER, in percentage of the total mass of the refrigerant per year) and at end-of-life (expressed as a percentage of the total mass of the refrigerant,  $\alpha$ ).

Table 3. TEWI formulae by heat generating technology

Heat generator technology	TEWI formula (g CO <sub>2</sub> -equivalent/kWh heating output)
Boiler heaters	$\frac{\beta_{\text{fuel}}}{\eta_s}$
Heat pump heaters	$\delta \times \frac{\beta_{\text{fuel}}}{\eta_s} + (1 - \delta) \times \frac{\beta_{\text{elec}}}{2.5 \times \eta_s} + \frac{\text{GWP}_{100} \times m \times (ER \times n + \alpha)}{P \times h \times n}$
Cogeneration heaters	$\frac{\beta_{\text{fuel}}}{\eta_{\text{thermal}}} - \frac{\eta_{\text{el}} + \beta_{\text{elec}}}{\eta_{\text{thermal}}}$
Package of heaters	$(1 - S_{\text{HP}}) \times \frac{\beta_{\text{fuel}}}{\eta_{s,B}} + S_{\text{HP}} \times \left( \delta \times \frac{\beta_{\text{fuel}}}{\eta_{s,HP}} + (1 - \delta) \times \frac{\beta_{\text{elec}}}{2.5 \times \eta_s} + \frac{\text{GWP}_{100} \times m \times (ER \times n + \alpha)}{P \times h \times n} \right)$

The main parameters in the TEWI formulae above are described in Table 4.

Table 4. Main parameters for computing the TEWI formulae

Parameter	Description of parameter	Units	Constant value or test to be performed to obtain parameter
$\beta_{elec}$	GHG emission intensity of electricity	[g CO <sub>2</sub> -equivalent/kWhelec]	384
$\beta_{fuel}$	GHG emission intensity of the fuel used by the heater	[g CO <sub>2</sub> -equivalent/kWhgas]	See <i>Table 5</i>
$\eta_s$	Seasonal space heating energy efficiency	[-]	To be tested and declared by the applicant (Criterion 1)
$\eta_{s,b}$	Seasonal space heating energy efficiency of the boiler heater part for average climate conditions	[-]	To be tested and declared by the applicant (Criterion 1)
$\eta_{s,HP}$	Seasonal space heating energy efficiency of the heat pump heater part for average climate conditions	[-]	To be tested and declared by the applicant (Criterion 1)
$\eta_{thermal}$	Thermal efficiency	[-]	See <i>Table 6</i>
$\eta_{el}$	Electrical efficiency	[-]	See <i>Table 6</i>
$\delta$	Proxy	[-]	= 0 if electrically-driven heat pump = 1 if fuel-driven heat pump
$GWP_{100}$	Global warming potential (effect over 100 years)	[g CO <sub>2</sub> -equivalent/g refrigerant, over 100-year period]	According to Annex I to Regulation (EC) No 842/2006
$m$	Refrigerant mass	[g]	To be declared by the applicant
$ER$	Refrigerant loss per year	[%/yr]	A value of ER = 3.5 %/yr shall be used.
$n$	Lifetime	[yr]	A value of n = 15 shall be used.
$\alpha$	Refrigerant loss at end of life (disposal loss)	[%]	A value of $\alpha$ = 35 % shall be used.
$p$	Design load	[kW]	To be declared by the applicant
$h$	Full load operating hours	[h/yr]	2000
$S_{HP}$	Share of heat output from the heat pump heater part over the total heat output	[-]	To be declared by the applicant

Table 5 describes how to evaluate parameter  $\beta_{\text{fuel}}$  in the TEWI formulae above depending on the fuel used by the heater. In case the boiler is designed for a fuel not listed in the table, the closest match of fuel shall be selected, based on the origin (fossil or biomass) and form (gaseous, liquid or solid) of the fuel used.

Table 5. Parameter  $\beta_{\text{fuel}}$  (GHG emission intensity) to compute the TEWI formulae

Fuel used by the heater	GHG emission intensity	Value (g CO <sub>2</sub> -equivalent/kWhgas)
Gaseous fossil fuels	$\beta_{\text{fuel}} = \beta_{\text{gas}}$	202
Liquid fossil fuels	$\beta_{\text{fuel}} = \beta_{\text{oil}}$	292
Solid fossil fuels	$\beta_{\text{fuel}} = \beta_{\text{coal}}$	392
Gaseous biomass	$\beta_{\text{fuel}} = \beta_{\text{bio-gas}}$	98
Liquid biomass	$\beta_{\text{fuel}} = \beta_{\text{bio-oil}}$	149
Wood logs	$\beta_{\text{fuel}} = \beta_{\text{bio-log}}$	19
Wood chips	$\beta_{\text{fuel}} = \beta_{\text{bio-chip}}$	16
Wood pellets	$\beta_{\text{fuel}} = \beta_{\text{bio-pellet}}$	39
Blends of fossil fuels and biomass	$\beta_{\text{fuel}}$ = weighted average derived from the sum of the weight fractions of the individual fuels multiplied by their GHG emission parameter	$\Sigma (\text{Fuel X \%} \times \beta_{\text{fuel X}}) + (\text{Fuel Y \%} \times \beta_{\text{fuel Y}}) + \dots (\text{Fuel N \%} \times \beta_{\text{fuel N}})$



Table 6 describes how to evaluate parameters  $\eta_{\text{thermal}}$  and  $\eta_{\text{el}}$  in the TEWI formula for cogeneration heaters.

Table 6. Parameters  $\eta_{\text{thermal}}$  and  $\eta_{\text{el}}$  to compute the TEWI formula for cogeneration heaters

Parameter	Expression
$\eta_{\text{thermal}}$	$\eta_{\text{thermal}} = \eta_s \cdot 2.5 \times \eta_{\text{el}}$
$\eta_{\text{el}}$	For cogeneration space heaters not equipped with supplementary heaters  $\eta_{\text{el}} = \eta_{\text{el,CHP100+Sup0}}$
	For cogeneration space heaters equipped with supplementary heaters  $\eta_{\text{el}} = 0.85 \times \eta_{\text{el,CHP100+Sup0}} + 0.15 \times \eta_{\text{el,CHP100+Sup100}}$
	Where: <ul style="list-style-type: none"> <li>• <math>\eta_s</math> means the seasonal space heating energy efficiency as defined in Regulation (EU) No 813/2013</li> <li>• <math>\eta_{\text{el}}</math> means the electrical efficiency as defined in Regulation (EU) No 813/2013</li> <li>• <math>\eta_{\text{el,CHP100+Sup0}}</math> means the electrical efficiency at rated heat output of cogeneration space heater with supplementary heater disabled, as defined in Regulation (EU) No 813/2013</li> <li>• <math>\eta_{\text{el,CHP100+Sup100}}</math> means the electrical efficiency at rated heat output of cogeneration space heater with supplementary heater enabled, as defined in Regulation (EU) No 813/2013</li> </ul>



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