EcoBoiler project

Executive Summary

INTRODUCTION AND SCOPE

This is the preparatory study for gas-fired, oil-fired and electric central heating (combi-) boilers in the context of the 2005/32/EC Framework Directive on Eco-design of Energy-using Products (EuP) of June 2005. For this product group Measures under the Framework Directive are to replace the provisions of the Boiler Efficiency Directive (BED) 92/42/EC regarding minimum energy efficiency performance standards (MEEPS) and labelling.

The study aims to establish to what extend the product group meets the criteria of Art. 15 of the Framework Directive regarding environmental impact, economic significance and improvement potential.

It is to assess whether Specific Measures following Annex II of the Framework Directive can be implemented or Generic Measures following Annex I should be applied.

In as much as measures regard energy efficiency and saving on other consumables, the study is to establish the improvement potential at the Least Life Cycle Costs (LLCC) and Best Available Technology (BAT).

In general, the study advises the European Commission and the Consultation Forum regarding appropriate measures to minimize environmental impact and maximize the free movement of goods in the internal market, without adverse effects for all concerned. And it is to indicate, through scenario-analysis and other projections, to what extend the implementation of Measures contributes in achieving policy goals.

The 800-page study consists of 7 Task Reports, dealing with

- Legislation and Standards
- Market Analysis
- Consumer and Infra-Structure
- Technical Analysis
- Definition of Base Case
- Design Options
- Policies, Scenarios, Impact- and Sensitivity Analysis

MAIN CONCLUSIONS

In 2005 the space heating function of gas- and oil-fired central heating boilers consumed 10.880 PJ primary energy (ca. 250 mtoe) and emitted 16-17% of all fuel-related CO2 in the EU-25. Carbon emissions are of the same magnitude as with the total Road Transport [see fig. 1, 2].

Around 5% of acidification emissions (NOx, SOx) in the EU-15 can be attributed to the space heating function of boilers.

For most environmental impact categories (Global Warming, Acidification, etc.) 80-99% of impacts follow from the use phase of the products and are mostly directly linked to energy

efficiency. The water heating function of combi-boilers is discussed in the preparatory study on water heaters (Lot 2).

Central heating boilers constitute an internal market of 6,6 mln. units/ year at a total value of € 5-6 bln (manufacturing selling prices. Production is close to 7 mln. units per year of which 12% exports. Imports are around 5% of value.

Improvement potential is considerable, especially when employing a system approach. At Least Life Cycle Cost (LLCC) targets on average an energy saving of close to 40% per unit can be achieved with respect of the Base Case. With Best Technology (BAT) the energy efficiency improvement can be over 60%. Carbon and NOx emission reductions per unit are in the same order of magnitude. For NOx an extra saving can be achieved with an additional emission limit value of 20 ppm, which would bring the EU in line with best international legislative practice.

The projected carbon saving at mandatory LLCC-target minimum levels is 130-170 Mt CO2 equivalent in 2020-2025, which constitutes a 5% saving on energy-related carbon emissions in the EU-15. In the New Member States boiler share in space heating is smaller, which is why the EU-25 saving is lower at 4,4%. The energy saving in 2020-2025 is around 2100-3100 PJ (48 – 71 mtoe).

The LLCC-targets are not technology-specific (no bans), but based on measured primary energy efficiency in combination with a mathematical model --based on EPBD-standards-- to validate dynamic boiler-operation. In the long run the model should be replaced by new harmonised standards for dynamic testing. Third party testing is already current practice for fossil-fuel fired appliances (safety reasons). In the interest of a level playing field it is proposed to make this a general requirement for CE-marking. As regards market surveillance through random spot checks, it is proposed to make this a responsibility at European level.

For individual residential boilers LLCC-targets are set at levels equivalent to e.g. good condensing boiler technology, best room-thermostats and/or weather control, thermostatic radiator valves (1 K). Energy and carbon savings are considerably higher than with low-end condensing technology only (factor 3 to 4).
Collective and non-residential boiler installations are at least as important as individual boilers in terms of total energy consumption and certainly in terms of saving potential. LLCC-targets are higher and may require the equivalent of heat pump technology and –if it is included in the scope- mini-CHP (Combined Heat and Power). BAT levels involve the employment of renewables (heat pumps, solar).

The study proposes to support the minimum targets with a comprehensive labelling scheme, featuring 10 efficiency classes (A-G and more) as well as 9 size categories (Small/ Medium/ Large/ etc.). EU-wide consistency of EPBD standards would further promote energy efficient products and remove EU-internal trade barriers.

Global competitiveness of the EU-industry will be enhanced rather than diminished by the measures, as current EU-legislation is significantly behind Japan, US, Canada, etc. in terms of ambition. Installers will benefit from the holistic approach, as it will help them to also install more sophisticated systems that are pre-set and pre-assembled. Consumer expenditure will decrease by over 10%, which comes down to a € 30 bln. saving per year in 2020 with respect of the baseline. No adverse effects on health and safety are expected. Affordability is not problematic, with the exception of instances where the measures prompt early replacement. The study proposes adequate financial measures to tackle this problem. The sensitivity analysis shows that LLCC-targets are robust and economical throughout different climate zones and regions in the EU.

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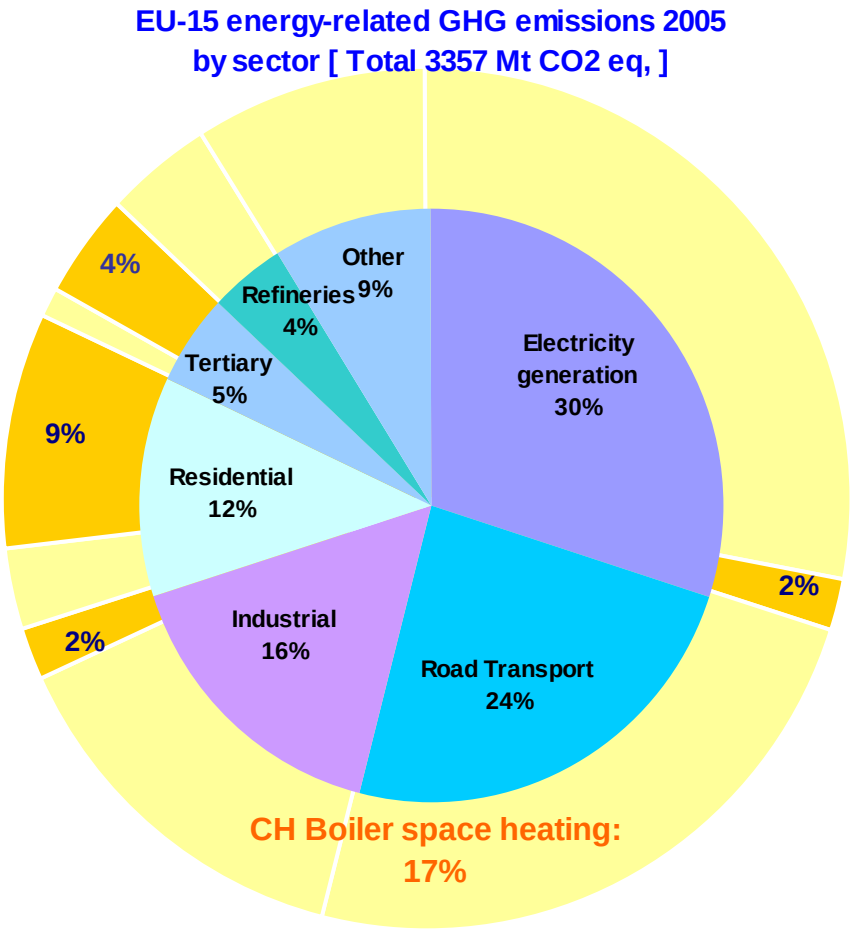

Fig. 1. EU-15 energy-related GHG emissions (over 80% of total GHG emissions) by sector according to EEA 2007, plus the attribution of CH-boiler per sector (total 17%) from Eco-design study. New Member States represent only 8% of the EU-25 boiler park, which means that relative share will be lower.

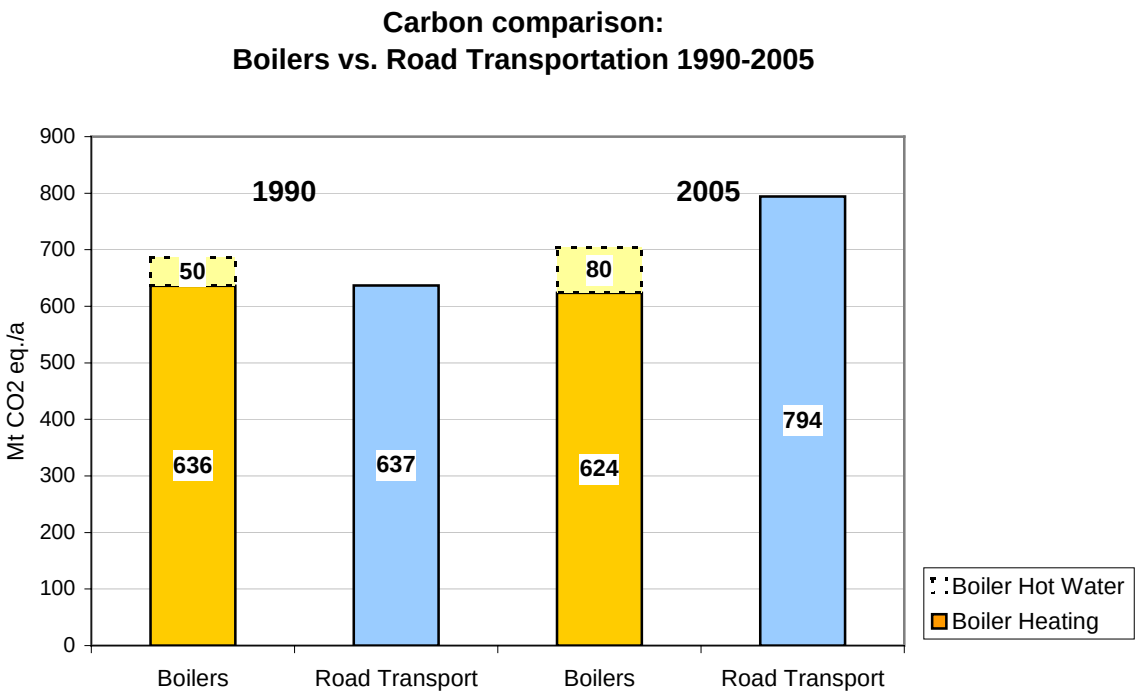

Fig. 2. Comparison carbon emissions from Road Transport (cars, vans, trucks, buses) and Central Heating boilers in 1990 and 2005. The figures for the water heating function of combi-boilers and boilers with an indirect cylinder will be discussed in the preparatory study on the Eco-design of Water Heaters.

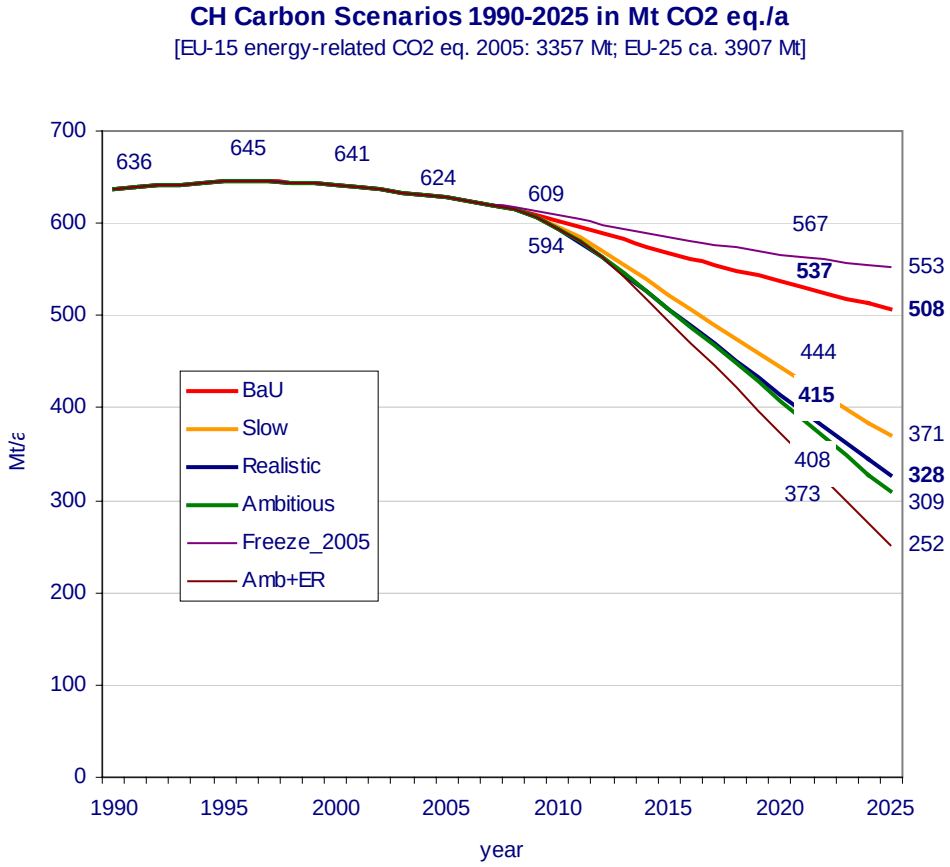

Fig. 3. Carbon scenarios for CH-boilers (space heating function only). In a realistic scenario the saving vs. Business-as-Usual is 537-415= 122 Mt CO2 equivalent in 2020. In 2025 this saving is projected to be 180 Mt. The most ambitious scenario, involving Early Replacement (Amb+ER), can be up over 250 Mt.

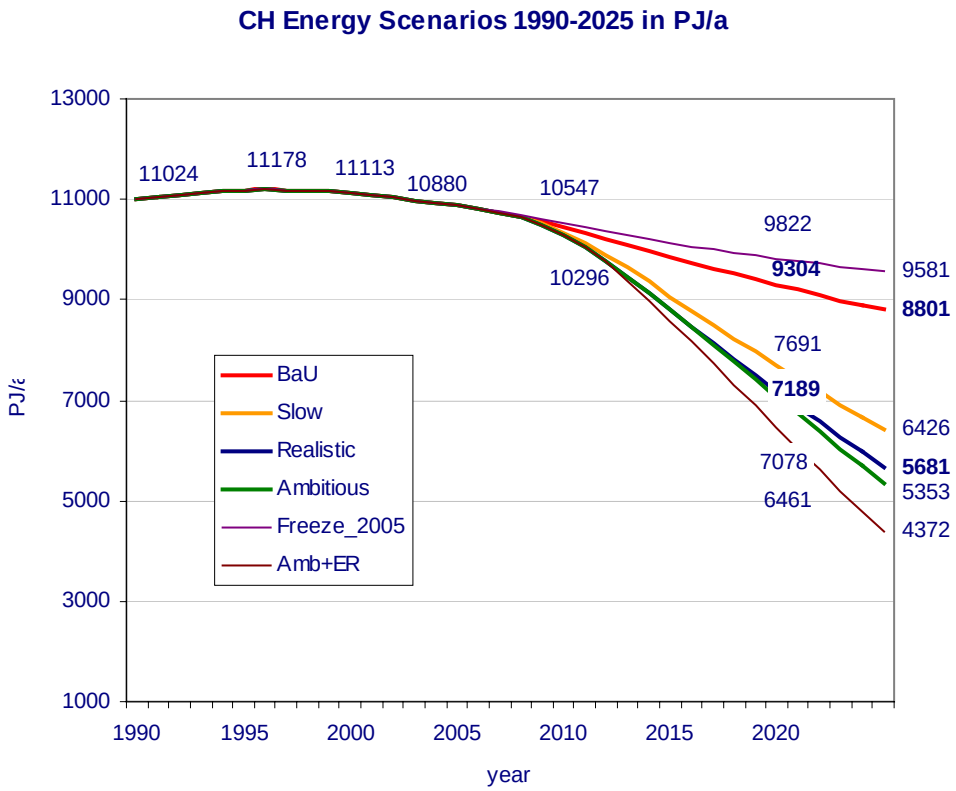

Fig. 4. Energy scenarios for CH-boilers (space heating function only). In a realistic scenario the saving vs. Business-as-Usual is 2115 PJ/a in 2020. In 2025 this saving is projected to be 3120 PJ/a. Conversion to mtoe: 1 mtoe = 41,87 - 44 PJ (depending on Net Calorific Value - Gross Calorific Value as a base; the study uses GCV).

CH Boiler Expenditure Scenarios 1990-2025 in bln. Euro/a

[Euro 2005, inflation corrected at 2%; Compare: EU-25 residential housing expenditure in 2003 is € 1112 bln. and total household expenditure € 6791 bln.]

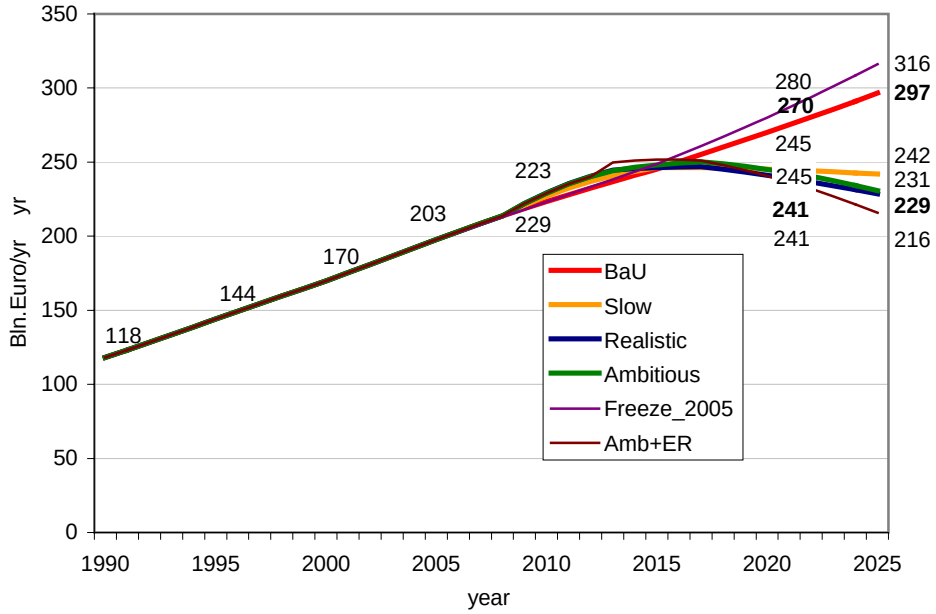

Fig. 5. Expenditure scenarios for CH-boilers (space heating function only). In a realistic scenario the saving vs. Business-as-Usual is **€** 30 bln. in 2020. In 2025 this saving is projected to be **€** 68 bln. (consumer rates). Based **€** 0,051 per kWh primary in the 2005-mix, as well as 6% fuel price and 2% electricity price increase per year.

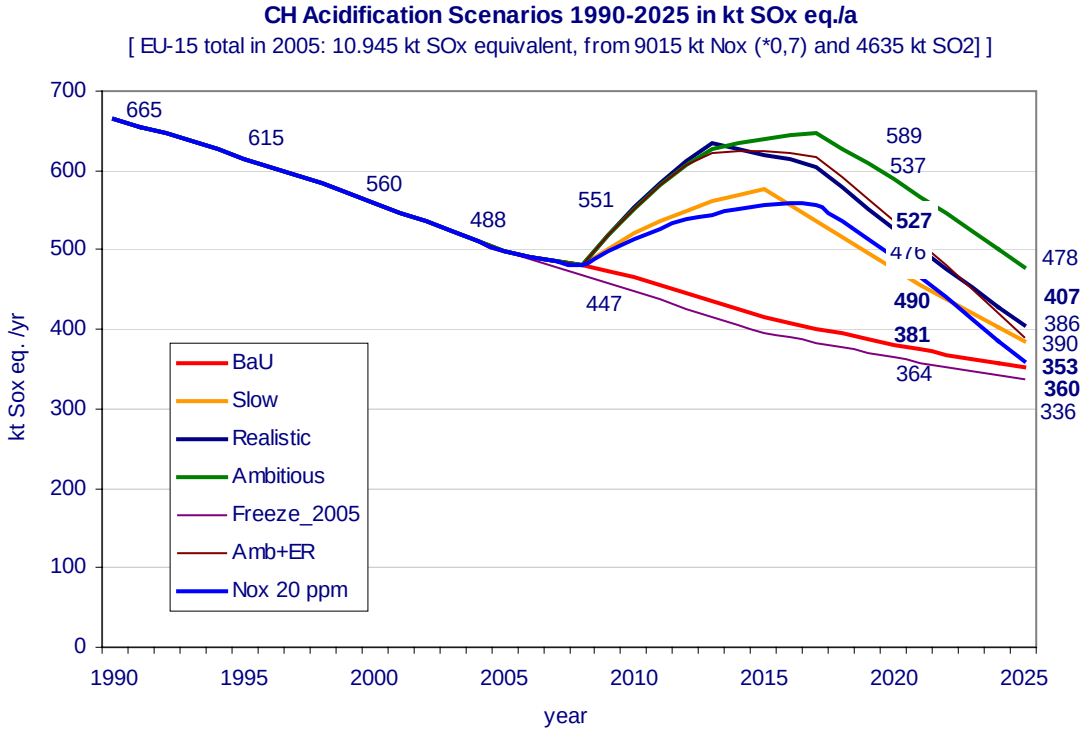

Fig. 5. Acidification-related emissions scenarios for CH-boilers (space heating function only). The design analysis shows that LLCC-targets for the larger boilers will require more heat pump solutions and hence higher share of electricity in the mix . This causes a surge in NOx and SO2 emissions in the transition phase 2009-2018 but can be remedied in 2018-2025.

All scenarios relate only to the space heating function of the gas-fired, oil-fired and electric Central Heating boilers. Water heating functions of the CH boiler are discussed with the dedicated waters in the study on Eco-design of Water Heaters.

Legend:

BaU (Business-as-Usual)	**Negative effects 2005-2020**: increase in number of households (10-12%), increase floor area (3-5%), higher heating comfort (8-10%), **Positive effects 2005**-2020: insulation and ventilation measures (30% over 2005-2020), increase boiler efficiency through park replacement (5%), extra efficiency through measures (3-5% efficiency points from low-end condensing being 50% of EU-sales in 2010), increase outdoor temperature (1%) **Overall 2005-2020:** ca. 18% decrease
Slow	Introduction minimum targets in 2015. No improvement beyond minimum required.
Realistic	Staged introduction minimum targets. Final tier 31.12.2012. Labelling per 1.1.2009. Support by labelling, EPBD, ESD, financial incentives, green/white certificates, promotion etc. further boosts efficiency by 3% annually, up till the year 2018. After that, the market is expected to stabilize.
Ambitious	Measures as above. Efficiency-increase 5% annually 2009-2018. Continued efforts will lead to further increase of 2% annually also after 2018.
Amb + ER	Ambituous plus Early Replacement of 1 mln. boilers annually starting 2013.
NOx 20 ppm	As Amb+ER plus emission limit value of 20 ppm for boilers not utilizing at least 10% renewables.
Freeze_2005	No technology change and technology market share changes since 2005.