EcoHotWater project

Executive Summary

INTRODUCTION AND SCOPE

This is the preparatory study for gas-fired, oil-fired and electric water heaters in the context of the 2005/32/EC Framework Directive on Eco-design of Energy-using Products (EuP) of June 2005.

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 700-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 water heaters, including the water heating function of gas- and oil-fired central heating boilers, consumed 3790 PJ primary energy (ca.86 mtoe) and emitted 6% of all fuel-related CO2 in the EU-25.

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.

Water heaters constitute an internal market of 17 mln. units/ year at a total value of € 4-5 bln (manufacturing selling prices, 2005). This includes dedicated water heaters and ca. 15% of combi-boiler prices. Eurostat data are not reliable, but seem to suggest imports and exports in the order of magnitude of 10% or less for dedicated water heaters in 2005.

Improvement potential is considerable. At Least Life Cycle Cost (LLCC) targets on average an energy saving of close to 35% per unit can be achieved with respect of the Base Case. With Best Available Technology (BAT) the energy efficiency improvement can be over 60%. Carbon emission reductions per unit are in the same order of magnitude. For NOx the saving is 29-39% in the "Realistic" scenario 2020-2025. An extra 15-20% saving can be achieved with an additional emission limit value of 20 ppm for fossil-fuel fired water heaters without renewables. This would bring the EU in line with best international legislative practice.

The projected carbon saving at mandatory LLCC-target minimum levels is 71-105 Mt CO2 equivalent in 2020-2025, which constitutes a 2,2 % saving on energy-related carbon emissions in the EU. The energy saving in 2020-2025 is 1270-1890 PJ (29 – 43 mtoe).

The LLCC-targets are not technology-specific (no bans), but mostly based on measured primary energy efficiency according to tapping patterns in harmonised standards. The values found are corrected for distribution losses and waste heat recovery. Multi-valent water heating solutions, i.e. (also) employing solar collectors and heat pumps, can be accommodated through relations found in EPBD-standards until appropriate test standards are available. 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.

Water heater efficiency is very much dependent on the load. For that reason specific LLCC-targets are set for each size class/ tapping pattern. For small single-point appliances primary energy efficiency is set at 24%, whilst for largest collective and non-residential water heating installations levels of over 90% are required, prompting the use of renewables or –if it is included in the scope- mini-CHP (Combined Heat and Power). In the Medium-size class high-quality combi-boilers, gas instantaneous water heaters and electric air-based heat pumps are typically technologies that would comply with the required LLCC-target levels. 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. Financial incentives, inclusion in the green/white certificate scheme, public procurement, etc. are other policy means.

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 € 15 bln. saving per year in 2020 with respect of the baseline. No adverse effects on health and safety are expected. Affordability is not problematic, as volume production of new solution will lower prices (e.g. for air-based heat pumps). The sensitivity analysis shows that LLCC-targets are robust and economical throughout different climate zones and regions in the EU.

ACKNOWLEDGEMENTS

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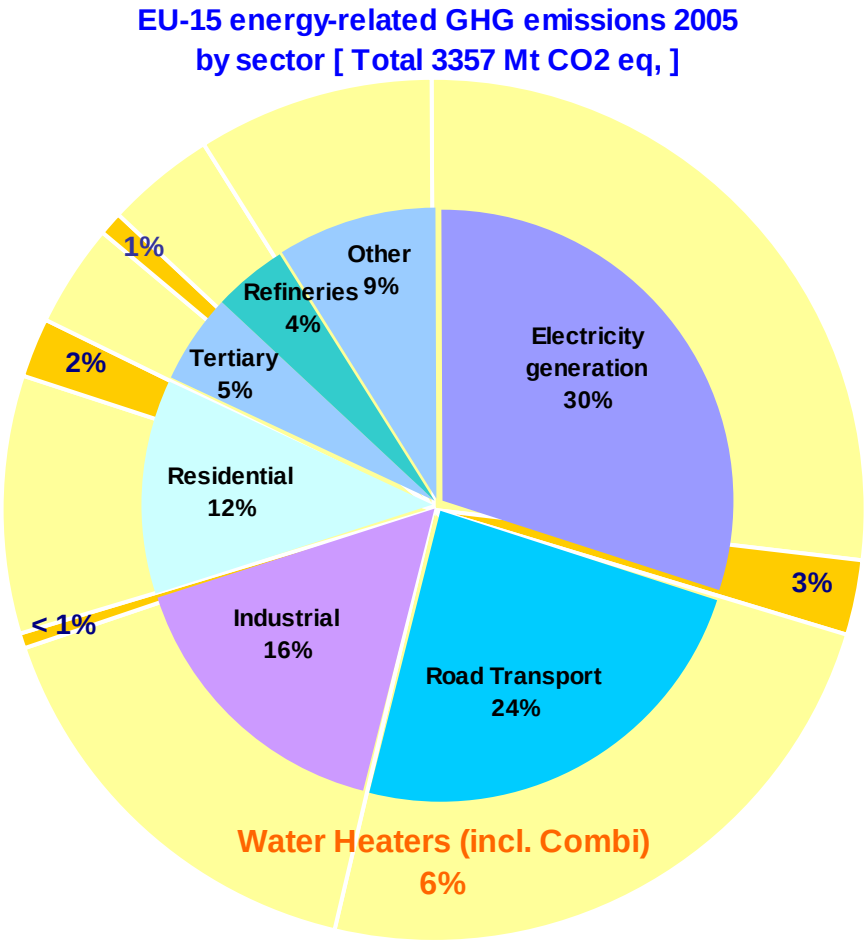

Fig. 1. EU-15 energy-related GHG emissions (over 80% of total GHG emissions) by sector according to EEA 2007, plus the contribution of Water Heating per sector (total 6%) from Eco-design study.

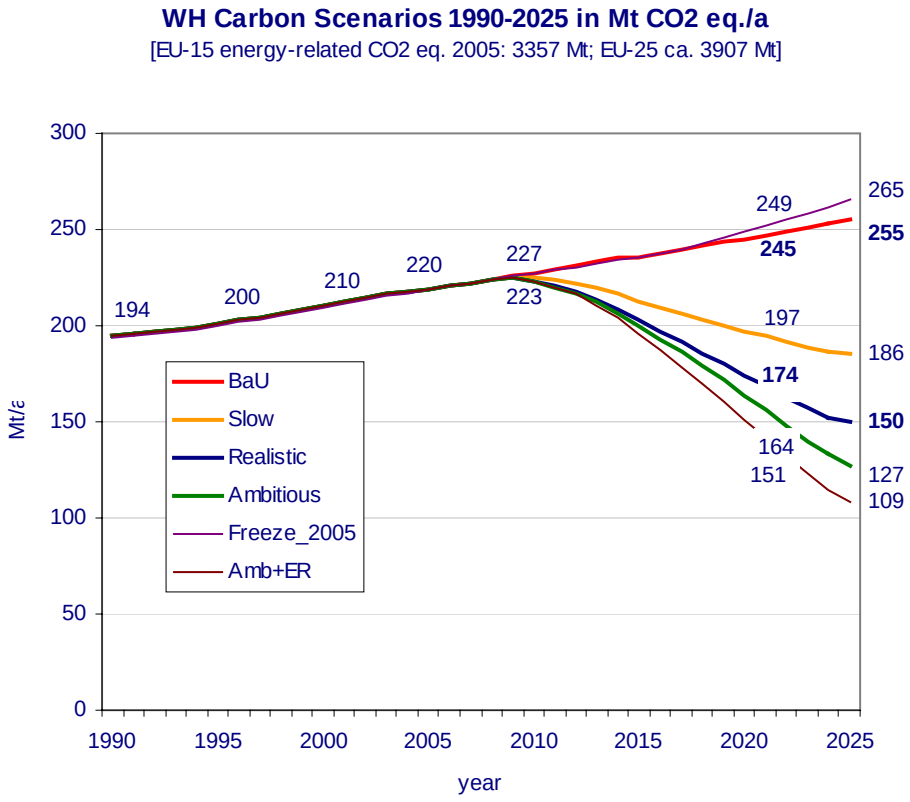

Fig. 2. Carbon scenarios for Water Heating. In a "Realistic" scenario the saving vs. Business-as-Usual is 245-174= 71 Mt CO2 equivalent in 2020. In 2025 this saving is projected to be 105 Mt. The most ambitious scenario, involving Early Replacement (Amb+ER), can be ca. 145 Mt.

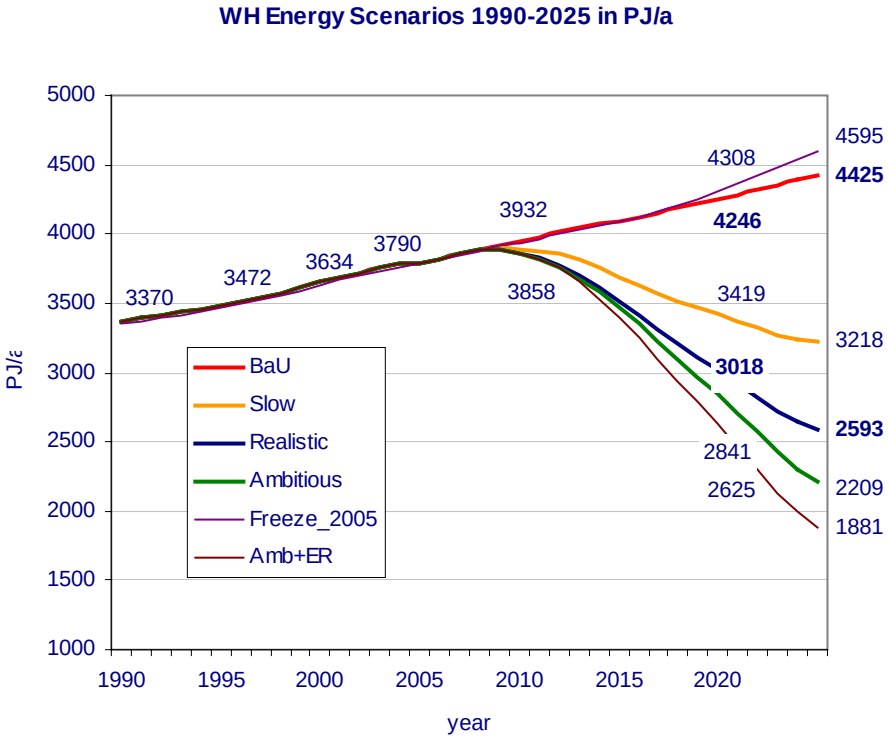

Fig. 3. Energy scenarios for Water Heating. In a realistic scenario the saving vs. Business-as-Usual is 1267 PJ/a in 2020. In 2025 this saving is projected to be 1883 PJ/a. Conversion to mtoe: 1 mtoe = 41,87 - 44 PJ (depending on Net Calorific Value - Gross Calorific Value as a base; the study uses GCV).

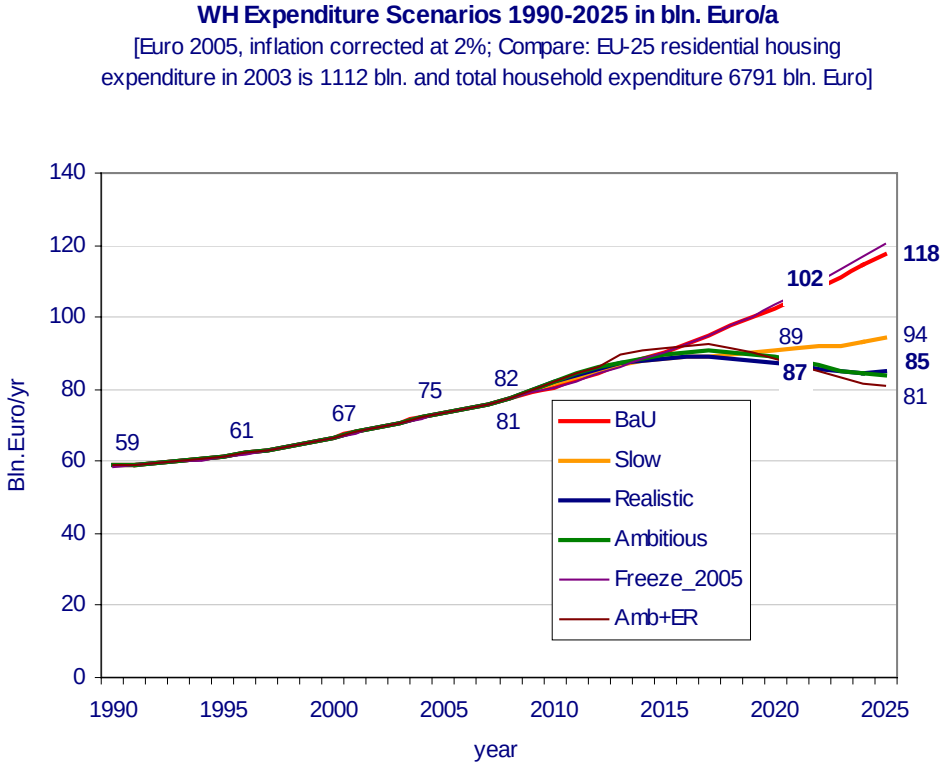

Fig. 4. Expenditure scenarios for Water Heating. In a realistic scenario the saving vs. Business-as-Usual is € 15 bln. in 2020. In 2025 this saving is projected to be € 33 bln. (consumer rates). Based on € 0,053 per kWh primary in the 2005-mix, as well as 6% fuel price and 2% electricity price increase per year.

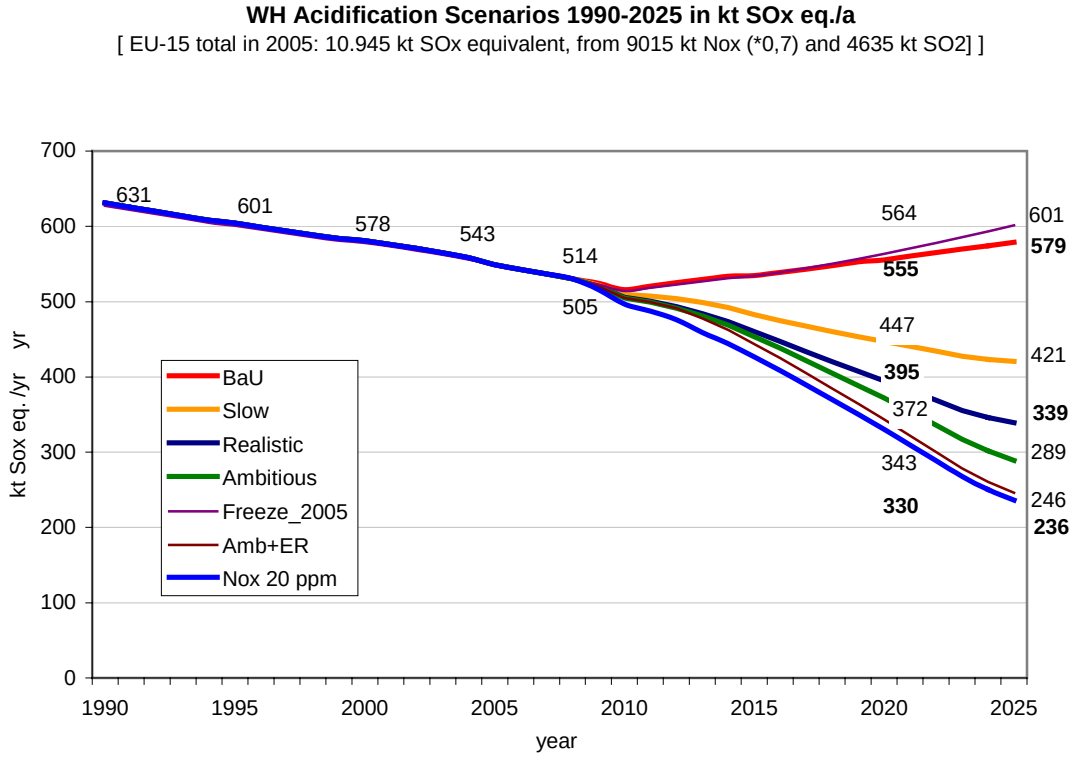

Fig. 5. Acidification-related emissions scenarios for Water Heating.

All scenarios relate to dedicated gas-fired, oil-fired and electric water heaters AND the water heating function of the Central Heating boilers. Space heating functions of the CH boiler are discussed in the preparatory study on Eco-design of Boilers.

Legend:

BaU (Business-as-Usual)	**Negative effects 2005-2020**: increase in number of households (10-12%), increase comfort (8-10%; more and longer showers), **Positive effects 2005-2020**: increase water heater efficiency through park replacement (5-7%). **Overall 2005-2020:** ca. 18% increase
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	Ambitious plus Early Replacement of 3 mln. water heaters annually starting 2013.
NOx 20 ppm	As Amb+ER plus emission limit value of 20 ppm for fossil-fuel fired water heaters not utilizing at least 10% renewables.
Freeze_2005	No technology change and technology market share changes since 2005.