EPBD Recast Article 14

Heating Systems Inspections

National Equivalence Report

Ireland

***Prepared for*:**

Sustainable Energy Authority of Ireland

FINAL

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EXECUTIVE SUMMARY

A comparison of the annual energy saving potential arising from a hypothetical regular inspection scheme complying with Article 14(1)–(3) and the alternative approach adopted in Ireland, complying with Article 14(4), is shown in the table below.

Hypothetical Regular Inspection Scheme Article 14(1)–(3)			**Alternative Measures Article 14(4)**		
Annual Energy Saving	GWh	98.9	Annual Energy Saving	GWh	314.1
Annual CO_2 Savings	tonnes	23,917	Annual CO_2 Savings	tonnes	67,658

The analysis, conducted in Q3/Q4 of 2013, shows that the alternative approach in Ireland, consisting of an awareness scheme and capital grants for heating system upgrades, would yield over three times the energy and CO_2 savings that would be achieved by a hypothetical inspection scheme over the reporting period from June 2011 to June 2014.

1. INTRODUCTION – OVERVIEW OF EPBD & EPBD RECAST REQUIREMENTS

1.1 EPBD Recast Article 14 – Inspection of Heating Systems

The EPBD Recast Article 14 – Inspection of Heating Systems requires member states to establish a regular inspection of the accessible parts of systems used for heating buildings, such as the heat generator, control system and circulation pump(s) with boilers of an effective rated output for space heating purposes of more than 20kW. The inspection shall include an assessment of the boiler efficiency and the boiler sizing compared with the heating requirements of the building. The assessment of the boiler sizing does not have to be repeated as long as no changes were made to the heating system or as regards the heating requirements of the building in the meantime.

The inspection frequency may be reduced or lightened where an electronic monitoring or control system is in place. The inspection frequency may be adjusted to reflect the type and effective rated output of the heating system whilst taking into account the inspection costs and the estimated energy costs savings that may result from the inspection. Heating systems with boilers of an effective rated output of more than 100kW shall be inspected at least every two years.

As an alternative to the above member states may opt to take measures to ensure the provision of advice to users concerning the replacement of boilers, other modifications to the heating system and alternative solutions to assess the efficiency and appropriate size of the boiler. The overall impact of this approach shall be equivalent to that arising from, the provisions set out above.

These requirements are summarised in the table below.

	EPBD Recast Article 14 Inspection of Heating Systems
Scope	Accessible parts of heating system such as heat generator, control system and circulation pump(s) with an effective rated output for space heating purposes of more than 20kW.
Frequency	20kW – 100kW not specified, greater than 100kW at least every 2 years. For gas boilers this period may be extended to 4 years.
Assessment	Boiler efficiency and sizing –one-off assessment for all boilers provided no change to heating system or heating requirements.
Fuels	All fuels
Effective Date	9 January 2013 for buildings occupied by public authorities and to other buildings from 9 July 2013 at the latest.

1.2 Notifications to EU Commission of Proposed Approach for Ireland

In September 2012, Ireland notified the EU Commission of its decision to avail of the alternative approach provided under Article 14(4) of the Recast EPBD. As set out in that notification, the approach implemented in Ireland centres on the implementation of an effective information campaign aimed at encouraging regular heating system inspections/maintenance and the replacement of inefficient heating systems with high efficiency alternatives. Similar awareness measures have been ongoing since 2006. These have been complemented by a range of additional incentives to encourage heating system upgrades. This approach will continue throughout the current reporting period from 30th June 2011 to 30th June 2014.

In March 2013, Ireland submitted an Equivalence Report to the European Commission which outlined the measures taken to deliver heating system energy savings that are equivalent to the savings

predicted from a mandatory inspection scheme. The Commission sought further clarifications regarding the assumptions and the energy savings set out in the March 2013 Equivalence Report.

The remit of the present document is to provide the Commission with an updated report on the actions undertaken in Ireland under Article 14(4) and the equivalence of these measures to a hypothetical mandatory inspection regime under Article 14(1)–(3) of the Recast EPBD Directive. This updated report presents boiler population estimates up to the end of 2012 and calculations of the energy and CO_2 savings that could result from a mandatory inspection scheme or from the alternative measures, under Article 14(4), that have been implemented in Ireland.

This comparison is undertaken for a reporting period from June 2011 to June 2014.

2. RESEARCH ON EQUIVALENCE IN 2013

In August 2013, a study was carried out to estimate the boiler population in Ireland at the end of 2012[1]. The analysis and results from this study are set out in a separate report (Ref. 493-X0001) which is included in Appendix A. A summary of the main findings from this analysis is also shown in Section 3.

The revised estimates of boiler population and other information sources were then used to prepare an up to date comparison of the impacts arising from the alternative measures implemented in Ireland and the impacts[2] that could arise from a hypothetical heating system inspection scheme.

A summary of the main information sources researched and the data analysed when preparing the updated equivalence assessment are set out below.

Central Statistics Office Reports

- Census data from April 2011 was analysed to determine the number and types of heating system installed in residential dwellings in Ireland. The Census also identified the number of dwellings with central heating systems powered by electricity. Electrical heating systems were excluded from the equivalence assessment.
- The Census established that there were 1.649 million occupied households in April 2011 out of a total number of dwellings in the State of 1.99 million. This information allowed the total numbers of "active" heating systems to be calculated. The "active" heating systems are deemed to be the most important cohort when carrying out an equivalence assessment because vacant houses with inactive heating systems do not consume fuel and no energy savings could arise from inspecting these systems. Only active heating systems were considered for the revised equivalence assessment.

SEAI's Building Energy Rating Database

- SEAI's database of Building Energy Rating (BER) certificates includes detailed information for 350,000 dwellings. This data was analysed to identify the number of additional gas, oil and solid fuel heating systems that were installed between April 2011 (the Census date) and 31st December 2012.
- The BER database was also analysed to estimate the size of the boilers installed in new properties constructed between 2006 and 2012. This work provided an estimate for the total number of residential boilers with capacities above 20 kW e.g. based on floor area, main fuel and other data.

Data from the Commission for Energy Regulation

- Data published by the Commission for Energy Regulation gave information on the number of industrial and commercial gas consumers as of December 2012. This information was used to estimate the number of gas boilers in the commercial sector in Ireland.

[1] December 2012 is the mid-point of the reporting period.

[2] On an annual average and biennial basis.

Boiler Servicing Market Research Reports

- New independent market research was commissioned by SEAI during Q2 and Q3 of 2013. This research analysed the frequency at which boilers are serviced in Ireland in 2013. This new data has been factored into the revised equivalence computations.

Ireland's 2012 Provisional National Energy Balance

- Up to date energy consumption data for the residential and commercial sectors in Ireland was obtained from Ireland's Provisional National Energy Balance for 2012. This new data has also been factored into the revised equivalence computations.

3. BOILER POPULATION AS OF DECEMBER 2012

The following are the summary findings of the report on the boiler population at the end of December 2012. A detailed derivation of the boiler population is available in Appendix A (Ref. 493-X0001).

- The estimated residential boiler population, as of December 2012, is 1.792 million. Of this total, 1.534 million boilers are in occupied households and this cohort is considered to be the "active" residential boiler population for the purposes of the equivalence assessment. The remaining heating systems are installed in vacant houses that do not consume fuel, i.e. no energy consumption attributable to these houses and no energy savings would arise from either awareness or inspection measures.
- An estimated 706,781 residential boilers have output ratings >20 kW. A large proportion of these boilers are located in larger detached housing in rural areas that are not connected to the gas grid. These boilers are typically oil fired.
- There are an estimated 574,727 oil boilers, 99,364 gas boilers and 32,690 solid fuel boilers >20 kW installed in occupied residential dwellings.
- Households in Ireland with oil-fired boilers increasingly use kerosene. It is estimated that approximately 75% of residential oil usage in Ireland during 2012 was kerosene. Gasoil fuel makes up the balance of oil fuels. Kerosene burns more cleanly[3] than gasoil and requires less servicing to retain clean, reliable and efficient operation.
- The Irish market differs from many other European markets with respect to the higher prevalence of oil boilers installed in dwellings. As a percentage of final energy demand in the residential sector, oil accounts for 38.6%[4] in Ireland, compared to 0.9% in Netherlands and 7.2% in UK.
- The boilers in the main urban centres are least affected by Article 14.1. This is because many of the houses in urban areas served by the gas grid are semi detached or terraced and are equipped with boilers below the 20 kW. These boilers would not require inspection under the Recast EPBD Directive.
- At the end of 2012, there were an estimated 47,396 commercial boilers >20 kW, of which 24,945 were gas fired and 22,451 were oil fired.
- Commercial boilers represented 3% of the total number of boilers in the residential and commercial sectors combined and 6.3% of the boiler population with rated outputs >20 kW. The 'commercial' sector includes public and private non-industrial sectors.
- When vacant housing is excluded, the total number of active residential and commercial boilers in Ireland, as of December 2012, is estimated to be 1.582 million. An inspection regime under Article 14.1 would apply to 754,176 of these, or 41% of the active boiler population.

The active boiler population figures were used when preparing the equivalence assessment. The breakdown of the active boiler population is shown in the table below.

[3] In assigning efficiency improvements for domestic oil fired boilers the percentage gains for kerosene and gas oil were combined based on their respective usage as published in the National Energy Balance 2012.

[4] Energy in the Residential Sector 2013 Report, SEAI, September 2013

Active Boiler Population (Residential and Commercial) by Size (December 2012)				
Fuel	**Under 20kW**	**20 - 100 kW**	**Over 100 kW**	**All Sizes**
Oil	175,666	595,381	1,796	772,843
Gas	496,808	122,304	2,005	621,117
Solid Fuel	155,372	32,690	-	188,062
Total	**827,846**	**750,375**	**3,801**	**1,582,023**

The derivation of the values in the above table can be seen in Appendix A.

4. IMPACT OF HYPOTHETICAL REGULAR INSPECTION REGIME

The potential savings that could arise from a hypothetical heating system inspection scheme was re-assessed. The expected savings were analysed for the residential and commercial boiler populations that fall within the remit of Articles 14(1)–(3).

4.1 Residential Sector

The following are the key assumptions that were used when assessing the impact of a hypothetical regular inspection scheme for residential heating systems.

Assumptions

- A biennial inspection regime is introduced.
- All dwellings with boilers within the remit of EPBD Article 14.1, (i.e. with capacities >20 kW) would undergo inspections (706,781).
- Approximately 76.3%[5] (~539,500) of residential heating systems >20 kW currently receive a maintenance servicing at least every 2 years. Efficiency gains that arise due to a mandatory inspection scheme are only credited to the 23.7% (~167,270) of heating systems that currently service boilers less frequently than biennially.
- Not all householders would be willing to spend money on extra servicing despite the introduction of a mandatory inspection scheme. It has been assumed that the conversion rate from service intervals greater than 2 years to biennial servicing is 50%.
- Dwellings that have had recent BER inspections have already received recommendations on heating system improvements and would be unlikely to benefit from a further heating system inspections/recommendations.
- On the basis of energy savings and the disruption to the household in undertaking different upgrades, we assumed that 1% of households would respond to recommendations arising from inspections by investing modest capital amounts in heating control system upgrades, without the incentive of a Government grant.
- Consumer research indicates that the main driver for residential boiler upgrades is breakdowns. This is particularly true during a period of economic austerity. This analysis assumes that inspection measures alone would not be sufficient to encourage boiler upgrades/replacement without the incentive of a grant.
- All households, on average, would reduce energy use following a biennial heating system inspection, leading to a 1% reduction in energy use across the inspected boiler population. This is achieved by lowering room temperatures, better tuning of the existing control systems or minor investment in insulation of heating system components.
- The shift to biennial servicing of oil and solid fuel boilers would lead to a 3.5% energy saving and the shift to biennial gas boiler servicing would lead to a 1% energy saving. These percentage savings represent the difference between the efficiency loss after 2 years and the higher losses that would occur if a longer service interval was chosen. The savings are based on published data from SEAI differentiated by fuel type[6].
- Any additional transport energy consumption resulting from visits to houses by heating system inspectors have been excluded from the analysis.
- The cost for a boiler inspection and a review of the heating system would be the same order of cost as a Building Energy Rating (BER) inspection i.e. €165. The cost of additional boiler servicing, if triggered by an inspection regime, is €100 per service.

[5] Based on the results of market research studies carried out by Millward Brown and Ignite on behalf of the Sustainable Energy Authority of Ireland (SEAI).

[6] http://www.seai.ie/Power_of_One/Heat_Your_Home_For_Less/Servicing_Your_Boiler/

- The cost attached to the establishment, maintenance and administration of a mandatory inspection scheme has not been included as part of this study. Further analysis would be required to quantify these additional costs. The payback period for a mandatory inspection scheme would be marginally longer if these costs were included.

The assessment of the impact of a regular regime of biennial inspections of heating system in the residential sector is presented in the following tables. The assessment assumes that more frequent inspections would give rise to savings via three mechanisms; investment in heating control system upgrades, switching to biennial servicing of boilers and improved operation of existing heating systems based on recommendations from inspectors.

Hypothetical Biennial Heating System Inspections					
	Units	**Oil**	**Gas**	**Solid Fuel**	**Total**
Average annual consumption per boiler	kWh	17,000	16,000	18,000	
Numbers of dwellings / heating systems >20 kW that have not been inspected within 5 years[7]		459,782	79,484	26,152	565,418
A) Heating Control System Upgrades					
Percentage of households investing in upgrades of heating control systems following inspection	%	1.0	1.0	1.0	
Number of dwellings investing in upgrades of heating control systems following inspection		4,598	795	262	5,654
Percentage savings from heating control system upgrade	%	20.0	20.0	20.0	
Annual saving from investment in heating control system upgrades	GWh	15.6	2.5	0.9	19.1
Biennial saving from investment in heating control system upgrades	GWh	31.3	5.1	1.9	38.2
B) Switch to Biennial Boiler Servicing (Boiler Efficiency)					
Number of households that currently exceed a biennial boiler servicing frequency (servicing at intervals > 2 years)		136,019	23,514	7,737	167,269
Households that switch to biennial servicing following inspection (50% of maximum)		68,009	11,757	3,868	83,634
Percentage savings due to switch to biennial servicing by households currently servicing less frequently than every 2 years	%	3.5	1.0	3.5	
Biennial saving by switch to biennial boiler servicing by 50% of inspected houses	GWh	40.5	1.9	2.4	44.8
C) Improved Operation of Existing Heating Systems					
Households that benefit from improved operation of existing heating systems after inspections (e.g. behavioural changes, control system tuning) (1% improvement)		459,782	79,484	26,152	565,418
Biennial saving across the inspected boiler population due to behavioural change	GWh	78.2	12.7	4.7	95.6
Total biennial savings (A + B + C)	GWh	149.9	19.7	9.0	178.6
Annual energy saving	GWh	74.9	9.8	4.5	89.3
Annual CO_2 savings	tonnes	18,344	1,832	1,464	21,640

The current best estimate of the impact of a hypothetical inspection system for all boilers >20 kW, which have not already undergone inspection of the energy system as part of the Building

[7] Building Energy Ratings have been carried out in approximately 20% of Irish households during the last 5 years. After each inspection, an independent report is provided to householders which outlines potential heating system upgrades and improvements. For this analysis, we have assumed that the balance (i.e. 80% of households) with boilers >20kW will not have received any heating system improvement recommendations and that this cohort would benefit from a hypothetical inspection scheme.

Energy Rating programme, is an annual energy saving of 89.3 GWh and an annual CO_2 saving of 21,640 tonnes.

If 100% of the households that currently service boilers at intervals >2 year were to switch to biennial servicing and if the energy savings from operational improvements were 2% annually, then the estimated energy savings from an inspection scheme would almost double i.e. 160 GWh and 38,675 tonnes CO_2. However, in our opinion, achieving this result from an inspection scheme alone is a highly unrealistic outcome given that the combined impact of multiple awareness programmes and Government grant support schemes have yielded a 1.6%[8] annual reduction in residential energy usage between 2006 and 2011. The estimated payback period for a residential inspection scheme is shown below.

Overall Impact of Hypothetical Biennial Boiler and Heating System Inspections					
	Units	**Oil**	**Gas**	**Solid Fuel**	**Total**
Annual energy saving	GWh	74.9	9.8	4.5	89.3
Unit cost of energy (2013)	€ / kWh	0.097	0.067	0.050	
Annual value of savings across all households	€ millions	7.27	0.66	0.22	8.15
Number of houses inspected		459,782	79,484	26,152	565,418
Unit cost of boiler and heating system inspection per house	€	165.00	165.00	165.00	
Biennial cost of inspection scheme	€ millions	75.86	13.11	4.32	93.29
Biennial cost of additional boiler servicing	€ millions	6.80	1.18	0.39	8.36
Biennial cost of heating control system upgrades by householders	€ millions	4.60	0.79	0.26	5.65
Total biennial cost	€ millions	87.26	15.09	4.96	107.31
Annual cost	€ millions	43.63	7.54	2.48	53.66
Payback period	years	6.00	11.44	11.06	6.58

As can be seen from the table above, the cost of a biennial inspection scheme is never recovered through savings resulting from reduced energy consumption because the payback period is estimated to be 6.5 years but inspection costs would recur every 2 years.

[8] Energy in the Residential Sector 2013 Report, SEAI, September 2013

4.2 Commercial Sector

The following are the key assumptions that were used when assessing the impact of a hypothetical inspection scheme for heating systems in commercial buildings.

- A biennial inspection regime is introduced.
- All commercial boiler within the remit of EPBD Article 14.1, (i.e. with capacities >20 kW) would undergo inspections (~47,396).
- Approximately 80% (37,916) of commercial heating systems >20 kW currently receive a maintenance servicing at least every 2 years. Efficiency gains that would arise due to a mandatory inspection scheme are only credited to the 20% (9,479) of heating systems that currently service boilers less frequently than biennially.
- Not all commercial operators would be willing to pay for extra servicing. It is assumed that the conversion rate to biennial servicing is 50%.
- The shift to biennial servicing of oil and solid fuel boilers leads to a 3.8% energy saving and the shift to biennial gas boiler servicing leads to a 0.7% energy saving. These percentage savings represent the difference between the efficiency loss after 2 years and the higher losses that would occur if a longer service interval was chosen.
- The servicing pattern for commercial boilers over the period 2011 to 2014 is assumed to be the same as the servicing pattern found, by SEAI during 2005, during a detailed survey of boiler servicing companies.

Outcome

The assessment of the impact of a regular biennial inspection scheme of both the boiler and the visible parts of the heating system is presented in the table overleaf.

Biennial Inspection of Commercial Boilers >20 kW				
	Units	**Oil**	**Gas**	**Total**
Average annual usage per boiler	kWh	186,000	186,000	
Number of boilers >20 kW		22,450	24,945	47,395
Percentage of Commercial Boilers receiving Maintenance Servicing				
Every 2 years or less	%	80	80	
Over 2 years between servicing	%	20	20	
Numbers of commercial boilers not serviced within 2 years		4,490	4,989	9,479
Efficiency Loss for Different Servicing Intervals[9]				
1 year	%	1.5	0.4	
2 years	%	4.2	1.0	
3 years	%	8.0	1.7	
Improvement from switch to biennial servicing	%	3.8	0.7	
Biennial Inspection with 50% Switch to More Frequent Maintenance Servicing				
Percentage of boilers switching to more frequent servicing following inspection recommendations	%	50	50	
Biennial energy saving	GWh	15.87	3.25	19.12
Annual energy saving	GWh	7.94	1.63	9.56
Annual CO_2 savings	tonnes	1,975	302	2,277
Payback Period for Biennial Inspections				
Unit cost of energy (2013)	€/kWh	0.1003	0.0591	
Annual value of savings	€ millions	3.18	0.38	3.57
Biennial cost of inspection scheme @ €300 for all boilers and space heating systems	€ millions	5.6	6.2	11.8
Biennial cost of extra maintenance service @ €300 for target population not servicing annually	€ millions	1.35	1.49	2.84
Biennial cost of inspections and extra servicing	€ millions	6.96	7.73	14.69
Annual cost of inspections and extra servicing	€ millions	3.48	3.87	7.35
Payback period	years	1.09	10.07	2.06

This analysis strongly suggests that a mandatory biennial inspection system for commercial gas boilers would not be justified given the estimated payback greater than 10 years. Greater efficiency gains could be achieved by more regular servicing of those oil boilers currently serviced less frequently than biennially.

[9] http://www.seai.ie/Power_of_One/Heat_Your_Home_For_Less/Servicing_Your_Boiler/

4.3 Residential and Commercial Combined

The overall impact of a hypothetical biennial inspection scheme for oil, gas and solid fuel boilers in the residential and commercial sectors is summarised in the table below.

Hypothetical Regular Inspection Scheme Article 14 (1) to (3)		
Heating control system upgrades	GWh	19.1
Switch to biennial boiler servicing	GWh	22.4
Heating system behaviour changes	GWh	47.8
Commercial heating system servicing improvements	GWh	9.6
Annual energy saving	GWh	98.9
Annual CO_2 savings	tonnes	23,917

The estimated payback period for regular biennial inspections of residential and commercial heating systems is shown below.

Hypothetical Inspection Scheme Payback Period (Residential & Commercial Sectors)				
	Units	Residential	Commercial	Total
Annual cost of a biennial inspections	€ millions	53.7	7.4	61.1
Annual value of energy savings	€ millions	8.2	3.6	11.8
Payback period	years	6.6	2.1[10]	5.2

[10] The payback period for commercial boilers is dominated by the potential energy savings from increased oil boiler servicing.

5. Detailed Analysis of Actions Implemented

EPBD Recast Article 14 enables member states to opt to take measures to ensure the provision of advice to users concerning the replacement of boilers, other modifications to the heating system and alternative solutions to assess the efficiency and appropriate size of the boiler. The overall impact of this approach shall be equivalent to that arising from a regular inspection scheme.

An aligned set of actions contributing to improving boiler and heating system efficiency in the Irish building stock is in place. These consist of actions yielding energy savings and CO_2 abatement of a direct nature from capital investment in high efficiency systems, plus actions of an indirect nature that influence such capital upgrading works or influence improvements to operational heating system efficiency, notably boiler maintenance servicing.

This section of the report deals with the individual actions taken to date, quantifies the energy savings arising and clearly demonstrates how, as an integrated suite of measures, they are equivalent or superior to a mandatory inspection programme.

5.1 National Awareness Campaigns Encouraging Regular Servicing or Replacement

Description

During the period 2006 – 2009 extensive multi-media consumer awareness and advice campaigns, entitled 'Power of One' were conducted (see www.powerofone.ie) which included a range of messages on home energy saving, including boiler servicing and management. Since 2008 Ireland has run national promotional / advertising campaigns in relation to regular servicing of boilers, using websites and popular and trade media. The campaign has been a partnership between SEAI and key heating industry stakeholders, viz. Bord Gáis Energy (BGE) (natural gas), OFTEC (oil) and Irish Liquid Petroleum Gas Association (ILPGA) (LPG). The campaign has had as its core message the encouragement of regular maintenance of residential and commercial boilers and the replacement of inefficient boilers or heating installations. In collaboration with industry stakeholders, the campaign has encompassed all major media streams including television, radio and national newspaper advertising, as well as web advertising and promotional literature. The campaign directed consumers to a portal web page at www.seai.ie/boilers which in turn linked directly to the web sites and panels of specialist boiler maintenance service providers maintained by the three key stakeholders.

A more holistic message than energy efficiency alone was carried in the campaign. Specifically, it has promoted the benefits of safety and reliability as well as energy efficiency/ cost savings. This is because of known consumer perceptions from the baseline study and the weakness, in economic terms, of an energy efficiency message alone.

As an example of boiler campaign statistics, the campaign in 2011 had reached daily and Sunday newspapers each with a readership of 3.6 million, broadcast listenership of 3.1 million and online advertising achieved 100,000 visits. The campaign led to an increase of over 20% in visits to the relevant web pages, and the residual effect was sustained for a significant period after the primary campaign ceased.

Outcome

SEAI organise detailed surveys to determine how frequently boilers are serviced in Ireland. The findings from surveys carried out between 2009 and 2013 are shown below.

Residential Boiler Servicing Frequency			
Year	**Annual**	**Every 2 Year**	**Combined**
2009	49.0%	18.0%	67.0%
2010	57.0%	11.0%	68.0%
2011	64.0%	14.0%	78.0%
2012*	58.3%	18.0%	76.3%
2013	52.7%	22.0%	74.7%

*The 2012 value is an interpolated average based on 2011 and 2013 market research.

The impact of the national awareness campaigns was quantified by comparing the boiler servicing frequencies for 2010 and 2012. The findings from SEAI's survey work indicate that there has been an increase of 8.3% in the percentage of households servicing their boilers biennially between 2010 and 2012.

The marginal decline in boiler servicing frequency between 2011 and 2013 is consistent with general consumer behaviour during periods of significant economic austerity. It is believed that the decline in servicing frequencies would have been far more pronounced were it not for the ongoing awareness campaigns.

Estimated Energy Savings

In order to estimate the energy saving due to the increased biennial boiler servicing between 2010 and 2012 triggered by the awareness campaigns, we have assumed a 3.5% energy efficiency improvement for oil and solid fuel boiler servicing and an energy efficiency improvement of 1% for gas boilers. This results in an annual energy saving of 46.2 GWh per annum which, given the fuel mix in the sector, gives rise to a CO_2 saving of 11,589 tonnes. The analysis of the saving arising from the national awareness campaign measures is summarised in the following table.

National Awareness Campaign (Savings from Increased Boiler Servicing)					
	Units	**Oil**	**Gas**	**Solid**	**Total**
Number of households switching to biennial servicing between December 2010 and December 2012[11]		62,533	49,681	15,672	127,886
Average annual energy usage (from National Energy Balance 2012)	kWh	14,647	12,300	14,647[12]	
Percentage saving by switching to biennial servicing	%	3.5	1.0	3.5	
Annual energy savings	GWh	32.06	6.11	8.03	46.20
Annual CO_2 savings	tonnes	7,846	1,137	2,606	11,589

5.2 Better Energy Homes (BEH) Scheme Grants for Efficient Heating Installations

Description

The Better Energy Homes scheme, established in 2009, provides assistance to homeowners to reduce energy use, costs and greenhouse gas emissions and improve the comfort levels within their home. The objectives of the scheme are to:

- Support homeowners in making intelligent choices to improve the energy performance of their home
- Reduce energy use, costs and greenhouse gas emissions

[11] This is the number of additional households undertaking biennial servicing compared to 2010.

[12] Energy usage by solid fuel central heating systems is assumed to be similar to oil fired central heating for which accurate data is available from the National Energy Balance.

- Build market capacity and competence by driving contractor standards and quality
- Stimulating market innovation

The incentive is in the form of a Cash Grant. Cash grants are fixed, irrespective of home size, though where actual expenditure is lower than the grant value only the lower amount will be paid. The grants are available to homeowners for the installation of boilers with seasonal heating efficiencies in excess of 90% and advanced heating controls to replace inefficient old systems in existing homes.

Since the introduction of energy supplier targets under the Energy Services / Energy Efficiency Directive, Ireland has operated a programme of energy credits allocated to prescribed works undertaken to published standards. These credits can be accrued by energy suppliers who cause energy efficient works to be completed in homes, among the measures are boiler upgrades, heating controls upgrades and boiler servicing. This credits scheme is anticipated to drive extensive volumes of energy retrofitting and boiler servicing.

Outcome

The following table provides a breakdown of the installations by technology:

Measure	Number of Installations
Cavity	88,328
Roof Insulation	99,114
Dry-lining Insulation	8,399
External Insulation	9,051
High Efficiency Gas Boiler with Heating Controls Upgrade	18,131
High Efficiency Oil Boiler with Heating Controls Upgrade	12,715
Heating Controls Upgrade Only	6,166
Solar Heating	3,136
Integral BER	87,968
Before / After BER	8,367
Total	**341,375**

Estimated Energy Savings

We have re-assessed the savings attributable to the Better Energy Homes scheme. The results are presented in the following table.

Better Energy Homes (BEH) Grant Support Schemes				
		Oil	**Gas**	**Total**
Average annual consumption per boiler[13]	kWh	17,000	16,000	
A) Heating Control Systems Upgrades				
Control system upgrades as of December 2012		2,542	3,624	6,166
Percentage annual savings from control systems upgrades	%	20	20	
Unit annual energy savings per control system upgrade	kWh	3,400	3,200	6,600
Annual energy savings – all control systems upgrades	GWh	8.64	11.60	20.24
B) High Efficiency Boilers and Heating Control Systems Upgrades				
High efficiency boilers upgrades with new heating controls		12,715	18,131	30,846
Percentage annual savings from high efficiency boiler upgrades with new heating controls	%	27.5	27.5	
Unit annual energy savings per high efficiency boiler upgrade with new heating controls	kWh	4,675	4,400	9,075
Annual energy savings -all high efficiency boiler upgrades with new heating controls	GWh	59.44	79.78	139.22
Energy & CO_2 Savings (A & B)				
Annual energy savings	GWh	68.1	91.4	159.5
Annual CO_2 savings	tonnes	16,664	17,004	33,668
Payback Period				
Average unit cost of heating control systems upgrades	€	900	900	
Average unit cost of high efficiency boiler & control system upgrades	€	3,500	3,500	
Total cost	€ millions	46.79	66.72	113.51
Unit cost of energy (2013)	€ / kWh	0.097	0.0673	
Annual savings due to BEH grant support scheme	€ millions	6.60	6.15	12.75
Payback period	years	7.08	10.85	8.90

[13] This scheme attracted investment by participants that operate boilers / heating systems that are larger than the national average.

5.3 Better Energy Workplace (BEW) Scheme: Grants for Commercial Sector

Description

The 2011 Better Energy Workplaces programme was designed to support exemplar sustainable energy projects and to evaluate new approaches for implementing energy upgrades in the commercial sectors. This programme supported 85 projects with a grant value of €11 million. This stimulated €34 million of additional funding bringing the total investment to €45 million. The projected ongoing annual energy savings from the 2011 scheme are 271 GWh, which is equivalent to 56,000 tonnes of CO_2 savings.

Outcome

A large proportion of the projects that received grant support from the scheme were gas/oil boiler upgrades, heating control upgrades and other HVAC improvements. The energy demand for most commercial buildings is dominated by the space heating requirements and a conservative estimate for this proportion is 40% of a building's total energy consumption. This proportion can be often higher for many commercial building types e.g. offices, hotels and entertainment venues.

Estimated Energy Savings

Based on this conservative estimate for the heating system energy usage, we have assessed that at least 40% of the annual energy savings from the Better Energy Workplace scheme can be attributed to heating system energy savings. This will give rise to energy savings of 108.4 GWh and CO_2 saving of 22,400 tonnes. This scheme continued until the end of 2012, resulting in additional ongoing energy savings through the reporting period to June 2014 and which will continue to contribute savings beyond 2014.

5.4 Summary of Savings due to Alternative Measures under Article 14(4)

An aligned set of actions that contribute to the improvement of boiler and heating system efficiency in Irish buildings has been developed by SEAI. These actions have yielded energy and CO_2 savings of a direct nature due to increased boiler servicing activity and new investment in energy efficient heating systems. The table below summarises the direct energy saving actions in operation during the reporting period and the savings attributable to each measure.

Action	Annual Energy Saving (GWh)	Annual CO_2 Savings (tonnes)	Operational Timeframe
National Awareness Campaign	46.2	11,589	2008 ongoing
Better Energy Homes Scheme	159.5	33,668	2008 (pilot) and ongoing to 2014
Better Energy Workplace Scheme	108.4	22,400	2011 – 2012
Total Annual Saving	**314.1**	**67,658**	

It is important to note that the capital investments triggered by the BEH and BEW scheme resulted in a step change improvement in energy use and reduction in CO_2 emissions. These will continue to contribute these savings on an annual basis for many years beyond 2014.

6. COMPARISON OF ENERGY SAVING POTENTIAL - ARTICLE 14(1 - 3) & 14(4)

A comparison of the annual energy saving potential arising from a hypothetical regular inspection scheme complying with Article 14(1) to 14(3) and the alternative approach adopted in Ireland, complying with Article 14(4), is shown below.

Hypothetical Regular Inspection Scheme Article 14(1) to (3)			Alternative Measures Article 14(4)		
Annual Energy Saving	GWh	98.9	Annual Energy Saving	GWh	314.1
Annual CO_2 Savings	tonnes	23,917	Annual CO_2 Savings	tonnes	67,658

The Commission should note that the direct measures outlined in this document are the key Irish schemes which will deliver energy savings in the reporting period (30th June 2011 to 30th June 2014) These measures apply to all boilers and are not restricted to boilers >20kW. Indirect measures, such as the maintenance of the Heat Appliance Register of Performance and the triple E Register, are also undertaken to empower consumer purchase decisions by providing independent advice on the selection of energy efficient heating systems. The annual energy savings attributable to indirect measures are difficult to quantify but these measures also lead to additional energy savings. These are not included in the total annual energy savings of 314.1 GWh attributable to the alternative measures in the table above. Despite the exclusion of these benefits, our equivalence analysis conducted in Q3/Q4 of 2013 indicates that, for the current three year reporting period, the energy savings attributable to the alternative measures exceed (by a significant margin) the estimated energy savings of 98.9 GWh that could arise from a hypothetical regular inspection scheme.

7. FUTURE FOCUS

As outlined in this report, Ireland has taken a number of promotional, regulatory, incentivising and accompanying initiatives in relation to heating system efficiency which are achieving impacts on energy saving and CO_2 abatement to levels significantly higher than would have been realistically achievable under EPBD Recast Article 14 paragraphs 1,2, and 3.

The mandatory minimum boiler efficiency of 90% introduced in December 2011 will provide on-going reductions in energy use. The Better Energy Homes Scheme grants are expected to continue for some period yet. Activity is currently underway to develop a range of payment support mechanisms including PAYS which is likely to see further investment in retrofitting actions.

As mentioned previously, energy suppliers who cause energy efficient works to be completed in homes can accrues energy credits towards their mandatory targets. Among the measures are boiler upgrades, heating controls upgrades and boiler servicing. This credits scheme is anticipated to drive extensive volumes of energy retrofitting and boiler servicing.

SEAI will continue to coordinate the national media campaign promoting boiler servicing and upgrade replacement. Consumer and business sector information, advice highlighting high efficiency boiler technologies, operational and maintenance practices, and training of boiler maintenance and installation technicians will be important initiatives in the future.

APPENDIX A: BOILER POPULATION REPORT (493-X0001)

Boiler Population Report

***Prepared for*:**

Sustainable Energy Authority of Ireland (SEAI)

FINAL

Ref: 493-X0001 Rev.1

October 2013

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EXECUTIVE SUMMARY

The key source of data on boiler numbers by fuel type in the residential sector is the national Census conducted by the Central Statistics Office in April 2011. This Census surveyed private households and asked about the main type of fuel used in central heating system.

A second important source of data is a summary database showing the results from Building Energy Ratings (BERs) conducted since 2008. The data from the BER database of 350,000 dwellings was used to update the residential boiler population inventory to include domestic boilers installed after Census day up until 31st December 2012.

The estimated boiler inventory in the residential sector as of 31st December 2012 is shown in Table 1.

Table 1: Residential Boiler Inventory (2012)

Fuel	Total (Active and Inactive)	Active Boiler Population
Oil	876,937	750,393
Gas	695,913	596,172
Solid Fuel	219,937	188,062
Total	1,792,787	1,534,627

The key sources of information used to estimate boiler numbers in the commercial sector were commercial gas customer numbers for 2012 from the Commission for Energy Regulation (CER) and commercial & public sector energy consumption data from the National Energy Balance. The number of commercial gas customers was used to estimate commercial gas boiler numbers and figures for oil boilers were then extrapolated using the ratio of gas to oil consumption in the commercial and public sectors from the National Energy Balance. The estimated boiler inventory in the commercial sector as of 31st December 2012 is shown in Table 2.

Table 2: Commercial Boiler Inventory (2012)

Fuel	Boiler Population
Oil	22,451
Gas	24,945
Solid Fuel	-
Total	**47,396**

Table 3 shows the combined inventory of boilers in the residential and commercial[14] sectors split according to output ratings.

[14] Commercial sector boiler numbers include those in the commercial, public sector and industry.

Table 3: Active Boiler Population Estimate (Residential and Commercial), by Size (2012)

Fuel	Under 20 kW	20 - 100 kW	Over 100 kW	All Sizes
Oil	175,666	595,381	1,796	772,843
Gas	496,808	122,304	2,005	621,117
Solid Fuel	155,372	32,690	-	188,062
Total	**827,846**	**750,375**	**3,801**	**1,582,023**

Some of the key findings from the study revising the boiler population are shown below:

- Out of a total of 1.582 million 'active' residential and commercial boilers, there are estimated to be 754,177 boilers over 20 kW, comprising 597,178 oil boilers, 124,309 gas boilers and 32,690 solid fuel boilers.
- Approximately 6.3% of the boilers >20kW are in the 'commercial' sector (i.e. public and private sector commercial enterprises and industrial sites), the balance are in households;
- 76% of the boilers over 20 kW in Ireland are oil-fired boilers in households. The majority of these are just over the Article 14 threshold of 20 kW;
- The Irish market differs from other European markets with respect to the higher percentage of oil fired boilers and also the higher market penetration of kerosene.

1. INTRODUCTION

The Energy Performance of Buildings Directive (EPBD) Recast is designed to improve the energy efficiency of buildings across Europe. Article 14 of the Directive aims to improve the performance of heating systems and offers two potential mechanisms for achieving compliance. Article 14.1 of the Directive requires Member States to implement measures for the regular inspection of boilers. The requirements of the inspection regime are qualified in Articles 14.2 and 14.3. Alternatively, Article 14.4 enables Member States to put in place alternative measures, i.e. using awareness and other programmes to achieve an equivalent impact on energy efficiency as the inspection regime.

Where a Member State chooses to apply the alternative measures allowed under Article 14.4 then it must submit a report to the Commission showing the equivalence of the alternative measures to the system of inspections set out under Articles 14.1, 14.2 and 14.3. Ireland previously informed the Commission of its intention to avail of the alternative approach provided under Article 14.4 and many of the measures which will produce equivalent results have already been initiated by the Sustainable Energy Authority of Ireland (SEAI). The impact assessment of a hypothetical inspection regime implemented in accordance with Article 14.1 was previously assessed by SEAI based on returns from a survey of approximately 200 boiler service firms undertaken in 2005. In April 2013, the Commission requested further clarifications of the assumptions made during the initial assessment and sought a revised estimate of the energy saving potential of any complementary measures that justify the equivalence of the alternative scheme to the energy saving potential estimate for a hypothetical regular inspection scheme.

In order to clarify these items, SEAI concluded that the boiler population model should be updated to estimate the number of boilers in use across the country and the type of fuels used by these boilers up to the end of 2012. This report outlines the approach taken to revise the boiler inventory and to partition the population by fuel type and boiler output categories.

2. RESIDENTIAL BOILER POPULATION

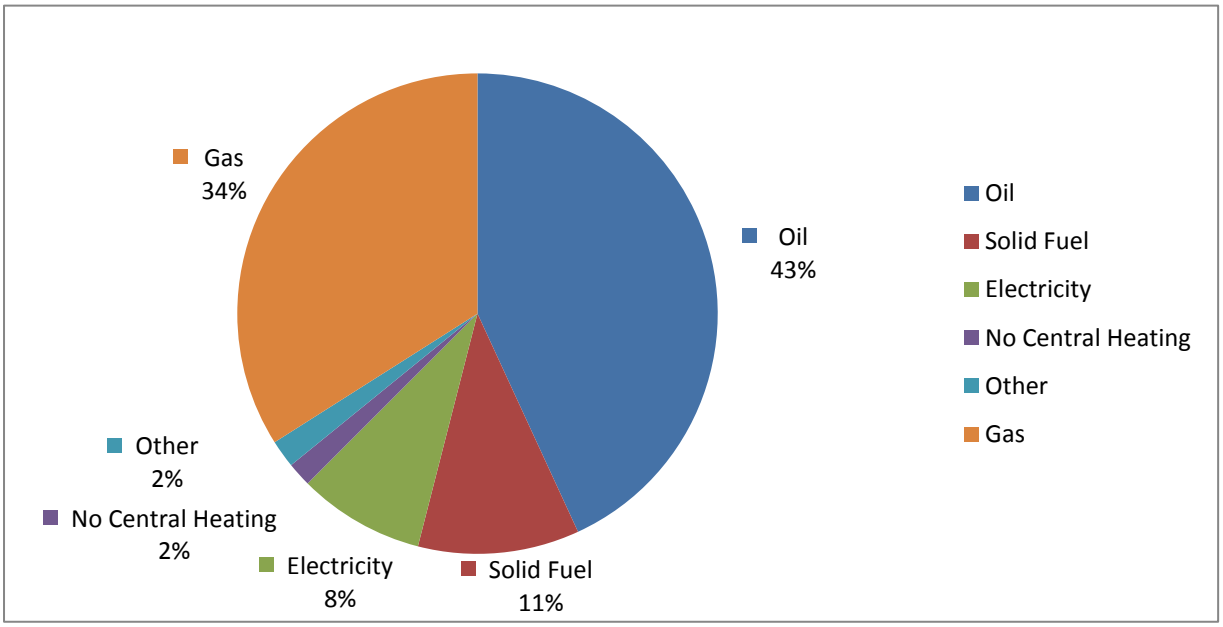
2.1 Occupied Housing

The2011 Census identified that the total number of dwellings in April 2011 was 1.995 million. This was broken down between occupied and vacant housing units: 1.649 million dwellings were identified as occupied and 345,437 were vacant or unoccupied at the time of the survey. The 2011 Census was the first time that the questionnaire required respondents to identify the type of fuel used by their central heating system. The number and types of central heating system reported are shown in Table 4 and the percentage share of each fuel type is shown in Figure 1.

Table 4: Central Heating Systems reported by Irish Households, Census 2011

Fuel Type	Number of Households
Oil	711,330
Gas – Natural Gas / LPG	560,667
Solid Fuel – Coal, Peat, Wood	179,178
Electricity	140,419
Other	8,524
No Central Heating	26,952
Not Stated	22,338
Total	1,649,408

Figure 1: Residential Central Heating Fuel Types (2011 Census)



The Census gives a good estimate for the number and types of residential boilers installed in occupied housing up to April 2011. However, in order to determine a more accurate estimate for the total boiler population, we made a number of adjustments to the 2011 numbers as follows:

- We apportioned the 22,338 households that did not report the type of central heating system used according to the percentages shown in Figure 1 and added to the totals for each fuel type category;

- We also apportioned the number of dwellings that were occupied by guests (10,703) or where the occupants were absent on the night (45,283) according to central heating fuel split from the Census;
- We also made adjustments to account for boilers in vacant housing / apartments (Section 2.2) and for new boilers installed as a result of house completions since April 2011 (Section 2.3).

2.2 Vacant Housing

The Census recorded statistics for the number of vacant houses in Ireland in April 2011. These houses are assumed to have heating systems comparable to the occupied cohort but the central heating systems are not actively used i.e. negligible boiler run hours. The Department of Environment has reported that 6% of the housing stock in Ireland is normally vacant at any one time. This suggests that a base vacancy rate for 2011 should be approximately 119,000. The actual vacancy rate was considerably higher than this, as shown in Table 5. This indicates that there is considerable oversupply in the Irish housing market.

Table 5: Vacant / Unoccupied Housing, Census 2011

Housing Occupancy Status	Number of Housing Units	Assumptions re Boilers
Holiday homes (vacant on night of Census)	59,395	Assume the energy consumption is dominated by the owner in their own household.
Vacant Houses / Flats	230,056	No central heating systems operating – negligible consumption. Exclude from active boiler population.

When calculating the total boiler population, vacant housing units were apportioned according to the split of central heating fuel types from the Census. These were then added to the total boiler inventory. However, these boilers will not be included as part of the 'active' boiler population. The 'active' boiler population is a subset of the total boiler population. In our view, estimating the 'active' boiler population is more useful when quantifying the energy savings potential that could arise from awareness measures or an inspection regime under Article 14.1 of the Recast EPBD.

2.3 New House Completions since Census 2011

The steps described above to adjust the boiler population were aimed at improving the residential boiler population estimates up to April 2011. House completion statistics were examined so that an estimate of the boiler population up to the end of 2012 could be calculated. The additional dwellings constructed in that period are shown in Table 6. In order to avoid double counting of housing units that were built between 1st January 2011 and the Census day, the total number of house completions for 2011 was reduced on a pro-rata basis from 10,480 to 7,609.

Table 6: New House Completions Statistics (2011 & 2012)

Year	New House Completions (11th April 2011 – 31st December 2012
11/4/2011 to 31/12/2011	7,609
2012	8,488
Total House Completions	**16,097**

We then carried out an analysis to determine the types of central heating system installed in new houses completed during 2011 and 2012. We sorted the SEAI's database of Building Energy rating (BER) certificates to identify the building energy ratings achieved by new dwellings that were constructed during 2011 / 2012 and the type of central heating system installed in each new dwelling. By analysing this data, we derived the split between the different central heating system types. The result is shown in Table 7. The 16,097 house completions from April 2011 to the end of 2012 apportioned according to the central heating fuel split from the BER data.

Table 7: Estimate of New boiler Installations between 11th April 2011 and 31st December 2012

Fuel Type	2011/2012 – Percentage of New Central Heating Systems (BER data)	New Build Dwellings with Central Heating (April 2011 to December 2012)
Oil	29.9%	4,821
Gas	52.9%	8,515
Solid Fuel	1.6%	259
Electricity	12.1%	1,945
Other	3.5%	557
Total	**100%**	**16,097**

2.4 Total and 'Active' Residential Boiler Population

The total residential boiler population includes boilers in vacant housing units. These contribute a negligible amount to the total heating fuel demand for the sector. These housing units do not present an opportunity for energy savings and have been excluded from the 'active' boiler population. Including boilers that do not operate for any appreciable hours in the year would, in our view, overestimate the savings potential that could be achieved by an inspection regime under Article 14.1 or alternative awareness or other measures since the efficiency of inactive boilers do not affect the energy savings that could be achieved across the boiler population.

The adjustments described above were added to the figures from the Census to determine an estimate for the residential boiler population up to the end of 2012. The split between the "total" and 'active' boiler population estimates are shown in Table 8.

Table 8: Total and Active Residential Boiler Inventory

Fuel	Total (Active and Inactive)	Active Boiler Population
Oil	876,937	750,393
Gas	695,913	596,172[15]
Solid Fuel	219,937	188,062
Total	**1,792,787**	**1,534,627**

[15] In its report on The Electricity and Gas Retail Markets Annual Report for 2012 the Commission for Energy Regulation reported that there were 630,559 connections in the domestic gas market.

3. COMMERCIAL BOILER POPULATION

Information on commercial boiler numbers in Ireland is not readily available and primary data is difficult to obtain without extensive surveying of commercial enterprises. In order to determine a reasonable estimate for commercial boiler numbers, an analysis was carried out of commercial gas customers for 2012. Figures for total customer numbers were available from the 'Electricity & Gas Retail Markets Annual Report 2012' published by the Commission for Energy Regulations. This data is shown in Table 9.

Table 9: Gas - Customer Numbers & Total Consumption

Tariff Type	No. of Customers	Total consumption (GWh)	Average Usage per Customer (kWh)
Industrial and Commercial (IC) Market Tariff	22,949	1,739	75,777
Fuel Variation Tariff (FVT)[16]	1,750	2,238	1,279,000
Regulated Tariff Formula (RTF)	246	5,662	23,016,000

We used the number of industrial and commercial gas customers, reported by CER at the end of 2012, as a proxy for the number of commercial gas boilers. We derived the number commercial oil boiler numbers using the ratio of gas to oil consumption in the commercial and public sectors from the provisional 2012 National Energy Balance. The ratio of commercial oil to gas consumption is shown in Table 10.

Table 10: Final Energy Use for Commercial/Public Services Sector (2012)

Fuel	Ktoe	GWh	%
Oil	360	4,187	47%
Gas	400	4,652	53%

The estimated commercial boiler inventory for 2012 is shown in Table 11.

Table 11: Commercial Boiler Inventory (2012)

Fuel	Total
Oil	22,451
Gas	24,945
Solid Fuel	-
Total	**47,396**

We noted that there is no usage of solid fuel recorded in the National Energy Balance for the commercial or public service sectors. There is solid fuel used in some industrial sites but this is largely for process heat rather than for space heating. Customers in the industrial and commercial categories are all assumed to be "active" consumers for the purpose of the boiler inventory.

[16] The numbers of gas consumers supplied under the FVT and RTF tariffs include many large industries which use a large proportion of their natural gas for process purposes rather than space heating.

4. TOTAL & 'ACTIVE' BOILER POPULATION

The combined residential and commercial total and 'active' boiler populations were calculated by summing the values found from the analysis of the residential boilers in Section 2 and commercial boilers in Section 3. These totals are shown in Table 12.

Table 12: Total & Active Boiler Population (up to the end of 2012)

Fuel	Total Boiler Population	Active Boiler Population
Oil	899,387	772,843
Gas	720,858	621,117
Solid Fuel	219,937	188,062
Total	**1,840,183**	**1,582,023**

5. BREAKDOWN OF 'ACTIVE' BOILER POPULATION BY SIZE

5.1 Residential Boiler Population – Split by Size

5.1.1 2005 Residential Boiler Population

An analysis of the 2005 boiler population report gave size splits for residential boilers up to the end of 2005. This data is shown in Table 13.

Table 13: Boiler Population (Residential), by Size (2005)

Fuel	Under 20kW	20 - 100 kW	Over 100 kW	Total (All Sizes)
Oil	92,434	549,866	-	642,300
Gas	394,000	96,000	-	490,000
Solid	52,000	13,000	-	65,000
Total	**538,434**	**658,866**	**-**	**1,197,300**

5.1.2 2006 -2012: Output Range of Additional Residential Boilers since 2005.

We analysed the BER database for buildings constructed from 2006 to 2012 to determine the numbers with oil, gas and solid fuel central heating. We then analysed each fuel group to determine the size of the residential floor area, in metres squared, as recorded during each building energy rating. The boiler sizes installed in each dwelling were then estimated using a rule of thumb for boiler capacity sizing. The rule used was that for dwellings built since 2006, a boiler capacity of 100 watts per square metre is required to heat the space. Using this rule and the floor areas from the BER database, boiler sizes were predicted for each dwelling. These were then partitioned into three size ranges depending on the boiler capacity estimated. The results from this analysis are shown in Table 14.

Table 14: Residential Boiler Sizes – New Houses Built between 2006 & 2012

Fuel	Under 20kW	20 - 100 kW	Over 100 kW
Oil	77%	23%	0%
Gas	97%	3%	~0.01%
Solid Fuel	84%	16%	0%

The active boiler population installed between 2006 and 2012 was then be split according to the percentages above to allocate the number of boilers across each size category for each fuel in the cohort of houses built between 2006 and 2012. The small percentage of houses with boilers > 20 kW is reflective of the new building energy regulations which pertained over this period and the introduction of minimum boiler efficiency standards.

Table 15: Residential Boiler Added between 2006 & 2012 Split by Boiler Size and Fuel

Fuel	Under 20kW	20 - 100 kW	Over 100 kW	Total (All Sizes)
Oil	83,232	24,861	-	108,093
Gas	102,808	3,355	9	106,172
Solid	103,372	19,690	-	123,062
Total	**289,412**	**47,907**	**9**	**337,327**

5.1.3 Residential Boiler Population

By summing the residential boiler population, split by size, from the 2005 study and the boiler population, split by size, for boilers installed between 2006 and 2012, we derived an estimate for the size split of the residential boiler inventory at the end of 2012. This is shown in Table 16.

Table 16: Boiler Population (Residential), by Size (2012)

Fuel	Under 20kW	20 - 100 kW	Over 100 kW	Total (All Sizes)
Oil	175,666	574,727	-	750,393
Gas	496,808	99,355	9	596,172
Solid	155,372	32,690	-	188,062
Total	**827,846**	**706,772**	**9**	**1,534,627**

The 2011 Census data has captured all fuel switching in the boiler population in terms of total boiler numbers using different fuels. The analysis of houses built since 2005 using the BER data allows a reasonable size split of that cohort of 337,327 boilers. The analysis cannot capture any changes in the size range split of the pre 2005 cohort since the 2005 survey.

5.2 Commercial Boiler Population – Split by Size

In order to determine a reasonable split between gas boiler sizes, a comparison was made between the number and type of enterprises operating in Ireland during 2005 and 2011. This comparison is shown in Table 17. As can be seen from the data, the reported number of micro enterprises in Ireland has increased significantly between 2005 and 2011 but growth rates for small, medium and large enterprises have been more modest.

Table 17: Enterprise Numbers in Ireland (2005 & 2011)

Type of Enterprise	2005	2011	% Increase
Micro (< 10 employees)	75,302	137,669	183%
Small (< 50 employees)	10,870	14,168	130%
Medium Size (<250 employees) & Large (>250 employees)	2,962	3,102	105%
Total	**89,134**	**154,939**	

Micro enterprises are defined as enterprises with less than 10 employees. Many of these (sole trader organisations) are more likely to operate out of home offices. Boilers installed in many micro enterprises are therefore already included as part of the residential boiler[17] population. Another portion of micro enterprises use electrical heating and it is expected that the remainder of micro enterprises use boilers that are below the 20 kW threshold set out in Article 14.1. For the commercial boiler analysis, we have only considered two size ranges: boilers with capacities between 20 – 100 kW and boiler exceeding 100 kW.

The average gas usage per customer for three commercial gas tariff types can be calculated using the total customer numbers and the total consumption for each group of customers. Based on the average consumption and notional run hours, gas customers within the industrial[18] & commercial gas market tariff can be assumed to operate boiler in the range from 20 – 100 kW. Customers using the Fuel Variation Tariff (FVT) and the Regulated Tariff Formula (RTF) can be assumed to operate boilers with capacities greater than 100 kW. By applying these assumptions, the gas boiler inventory was split between the '20 -100 kW' and the 'over 100 kW' categories.

We have assumed that commercial oil boiler total number estimated in Section 3 can also be split in the same proportion as the pattern for gas boilers to provide an estimate of the number of oil boilers falling into each category. The results from this analysis are shown in Table 18.

Table 18: Boiler Population (Commercial), by Size (2012)

Fuel	20 - 100 kW	Over 100 kW	Total (All Boiler > 20 kW)
Oil	20,654	1,796	22,451
Gas	22,949	1,996	24,945
Solid	-	-	-
Total	**43,603**	**3,792**	**47,396**

5.3 'Active' Residential & Commercial Boiler Population – Split by Size

The total for the residential and commercial boiler populations, split by size, can be summed to give an overall estimate for the boiler types and capacities installed in Ireland at the end of 2012. In total, we have estimated that 754,176 'active' boilers exceed the 20kW capacity rating.

Table 19: Boiler Population (Residential and Commercial), by Size (2012)

Fuel	Under 20kW	20 - 100 kW	Over 100 kW	Total (All Sizes)
Oil	175,666	595,381	1,796	772,843
Gas	496,808	122,304	2,005	621,117
Solid Fuel	155,372	32,690	-	188,062
Total	**827,846**	**750,375**	**3,801**	**1,582,023**

[17] CER reports a total of 630,559 "domestic market" customer numbers as of Q4 2012.

[18] Many of the industrial gas customers use a high proportion of gas for process heat rather than space heating.