Preparatory Studies for Eco-design Requirements of Energy-using Products

Lot 24: Professional Washing Machines, Dryers and Dishwashers

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Washing Machines and Dryers

Task 8: Scenario, Policy, Impact and Sensitivity Analysis

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For reasons of better readability, two Task 8 reports were prepared.

The report at hand covers ***professional washing machines and dryers.***

The Task 8 report on *professional dishwashers*
is published separately.

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1 Introduction: objective of Task 8

This task summarises the previous tasks and looks at suitable policy means to achieve the potential reduction in environmental impacts identified. Among the policy options to be considered are implementing Least Life Cycle Cost (LLCC) as a minimum level and Best Available Technology (BAT) as a promotional target, using legislative or voluntary agreements, labelling, public procurement and other incentives.

The policy options considered and the conclusions are the opinions of the project team and do not represent the views of the European Commission. Unlike Tasks 1-7, which will serve as the baseline data for future work to be conducted by the European Commission (Impact Assessment, further discussion in the Consultation Forum and possible development of implementing measures), Task 8 simply serves as a summary of policy implications as seen by the project team. Some parts of this chapter may be analysed in greater detail at the Impact Assessment stage.

The task draws up scenarios for the period 2010-2030, quantifying the improvements that can be achieved with respect to a Business-as-Usual (BAU) scenario and comparing the outcomes with EU energy and environmental targets.

It estimates the impact on consumers and industry as described in Annex 2 of the Directive, explicitly describing and taking into account the typical design cycle (platform change) in a product sector as well as the cost of redesign necessary to apply the policy recommendations of Task 8. Finally, in a sensitivity analysis of the main parameters, it studies the robustness of the outcomes.

In addition, an analysis of which significant impacts may have to be measured under possible implementing measures and what measurement methods would need to be developed or adapted is provided.

2 Policy and scenario analysis

This section presents suggestions of policy options and a scenario analysis for the period 2010-2030. The scenarios quantify the improvements that can be achieved in comparison with a BAU (Business-As-Usual) scenario and compare the outcomes with EU environmental targets.

2.1 Scope

The policy analysis should identify policy options, considering the outcomes of all previous tasks. Notably, the options should:

- Be based on the exact product definitions in Task 1 as modified/confirmed by the other tasks;
- Provide Eco-design requirements, such as minimum (or maximum) requirements, considering the sensitivity analysis carried out in this task;
- Be complemented, where appropriate, with (dynamic) labelling and benchmark categories linked to possible incentives relating to public procurement or direct and indirect fiscal instruments;
- Where appropriate, apply existing standards or propose needs/generic requirements for harmonised standards to be developed;
- Provide measurement requirements, including test standards and/or methods;
- Consider possible self-regulation, such as voluntary agreements or sectoral benchmark initiatives;

2.2 Generic eco-design requirements

Generic eco-design requirements aim at improving the environmental performance of products, focusing on significant environmental aspects thereof without setting limit values. According to Ecodesign Directive 2009/125/EC they method must be applied when it is not appropriate to set limit values for the product group under examination.

Generic eco-design requirements for professional laundry appliances may enable the customer to know more about the products on the market in order to allow easier comparison.

2.2.1 Need for the definition of a standard programme

Similarly to the recent Regulation for household washing machines (N 1015/2010)[1], also for professional washing machines (and dryers) a 'standard programme' should be defined. Thus, for the calculation of the energy consumption and other parameters for professional laundry machines, a typical cycle which cleans and dries typically soiled laundry (hereafter standard washing cycle / standard drying cycle) shall be used within each washing machine and dryer category. This cycle shall be clearly understandable by the user and *as much as possible representative for the real-life conditions within the key customer segments for each product category*. Further, it shall be clearly identifiable on the programme selection device of the professional appliance or the display of the appliance, if any, or both, and named 'standard programme' and shall be set as the default cycle for professional laundry machines equipped with automatic programme selection or any function for automatically selecting a cleaning or drying programme or maintaining the selection of a programme.

1 No Regulation for household dryers has been adopted in the EU yet (status: May 2011).

2.2.2 Information requirements

Further, the **booklet of instructions** should provide information on:

- the standard cleaning or drying cycle referred to as ‘standard programme’, which would be the most energy and water (only for dryers) efficient programme for normally soiled or to be dried laundry.
- Power consumption of the operating, low-power and off modes.
- Indicative information on the main characteristics of the different programmes available (energy and water efficiency, drying efficiency, temperature, time, etc.).
- Recommendations on the types of detergents suitable, depending on the washing temperature and cleaning / hygienic needs.

This information would not be sufficient to achieve large savings on its own. Taking into account the fact that professional washing machines and dryers might also be operated by untrained personnel, the development of **user guided programme menus** directly indicating the above information could further support changing the user behaviour. Making information about energy consumption available on the internet and in sales brochures would be another approach (e.g. basic information on resource efficient cleaning and drying processes). In parallel, harmonised information could be provided by the European Commission, such as:

a) Examples for best practice.
b) Overview on consumption values and benchmarks of appliances currently being on the market (based on a standardised measurement method).
c) Life cycle costs calculator which can be individually adapted according to the in-situ parameters.

However, precondition for implementing these generic eco-design requirements is a harmonised measurement standard which is currently not available. It would considerably help manufacturers in establishing the ecological profile of their products in a harmonised and understandable way (cf. Section 2.3.1).

In addition, household washing machines are supposed to offer end-users a low-temperature cycle at 20°C. Given the large energy savings potential of such a program, which relies only on user behaviour and not on technical improvement of the machines, it would be relevant to have a compulsory low temperature (20°C or 30°C) program for some professional washing machines, at least for machines used in semi-commercial customer segments like Apartment Household Laundry (AHL) and Coin & Card Laundry (CCL), e.g. for categories WM1 and WM2 (Semi-professional washer extractor, professional washer extractor <15 kg) and D1, D2 and D4 (Semi-professional dryers, air-vented / condenser, professional tumble dryer <15 kg).

2.2.3 Detergent consumption

As shown in Task 5, detergent consumption can have important environmental impacts, especially eutrophication potential. In this study, detergents have been treated for the most part indirectly, since detergent consumption is linked to water consumption. Improvement options such as automatic detergent dispensing were not considered to be among the most relevant for professional washing machines. Besides, the washing process is a complex balance between the duration of the process, the cleaning capacity of the detergent used, the mechanical action and the temperature of the process. In the context of this study, a typical process temperature, a typical time and a typical detergent have been estimated in order to be able to study the machines from energy and water performance perspectives.

Nevertheless, different detergent types may have different levels of environmental impact. Some new detergents may allow a slightly lower washing temperature, and thus lower energy consumption, than regular detergents. In general, lower temperatures either imply larger doses or another composition and ingredients of detergents in order to maintain the wash performance. A larger dose of detergent in turn implies greater water consumption; another composition might imply further environmental impacts. A new measurement standard and performance requirements should take these relationships into account.

It is commonly considered that misuse of detergent is more likely to involve over-dosage than under-dosage (at least for smaller machines) and would thus exacerbate negative environmental impacts.

Optimum detergent dosage depends on a range of factors including detergent formulation, water hardness, temperature, as well as filling and soiling. Although consumer behaviour is partly beyond the scope of eco-design, **better information on optimum dosage** could be provided to users. Further, eco-design requirements for automatic detergent feeders could include a visual means to verify that detergents are delivered or a visual or audible alarm to signal if detergents are not available for delivery to the respective washing system.

Finally, it should be noted that especially for large professional washing machines, the detergent service and supply (cleaners system) is provided by third party companies. Thus, **green procurement requirements for detergents** could also be included in the criteria to award the service contract to the best companies.

2.3 Specific eco-design requirements

Specific eco-design requirements aim at improving a selected environmental aspect of the product. According to Ecodesign Directive 2009/125/EC, they may take the form of requirements for reduced consumption of a given resource, such as a limit on the use of a resource in the various stages of an product’s life cycle, as appropriate (such as a limit on water consumption in the use phase or on the quantities of a given material incorporated in the product or a requirement for minimum quantities of recycled material).

Generally, in the white goods sector energy (and water) efficiency has increased substantially in the past thirty years thanks to implementation of the most easy and straightforward technical solutions. The required effort and investment per unit of energy efficiency gained are now becoming larger and manufacturers may now tend to slow down their efforts in innovation and research because of this, especially in the household appliances sector. For professional appliances, the possible improvement potential seems to be more unclear as currently no standardised comparison between two different machines is possible in the EU. However, a common measurement standard is prerequisite for the implementation of efficiency requirements and labelling programmes, which would allow the end user to benefit from a relevant methodology providing him with reliable data and fair assessment of product performance. Therefore, the influence of the customers on the market development would be highly increased as their choices would be eased and justified by this initiative.

2.3.1 Need for the development of harmonised standards and definitions

Standard measurement methods are necessary to enable the setting of performance requirements. Today, there are no standards officially and widely used in the EU for the product categories in the scope of Lot 24, part professional washing machines and dryers. This lack of standards is also a reason why consumption data was hard to obtain and remains uncertain within this study. Discussions are currently ongoing at the EU level within the CENELEC Technical Committee TC 59X.

A harmonised testing methodology should take into account and define several parameters (ideally reflecting the requirements of the main customer segments in which the product categories are applied to):

- Ambient temperature and humidity;
- Water temperature and hardness;
- Energy source for heating water / air;
- Input water temperature and other chemical and physical characteristics of the water;
- Residual moisture of laundry before drying process;
- Rated washing / drying capacity (maximum amount of load that can be washed/dried in one washing/drying cycle, in kg laundry per hour or per cycle); filling ratio;
- Type (formulation) and dosage of detergent and laundry aid;
- Standard laundry in terms of type, amount and soiling;
- Definition of a test cycle (inter alia selection of programme).

Relevant parameters to measure when establishing standards for professional washing machines and dryers include:

- Cleaning / drying / spin extraction performance and, if necessary, hygienic performance; for washing machines additionally rinsing performance;
- Energy and/or water consumption per kg laundry or on a per cycle basis;
- Energy demand in low-power modes (left-on, and if applicable: off mode); if possible, the termination of low-power modes should follow the definitions of Commission Regulation (EC) No. 1275/2008 on Standby.
- Detergent/rinse aid consumption (defined quality);
- Cycle time (more important for professional appliances than for household ones);
- Noise level[2];
- Damage to textiles;
- The standard cycle conditions should reflect the real-life use conditions: energy and water consumption in partial load / discontinuous operation; possibly consumption in other than 'standard' program.

Standard conditions should represent real-life conditions as precisely as possible. However, as there is a great variation in the user behaviour of professional washing machines and dryers within the categories as well as customer segments identified, the energy and water consumption in day-to-day operation may still differ from that under standard test conditions.

The fact that multiple parameters have to be taken into account is crucial as some of them may conflict with each other. For instance, water efficiency could be improved by reducing the rinsing/drying performance, leading to non-satisfactory results of the washing process. Therefore, if levels of resources and consumables consumption are to be set, they should be associated with corresponding cleaning or drying performance levels.

In the commercial and industrial sectors, customers have different needs and the appliances are often customised to the demand of the customer. The goal of the standardisation process would ideally be to find one or several standard programme(s) that can be run on the machine to test it and measure its performance level, even if the washing programme wanted and used by the customer is different.

Along with the standards measurement methods, a tolerance level (taking into account the uncertainties of the measurement methods) should be properly defined according to the product category specificities. Working group TC59X has mentioned the importance of tolerance as reproducibility of tests is one of the major issue of professional laundry appliances testing.

2 Only in the case it is not yet covered under safety legislation.

2.3.2 Labelling requirements

Based on a harmonised measurement standard which would need to be developed first (see previous section), an energy labelling scheme could promote a voluntary shift in the market. Unlike performance requirements (which aim at removing the worst-performing products from the market), a label would help the consumers to pull the market towards the best-performing products via their purchase decisions. It should therefore be seen as a complementary tool to minimum requirements. To be fully effective, such a scheme should be mandatory so that all products on the market can be fairly compared.

In the context of professional laundry appliances, it would be more appropriate for the smaller machines considered in this study: the more customers are influenced by the presence of labels at the time of purchase, the more effective the initiative is. Customers of larger industrial machines tend to have a more sophisticated understanding and are already provided with a more detailed level of information at the time of purchase, while retailers have even more incentive to provide high efficiency machines than retailers of smaller machines. This does not, however, mean that a labelling programme could not be implemented for heavy duty machines.

In the case of washing machines, energy consumption is intricately linked with water and detergent consumption and washing performance. Although energy consumption is the most appropriate basis for classification, any labelling scheme should take a holistic approach either by setting reference water and detergent consumption and reference washing performance associated with the energy consumption measured, or by providing clear and transparent information for all these other variables as is currently done for household washing machines (the label indicates the energy and water consumption and the washing performance, see Figure 1). For dryers the situation is similar, as energy consumption is linked to drying efficiency. Therefore, the label should display all relevant parameters to allow a fair and direct comparison between two products.

Council Directive 92/75/EEC on the indication by labelling and standard product information of the consumption of energy and other resources by household appliances was recast in 2010 and replaced by Directive 2010/30/EU, which now covers energy-related products. Implementing Directives under this Energy Labelling Directive have already been adopted for household washing machines, household washer-dryers and household tumble dryers.

Washing machines

For household washing machines, Regulation No 1061/2010 recently replaced Directive 95/12/EC (which will be repealed from 20 December 2011), in particular by updating the performance levels and introducing more ambitious levels (A^+, A^{++}, A^{+++}). It only deals with electric appliances (that can possibly be powered by batteries).

The following notes define the information to be included on the label (see Figure 1):

1. Supplier's name and name of model;
2. The energy efficiency class of the washing machine, determined in accordance with harmonised standards. The indicator letter should be placed at the same level as the relevant arrow;
3. Weighted annual energy consumption;
4. Weighted annual water consumption;
5. Rated capacity, in kg, for the standard programme;
6. Drying efficiency;
7. Noise emissions in dB.

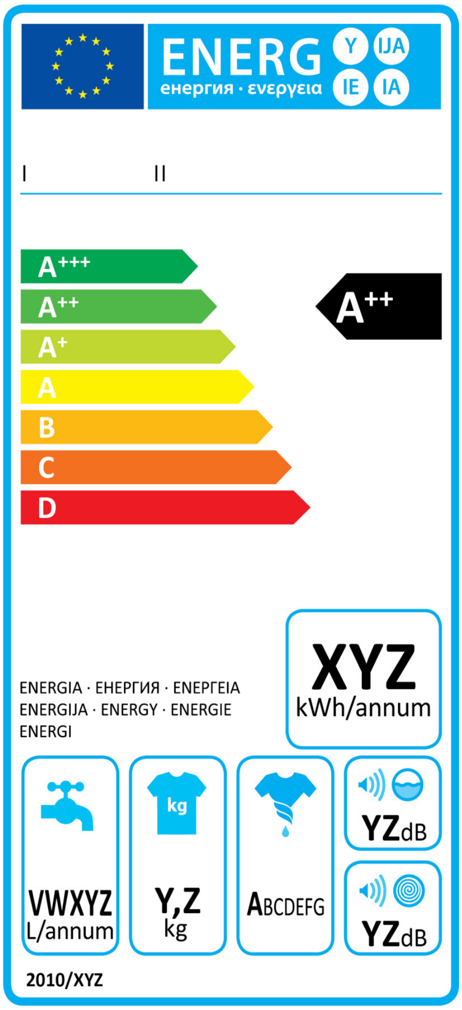

Figure 1 Household washing machines label

Household washer-dryers are covered by a separate Labelling Directive (96/60/EC). The following notes define the information to be included on the label (see Figure 2):

1. Supplier's name and name of model;
2. The energy efficiency class of the machine, determined in accordance with harmonised standards.
3. Energy consumption by cycle (for washing and drying, and for washing only);
4. Washing performance class;
5. Rated capacity, in kg, for washing, and for drying;
6. Water consumption
7. Noise emissions in dB.

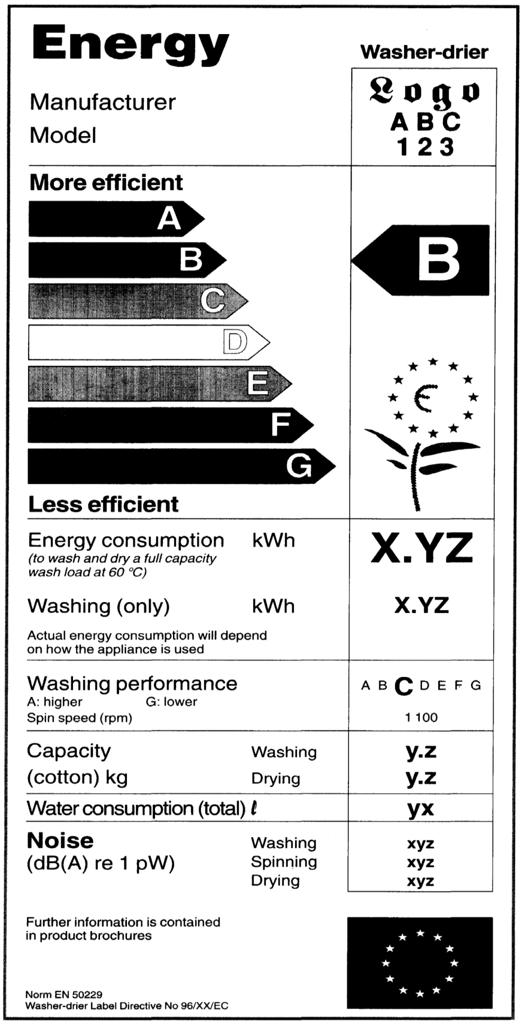

Figure 2 Household washer driers label

The label for professional washing machines could be similar in most respects to the one used for household appliances. When drafting the labelling regulation it should be discussed whether a single labelling scheme could be applicable for all types of professional washing machines (for instance washer extractors, washer dryers, tunnel washing machines) in order to allow comparison of products. This also includes the consideration if a single labelling scheme could cover machines with different heating options: A key difference with the current situation of domestic appliances is that the domestic labelling scheme only concerns electric washing machines as these are the most common products found on the market. However, for professional appliances, the situation is different as other heating options are used more widely (e.g. direct gas, steam). For example, taking primary energy (instead of electricity consumption) as an indicator could be an alternative way to define the energy efficiency classes[3].

Along with the pictograms on the label more detailed information should be provided in the product fiche / technical information of the professional washing machines and dryers and shall be included in the product brochure or other literature provided with the product (cf. also Section 2.2).

Dryers

Household tumble dryers are covered by the implementing Directive (95/13/EC) but only electrical appliances are concerned by this legislation. The European Commission is in the process of reviewing this energy label.

The following notes define the information to be included on the label (see Figure 3):

1. Supplier's name and name of model;
2. The energy efficiency class of the washing machine, determined in accordance with harmonised standards.
3. Energy consumption by cycle;
4. Rated capacity of cotton, in kg;
5. Type of product: air vented or condensing;
6. Noise emissions in dB.

The household tumble driers labelling scheme has been less influential compared to that of household washing machines. According to the preparatory study on domestic driers (Lot 16), most dryers on the market used the same technology resulting in rather similar levels of energy efficiency (class C) for a long time, thus the label could not have a significant influence on the purchase choice of consumers. The development of new technologies (heat pump dryers, efficiency class A, and gas dryers) led to a significant diversification of the

3 Efficiency factors for the different heating processes should then be estimated at the EU level.

efficiency spectrum. However, the current efficiency classes are not representative enough of the best available products. For example:

- gas dryers are not covered by the label at all;
- heat pump dryers perform well beyond the A class limit but their purchase prices are much more expensive so that the additional investment may not look interesting by only looking at the efficiency classes that are currently defined (without looking at the energy consumption value). Therefore, customers may avoid them, not being aware of the important energy savings.

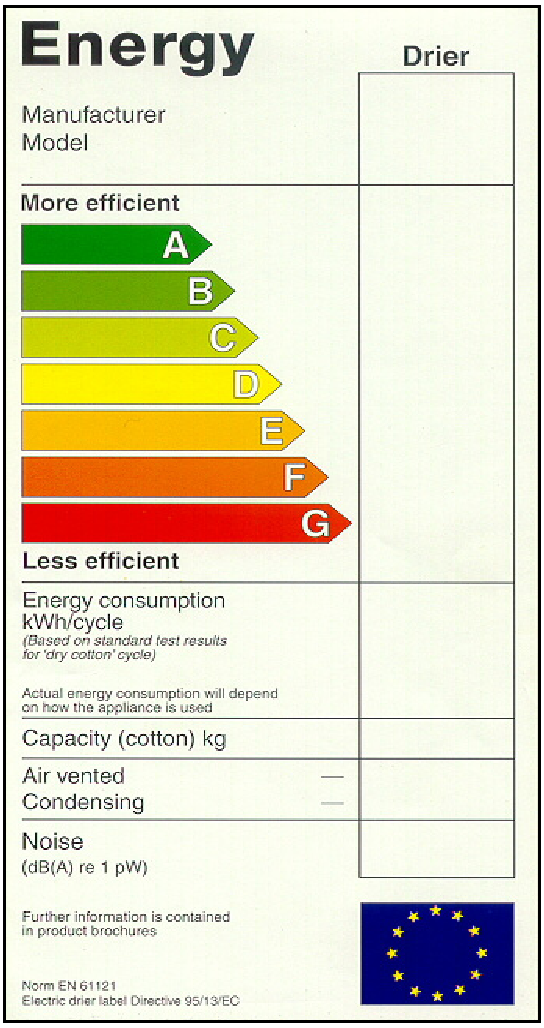

Figure 3 Household tumble driers label

The European Commission is in the process of reviewing this energy label. The figure below shows an example of the proposed new energy label for condenser driers.

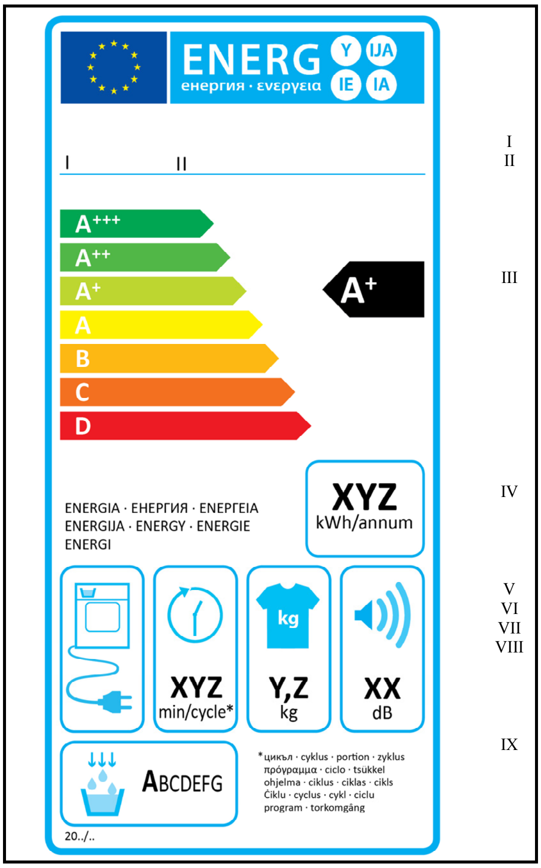

Figure 4 Proposed new energy label for condenser driers

Information to be provided includes:

I. supplier's name or trade mark;

II. supplier's model identifier, meaning the code, usually alphanumeric, which distinguishes a specific household tumble drier model from other models with the same trade mark or supplier's name;

III. the energy efficiency class;

IV. weighted annual energy consumption (AEC) in kWh/year;

V. information on the type of household tumble drier;

VI. programme time of the standard cotton programme at full load in minutes and rounded to the nearest minute;

VII. rated capacity, in kg, for the standard cotton programme at full load;

VIII. airborne acoustic noise emissions, during the drying phase, for the standard cotton programme at full load, expressed in dB(A) re 1 pW;

IX. the condensation efficiency class.

The label itself for professional dryers could be similar in most respects to that used for household appliances. When drafting the labelling regulation it should be discussed whether a single labelling scheme could be applicable for all types of professional dryers (for instance tumble dryers, cabinet dryers, condenser or air vented dryers, pass-through dryers) in order to allow comparison of products. This also includes the consideration if a single labelling scheme could cover machines with different heating options: A key difference with the current situation of domestic appliances is that the domestic labelling scheme only concerns electric dryers as these are the most common products found on the market. However, for professional appliances, the situation is different as other heating options are used more widely (e.g. direct gas, steam). For instance, the label "Energy Saving Trust Recommended" implemented in the UK for gas-fired domestic tumble dryers can be put on products with a primary energy consumption and carbon emission equal to or better than the equivalent primary energy consumption and carbon emission of electric tumble dryers in EU Energy Label B.

Along with the pictograms on the label more detailed information should be provided in the product fiche / technical information of the professional washing machines and dryers and shall be included in the product brochure or other literature provided with the product (cf. also Section 2.2).

2.3.3 Benchmarking

According to Ecodesign Directive 2009/125/EC, in addition to the legally binding requirements, indicative benchmarks for best available technologies should be identified to ensure the wide availability and easy accessibility of information on the lifecycle and environmental performance of professional washing machines and dryers.

The technical, environmental and economic analysis of preparatory study Lot 24 has already identified the best-performing products and technology available on the market (cf. Task 6). However, due to lack of standardised performance measurement data, this analysis should be renewed as soon as a harmonized measurement standard is applied. Thus, at the time of entry into force of a Regulation on professional washing machines and dryers, data on best available technology on the market in terms of their energy efficiency, energy and water consumption, cleaning and drying efficiency and airborne acoustical noise emissions should be available and being published in the Annexes of the Eco-design Regulation.

Benchmarks are non-binding for manufacturers but would allow the evaluation of the efficiency, consumption and environmental performance achieved by a new product against the best-performing products available on the EU market.

2.3.4 Energy and Water Requirements

Currently no eco-design requirements on energy efficiency exist in the EU for professional washing machines or dryers. Eco-design requirements have been recently adopted for household washing machines under the Regulation No. 1015/2010, but not for household driers yet.

Very few initiatives have been launched in third countries either. Only the United States with energy efficiency requirements for commercial clothes washers (they will be applicable from January 8, 2013), and Canada with a voluntary Energy Star labelling programme also for commercial clothes washers, have implemented programmes so far. No measures for commercial dryers have been found.

Eco-design requirements may be a relevant option to remove the least efficient appliances. Indicative levels are suggested in this section, based on the analysis made in previous tasks. However, because of the current lack of available and harmonised data on product performance, **these suggested levels should be considered with caution and discussed again once harmonised measurement methods have been defined, as suggested in Section 2.2.1.** For example, cleaning performance was not assessed in the framework of the study but will be a key parameter to measure in a standardised process, in order to allow fair comparison of products. As average EU parameters were estimated to carry out the environmental and economic analysis, the results may not be representative for all situations (see sensitivity analysis). **Finally, as an additional delay will be required before the finalisation of the standards, the market may continue to evolve and more ambitious targets could be set when the levels of eco-design requirements are decided.**

The current definition and quantification of performance requirements may have to be completed or amended in accordance with future harmonised standards. Indeed, the washing process itself is a complex balance between parameters that compete with each other (e.g. energy efficiency and cleaning performance). In the framework of this study, only basic quantification of the energy aspect has been possible so the levels for eco-design requirements suggested will refer to these. In reality, more parameters will be needed (see Section 2.2.1 for more details).

Eco-design requirements could be considered in the form of “Tier 1” and “Tier 2” requirements. Tier 1 would apply from 2014 onwards, assuming a standard measurement method can be developed by the relevant organisation (CENELEC) by 2012/2013. Tier 2 would apply from 2017 onwards, and would enable more ambitious targets to be kept as a long-term goal (e.g. heat pump efficiency levels for dryers). According to the Ecodesign Directive, eco-deisgn requirements should not exceed the LLCC level, to avoid creating difficulties for consumers (in terms of monetary impacts) and for manufacturers (in terms of both technical and monetary impacts). However, by 2017 new technologies will become available so that today’s BAT level may no longer be BAT in 2017, and may benefit from a different economic situation (e.g. higher energy rates, lower purchase prices). BAT should therefore be kept as a long-term target, for instance by benchmarking BAT products in the future Eco-design Regulation.

The proposals for eco-design requirements have been made based on the LLCC and BAT analysis in Task 7. All the eco-design requirements suggested are economically and environmentally beneficial in comparison with the base case products. When the gap in performance was estimated to be too large to set LLCC as Tier 1 (2014), LLCC was set in Tier 2 with an intermediary step: this is the case for WM 4-6-7 and all dryers. This is based on the consultants' opinion and could be discussed further during the Consultation Forum with all relevant stakeholders.

Table 1 summarises the suggested eco-design requirements for professional laundry appliances.

Table 1 Proposals for eco-design requirements by product category[4]

Base case	Capacity per cycle	Tier 1 (2014)	Tier 2 (2017)
WM 1 - Semi-professional washer extractor	6	M 1.4 Load control (LLCC) 0.13 kWh 7.2 L	-
WM 2 - Professional washer extractor (<15 kg)	10	M 1.4 Load control (LLCC) 0.141 kWh 9.4 L	-
WM 3 - Professional washer extractor (15-40 kg)	24	M 1.4 Load control (LLCC) 0.175 kWh 10.2 L	-
WM 4 - Professional washer extractor (>40 kg)	90	M 1.4 Load control 0.310 kWh 10.9 L	M 1.3 Water recovery (LLCC, BAT) 0.244 kWh 8.9 L
WM 5 - Professional washer dryer	6	M 1.5 Further control systems 0.72 kWh 9 L	M 1.4 Load control (LLCC, BAT) 0.64 kWh 7.1 L
WM 6 - Professional barrier washer	32	M 1.4 Load control 0.345 kWh 12.5 L	M 1.3 Water recovery (LLCC, BAT) 0.275 kWh 10.1 L
WM 7 - Washing tunnel machine	1 500 (kg per hour)	M 1.2 Heat exchanger 0.27 kWh 6 L	BA product (LLCC, BAT) 0.22 kWh 3 L

[4] Energy and water consumption are given in operation mode for by kg of laundry

Base case	Capacity per cycle	Tier 1 (2014)	Tier 2 (2017)
D 1 - Semi-professional dryer, condenser	6	M 2.5 Load control 0.54 kWh	M 2.2 Heat pump (LLCC) 0.27 kWh
D 2 - Semi-professional dryer, air vented	6	M 2.5 Load control 0.51 kWh	M 2.2 Heat pump (LLCC, BAT) 0.28 kWh
D 3 - Professional cabinet dryer	8	M 2.4 Improved air flow system 0.63 kWh	M 2.2 Heat pump (LLCC) 0.28 kWh
D 4 - Professional tumble dryer (<15 kg)	10	M 2.6 Residual moisture control 0.485 kWh	BA product (LLCC, BAT) 0.20 kWh
D 5 - Professional tumble dryer (15–40 kg)	23	M 2.4 Improved air flow system 0.58 kWh	M 2.2 Heat pump (LLCC, BAT) 0.275 kWh
D 6 - Professional tumble dryer (>40 kg)	70	M 2.4 Improved air flow system 0.81 kWh	M 2.2 Heat pump (LLCC, BAT) 0.35 kWh
D 7 - Pass-through (transfer) tumble dryer	400 (kg/hour)	M 2.3 Heat recovery from exhaust air 0.71 kWh	BA product (LLCC, BAT) 0.6 kWh

The performance levels indicated should be extrapolated for products with different capacities, according to rules that will need to be defined in the relevant standards. **The energy and water parameters in the table are quantified thanks to the parameters that were available within this study but in practice the harmonised standardisation process may result in other ways to measure product consumption and performance parameters.**

As specified in the framework of the Ecodesign Directive, the approach to checking compliance with the eco-design requirements is based on self-declaration in the case of domestic laundry appliances, and the same approach shall be adopted for professional appliances. The information required should be measured according to harmonised standards. Once the harmonised standard has been defined, a detailed market review of the various categories should be done to assess whether the eco-design requirements proposed are still relevant or should be amended.

2.3.5 Verification procedure for market surveillance purposes

Member States shall apply a verification procedure when performing the market surveillance checks for compliance of products with the according requirements. In order to facilitate compliance checks, manufacturers shall provide information in the technical documentation in so far as this information relates to the requirements laid down in the Regulation.

For comparison: for household washing machines, the verification procedure for the purposes of checking conformity with the requirements, defines that authorities of the

Member State shall test a single household washing machine. If the measured parameters do not meet the values declared in the technical documentation file by the manufacturer within the tolerance range set out in the eco-design regulation, the measurements shall be carried out on three more household washing machines. The arithmetic mean of the measured values of these three household washing machines shall meet the requirements within the tolerance ranges defined in the regulation.

A similar approach is deemed relevant to the case of professional washing machines and dryers: The usual procedure so far would be self-declaration with market surveillance. Framework Directive 2010/30/EG and the according implementation measures include that Member States shall test products and might require conformity in case of non-compliance; in case of recurrence the product might be taken off the market. However, practical experience e.g. from Germany[5] repeatedly shows that there are still great problems with the correct implementation of the energy labelling directive due to a lack of governmental controls and sanctions.

Based on this experience, suppliers of professional washing machines and dryers could also be required to establish a more demanding approach. According to stakeholders' feedback, for domestic appliances a voluntary agreement (VA) enabling mutual testing between competitors is appropriate and works well; thus it could be adapted for professional appliances as well.

Basis would be sufficient technical documentation to assess the accuracy of the provided information (e.g. general description of the product, internal or independent tests reports). The information required should be measured according to harmonised standards. However, these standards are still under development at the time of the study at hand (see 2.3.1). Once the harmonised standard has been defined, a detailed market review of the various categories should be done to assess whether the minimum performance standards proposed are still relevant or should be amended.

2.3.6 Criteria for Green public procurement

Public procurement accounts for a large share of EU GDP and has a key role to play in market transformation by favouring products with the least environmental impact. Both environmental and cost criteria are important in any purchasing decision, and care must be taken that neither criterion is given undue weight. In the context of this study, an appropriate approach might be to propose more ambitious requirements for public procurement (oriented to the benchmarks, see 2.3.3) than the general eco-design requirements (see 2.3.4). As stated in Task 2, government institutions, including the armed services, prisons, schools, and

5 According to tests of Deutsche Umwelthilfe, the provided tags and data tapes are often false or even not at all attached to the appliances. This concerns mainly air conditioning appliances being provided as special offer in the summer months in and built-in appliances (white goods) offered in kitchen studios and furniture stores (source: http://www.duh.de/energielabel.html).

hospitals, bought about 11% of the professional laundry equipment production in the United States in the late 1990s. Thus, all public customers (e.g. hospitals) could help drive the market towards more efficient appliances, as they represent a significant share of the markets concerned.

Therefore, Table 2 below presents suggested levels that could be set as GPP targets, being more ambitious than the basic requirements proposed in Section 2.3.4. For base cases WM 4-5-6-7 and dryer base cases, the Tier 2 target of the basic eco-design requirements could be set in Tier 1 for the GPP eco-design requirements. For these base cases, all the targets represent the LLCC option identified in Task 7. For the base cases WM 1-2-3, the LLCC option is already set in Tier 1 in the basic eco-design requirements but there is still room for improvement potential: the BA products are performing better regarding water and energy consumption, even if not resulting in the lowest life cycle costs. Therefore, it is suggested to implement BA product levels in Tier 1 to enable these additional energy and water savings, and to help drive the market towards the most efficient appliances.

Table 2 Proposals for GPP eco-design requirements by product category[6]

Base case	Capacity per cycle	Tier 1 (2014)
WM 1 - Semi-professional washer extractor	6	BA product 0.11 kWh 5.7 L
WM 2 - Professional washer extractor (<15 kg)	10	BA product 0.136 kWh 9.2 L
WM 3 - Professional washer extractor (15–40 kg)	24	BA product 0.170 kWh 10.1 L
WM 4 - Professional washer extractor (>40 kg)	90	M 1.3 Water recovery (LLCC, BAT) 0.244 kWh 8.9 L
WM 5 - Professional washer dryer	6	M 1.4 Load control (LLCC, BAT) 0.64 kWh 7.1 L
WM 6 - Professional barrier washer	32	M 1.3 Water recovery (LLCC, BAT) 0.275 kWh 10.1 L
WM 7 - Washing tunnel machine	1 500 (kg per hour)	BA product (LLCC, BAT) 0.22 kWh 3 L

[6] Energy and water consumption are given in operation mode for by kg of laundry

Base case	Capacity per cycle	Tier 1 (2014)
D 1 - Semi-professional dryer, condenser	6	M 2.2 Heat pump (LLCC) 0.27 kWh
D 2 - Semi-professional dryer, air vented	6	M 2.2 Heat pump (LLCC, BAT) 0.28 kWh
D 3 - Professional cabinet dryer	8	M 2.2 Heat pump (LLCC) 0.28 kWh
D 4 - Professional tumble dryer (<15 kg)	10	BA product (LLCC, BAT) 0.20 kWh
D 5 - Professional tumble dryer (15–40 kg)	23	M 2.2 Heat pump (LLCC, BAT) 0.275 kWh
D 6 - Professional tumble dryer (>40 kg)	70	M 2.2 Heat pump (LLCC, BAT) 0.35 kWh
D 7 - Pass-through (transfer) tumble dryer	400 (kg/hour)	BA product (LLCC, BAT) 0.6 kWh

2.4 Policy scenario analysis

An excel tool allowing estimates of the impacts of different scenarios was created and used in order to build the scenario analysis (2010-2020, 2010-2025 and 2010-2030) in this section. Two separate documents were developed to deal separately with washing machines and dryers. The tool was designed quite simply and relies on the following assumptions:

- The stock and sales estimates were obtained with an assumed annual growth rate of 1% for all base cases, except for WM 6 Professional Barrier Washer (growth rate of 2%). Initial stock (year 2009) was extracted from the market data presented in Task 2.
- The tool displays the expenditure (in €) and the primary energy (in J) related to the consumption of the products, following different policy options. The primary energy displayed is not limited to the use phase, but takes into account the energy required over the whole life time (including manufacturing, distribution and end-of-life phases). The model is kept simple because the global energy consumption is allocated uniformly over the life time of the product even though in theory, this is only true for the use phase. Given the low shares of other life cycle phases in energy consumption (see Task 5), this assumption is considered acceptable for the purposes of this analysis as a more “realistic” modelling exercise would make an insignificant difference to the overall results.

- Primary energy consumption was estimated as the most relevant and representative indicator to be modelled in the tool (see Task 7).
- Expenditure measures the yearly costs associated with the entire market. It consists of the amount of money spent to buy the products (purchase price), which is taken into account when the washing machines/dryer is bought and of the operating costs (energy, water, detergent costs, maintenance and repair) which are split over the life time of the appliance.
- The model is built on a discrete basis (data given for each year).

In subsections below, three scenarios are built: a Business-as-Usual (BAU) scenario, which assumes that the products on the market do not include any improvement options over the outlook period; a Best Available technology (BAT) scenario, which assumes that the BAT options are implemented in the near future for all product categories (ideally, that could be the target in the long term); a Least Life Cycle Cost (LLCC) scenario, which assumes that the LLCC options are implemented in the near future. The BAT, LLCC and the two-tier eco-design requirement scenarios are also compared to the BAU scenario, in order to have an estimate of the improvement potential of the improvement options on a large scale. Most of the description in the sections below refers to 2025 for comparison.

The following inputs regarding the market data are used within the modelling tool:

Table 3 Market inputs of the policy analysis model

Category	Stock		Growth	Life time
	2009	2025	(% per year)	(years)
WM 1 - Semi-professional washer extractor	193 139	226 471	1	8
WM 2 - Professional washing extractor (<15 kg)	557 280	653 455	1	13
WM 3 - Professional washing extractor (15–40 kg)	81 379	95 423	1	14
WM 4 - Professional washing extractor (>40 kg)	2 799	3 282	1	15
WM 5 - Professional washer dryer	2 093	2 454	1	11
WM 6 - Professional barrier Washer	10 471	14 374	2	14
WM 7 - Washing tunnel machine	3 063	3 592	1	13
D 1 - Semi-professional dryer, condenser	24 722	28 988	1	8
D 2 - Semi- professional dryer, air vented	33 219	38 952	1	8
D 3 - Professional Cabinet dryer	149 737	175 578	1	15
D 4 - Professional air tumble dryer (<15 kg)	195 967	229 787	1	13
D 5 - Professional air tumble dryer (15–40 kg)	45 939	53 867	1	14
D 6 - Professional air tumble dryer (>40 kg)	3 674	4 308	1	13
D 7 - Industrial pass-through (transfer) tumble dryer	14 697	17 233	1	13

The replacement rate of products has been estimated to be inversely proportional to the life time. For example, 12.5% (1/8) of the stock of base cases WM 1, D 1 or D 2 is replaced each year. Table 4 and Table 5 present the market data over time that result from the inputs.

Table 4 Washing machine market data of the policy analysis model

Year	Units	WM1	WM2	WM3	WM4	WM5	WM6	WM7
2009	Stock	193 139	557 280	81 379	2 799	2 093	10 471	3 063
	Sales	26 074	48 440	6 627	215	211	957	266
	Replaced	24 142	42 868	5 813	187	190	748	236
2010	Stock	195 070	562 853	82 193	2 827	2 114	10 680	3 094
	Sales	26 335	48 925	6 693	217	213	976	269
	Replaced	24 384	43 296	5 871	188	192	763	238
2011	Stock	197 021	568 481	83 015	2 855	2 135	10 894	3 125
	Sales	26 598	49 414	6 760	219	215	996	272
	Replaced	24 628	43 729	5 930	190	194	778	240
2012	Stock	198 991	574 166	83 845	2 884	2 156	11 112	3 156
	Sales	26 864	49 908	6 827	221	218	1 016	274
	Replaced	24 874	44 167	5 989	192	196	794	243
2013	Stock	200 981	579 908	84 683	2 913	2 178	11 334	3 187
	Sales	27 132	50 407	6 896	223	220	1 036	277
	Replaced	25 123	44 608	6 049	194	198	810	245
2014	Stock	202 991	585 707	85 530	2 942	2 200	11 561	3 219
	Sales	27 404	50 911	6 965	226	222	1 057	280
	Replaced	25 374	45 054	6 109	196	200	826	248
2015	Stock	205 021	591 564	86 385	2 971	2 222	11 792	3 251
	Sales	27 678	51 421	7 034	228	224	1 078	283
	Replaced	25 628	45 505	6 170	198	202	842	250
2016	Stock	207 071	597 480	87 249	3 001	2 244	12 028	3 284
	Sales	27 955	51 935	7 105	230	226	1 100	285
	Replaced	25 884	45 960	6 232	200	204	859	253
2017	Stock	209 142	603 454	88 122	3 031	2 266	12 268	3 317
	Sales	28 234	52 454	7 176	232	229	1 122	288
	Replaced	26 143	46 420	6 294	202	206	876	255
2018	Stock	211 233	609 489	89 003	3 061	2 289	12 514	3 350
	Sales	28 516	52 979	7 247	235	231	1 144	291
	Replaced	26 404	46 884	6 357	204	208	894	258
2019	Stock	213 346	615 584	89 893	3 092	2 312	12 764	3 383
	Sales	28 802	53 508	7 320	237	233	1 167	294
	Replaced	26 668	47 353	6 421	206	210	912	260

Year	Units	WM1	WM2	WM3	WM4	WM5	WM6	WM7
2020	Stock	215 479	621 740	90 792	3 123	2 335	13 019	3 417
	Sales	29 090	54 044	7 393	239	236	1 190	297
	Replaced	26 935	47 826	6 485	208	212	930	263
2021	Stock	217 634	627 957	91 700	3 154	2 358	13 280	3 451
	Sales	29 381	54 584	7 467	242	238	1 214	300
	Replaced	27 204	48 304	6 550	210	214	949	265
2022	Stock	219 810	634 237	92 617	3 186	2 382	13 545	3 486
	Sales	29 674	55 130	7 542	244	240	1 238	303
	Replaced	27 476	48 787	6 615	212	217	968	268
2023	Stock	222 008	640 579	93 543	3 217	2 406	13 816	3 521
	Sales	29 971	55 681	7 617	247	243	1 263	306
	Replaced	27 751	49 275	6 682	214	219	987	271
2024	Stock	224 228	646 985	94 478	3 250	2 430	14 093	3 556
	Sales	30 271	56 238	7 693	249	245	1 288	309
	Replaced	28 029	49 768	6 748	217	221	1 007	274
2025	Stock	226 471	653 455	95 423	3 282	2 454	14 374	3 592
	Sales	30 574	56 800	7 770	252	248	1 314	312
	Replaced	28 309	50 266	6 816	219	223	1 027	276
2026	Stock	228 735	659 989	96 378	3 315	2 479	14 662	3 628
	Sales	30 879	57 368	7 848	254	250	1 341	315
	Replaced	28 592	50 768	6 884	221	225	1 047	279
2027	Stock	231 023	666 589	97 341	3 348	2 504	14 955	3 664
	Sales	31 188	57 942	7 926	257	253	1 367	318
	Replaced	28 878	51 276	6 953	223	228	1 068	282
2028	Stock	233 333	673 255	98 315	3 381	2 529	15 254	3 700
	Sales	31 500	58 521	8 006	259	255	1 395	322
	Replaced	29 167	51 789	7 022	225	230	1 090	285
2029	Stock	235 666	679 988	99 298	3 415	2 554	15 559	3 737
	Sales	31 815	59 107	8 086	262	258	1 423	325
	Replaced	29 458	52 307	7 093	228	232	1 111	287
2030	Stock	238 023	686 787	100 291	3 449	2 579	15 871	3 775
	Sales	32 133	59 698	8 167	264	260	1 451	328
	Replaced	29 753	52 830	7 164	230	234	1 134	290

Table 5 Dryer market data of the policy analysis model

Year	Units	D1	D2	D3	D4	D5	D6	D7
2009	Stock	24 722	33 219	149 737	195 967	45 939	3 674	14 697
	Sales	3 337	4 485	11 480	17 034	3 741	319	1 278
	Replaced	3 090	4 152	9 982	15 074	3 281	283	1 131
2010	Stock	24 969	33 551	151 234	197 927	46 398	3 711	14 844
	Sales	3 371	4 529	11 595	17 204	3 778	323	1 290
	Replaced	3 121	4 194	10 082	15 225	3 314	285	1 142
2011	Stock	25 219	33 887	152 747	199 906	46 862	3 748	14 992
	Sales	3 405	4 575	11 711	17 376	3 816	326	1 303
	Replaced	3 152	4 236	10 183	15 377	3 347	288	1 153
2012	Stock	25 471	34 226	154 274	201 905	47 331	3 785	15 142
	Sales	3 439	4 620	11 828	17 550	3 854	329	1 316
	Replaced	3 184	4 278	10 285	15 531	3 381	291	1 165
2013	Stock	25 726	34 568	155 817	203 924	47 804	3 823	15 294
	Sales	3 473	4 667	11 946	17 726	3 893	332	1 329
	Replaced	3 216	4 321	10 388	15 686	3 415	294	1 176
2014	Stock	25 983	34 914	157 375	205 963	48 282	3 861	15 447
	Sales	3 508	4 713	12 065	17 903	3 932	336	1 343
	Replaced	3 248	4 364	10 492	15 843	3 449	297	1 188
2015	Stock	26 243	35 263	158 949	208 023	48 765	3 900	15 601
	Sales	3 543	4 760	12 186	18 082	3 971	339	1 356
	Replaced	3 280	4 408	10 597	16 002	3 483	300	1 200
2016	Stock	26 505	35 615	160 538	210 103	49 253	3 939	15 757
	Sales	3 578	4 808	12 308	18 263	4 011	342	1 370
	Replaced	3 313	4 452	10 703	16 162	3 518	303	1 212
2017	Stock	26 770	35 971	162 144	212 204	49 745	3 978	15 915
	Sales	3 614	4 856	12 431	18 445	4 051	346	1 383
	Replaced	3 346	4 496	10 810	16 323	3 553	306	1 224
2018	Stock	27 038	36 331	163 765	214 326	50 243	4 018	16 074
	Sales	3 650	4 905	12 555	18 630	4 091	349	1 397
	Replaced	3 380	4 541	10 918	16 487	3 589	309	1 236
2019	Stock	27 308	36 694	165 403	216 469	50 745	4 058	16 235
	Sales	3 687	4 954	12 681	18 816	4 132	353	1 411
	Replaced	3 414	4 587	11 027	16 651	3 625	312	1 249
2020	Stock	27 582	37 061	167 057	218 634	51 253	4 099	16 397
	Sales	3 724	5 003	12 808	19 004	4 173	356	1 425
	Replaced	3 448	4 633	11 137	16 818	3 661	315	1 261

Year	Units	D1	D2	D3	D4	D5	D6	D7
2021	Stock	27 857	37 432	168 727	220 821	51 765	4 140	16 561
	Sales	3 761	5 053	12 936	19 194	4 215	360	1 440
	Replaced	3 482	4 679	11 248	16 986	3 698	318	1 274
2022	Stock	28 136	37 806	170 415	223 029	52 283	4 181	16 727
	Sales	3 798	5 104	13 065	19 386	4 257	363	1 454
	Replaced	3 517	4 726	11 361	17 156	3 734	322	1 287
2023	Stock	28 417	38 184	172 119	225 259	52 806	4 223	16 894
	Sales	3 836	5 155	13 196	19 580	4 300	367	1 468
	Replaced	3 552	4 773	11 475	17 328	3 772	325	1 300
2024	Stock	28 701	38 566	173 840	227 512	53 334	4 265	17 063
	Sales	3 875	5 206	13 328	19 776	4 343	371	1 483
	Replaced	3 588	4 821	11 589	17 501	3 810	328	1 313
2025	Stock	28 988	38 952	175 578	229 787	53 867	4 308	17 233
	Sales	3 913	5 259	13 461	19 974	4 386	374	1 498
	Replaced	3 624	4 869	11 705	17 676	3 848	331	1 326
2026	Stock	29 278	39 341	177 334	232 085	54 406	4 351	17 406
	Sales	3 953	5 311	13 596	20 174	4 430	378	1 513
	Replaced	3 660	4 918	11 822	17 853	3 886	335	1 339
2027	Stock	29 571	39 735	179 108	234 405	54 950	4 395	17 580
	Sales	3 992	5 364	13 732	20 375	4 474	382	1 528
	Replaced	3 696	4 967	11 941	18 031	3 925	338	1 352
2028	Stock	29 867	40 132	180 899	236 749	55 499	4 439	17 756
	Sales	4 032	5 418	13 869	20 579	4 519	386	1 543
	Replaced	3 733	5 017	12 060	18 211	3 964	341	1 366
2029	Stock	30 166	40 533	182 708	239 117	56 054	4 483	17 933
	Sales	4 072	5 472	14 008	20 785	4 564	390	1 559
	Replaced	3 771	5 067	12 181	18 394	4 004	345	1 379
2030	Stock	30 467	40 939	184 535	241 508	56 615	4 528	18 112
	Sales	4 113	5 527	14 148	20 993	4 610	394	1 574
	Replaced	3 808	5 117	12 302	18 578	4 044	348	1 393

2.4.1 Business-as-Usual scenario

The BAU scenario considers that the base case remains the only product sold on the market in the future: no improvement option or any other type of improvement are introduced to the market or purchased. In this model, it is consequently assumed that there is no phenomenon of continuous improvement of the products. This scenario is taken as a reference in order to compare the results with those of the BAT and LLCC scenarios.

Figure 5, Figure 6, Figure 7 and Figure 8 show the breakdown by base case of the energy consumption and the expenditure over the period 2010-2025. Concerning washing machines, WM 7 have the largest share (43%) in energy consumption while WM 2 machines have the largest share in expenditure (40%). For dryers, D 7 machines have by far the largest shares for both energy consumption and expenditure (64% and 52%).

Table 6 and Table 7 present all the outcomes of the model. In 2025, professional washing machines would require 73.8 PJ of primary energy, and the total consumption over the period 2010-2025 represents 1 094 PJ. Regarding expenditure, 2 665 m€ are expected to be spent for professional washing machines in 2025, and 39.5 b€[7] over the period 2010-2025.

Regarding professional dryers, they would require 131 PJ of primary energy in 2025, and the total consumption over the period 2010-2025 represents 1 947 PJ. Regarding expenditure, 1 250 m€ are expected to be spent for professional dryers in 2025, and 18.6 b€[8] over the period 2010-2025.

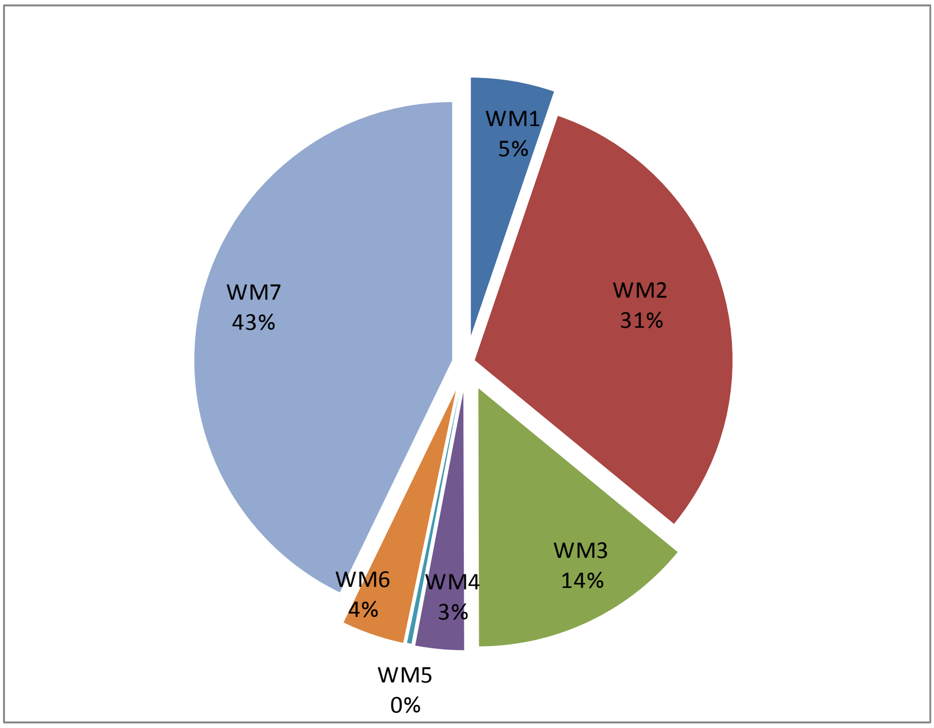

Figure 5 Breakdown of primary energy consumption of the washing machine base cases over the period 2010-2025

[7] Billion Euros

[8] Billion Euros

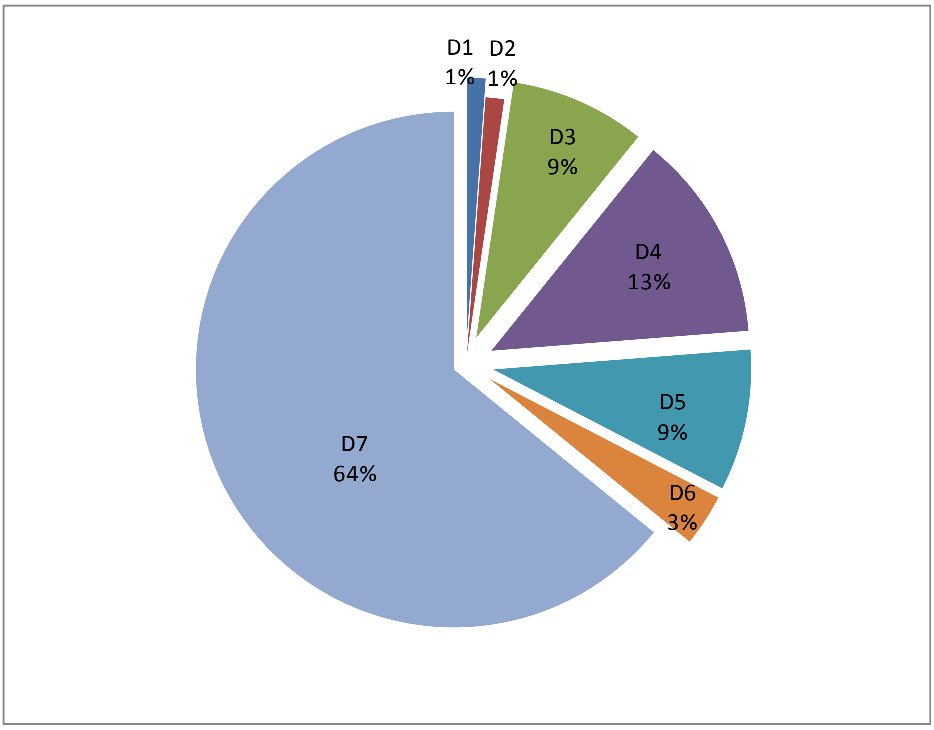

Figure 6 Breakdown of primary energy consumption of the dryer base cases over the period 2010-2025

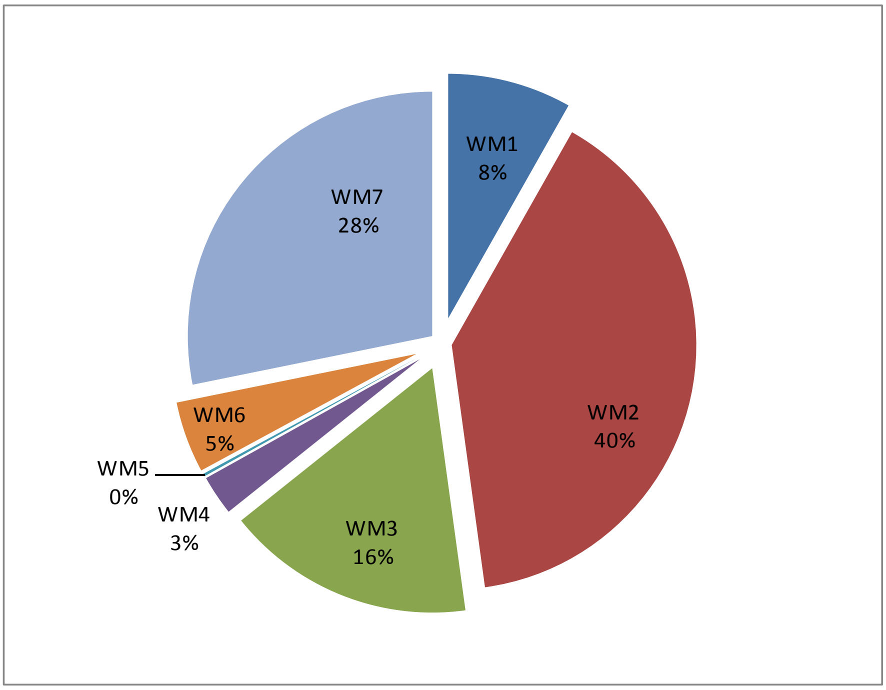

Figure 7 Breakdown of total expenditure of the washing machine base cases over the period 2010-2025

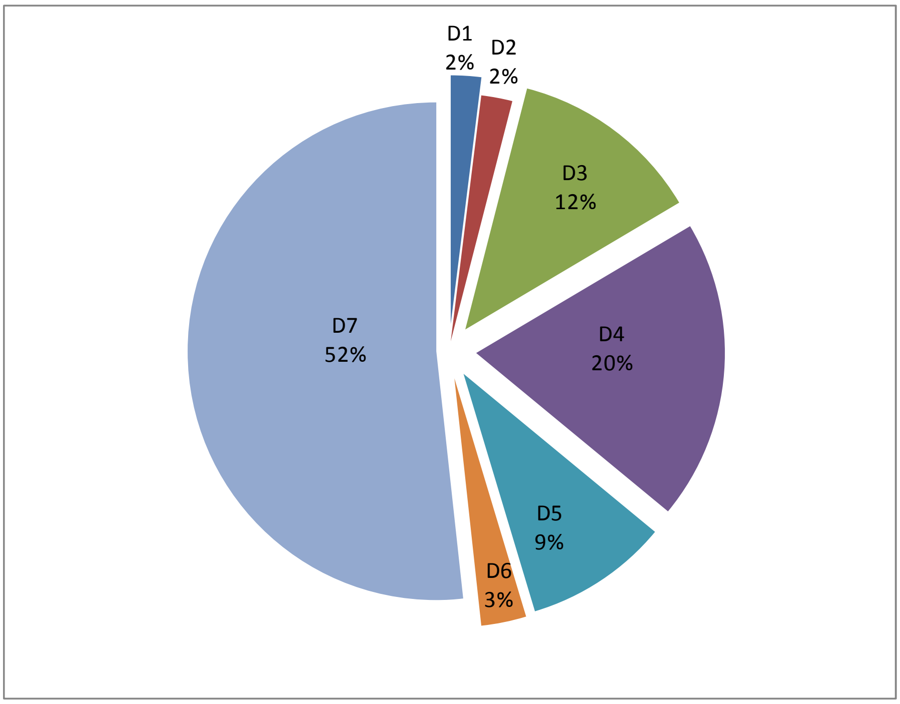

Figure 8 Breakdown of total expenditure of the dryer base cases over the period 2010-2025

Table 6 BAU scenario outcomes for washing machines: market data, energy consumption and expenditure

Year	Units	WM1	WM2	WM3	WM4	WM5	WM6	WM7	Total
2009	Stock (units)	193 139	557 280	81 379	2 799	2 093	10 471	3 063	850 224
	Sales (units)	26 074	48 440	6 627	215	211	957	266	82 790
	Energy (TJ)	3 280.8	19 276.4	8 801.3	1 902.1	178.3	2 243.0	26 882.5	62 564.5
	Expenditure (m€)	185.6	897.9	372.7	59.7	4.0	98.0	638.5	2 256.3
2010	Stock (units)	195 070	562 853	82 193	2 827	2 114	10 680	3 094	858 831
	Sales (units)	26 335	48 925	6 693	217	213	976	269	83 628
	Energy (TJ)	3 313.7	19 469.2	8 889.3	1 921.1	180.1	2 287.8	27 151.4	63 212.6
	Expenditure (m€)	187.4	906.8	376.4	60.3	4.0	99.9	644.9	2 279.8
2011	Stock (units)	197 021	568 481	83 015	2 855	2 135	10 894	3 125	867 526
	Sales (units)	26 598	49 414	6 760	219	215	996	272	84 474
	Energy (TJ)	3 346.8	19 663.9	8 978.2	1 940.3	181.9	2 333.6	27 422.9	63 867.6
	Expenditure (m€)	189.3	915.9	380.2	60.9	4.1	101.9	651.3	2 303.6
2012	Stock (units)	198 991	574 166	83 845	2 884	2 156	11 112	3 156	876 310
	Sales (units)	26 864	49 908	6 827	221	218	1 016	274	85 328
	Energy (TJ)	3 380.3	19 860.5	9 068.0	1 959.7	183.7	2 380.3	27 697.1	64 529.6
	Expenditure (m€)	191.2	925.1	384.0	61.5	4.1	104.0	657.8	2 327.7
2013	Stock (units)	200 981	579 908	84 683	2 913	2 178	11 334	3 187	885 184
	Sales (units)	27 132	50 407	6 896	223	220	1 036	277	86 192
	Energy (TJ)	3 414.1	20 059.2	9 158.6	1 979.3	185.6	2 427.9	27 974.1	65 198.7
	Expenditure (m€)	193.1	934.3	387.8	62.1	4.2	106.0	664.4	2 352.0
2014	Stock (units)	202 991	585 707	85 530	2 942	2 200	11 561	3 219	894 150
	Sales (units)	27 404	50 911	6 965	226	222	1 057	280	87 064
	Energy (TJ)	3 448.2	20 259.7	9 250.2	1 999.1	187.4	2 476.4	28 253.8	65 875.0
	Expenditure (m€)	195.0	943.7	391.7	62.8	4.2	108.2	671.1	2 376.6

Year	Units	WM1	WM2	WM3	WM4	WM5	WM6	WM7	Total
2015	Stock (units)	205 021	591 564	86 385	2 971	2 222	11 792	3 251	903 207
	Sales (units)	27 678	51 421	7 034	228	224	1 078	283	87 945
	Energy (TJ)	3 482.7	20 462.3	9 342.7	2 019.1	189.3	2 526.0	28 536.4	66 558.5
	Expenditure (m€)	197.0	953.1	395.6	63.4	4.2	110.3	677.8	2 401.4
2016	Stock (units)	207 071	597 480	87 249	3 001	2 244	12 028	3 284	912 357
	Sales (units)	27 955	51 935	7 105	230	226	1 100	285	88 836
	Energy (TJ)	3 517.5	20 667.0	9 436.2	2 039.3	191.2	2 576.5	28 821.7	67 249.3
	Expenditure (m€)	198.9	962.6	399.6	64.0	4.3	112.5	684.5	2 426.5
2017	Stock (units)	209 142	603 454	88 122	3 031	2 266	12 268	3 317	921 601
	Sales (units)	28 234	52 454	7 176	232	229	1 122	288	89 735
	Energy (TJ)	3 552.7	20 873.6	9 530.5	2 059.7	193.1	2 628.0	29 109.9	67 947.6
	Expenditure (m€)	200.9	972.3	403.6	64.7	4.3	114.8	691.4	2 451.9
2018	Stock (units)	211 233	609 489	89 003	3 061	2 289	12 514	3 350	930 939
	Sales (units)	28 516	52 979	7 247	235	231	1 144	291	90 644
	Energy (TJ)	3 588.2	21 082.4	9 625.8	2 080.3	195.0	2 680.6	29 401.0	68 653.3
	Expenditure (m€)	202.9	982.0	407.6	65.3	4.4	117.1	698.3	2 477.6
2019	Stock (units)	213 346	615 584	89 893	3 092	2 312	12 764	3 383	940 374
	Sales (units)	28 802	53 508	7 320	237	233	1 167	294	91 561
	Energy (TJ)	3 624.1	21 293.2	9 722.1	2 101.1	197.0	2 734.2	29 695.0	69 366.7
	Expenditure (m€)	205.0	991.8	411.7	66.0	4.4	119.4	705.3	2 503.5
2020	Stock (units)	215 479	621 740	90 792	3 123	2 335	13 019	3 417	949 905
	Sales (units)	29 090	54 044	7 393	239	236	1 190	297	92 489
	Energy (TJ)	3 660.3	21 506.1	9 819.3	2 122.1	198.9	2 788.9	29 992.0	70 087.7
	Expenditure (m€)	207.0	1 001.7	415.8	66.6	4.4	121.8	712.3	2 529.7
2021	Stock (units)	217 634	627 957	91 700	3 154	2 358	13 280	3 451	959 534
	Sales (units)	29 381	54 584	7 467	242	238	1 214	300	93 425
	Energy (TJ)	3 696.9	21 721.2	9 917.5	2 143.3	200.9	2 844.7	30 291.9	70 816.5
	Expenditure (m€)	209.1	1 011.7	420.0	67.3	4.5	124.2	719.5	2 556.3

Year	Units	WM1	WM2	WM3	WM4	WM5	WM6	WM7	Total
2022	Stock (units)	219 810	634 237	92 617	3 186	2 382	13 545	3 486	969 263
	Sales (units)	29 674	55 130	7 542	244	240	1 238	303	94 372
	Energy (TJ)	3 733.9	21 938.4	10 016.7	2 164.8	202.9	2 901.5	30 594.8	71 553.1
	Expenditure (m€)	211.2	1 021.9	424.2	68.0	4.5	126.7	726.7	2 583.1
2023	Stock (units)	222 008	640 579	93 543	3 217	2 406	13 816	3 521	979 091
	Sales (units)	29 971	55 681	7 617	247	243	1 263	306	95 328
	Energy (TJ)	3 771.3	22 157.8	10 116.8	2 186.4	205.0	2 959.6	30 900.8	72 297.6
	Expenditure (m€)	213.3	1 032.1	428.4	68.6	4.6	129.3	733.9	2 610.2
2024	Stock (units)	224 228	646 985	94 478	3 250	2 430	14 093	3 556	989 020
	Sales (units)	30 271	56 238	7 693	249	245	1 288	309	96 294
	Energy (TJ)	3 809.0	22 379.4	10 218.0	2 208.3	207.0	3 018.8	31 209.8	73 050.2
	Expenditure (m€)	215.4	1 042.4	432.7	69.3	4.6	131.8	741.3	2 637.6
2025	Stock (units)	226 471	653 455	95 423	3 282	2 454	14 374	3 592	999 051
	Sales (units)	30 574	56 800	7 770	252	248	1 314	312	97 270
	Energy (TJ)	3 847.1	22 603.2	10 320.2	2 230.4	209.1	3 079.1	31 521.9	73 810.9
	Expenditure (m€)	217.6	1 052.8	437.0	70.0	4.7	134.5	748.7	2 665.3
2026	Stock (units)	228 735	659 989	96 378	3 315	2 479	14 662	3 628	1 009 185
	Sales (units)	30 879	57 368	7 848	254	250	1 341	315	98 256
	Energy (TJ)	3 885.5	22 829.2	10 423.4	2 252.7	211.2	3 140.7	31 837.1	74 579.8
	Expenditure (m€)	219.8	1 063.3	441.4	70.7	4.7	137.2	756.2	2 693.3
2027	Stock (units)	231 023	666 589	97 341	3 348	2 504	14 955	3 664	1 019 424
	Sales (units)	31 188	57 942	7 926	257	253	1 367	318	99 252
	Energy (TJ)	3 924.4	23 057.5	10 527.6	2 275.2	213.3	3 203.5	32 155.5	75 357.0
	Expenditure (m€)	222.0	1 074.0	445.8	71.4	4.8	139.9	763.7	2 721.6
2028	Stock (units)	233 333	673 255	98 315	3 381	2 529	15 254	3 700	1 029 767
	Sales (units)	31 500	58 521	8 006	259	255	1 395	322	100 258
	Energy (TJ)	3 963.6	23 288.1	10 632.9	2 297.9	215.4	3 267.6	32 477.0	76 142.6
	Expenditure (m€)	224.2	1 084.7	450.2	72.1	4.8	142.7	771.4	2 750.2

Year	Units	WM1	WM2	WM3	WM4	WM5	WM6	WM7	Total
2029	Stock (units)	235 666	679 988	99 298	3 415	2 554	15 559	3 737	1 040 218
	Sales (units)	31 815	59 107	8 086	262	258	1 423	325	101 274
	Energy (TJ)	4 003.3	23 520.9	10 739.2	2 320.9	217.6	3 333.0	32 801.8	76 936.7
	Expenditure (m€)	226.4	1 095.6	454.7	72.9	4.9	145.6	779.1	2 779.1
2030	Stock (units)	238 023	686 787	100 291	3 449	2 579	15 871	3 775	1 050 775
	Sales (units)	32 133	59 698	8 167	264	260	1 451	328	102 301
	Energy (TJ)	4 043.3	23 756.1	10 846.6	2 344.1	219.7	3 399.6	33 129.8	77 739.4
	Expenditure (m€)	228.7	1 106.5	459.3	73.6	4.9	148.5	786.9	2 808.3
2010-2020	**Energy (TJ)**	**38 328.5**	**225 197.2**	**102 821.0**	**22 221.2**	**2 083.1**	**27 840.2**	**314 055.4**	**732 546.5**
2010-2020	**Expenditure (m€)**	**2 167.8**	**10 489.4**	**4 353.9**	**697.6**	**46.6**	**1 215.9**	**7 459.2**	**26 430.2**
2010-2025	**Energy (TJ)**	**57 186.7**	**335 997.1**	**153 410.2**	**33 154.3**	**3 108.0**	**42 643.9**	**468 574.6**	**1 094 074.7**
2010-2025	**Expenditure (m€)**	**3 234.4**	**15 650.2**	**6 496.1**	**1 040.8**	**69.5**	**1 862.4**	**11 129.2**	**39 482.6**
2010-2030	**Energy (TJ)**	**77 006.7**	**452 448.8**	**206 579.9**	**44 645.2**	**4 185.2**	**58 988.3**	**630 975.9**	**1 474 830.1**
2010-2030	**Expenditure (m€)**	**4 355.4**	**21 074.4**	**8 747.5**	**1 401.6**	**93.6**	**2 576.2**	**14 986.4**	**53 235.0**

Table 7 BAU scenario outcomes for dryers: market data, energy consumption and expenditure

Year	Units	D1	D2	D3	D4	D5	D6	D7	Total
2009	Stock (units)	24 722	33 219	149 737	195 967	45 939	3 674	14 697	467 955
	Sales (units)	3 337	4 485	11 480	17 034	3 741	319	1 278	41 674
	Energy (TJ)	1 288.9	1 304.1	9 474.7	14 477.3	9 891.7	3 633.9	71 641.2	111 711.6
	Expenditure (m€)	21.0	21.6	133.1	207.8	99.9	31.2	551.4	1 066.1
2010	Stock (units)	24 969	33 551	151 234	197 927	46 398	3 711	14 844	472 635
	Sales (units)	3 371	4 529	11 595	17 204	3 778	323	1 290	42 090
	Energy (TJ)	1 301.7	1 317.1	9 569.5	14 622.0	9 990.6	3 670.2	72 357.6	112 828.8
	Expenditure (m€)	21.2	21.8	134.4	209.9	100.9	31.5	556.9	1 076.7
2011	Stock (units)	25 219	33 887	152 747	199 906	46 862	3 748	14 992	477 361
	Sales (units)	3 405	4 575	11 711	17 376	3 816	326	1 303	42 511
	Energy (TJ)	1 314.8	1 330.3	9 665.1	14 768.3	10 090.5	3 706.9	73 081.2	113 957.1
	Expenditure (m€)	21.4	22.0	135.8	212.0	101.9	31.8	562.5	1 087.5
2012	Stock (units)	25 471	34 226	154 274	201 905	47 331	3 785	15 142	482 135
	Sales (units)	3 439	4 620	11 828	17 550	3 854	329	1 316	42 936
	Energy (TJ)	1 327.9	1 343.6	9 761.8	14 915.9	10 191.4	3 744.0	73 812.0	115 096.6
	Expenditure (m€)	21.6	22.3	137.1	214.1	103.0	32.1	568.1	1 098.4
2013	Stock (units)	25 726	34 568	155 817	203 924	47 804	3 823	15 294	486 956
	Sales (units)	3 473	4 667	11 946	17 726	3 893	332	1 329	43 366
	Energy (TJ)	1 341.2	1 357.0	9 859.4	15 065.1	10 293.3	3 781.4	74 550.1	116 247.6
	Expenditure (m€)	21.8	22.5	138.5	216.3	104.0	32.5	573.8	1 109.3
2014	Stock (units)	25 983	34 914	157 375	205 963	48 282	3 861	15 447	491 825
	Sales (units)	3 508	4 713	12 065	17 903	3 932	336	1 343	43 799
	Energy (TJ)	1 354.6	1 370.6	9 958.0	15 215.8	10 396.3	3 819.2	75 295.6	117 410.1
	Expenditure (m€)	22.0	22.7	139.9	218.4	105.0	32.8	579.5	1 120.4

Year	Units	D1	D2	D3	D4	D5	D6	D7	Total
2015	Stock (units)	26 243	35 263	158 949	208 023	48 765	3 900	15 601	496 744
	Sales (units)	3 543	4 760	12 186	18 082	3 971	339	1 356	44 237
	Energy (TJ)	1 368.1	1 384.3	10 057.6	15 367.9	10 500.2	3 857.4	76 048.6	118 584.2
	Expenditure (m€)	22.3	22.9	141.3	220.6	106.1	33.1	585.3	1 131.6
2016	Stock (units)	26 505	35 615	160 538	210 103	49 253	3 939	15 757	501 711
	Sales (units)	3 578	4 808	12 308	18 263	4 011	342	1 370	44 680
	Energy (TJ)	1 381.8	1 398.1	10 158.2	15 521.6	10 605.2	3 896.0	76 809.1	119 770.0
	Expenditure (m€)	22.5	23.2	142.7	222.8	107.2	33.4	591.2	1 143.0
2017	Stock (units)	26 770	35 971	162 144	212 204	49 745	3 978	15 915	506 728
	Sales (units)	3 614	4 856	12 431	18 445	4 051	346	1 383	45 126
	Energy (TJ)	1 395.6	1 412.1	10 259.7	15 676.8	10 711.3	3 935.0	77 577.2	120 967.7
	Expenditure (m€)	22.7	23.4	144.1	225.1	108.2	33.8	597.1	1 154.4
2018	Stock (units)	27 038	36 331	163 765	214 326	50 243	4 018	16 074	511 795
	Sales (units)	3 650	4 905	12 555	18 630	4 091	349	1 397	45 578
	Energy (TJ)	1 409.6	1 426.2	10 362.3	15 833.6	10 818.4	3 974.3	78 353.0	122 177.4
	Expenditure (m€)	22.9	23.6	145.6	227.3	109.3	34.1	603.1	1 165.9
2019	Stock (units)	27 308	36 694	165 403	216 469	50 745	4 058	16 235	516 913
	Sales (units)	3 687	4 954	12 681	18 816	4 132	353	1 411	46 034
	Energy (TJ)	1 423.7	1 440.5	10 466.0	15 991.9	10 926.6	4 014.0	79 136.5	123 399.2
	Expenditure (m€)	23.2	23.9	147.0	229.6	110.4	34.5	609.1	1 177.6
2020	Stock (units)	27 582	37 061	167 057	218 634	51 253	4 099	16 397	522 083
	Sales (units)	3 724	5 003	12 808	19 004	4 173	356	1 425	46 494
	Energy (TJ)	1 437.9	1 454.9	10 570.6	16 151.8	11 035.8	4 054.2	79 927.8	124 633.1
	Expenditure (m€)	23.4	24.1	148.5	231.9	111.5	34.8	615.2	1 189.4
2021	Stock (units)	27 857	37 432	168 727	220 821	51 765	4 140	16 561	527 303
	Sales (units)	3 761	5 053	12 936	19 194	4 215	360	1 440	46 959
	Energy (TJ)	1 452.3	1 469.4	10 676.3	16 313.4	11 146.2	4 094.7	80 727.1	125 879.5
	Expenditure (m€)	23.6	24.4	150.0	234.2	112.6	35.1	621.4	1 201.3

Year	Units	D1	D2	D3	D4	D5	D6	D7	Total
2022	Stock (units)	28 136	37 806	170 415	223 029	52 283	4 181	16 727	532 576
	Sales (units)	3 798	5 104	13 065	19 386	4 257	363	1 454	47 428
	Energy (TJ)	1 466.8	1 484.1	10 783.1	16 476.5	11 257.7	4 135.7	81 534.4	127 138.3
	Expenditure (m€)	23.9	24.6	151.5	236.5	113.7	35.5	627.6	1 213.3
2023	Stock (units)	28 417	38 184	172 119	225 259	52 806	4 223	16 894	537 902
	Sales (units)	3 836	5 155	13 196	19 580	4 300	367	1 468	47 903
	Energy (TJ)	1 481.5	1 499.0	10 890.9	16 641.2	11 370.2	4 177.0	82 349.7	128 409.7
	Expenditure (m€)	24.1	24.8	153.0	238.9	114.9	35.9	633.8	1 225.4
2024	Stock (units)	28 701	38 566	173 840	227 512	53 334	4 265	17 063	543 281
	Sales (units)	3 875	5 206	13 328	19 776	4 343	371	1 483	48 382
	Energy (TJ)	1 496.3	1 514.0	10 999.8	16 807.7	11 483.9	4 218.8	83 173.2	129 693.8
	Expenditure (m€)	24.4	25.1	154.5	241.3	116.0	36.2	640.2	1 237.7
2025	Stock (units)	28 988	38 952	175 578	229 787	53 867	4 308	17 233	548 714
	Sales (units)	3 913	5 259	13 461	19 974	4 386	374	1 498	48 865
	Energy (TJ)	1 511.3	1 529.1	11 109.8	16 975.7	11 598.8	4 261.0	84 005.0	130 990.7
	Expenditure (m€)	24.6	25.3	156.1	243.7	117.2	36.6	646.6	1 250.0
2026	Stock (units)	29 278	39 341	177 334	232 085	54 406	4 351	17 406	554 201
	Sales (units)	3 953	5 311	13 596	20 174	4 430	378	1 513	49 354
	Energy (TJ)	1 526.4	1 544.4	11 220.9	17 145.5	11 714.8	4 303.6	84 845.0	132 300.6
	Expenditure (m€)	24.8	25.6	157.6	246.1	118.4	36.9	653.0	1 262.5
2027	Stock (units)	29 571	39 735	179 108	234 405	54 950	4 395	17 580	559 743
	Sales (units)	3 992	5 364	13 732	20 375	4 474	382	1 528	49 848
	Energy (TJ)	1 541.7	1 559.8	11 333.1	17 317.0	11 831.9	4 346.6	85 693.5	133 623.6
	Expenditure (m€)	25.1	25.8	159.2	248.6	119.5	37.3	659.6	1 275.2
2028	Stock (units)	29 867	40 132	180 899	236 749	55 499	4 439	17 756	565 341
	Sales (units)	4 032	5 418	13 869	20 579	4 519	386	1 543	50 346
	Energy (TJ)	1 557.1	1 575.4	11 446.5	17 490.1	11 950.2	4 390.1	86 550.4	134 959.8
	Expenditure (m€)	25.3	26.1	160.8	251.1	120.7	37.7	666.2	1 287.9

Year	Units	D1	D2	D3	D4	D5	D6	D7	Total
2029	**Stock (units)**	30 166	40 533	182 708	239 117	56 054	4 483	17 933	570 994
	Sales (units)	4 072	5 472	14 008	20 785	4 564	390	1 559	50 850
	Energy (TJ)	1 572.6	1 591.2	11 560.9	17 665.0	12 069.7	4 434.0	87 415.9	136 309.4
	Expenditure (m€)	25.6	26.4	162.4	253.6	121.9	38.1	672.8	1 300.8
2030	**Stock (units)**	30 467	40 939	184 535	241 508	56 615	4 528	18 112	576 704
	Sales (units)	4 113	5 527	14 148	20 993	4 610	394	1 574	51 358
	Energy (TJ)	1 588.4	1 607.1	11 676.5	17 841.7	12 190.4	4 478.3	88 290.1	137 672.5
	Expenditure (m€)	25.8	26.6	164.0	256.1	123.2	38.4	679.6	1 313.8
2010-2020	**Energy (TJ)**	**15 057.0**	**15 234.6**	**110 688.3**	**169 130.8**	**115 559.6**	**42 452.7**	**836 948.8**	**1 305 071.7**
2010-2020	**Expenditure (m€)**	**245.0**	**252.5**	**1 554.8**	**2 428.1**	**1 167.6**	**364.4**	**6 442.0**	**12 454.3**
2010-2025	**Energy (TJ)**	**22 465.3**	**22 730.2**	**165 148.3**	**252 345.3**	**172 416.3**	**63 339.9**	**1 248 738.3**	**1 947 183.5**
2010-2025	**Expenditure (m€)**	**365.6**	**376.7**	**2 319.8**	**3 622.7**	**1 742.0**	**543.6**	**9 611.5**	**18 581.9**
2010-2030	**Energy (TJ)**	**30 251.4**	**30 608.2**	**222 386.3**	**339 804.5**	**232 173.4**	**85 292.6**	**1 681 533.1**	**2 622 049.6**
2010-2030	**Expenditure (m€)**	**492.3**	**507.2**	**3 123.8**	**4 878.3**	**2 345.8**	**732.0**	**12 942.7**	**25 022.1**

2.4.2 Least Life Cycle Cost scenario

The Least Life Cycle Cost (LLCC) scenario considers that all LLCC improvement options are implemented for each base case, as described in Task 7. The market modelling includes that from 2014, all products sold are equivalent to these LLCC options and no more base case products are sold (the market shift takes place in one single step). Table 8 reminds the LLCC options that were identified for each base case in Task 7.

Table 8 LLCC improvement option for each base case

Base case	LLCC Improvement option
WM 1 - Semi-professional washer extractor	M 1.4 Load control
WM 2 - Professional washing extractor (<15 kg)	M 1.4 Load control
WM 3 - Professional washing extractor (15–40 kg)	M 1.4 Load control
WM 4 - Professional washing extractor (>40 kg)	M 1.3 Water recovery
WM 5 - Professional washer dryer	M 1.4 Load control
WM 6 - Professional barrier Washer	M 1.3 Water recovery
WM 7 - Washing tunnel machine	BA product
D 1 - Semi-professional dryer, condenser	M 2.2 Heat pump
D 2 - Semi- professional dryer, air vented	M 2.2 Heat pump
D 3 - Professional Cabinet dryer	M 2.2 Heat pump
D 4 - Professional air tumble dryer (<15 kg)	BA Product
D 5 - Professional air tumble dryer (15–40 kg)	M 2.2 Heat pump
D 6 - Professional air tumble dryer (>40 kg)	M 2.2 Heat pump
D 7 - Industrial pass-through (transfer) tumble dryer	BA product

Table 9 and Table 10 present the outcomes of this scenario modelling. In 2025, the professional washing machine market would require 56.3 PJ of primary energy (-23.7% compared to BAU), and would represent 2.31 b€ (-13.3% compared to BAU). Over the period 2010-2025, the total primary energy consumption would be 990 PJ (-9.5% compared to BAU) and the total expenditure 38.1 b€ (-3.6% compared to BAU).

In 2025, the professional dryer market would require 87.6 PJ of primary energy (-33.1% compared to BAU), and would represent 1.12 b€ (-10.7% compared to BAU). Over the period 2010-2025, the total primary energy consumption would be 1 689 PJ (-13.3% compared to BAU) and the total expenditure 18.8 b€ (+1.3% compared to BAU).

Table 9 LLCC scenario outcomes and comparison with BAU scenario for washing machines: market data, energy consumption and expenditure

Year	Indicator	WM1		WM2		WM3		WM4		WM5		WM6		WM7		Total	Difference with BAU	
		2010 Base case	2014 M 1.4 Load control	2010 Base case	2014 M 1.4 Load control	2010 Base case	2014 M 1.4 Load control	2010 Base case	2014 M 1.3 Water recov.	2010 Base case	2014 M 1.4 Load control	2010 Base case	2014 M 1.3 Water recov.	2010 Base case	2014 BA product		absolute	relative
	Product price (€/unit)	2 670	3 097	5 000	5 800	15 250	17 690	58 750	76 375	8 000	8 160	38 250	49 725	390 000	507 000			
2009	Stock (units)	193 139	0	557 280	0	81 379	0	2 799	0	2 093	0	10 471	0	3 063	0	850 224	0.0	0.0%
	Sales (units)	26 074	0	48 440	0	6 627	0	215	0	211	0	957	0	266	0	82 790	0.0	0.0%
	Energy (TJ)	3 280.8	0.0	19 276.4	0.0	8 801.3	0.0	1 902.1	0.0	178.3	0.0	2 243.0	0.0	26 882.5	0.0	62 564.5	0.0	0.0%
	Expenditure (m€)	185.6	0.0	897.9	0.0	372.7	0.0	59.7	0.0	4.0	0.0	98.0	0.0	638.5	0.0	2 256.3	0.0	0.0%
2010	Stock (units)	195 070	0	562 853	0	82 193	0	2 827	0	2 114	0	10 680	0	3 094	0	858 831	0.0	0.0%
	Sales (units)	26 335	0	48 925	0	6 693	0	217	0	213	0	976	0	269	0	83 628	0.0	0.0%
	Energy (TJ)	3 313.7	0.0	19 469.2	0.0	8 889.3	0.0	1 921.1	0.0	180.1	0.0	2 287.8	0.0	27 151.4	0.0	63 212.6	0.0	0.0%
	Expenditure (m€)	187.4	0.0	906.8	0.0	376.4	0.0	60.3	0.0	4.0	0.0	99.9	0.0	644.9	0.0	2 279.8	0.0	0.0%
2011	Stock (units)	197 021	0	568 481	0	83 015	0	2 855	0	2 135	0	10 894	0	3 125	0	867 526	0.0	0.0%
	Sales (units)	26 598	0	49 414	0	6 760	0	219	0	215	0	996	0	272	0	84 474	0.0	0.0%
	Energy (TJ)	3 346.8	0.0	19 663.9	0.0	8 978.2	0.0	1 940.3	0.0	181.9	0.0	2 333.6	0.0	27 422.9	0.0	63 867.6	0.0	0.0%
	Expenditure (m€)	189.3	0.0	915.9	0.0	380.2	0.0	60.9	0.0	4.1	0.0	101.9	0.0	651.3	0.0	2 303.6	0.0	0.0%
2012	Stock (units)	198 991	0	574 166	0	83 845	0	2 884	0	2 156	0	11 112	0	3 156	0	876 310	0.0	0.0%
	Sales (units)	26 864	0	49 908	0	6 827	0	221	0	218	0	1 016	0	274	0	85 328	0.0	0.0%
	Energy (TJ)	3 380.3	0.0	19 860.5	0.0	9 068.0	0.0	1 959.7	0.0	183.7	0.0	2 380.3	0.0	27 697.1	0.0	64 529.6	0.0	0.0%
	Expenditure (m€)	191.2	0.0	925.1	0.0	384.0	0.0	61.5	0.0	4.1	0.0	104.0	0.0	657.8	0.0	2 327.7	0.0	0.0%
2013	Stock (units)	200 981	0	579 908	0	84 683	0	2 913	0	2 178	0	11 334	0	3 187	0	885 184	0.0	0.0%
	Sales (units)	27 132	0	50 407	0	6 896	0	223	0	220	0	1 036	0	277	0	86 192	0.0	0.0%
	Energy (TJ)	3 414.1	0.0	20 059.2	0.0	9 158.6	0.0	1 979.3	0.0	185.6	0.0	2 427.9	0.0	27 974.1	0.0	65 198.7	0.0	0.0%
	Expenditure (m€)	193.1	0.0	934.3	0.0	387.8	0.0	62.1	0.0	4.2	0.0	106.0	0.0	664.4	0.0	2 352.0	0.0	0.0%

Year	Indicator	WM1		WM2		WM3		WM4		WM5		WM6		WM7		Total	Difference with BAU	
		2010 Base case	2014 M 1.4 Load control	2010 Base case	2014 M 1.4 Load control	2010 Base case	2014 M 1.4 Load control	2010 Base case	2014 M 1.3 Water recov.	2010 Base case	2014 M 1.4 Load control	2010 Base case	2014 M 1.3 Water recov.	2010 Base case	2014 BA product		absolute	relative
2014	**Stock (units)**	202 991	0	585 707	0	85 530	0	2 942	0	2 200	0	11 561	0	3 219	0	894 150	**0.0**	**0.0%**
	Sales (units)	0	27 404	0	50 911	0	6 965	0	226	0	222	0	1 057	0	280	87 064	**0.0**	**0.0%**
	Energy (TJ)	3 448.2	0.0	20 259.7	0.0	9 250.2	0.0	1 999.1	0.0	187.4	0.0	2 476.4	0.0	28 253.8	0.0	65 875.0	**0.0**	**0.0%**
	Expenditure (m€)	121.9	84.9	689.1	295.3	285.5	123.2	49.5	17.2	2.4	1.8	67.7	52.6	561.9	141.9	2 494.9	**118.3**	**5.0%**
2015	**Stock (units)**	177 617	27 404	540 653	50 911	79 421	6 965	2 746	226	2 000	222	10 735	1 057	2 972	280	903 207	**0.0**	**0.0%**
	Sales (units)	0	27 678	0	51 421	0	7 034	0	228	0	224	0	1 078	0	283	87 945	**0.0**	**0.0%**
	Energy (TJ)	3 017.2	392.1	18 701.3	1 460.6	8 589.5	623.2	1 865.8	106.0	170.4	15.2	2 299.6	157.4	26 080.4	1 548.6	65 027.2	**-1 531.3**	**-2.3%**
	Expenditure (m€)	106.6	99.2	636.1	346.4	265.1	143.1	46.2	20.0	2.2	2.0	62.9	58.0	518.7	171.6	2 478.1	**76.7**	**3.2%**
2016	**Stock (units)**	151 990	55 082	495 148	102 332	73 250	13 999	2 548	453	1 798	446	9 893	2 135	2 721	562	912 357	**0.0**	**0.0%**
	Sales (units)	0	27 955	0	51 935	0	7 105	0	230	0	226	0	1 100	0	285	88 836	**0.0**	**0.0%**
	Energy (TJ)	2 581.8	788.1	17 127.3	2 935.8	7 922.2	1 252.6	1 731.2	213.0	153.2	30.5	2 119.1	318.0	23 885.3	3 112.6	64 170.8	**-3 078.5**	**-4.6%**
	Expenditure (m€)	91.2	113.7	582.6	398.0	244.5	163.1	42.9	22.8	2.0	2.2	58.0	63.6	475.0	201.6	2 461.1	**34.6**	**1.4%**
2017	**Stock (units)**	126 106	83 036	449 188	154 267	67 018	21 103	2 348	683	1 594	673	9 034	3 235	2 469	848	921 601	**0.0**	**0.0%**
	Sales (units)	0	28 234	0	52 454	0	7 176	0	232	0	229	0	1 122	0	288	89 735	**0.0**	**0.0%**
	Energy (TJ)	2 142.2	1 188.1	15 537.5	4 425.7	7 248.2	1 888.3	1 595.3	321.1	135.8	46.0	1 935.1	481.8	21 668.3	4 692.3	63 305.6	**-4 642.0**	**-6.8%**
	Expenditure (m€)	75.7	128.3	528.5	450.1	223.7	183.4	39.5	25.6	1.8	2.4	52.9	69.3	431.0	231.9	2 444.0	**-7.9**	**-0.3%**
2018	**Stock (units)**	99 963	111 270	402 768	206 721	60 724	28 279	2 145	916	1 388	901	8 157	4 356	2 214	1 136	930 939	**0.0**	**0.0%**
	Sales (units)	0	28 516	0	52 979	0	7 247	0	235	0	231	0	1 144	0	291	90 644	**0.0**	**0.0%**
	Energy (TJ)	1 698.1	1 592.1	13 931.8	5 930.5	6 567.4	2 530.4	1 458.0	430.3	118.2	61.6	1 747.4	648.9	19 429.1	6 287.8	62 431.6	**-6 221.8**	**-9.1%**
	Expenditure (m€)	60.0	143.1	473.9	502.8	202.7	203.9	36.1	28.4	1.5	2.6	47.8	75.2	386.4	262.5	2 426.8	**-50.8**	**-2.1%**
2019	**Stock (units)**	73 559	139 787	355 884	259 700	54 367	35 526	1 941	1 150	1 180	1 132	7 263	5 501	1 956	1 427	940 374	**0.0**	**0.0%**
	Sales (units)	0	28 802	0	53 508	0	7 320	0	237	0	233	0	1 167	0	294	91 561	**0.0**	**0.0%**
	Energy (TJ)	1 249.5	2 000.2	12 310.1	7 450.4	5 879.8	3 178.9	1 319.3	540.5	100.5	77.4	1 555.9	819.3	17 167.4	7 899.3	61 548.6	**-7 818.1**	**-11.3%**
	Expenditure (m€)	44.2	158.0	418.7	555.9	181.5	224.6	32.7	31.3	1.3	2.9	42.5	81.1	341.4	293.4	2 409.3	**-94.2**	**-3.8%**

Year	Indicator	WM1		WM2		WM3		WM4		WM5		WM6		WM7		Total	Difference with BAU	
		2010 Base case	2014 M 1.4 Load control	2010 Base case	2014 M 1.4 Load control	2010 Base case	2014 M 1.4 Load control	2010 Base case	2014 M 1.3 Water recov.	2010 Base case	2014 M 1.4 Load control	2010 Base case	2014 M 1.3 Water recov.	2010 Base case	2014 BA product		absolute	relative
2020	Stock (units)	46 891	168 589	308 532	313 208	47 946	42 846	1 735	1 388	969	1 366	6 352	6 668	1 696	1 721	949 905	0.0	0.0%
	Sales (units)	0	29 090	0	54 044	0	7 393	0	239	0	236	0	1 190	0	297	92 489	0.0	0.0%
	Energy (TJ)	796.5	2 412.3	10 672.2	8 985.5	5 185.4	3 833.9	1 179.2	651.9	82.6	93.3	1 360.6	993.1	14 883.2	9 526.8	60 656.6	-9 431.1	-13.5%
	Expenditure (m€)	28.1	173.0	363.0	609.6	160.0	245.4	29.2	34.1	1.1	3.1	37.2	87.2	296.0	324.6	2 391.7	-138.0	-5.5%
2021	Stock (units)	19 956	197 678	260 706	367 251	41 461	50 239	1 527	1 627	757	1 601	5 422	7 858	1 433	2 019	959 534	0.0	0.0%
	Sales (units)	0	29 381	0	54 584	0	7 467	0	242	0	238	0	1 214	0	300	93 425	0.0	0.0%
	Energy (TJ)	339.0	2 828.5	9 017.9	10 535.9	4 484.0	4 495.4	1 037.7	764.4	64.5	109.4	1 161.4	1 170.4	12 576.1	11 170.7	59 755.4	-11 061.0	-15.6%
	Expenditure (m€)	12.0	188.2	306.7	663.9	138.4	266.5	25.7	37.1	0.8	3.3	31.8	93.3	250.1	356.1	2 373.9	-182.3	-7.1%
2022	Stock (units)	0	219 810	212 401	421 835	34 911	57 706	1 317	1 869	543	1 839	4 473	9 072	1 167	2 319	969 263	0.0	0.0%
	Sales (units)	0	29 674	0	55 130	0	7 542	0	244	0	240	0	1 238	0	303	94 372	0.0	0.0%
	Energy (TJ)	0.0	3 145.2	7 347.0	12 101.8	3 775.6	5 163.5	894.9	878.0	46.2	125.7	958.2	1 351.3	10 246.0	12 831.0	58 864.5	-12 688.6	-17.7%
	Expenditure (m€)	0.0	200.0	249.9	718.6	116.5	287.8	22.2	40.0	0.6	3.5	26.2	99.6	203.8	387.9	2 356.8	-226.3	-8.8%
2023	Stock (units)	0	222 008	163 614	476 965	28 295	65 248	1 104	2 113	326	2 080	3 506	10 311	899	2 622	979 091	0.0	0.0%
	Sales (units)	0	29 971	0	55 681	0	7 617	0	247	0	243	0	1 263	0	306	95 328	0.0	0.0%
	Energy (TJ)	0.0	3 176.7	5 659.4	13 683.4	3 060.2	5 838.4	750.5	992.8	27.8	142.1	751.0	1 535.8	7 892.5	14 507.9	58 018.3	-14 279.3	-19.8%
	Expenditure (m€)	0.0	202.0	192.5	774.0	94.4	309.4	18.6	43.0	0.4	3.7	20.5	106.1	157.0	420.1	2 341.7	-268.5	-10.3%
2024	Stock (units)	0	224 228	114 338	532 646	21 613	72 865	890	2 360	108	2 322	2 519	11 574	628	2 928	989 020	0.0	0.0%
	Sales (units)	0	30 271	0	56 238	0	7 693	0	249	0	245	0	1 288	0	309	96 294	0.0	0.0%
	Energy (TJ)	0.0	3 208.4	3 955.0	15 280.9	2 337.5	6 519.9	604.8	1 108.7	9.2	158.7	539.6	1 723.9	5 515.6	16 201.5	57 163.5	-15 886.7	-21.7%
	Expenditure (m€)	0.0	204.0	134.5	829.9	72.1	331.1	15.0	46.0	0.1	4.0	14.8	112.6	109.7	452.6	2 326.4	-311.2	-11.8%
2025	Stock (units)	0	226 471	64 570	588 884	14 865	80 558	673	2 609	0	2 454	1 512	12 862	355	3 237	999 051	0.0	0.0%
	Sales (units)	0	30 574	0	56 800	0	7 770	0	252	0	248	0	1 314	0	312	97 270	0.0	0.0%
	Energy (TJ)	0.0	3 240.5	2 233.5	16 894.2	1 607.7	7 208.3	457.6	1 225.7	0.0	167.7	323.9	1 915.8	3 114.8	17 912.1	56 301.8	-17 509.0	-23.7%
	Expenditure (m€)	0.0	206.1	76.0	886.3	49.6	353.0	11.3	49.0	0.0	4.1	8.9	119.3	61.9	485.4	2 311.0	-354.3	-13.3%

Year	Indicator	WM1		WM2		WM3		WM4		WM5		WM6		WM7		Total	Difference with BAU	
		2010 Base case	2014 M 1.4 Load control	2010 Base case	2014 M 1.4 Load control	2010 Base case	2014 M 1.4 Load control	2010 Base case	2014 M 1.3 Water recov.	2010 Base case	2014 M 1.4 Load control	2010 Base case	2014 M 1.3 Water recov.	2010 Base case	2014 BA product		absolute	relative
2026	**Stock (units)**	0	228 735	14 305	645 685	8 049	88 329	455	2 860	0	2 479	485	14 176	79	3 549	1 009 185	**0.0**	**0.0%**
	Sales (units)	0	30 879	0	57 368	0	7 848	0	254	0	250	0	1 341	0	315	98 256	**0.0**	**0.0%**
	Energy (TJ)	0.0	3 272.9	494.8	18 523.8	870.5	7 903.6	308.9	1 343.9	0.0	169.4	104.0	2 111.6	690.0	19 639.8	55 433.1	**-19 146.6**	**-25.7%**
	Expenditure (m€)	0.0	208.1	16.8	943.3	26.9	375.2	7.6	52.1	0.0	4.1	2.8	126.1	13.7	518.5	2 295.5	**-397.8**	**-14.8%**
2027	**Stock (units)**	0	231 023	0	666 589	1 165	96 176	234	3 115	0	2 504	0	14 955	0	3 664	1 019 424	**0.0**	**0.0%**
	Sales (units)	0	31 188	0	57 942	0	7 926	0	257	0	253	0	1 367	0	318	99 252	**0.0**	**0.0%**
	Energy (TJ)	0.0	3 305.6	0.0	19 123.5	126.0	8 605.8	158.7	1 463.4	0.0	171.1	0.0	2 227.6	0.0	20 275.6	55 457.2	**-19 899.8**	**-26.4%**
	Expenditure (m€)	0.0	210.2	0.0	966.4	3.9	397.6	3.9	55.2	0.0	4.2	0.0	130.7	0.0	531.7	2 303.9	**-417.7**	**-15.3%**
2028	**Stock (units)**	0	233 333	0	673 255	0	98 315	10	3 371	0	2 529	0	15 254	0	3 700	1 029 767	**0.0**	**0.0%**
	Sales (units)	0	31 500	0	58 521	0	8 006	0	259	0	255	0	1 395	0	322	100 258	**0.0**	**0.0%**
	Energy (TJ)	0.0	3 338.7	0.0	19 314.7	0.0	8 797.1	7.0	1 584.0	0.0	172.8	0.0	2 272.1	0.0	20 478.4	55 964.8	**-20 177.8**	**-26.5%**
	Expenditure (m€)	0.0	212.3	0.0	976.1	0.0	404.7	0.2	58.3	0.0	4.2	0.0	133.4	0.0	537.1	2 326.2	**-423.9**	**-15.4%**
2029	**Stock (units)**	0	235 666	0	679 988	0	99 298	0	3 415	0	2 554	0	15 559	0	3 737	1 040 218	**0.0**	**0.0%**
	Sales (units)	0	31 815	0	59 107	0	8 086	0	262	0	258	0	1 423	0	325	101 274	**0.0**	**0.0%**
	Energy (TJ)	0.0	3 372.1	0.0	19 507.9	0.0	8 885.1	0.0	1 604.7	0.0	174.5	0.0	2 317.6	0.0	20 683.2	56 545.0	**-20 391.7**	**-26.5%**
	Expenditure (m€)	0.0	214.5	0.0	985.8	0.0	408.8	0.0	59.0	0.0	4.3	0.0	136.0	0.0	542.4	2 350.8	**-428.3**	**-15.4%**
2030	**Stock (units)**	0	238 023	0	686 787	0	100 291	0	3 449	0	2 579	0	15 871	0	3 775	1 050 775	**0.0**	**0.0%**
	Sales (units)	0	32 133	0	59 698	0	8 167	0	264	0	260	0	1 451	0	328	102 301	**0.0**	**0.0%**
	Energy (TJ)	0.0	3 405.8	0.0	19 702.9	0.0	8 974.0	0.0	1 620.7	0.0	176.2	0.0	2 363.9	0.0	20 890.0	57 133.6	**-20 605.8**	**-26.5%**
	Expenditure (m€)	0.0	216.6	0.0	995.7	0.0	412.9	0.0	59.6	0.0	4.3	0.0	138.7	0.0	547.8	2 375.6	**-432.7**	**-15.4%**
2010-2020	**Energy (TJ)**	**28 388.3**	**8 373.0**	**187 592.8**	**31 188.4**	**86 736.8**	**13 307.3**	**18 948.5**	**2 262.8**	**1 679.3**	**323.9**	**22 923.7**	**3 418.6**	**261 613.1**	**33 067.5**	**699 823.9**	**-32 722.7**	**-4.5%**
	Expenditure (m€)	**1 288.7**	**900.1**	**7 374.0**	**3 158.1**	**3 091.3**	**1 286.7**	**521.0**	**179.3**	**28.6**	**17.1**	**780.8**	**487.0**	**5 628.9**	**1 627.3**	**26 368.9**	**-61.3**	**-0.2%**
2010-2025	**Energy (TJ)**	**28 727.3**	**23 972.3**	**215 805.6**	**99 684.7**	**102 001.8**	**42 532.8**	**22 693.9**	**7 232.4**	**1 827.0**	**1 027.4**	**26 657.8**	**11 115.9**	**300 958.1**	**105 690.6**	**989 927.4**	**-104 147.3**	**-9.5%**
	Expenditure (m€)	**1 300.7**	**1 900.5**	**8 333.7**	**7 030.7**	**3 562.5**	**2 834.6**	**613.7**	**394.4**	**30.5**	**35.7**	**883.0**	**1 018.1**	**6 411.4**	**3 729.4**	**38 078.7**	**-1 403.9**	**-3.6%**

Year	Indicator	WM1		WM2		WM3		WM4		WM5		WM6		WM7		Total	Difference with BAU	
		2010 Base case	2014 M 1.4 Load control	2010 Base case	2014 M 1.4 Load control	2010 Base case	2014 M 1.4 Load control	2010 Base case	2014 M 1.3 Water recov.	2010 Base case	2014 M 1.4 Load control	2010 Base case	2014 M 1.3 Water recov.	2010 Base case	2014 BA product		absolute	relative
2010-2030	Energy (TJ)	28 727.3	40 667.4	216 300.4	195 857.4	102 998.3	85 698.4	23 168.5	14 849.1	1 827.0	1 891.3	26 761.8	22 408.6	301 648.1	207 657.6	1 270 461.1	-204 369.0	-13.9%
	Expenditure (m€)	1 300.7	2 962.3	8 350.5	11 897.9	3 593.2	4 833.7	625.5	678.6	30.5	56.8	885.8	1 683.1	6 425.2	6 407.0	49 730.6	-3 504.4	-6.6%

Table 10 LLCC scenario outcomes and comparison with BAU scenario for dryers: market data, energy consumption and expenditure

Year	Unit	D1		D2		D3		D4		D5		D6		D7		Total	Difference with BAU	
		2010 Base case	2014 M 2.2 Heat pump	2010 Base case	2014 M 2.2 Heat pump	2010 Base case	2014 M 2.2 Heat pump	2010 Base case	2014 BA Product	2010 Base case	2014 M 2.2 Heat pump	2010 Base case	2014 M 2.2 Heat pump	2010 Base case	2014 BA product		absolute	relative
	Product price (€/unit)	1 970	3 546	1 680	2 688	3 500	7 000	4 000	7 200	7 125	12 825	21 500	38 700	62 500	88 125			
2009	Stock (units)	24 722	0	33 219	0	149 737	0	195 967	0	45 939	0	3 674	0	14 697	0	467 955	0.0	0.0%
	Sales (units)	3 337	0	4 485	0	11 480	0	17 034	0	3 741	0	319	0	1 278	0	41 674	0.0	0.0%
	Energy (TJ)	1 288.9	0.0	1 304.1	0.0	9 474.7	0.0	14 477.3	0.0	9 891.7	0.0	3 633.9	0.0	71 641.2	0.0	111 711.6	0.0	0.0%
	Expenditure (m€)	21.0	0.0	21.6	0.0	133.1	0.0	207.8	0.0	99.9	0.0	31.2	0.0	551.4	0.0	1 066.1	0.0	0.0%
2010	Stock (units)	24 969	0	33 551	0	151 234	0	197 927	0	46 398	0	3 711	0	14 844	0	472 635	0.0	0.0%
	Sales (units)	3 371	0	4 529	0	11 595	0	17 204	0	3 778	0	323	0	1 290	0	42 090	0.0	0.0%
	Energy (TJ)	1 301.7	0.0	1 317.1	0.0	9 569.5	0.0	14 622.0	0.0	9 990.6	0.0	3 670.2	0.0	72 357.6	0.0	112 828.8	0.0	0.0%
	Expenditure (m€)	21.2	0.0	21.8	0.0	134.4	0.0	209.9	0.0	100.9	0.0	31.5	0.0	556.9	0.0	1 076.7	0.0	0.0%
2011	Stock (units)	25 219	0	33 887	0	152 747	0	199 906	0	46 862	0	3 748	0	14 992	0	477 361	0.0	0.0%
	Sales (units)	3 405	0	4 575	0	11 711	0	17 376	0	3 816	0	326	0	1 303	0	42 511	0.0	0.0%
	Energy (TJ)	1 314.8	0.0	1 330.3	0.0	9 665.1	0.0	14 768.3	0.0	10 090.5	0.0	3 706.9	0.0	73 081.2	0.0	113 957.1	0.0	0.0%
	Expenditure (m€)	21.4	0.0	22.0	0.0	135.8	0.0	212.0	0.0	101.9	0.0	31.8	0.0	562.5	0.0	1 087.5	0.0	0.0%
2012	Stock (units)	25 471	0	34 226	0	154 274	0	201 905	0	47 331	0	3 785	0	15 142	0	482 135	0.0	0.0%
	Sales (units)	3 439	0	4 620	0	11 828	0	17 550	0	3 854	0	329	0	1 316	0	42 936	0.0	0.0%
	Energy (TJ)	1 327.9	0.0	1 343.6	0.0	9 761.8	0.0	14 915.9	0.0	10 191.4	0.0	3 744.0	0.0	73 812.0	0.0	115 096.6	0.0	0.0%
	Expenditure (m€)	21.6	0.0	22.3	0.0	137.1	0.0	214.1	0.0	103.0	0.0	32.1	0.0	568.1	0.0	1 098.4	0.0	0.0%

Year	Unit	D1		D2		D3		D4		D5		D6		D7		Total	Difference with BAU	
		2010 Base case	2014 M 2.2 Heat pump	2010 Base case	2014 M 2.2 Heat pump	2010 Base case	2014 M 2.2 Heat pump	2010 Base case	2014 BA Product	2010 Base case	2014 M 2.2 Heat pump	2010 Base case	2014 M 2.2 Heat pump	2010 Base case	2014 BA product		absolute	relative
2013	Stock (units)	25 726	0	34 568	0	155 817	0	203 924	0	47 804	0	3 823	0	15 294	0	486 956	0.0	0.0%
	Sales (units)	3 473	0	4 667	0	11 946	0	17 726	0	3 893	0	332	0	1 329	0	43 366	0.0	0.0%
	Energy (TJ)	1 341.2	0.0	1 357.0	0.0	9 859.4	0.0	15 065.1	0.0	10 293.3	0.0	3 781.4	0.0	74 550.1	0.0	116 247.6	0.0	0.0%
	Expenditure (m€)	21.8	0.0	22.5	0.0	138.5	0.0	216.3	0.0	104.0	0.0	32.5	0.0	573.8	0.0	1 109.3	0.0	0.0%
2014	Stock (units)	25 983	0	34 914	0	157 375	0	205 963	0	48 282	0	3 861	0	15 447	0	491 825	0.0	0.0%
	Sales (units)	0	3 508	0	4 713	0	12 065	0	17 903	0	3 932	0	336	0	1 343	43 799	0.0	0.0%
	Energy (TJ)	1 354.6	0.0	1 370.6	0.0	9 958.0	0.0	15 215.8	0.0	10 396.3	0.0	3 819.2	0.0	75 295.6	0.0	117 410.1	0.0	0.0%
	Expenditure (m€)	15.1	12.4	14.8	12.7	97.6	84.5	146.8	128.9	77.0	50.4	25.6	13.0	495.6	118.3	1 292.8	172.4	15.4%
2015	Stock (units)	22 735	3 508	30 549	4 713	146 883	12 065	190 120	17 903	44 834	3 932	3 564	336	14 258	1 343	496 744	0.0	0.0%
	Sales (units)	0	3 543	0	4 760	0	12 186	0	18 082	0	3 971	0	339	0	1 356	44 237	0.0	0.0%
	Energy (TJ)	1 185.3	86.7	1 199.3	98.0	9 294.1	325.8	14 045.3	463.3	9 653.7	354.3	3 525.4	135.7	69 503.7	4 913.4	114 784.0	-3 800.2	-3.2%
	Expenditure (m€)	13.2	13.6	12.9	13.9	91.1	88.6	135.5	134.9	71.5	53.6	23.6	14.1	457.5	152.8	1 276.9	145.3	12.8%
2016	Stock (units)	19 455	7 051	26 141	9 474	136 287	24 252	174 118	35 985	41 350	7 902	3 264	675	13 058	2 699	501 711	0.0	0.0%
	Sales (units)	0	3 578	0	4 808	0	12 308	0	18 263	0	4 011	0	342	0	1 370	44 680	0.0	0.0%
	Energy (TJ)	1 014.3	174.4	1 026.2	197.0	8 623.6	654.8	12 863.2	931.3	8 903.6	712.1	3 228.7	272.8	63 653.8	9 876.0	112 131.7	-7 638.3	-6.4%
	Expenditure (m€)	11.3	14.7	11.1	15.1	84.6	92.7	124.1	141.0	66.0	56.8	21.6	15.3	419.0	187.6	1 260.9	117.9	10.3%
2017	Stock (units)	16 142	10 629	21 690	14 282	125 584	36 559	157 956	54 248	37 832	11 913	2 961	1 017	11 846	4 068	506 728	0.0	0.0%
	Sales (units)	0	3 614	0	4 856	0	12 431	0	18 445	0	4 051	0	346	0	1 383	45 126	0.0	0.0%
	Energy (TJ)	841.5	262.9	851.5	296.9	7 946.4	987.1	11 669.2	1 403.9	8 146.1	1 073.5	2 929.0	411.3	57 745.4	14 888.2	109 452.8	-11 514.9	-9.5%
	Expenditure (m€)	9.4	15.8	9.2	16.3	77.9	96.9	112.6	147.1	60.4	60.1	19.6	16.5	380.1	222.8	1 244.7	90.3	7.8%
2018	Stock (units)	12 795	14 243	17 193	19 138	114 775	48 990	141 633	72 693	34 279	15 964	2 655	1 363	10 622	5 452	511 795	0.0	0.0%
	Sales (units)	0	3 650	0	4 905	0	12 555	0	18 630	0	4 091	0	349	0	1 397	45 578	0.0	0.0%
	Energy (TJ)	667.1	352.2	674.9	397.9	7 262.4	1 322.7	10 463.3	1 881.3	7 381.0	1 438.5	2 626.3	551.1	51 777.9	19 950.6	106 747.2	-15 430.2	-12.6%
	Expenditure (m€)	7.5	17.0	7.3	17.5	71.2	101.2	101.0	153.3	54.7	63.4	17.6	17.7	340.8	258.3	1 228.4	62.4	5.4%
2019	Stock (units)	9 416	17 893	12 652	24 043	103 857	61 546	125 146	91 323	30 690	20 055	2 346	1 712	9 386	6 849	516 913	0.0	0.0%
	Sales (units)	0	3 687	0	4 954	0	12 681	0	18 816	0	4 132	0	353	0	1 411	46 034	0.0	0.0%

Year	Unit	D1		D2		D3		D4		D5		D6		D7		Total	Difference with BAU	
		2010 Base case	2014 M 2.2 Heat pump	2010 Base case	2014 M 2.2 Heat pump	2010 Base case	2014 M 2.2 Heat pump	2010 Base case	2014 BA Product	2010 Base case	2014 M 2.2 Heat pump	2010 Base case	2014 M 2.2 Heat pump	2010 Base case	2014 BA product		absolute	relative
	Energy (TJ)	490.9	442.5	496.7	499.9	6 571.6	1 661.7	9 245.3	2 363.4	6 608.3	1 807.1	2 320.6	692.3	45 750.8	25 063.5	104 014.5	**-19 384.6**	**-15.7%**
	Expenditure (m€)	5.5	18.2	5.4	18.8	64.4	105.5	89.2	159.6	49.0	66.7	15.5	18.9	301.2	294.1	1 211.8	**34.2**	**2.9%**
2020	**Stock (units)**	6 002	21 580	8 065	28 996	92 830	74 227	108 495	110 139	27 066	24 187	2 034	2 065	8 137	8 260	522 083	**0.0**	**0.0%**
	Sales (units)	0	3 724	0	5 003	0	12 808	0	19 004	0	4 173	0	356	0	1 425	46 494	**0.0**	**0.0%**
	Energy (TJ)	312.9	533.7	316.6	602.9	5 873.9	2 004.0	8 015.2	2 850.3	5 827.8	2 179.4	2 011.8	835.0	39 663.3	30 227.6	101 254.5	**-23 378.6**	**-18.8%**
	Expenditure (m€)	3.5	19.3	3.4	20.0	57.6	109.8	77.3	165.9	43.2	70.0	13.5	20.1	261.1	330.4	1 195.1	**5.8**	**0.5%**
2021	**Stock (units)**	2 554	25 303	3 432	34 000	81 693	87 034	91 677	129 144	23 405	28 360	1 719	2 421	6 876	9 685	527 303	**0.0**	**0.0%**
	Sales (units)	0	3 761	0	5 053	0	12 936	0	19 194	0	4 215	0	360	0	1 440	46 959	**0.0**	**0.0%**
	Energy (TJ)	133.2	625.7	134.7	706.9	5 169.2	2 349.8	6 772.7	3 342.2	5 039.6	2 555.5	1 700.0	979.0	33 515.0	35 443.3	98 466.9	**-27 412.6**	**-21.8%**
	Expenditure (m€)	1.5	20.5	1.5	21.3	50.7	114.2	65.4	172.3	37.3	73.4	11.4	21.3	220.6	367.0	1 178.3	**-23.0**	**-1.9%**
2022	**Stock (units)**	0	28 136	0	37 806	70 445	99 970	74 691	148 338	19 707	32 576	1 400	2 781	5 602	11 125	532 576	**0.0**	**0.0%**
	Sales (units)	0	3 798	0	5 104	0	13 065	0	19 386	0	4 257	0	363	0	1 454	47 428	**0.0**	**0.0%**
	Energy (TJ)	0.0	695.8	0.0	786.0	4 457.4	2 699.1	5 517.9	3 838.9	4 243.4	2 935.3	1 385.0	1 124.6	27 305.3	40 711.2	95 699.8	**-31 438.4**	**-24.7%**
	Expenditure (m€)	0.0	21.5	0.0	22.3	43.7	118.6	53.2	178.7	31.4	76.8	9.3	22.6	179.7	403.9	1 161.8	**-51.5**	**-4.2%**
2023	**Stock (units)**	0	28 417	0	38 184	59 084	113 035	57 535	167 724	15 973	36 833	1 079	3 145	4 315	12 579	537 902	**0.0**	**0.0%**
	Sales (units)	0	3 836	0	5 155	0	13 196	0	19 580	0	4 300	0	367	0	1 468	47 903	**0.0**	**0.0%**
	Energy (TJ)	0.0	702.8	0.0	793.9	3 738.6	3 051.8	4 250.4	4 340.6	3 439.3	3 318.9	1 066.9	1 271.5	21 033.4	46 031.8	93 039.8	**-35 369.8**	**-27.5%**
	Expenditure (m€)	0.0	21.7	0.0	22.5	36.7	123.1	41.0	185.2	25.5	80.3	7.1	23.8	138.5	441.2	1 146.6	**-78.8**	**-6.4%**
2024	**Stock (units)**	0	28 701	0	38 566	47 609	126 231	40 207	187 305	12 201	41 133	754	3 512	3 015	14 047	543 281	**0.0**	**0.0%**
	Sales (units)	0	3 875	0	5 206	0	13 328	0	19 776	0	4 343	0	371	0	1 483	48 382	**0.0**	**0.0%**
	Energy (TJ)	0.0	709.8	0.0	801.8	3 012.5	3 408.1	2 970.3	4 847.3	2 627.1	3 706.4	745.6	1 420.0	14 698.8	51 405.5	90 353.2	**-39 340.5**	**-30.3%**
	Expenditure (m€)	0.0	21.9	0.0	22.7	29.5	127.6	28.7	191.8	19.5	83.8	5.0	25.1	96.8	478.9	1 131.2	**-106.5**	**-8.6%**
2025	**Stock (units)**	0	28 988	0	38 952	36 020	139 559	22 706	207 081	8 391	45 476	426	3 882	1 703	15 530	548 714	**0.0**	**0.0%**
	Sales (units)	0	3 913	0	5 259	0	13 461	0	19 974	0	4 386	0	374	0	1 498	48 865	**0.0**	**0.0%**
	Energy (TJ)	0.0	716.9	0.0	809.8	2 279.2	3 767.9	1 677.4	5 359.1	1 806.8	4 097.7	421.0	1 569.9	8 300.9	56 833.0	87 639.8	**-43 350.9**	**-33.1%**
	Expenditure (m€)	0.0	22.1	0.0	23.0	22.3	132.1	16.2	198.4	13.4	87.3	2.8	26.4	54.6	517.0	1 115.7	**-134.4**	**-10.7%**

Year	Unit	D1		D2		D3		D4		D5		D6		D7		Total	Difference with BAU	
		2010 Base case	2014 M 2.2 Heat pump	2010 Base case	2014 M 2.2 Heat pump	2010 Base case	2014 M 2.2 Heat pump	2010 Base case	2014 BA Product	2010 Base case	2014 M 2.2 Heat pump	2010 Base case	2014 M 2.2 Heat pump	2010 Base case	2014 BA product		absolute	relative
2026	Stock (units)	0	29 278	0	39 341	24 314	153 020	5 030	227 054	4 544	49 862	94	4 257	377	17 028	554 201	0.0	0.0%
	Sales (units)	0	3 953	0	5 311	0	13 596	0	20 174	0	4 430	0	378	0	1 513	49 354	0.0	0.0%
	Energy (TJ)	0.0	724.1	0.0	817.9	1 538.5	4 131.4	371.6	5 876.0	978.4	4 493.0	93.3	1 721.3	1 838.9	62 314.8	84 899.2	-47 401.4	-35.8%
	Expenditure (m€)	0.0	22.3	0.0	23.2	15.1	136.7	3.6	205.1	7.2	90.9	0.6	27.7	12.1	555.5	1 100.0	-162.5	-12.9%
2027	Stock (units)	0	29 571	0	39 735	12 492	166 615	0	234 405	658	54 292	0	4 395	0	17 580	559 743	0.0	0.0%
	Sales (units)	0	3 992	0	5 364	0	13 732	0	20 375	0	4 474	0	382	0	1 528	49 848	0.0	0.0%
	Energy (TJ)	0.0	731.3	0.0	826.1	790.4	4 498.4	0.0	6 066.3	141.6	4 892.1	0.0	1 777.0	0.0	64 332.3	84 055.6	-49 568.0	-37.1%
	Expenditure (m€)	0.0	22.5	0.0	23.4	7.8	141.3	0.0	208.5	1.0	94.5	0.0	28.2	0.0	570.5	1 097.8	-177.4	-13.9%
2028	Stock (units)	0	29 867	0	40 132	552	180 347	0	236 749	0	55 499	0	4 439	0	17 756	565 341	0.0	0.0%
	Sales (units)	0	4 032	0	5 418	0	13 869	0	20 579	0	4 519	0	386	0	1 543	50 346	0.0	0.0%
	Energy (TJ)	0.0	738.6	0.0	834.4	34.9	4 869.2	0.0	6 126.9	0.0	5 000.9	0.0	1 794.8	0.0	64 975.6	84 375.3	-50 584.5	-37.5%
	Expenditure (m€)	0.0	22.8	0.0	23.7	0.3	146.0	0.0	210.6	0.0	95.9	0.0	28.5	0.0	576.2	1 104.0	-184.0	-14.3%
2029	Stock (units)	0	30 166	0	40 533	0	182 708	0	239 117	0	56 054	0	4 483	0	17 933	570 994	0.0	0.0%
	Sales (units)	0	4 072	0	5 472	0	14 008	0	20 785	0	4 564	0	390	0	1 559	50 850	0.0	0.0%
	Energy (TJ)	0.0	746.0	0.0	842.7	0.0	4 932.9	0.0	6 188.2	0.0	5 050.9	0.0	1 812.8	0.0	65 625.4	85 198.9	-51 110.6	-37.5%
	Expenditure (m€)	0.0	23.0	0.0	23.9	0.0	147.6	0.0	212.7	0.0	96.8	0.0	28.8	0.0	581.9	1 114.8	-186.0	-14.3%
2030	Stock (units)	0	30 467	0	40 939	0	184 535	0	241 508	0	56 615	0	4 528	0	18 112	576 704	0.0	0.0%
	Sales (units)	0	4 113	0	5 527	0	14 148	0	20 993	0	4 610	0	394	0	1 574	51 358	0.0	0.0%
	Energy (TJ)	0.0	753.5	0.0	851.1	0.0	4 982.2	0.0	6 250.1	0.0	5 101.4	0.0	1 830.9	0.0	66 281.6	86 050.9	-51 621.7	-37.5%
	Expenditure (m€)	0.0	23.2	0.0	24.1	0.0	149.1	0.0	214.8	0.0	97.8	0.0	29.1	0.0	587.7	1 126.0	-187.9	-14.3%
2010-2020	**Energy (TJ)**	**11 152.1**	**1 852.3**	**11 283.6**	**2 092.5**	**94 386.0**	**6 956.0**	**140 888.6**	**9 893.5**	**97 482.7**	**7 564.8**	**35 363.7**	**2 898.2**	**697 191.5**	**104 919.4**	**1 223 924.9**	**-81 146.8**	**-6.2%**
2010-2020	**Expenditure (m€)**	**151.6**	**111.0**	**152.7**	**114.2**	**1 090.3**	**679.2**	**1 639.0**	**1 030.7**	**831.6**	**421.0**	**264.9**	**115.6**	**4 916.7**	**1 564.3**	**13 082.6**	**628.4**	**5.0%**
2010-2025	**Energy (TJ)**	**11 285.3**	**5 303.4**	**11 418.4**	**5 990.9**	**113 042.8**	**22 232.7**	**162 077.4**	**31 621.5**	**114 638.9**	**24 178.6**	**40 682.2**	**9 263.2**	**802 044.9**	**335 344.3**	**1 689 124.4**	**-258 059.1**	**-13.3%**
2010-2025	**Expenditure (m€)**	**153.1**	**218.6**	**154.1**	**226.1**	**1 273.3**	**1 294.7**	**1 843.4**	**1 957.1**	**958.7**	**822.7**	**300.5**	**234.9**	**5 606.9**	**3 772.3**	**18 816.1**	**234.2**	**1.3%**

Year	Unit	D1		D2		D3		D4		D5		D6		D7		Total	Difference with BAU	
		2010 Base case	2014 M 2.2 Heat pump	2010 Base case	2014 M 2.2 Heat pump	2010 Base case	2014 M 2.2 Heat pump	2010 Base case	2014 BA Product	2010 Base case	2014 M 2.2 Heat pump	2010 Base case	2014 M 2.2 Heat pump	2010 Base case	2014 BA product		absolute	relative
2010-2030	Energy (TJ)	11 285.3	8 996.8	11 418.4	10 163.2	115 406.6	45 646.8	162 449.0	62 129.0	115 758.8	48 717.0	40 775.5	18 200.0	803 883.8	658 874.1	2 113 704.3	-508 345.2	-19.4%
2010-2030	Expenditure (m€)	153.1	332.5	154.1	344.4	1 296.5	2 015.5	1 847.0	3 008.9	967.0	1 298.4	301.1	377.2	5 619.0	6 644.0	24 358.7	-663.5	-2.7%

2.4.3 Best Available Technology scenario

The BAT scenario considers that all BAT improvement options are implemented for each base case, as described in Task 7. The market modelling includes that from 2014, all products sold are equivalent to these BAT options and no more base case products are sold (the market shift takes place in one single step). Table 11 reminds the BAT options that were identified for each base case in Task 7.

Table 11 BAT improvement option for each base case

Base case	BAT Improvement option
WM 1 - Semi-professional washer extractor	BA product
WM 2 - Professional washing extractor (<15 kg)	BA product
WM 3 - Professional washing extractor (15–40 kg)	BA product
WM 4 - Professional washing extractor (>40 kg)	M 1.3 Water recovery
WM 5 - Professional washer dryer	M 1.4 Load control
WM 6 - Professional barrier washer	M 1.3 Water recovery
WM 7 - Washing tunnel machine	BA Product
D 1 - Semi-professional dryer, condenser	BA product
D 2 - Semi- professional dryer, air vented	M 2.2 Heat pump
D 3 - Professional cabinet dryer	BA product
D 4 - Professional air tumble dryer (<15 kg)	BA Product
D 5 - Professional air tumble dryer (15–40 kg)	M 2.2 Heat pump
D 6 - Professional air tumble dryer (>40 kg)	M 2.2 Heat pump
D 7 - Industrial pass-through (transfer) tumble dryer	BA product

Table 12 and Table 13 present the outcomes of this scenario modelling. In 2025, the professional washing machine market would require 55.2 PJ of primary energy (-25.2% compared to BAU), and would represent 2.40 b€ (-10.1% compared to BAU). Over the period 2010-2025, the total primary energy consumption would be 983 PJ (-10.2% compared to BAU) and the total expenditure 39.2 b€ (-0.8% compared to BAU).

In 2025, the professional dryer market would require 86.8 PJ of primary energy (-33.8% compared to BAU), and would represent 1.14 b€ (-9.0% compared to BAU). Over the period 2010-2025, the total primary energy consumption would be 1 684 PJ (-13.5% compared to BAU) and the total expenditure 19.1 b€ (+2.8% compared to BAU).

Table 12 BAT scenario outcomes and comparison with BAU scenario for washing machines: market data, energy consumption and expenditure

Year	Units	WM1		WM2		WM3		WM4		WM5		WM6		WM7		Total	Difference with BAU	
		2010 Base case	2014 BA product	2010 Base case	2014 BA product	2010 Base case	2014 BA product	2010 Base case	2014 M 1.3 Water recov.	2010 Base case	2014 M 1.4 Load control	2010 Base case	2014 M 1.3 Water recov.	2010 Base case	2014 BA product		absolute	relative
	Product price (€/unit)	2 670	5 340	5 000	6 250	15 250	19 825	58 750	76 375	8 000	8 160	38 250	49 725	390 000	507 000			
2009	Stock (units)	193 139	0	557 280	0	81 379	0	2 799	0	2 093	0	10 471	0	3 063	0	850 224	0.0	0.0%
	Sales (units)	26 074	0	48 440	0	6 627	0	215	0	211	0	957	0	266	0	82 790	0.0	0.0%
	Energy (TJ)	3 280.8	0.0	19 276.4	0.0	8 801.3	0.0	1 902.1	0.0	178.3	0.0	2 243.0	0.0	26 882.5	0.0	62 564.5	0.0	0.0%
	Expenditure (m€)	185.6	0.0	897.9	0.0	372.7	0.0	59.7	0.0	4.0	0.0	98.0	0.0	638.5	0.0	2 256.3	0.0	0.0%
2010	Stock (units)	195 070	0	562 853	0	82 193	0	2 827	0	2 114	0	10 680	0	3 094	0	858 831	0.0	0.0%
	Sales (units)	26 335	0	48 925	0	6 693	0	217	0	213	0	976	0	269	0	83 628	0.0	0.0%
	Energy (TJ)	3 313.7	0.0	19 469.2	0.0	8 889.3	0.0	1 921.1	0.0	180.1	0.0	2 287.8	0.0	27 151.4	0.0	63 212.6	0.0	0.0%
	Expenditure (m€)	187.4	0.0	906.8	0.0	376.4	0.0	60.3	0.0	4.0	0.0	99.9	0.0	644.9	0.0	2 279.8	0.0	0.0%
2011	Stock (units)	197 021	0	568 481	0	83 015	0	2 855	0	2 135	0	10 894	0	3 125	0	867 526	0.0	0.0%
	Sales (units)	26 598	0	49 414	0	6 760	0	219	0	215	0	996	0	272	0	84 474	0.0	0.0%
	Energy (TJ)	3 346.8	0.0	19 663.9	0.0	8 978.2	0.0	1 940.3	0.0	181.9	0.0	2 333.6	0.0	27 422.9	0.0	63 867.6	0.0	0.0%
	Expenditure (m€)	189.3	0.0	915.9	0.0	380.2	0.0	60.9	0.0	4.1	0.0	101.9	0.0	651.3	0.0	2 303.6	0.0	0.0%
2012	Stock (units)	198 991	0	574 166	0	83 845	0	2 884	0	2 156	0	11 112	0	3 156	0	876 310	0.0	0.0%
	Sales (units)	26 864	0	49 908	0	6 827	0	221	0	218	0	1 016	0	274	0	85 328	0.0	0.0%
	Energy (TJ)	3 380.3	0.0	19 860.5	0.0	9 068.0	0.0	1 959.7	0.0	183.7	0.0	2 380.3	0.0	27 697.1	0.0	64 529.6	0.0	0.0%
	Expenditure (m€)	191.2	0.0	925.1	0.0	384.0	0.0	61.5	0.0	4.1	0.0	104.0	0.0	657.8	0.0	2 327.7	0.0	0.0%
2013	Stock (units)	200 981	0	579 908	0	84 683	0	2 913	0	2 178	0	11 334	0	3 187	0	885 184	0.0	0.0%
	Sales (units)	27 132	0	50 407	0	6 896	0	223	0	220	0	1 036	0	277	0	86 192	0.0	0.0%
	Energy (TJ)	3 414.1	0.0	20 059.2	0.0	9 158.6	0.0	1 979.3	0.0	185.6	0.0	2 427.9	0.0	27 974.1	0.0	65 198.7	0.0	0.0%
	Expenditure (m€)	193.1	0.0	934.3	0.0	387.8	0.0	62.1	0.0	4.2	0.0	106.0	0.0	664.4	0.0	2 352.0	0.0	0.0%

Year	Units	WM1		WM2		WM3		WM4		WM5		WM6		WM7		Total	Difference with BAU	
		2010 Base case	2014 BA product	2010 Base case	2014 BA product	2010 Base case	2014 BA product	2010 Base case	2014 M 1.3 Water recov.	2010 Base case	2014 M 1.4 Load control	2010 Base case	2014 M 1.3 Water recov.	2010 Base case	2014 BA product		absolute	relative
2014	**Stock (units)**	202 991	0	585 707	0	85 530	0	2 942	0	2 200	0	11 561	0	3 219	0	894 150	**0.0**	**0.0%**
	Sales (units)	0	27 404	0	50 911	0	6 965	0	226	0	222	0	1 057	0	280	87 064	**0.0**	**0.0%**
	Energy (TJ)	3 448.2	0.0	20 259.7	0.0	9 250.2	0.0	1 999.1	0.0	187.4	0.0	2 476.4	0.0	28 253.8	0.0	65 875.0	**0.0**	**0.0%**
	Expenditure (m€)	121.9	146.3	689.1	318.2	285.5	138.1	49.5	17.2	2.4	1.8	67.7	52.6	561.9	141.9	2 594.1	**217.5**	**9.2%**
2015	**Stock (units)**	177 617	27 404	540 653	50 911	79 421	6 965	2 746	226	2 000	222	10 735	1 057	2 972	280	903 207	**0.0**	**0.0%**
	Sales (units)	0	27 678	0	51 421	0	7 034	0	228	0	224	0	1 078	0	283	87 945	**0.0**	**0.0%**
	Energy (TJ)	3 017.2	335.4	18 701.3	1 415.6	8 589.5	612.7	1 865.8	106.0	170.4	15.2	2 299.6	157.4	26 080.4	1 548.6	64 915.1	**-1 643.4**	**-2.5%**
	Expenditure (m€)	106.6	159.3	636.1	368.8	265.1	158.1	46.2	20.0	2.2	2.0	62.9	58.0	518.7	171.6	2 575.6	**174.2**	**7.3%**
2016	**Stock (units)**	151 990	55 082	495 148	102 332	73 250	13 999	2 548	453	1 798	446	9 893	2 135	2 721	562	912 357	**0.0**	**0.0%**
	Sales (units)	0	27 955	0	51 935	0	7 105	0	230	0	226	0	1 100	0	285	88 836	**0.0**	**0.0%**
	Energy (TJ)	2 581.8	674.2	17 127.3	2 845.3	7 922.2	1 231.6	1 731.2	213.0	153.2	30.5	2 119.1	318.0	23 885.3	3 112.6	63 945.5	**-3 303.9**	**-4.9%**
	Expenditure (m€)	91.2	172.3	582.6	419.9	244.5	178.4	42.9	22.8	2.0	2.2	58.0	63.6	475.0	201.6	2 557.0	**130.5**	**5.4%**
2017	**Stock (units)**	126 106	83 036	449 188	154 267	67 018	21 103	2 348	683	1 594	673	9 034	3 235	2 469	848	921 601	**0.0**	**0.0%**
	Sales (units)	0	28 234	0	52 454	0	7 176	0	232	0	229	0	1 122	0	288	89 735	**0.0**	**0.0%**
	Energy (TJ)	2 142.2	1 016.4	15 537.5	4 289.3	7 248.2	1 856.7	1 595.3	321.1	135.8	46.0	1 935.1	481.8	21 668.3	4 692.3	62 965.9	**-4 981.7**	**-7.3%**
	Expenditure (m€)	75.7	185.5	528.5	471.6	223.7	198.8	39.5	25.6	1.8	2.4	52.9	69.3	431.0	231.9	2 538.2	**86.3**	**3.5%**
2018	**Stock (units)**	99 963	111 270	402 768	206 721	60 724	28 279	2 145	916	1 388	901	8 157	4 356	2 214	1 136	930 939	**0.0**	**0.0%**
	Sales (units)	0	28 516	0	52 979	0	7 247	0	235	0	231	0	1 144	0	291	90 644	**0.0**	**0.0%**
	Energy (TJ)	1 698.1	1 362.0	13 931.8	5 747.8	6 567.4	2 488.0	1 458.0	430.3	118.2	61.6	1 747.4	648.9	19 429.1	6 287.8	61 976.4	**-6 677.0**	**-9.7%**
	Expenditure (m€)	60.0	198.9	473.9	523.7	202.7	219.5	36.1	28.4	1.5	2.6	47.8	75.2	386.4	262.5	2 519.2	**41.6**	**1.7%**
2019	**Stock (units)**	73 559	139 787	355 884	259 700	54 367	35 526	1 941	1 150	1 180	1 132	7 263	5 501	1 956	1 427	940 374	**0.0**	**0.0%**
	Sales (units)	0	28 802	0	53 508	0	7 320	0	237	0	233	0	1 167	0	294	91 561	**0.0**	**0.0%**
	Energy (TJ)	1 249.5	1 711.1	12 310.1	7 220.9	5 879.8	3 125.6	1 319.3	540.5	100.5	77.4	1 555.9	819.3	17 167.4	7 899.3	60 976.7	**-8 390.0**	**-12.1%**
	Expenditure (m€)	44.2	212.3	418.7	576.4	181.5	240.4	32.7	31.3	1.3	2.9	42.5	81.1	341.4	293.4	2 500.0	**-3.5**	**-0.1%**

Year	Units	WM1		WM2		WM3		WM4		WM5		WM6		WM7		Total	Difference with BAU	
		2010 Base case	2014 BA product	2010 Base case	2014 BA product	2010 Base case	2014 BA product	2010 Base case	2014 M 1.3 Water recov.	2010 Base case	2014 M 1.4 Load control	2010 Base case	2014 M 1.3 Water recov.	2010 Base case	2014 BA product		absolute	relative
2020	Stock (units)	46 891	168 589	308 532	313 208	47 946	42 846	1 735	1 388	969	1 366	6 352	6 668	1 696	1 721	949 905	0.0	0.0%
	Sales (units)	0	29 090	0	54 044	0	7 393	0	239	0	236	0	1 190	0	297	92 489	0.0	0.0%
	Energy (TJ)	796.5	2 063.6	10 672.2	8 708.7	5 185.4	3 769.6	1 179.2	651.9	82.6	93.3	1 360.6	993.1	14 883.2	9 526.8	59 966.9	-10 120.8	-14.4%
	Expenditure (m€)	28.1	225.9	363.0	629.6	160.0	261.4	29.2	34.1	1.1	3.1	37.2	87.2	296.0	324.6	2 480.6	-49.1	-1.9%
2021	Stock (units)	19 956	197 678	260 706	367 251	41 461	50 239	1 527	1 627	757	1 601	5 422	7 858	1 433	2 019	959 534	0.0	0.0%
	Sales (units)	0	29 381	0	54 584	0	7 467	0	242	0	238	0	1 214	0	300	93 425	0.0	0.0%
	Energy (TJ)	339.0	2 419.7	9 017.9	10 211.3	4 484.0	4 420.1	1 037.7	764.4	64.5	109.4	1 161.4	1 170.4	12 576.1	11 170.7	58 946.7	-11 869.8	-16.8%
	Expenditure (m€)	12.0	239.7	306.7	683.4	138.4	282.7	25.7	37.1	0.8	3.3	31.8	93.3	250.1	356.1	2 461.0	-95.2	-3.7%
2022	Stock (units)	0	219 810	212 401	421 835	34 911	57 706	1 317	1 869	543	1 839	4 473	9 072	1 167	2 319	969 263	0.0	0.0%
	Sales (units)	0	29 674	0	55 130	0	7 542	0	244	0	240	0	1 238	0	303	94 372	0.0	0.0%
	Energy (TJ)	0.0	2 690.6	7 347.0	11 729.0	3 775.6	5 077.0	894.9	878.0	46.2	125.7	958.2	1 351.3	10 246.0	12 831.0	57 950.5	-13 602.6	-19.0%
	Expenditure (m€)	0.0	250.5	249.9	737.6	116.5	304.2	22.2	40.0	0.6	3.5	26.2	99.6	203.8	387.9	2 442.6	-140.5	-5.4%
2023	Stock (units)	0	222 008	163 614	476 965	28 295	65 248	1 104	2 113	326	2 080	3 506	10 311	899	2 622	979 091	0.0	0.0%
	Sales (units)	0	29 971	0	55 681	0	7 617	0	247	0	243	0	1 263	0	306	95 328	0.0	0.0%
	Energy (TJ)	0.0	2 717.5	5 659.4	13 261.9	3 060.2	5 740.5	750.5	992.8	27.8	142.1	751.0	1 535.8	7 892.5	14 507.9	57 039.8	-15 257.8	-21.1%
	Expenditure (m€)	0.0	253.0	192.5	792.4	94.4	325.9	18.6	43.0	0.4	3.7	20.5	106.1	157.0	420.1	2 427.7	-182.5	-7.0%
2024	Stock (units)	0	224 228	114 338	532 646	21 613	72 865	890	2 360	108	2 322	2 519	11 574	628	2 928	989 020	0.0	0.0%
	Sales (units)	0	30 271	0	56 238	0	7 693	0	249	0	245	0	1 288	0	309	96 294	0.0	0.0%
	Energy (TJ)	0.0	2 744.7	3 955.0	14 810.1	2 337.5	6 410.7	604.8	1 108.7	9.2	158.7	539.6	1 723.9	5 515.6	16 201.5	56 119.7	-16 930.4	-23.2%
	Expenditure (m€)	0.0	255.5	134.5	847.8	72.1	347.9	15.0	46.0	0.1	4.0	14.8	112.6	109.7	452.6	2 412.6	-225.0	-8.5%
2025	Stock (units)	0	226 471	64 570	588 884	14 865	80 558	673	2 609	0	2 454	1 512	12 862	355	3 237	999 051	0.0	0.0%
	Sales (units)	0	30 574	0	56 800	0	7 770	0	252	0	248	0	1 314	0	312	97 270	0.0	0.0%
	Energy (TJ)	0.0	2 772.1	2 233.5	16 373.7	1 607.7	7 087.5	457.6	1 225.7	0.0	167.7	323.9	1 915.8	3 114.8	17 912.1	55 192.2	-18 618.7	-25.2%
	Expenditure (m€)	0.0	258.1	76.0	903.7	49.6	370.0	11.3	49.0	0.0	4.1	8.9	119.3	61.9	485.4	2 397.4	-267.9	-10.1%

Year	Units	WM1		WM2		WM3		WM4		WM5		WM6		WM7		Total	Difference with BAU	
		2010 Base case	2014 BA product	2010 Base case	2014 BA product	2010 Base case	2014 BA product	2010 Base case	2014 M 1.3 Water recov.	2010 Base case	2014 M 1.4 Load control	2010 Base case	2014 M 1.3 Water recov.	2010 Base case	2014 BA product		absolute	relative
2026	Stock (units)	0	228 735	14 305	645 685	8 049	88 329	455	2 860	0	2 479	485	14 176	79	3 549	1 009 185	0.0	0.0%
	Sales (units)	0	30 879	0	57 368	0	7 848	0	254	0	250	0	1 341	0	315	98 256	0.0	0.0%
	Energy (TJ)	0.0	2 799.9	494.8	17 953.1	870.5	7 771.1	308.9	1 343.9	0.0	169.4	104.0	2 111.6	690.0	19 639.8	54 256.9	-20 322.8	-27.2%
	Expenditure (m€)	0.0	260.7	16.8	960.2	26.9	392.4	7.6	52.1	0.0	4.1	2.8	126.1	13.7	518.5	2 382.1	-311.2	-11.6%
2027	Stock (units)	0	231 023	0	666 589	1 165	96 176	234	3 115	0	2 504	0	14 955	0	3 664	1 019 424	0.0	0.0%
	Sales (units)	0	31 188	0	57 942	0	7 926	0	257	0	253	0	1 367	0	318	99 252	0.0	0.0%
	Energy (TJ)	0.0	2 827.9	0.0	18 534.3	126.0	8 461.6	158.7	1 463.4	0.0	171.1	0.0	2 227.6	0.0	20 275.6	54 246.0	-21 110.9	-28.0%
	Expenditure (m€)	0.0	263.3	0.0	983.3	3.9	415.0	3.9	55.2	0.0	4.2	0.0	130.7	0.0	531.7	2 391.2	-330.4	-12.1%
2028	Stock (units)	0	233 333	0	673 255	0	98 315	10	3 371	0	2 529	0	15 254	0	3 700	1 029 767	0.0	0.0%
	Sales (units)	0	31 500	0	58 521	0	8 006	0	259	0	255	0	1 395	0	322	100 258	0.0	0.0%
	Energy (TJ)	0.0	2 856.1	0.0	18 719.6	0.0	8 649.7	7.0	1 584.0	0.0	172.8	0.0	2 272.1	0.0	20 478.4	54 739.8	-21 402.8	-28.1%
	Expenditure (m€)	0.0	265.9	0.0	993.1	0.0	422.3	0.2	58.3	0.0	4.2	0.0	133.4	0.0	537.1	2 414.4	-335.8	-12.2%
2029	Stock (units)	0	235 666	0	679 988	0	99 298	0	3 415	0	2 554	0	15 559	0	3 737	1 040 218	0.0	0.0%
	Sales (units)	0	31 815	0	59 107	0	8 086	0	262	0	258	0	1 423	0	325	101 274	0.0	0.0%
	Energy (TJ)	0.0	2 884.7	0.0	18 906.8	0.0	8 736.2	0.0	1 604.7	0.0	174.5	0.0	2 317.6	0.0	20 683.2	55 307.7	-21 629.0	-28.1%
	Expenditure (m€)	0.0	268.6	0.0	1 003.0	0.0	426.5	0.0	59.0	0.0	4.3	0.0	136.0	0.0	542.4	2 439.8	-339.3	-12.2%
2030	Stock (units)	0	238 023	0	686 787	0	100 291	0	3 449	0	2 579	0	15 871	0	3 775	1 050 775	0.0	0.0%
	Sales (units)	0	32 133	0	59 698	0	8 167	0	264	0	260	0	1 451	0	328	102 301	0.0	0.0%
	Energy (TJ)	0.0	2 913.5	0.0	19 095.9	0.0	8 823.6	0.0	1 620.7	0.0	176.2	0.0	2 363.9	0.0	20 890.0	55 883.9	-21 855.4	-28.1%
	Expenditure (m€)	0.0	271.2	0.0	1 013.1	0.0	430.8	0.0	59.6	0.0	4.3	0.0	138.7	0.0	547.8	2 465.6	-342.8	-12.2%
2010-2020	Energy (TJ)	28 388	7 163	187 593	30 228	86 737	13 084	18 948	2 263	1 679	324	22 924	3 419	261 613	33 067	697 430	-35 117	-4.8%
2010-2020	Expenditure (m€)	1 289	1 301	7 374	3 308	3 091	1 395	521	179	29	17	781	487	5 629	1 627	27 028	597	2.3%
2010-2025	Energy (TJ)	28 727	20 507	215 806	96 614	102 002	41 820	22 694	7 232	1 827	1 027	26 658	11 116	300 958	105 691	982 679	-111 396	-10.2%
2010-2025	Expenditure (m€)	1 301	2 557	8 334	7 273	3 562	3 025	614	394	30	36	883	1 018	6 411	3 729	39 169	-314	-0.8%
2010-2030	Energy (TJ)	28 727	34 790	216 300	189 823	102 998	84 262	23 168	14 849	1 827	1 891	26 762	22 409	301 648	207 658	1 257 113	-217 717	-14.8%
2010-2030	Expenditure (m€)	1 301	3 887	8 350	12 226	3 593	5 112	625	679	30	57	886	1 683	6 425	6 407	51 262	-1 973	-3.7%

Table 13 BAT scenario outcomes and comparison with BAU scenario for dryers: market data, energy consumption and expenditure

Year	Unit	D1		D2		D3		D4		D5		D6		D7		Total	Difference with BAU	
		2010 Base case	2014 BA product	2010 Base case	2014 M 2.2 Heat pump	2010 Base case	2014 BA product	2010 Base case	2014 BA product	2010 Base case	2014 M 2.2 Heat pump	2010 Base case	2014 M 2.2 Heat pump	2010 Base case	2014 BA product		absolute	relative
	Product price (€/unit)	1 970	4 925	1 680	2 688	3 500	8 750	4 000	7 200	7 125	12 825	21 500	38 700	62 500	88 125			
2009	Stock (units)	24 722	0	33 219	0	149 737	0	195 967	0	45 939	0	3 674	0	14 697	0	467 955	0.0	0.0%
	Sales (units)	3 337	0	4 485	0	11 480	0	17 034	0	3 741	0	319	0	1 278	0	41 674	0.0	0.0%
	Energy (TJ)	1 288.9	0.0	1 304.1	0.0	9 474.7	0.0	14 477.3	0.0	9 891.7	0.0	3 633.9	0.0	71 641.2	0.0	111 711.6	0.0	0.0%
	Expenditure (m€)	21.0	0.0	21.6	0.0	133.1	0.0	207.8	0.0	99.9	0.0	31.2	0.0	551.4	0.0	1 066.1	0.0	0.0%
2010	Stock (units)	24 969	0	33 551	0	151 234	0	197 927	0	46 398	0	3 711	0	14 844	0	472 635	0.0	0.0%
	Sales (units)	3 371	0	4 529	0	11 595	0	17 204	0	3 778	0	323	0	1 290	0	42 090	0.0	0.0%
	Energy (TJ)	1 301.7	0.0	1 317.1	0.0	9 569.5	0.0	14 622.0	0.0	9 990.6	0.0	3 670.2	0.0	72 357.6	0.0	112 828.8	0.0	0.0%
	Expenditure (m€)	21.2	0.0	21.8	0.0	134.4	0.0	209.9	0.0	100.9	0.0	31.5	0.0	556.9	0.0	1 076.7	0.0	0.0%
2011	Stock (units)	25 219	0	33 887	0	152 747	0	199 906	0	46 862	0	3 748	0	14 992	0	477 361	0.0	0.0%
	Sales (units)	3 405	0	4 575	0	11 711	0	17 376	0	3 816	0	326	0	1 303	0	42 511	0.0	0.0%
	Energy (TJ)	1 314.8	0.0	1 330.3	0.0	9 665.1	0.0	14 768.3	0.0	10 090.5	0.0	3 706.9	0.0	73 081.2	0.0	113 957.1	0.0	0.0%
	Expenditure (m€)	21.4	0.0	22.0	0.0	135.8	0.0	212.0	0.0	101.9	0.0	31.8	0.0	562.5	0.0	1 087.5	0.0	0.0%
2012	Stock (units)	25 471	0	34 226	0	154 274	0	201 905	0	47 331	0	3 785	0	15 142	0	482 135	0.0	0.0%
	Sales (units)	3 439	0	4 620	0	11 828	0	17 550	0	3 854	0	329	0	1 316	0	42 936	0.0	0.0%
	Energy (TJ)	1 327.9	0.0	1 343.6	0.0	9 761.8	0.0	14 915.9	0.0	10 191.4	0.0	3 744.0	0.0	73 812.0	0.0	115 096.6	0.0	0.0%
	Expenditure (m€)	21.6	0.0	22.3	0.0	137.1	0.0	214.1	0.0	103.0	0.0	32.1	0.0	568.1	0.0	1 098.4	0.0	0.0%
2013	Stock (units)	25 726	0	34 568	0	155 817	0	203 924	0	47 804	0	3 823	0	15 294	0	486 956	0.0	0.0%
	Sales (units)	3 473	0	4 667	0	11 946	0	17 726	0	3 893	0	332	0	1 329	0	43 366	0.0	0.0%
	Energy (TJ)	1 341.2	0.0	1 357.0	0.0	9 859.4	0.0	15 065.1	0.0	10 293.3	0.0	3 781.4	0.0	74 550.1	0.0	116 247.6	0.0	0.0%
	Expenditure (m€)	21.8	0.0	22.5	0.0	138.5	0.0	216.3	0.0	104.0	0.0	32.5	0.0	573.8	0.0	1 109.3	0.0	0.0%

Year	Unit	D1		D2		D3		D4		D5		D6		D7		Total	Difference with BAU	
		2010 Base case	2014 BA product	2010 Base case	2014 M 2.2 Heat pump	2010 Base case	2014 BA product	2010 Base case	2014 BA product	2010 Base case	2014 M 2.2 Heat pump	2010 Base case	2014 M 2.2 Heat pump	2010 Base case	2014 BA product		absolute	relative
2014	**Stock (units)**	25 983	0	34 914	0	157 375	0	205 963	0	48 282	0	3 861	0	15 447	0	491 825	**0.0**	**0.0%**
	Sales (units)	0	3 508	0	4 713	0	12 065	0	17 903	0	3 932	0	336	0	1 343	43 799	**0.0**	**0.0%**
	Energy (TJ)	1 354.6	0.0	1 370.6	0.0	9 958.0	0.0	15 215.8	0.0	10 396.3	0.0	3 819.2	0.0	75 295.6	0.0	117 410.1	**0.0**	**0.0%**
	Expenditure (m€)	15.1	17.3	14.8	12.7	97.6	105.6	146.8	128.9	77.0	50.4	25.6	13.0	495.6	118.3	1 318.8	**198.3**	**17.7%**
2015	**Stock (units)**	22 735	3 508	30 549	4 713	146 883	12 065	190 120	17 903	44 834	3 932	3 564	336	14 258	1 343	496 744	**0.0**	**0.0%**
	Sales (units)	0	3 543	0	4 760	0	12 186	0	18 082	0	3 971	0	339	0	1 356	44 237	**0.0**	**0.0%**
	Energy (TJ)	1 185.3	65.5	1 199.3	98.0	9 294.1	266.1	14 045.3	463.3	9 653.7	354.3	3 525.4	135.7	69 503.7	4 913.4	114 703.1	**-3 881.1**	**-3.3%**
	Expenditure (m€)	13.2	18.2	12.9	13.9	91.1	109.4	135.5	134.9	71.5	53.6	23.6	14.1	457.5	152.8	1 302.5	**170.8**	**15.1%**
2016	**Stock (units)**	19 455	7 051	26 141	9 474	136 287	24 252	174 118	35 985	41 350	7 902	3 264	675	13 058	2 699	501 711	**0.0**	**0.0%**
	Sales (units)	0	3 578	0	4 808	0	12 308	0	18 263	0	4 011	0	342	0	1 370	44 680	**0.0**	**0.0%**
	Energy (TJ)	1 014.3	131.7	1 026.2	197.0	8 623.6	534.8	12 863.2	931.3	8 903.6	712.1	3 228.7	272.8	63 653.8	9 876.0	111 969.1	**-7 800.9**	**-6.5%**
	Expenditure (m€)	11.3	19.2	11.1	15.1	84.6	113.3	124.1	141.0	66.0	56.8	21.6	15.3	419.0	187.6	1 286.0	**143.0**	**12.5%**
2017	**Stock (units)**	16 142	10 629	21 690	14 282	125 584	36 559	157 956	54 248	37 832	11 913	2 961	1 017	11 846	4 068	506 728	**0.0**	**0.0%**
	Sales (units)	0	3 614	0	4 856	0	12 431	0	18 445	0	4 051	0	346	0	1 383	45 126	**0.0**	**0.0%**
	Energy (TJ)	841.5	198.5	851.5	296.9	7 946.4	806.2	11 669.2	1 403.9	8 146.1	1 073.5	2 929.0	411.3	57 745.4	14 888.2	109 207.7	**-11 760.0**	**-9.7%**
	Expenditure (m€)	9.4	20.2	9.2	16.3	77.9	117.2	112.6	147.1	60.4	60.1	19.6	16.5	380.1	222.8	1 269.3	**114.9**	**10.0%**
2018	**Stock (units)**	12 795	14 243	17 193	19 138	114 775	48 990	141 633	72 693	34 279	15 964	2 655	1 363	10 622	5 452	511 795	**0.0**	**0.0%**
	Sales (units)	0	3 650	0	4 905	0	12 555	0	18 630	0	4 091	0	349	0	1 397	45 578	**0.0**	**0.0%**
	Energy (TJ)	667.1	266.0	674.9	397.9	7 262.4	1 080.4	10 463.3	1 881.3	7 381.0	1 438.5	2 626.3	551.1	51 777.9	19 950.6	106 418.7	**-15 758.7**	**-12.9%**
	Expenditure (m€)	7.5	21.2	7.3	17.5	71.2	121.1	101.0	153.3	54.7	63.4	17.6	17.7	340.8	258.3	1 252.5	**86.6**	**7.4%**
2019	**Stock (units)**	9 416	17 893	12 652	24 043	103 857	61 546	125 146	91 323	30 690	20 055	2 346	1 712	9 386	6 849	516 913	**0.0**	**0.0%**
	Sales (units)	0	3 687	0	4 954	0	12 681	0	18 816	0	4 132	0	353	0	1 411	46 034	**0.0**	**0.0%**
	Energy (TJ)	490.9	334.2	496.7	499.9	6 571.6	1 357.3	9 245.3	2 363.4	6 608.3	1 807.1	2 320.6	692.3	45 750.8	25 063.5	103 601.8	**-19 797.3**	**-16.0%**
	Expenditure (m€)	5.5	22.2	5.4	18.8	64.4	125.1	89.2	159.6	49.0	66.7	15.5	18.9	301.2	294.1	1 235.6	**58.0**	**4.9%**

Year	Unit	D1		D2		D3		D4		D5		D6		D7		Total	Difference with BAU	
		2010 Base case	2014 BA product	2010 Base case	2014 M 2.2 Heat pump	2010 Base case	2014 BA product	2010 Base case	2014 BA product	2010 Base case	2014 M 2.2 Heat pump	2010 Base case	2014 M 2.2 Heat pump	2010 Base case	2014 BA product		absolute	relative
2020	Stock (units)	6 002	21 580	8 065	28 996	92 830	74 227	108 495	110 139	27 066	24 187	2 034	2 065	8 137	8 260	522 083	0.0	0.0%
	Sales (units)	0	3 724	0	5 003	0	12 808	0	19 004	0	4 173	0	356	0	1 425	46 494	0.0	0.0%
	Energy (TJ)	312.9	403.1	316.6	602.9	5 873.9	1 636.9	8 015.2	2 850.3	5 827.8	2 179.4	2 011.8	835.0	39 663.3	30 227.6	100 756.8	-23 876.4	-19.2%
	Expenditure (m€)	3.5	23.2	3.4	20.0	57.6	129.2	77.3	165.9	43.2	70.0	13.5	20.1	261.1	330.4	1 218.4	29.0	2.4%
2021	Stock (units)	2 554	25 303	3 432	34 000	81 693	87 034	91 677	129 144	23 405	28 360	1 719	2 421	6 876	9 685	527 303	0.0	0.0%
	Sales (units)	0	3 761	0	5 053	0	12 936	0	19 194	0	4 215	0	360	0	1 440	46 959	0.0	0.0%
	Energy (TJ)	133.2	472.6	134.7	706.9	5 169.2	1 919.4	6 772.7	3 342.2	5 039.6	2 555.5	1 700.0	979.0	33 515.0	35 443.3	97 883.3	-27 996.2	-22.2%
	Expenditure (m€)	1.5	24.3	1.5	21.3	50.7	133.2	65.4	172.3	37.3	73.4	11.4	21.3	220.6	367.0	1 201.1	-0.2	0.0%
2022	Stock (units)	0	28 136	0	37 806	70 445	99 970	74 691	148 338	19 707	32 576	1 400	2 781	5 602	11 125	532 576	0.0	0.0%
	Sales (units)	0	3 798	0	5 104	0	13 065	0	19 386	0	4 257	0	363	0	1 454	47 428	0.0	0.0%
	Energy (TJ)	0.0	525.5	0.0	786.0	4 457.4	2 204.6	5 517.9	3 838.9	4 243.4	2 935.3	1 385.0	1 124.6	27 305.3	40 711.2	95 035.1	-32 103.2	-25.3%
	Expenditure (m€)	0.0	25.1	0.0	22.3	43.7	137.3	53.2	178.7	31.4	76.8	9.3	22.6	179.7	403.9	1 184.2	-29.1	-2.4%
2023	Stock (units)	0	28 417	0	38 184	59 084	113 035	57 535	167 724	15 973	36 833	1 079	3 145	4 315	12 579	537 902	0.0	0.0%
	Sales (units)	0	3 836	0	5 155	0	13 196	0	19 580	0	4 300	0	367	0	1 468	47 903	0.0	0.0%
	Energy (TJ)	0.0	530.8	0.0	793.9	3 738.6	2 492.8	4 250.4	4 340.6	3 439.3	3 318.9	1 066.9	1 271.5	21 033.4	46 031.8	92 308.8	-36 100.9	-28.1%
	Expenditure (m€)	0.0	25.3	0.0	22.5	36.7	141.5	41.0	185.2	25.5	80.3	7.1	23.8	138.5	441.2	1 168.7	-56.7	-4.6%
2024	Stock (units)	0	28 701	0	38 566	47 609	126 231	40 207	187 305	12 201	41 133	754	3 512	3 015	14 047	543 281	0.0	0.0%
	Sales (units)	0	3 875	0	5 206	0	13 328	0	19 776	0	4 343	0	371	0	1 483	48 382	0.0	0.0%
	Energy (TJ)	0.0	536.1	0.0	801.8	3 012.5	2 783.8	2 970.3	4 847.3	2 627.1	3 706.4	745.6	1 420.0	14 698.8	51 405.5	89 555.2	-40 138.5	-30.9%
	Expenditure (m€)	0.0	25.6	0.0	22.7	29.5	145.7	28.7	191.8	19.5	83.8	5.0	25.1	96.8	478.9	1 153.0	-84.6	-6.8%
2025	Stock (units)	0	28 988	0	38 952	36 020	139 559	22 706	207 081	8 391	45 476	426	3 882	1 703	15 530	548 714	0.0	0.0%
	Sales (units)	0	3 913	0	5 259	0	13 461	0	19 974	0	4 386	0	374	0	1 498	48 865	0.0	0.0%
	Energy (TJ)	0.0	541.5	0.0	809.8	2 279.2	3 077.7	1 677.4	5 359.1	1 806.8	4 097.7	421.0	1 569.9	8 300.9	56 833.0	86 774.1	-44 216.6	-33.8%
	Expenditure (m€)	0.0	25.9	0.0	23.0	22.3	149.9	16.2	198.4	13.4	87.3	2.8	26.4	54.6	517.0	1 137.2	-112.8	-9.0%

Year	Unit	D1		D2		D3		D4		D5		D6		D7		Total	Difference with BAU	
		2010 Base case	2014 BA product	2010 Base case	2014 M 2.2 Heat pump	2010 Base case	2014 BA product	2010 Base case	2014 BA product	2010 Base case	2014 M 2.2 Heat pump	2010 Base case	2014 M 2.2 Heat pump	2010 Base case	2014 BA product		absolute	relative
2026	Stock (units)	0	29 278	0	39 341	24 314	153 020	5 030	227 054	4 544	49 862	94	4 257	377	17 028	554 201	0.0	0.0%
	Sales (units)	0	3 953	0	5 311	0	13 596	0	20 174	0	4 430	0	378	0	1 513	49 354	0.0	0.0%
	Energy (TJ)	0.0	546.9	0.0	817.9	1 538.5	3 374.5	371.6	5 876.0	978.4	4 493.0	93.3	1 721.3	1 838.9	62 314.8	83 965.1	-48 335.5	-36.5%
	Expenditure (m€)	0.0	26.1	0.0	23.2	15.1	154.2	3.6	205.1	7.2	90.9	0.6	27.7	12.1	555.5	1 121.3	-141.3	-11.2%
2027	Stock (units)	0	29 571	0	39 735	12 492	166 615	0	234 405	658	54 292	0	4 395	0	17 580	559 743	0.0	0.0%
	Sales (units)	0	3 992	0	5 364	0	13 732	0	20 375	0	4 474	0	382	0	1 528	49 848	0.0	0.0%
	Energy (TJ)	0.0	552.3	0.0	826.1	790.4	3 674.4	0.0	6 066.3	141.6	4 892.1	0.0	1 777.0	0.0	64 332.3	83 052.6	-50 571.0	-37.8%
	Expenditure (m€)	0.0	26.4	0.0	23.4	7.8	158.5	0.0	208.5	1.0	94.5	0.0	28.2	0.0	570.5	1 118.8	-156.4	-12.3%
2028	Stock (units)	0	29 867	0	40 132	552	180 347	0	236 749	0	55 499	0	4 439	0	17 756	565 341	0.0	0.0%
	Sales (units)	0	4 032	0	5 418	0	13 869	0	20 579	0	4 519	0	386	0	1 543	50 346	0.0	0.0%
	Energy (TJ)	0.0	557.9	0.0	834.4	34.9	3 977.2	0.0	6 126.9	0.0	5 000.9	0.0	1 794.8	0.0	64 975.6	83 302.6	-51 657.2	-38.3%
	Expenditure (m€)	0.0	26.6	0.0	23.7	0.3	162.9	0.0	210.6	0.0	95.9	0.0	28.5	0.0	576.2	1 124.7	-163.3	-12.7%
2029	Stock (units)	0	30 166	0	40 533	0	182 708	0	239 117	0	56 054	0	4 483	0	17 933	570 994	0.0	0.0%
	Sales (units)	0	4 072	0	5 472	0	14 008	0	20 785	0	4 564	0	390	0	1 559	50 850	0.0	0.0%
	Energy (TJ)	0.0	563.4	0.0	842.7	0.0	4 029.2	0.0	6 188.2	0.0	5 050.9	0.0	1 812.8	0.0	65 625.4	84 112.7	-52 196.8	-38.3%
	Expenditure (m€)	0.0	26.9	0.0	23.9	0.0	164.6	0.0	212.7	0.0	96.8	0.0	28.8	0.0	581.9	1 135.7	-165.1	-12.7%
2030	Stock (units)	0	30 467	0	40 939	0	184 535	0	241 508	0	56 615	0	4 528	0	18 112	576 704	0.0	0.0%
	Sales (units)	0	4 113	0	5 527	0	14 148	0	20 993	0	4 610	0	394	0	1 574	51 358	0.0	0.0%
	Energy (TJ)	0.0	569.1	0.0	851.1	0.0	4 069.5	0.0	6 250.1	0.0	5 101.4	0.0	1 830.9	0.0	66 281.6	84 953.8	-52 718.7	-38.3%
	Expenditure (m€)	0.0	27.2	0.0	24.1	0.0	166.3	0.0	214.8	0.0	97.8	0.0	29.1	0.0	587.7	1 147.1	-166.8	-12.7%
2010-2020	Energy (TJ)	11 152	1 399	11 284	2 092	94 386	5 682	140 889	9 893	97 483	7 565	35 364	2 898	697 192	104 919	1 222 197	-82 874	-6.4%
	Expenditure (m€)	152	142	153	114	1 090	821	1 639	1 031	832	421	265	116	4 917	1 564	13 255	801	6.4%
2010-2025	Energy (TJ)	11 285	4 005	11 418	5 991	113 043	18 160	162 077	31 622	114 639	24 179	40 682	9 263	802 045	335 344	1 683 754	-263 430	-13.5%
	Expenditure (m€)	153	268	154	226	1 273	1 528	1 843	1 957	959	823	300	235	5 607	3 772	19 099	517	2.8%
2010-2030	Energy (TJ)	11 285	6 795	11 418	10 163	115 407	37 285	162 449	62 129	115 759	48 717	40 775	18 200	803 884	658 874	2 103 141	-518 909	-19.8%
	Expenditure (m€)	153	401	154	344	1 296	2 335	1 847	3 009	967	1 298	301	377	5 619	6 644	24 747	-276	-1.1%

2.4.4 Comparison of BAT and LLCC scenarios with BAU

Figure 9 to Figure 26 show the evolution of total primary energy consumption and expenditure in time (between 2010 and 2030), by base case and according to the BAT and LLCC scenarios previously described.

The figures show that in the LLCC scenarios the initial larger investment due to higher product prices can be counterbalanced by the lower operating costs: for example this is the case for base case WM 2 in both LLCC and BAT scenarios. But, depending on the specific case, the investment will be either never paid back or will be paid back in a much longer period under the BAT scenarios.

As planned, the BAT scenario is therefore the scenario that enables the largest primary energy savings (both annually and over the period 2010-2025) while the LLCC scenario results in the smallest annual expenditure.

For base cases where the same improvement option corresponds to both the LLCC and the BAT option, the figures obviously show no differences between the LLCC and the BAT scenarios: this is the case for WM 4-5-6-7 and D 2-4-5-6-7. For WM 2-3, the difference between the two scenarios is relatively low. The payback period for BAT scenario of WM 3 is around 5 years longer than for LLCC scenario and the primary energy consumptions are almost similar. Base case WM 1 shows some more important differences: the reduction of energy consumption in 2030 is about twice more important for the BAT than for the LLCC; the BAT scenario never becomes economically interesting in comparison with the BAU scenario while the payback period with the LLCC scenario is approximately five years. D 1 and D 3 result in similar situations: the energy savings enabled by the BAT scenario are a bit larger than with the LLCC scenario, but it is not economically beneficial on the period considered (till 2030).

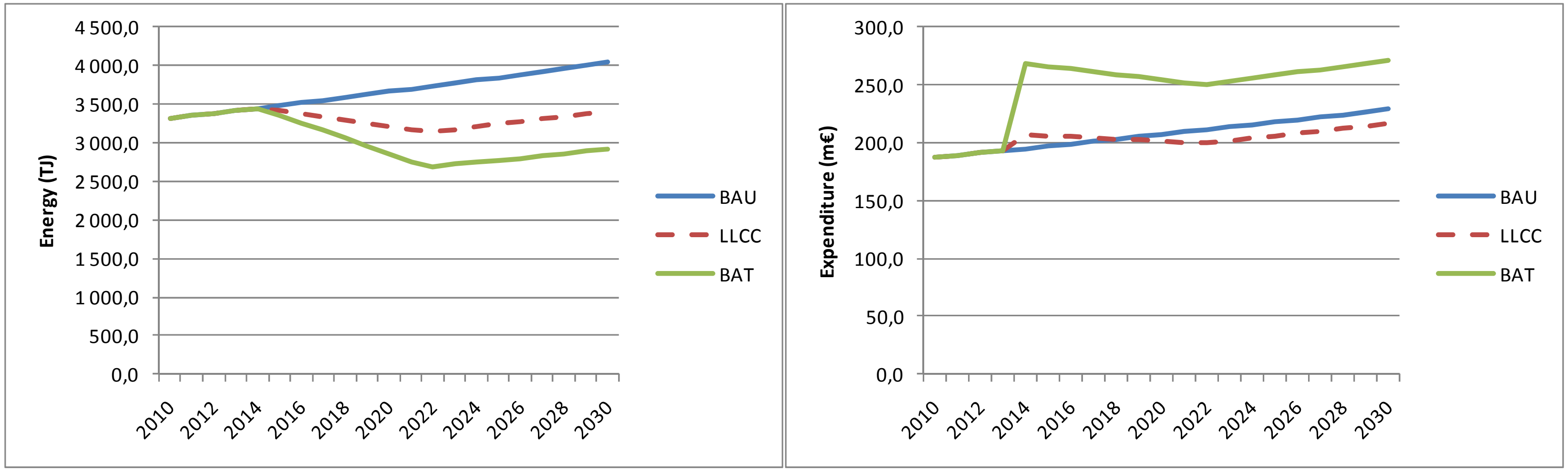

Figure 9 Primary energy consumption and expenditure by scenario, base case WM 1

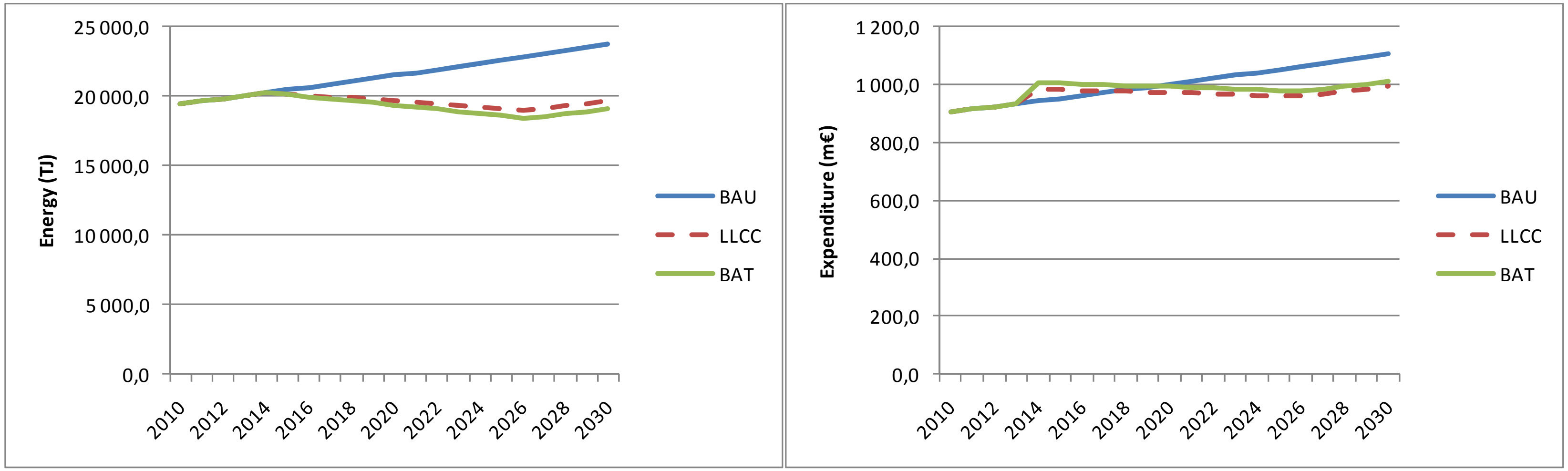

Figure 10 Primary energy consumption and expenditure by scenario, base case WM 2

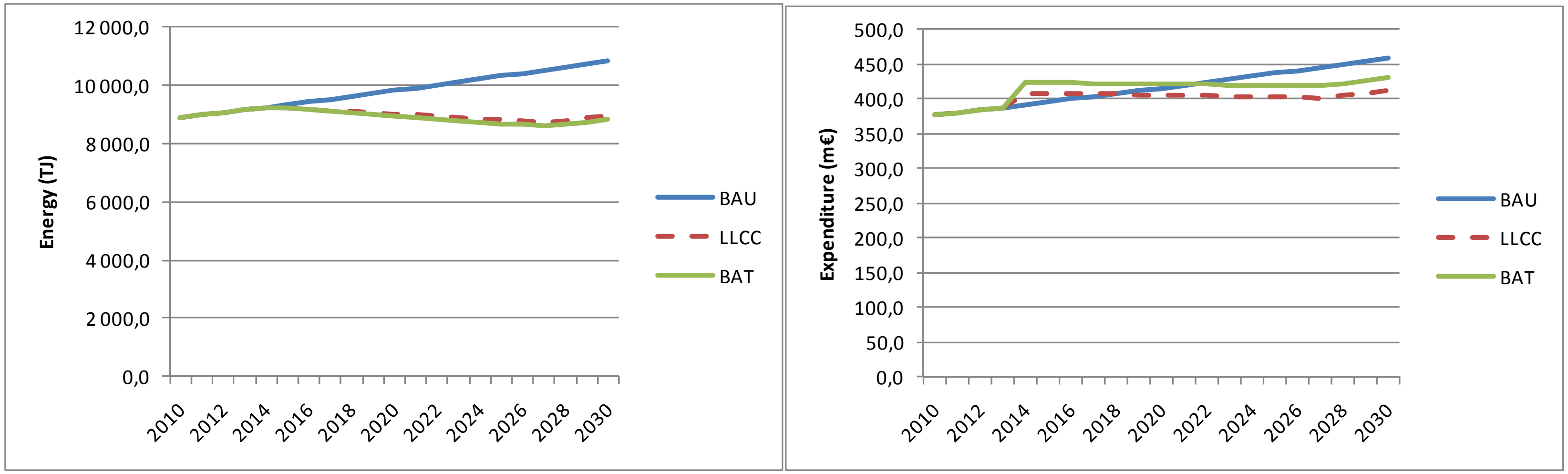

Figure 11 Primary energy consumption and expenditure by scenario, base case WM 3

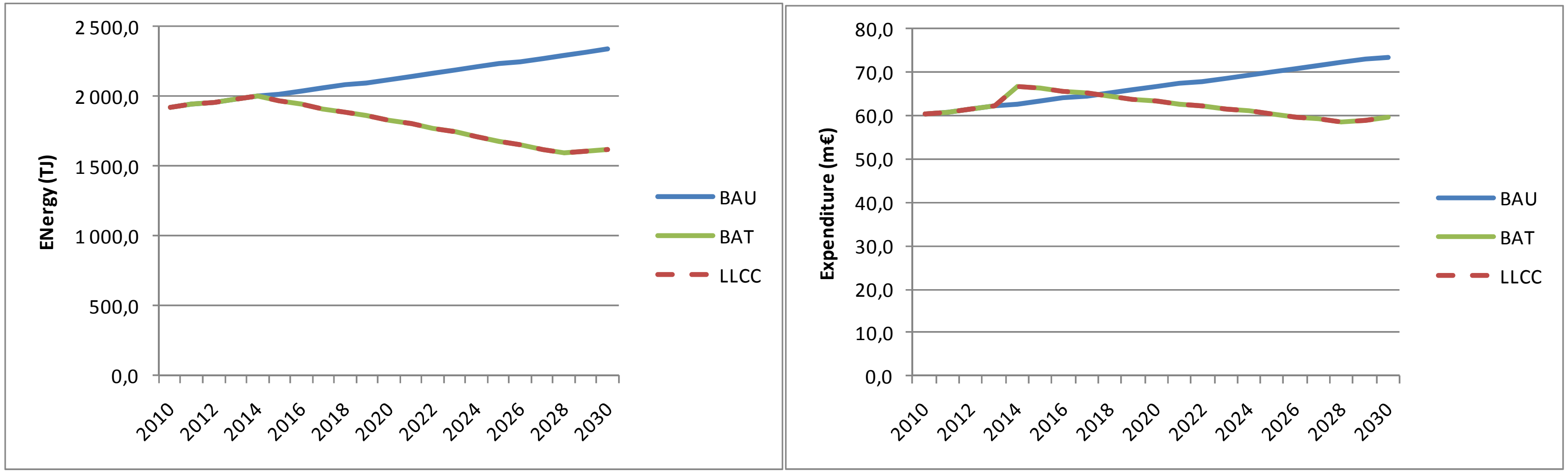

Figure 12 Primary energy consumption and expenditure by scenario, base case WM 4

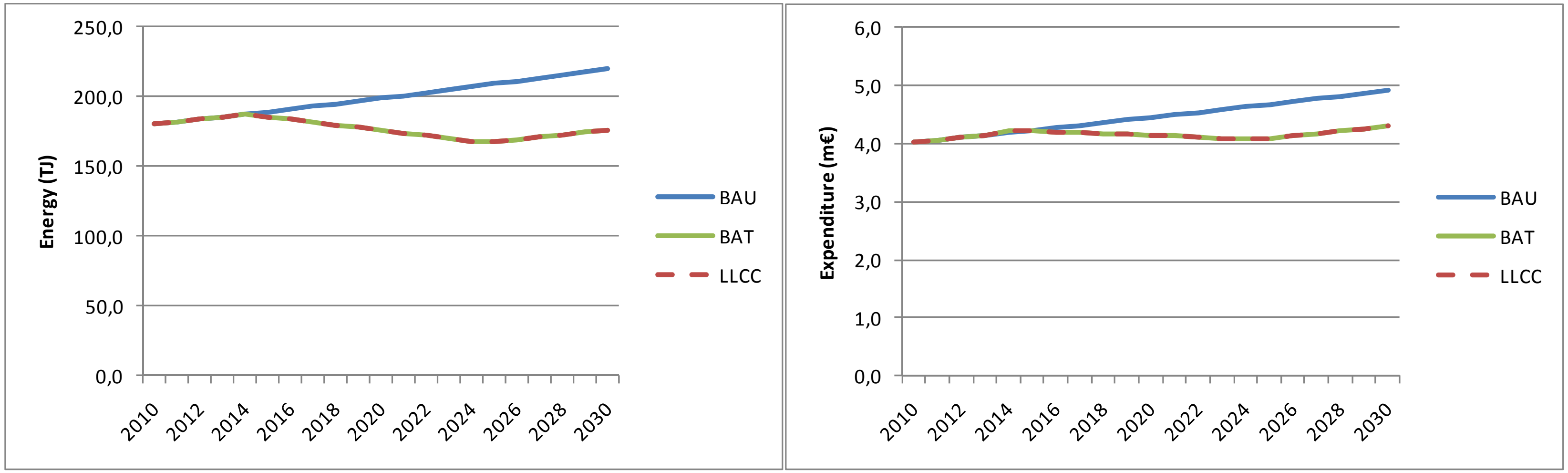

Figure 13 Primary energy consumption and expenditure by scenario, base case WM 5

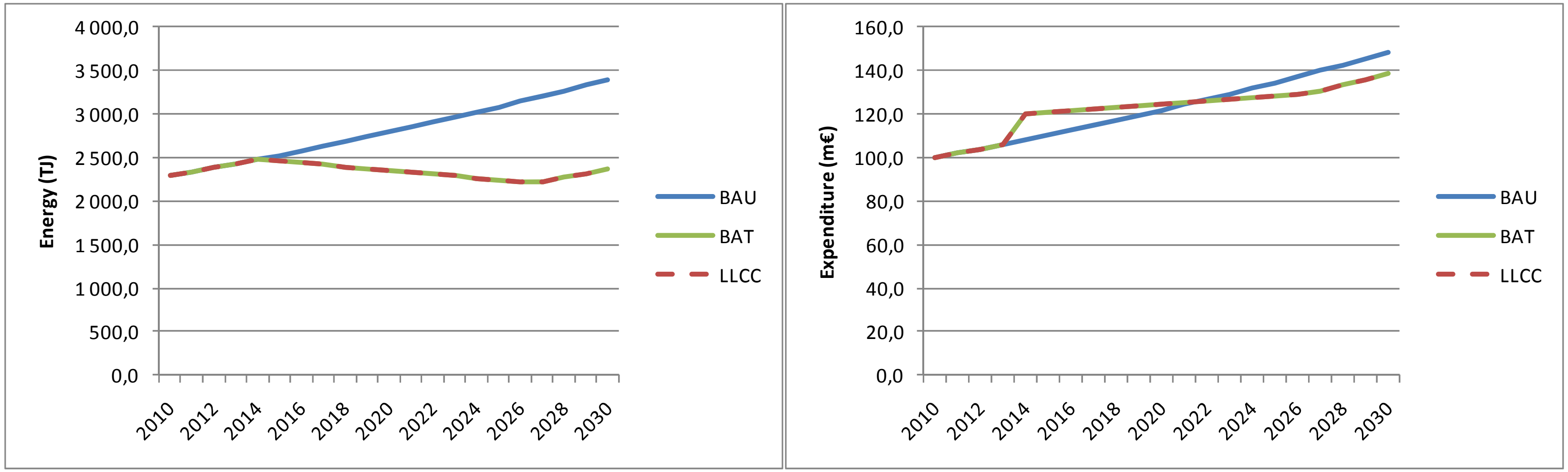

Figure 14 Primary energy consumption and expenditure by scenario, base case WM 6

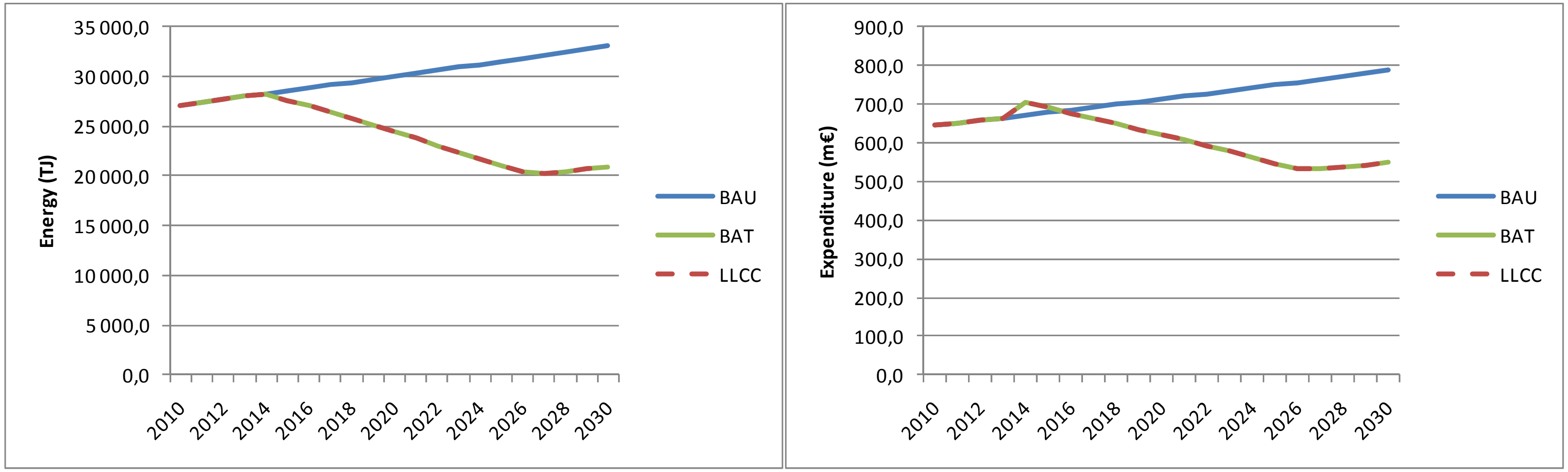

Figure 15 Primary energy consumption and expenditure by scenario, base case WM 7

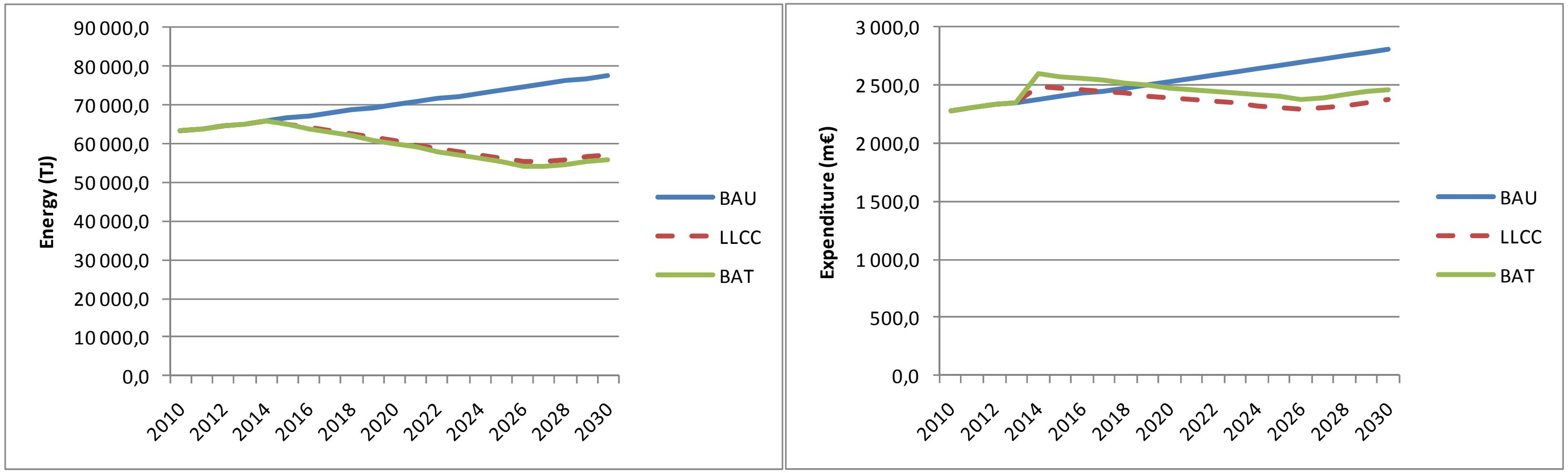

Figure 16 Primary energy consumption and expenditure by scenario, total for all professional washing machines base cases

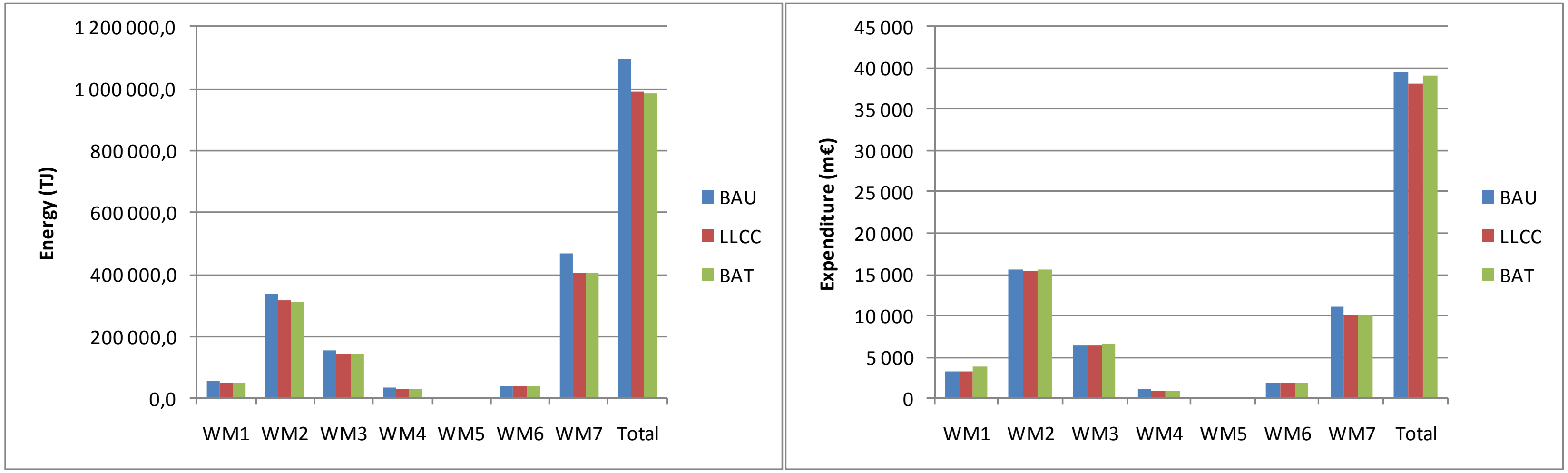

Figure 17 Primary energy consumption and expenditure by scenario, for professional washing machines over the period 2010-2025

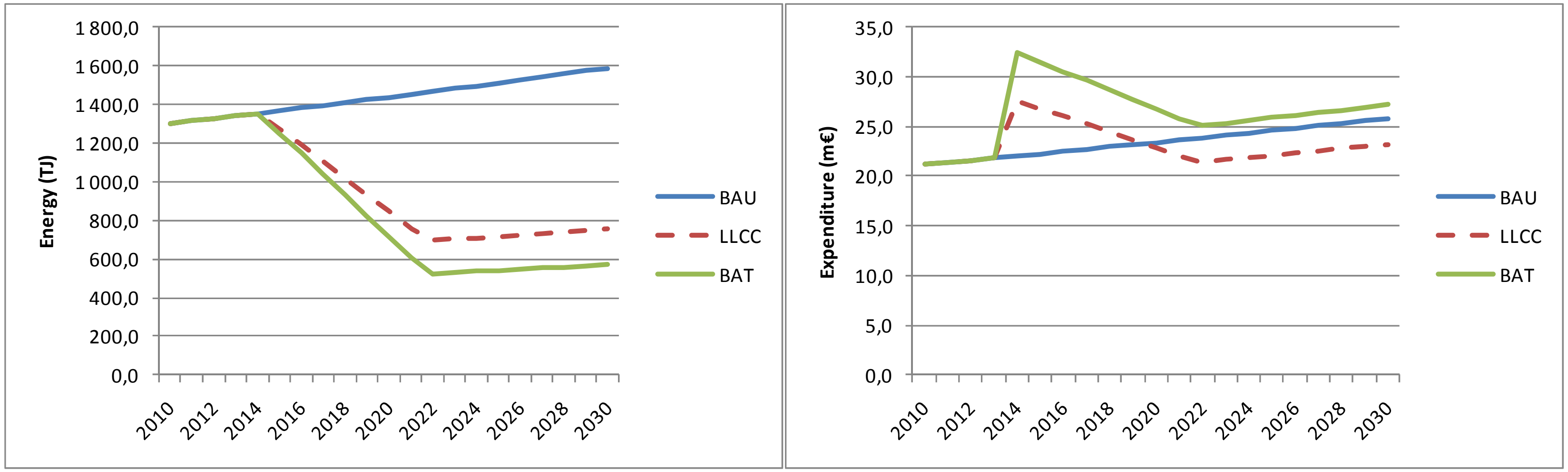

Figure 18 Primary energy consumption and expenditure by scenario, base case D 1

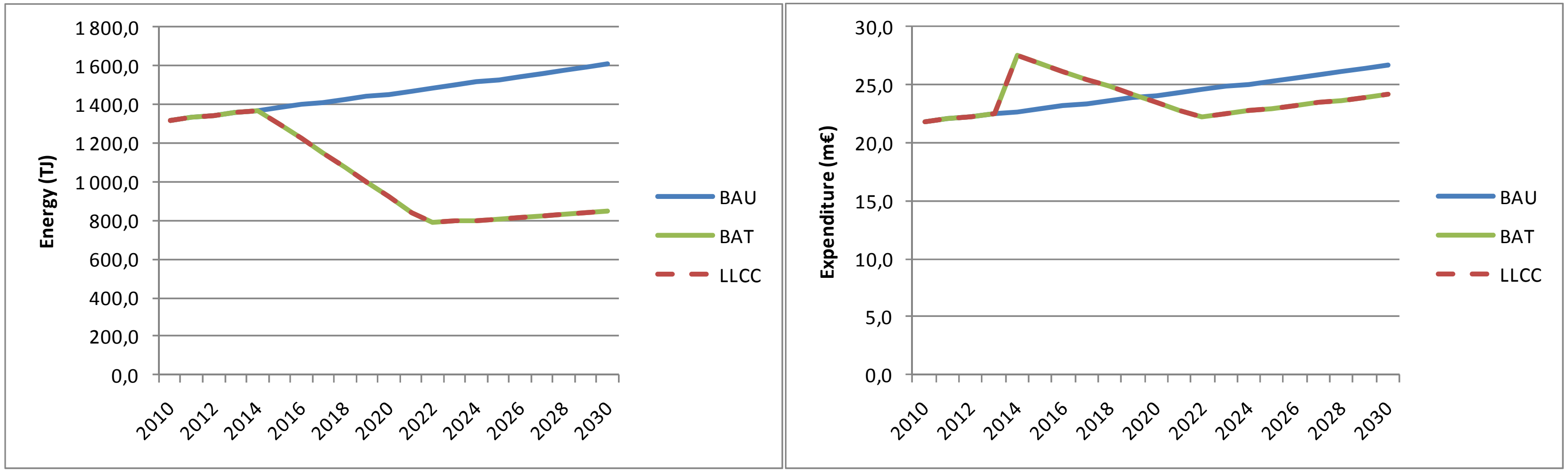

Figure 19 Primary energy consumption and expenditure by scenario, base case D 2

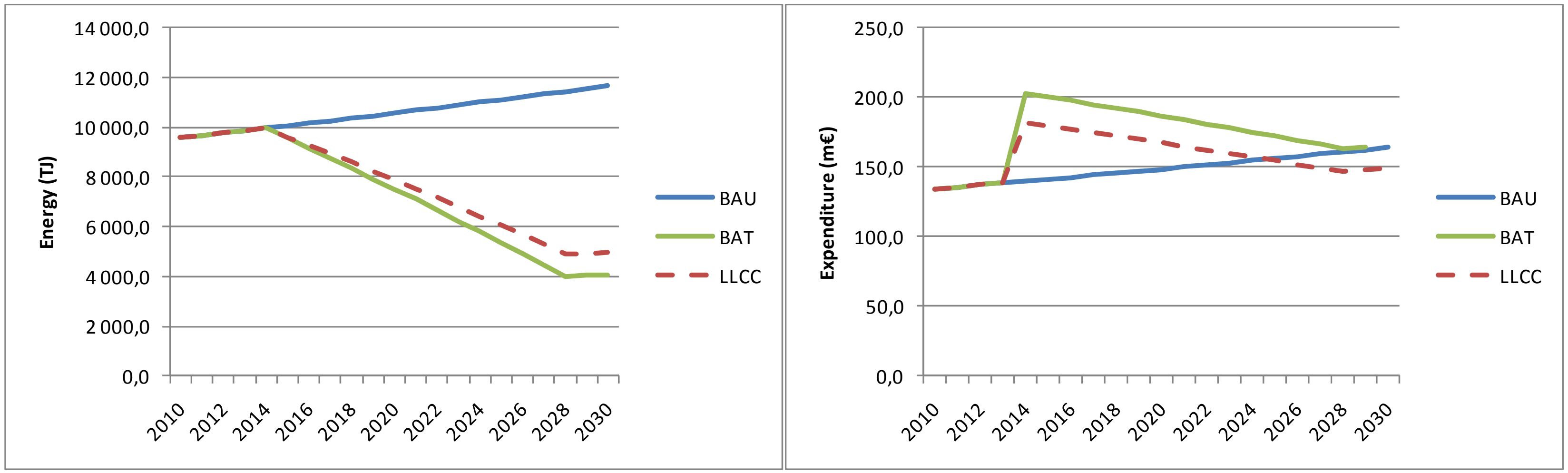

Figure 20 Primary energy consumption and expenditure by scenario, base case D 3

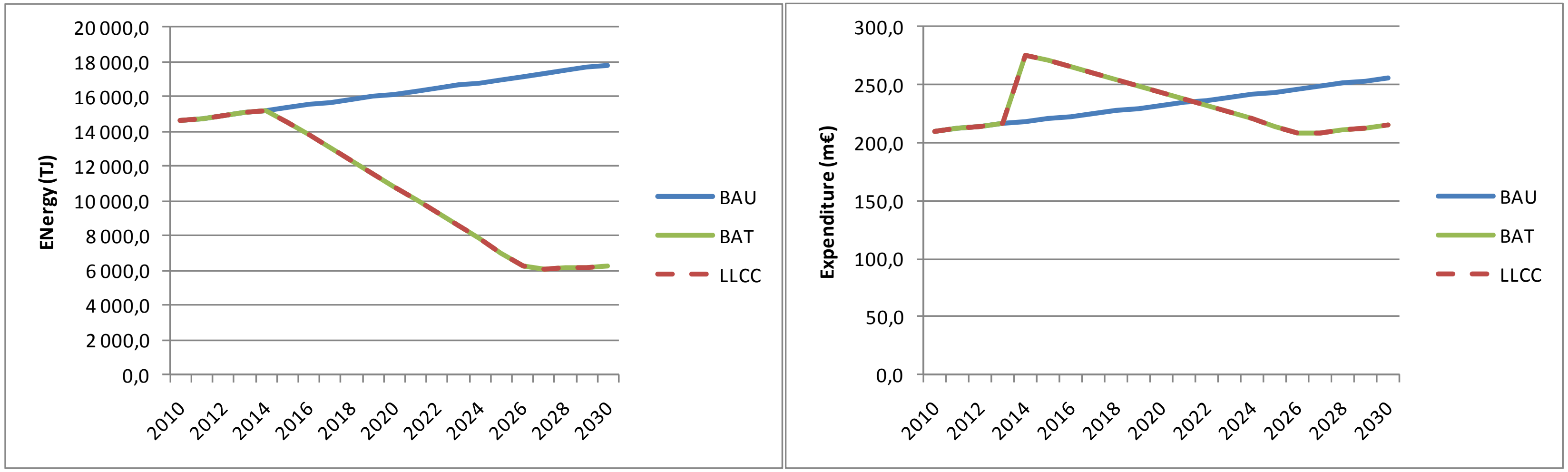

Figure 21 Primary energy consumption and expenditure by scenario, base case D 4

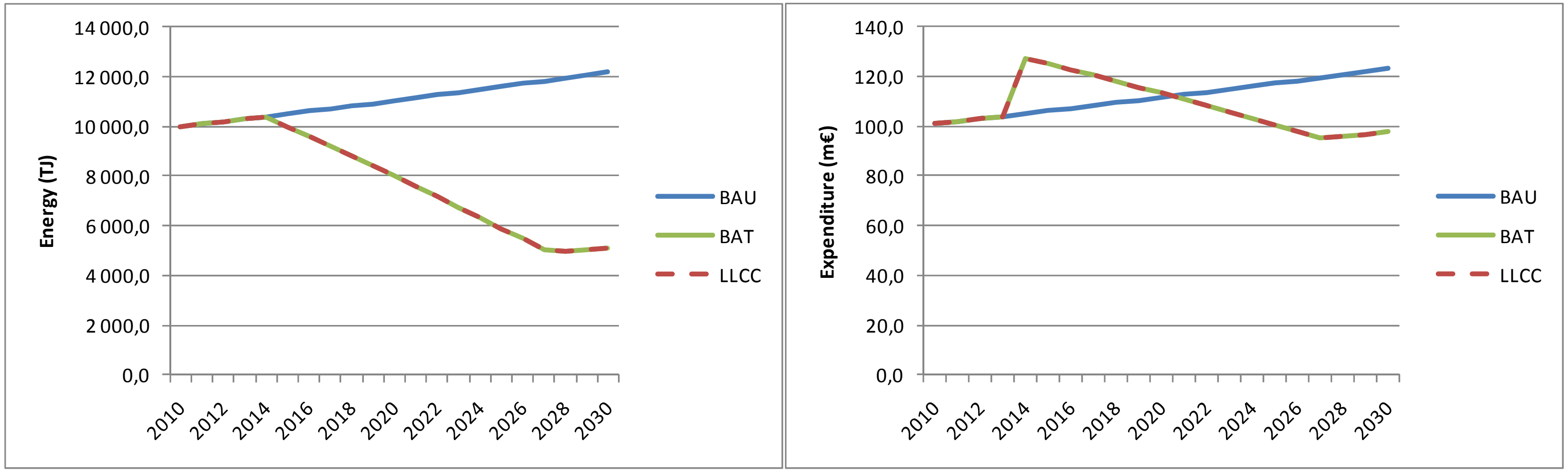

Figure 22 Primary energy consumption and expenditure by scenario, base case D 5

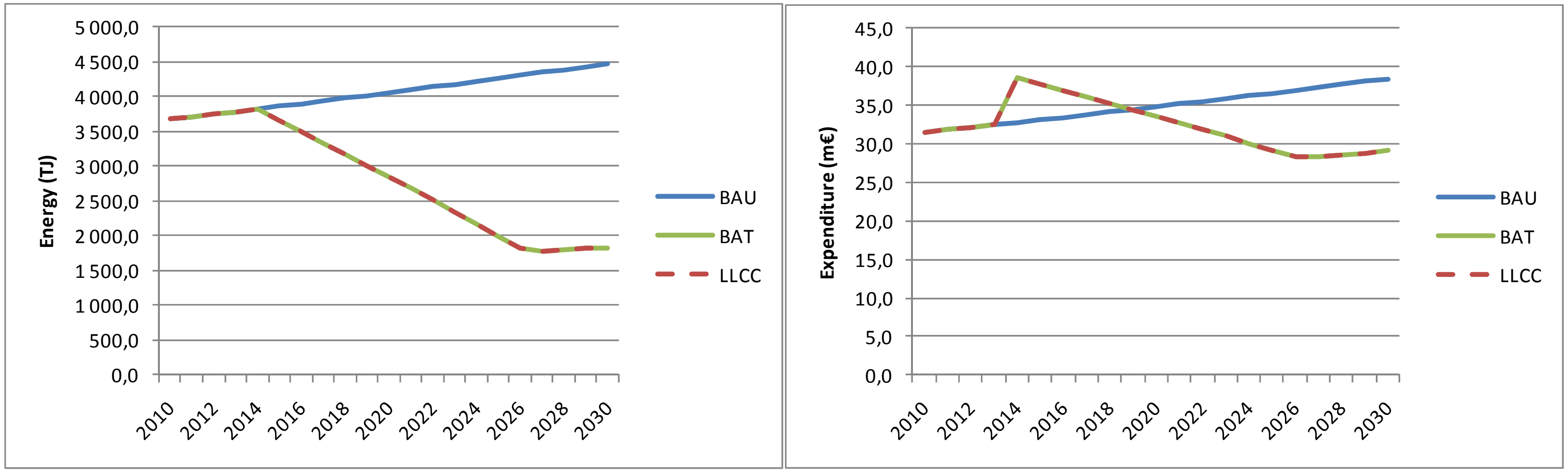

Figure 23 Primary energy consumption and expenditure by scenario, base case D 6

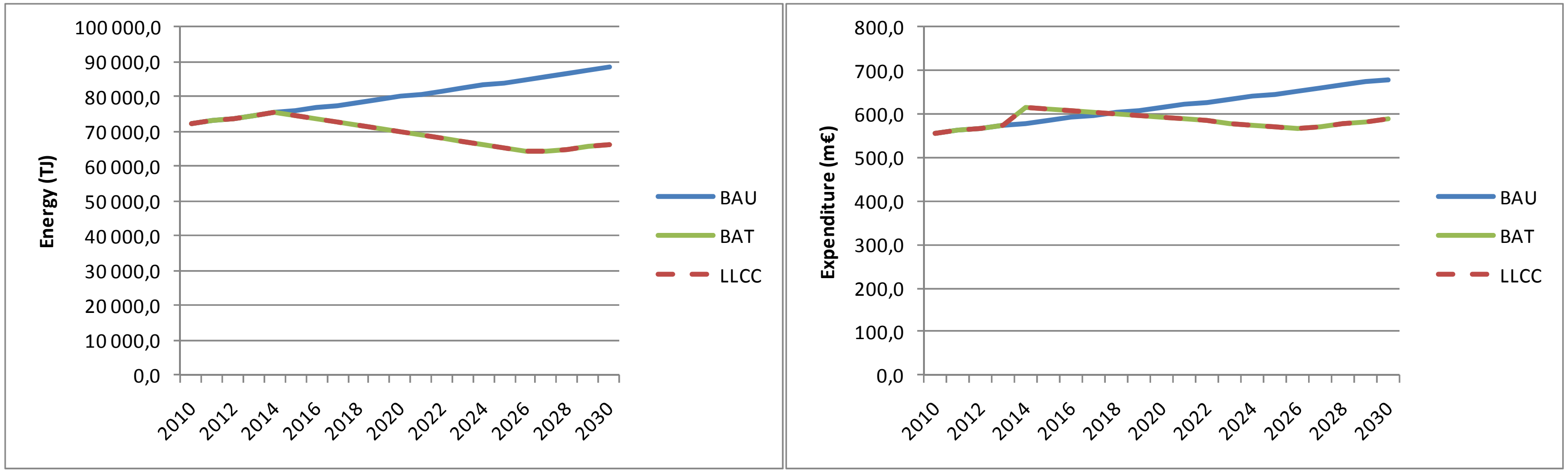

Figure 24 Primary energy consumption and expenditure by scenario, base case D 7

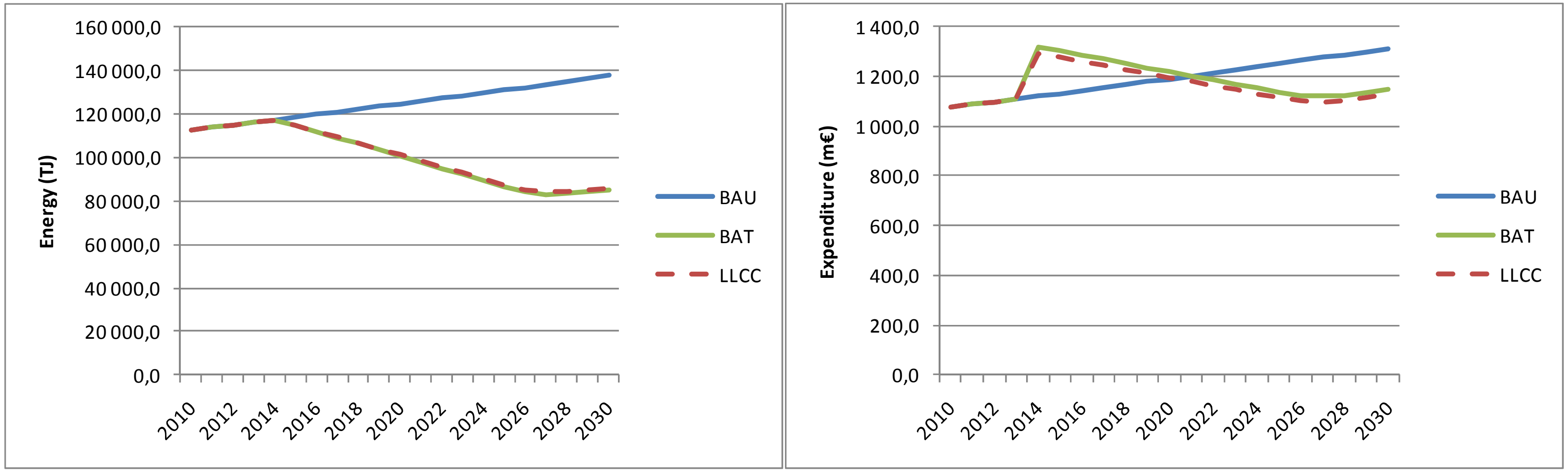

Figure 25 Primary energy consumption and expenditure by scenario, total for all dryers base cases

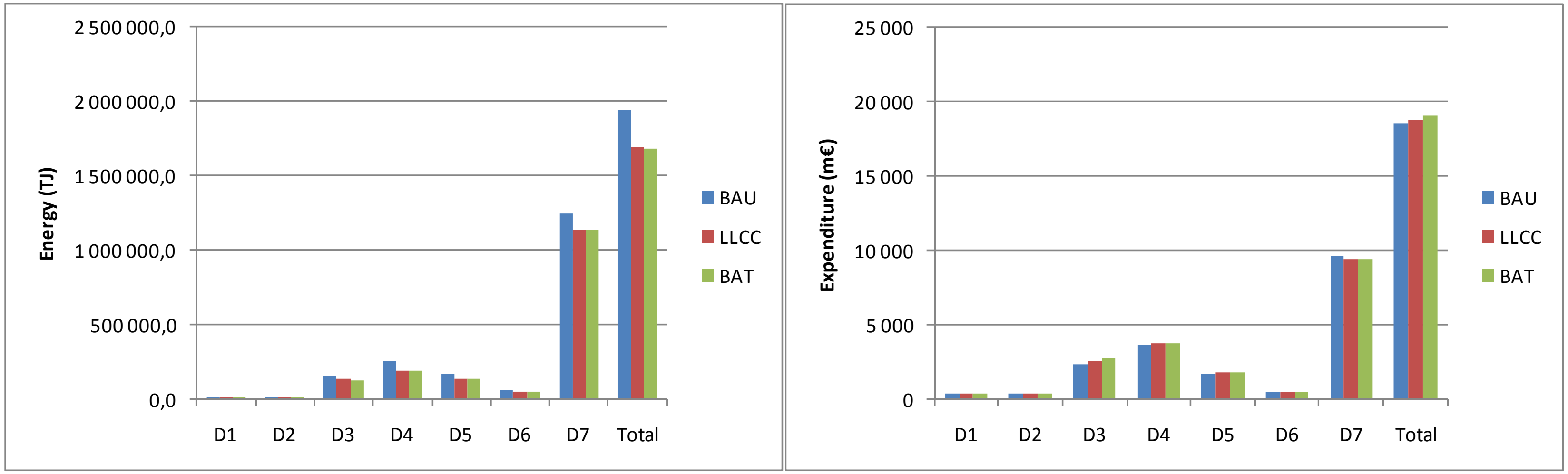

Figure 26 Primary energy consumption and expenditure by scenario, for dryers, over the period 2010-2025

3 Impact analysis

This section presents the impact analysis. It consists of an estimate of the impact on consumers (purchasing power, societal costs) and industry (employment, profitability, competitiveness, investment level, etc.), explicitly describing and taking into account the typical design cycle (platform change) in this product sector.

3.1 Impacts on manufacturers and competition

All the technologies described in this study and considered as improvement options in the scenarios are already available on the market today. As a result, the possible implementation of eco-design requirements dealing with relevant targets should not have a major negative impact on manufacturers, especially because the professional laundry sector is very competitive and has been continuously improving product performance (See Task 2).

Regarding the definition of a timeline to implement the requirements, it should take into account the time necessary to adapt production lines. This redesign time is very variable depending on the type of change to be achieved: it has been estimated that between 6 and 36 months are needed for a change of a single part of the appliance (see Task 2). The full redesign cycle may take even longer. Assuming the development of the required standards (see Section 2.2.1) is finished by 2012/2013, Tier 1 has thus been set at 2014 for the eco-design requirements.

Manufacturers of professional laundry appliances are mostly large international companies. If eco-design requirements were set, all manufacturers should be able to keep up with the market requirements, using common technology or their own technological developments. Appropriate and progressive targets should be set, both in terms of performance and timeline.

EU manufacturers claim to produce amongst the most efficient professional laundry appliances manufactured worldwide. Therefore, the implementation of eco-design requirements is not expected to hamper the economic development of large EU manufacturers, to the benefit of extra-EU competitors.

3.2 Monetary impacts

The scenario analysis partly addresses monetary impacts. The LLCC and BAT scenarios reduce the monetary expenditure for many base cases (see Section 2.4). Table 14 and Table 15 show the payback periods of the improvement options by base case, as presented in Task 7.

Table 14 Payback periods (in years) of the improvement options for professional washing machines

Base case	Life time considered in previous analysis	M 1.1 Increased motor efficiency	M 1.2 Heat ex-changer	M 1.3 Water recovery	M 1.4 Load control	M 1.5 Further control systems	M 1.7 Drum construc-tion	BA product
WM 1	8	>20	14	15	4	4	17	17
WM 2	12	>20	11	11	3	1	4	5
WM 3	14	>20	14	12	4	1	5	7
WM 4	15	>20	>20	4	3	4	-	6
WM 5	11	>20	-	-	1	1	-	-
WM 6	14	>20	>20	7	5	9	-	15
WM 7	13	>20	1	-	-	-	-	1

Table 15 Payback periods (in years) of the improvement options for professional dryers

Base case	Life time considered In previous analysis	M 2.1 Increased motor effi-ciency	M 2.2 Heat pump	M 2.3 Heat recovery from exhaust air	M 2.4 Im-proved air flow system	M 2.5 Load control	M 2.6 Residual Moisture Control	M 2.7 Im-proved insu-lation	BA product
D 1	8	6	6	-	3	4	4	4	9
D 2	8	7	5	15	4	4	4	4	9
D 3	15	-	10	>20	3	-	-	5	14
D 4	13	4	8	15	4	7	3	4	7
D 5	14	4	6	13	3	6	4	4	6
D 6	13	7	5	>20	6	8	12	20	5
D 7	13	15	-	3	-	-	-	7	4

The possible implementation of eco-design requirements may require additional capital investment from manufacturers to adapt manufacturing techniques to efficiently produce the more efficient products (e.g. changing production lines before their “end-of-life”). It is, however, not estimated that these investments would represent a significant burden for manufacturers as they are used to continuously improving the efficiency of their appliances. Investment costs may also be partly counterbalanced by slightly higher selling prices of more efficient machines. On the other hand, economies of scale may enable manufacturers to have a larger margin and/or drop prices when selling efficient appliances.

On the consumers’ side, purchasing more efficient professional washing machines and dryers may represent a larger initial investment but if eco-design requirements are set based on LCC calculations, the investment becomes beneficial in the long term. Owners of smaller appliances (e.g. used in AHL or Laundromats) are usually more reluctant to long payback times, compared to owners of large capacity appliances.

3.3 Impacts on consumer use

For the improvement options presented, the functional unit and the service given by the improved product remains the same as the base case (this is a necessary condition to make a relevant comparative life cycle assessment) (see Task 6): this is a crucial condition to assess their implementation in professional laundry appliances. Thus, there should be no trade-off in terms of functionality (e.g. increase of noise), for the increase of energy, water or detergent efficiency. In particular, the measure of the cleaning and drying performance should appear in the measurement standards to be developed (see Section 2.2.1).

3.4 Impacts on innovation and development

The Best Not yet Available Technology and current research priorities in the sector were not very thoroughly described throughout this study, because of a major lack of data. Such information is very sensitive and manufacturers were obviously not willing to share. In addition, little or no independent research has been carried out. The possible implementation of minimum eco-design requirements can be seen as an opportunity for manufacturers to look for innovative and efficient technological solutions in order to decrease costs. Again, given the competitiveness of the sector, it seems that following the current trend regarding research and development is feasible for the manufacturers and should enable them to meet proposed requirements.

3.5 Social impacts

Most of the EU manufacturers have their production plants within the EU. If eco-design requirements were set, they should not have a detrimental impact on the number of jobs or the well-being of the EU manufacturers' employees. Companies have experience in carrying out continuous production transitions. Regarding the security of supply, the improvement options presented do not require any specific material that might be difficult to obtain in the EU so that the supply chain could be kept unchanged, without damaging EU industries.

4 Sensitivity analysis of the main parameters

The sensitivity analysis checks the robustness of the overall outcomes. It should cover the main parameters as described in Annex II of the EuP directive (such as the price of energy, the cost of raw materials or production costs, discount rates, including, where appropriate, external environmental costs, such as avoided greenhouse gas emissions), to check if there are significant changes and if the overall conclusions are reliable and robust.

The parameters that were considered the most relevant for this sensitivity analysis (because of their importance and/or uncertainty) in the case of professional laundry appliances are listed below:

- Energy, water and detergent consumption;
- Intensity of use of the machines (kg of laundry per year);
- Life time;
- Energy (electricity and gas), water and detergent prices;
- Product price;
- Discount rate.

Parameters such as resource and consumables prices, product purchase prices and discount rate have a direct influence on the LCC calculations of the base cases and their improvement options (but not on the environmental impacts of the products) while others (resource and consumables consumption, life time) will influence both the environmental impacts of the products and the LCC through operating costs.

The influence of the single parameters on the results will be first studied separately and the analysis of combined changes in several parameters at the same time will be made in Section 4.7.

4.1 Resource and consumables consumption

4.1.1 Assumptions

In Task 4, average energy, water and detergent consumption data were determined for the base cases. Given the uncertainty that remains regarding the definition of “average market” products, the sensitivity analysis will consider an error margin of 20% on the given values, both for minimum and maximum values. The tested values are therefore presented in Table 16, Table 17 and Table 18.

Table 16 Energy consumption range for the sensitivity analysis

Base Case	Base total energy consumption (kWh per year)	Min	Max
WM 1 - Semi-professional washer extractor	1 332	1 066	1 598
WM 2 - Professional washing extractor (<15 kg)	3 026	2 421	3 631
WM 3 - Professional washing extractor (15-40 kg)	10 973	8 778	13 168
WM 4 - Professional washing extractor (>40 kg)	81 648	65 318	97 978
WM 5 - Professional washer dryer	7 400	5 920	8 880
WM 6 - Professional barrier washer	26 461	21 169	31 753
WM 7 - Washing tunnel machine	1 606 500	1 285 200	1 927 800
D 1 - Semi-professional dryer, condenser	4 877	3 902	5 852
D 2 - Semi-professional dryer, air vented	4 552	3 642	5 462
D 3 - Professional cabinet dryer	5 924	4 739	7 109
D 4 - Professional air tumble dryer (<15 kg)	9 936	7 949	11 923
D 5 - Professional air tumble dryer (15–40 kg)	32 805	26 244	39 366
D 6 - Professional air tumble dryer (>40 kg)	171 360	137 088	205 632
D 7 - Industrial pass-through (transfer) tumble dryer	979 200	783 360	1 175 040

Table 17 Water consumption range for the sensitivity analysis

Base case	Base water consumption (m^3 per year)	Min	Max
WM 1 - Semi-professional washer extractor	85	68	102
WM 2 - Professional washing extractor (<15 kg)	233	186	280
WM 3 - Professional washing extractor (15-40 kg)	741	593	889
WM 4 - Professional washing extractor (>40 kg)	3 266	2 613	3 919
WM 5 - Professional washer dryer	100	80	120
WM 6 - Professional barrier washer	1 081	865	1 297
WM 7 - Washing tunnel machine	27 540	22 032	33 048

Table 18 Detergent consumption range for the sensitivity analysis

Base case	Base detergent consumption (kg per year)	Min	Max
WM 1 - Semi-professional washer extractor	161	129	193
WM 2 - Professional washing extractor (<15 kg)	330	264	396
WM 3 - Professional washing extractor (15-40 kg)	798	638	958
WM 4 - Professional washing extractor (>40 kg)	4 199	3 359	5 039
WM 5 - Professional washer dryer	140	112	168
WM 6 - Professional barrier washer	1 216	973	1 459
WM 7 - Washing tunnel machine	41 310	33 048	49 572

4.1.2 Results

Figure 27 to Figure 82 show the influence of the variation of the energy consumption per cycle on the total energy consumption over the life cycle and the life cycle costs of the different base cases and associated improvement options. For washing machines, the influence of the water consumption on total energy consumption and life cycle costs, and the influence of the detergent consumption on eutrophisation and life cycle costs are also presented.

The option leading to the lowest energy consumption, eutrophication or life cycle costs always remain the same for a given base case, whatever the consumption values considered (base, min or max). However, a few relative changes in the rankings of options happen, for instance:

- For base case D 1, the LCC of the BA product becomes lower than the LCC of the base case with the upper values;
- For base case D 3, the LCC of the BA product becomes higher than the LCC of the base case with the lower values;
- For base case D 4, the LCC of the M 2.3 option becomes lower than the LCC of the base case with the upper values.

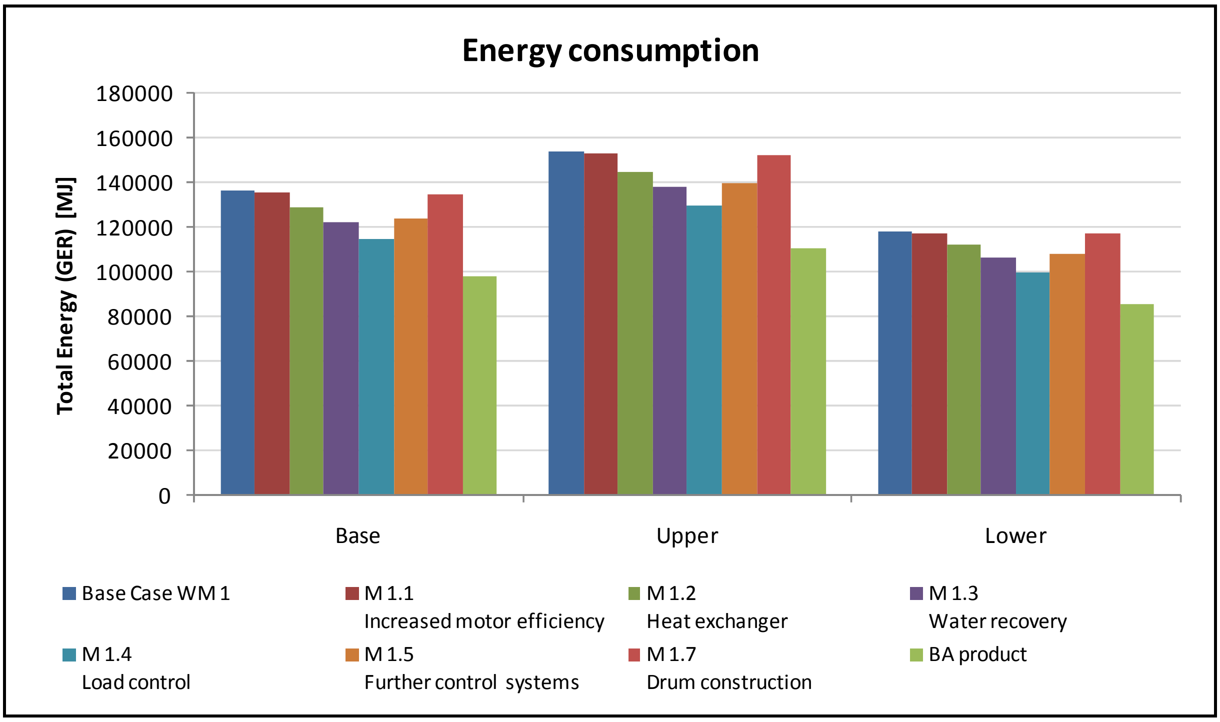

Figure 27 Base case WM 1 and improvement options – impact of energy consumption on total energy over life time by product.

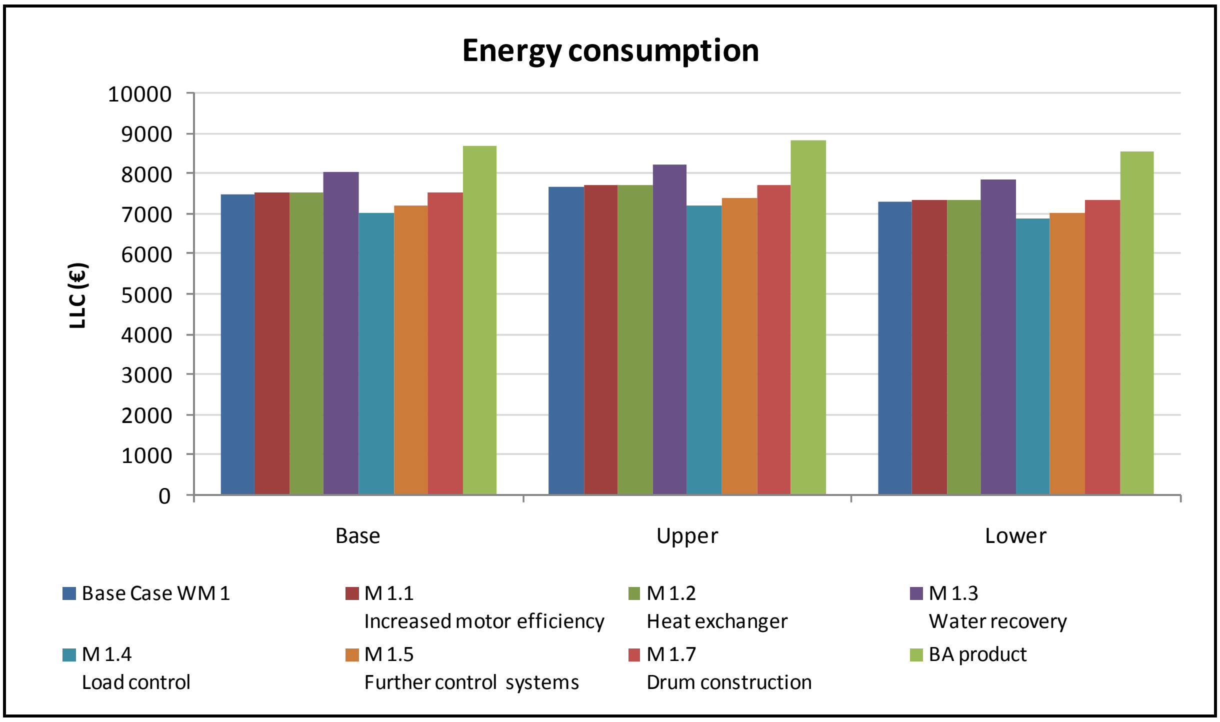

Figure 28 Base case WM 1 and improvement options – impact of energy consumption on LCC by product

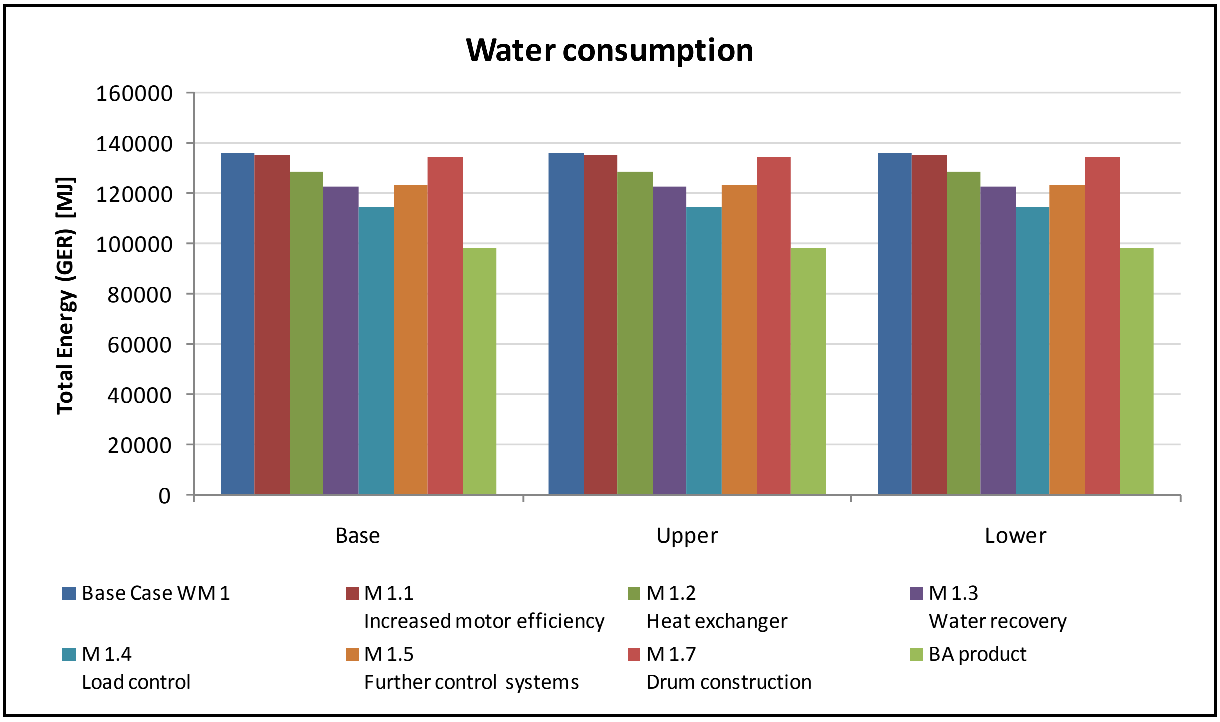

Figure 29 Base case WM 1 and improvement options – impact of water consumption on total energy over life time by product.

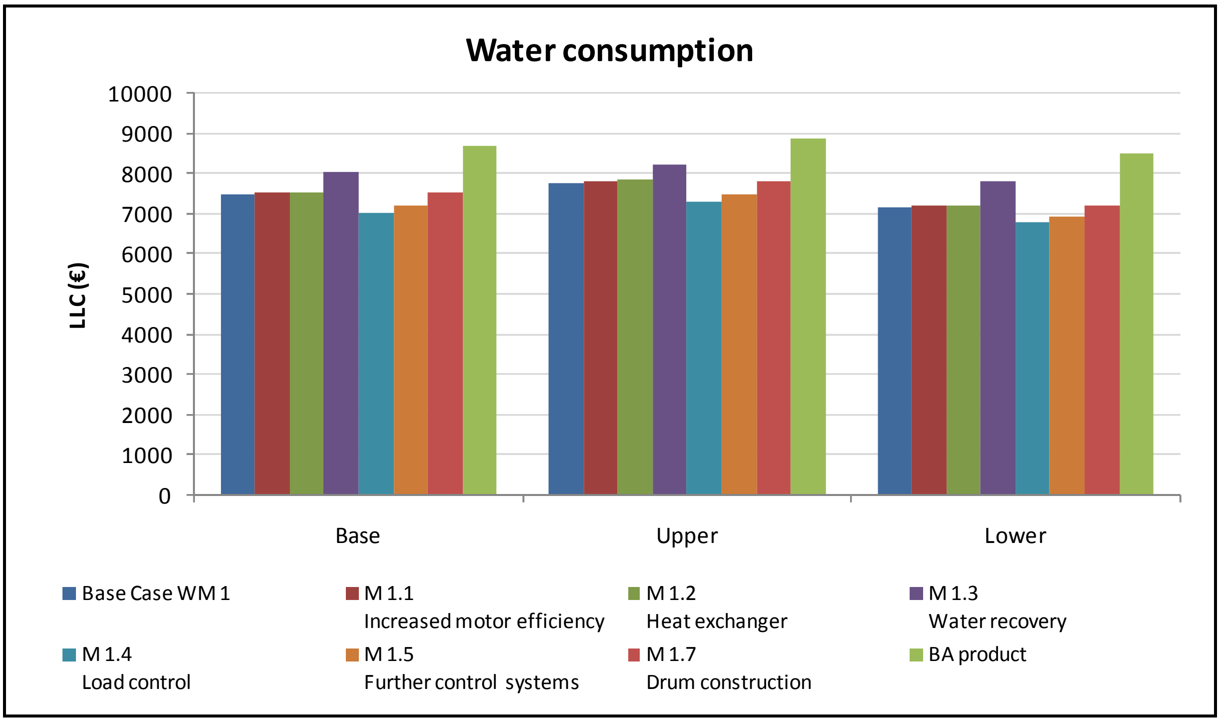

Figure 30 Base case WM 1 and improvement options – impact of water consumption on LCC by product

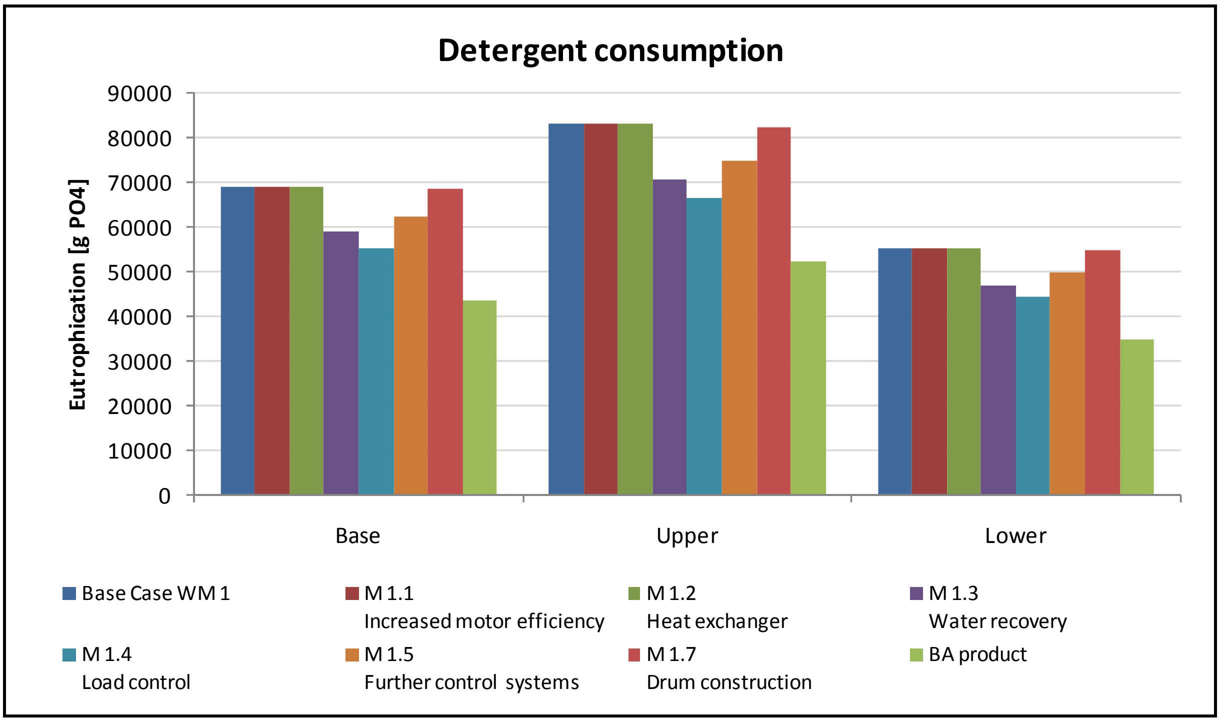

Figure 31 Base case WM 1 and improvement options – impact of detergent consumption on eutrophication over life time by product

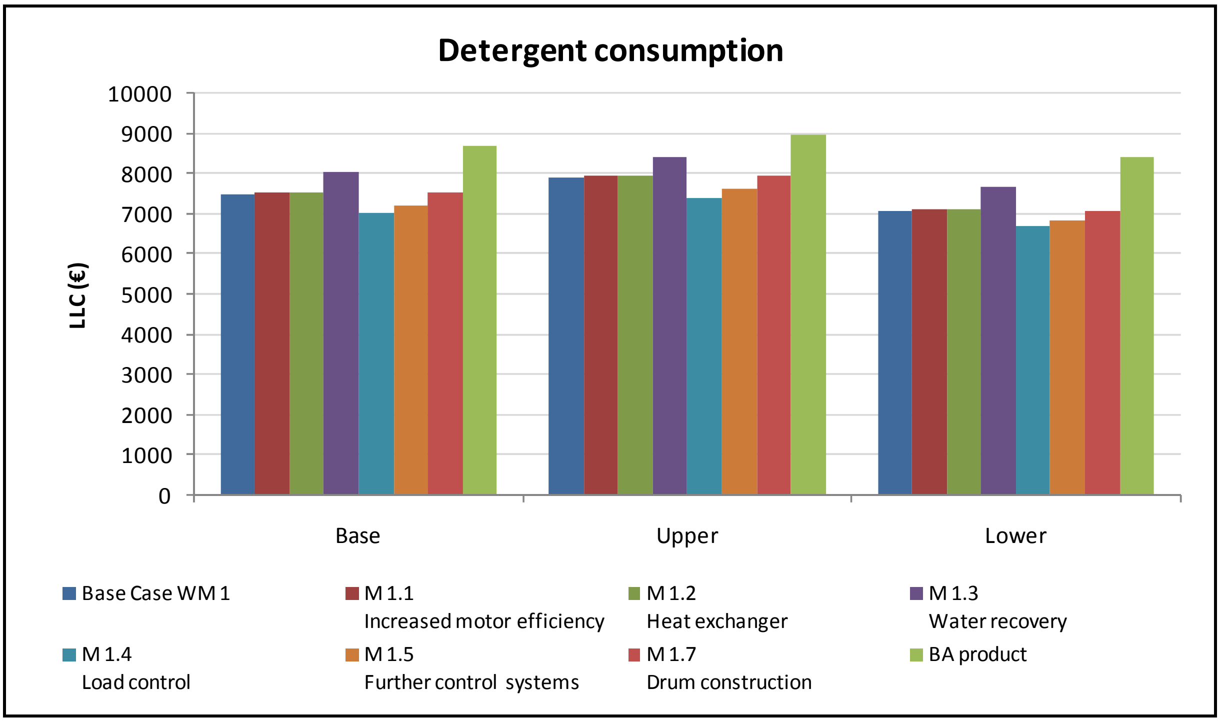

Figure 32 Base case WM 1 and improvement options – impact of detergent consumption on LCC by product

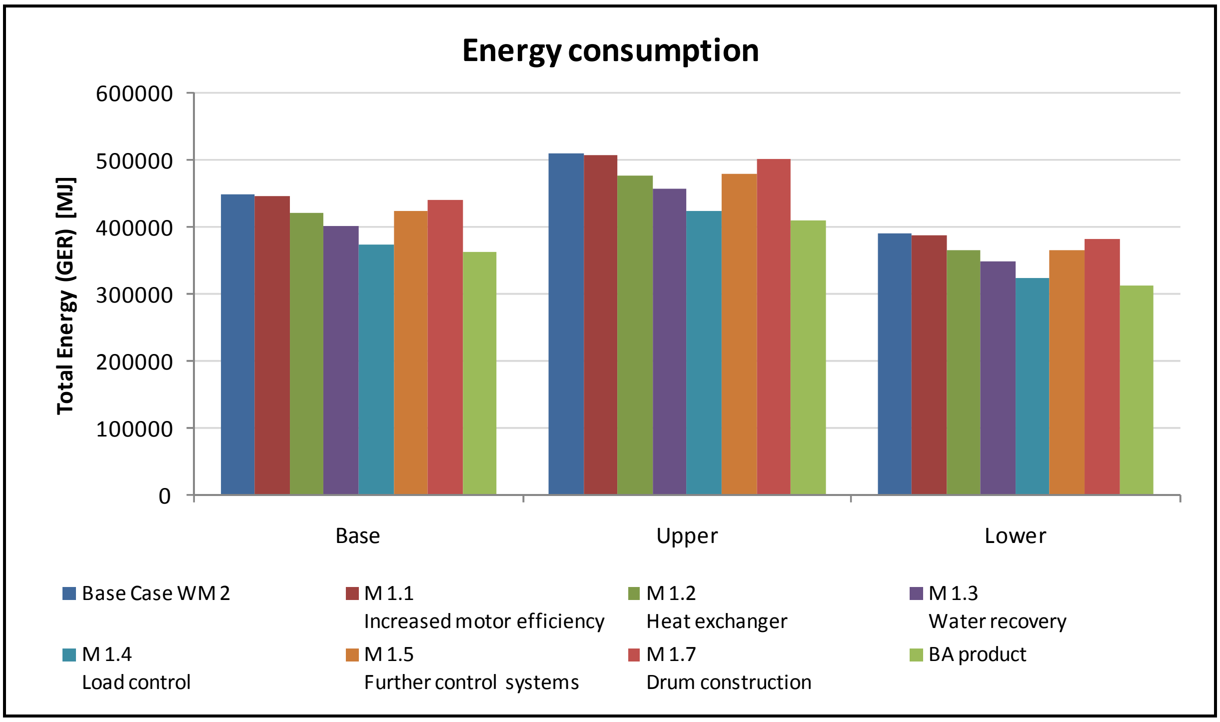

Figure 33 Base case WM 2 and improvement options – impact of energy consumption on total energy over life time by product.

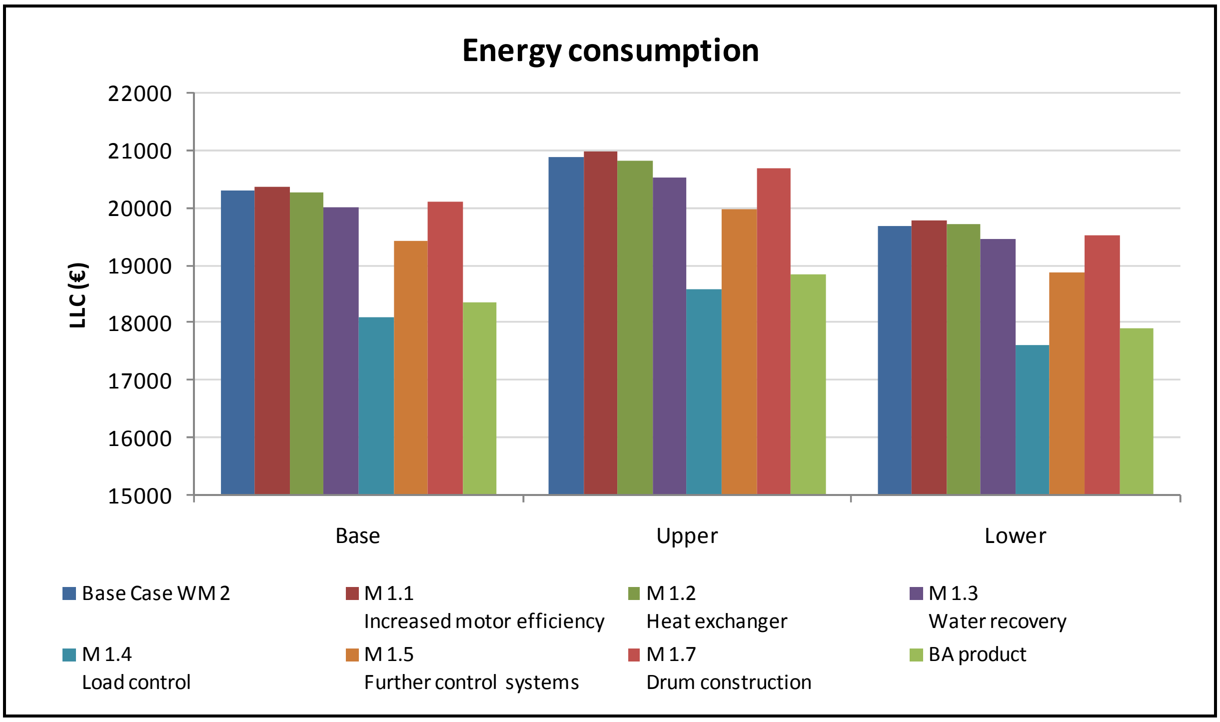

Figure 34 Base case WM 2 and improvement options – impact of energy consumption on LCC by product

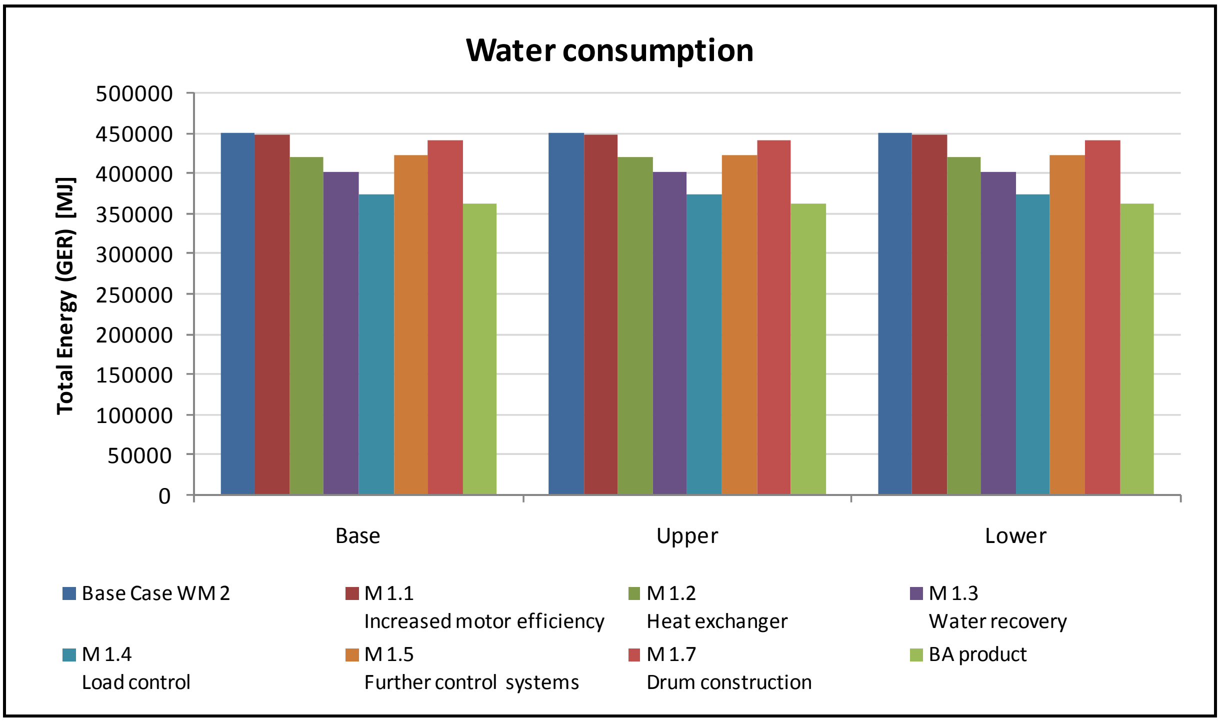

Figure 35 Base case WM 2 and improvement options – impact of water consumption on total energy over life time by product

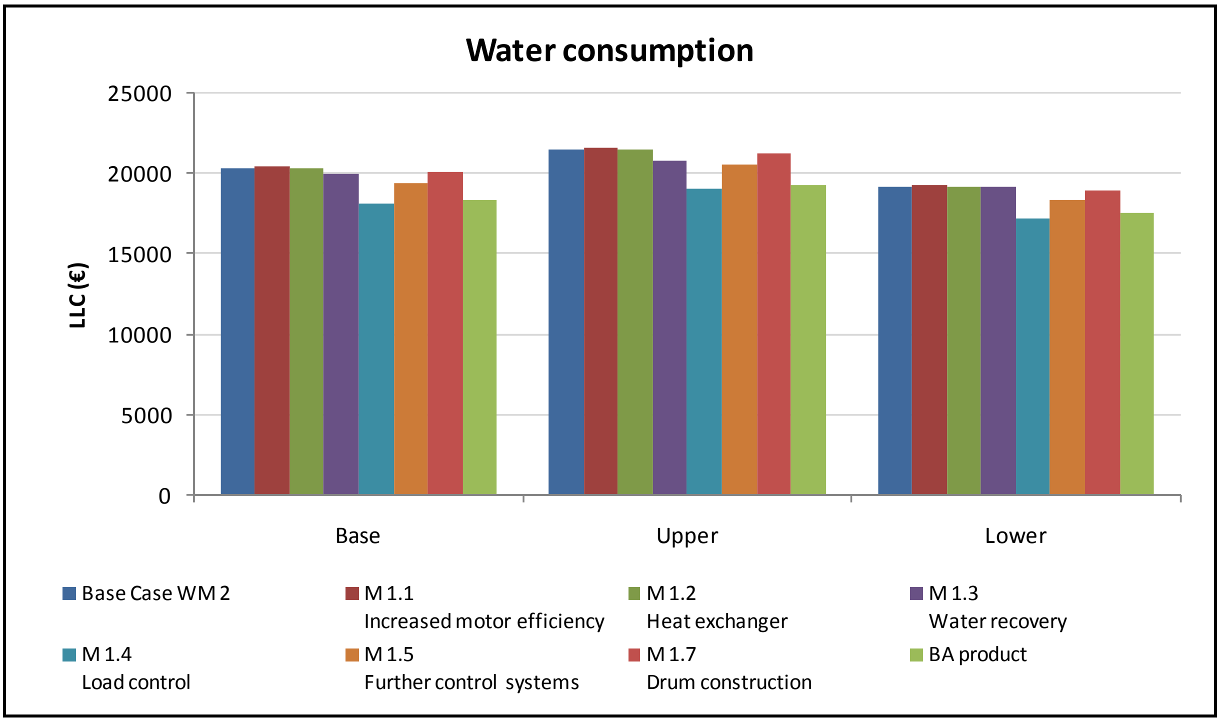

Figure 36 Base case WM 2 and improvement options – impact of water consumption on LCC by product

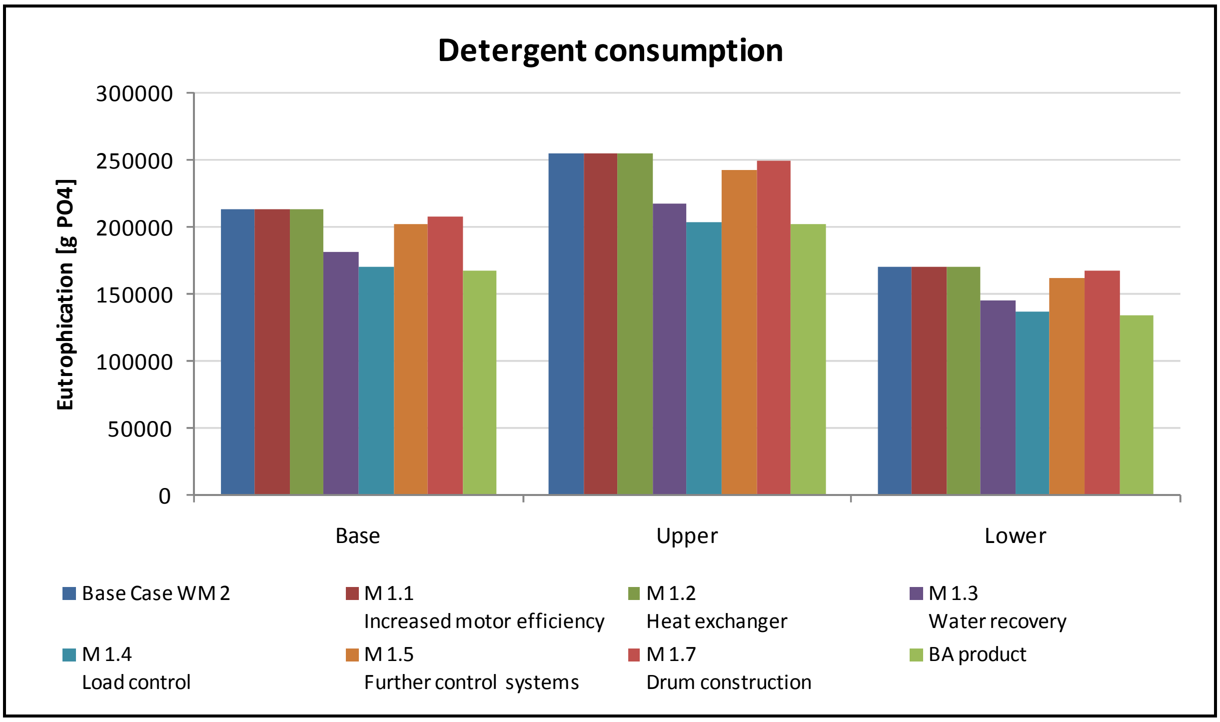

Figure 37 Base case WM 2 and improvement options – impact of detergent consumption on eutrophication over life time by product

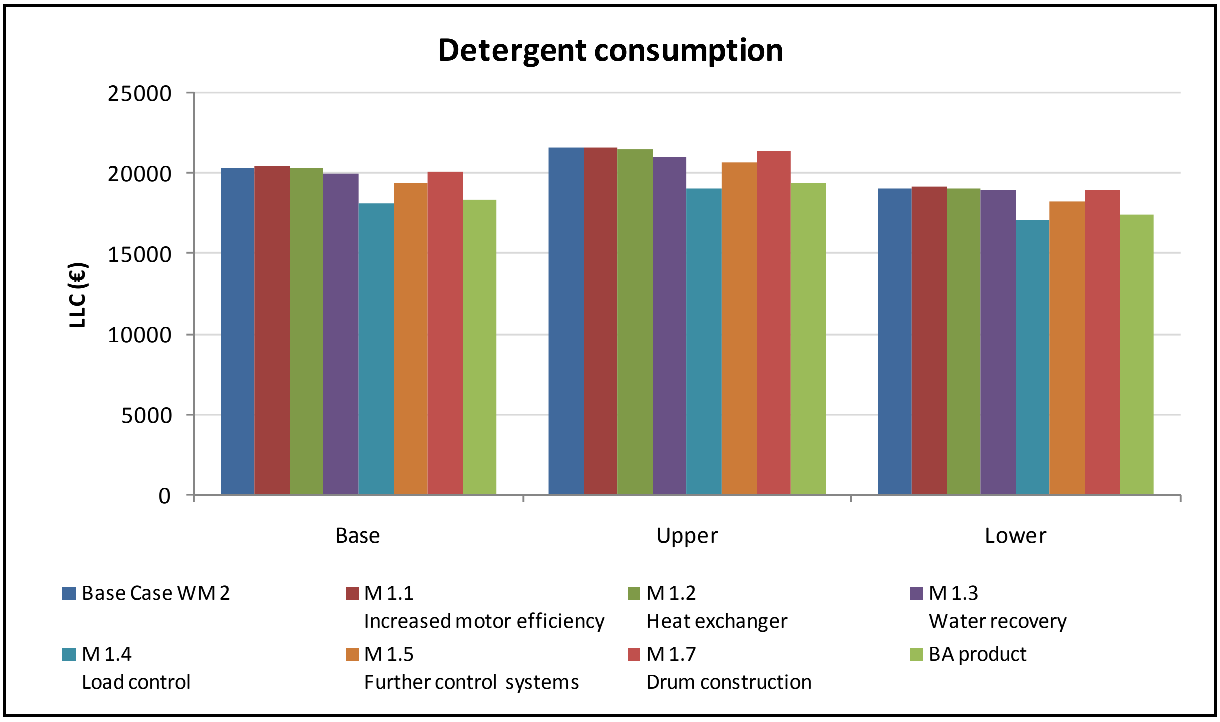

Figure 38 Base case WM 2 and improvement options – impact of detergent consumption on LCC by product

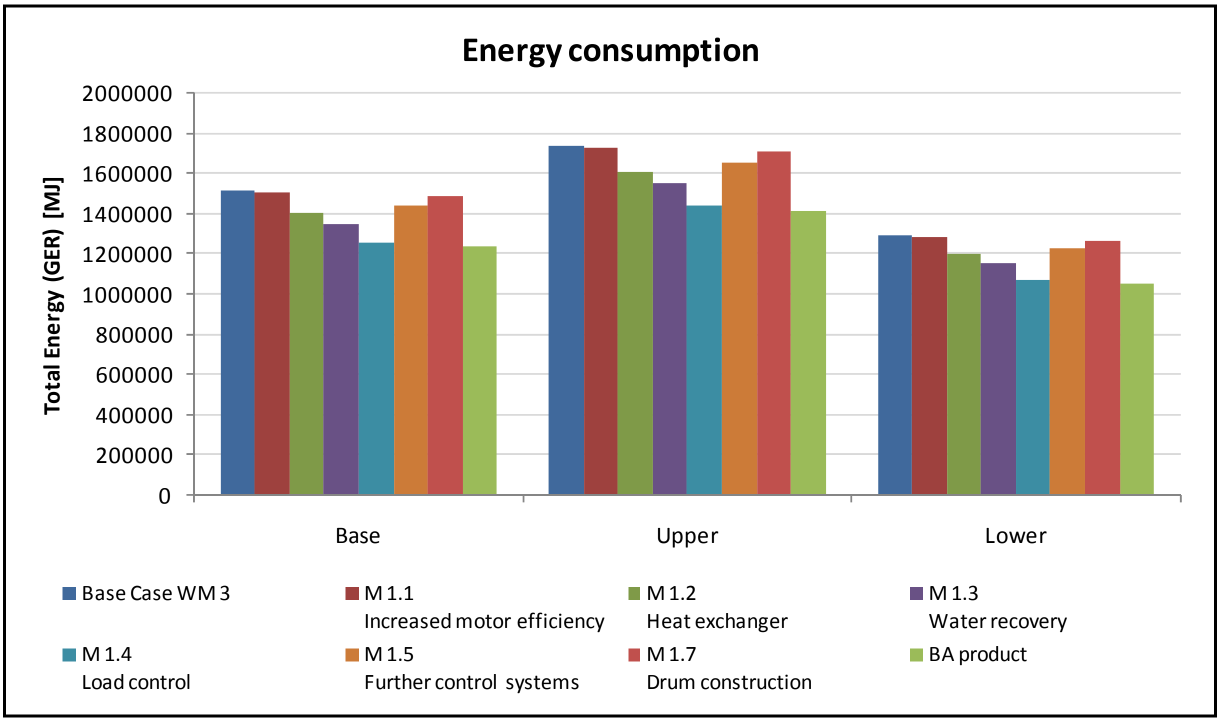

Figure 39 Base case WM 3 and improvement options – impact of energy consumption on total energy over life time by product

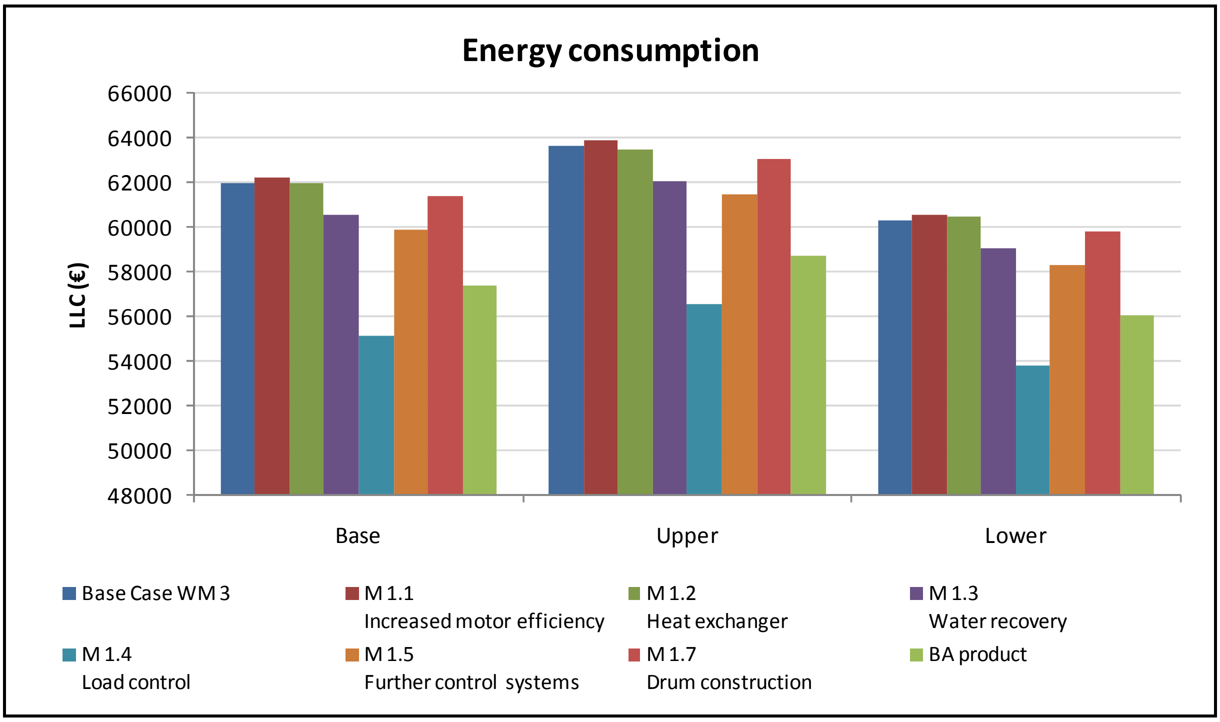

Figure 40 Base case WM 3 and improvement options – impact of energy consumption on LCC by product

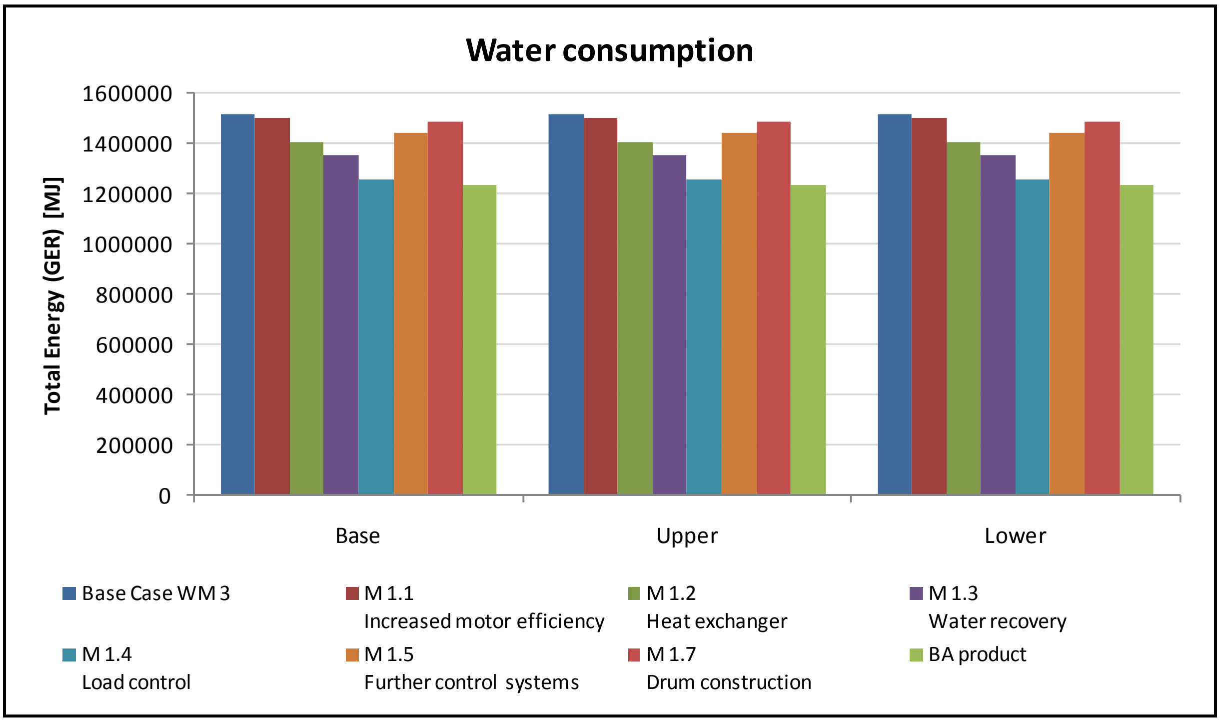

Figure 41 Base case WM 3 and improvement options – impact of water consumption on total energy over life time by product

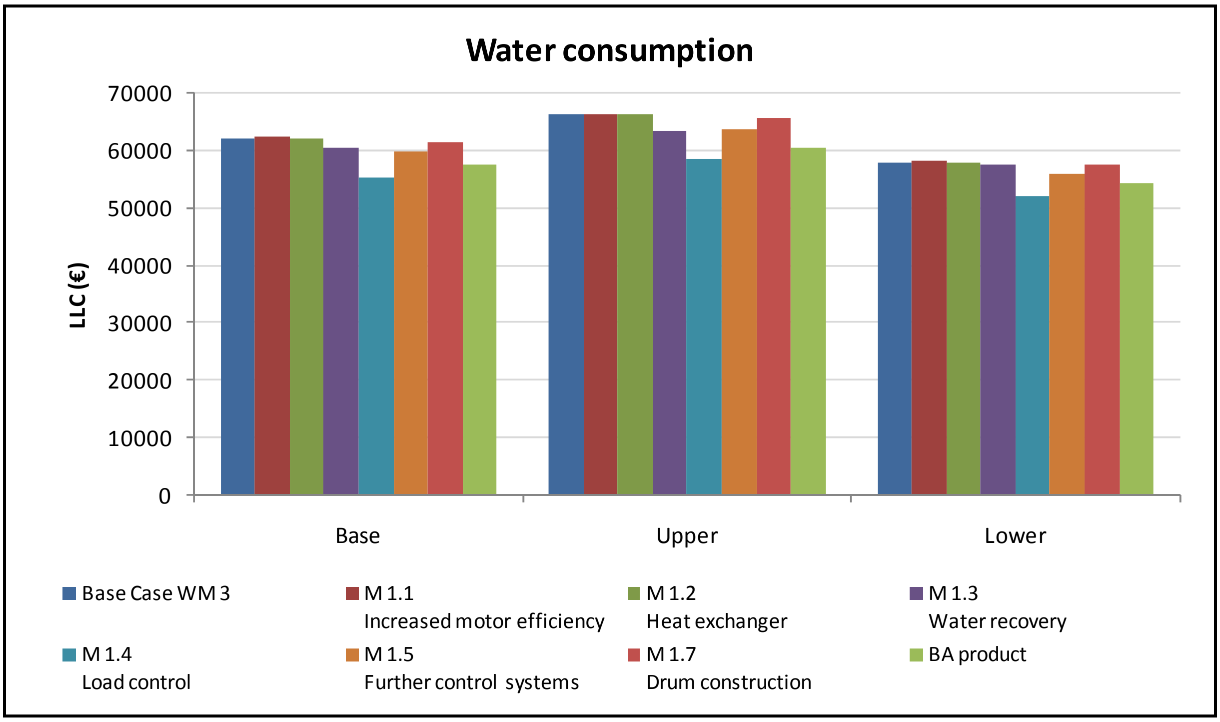

Figure 42 Base case WM 3 and improvement options – impact of water consumption on LCC by product

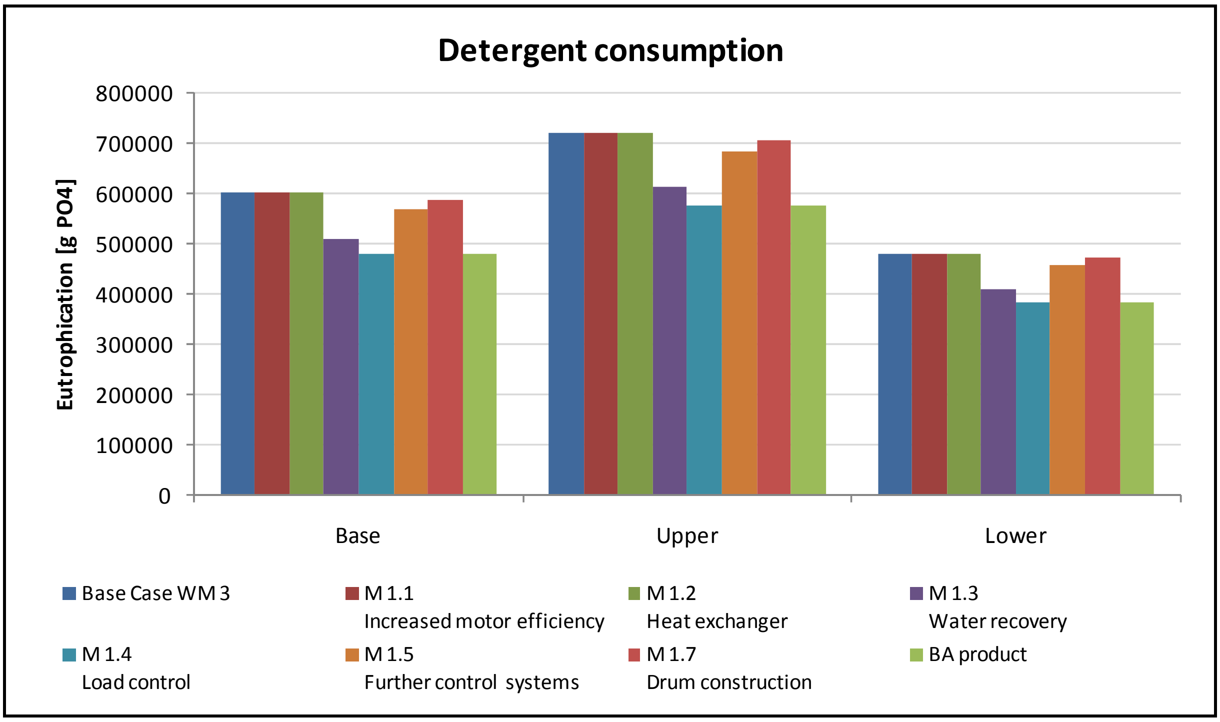

Figure 43 Base case WM 3 and improvement options – impact of detergent consumption on eutrophication over life time by product

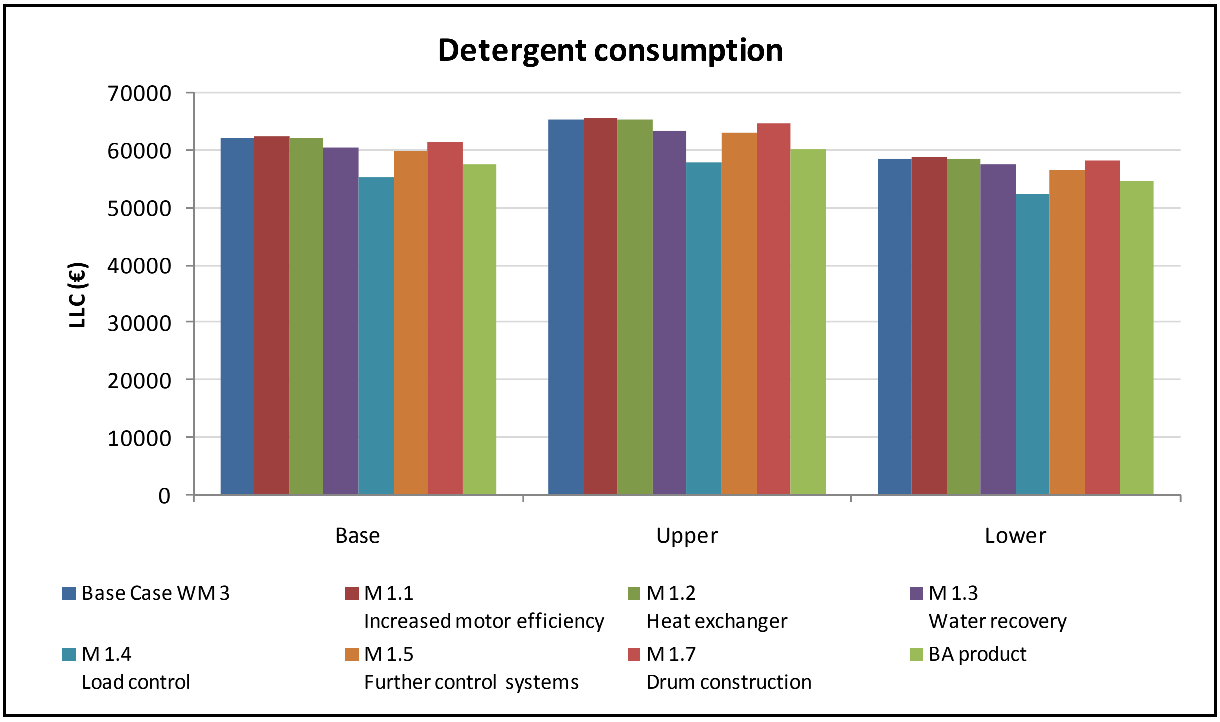

Figure 44 Base case WM 3 and improvement options – impact of detergent consumption on LCC by product

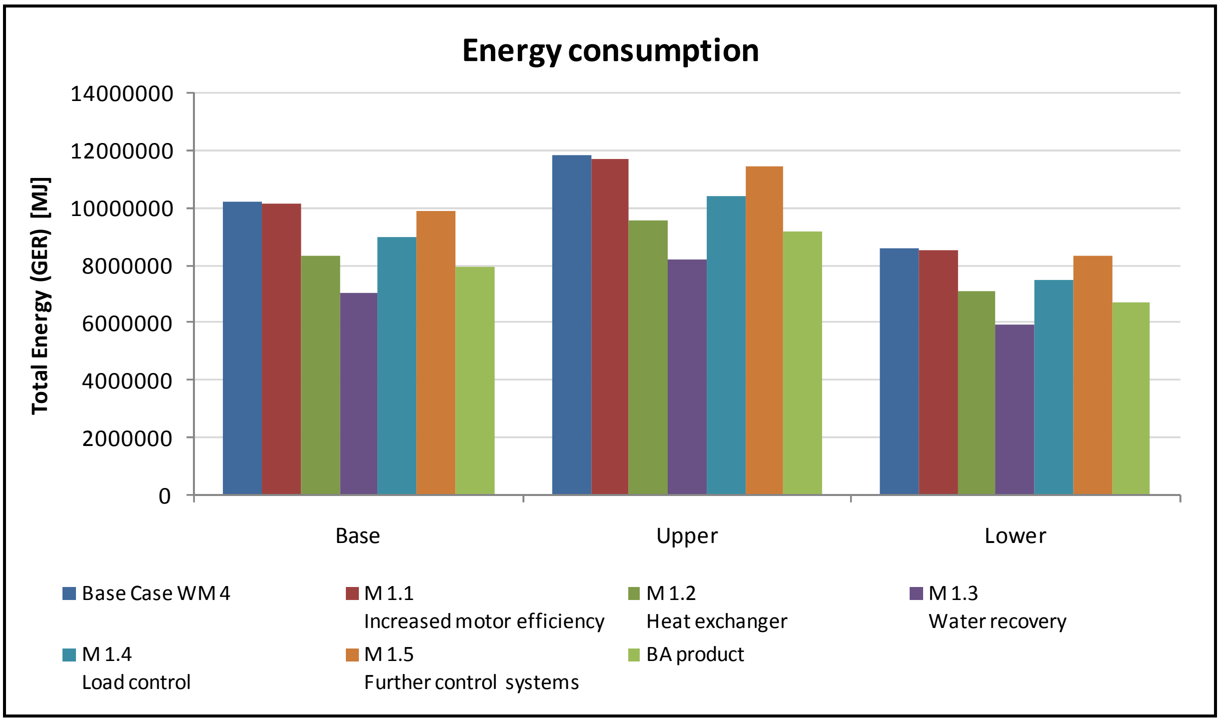

Figure 45 Base case WM 4 and improvement options – impact of energy consumption on total energy over life time by product

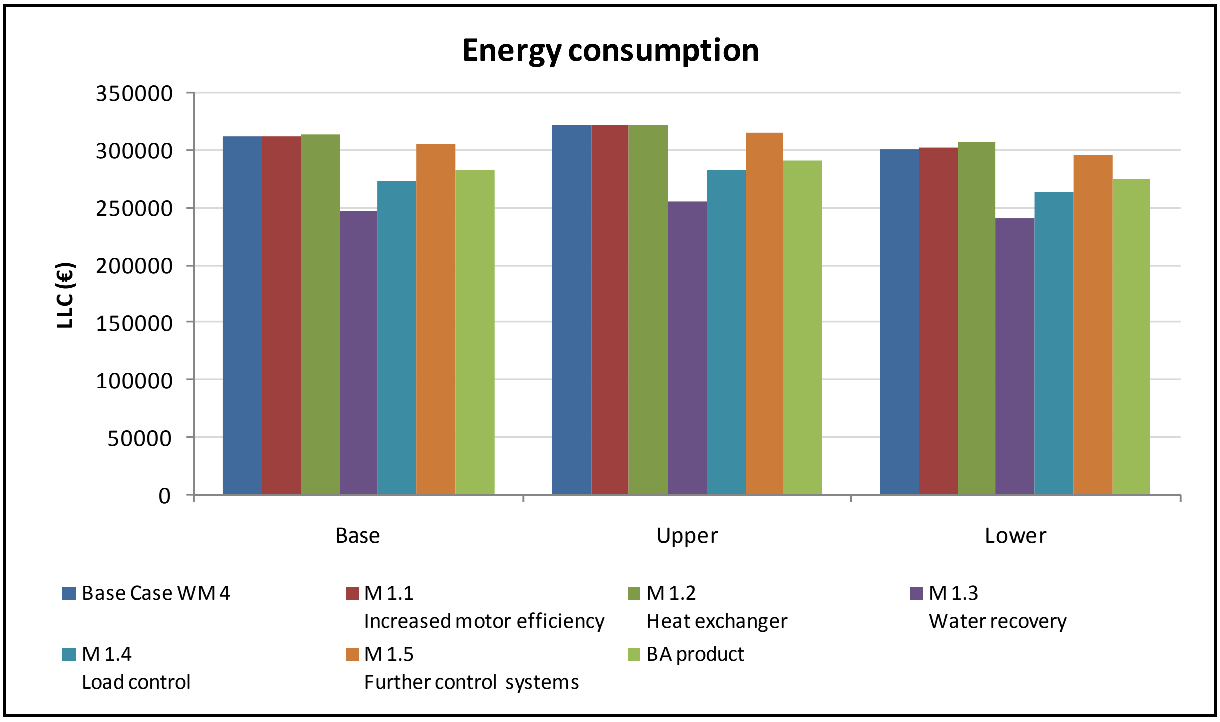

Figure 46 Base case WM 4 and improvement options – impact of energy consumption on LCC by product

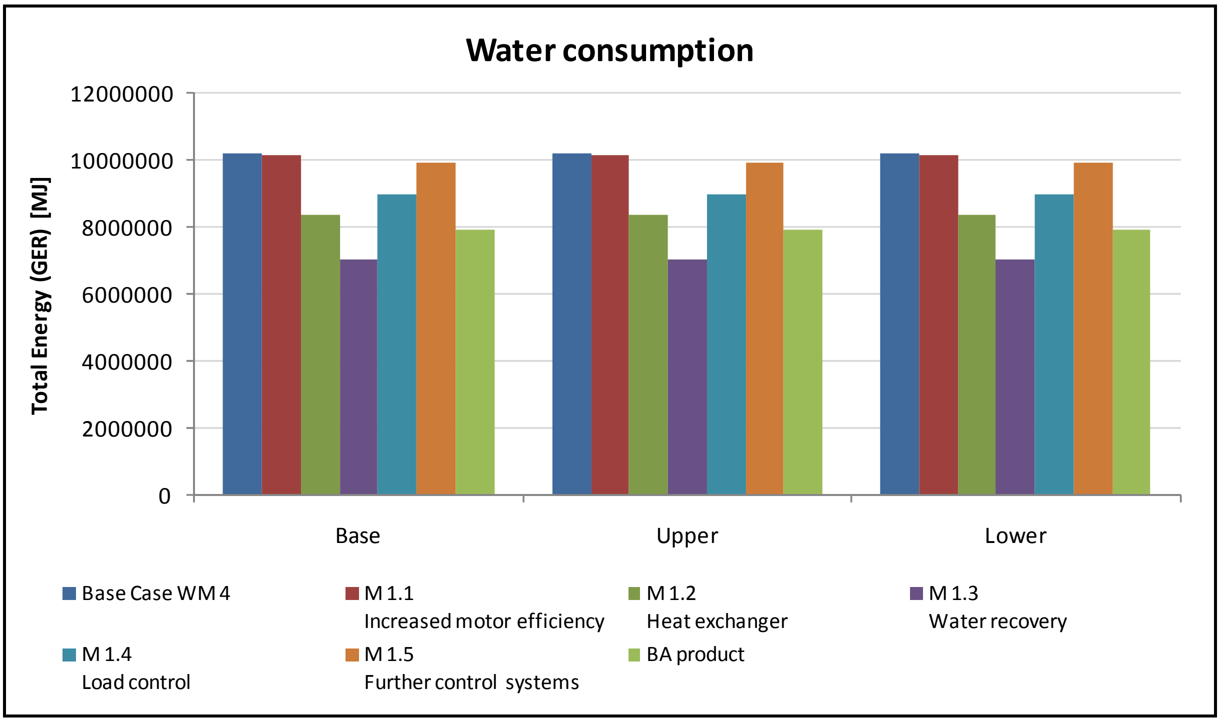

Figure 47 Base case WM 4 and improvement options – impact of water consumption on total energy over life time by product

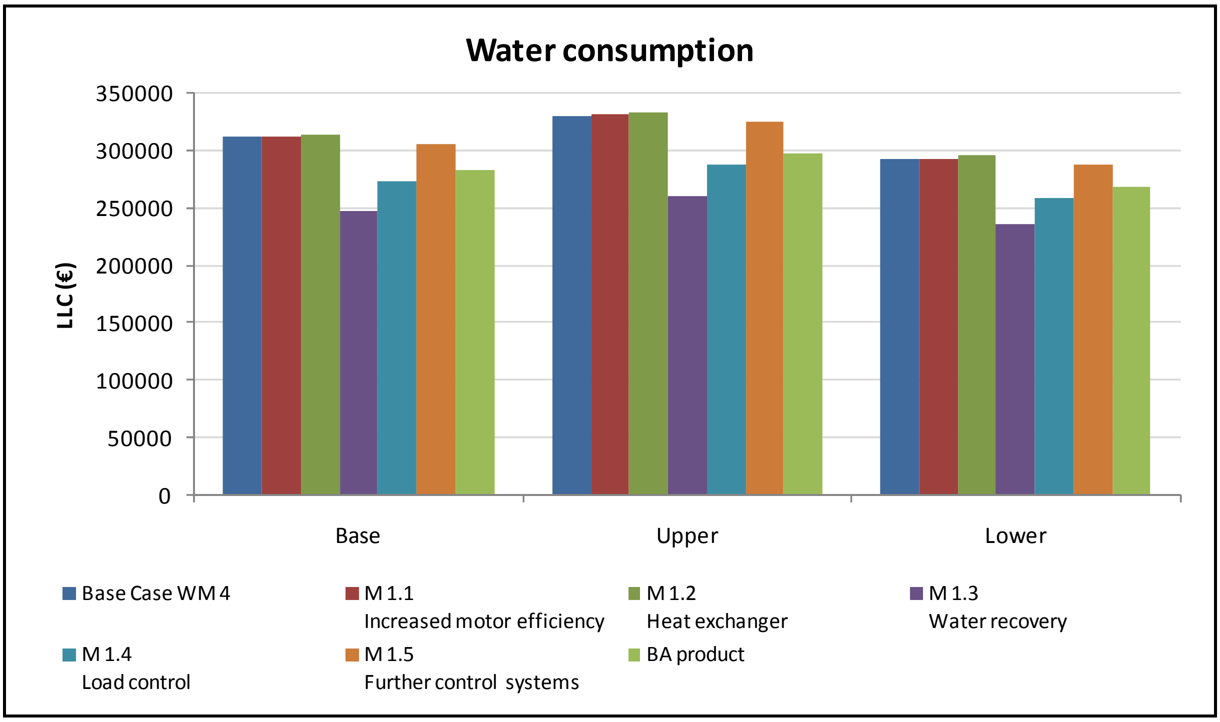

Figure 48 Base case WM 4 and improvement options – impact of water consumption on LCC by product

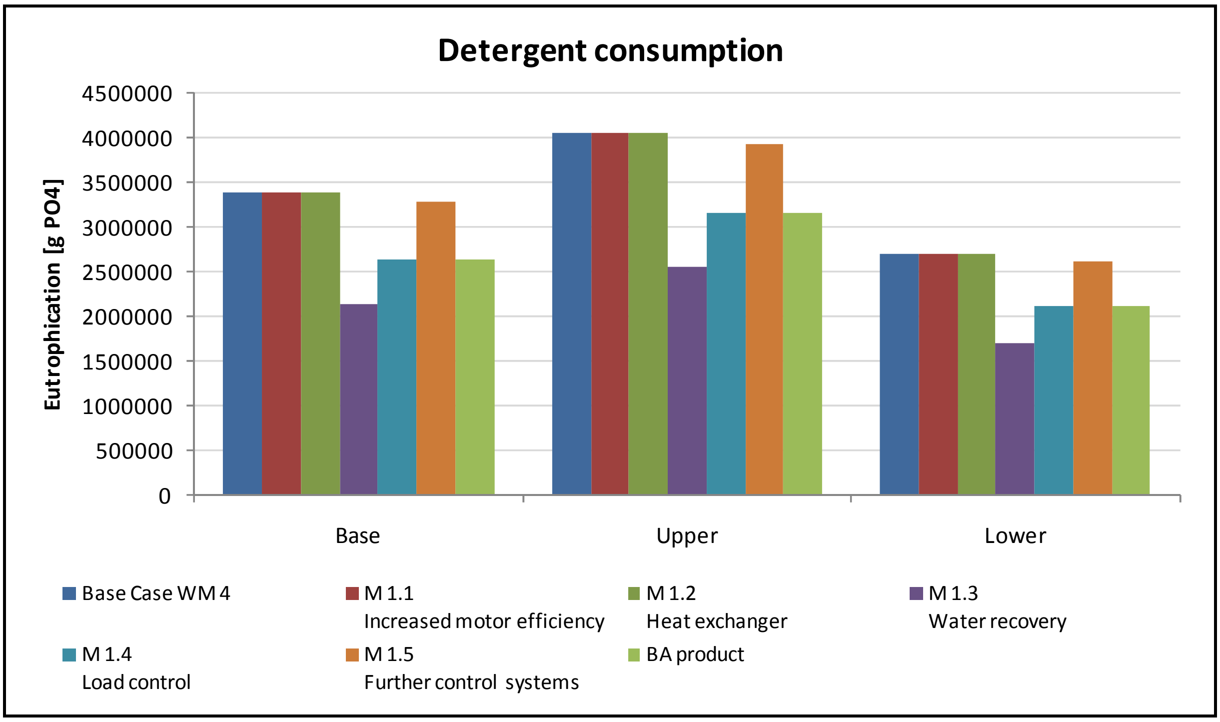

Figure 49 Base case WM 4 and improvement options – impact of detergent consumption on eutrophication over life time by product

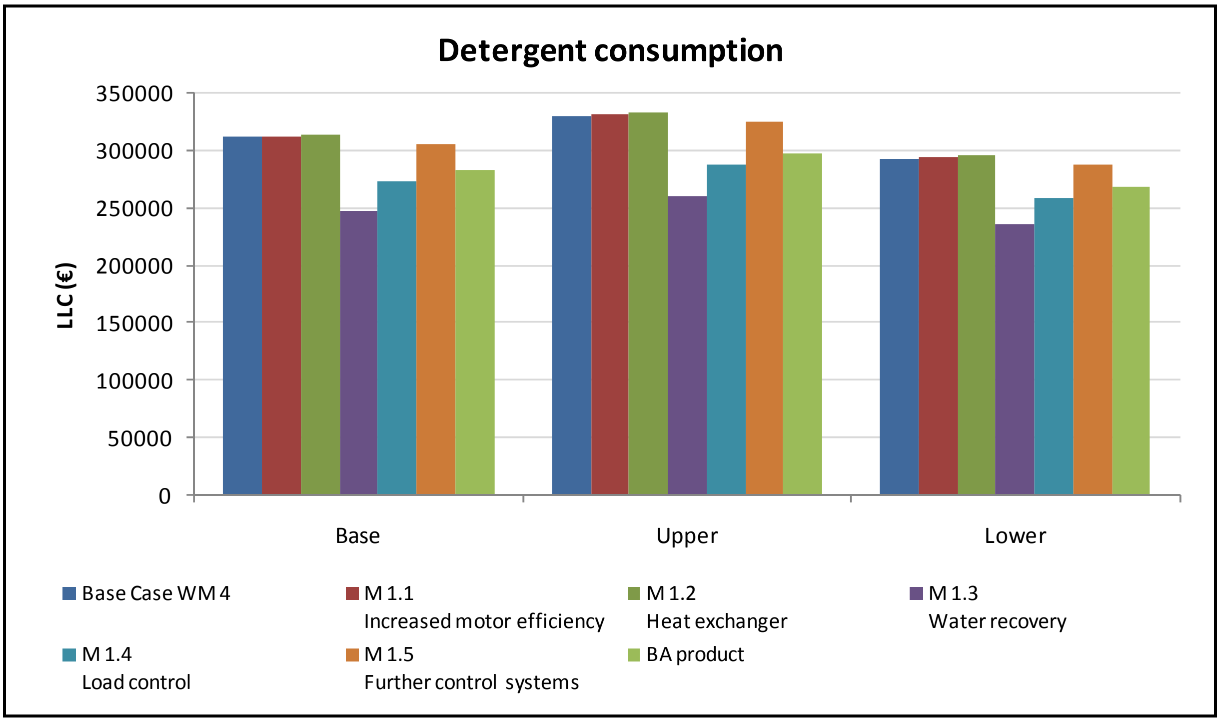

Figure 50 Base case WM 4 and improvement options – impact of detergent consumption on LCC by product

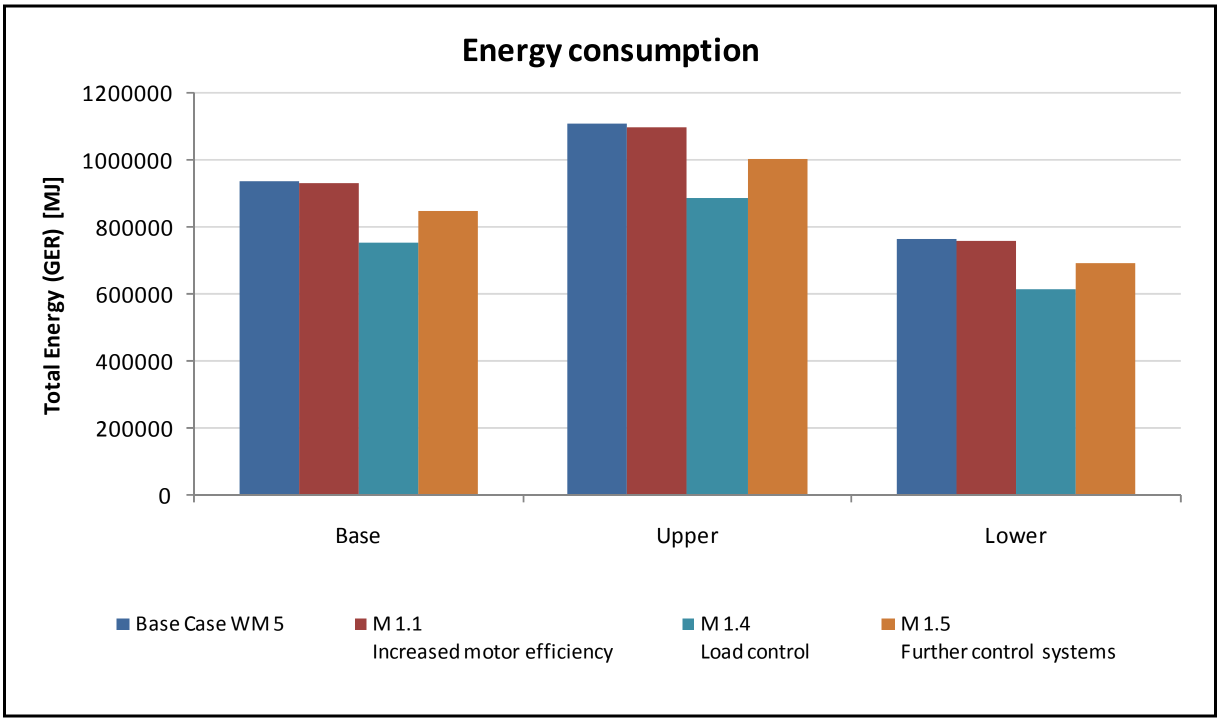

Figure 51 Base case WM 5 and improvement options – impact of energy consumption on total energy over life time by product

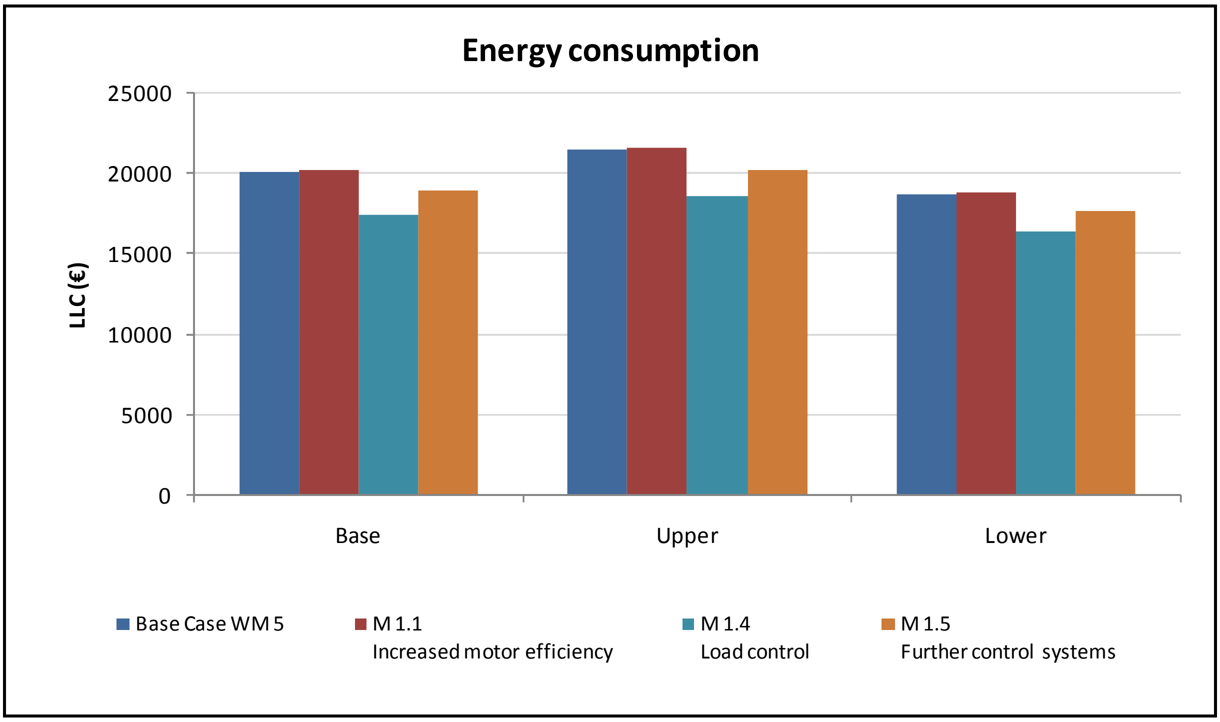

Figure 52 Base case WM 5 and improvement options – impact of energy consumption on LCC by product

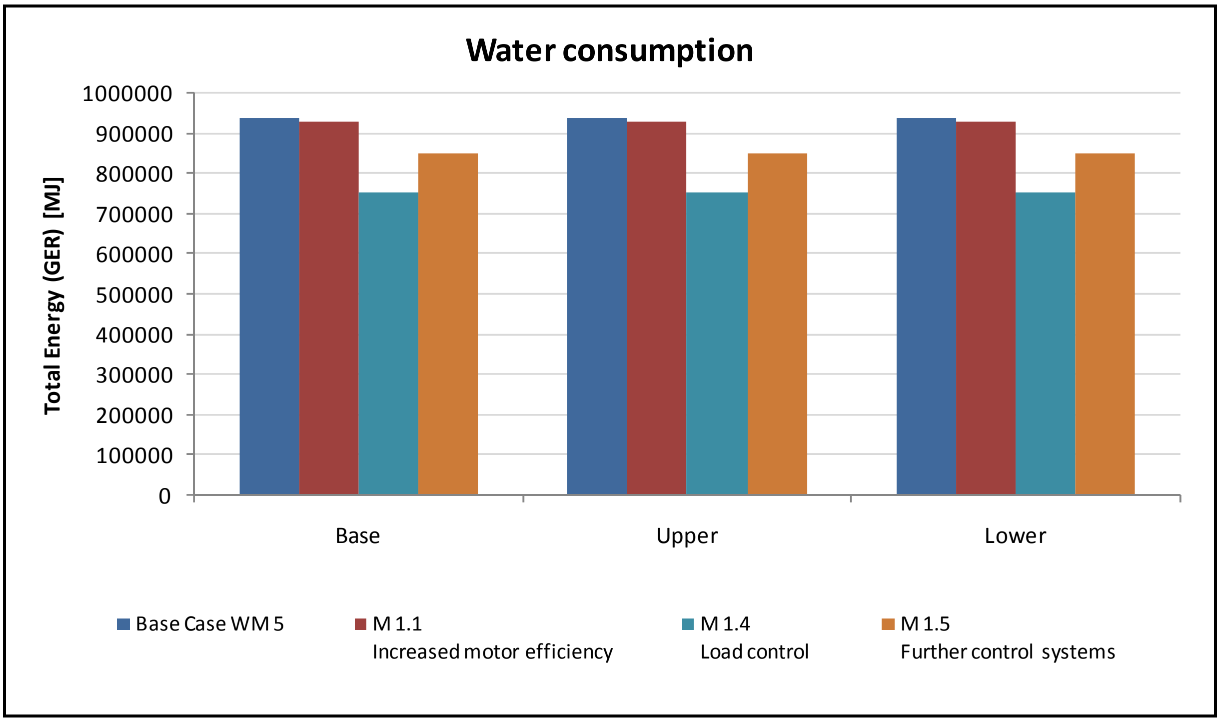

Figure 53 Base case WM 5 and improvement options – impact of water consumption on total energy over life time by product

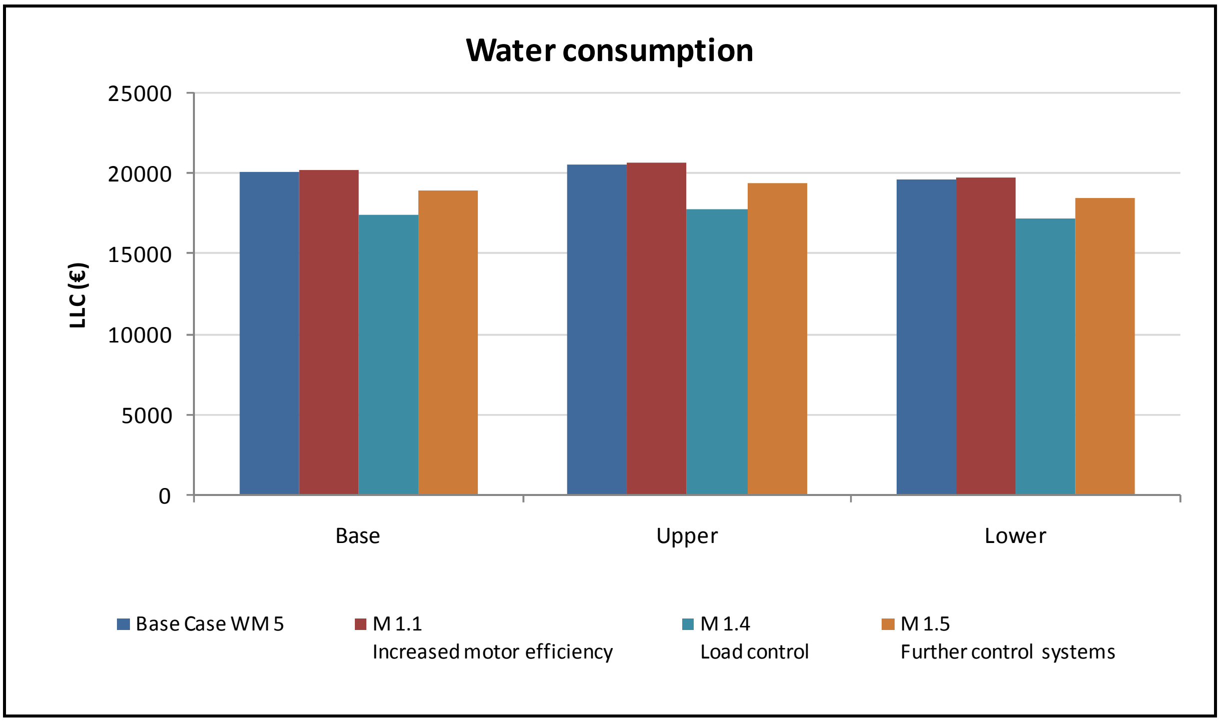

Figure 54 Base case WM 5 and improvement options – impact of water consumption on LCC by product

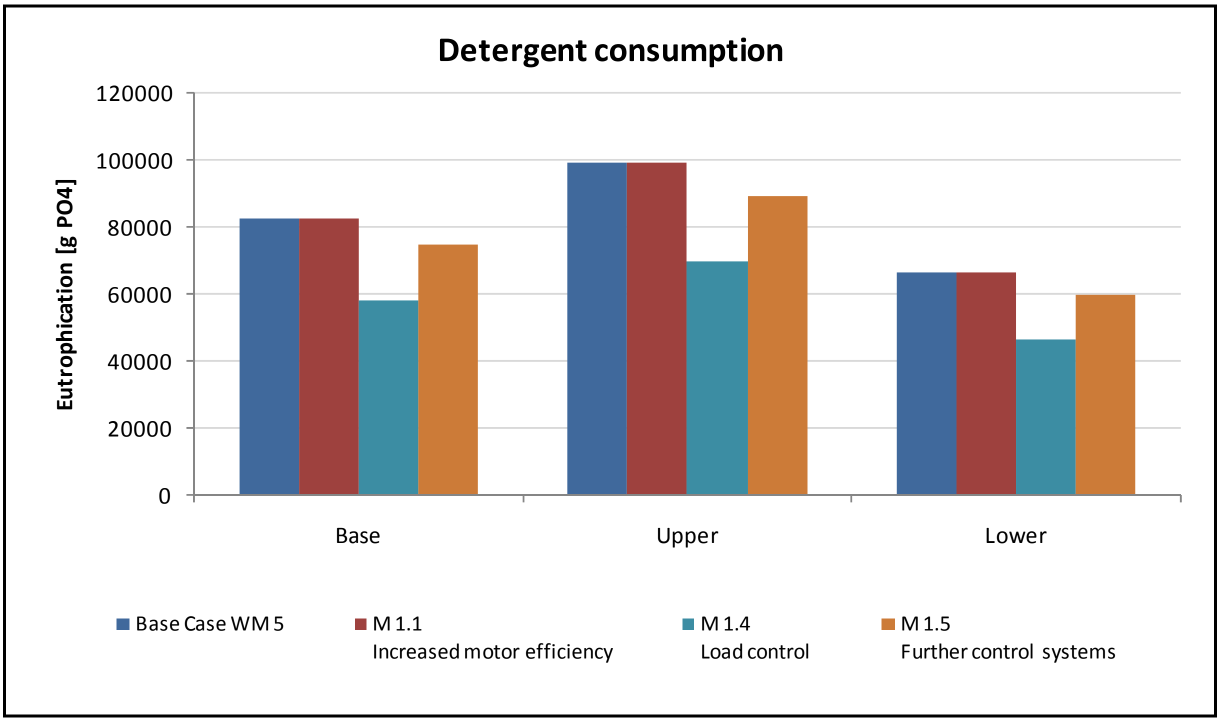

Figure 55 Base case WM 5 and improvement options – impact of detergent consumption on eutrophication over life time by product

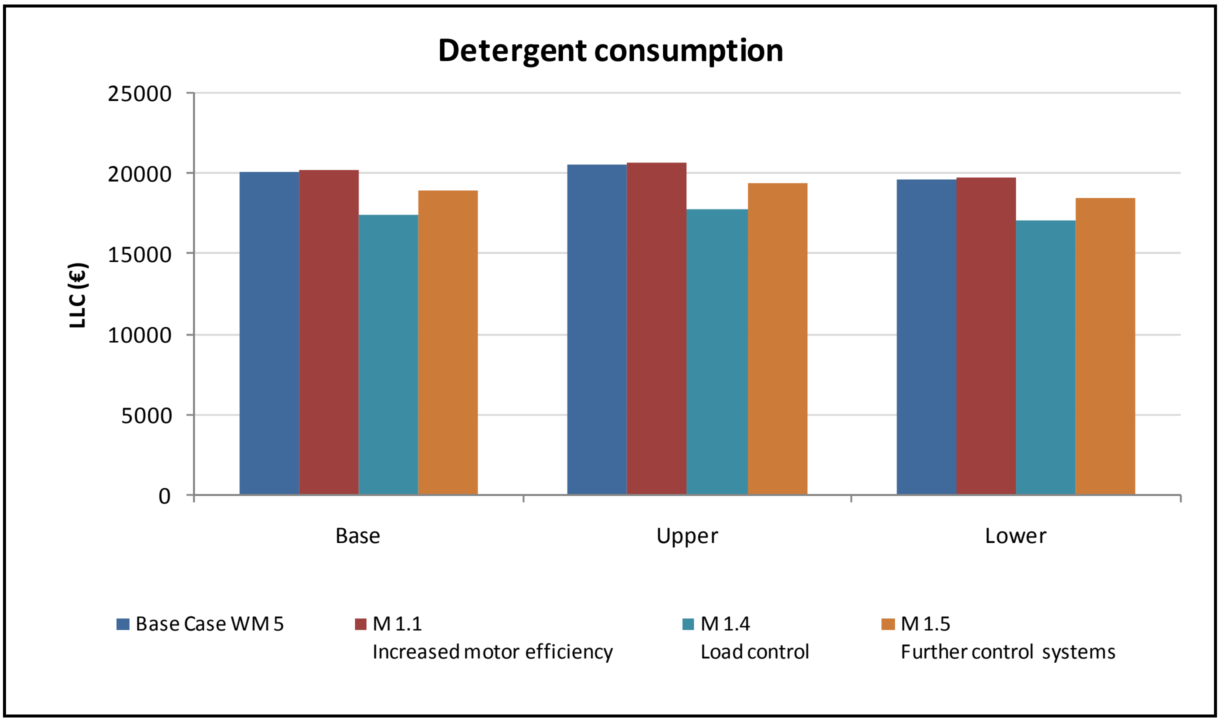

Figure 56 Base case WM 5 and improvement options – impact of detergent consumption on LCC by product

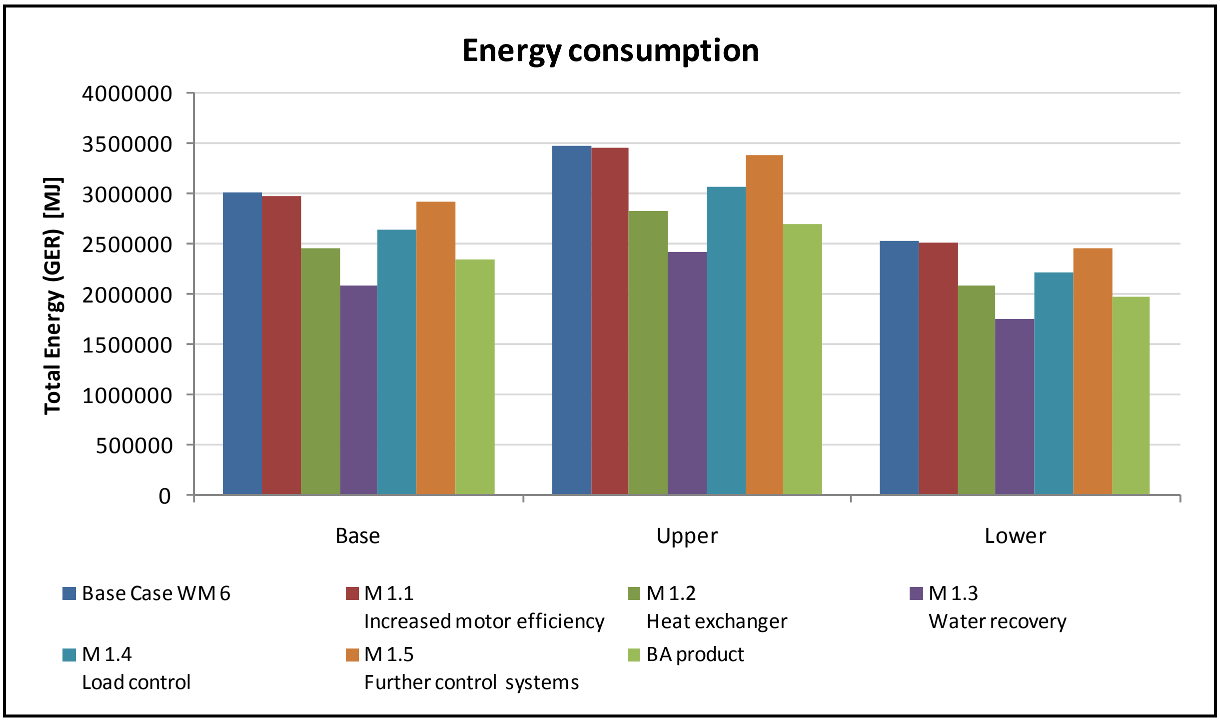

Figure 57 Base case WM 6 and improvement options – impact of energy consumption on total energy over life time by product

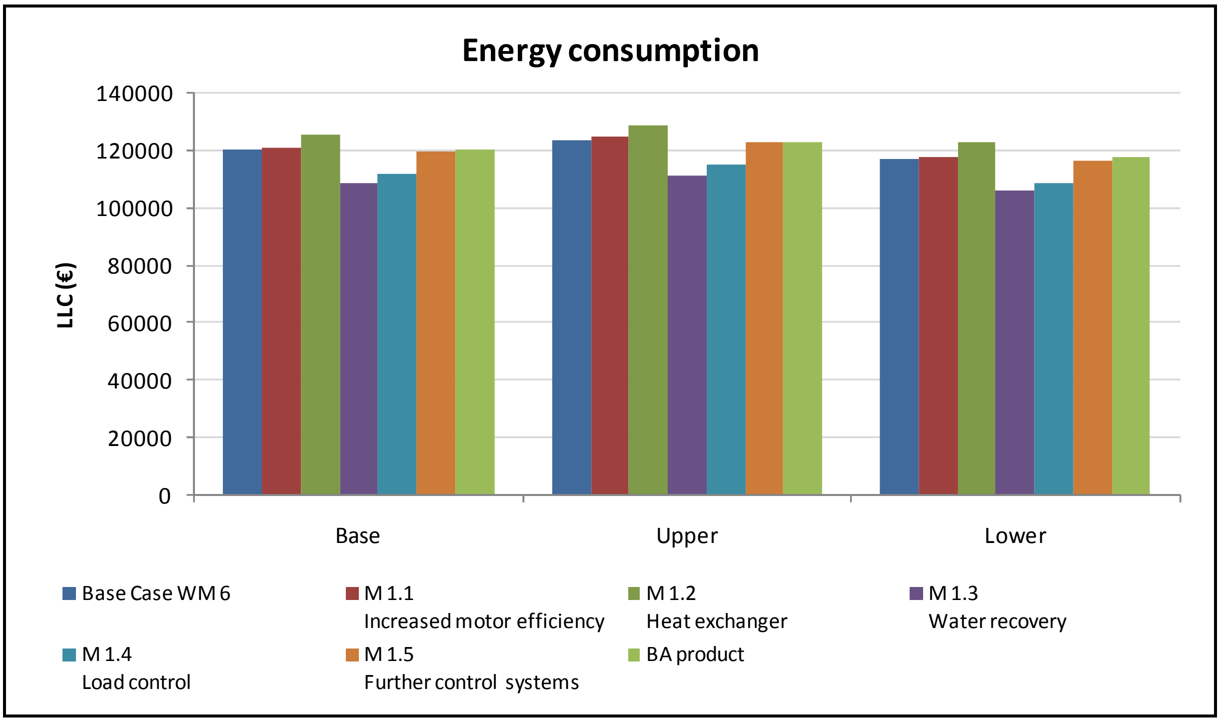

Figure 58 Base case WM 6 and improvement options – impact of energy consumption on LCC by product

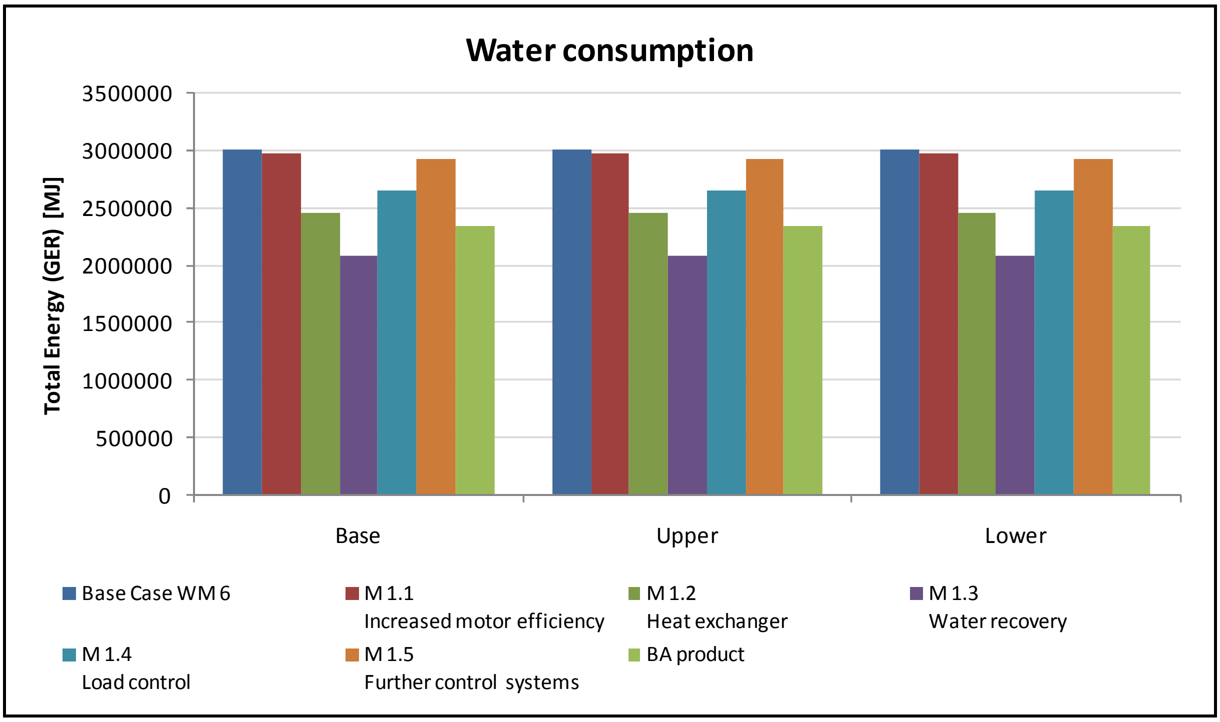

Figure 59 Base case WM 6 and improvement options – impact of water consumption on total energy over life time by product

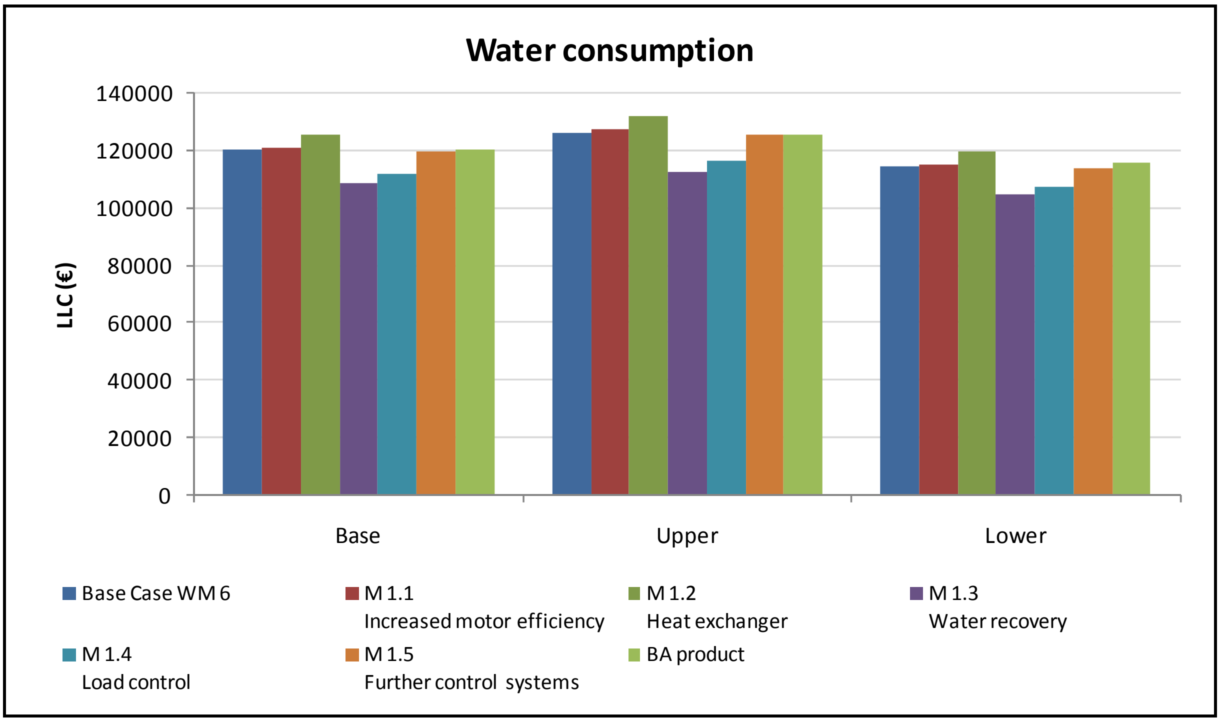

Figure 60 Base case WM 6 and improvement options – impact of water consumption on LCC by product

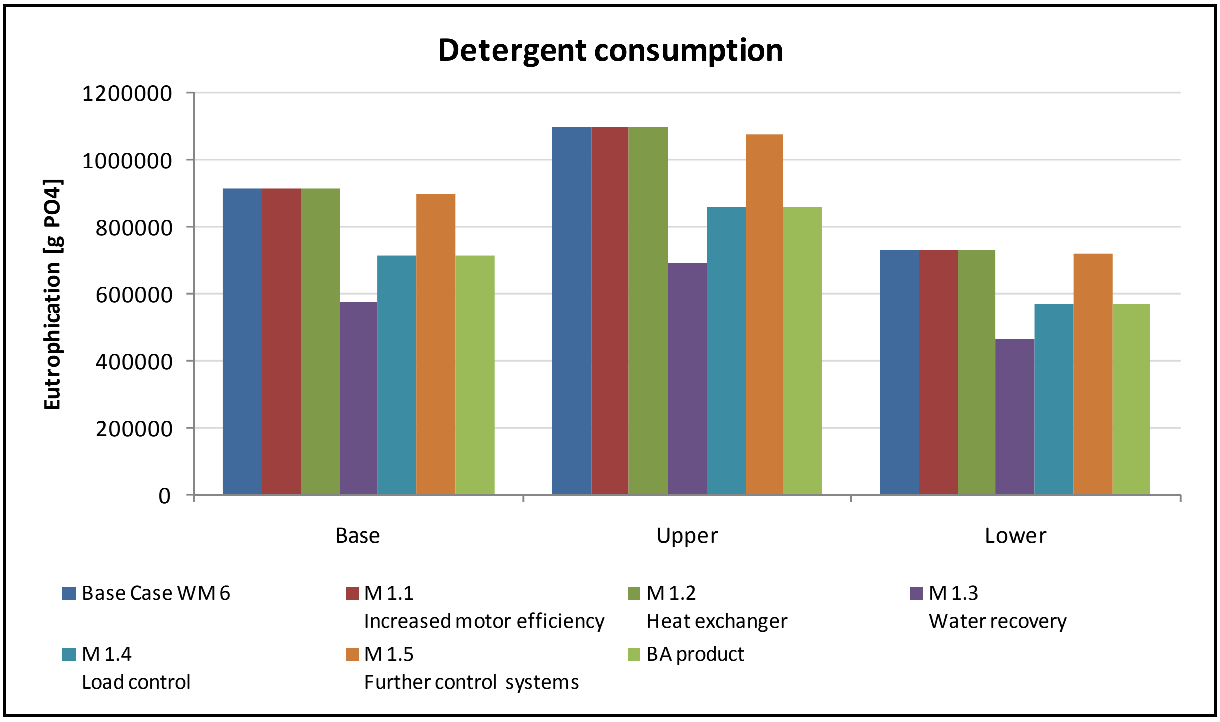

Figure 61 Base case WM 6 and improvement options – impact of detergent consumption on eutrophication over life time by product

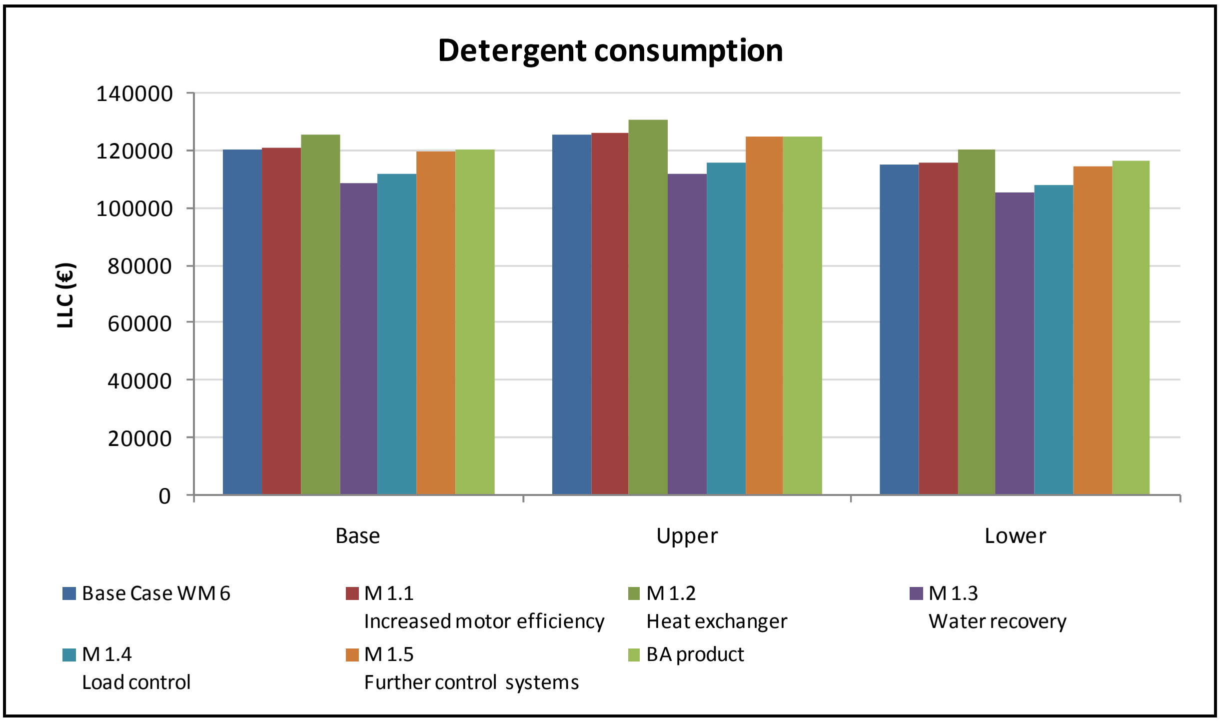

Figure 62 Base case WM 6 and improvement options – impact of detergent consumption on LCC by product

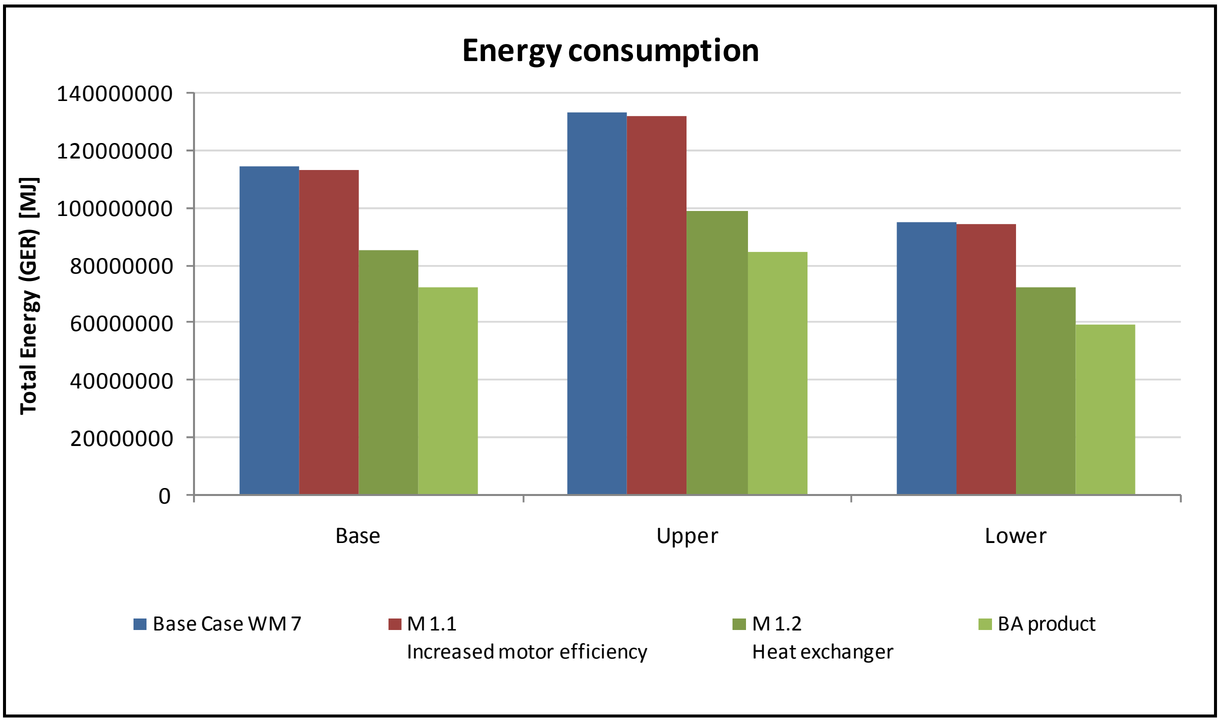

Figure 63 Base case WM 7 and improvement options – impact of energy consumption on total energy over life time by product

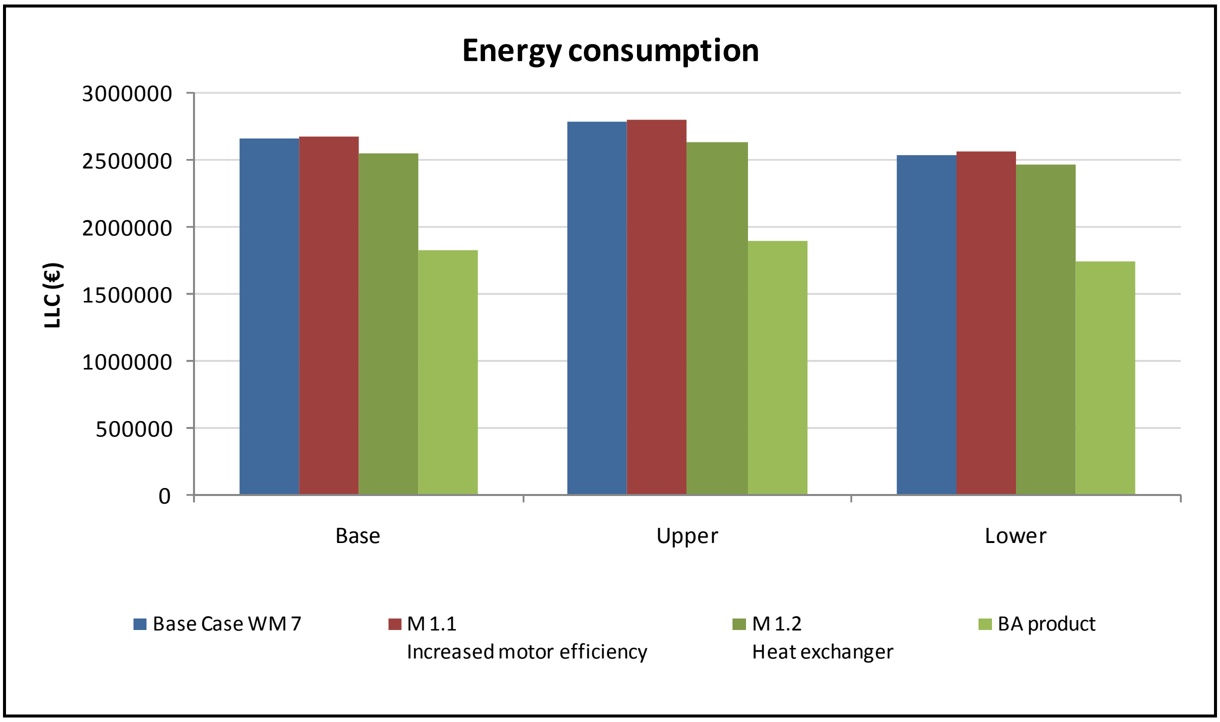

Figure 64 Base case WM 7 and improvement options – impact of energy consumption on LCC by product

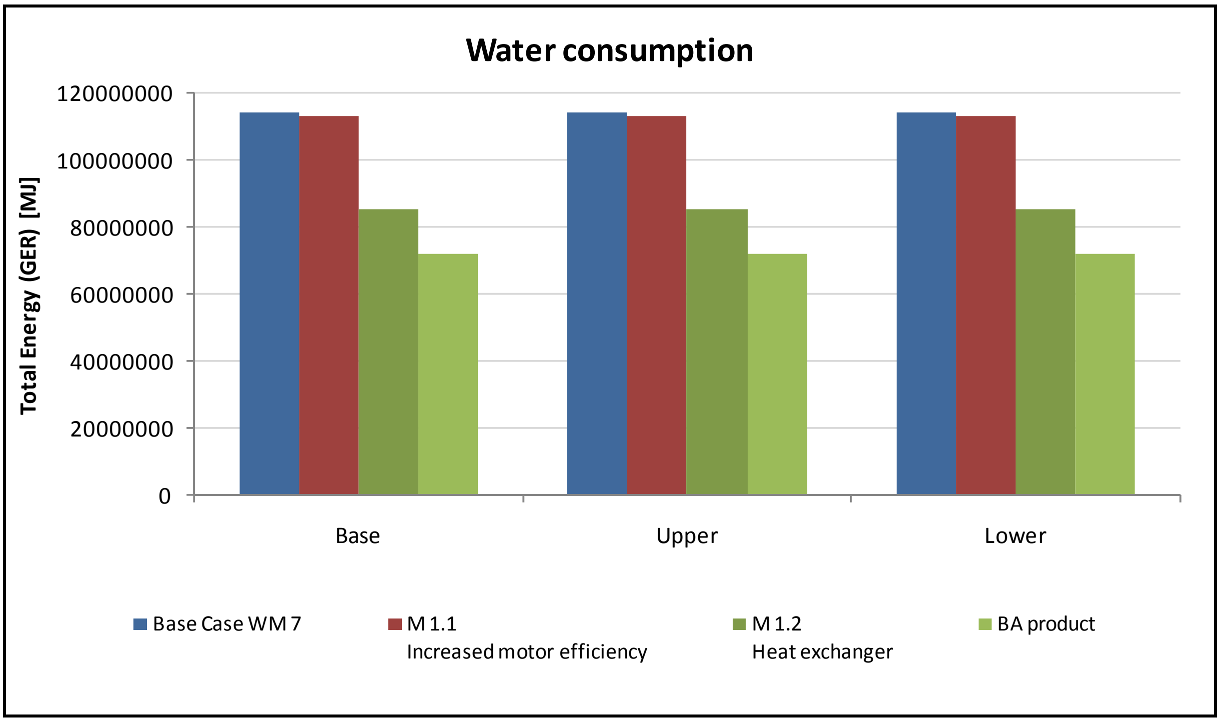

Figure 65 Base case WM 7 and improvement options – impact of water consumption on total energy over life time by product

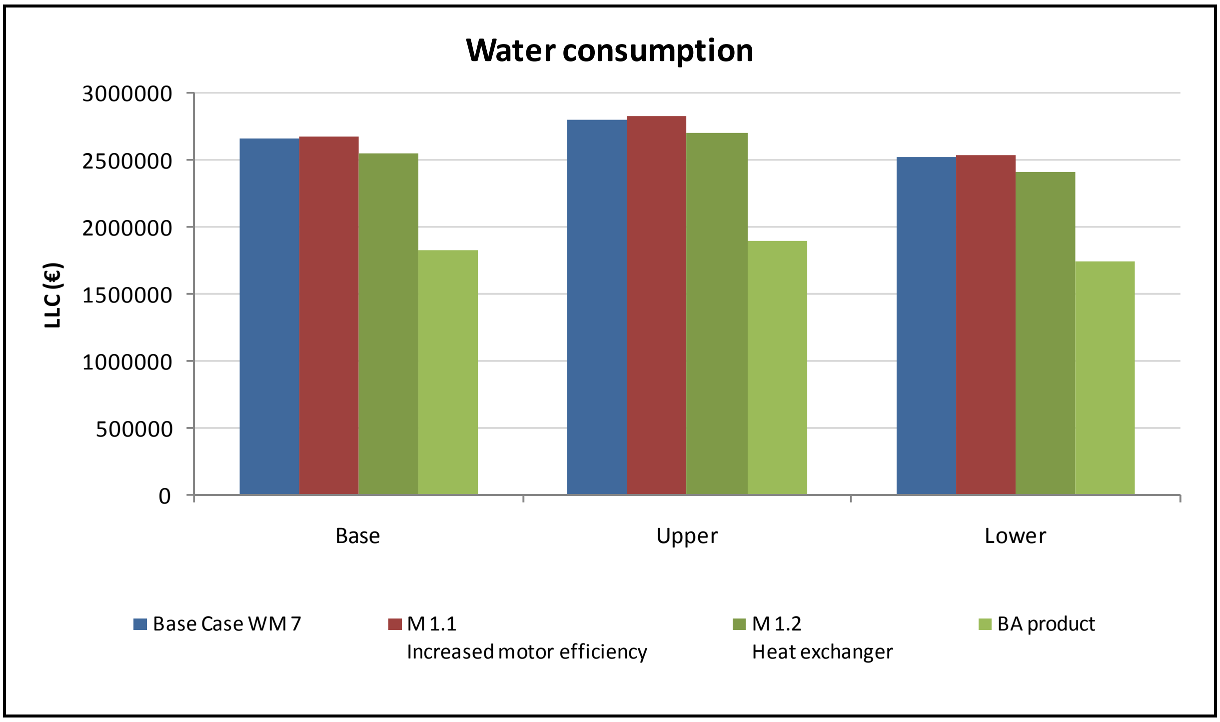

Figure 66 Base case WM 7 and improvement options – impact of water consumption on LCC by product

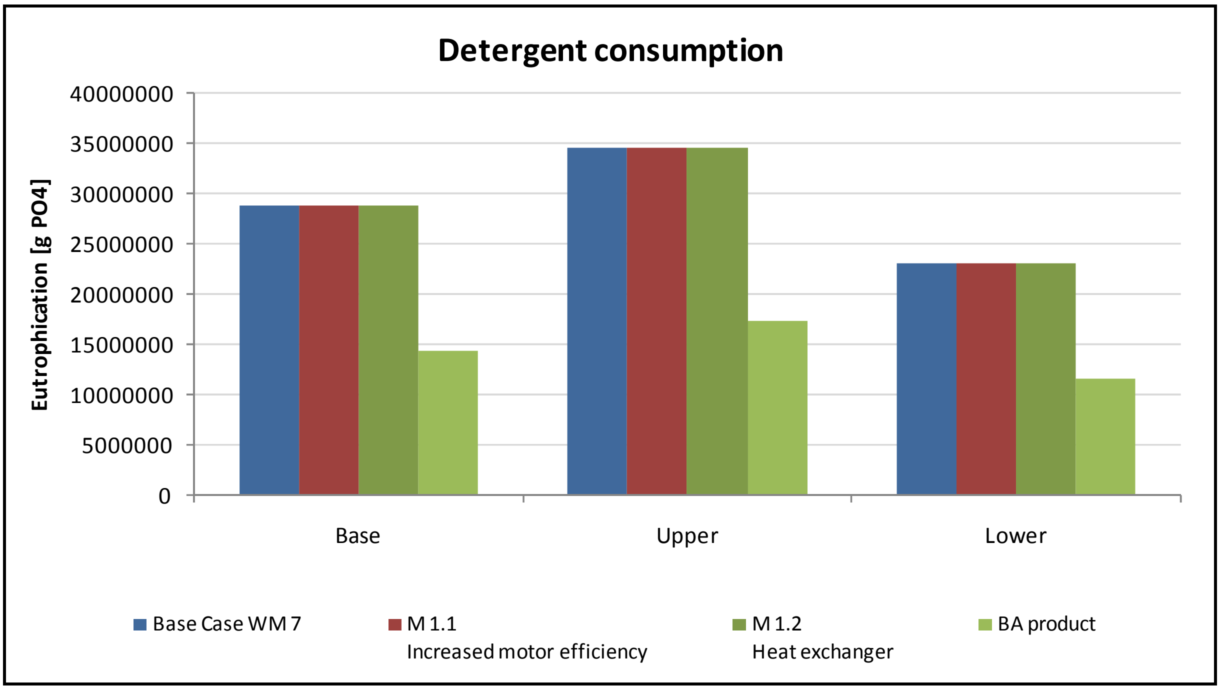

Figure 67 Base case WM 7 and improvement options – impact of detergent consumption on eutrophication over life time by product

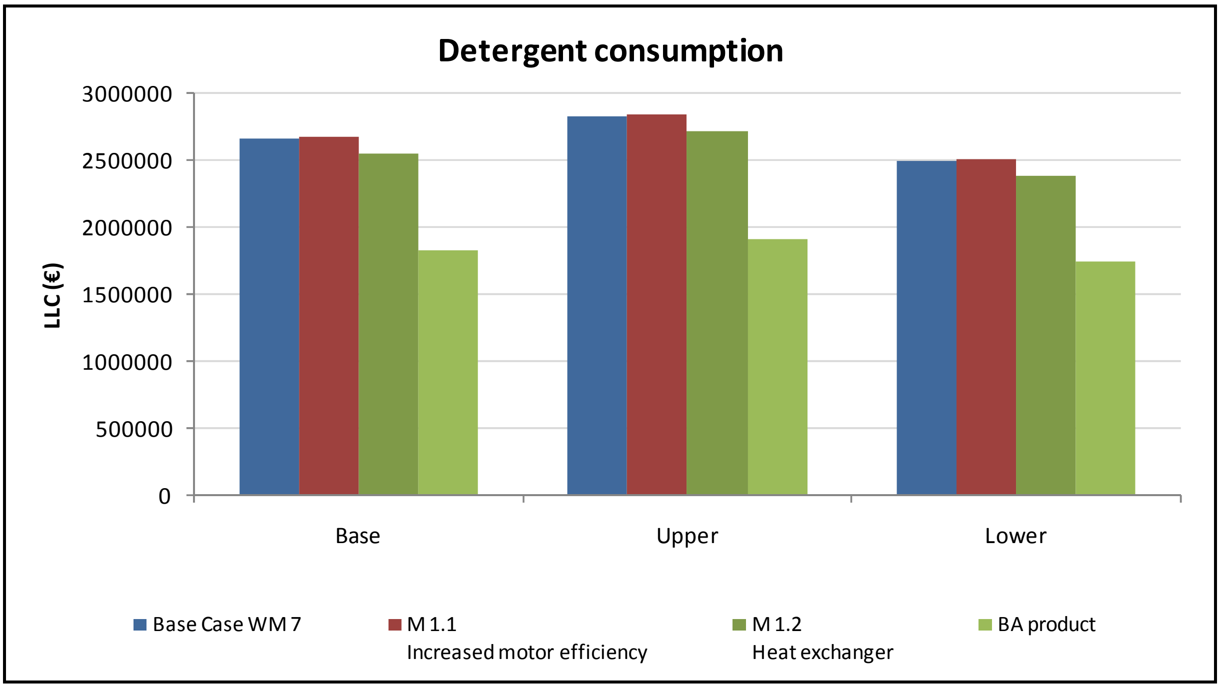

Figure 68 Base case WM 7 and improvement options – impact of detergent consumption on LCC by product

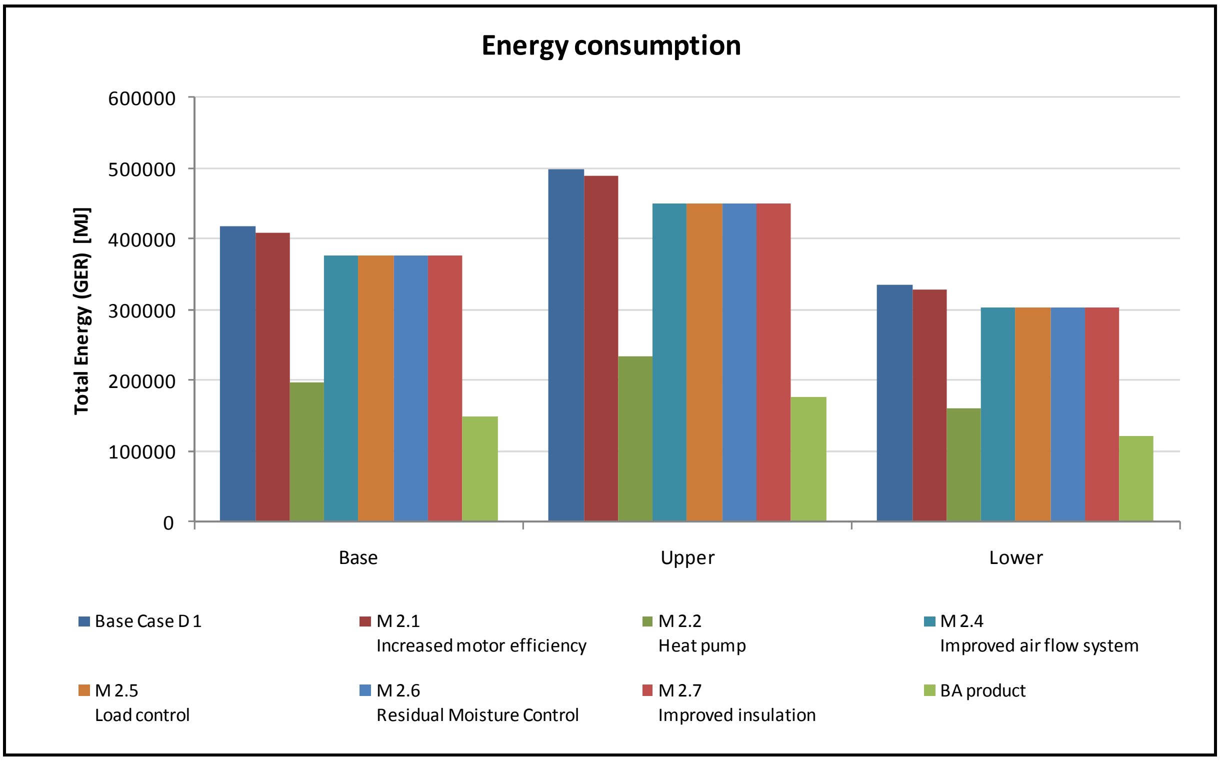

Figure 69 Base case D 1 and improvement options – impact of energy consumption on total energy over life time by product

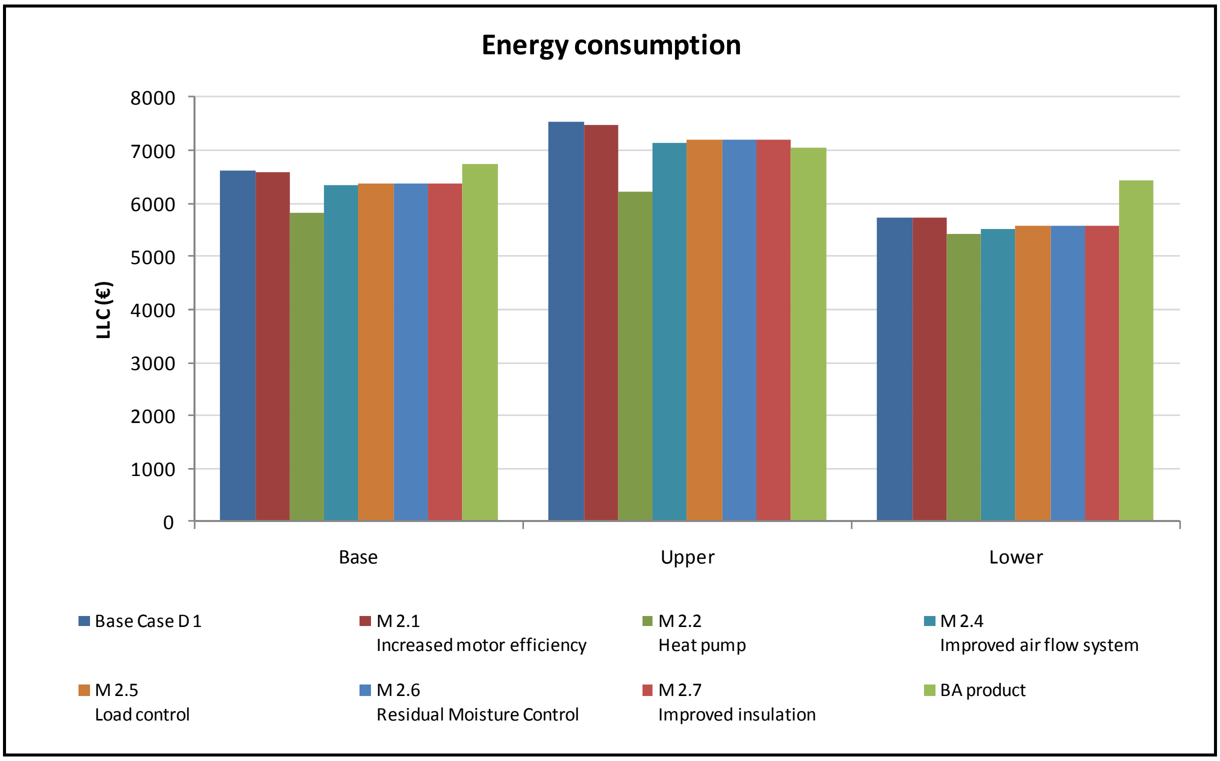

Figure 70 Base case D 1 and improvement options – impact of energy consumption on LCC by product

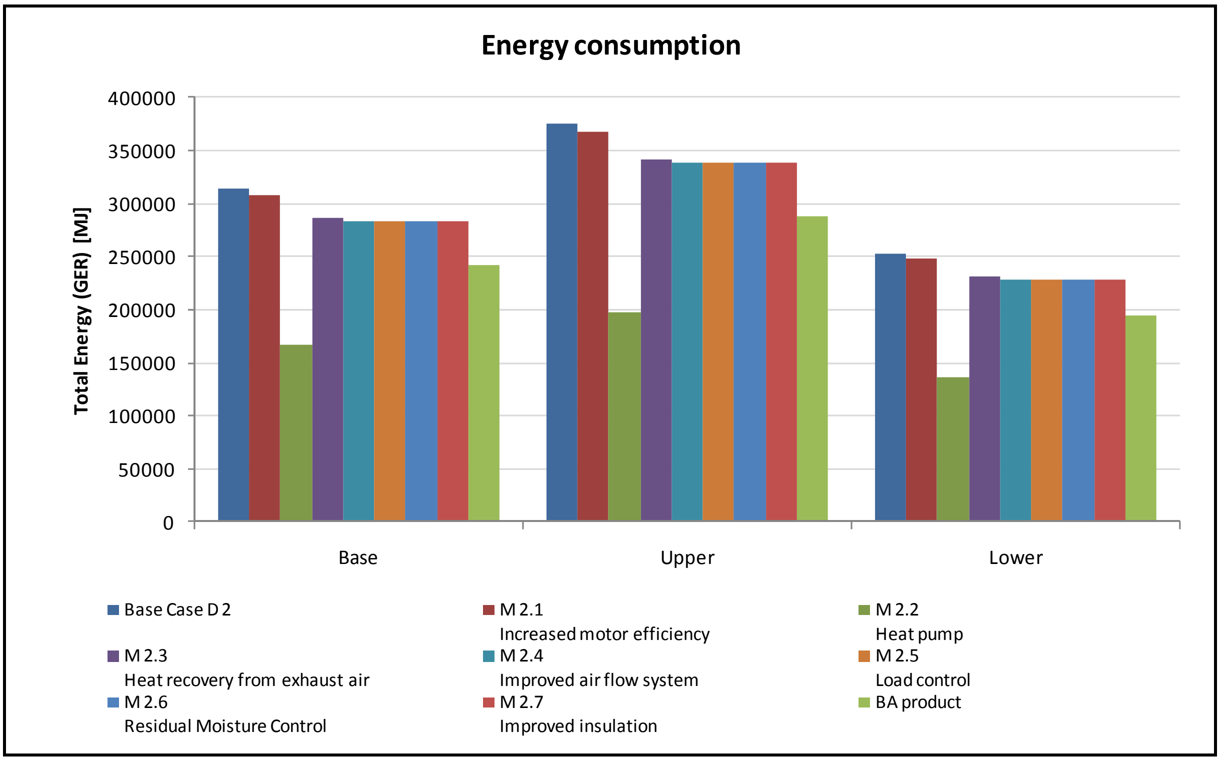

Figure 71 Base case D 2 and improvement options – impact of energy consumption on total energy over life time by product

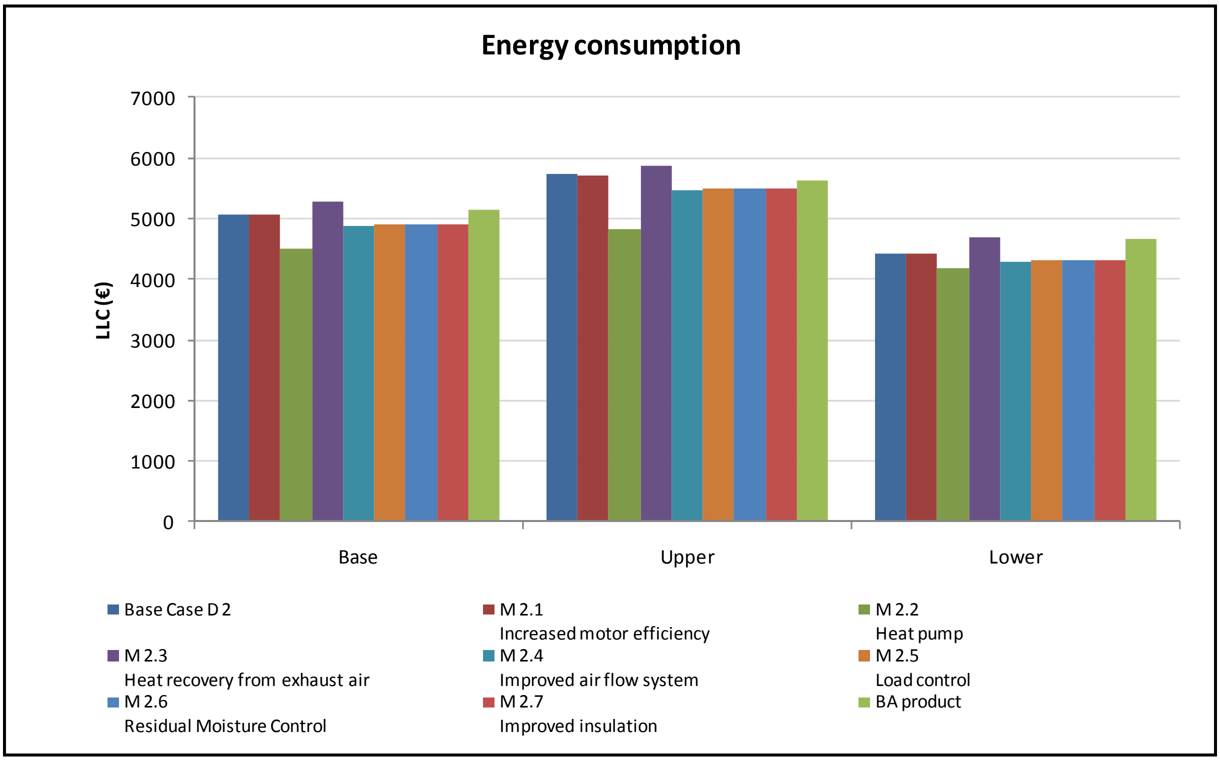

Figure 72 Base case D 2 and improvement options – impact of energy consumption on LCC by product

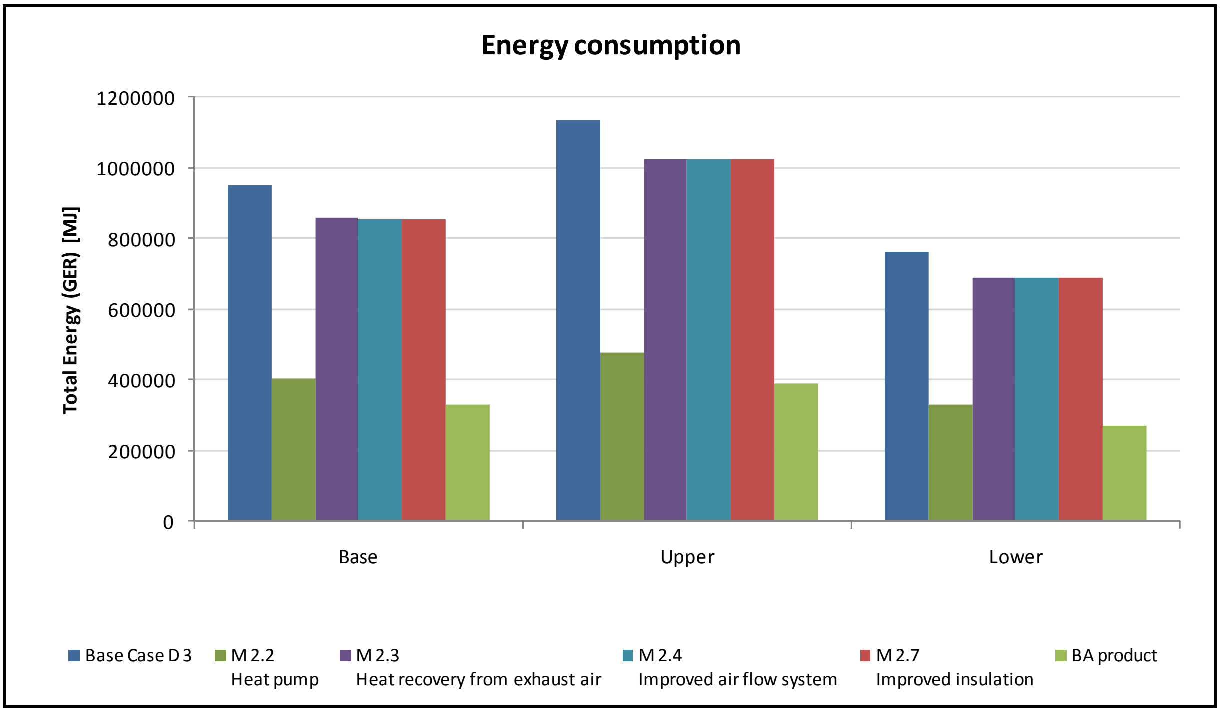

Figure 73 Base case D 3 and improvement options – impact of energy consumption on total energy over life time by product

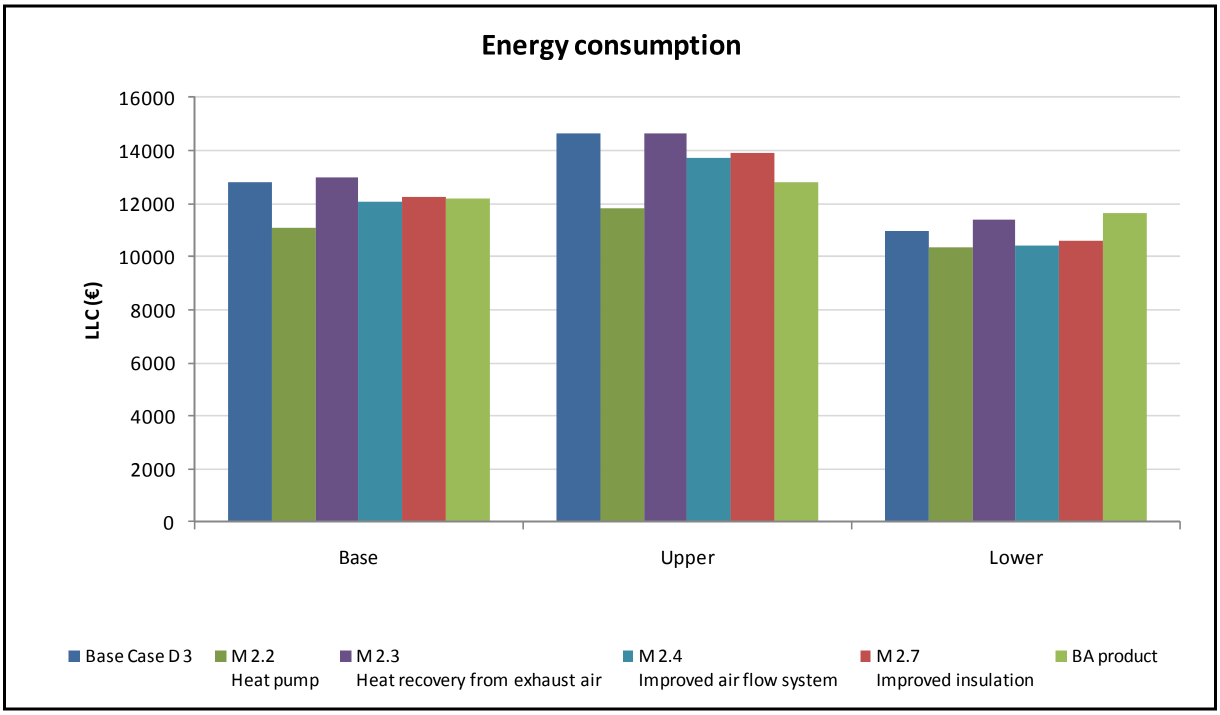

Figure 74 Base case D 3 and improvement options – impact of energy consumption on LCC by product

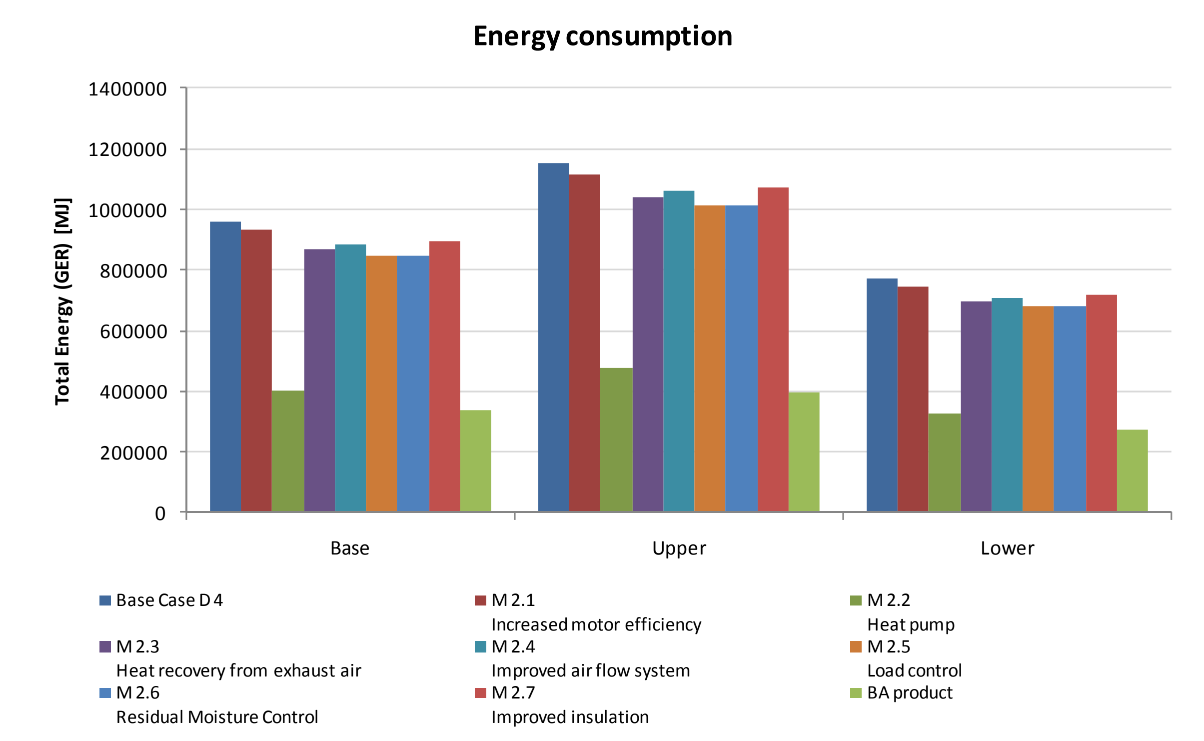

Figure 75 Base case D 4 and improvement options – impact of energy consumption on total energy over life time by product

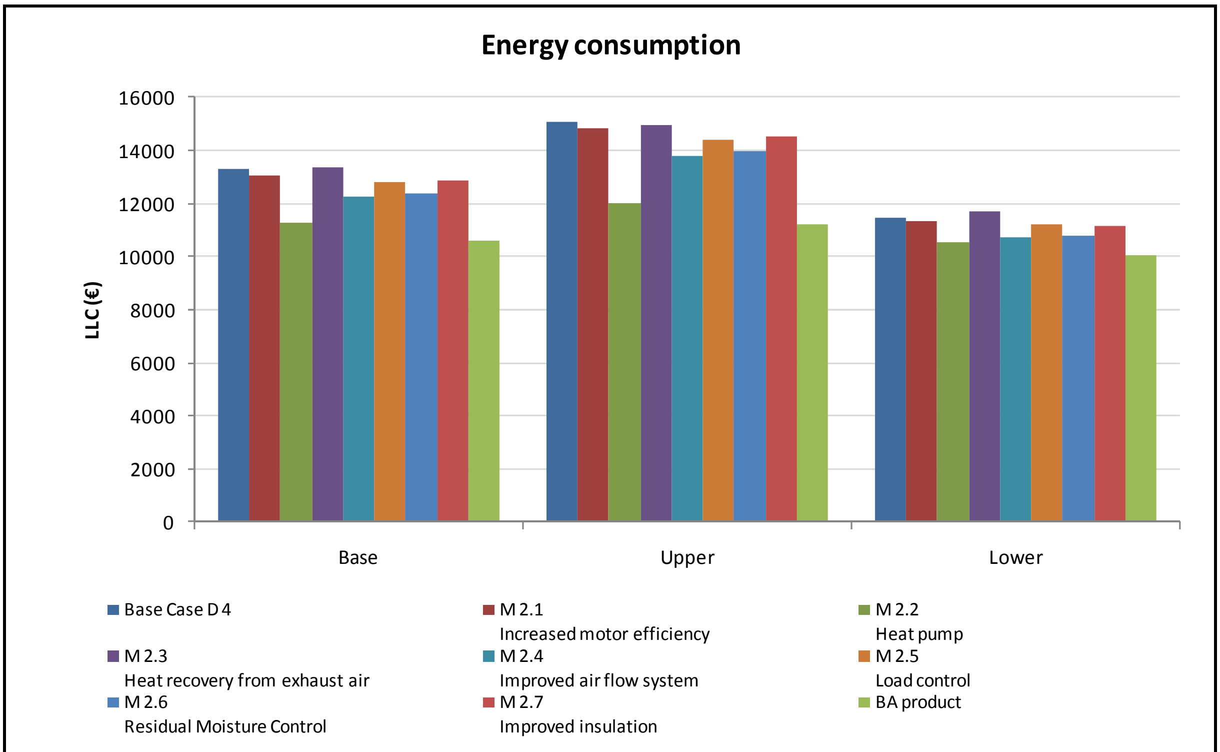

Figure 76 Base case D 4 and improvement options – impact of energy consumption on LCC by product

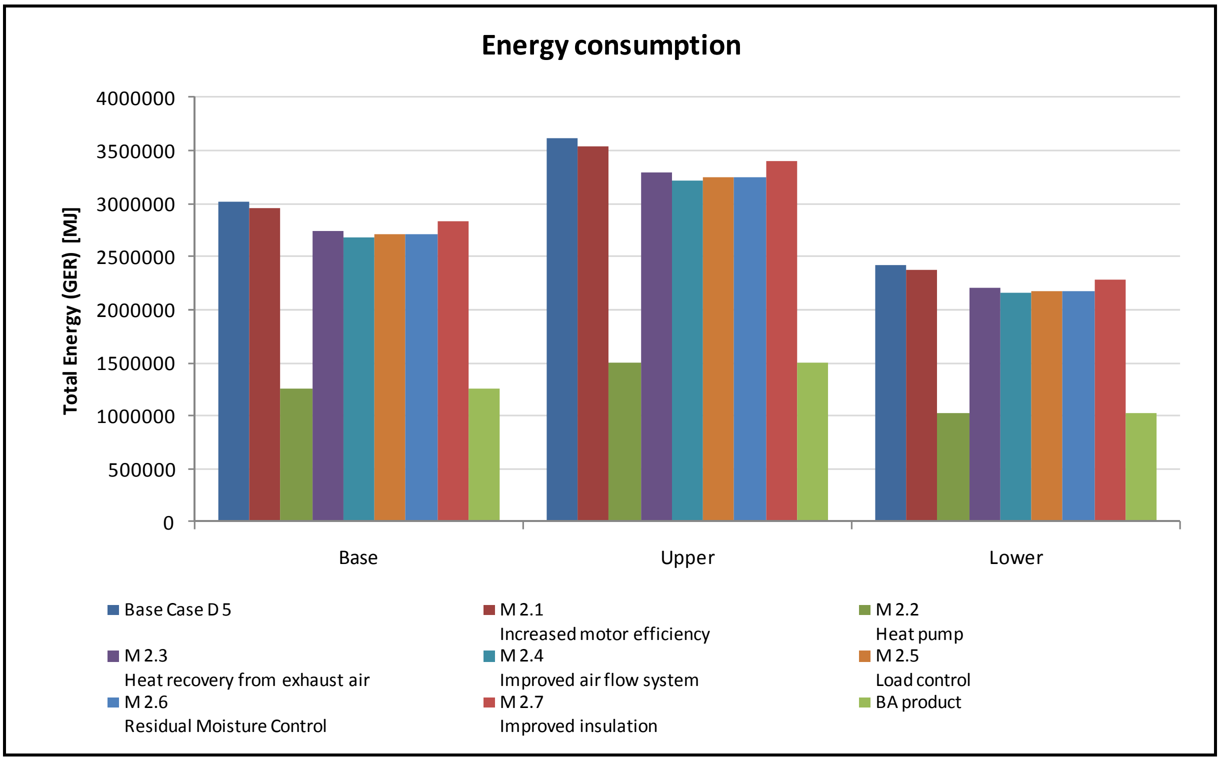

Figure 77 Base case D 5 and improvement options – impact of energy consumption on total energy over life time by product

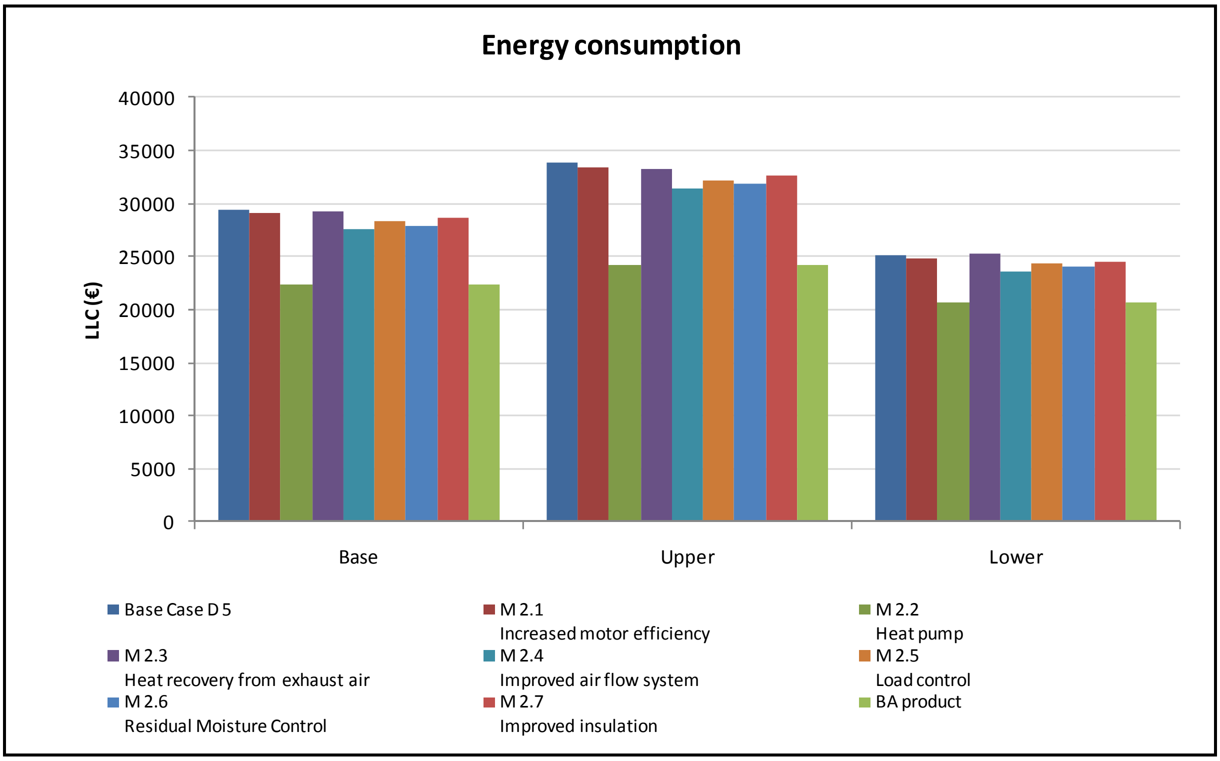

Figure 78 Base case D 5 and improvement options – impact of energy consumption on LCC by product

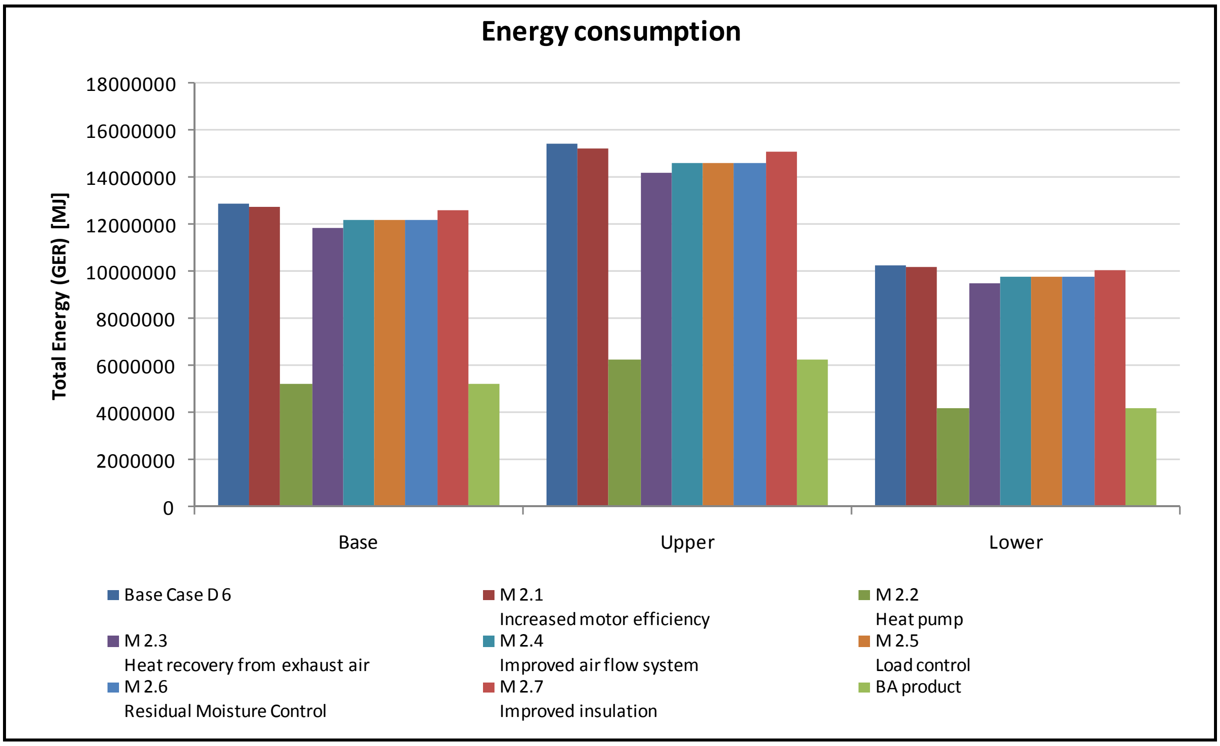

Figure 79 Base case D 6 and improvement options – impact of energy consumption on total energy over life time by product

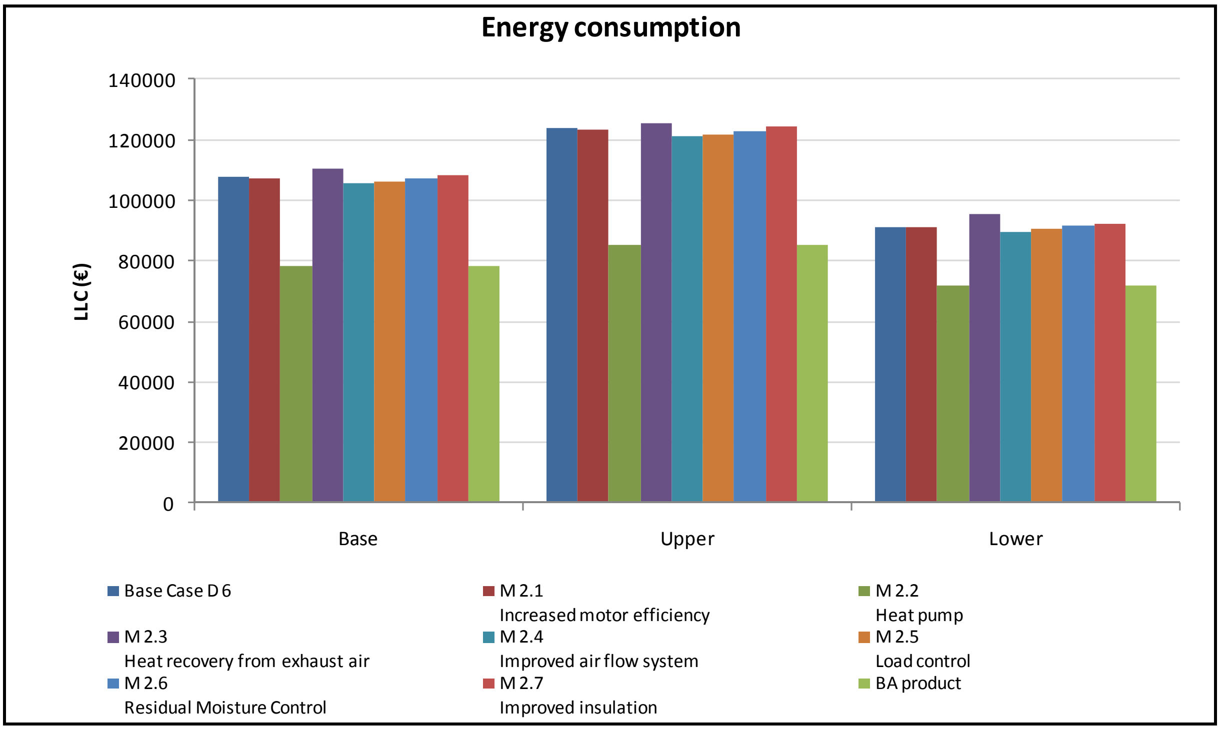

Figure 80 Base case D 6 and improvement options – impact of energy consumption on LCC by product

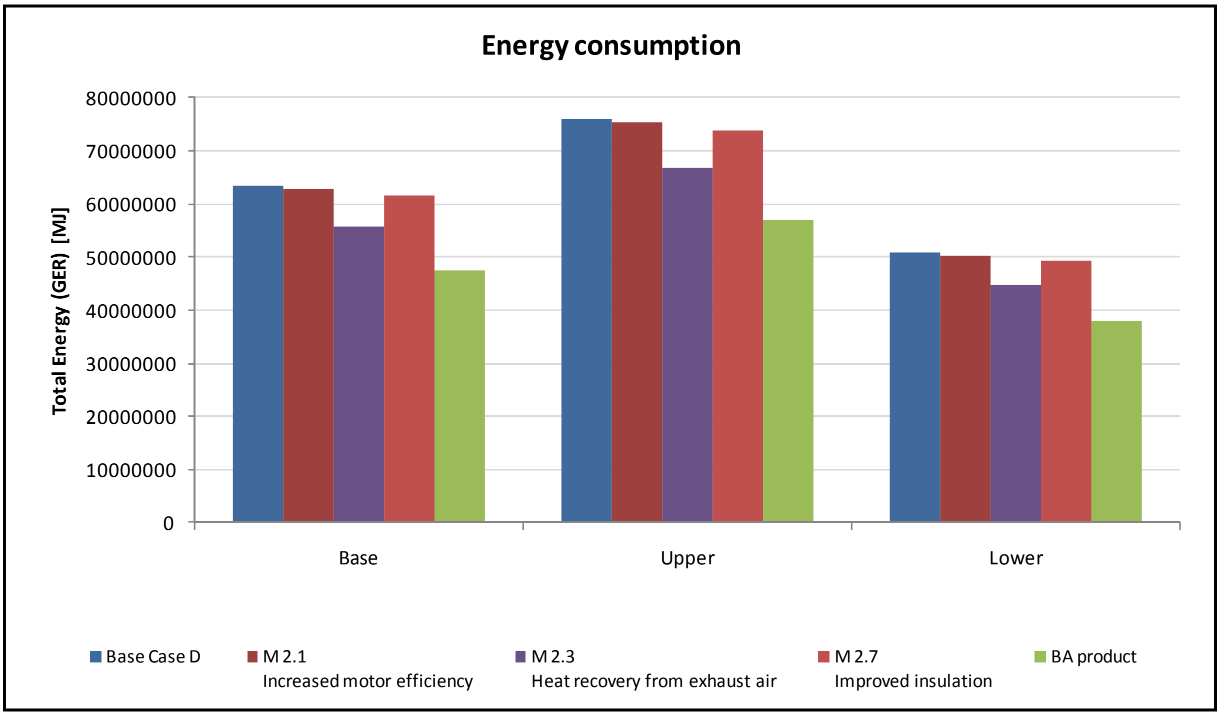

Figure 81 Base case D 7 and improvement options – impact of energy consumption on total energy over life time by product

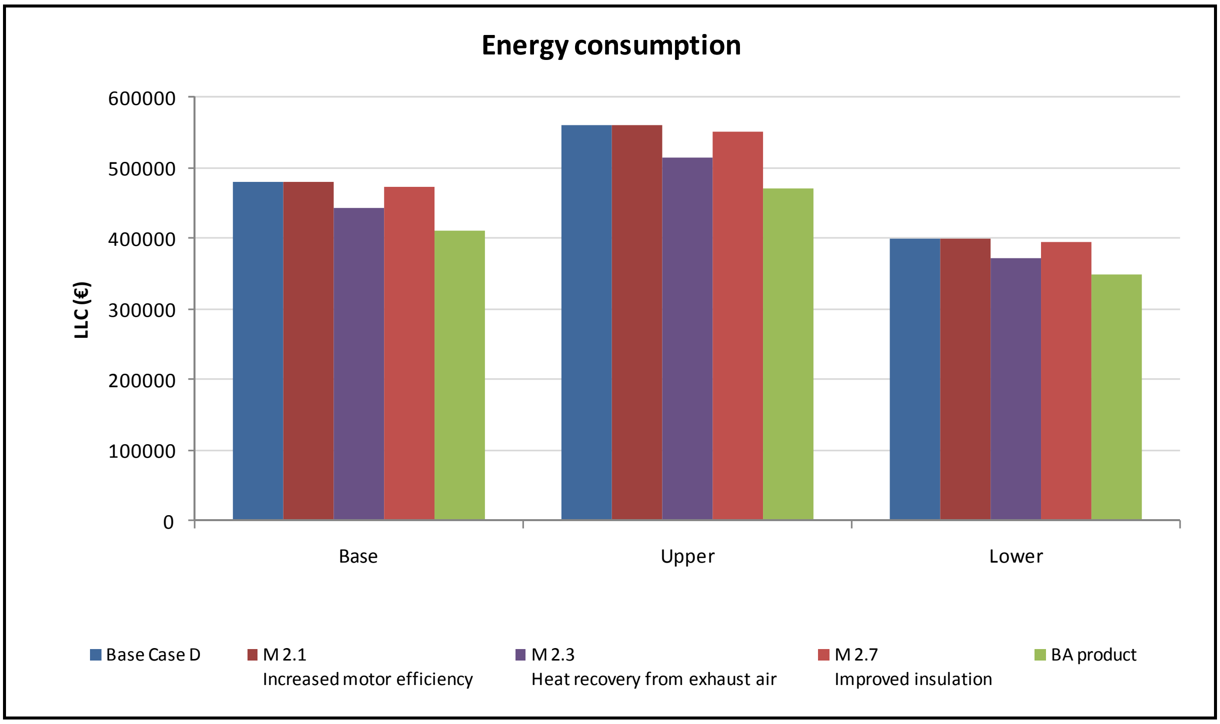

Figure 82 Base case D 7 and improvement options – impact of energy consumption on LCC by product

4.2 Intensity of use

4.2.1 Assumptions

In Task 4, average energy, water and detergent consumption data were determined for the base cases. These parameters are directly dependent on the intensity of use of the machines (i.e. the number of kg of laundry washed per year). This intensity can be variable depending on the end user and the type of application and assumptions on this parameter have been made in Task 4 (related to the main market segment considered).

The sensitivity analysis will consider an error margin of 20% on the given values, both for minimum and maximum values. The tested values are therefore presented in Table 19.

Table 20, Table 18 and Table 19 present the calculated values of the energy, water and detergent consumption corresponding to the minimum and maximum intensity of use: in contrast to Section 4.1, these consumption values now vary simultaneously in the analysis. The analysis is made only for professional washing machines as it would give the same results for dryers than the results in Section 4.1 (as only energy consumption occurs for dryers).

Table 19 Use intensity range for the sensitivity analysis

Base Case	Base typical use intensity (kg of laundry per year)	Min	Max
WM 1 - Semi-professional washer extractor	7 000	5 600	8 400
WM 2 - Professional washing extractor (<15 kg)	14 400	11 520	17 280
WM 3 - Professional washing extractor (15–40 kg)	42 200	33 760	50 640
WM 4 - Professional washing extractor (>40 kg)	194 400	155 520	233 280
WM 5 - Professional washer dryer	7 400	5 920	8 880
WM 6 - Professional barrier washer	56 300	45 040	67 560
WM 7 - Washing tunnel machine	3 825 000	3 060 000	4 590 000

Table 20 Energy consumption range corresponding to the use intensity range for the sensitivity analysis

Base case	Base total energy consumption (kWh per year)	Min	Max
WM 1 - Semi-professional washer extractor	1 332	1 066	1 598
WM 2 - Professional washing extractor (<15 kg)	3 026	2 421	3 631
WM 3 - Professional washing extractor (15–40 kg)	10 973	8 778	13 168
WM 4 - Professional washing extractor (>40 kg)	81 648	65 318	97 978
WM 5 - Professional washer dryer	7 400	5 920	8 880
WM 6 - Professional barrier washer	26 461	21 169	31 753
WM 7 - Washing tunnel machine	1 606 500	1 285 200	1 927 800

Table 21 Water consumption range corresponding to the use intensity range for the sensitivity analysis

Base case	Base water consumption (m^3 per year)	Min	Max
WM 1 - Semi-professional washer extractor	85	68	102
WM 2 - Professional washing extractor (<15 kg)	233	186	280
WM 3 - Professional washing extractor (15–40 kg)	741	593	889
WM 4 - Professional washing extractor (>40 kg)	3 266	2 613	3 919
WM 5 - Professional washer dryer	100	80	120
WM 6 - Professional barrier washer	1 081	865	1 297
WM 7 - Washing tunnel machine	27 540	22 032	33 048

Table 22 Detergent consumption range corresponding to the use intensity range for the sensitivity analysis

Base case	Base detergent consumption (kg per year)	Min	Max
WM 1 - Semi-professional washer extractor	161	129	193
WM 2 - Professional washing extractor (<15 kg)	330	264	396
WM 3 - Professional washing extractor (15–40 kg)	798	638	958
WM 4 - Professional washing extractor (>40 kg)	4 199	3 359	5 039
WM 5 - Professional washer dryer	140	112	168
WM 6 - Professional barrier washer	1 216	973	1 459
WM 7 - Washing tunnel machine	41 310	33 048	49 572

4.2.2 Results

Figure 83 to Figure 96 show the influence of the variation of the intensity of use on the total energy consumption and the life cycle costs of the different washing machine base cases and associated improvement options.

The option leading to the lowest energy consumption or life cycle costs always remain the same for a given base case, whatever the intensity use values considered (base, lower or upper). However, a few relative changes in the rankings of options happen, for instance:

- For base case WM 2, the LCC of M 1.3 option becomes higher than the LCC of the base case with the lower values;
- For base case WM 3, the LCC of M 1.3 option becomes higher than the LCC of the base case with the lower values;
- For base case WM 6, the LCC of the BA product becomes lower than the LCC of the base case with the upper values.

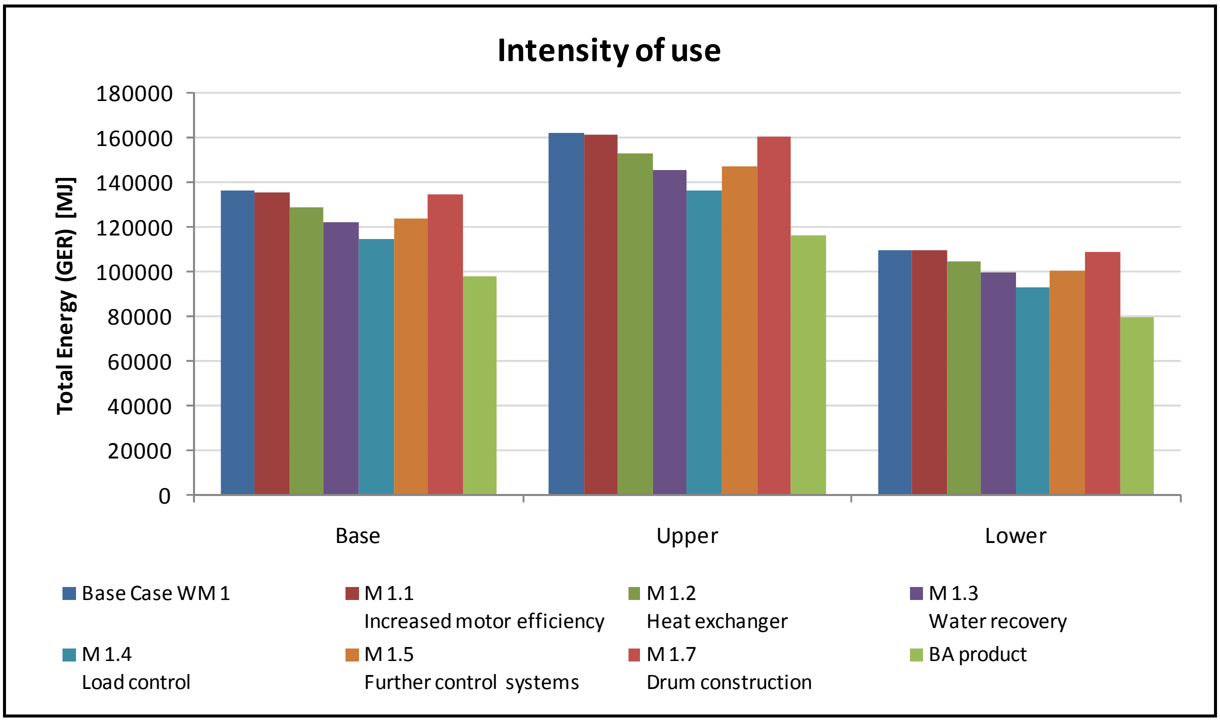

Figure 83 Base case WM 1 and improvement options – impact of intensity of use on total energy over life time by product

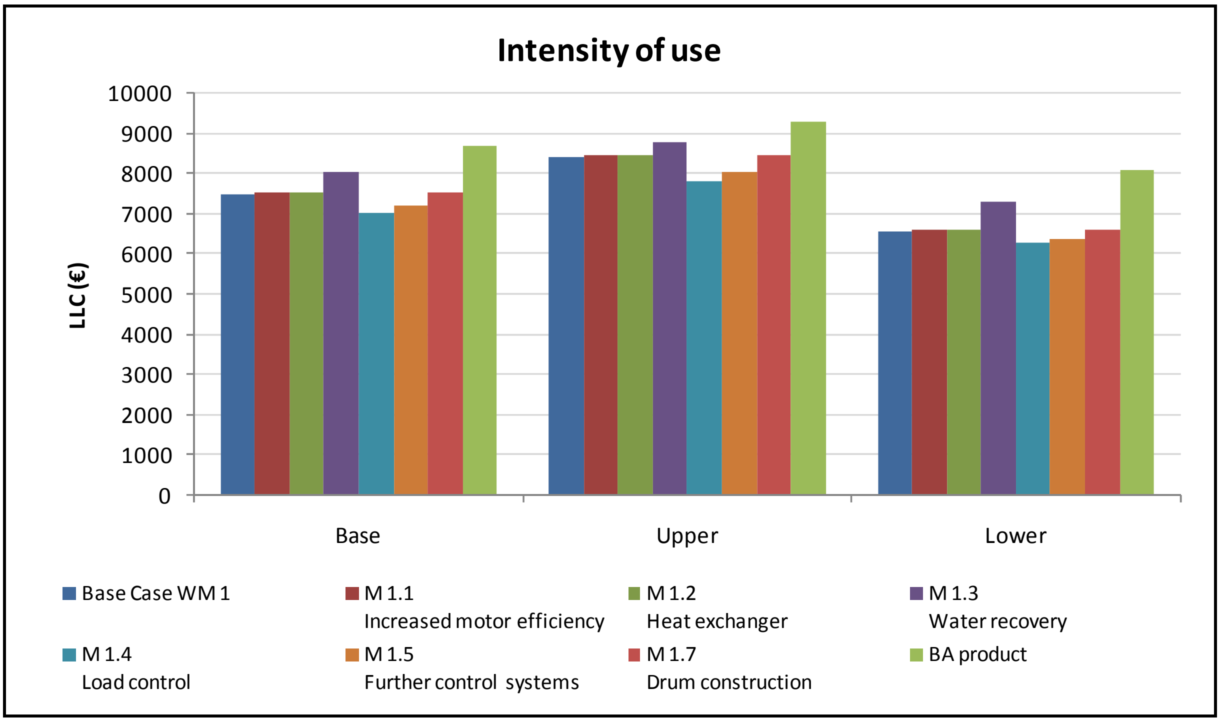

Figure 84 Base case WM 1 and improvement options – impact of intensity of use on LCC by product

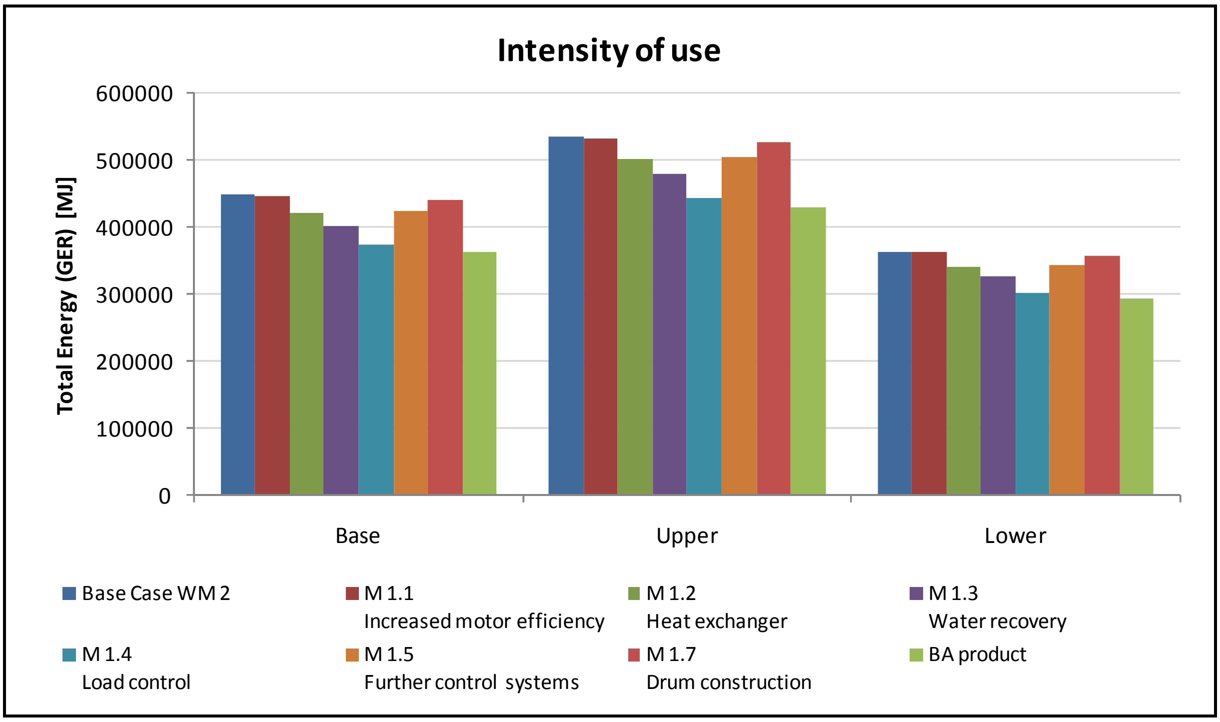

Figure 85 Base case WM 2 and improvement options – impact of intensity of use on total energy over life time by product.

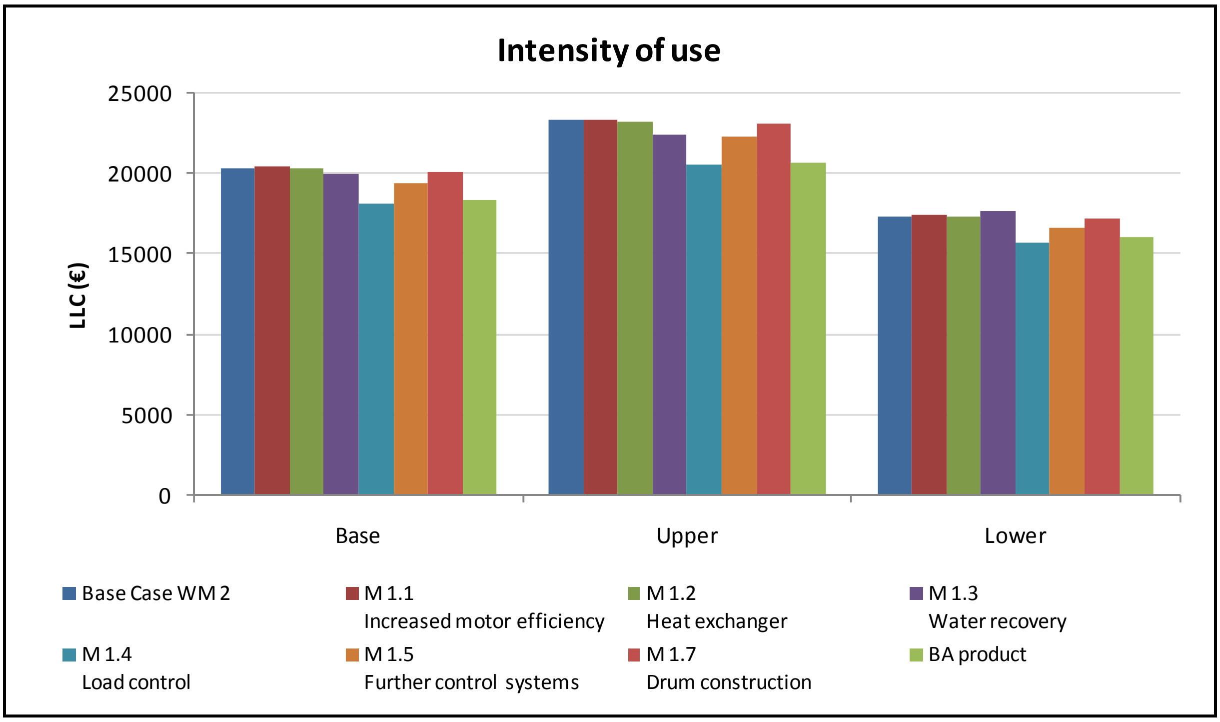

Figure 86 Base case WM 2 and improvement options – impact of intensity of use on LCC by product

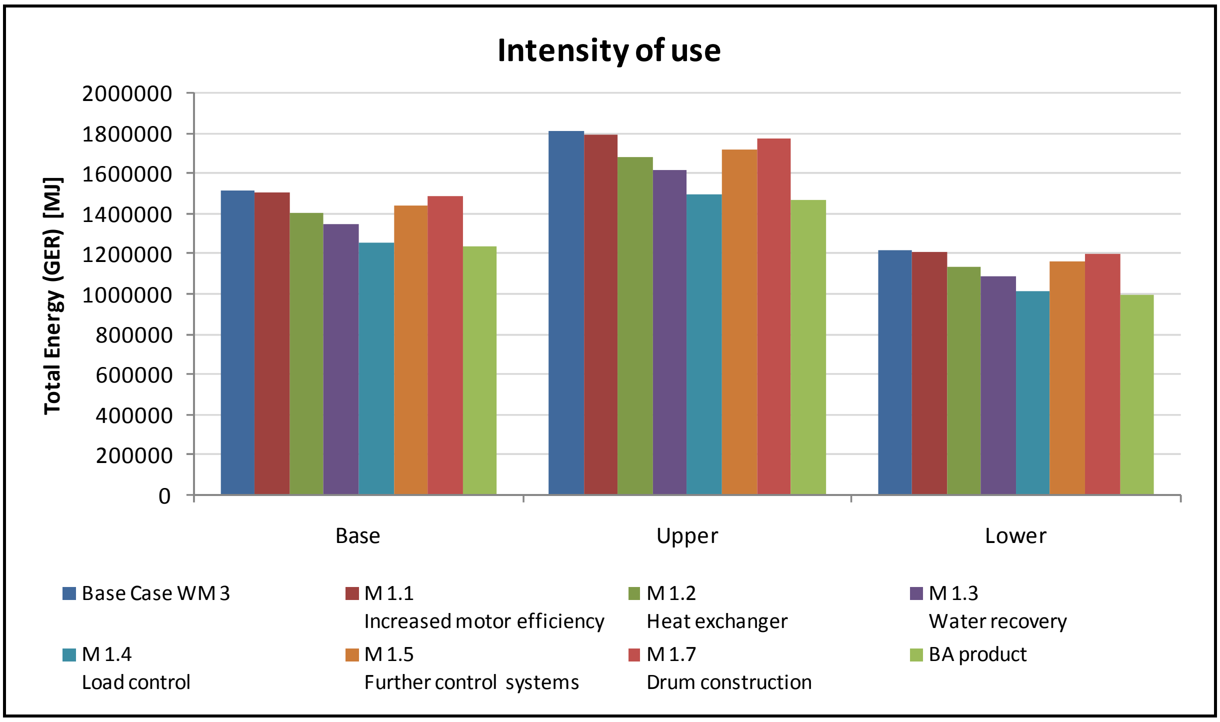

Figure 87 Base case WM 3 and improvement options – impact of intensity of use on total energy over life time by product

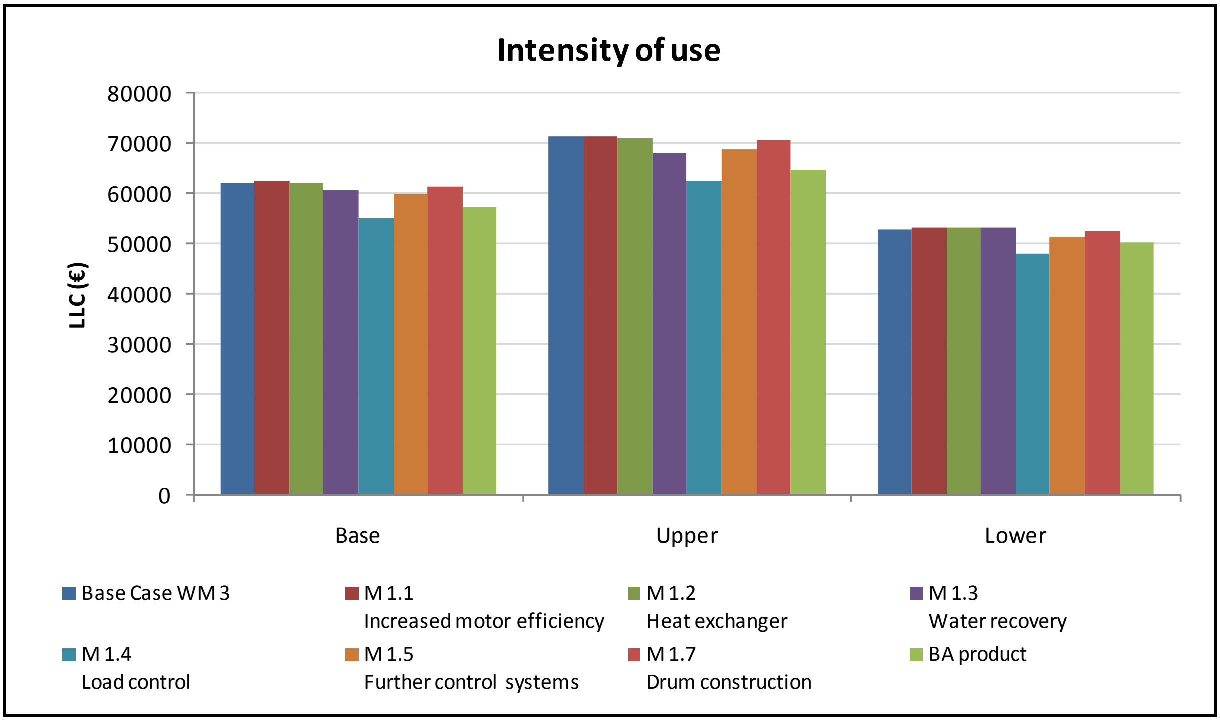

Figure 88 Base case WM 3 and improvement options – impact of intensity of use on LCC by product

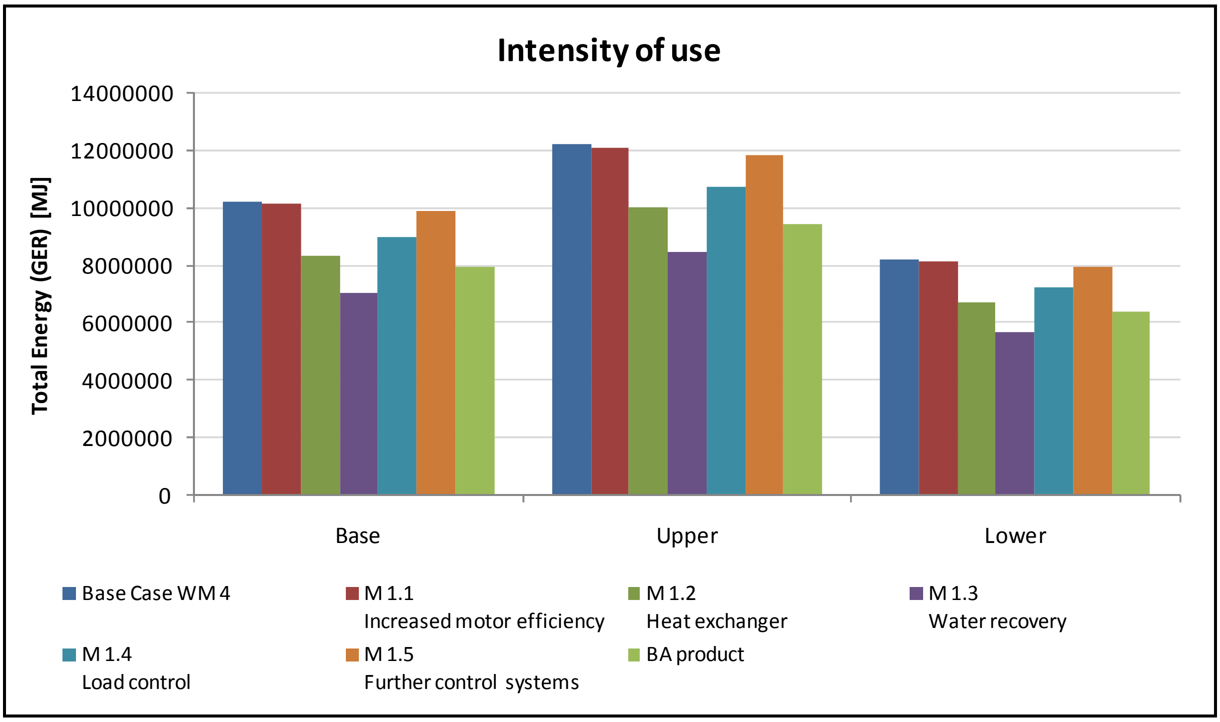

Figure 89 Base case WM 4 and improvement options – impact of intensity of use on total energy over life time by product

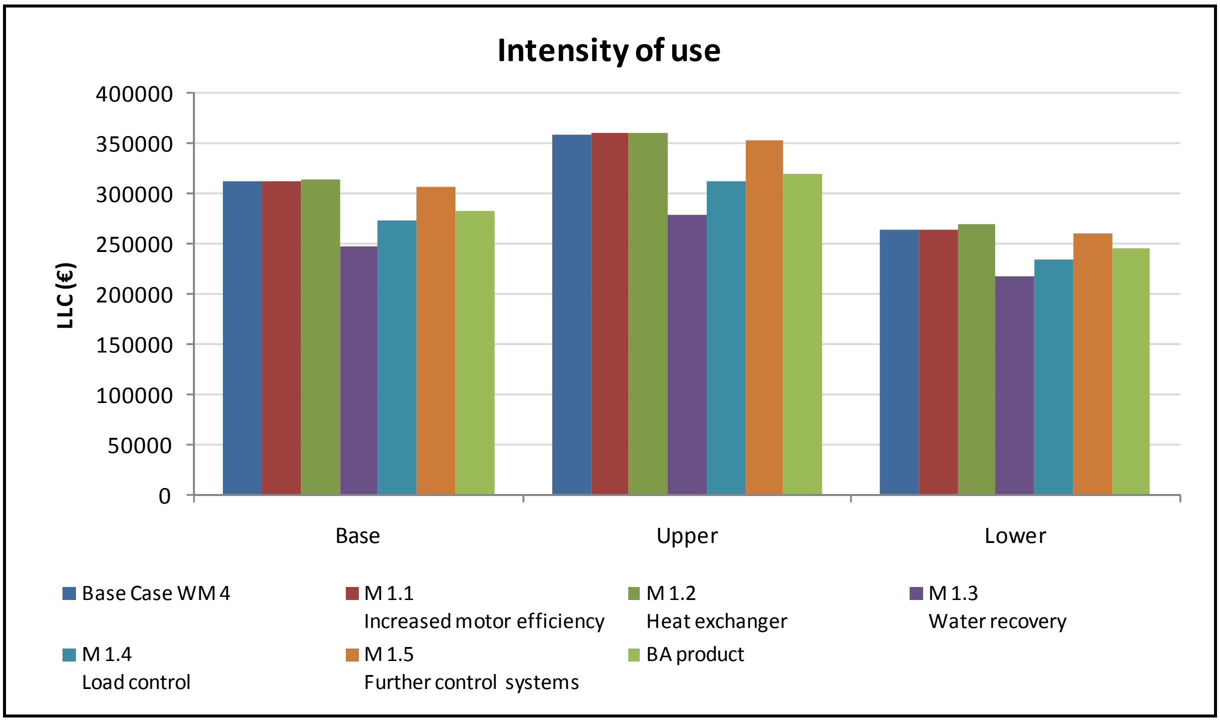

Figure 90 Base case WM 4 and improvement options – impact of intensity of use on LCC by product

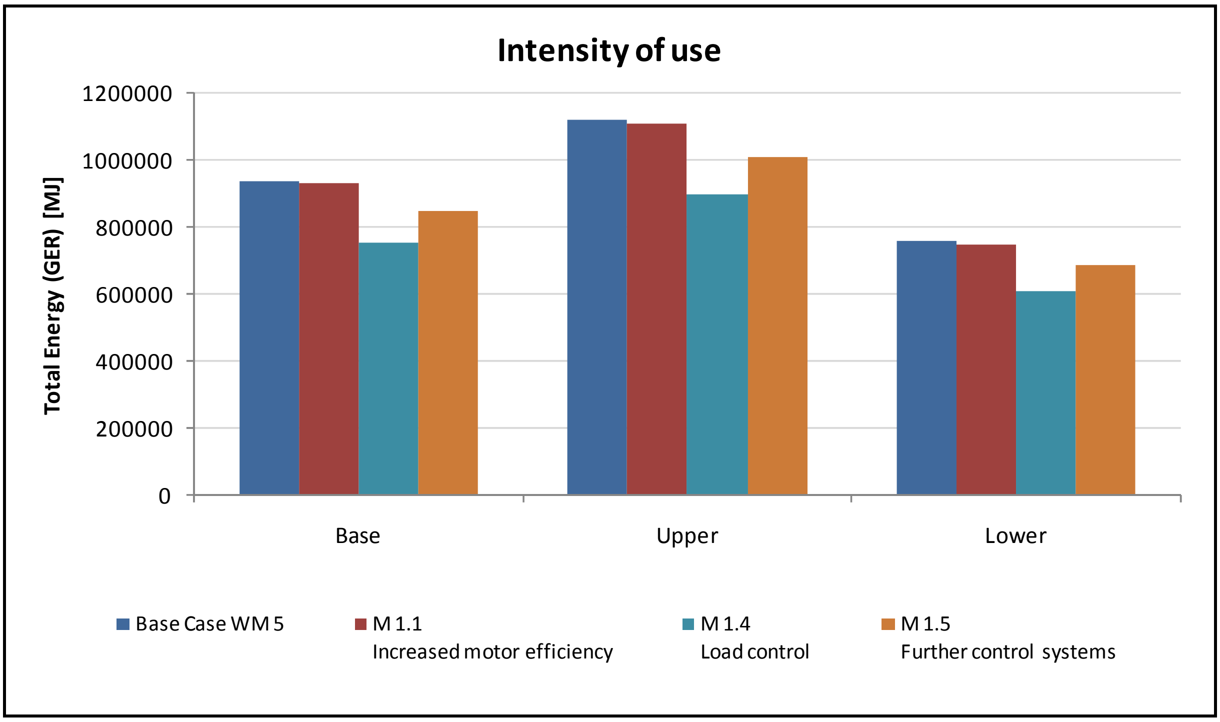

Figure 91 Base case WM 5 and improvement options – impact of intensity of use on total energy over life time by product

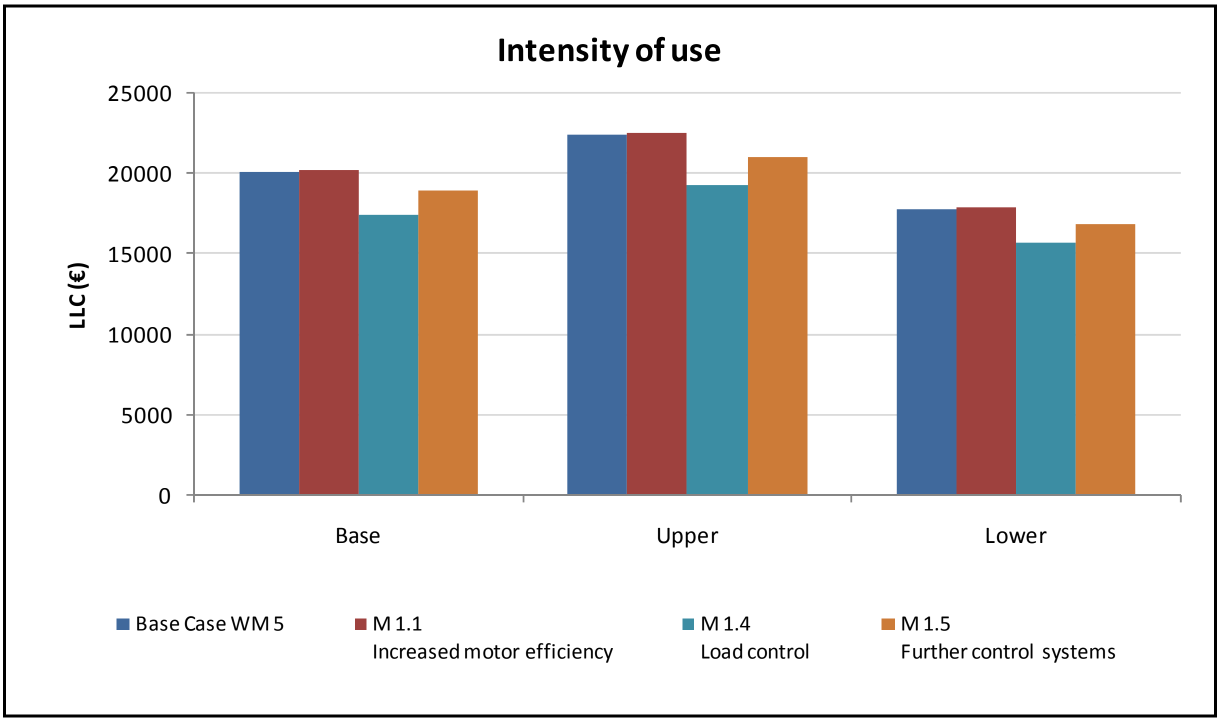

Figure 92 Base case WM 5 and improvement options – impact of intensity of use on LCC by product

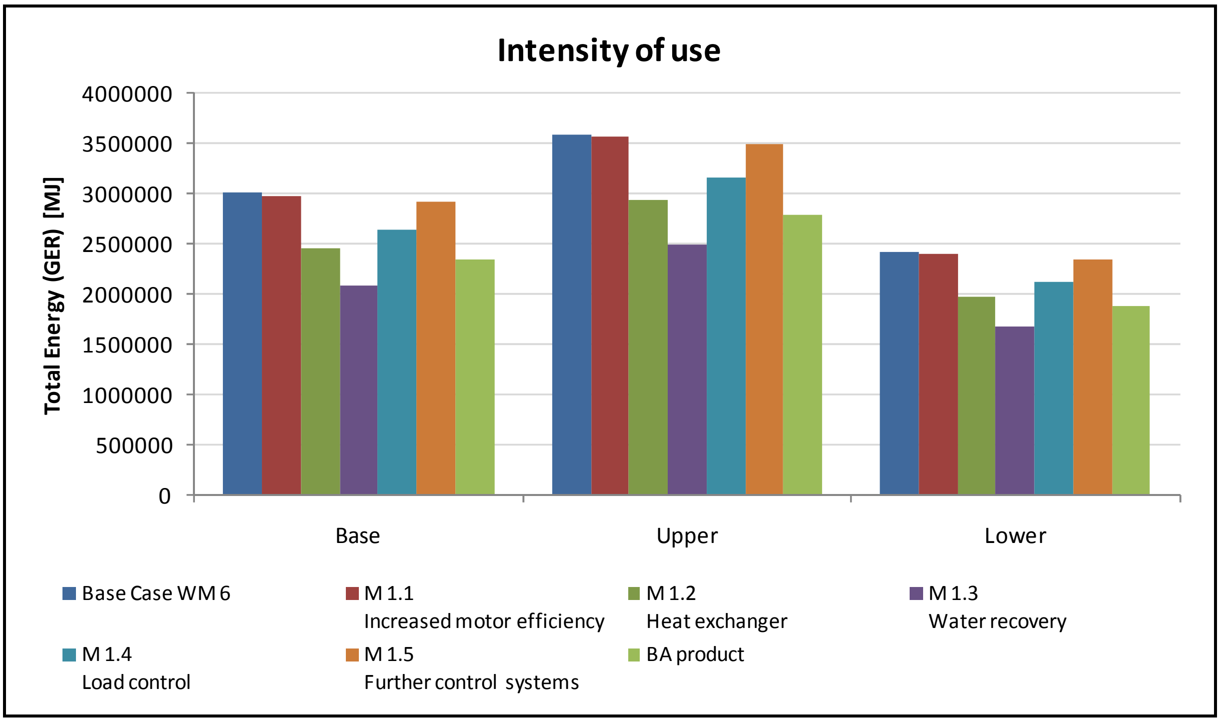

Figure 93 Base case WM 6 and improvement options – impact of intensity of use on total energy over life time by product

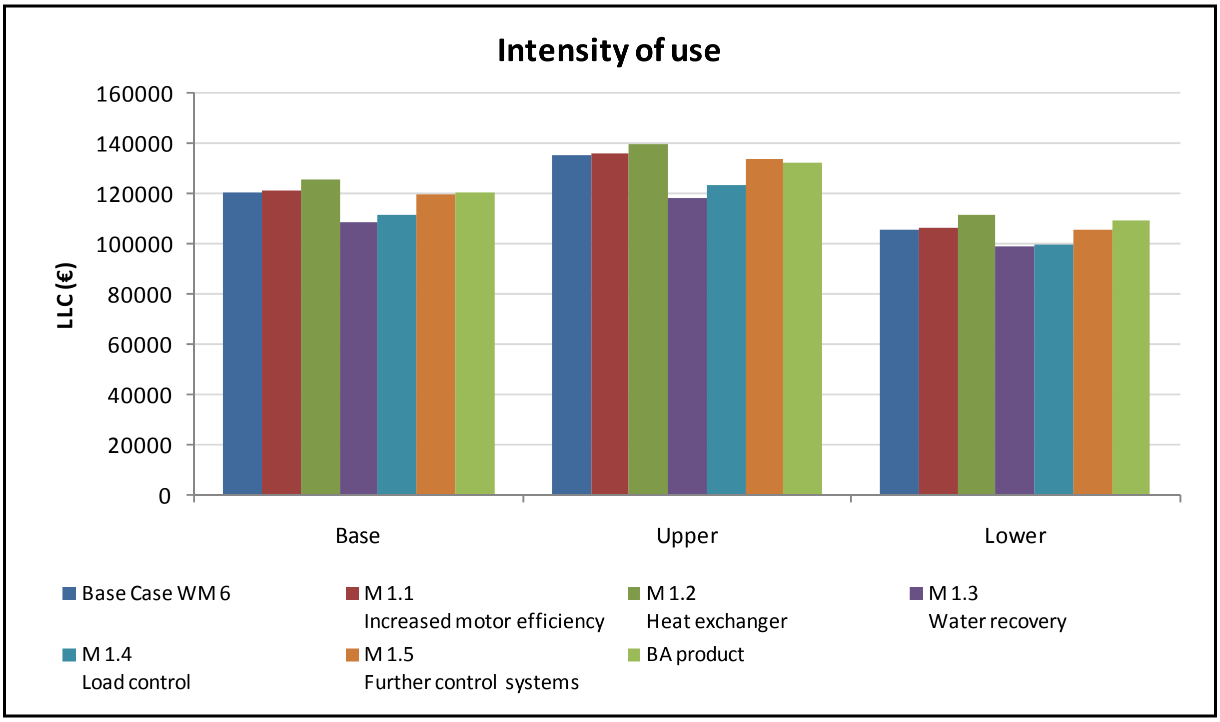

Figure 94 Base case WM 6 and improvement options – impact of intensity of use on LCC by product

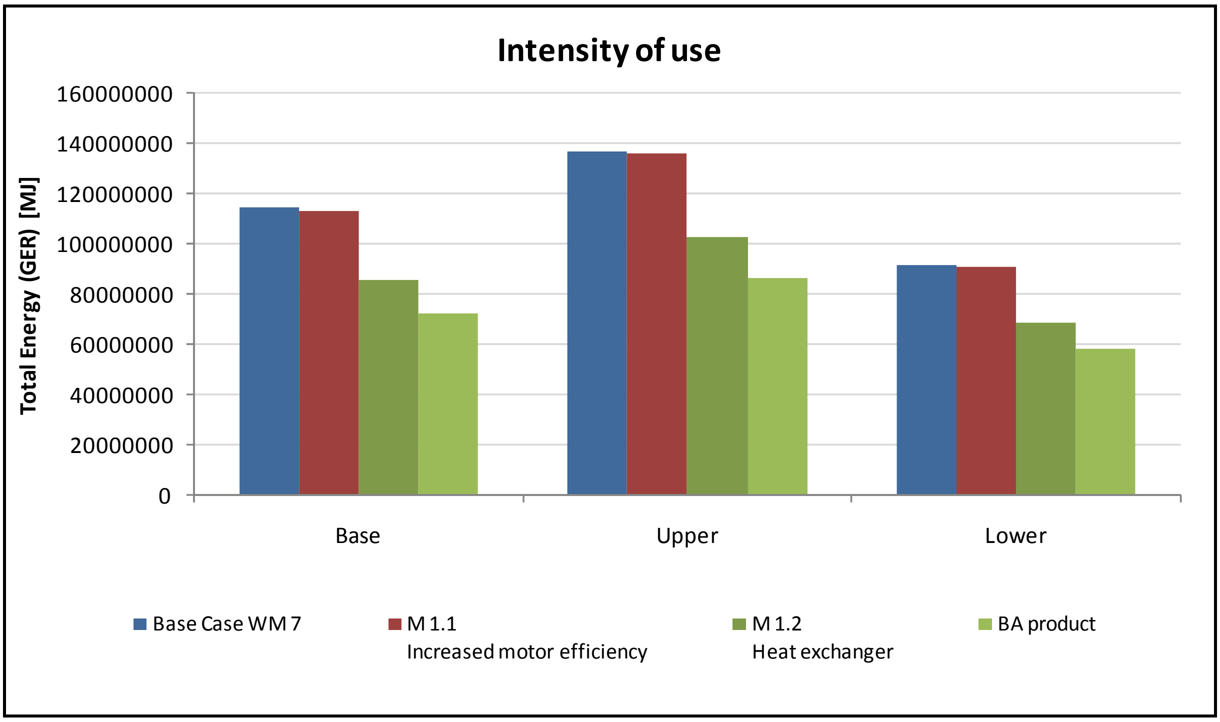

Figure 95 Base case WM 7 and improvement options – impact of intensity of use on total energy over life time by product

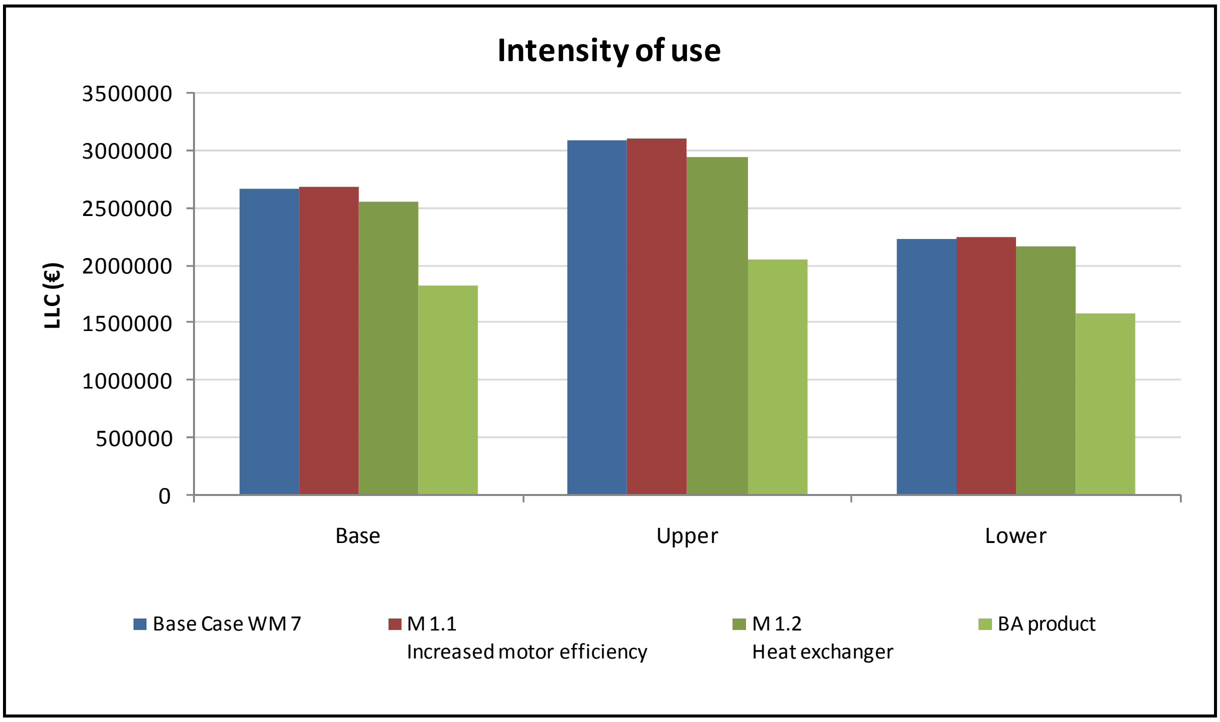

Figure 96 Base case WM 7 and improvement options – impact of intensity of use on LCC by product

4.3 Product life time

4.3.1 Assumptions

The product life time is a major assumption as it has an influence on both the environmental impacts (by increasing the impacts of the use phase) and the life cycle costs (by increasing the operating costs during the use phase). Given the importance of the use phase as discussed in Task 5, it is paramount to take this parameter into account in the sensitivity analysis. Table 23 presents the minimum and maximum values that will be used for each base case: an error of 2 years is assumed between extreme values and the average life times considered in the study.

Table 23 Product life time ranges for the sensitivity analysis

Base case	Base product life time (in years)	Min	Max
WM 1 - Semi-professional washer extractor	8	6	10
WM 2 - Professional washing extractor (<15 kg)	12	10	14
WM 3 - Professional washing extractor (15–40 kg)	14	12	16
WM 4 - Professional washing extractor (>40 kg)	15	13	17
WM 5 - Professional washer dryer	11	9	13
WM 6 - Professional barrier Washer	14	12	16
WM 7 - Washing tunnel machine	13	11	15
D 1 - Semi-professional dryer, condenser	8	6	10
D 2 - Semi- professional dryer, air vented	8	6	10
D 3 - Professional Cabinet dryer	15	13	17
D 4 - Professional air tumble dryer (<15 kg)	13	11	15
D 5 - Professional air tumble dryer (15–40 kg)	14	12	16
D 6 - Professional air tumble dryer (>40 kg)	13	11	15
D 7 - Industrial pass-through (transfer) tumble dryer	13	11	15

4.3.2 Results

Figure 97 to Figure 124 show the influence of the variation of the life time on the total energy consumption and the life cycle costs of the different base cases and associated improvement options.

The option leading to the lowest energy consumption or life cycle costs always remain the same for a given base case, whatever the life time values considered (base, lower or upper). However, a few relative changes in the rankings of options happen, for instance:

- For base case WM 2, the LCC of M 1.3 option becomes higher than the LCC of the base case with the lower values;
- For base case WM 6, the LCC of the BA product becomes lower than the LCC of the base case with the upper values;
- For base case D 1, the LCC of the BA product becomes lower than the LCC of the base case with the upper values.

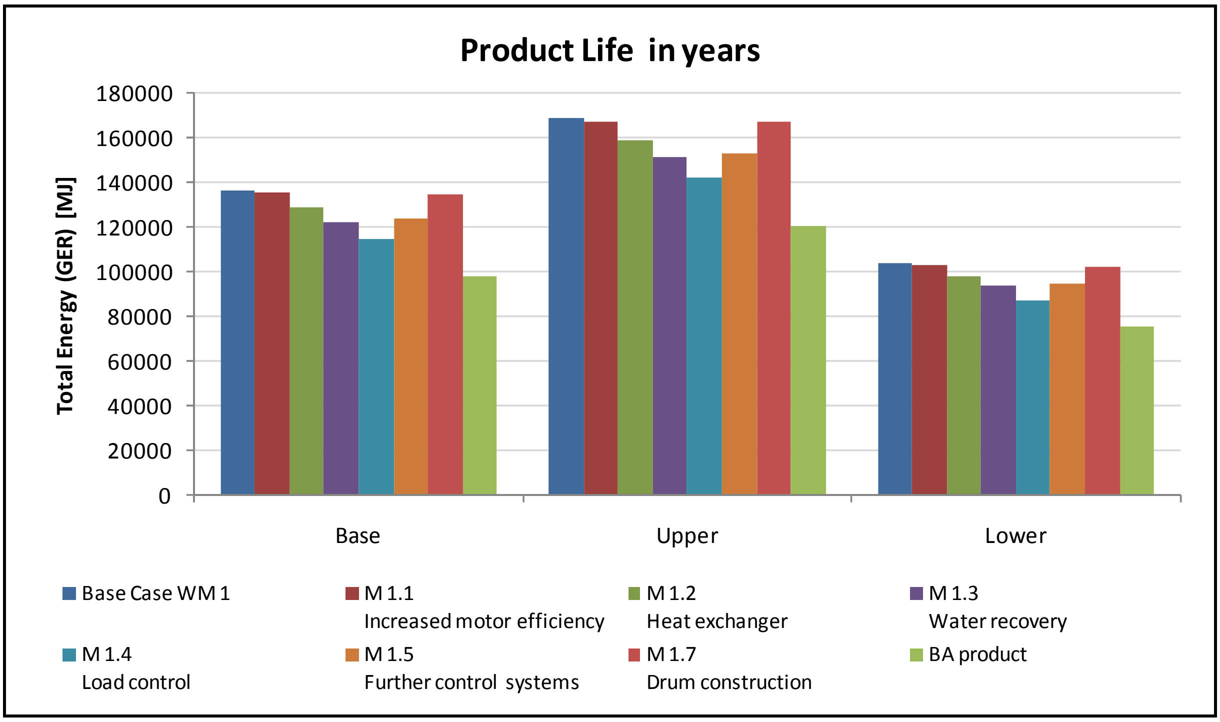

Figure 97 Base case WM 1 and improvement options – impact of life time on total energy over life time by product

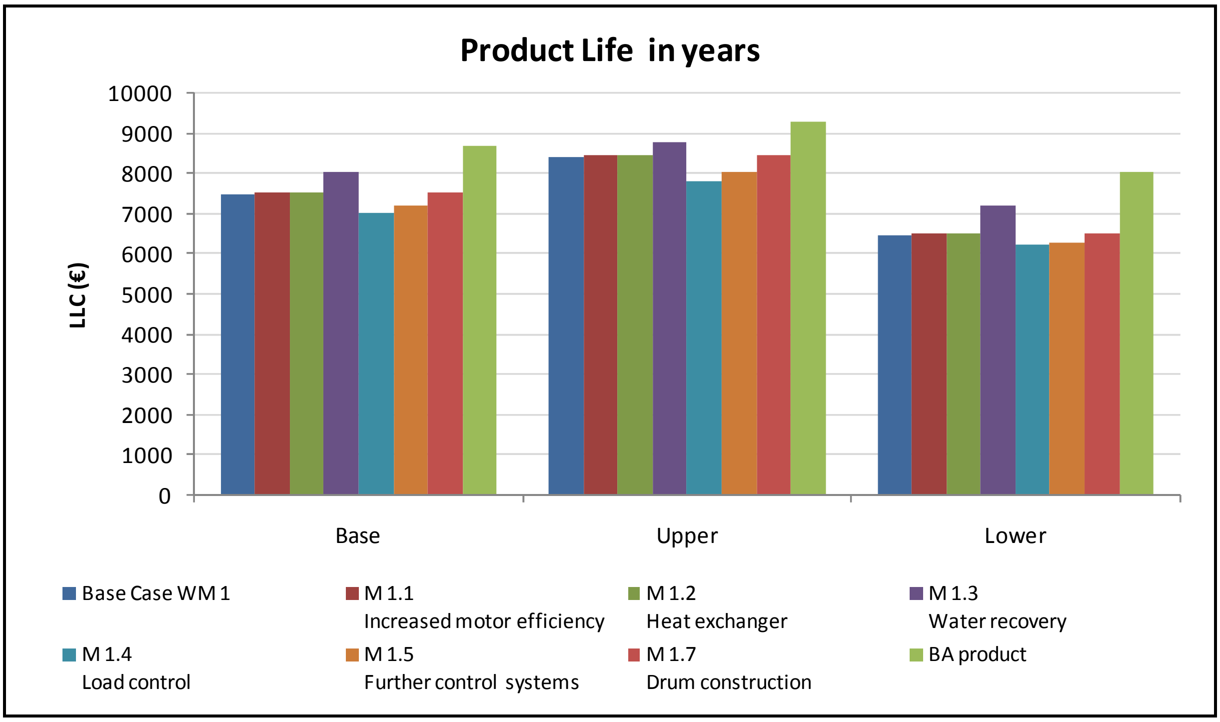

Figure 98 Base case WM 1 and improvement options – impact of life time on LCC by product

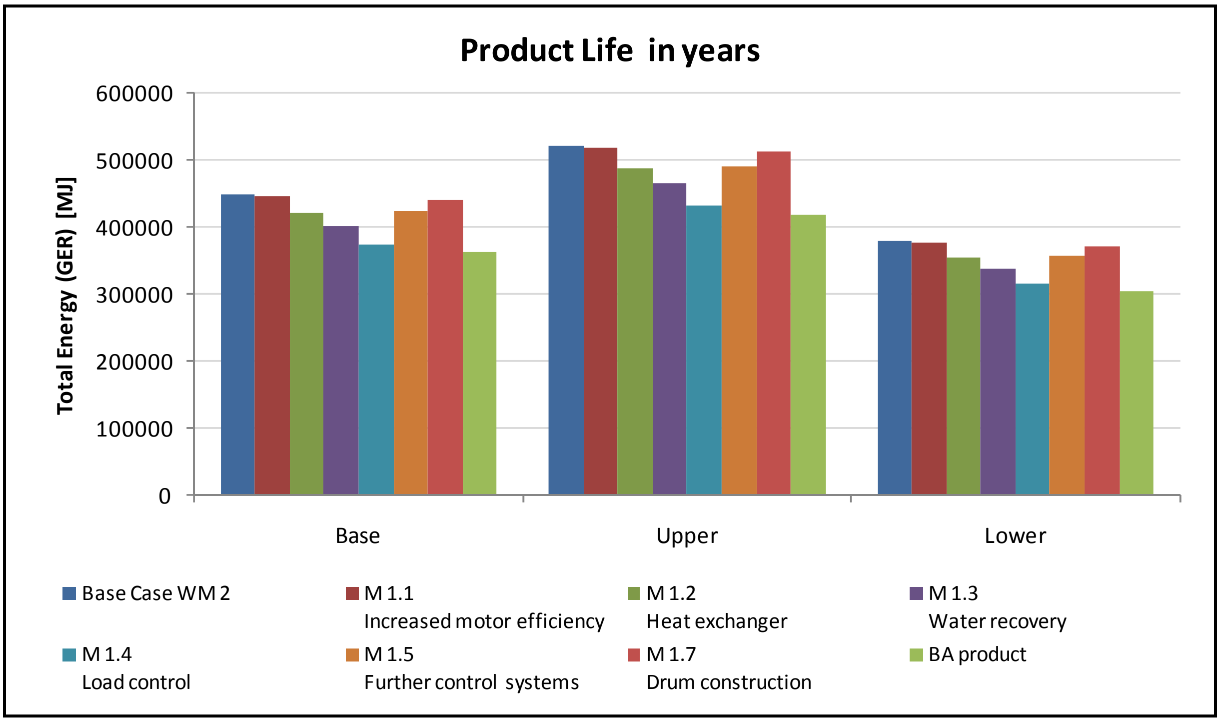

Figure 99 Base case WM 2 and improvement options – impact of life time on total energy over life time by product

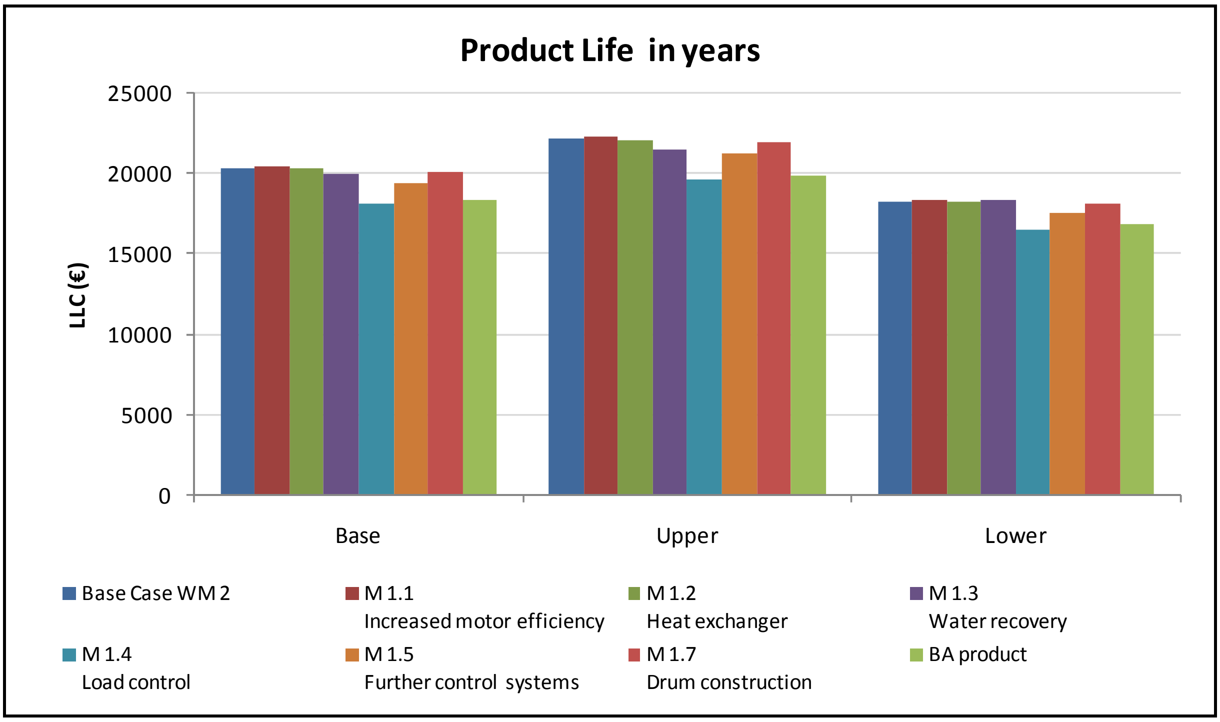

Figure 100 Base case WM 2 and improvement options – impact of life time on LCC by product

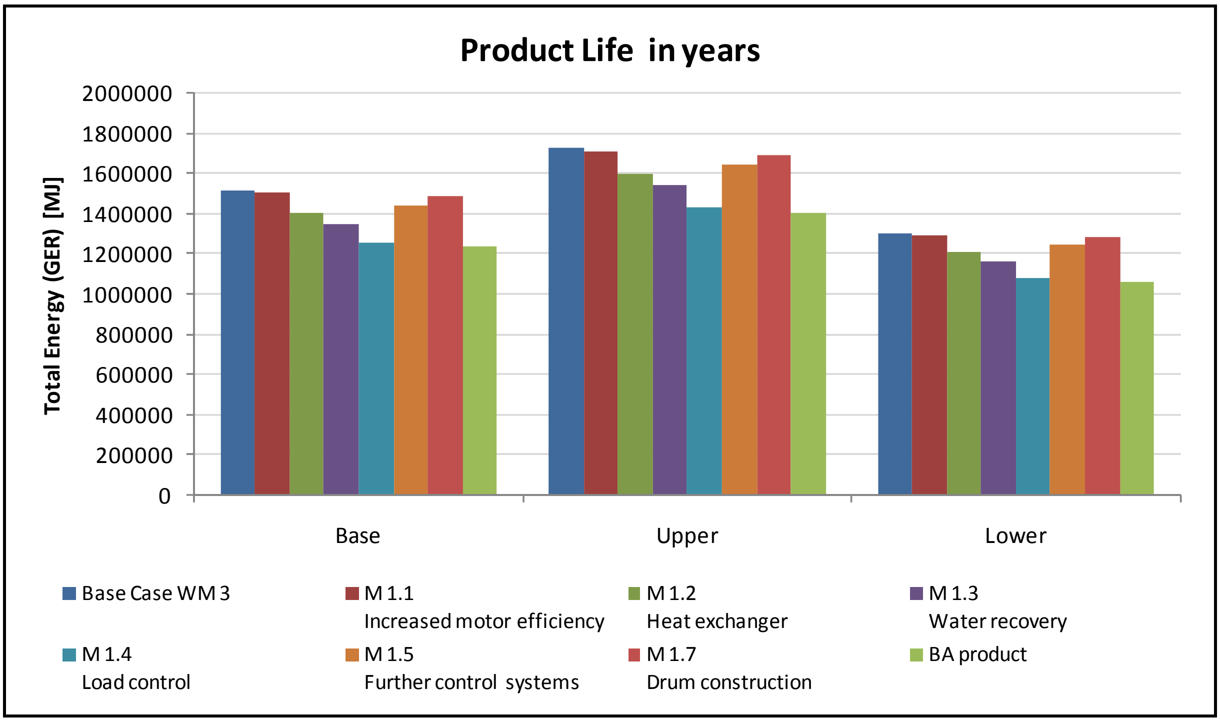

Figure 101 Base case WM 3 and improvement options – impact of life time on total energy over life time by product

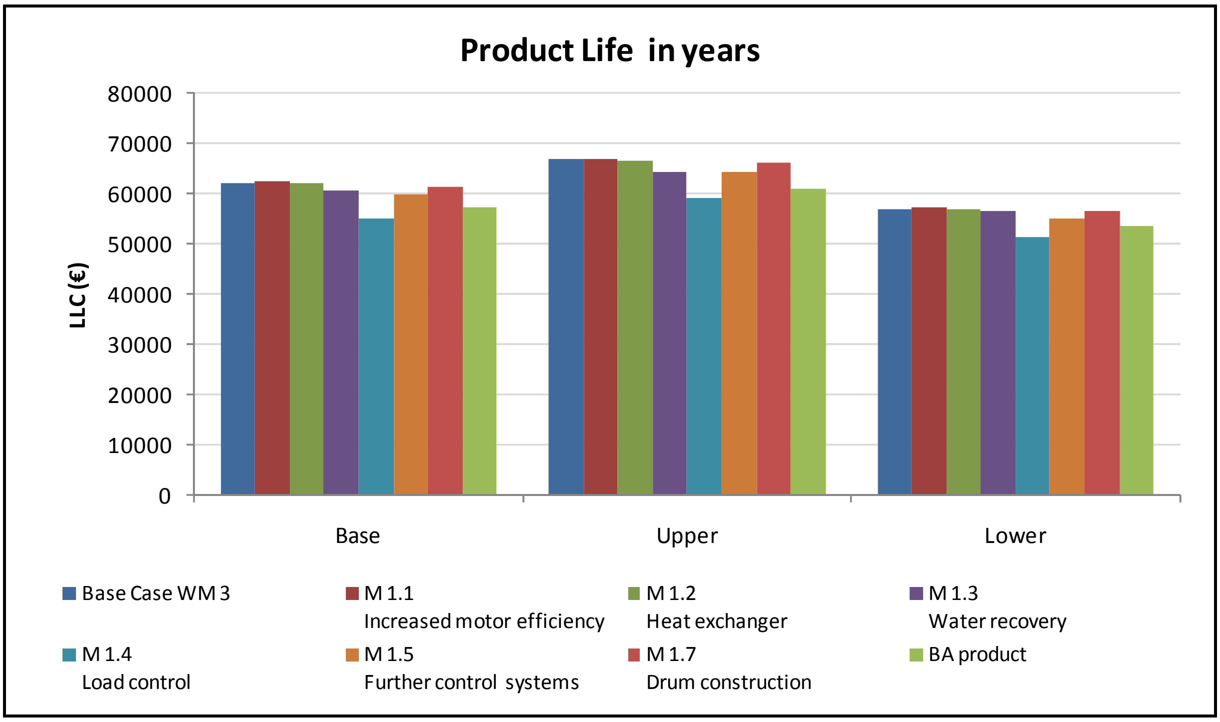

Figure 102 Base case WM 3 and improvement options – impact of life time on LCC by product

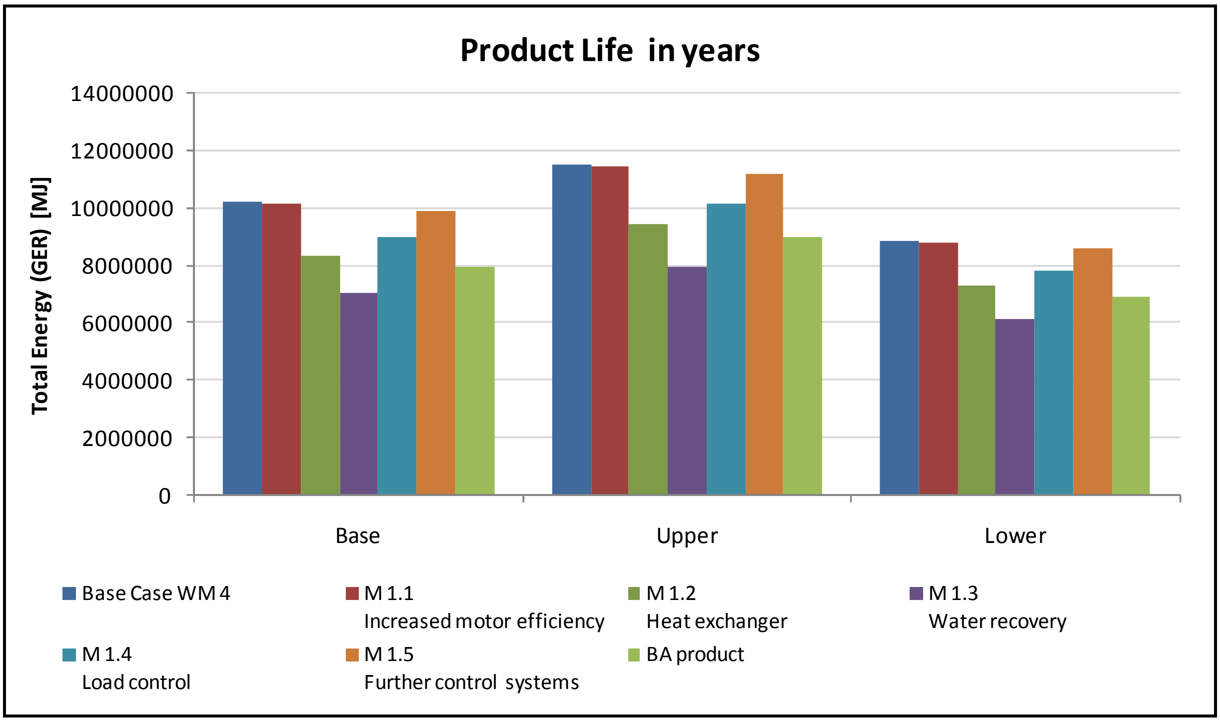

Figure 103 Base case WM 4 and improvement options – impact of life time on total energy over life time by product

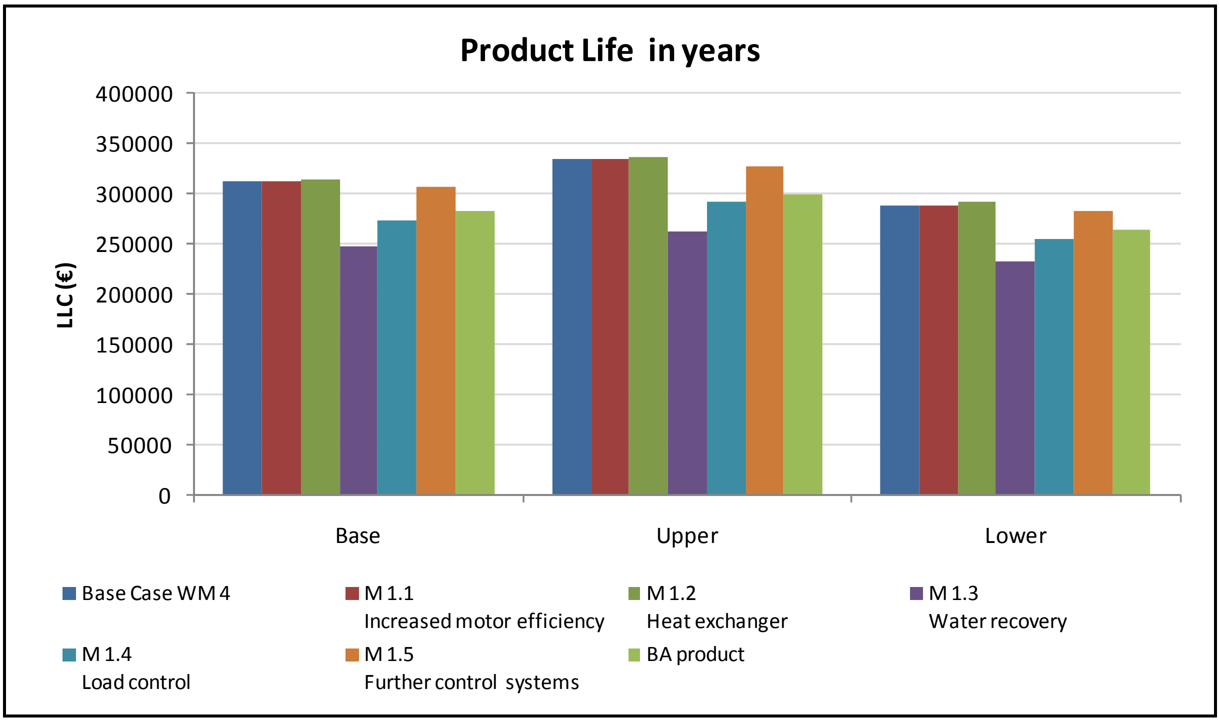

Figure 104 Base case WM 4 and improvement options – impact of life time on LCC by product

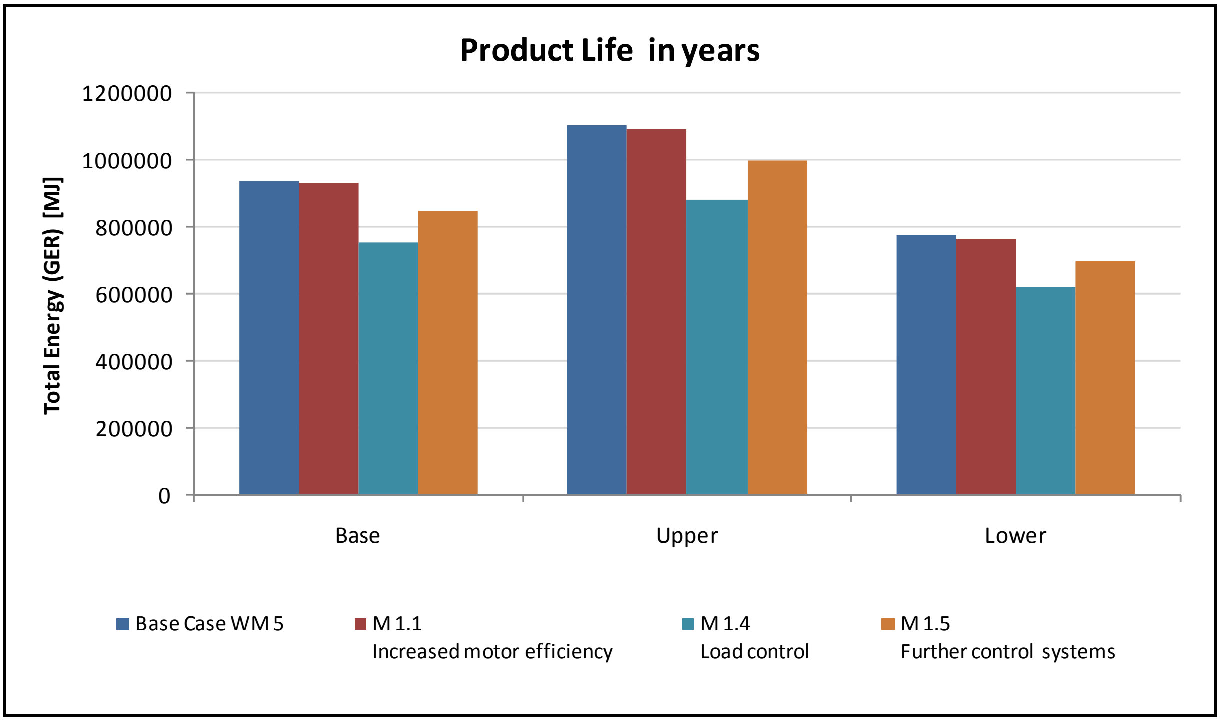

Figure 105 Base case WM 5 and improvement options – impact of life time on total energy over life time by product

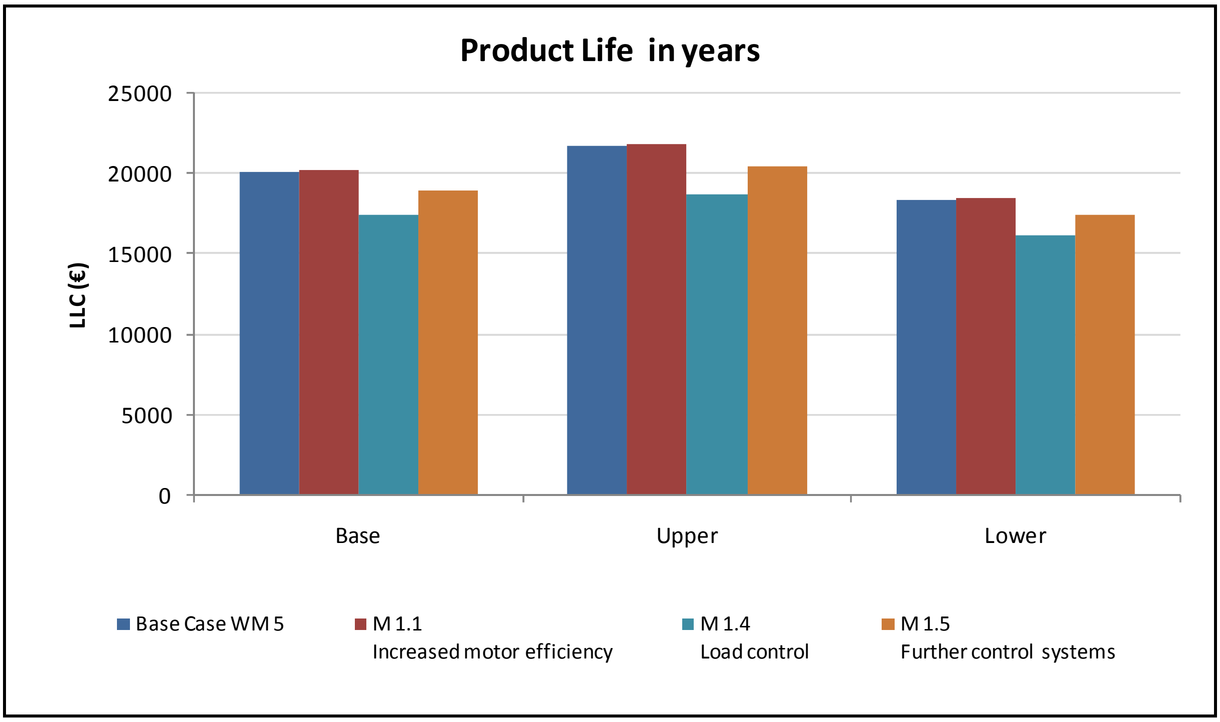

Figure 106 Base case WM 5 and improvement options – impact of life time on LCC by product

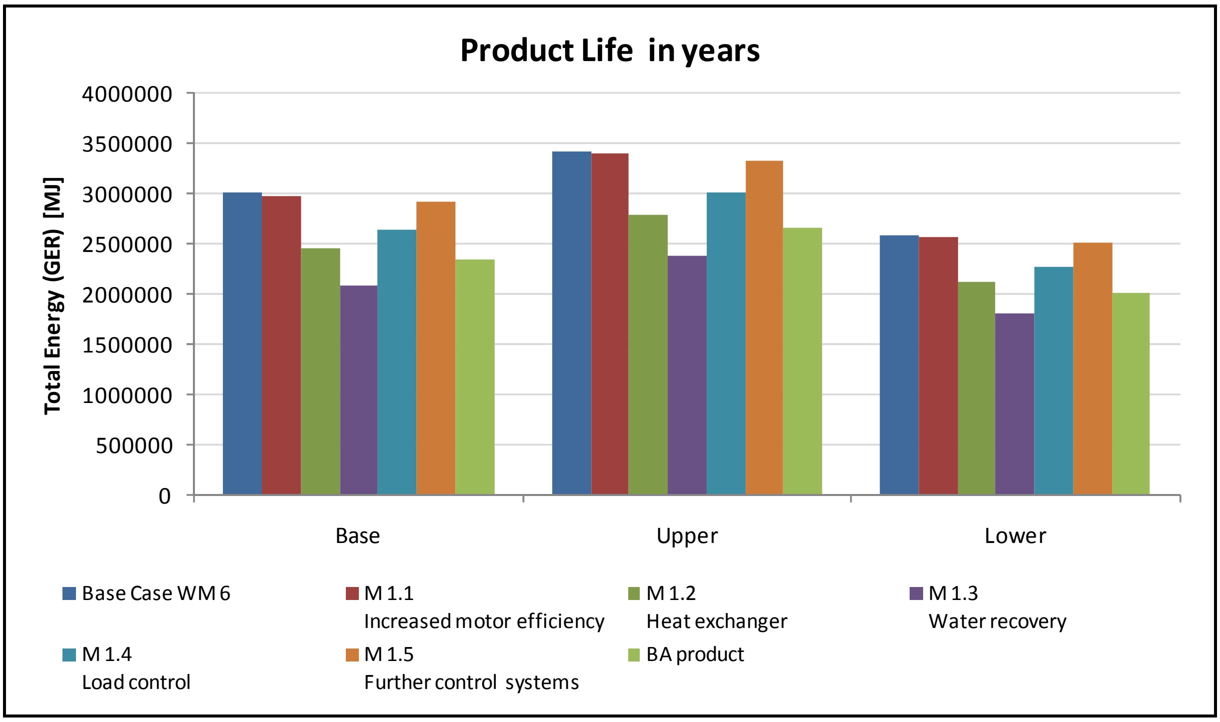

Figure 107 Base case WM 6 and improvement options – impact of life time on total energy over life time by product

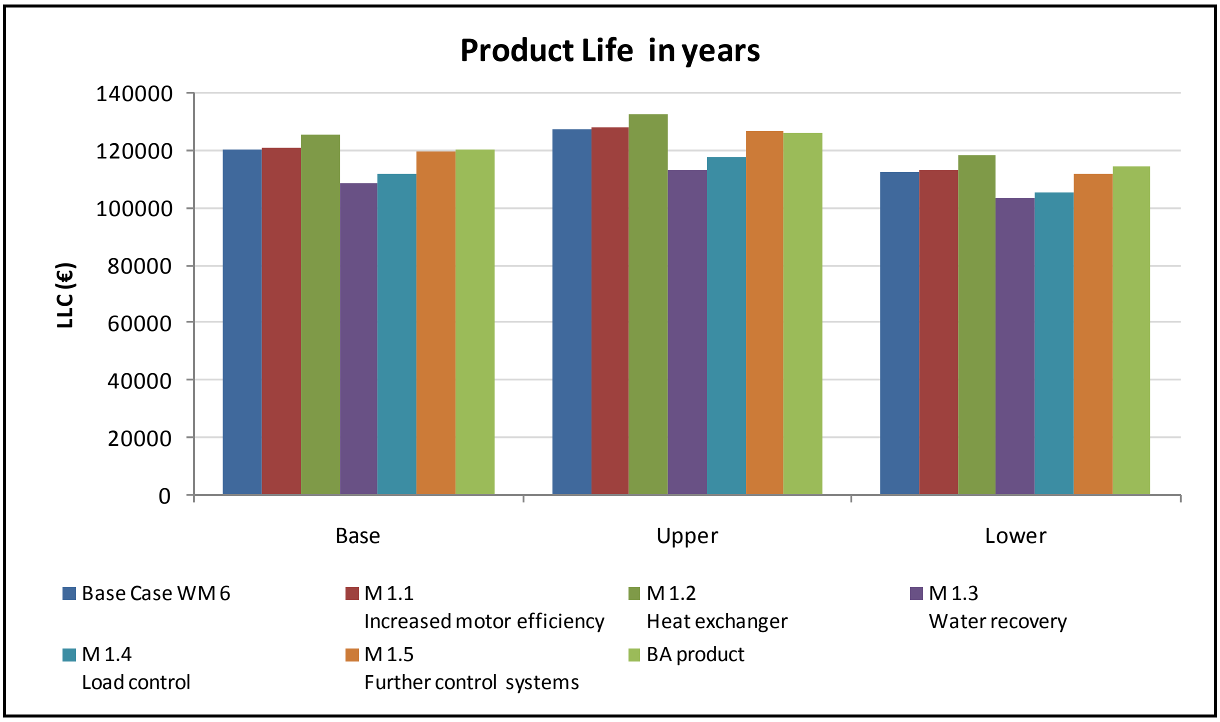

Figure 108 Base case WM 6 and improvement options – impact of life time on LCC by product

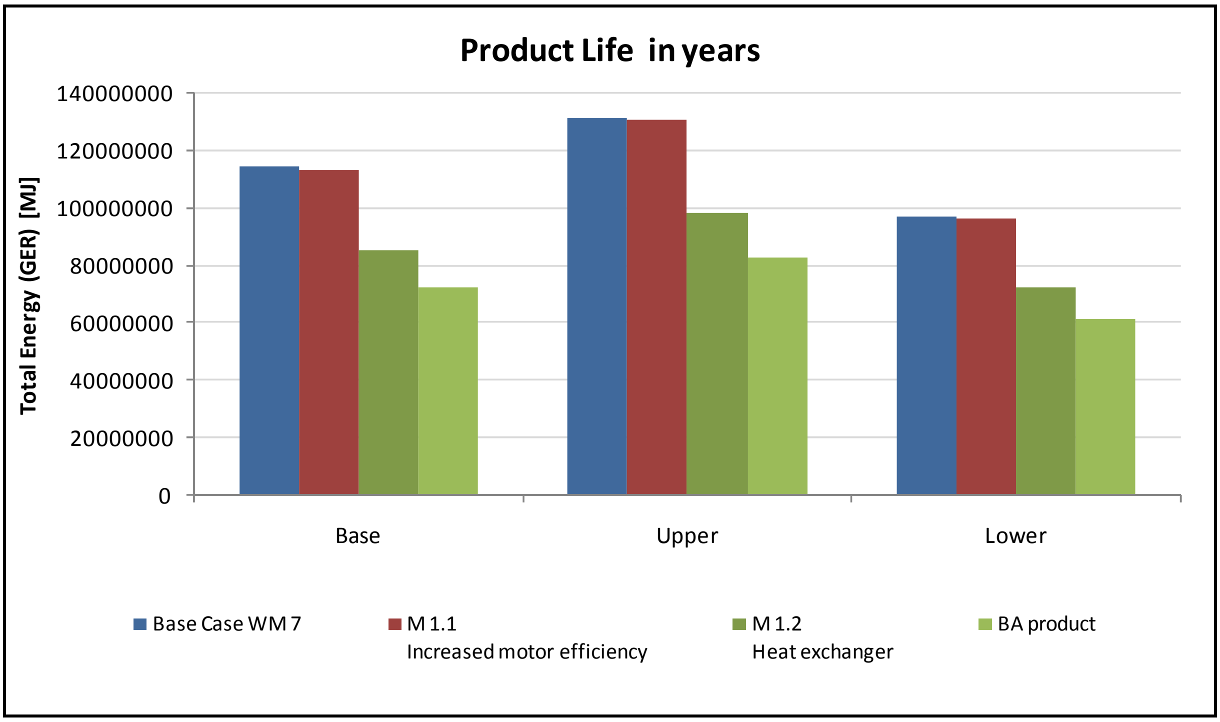

Figure 109 Base case WM 7 and improvement options – impact of life time on total energy over life time by product

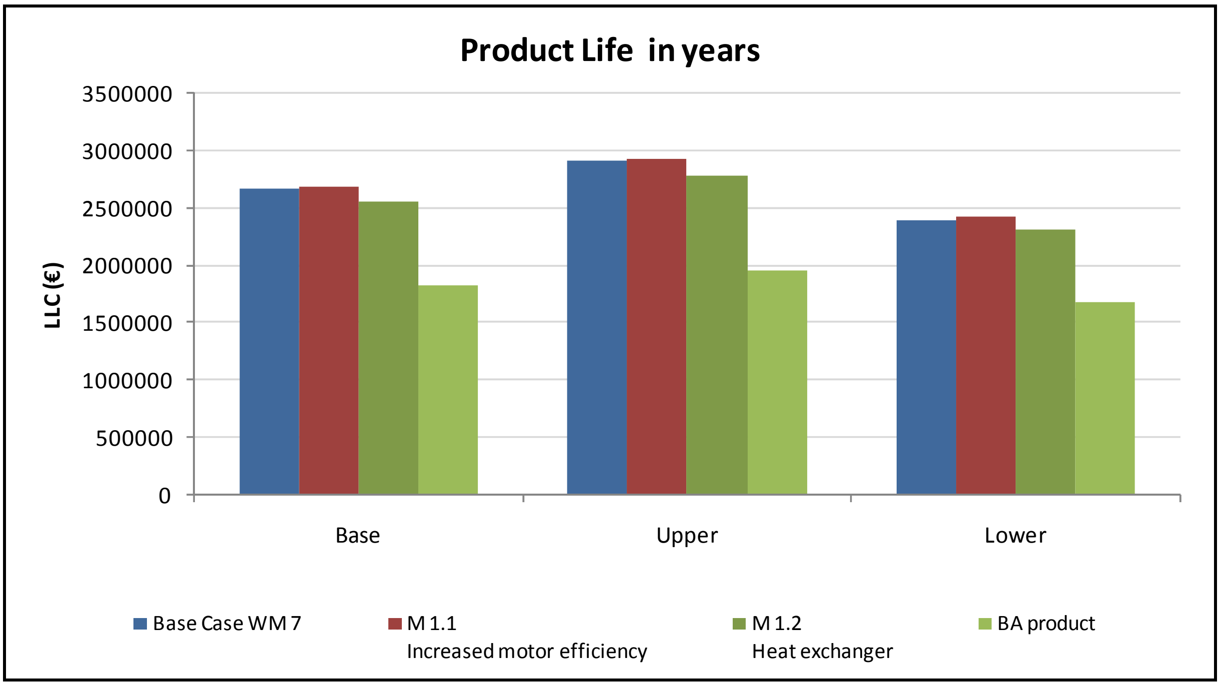

Figure 110 Base case WM 7 and improvement options – impact of life time on LCC by product

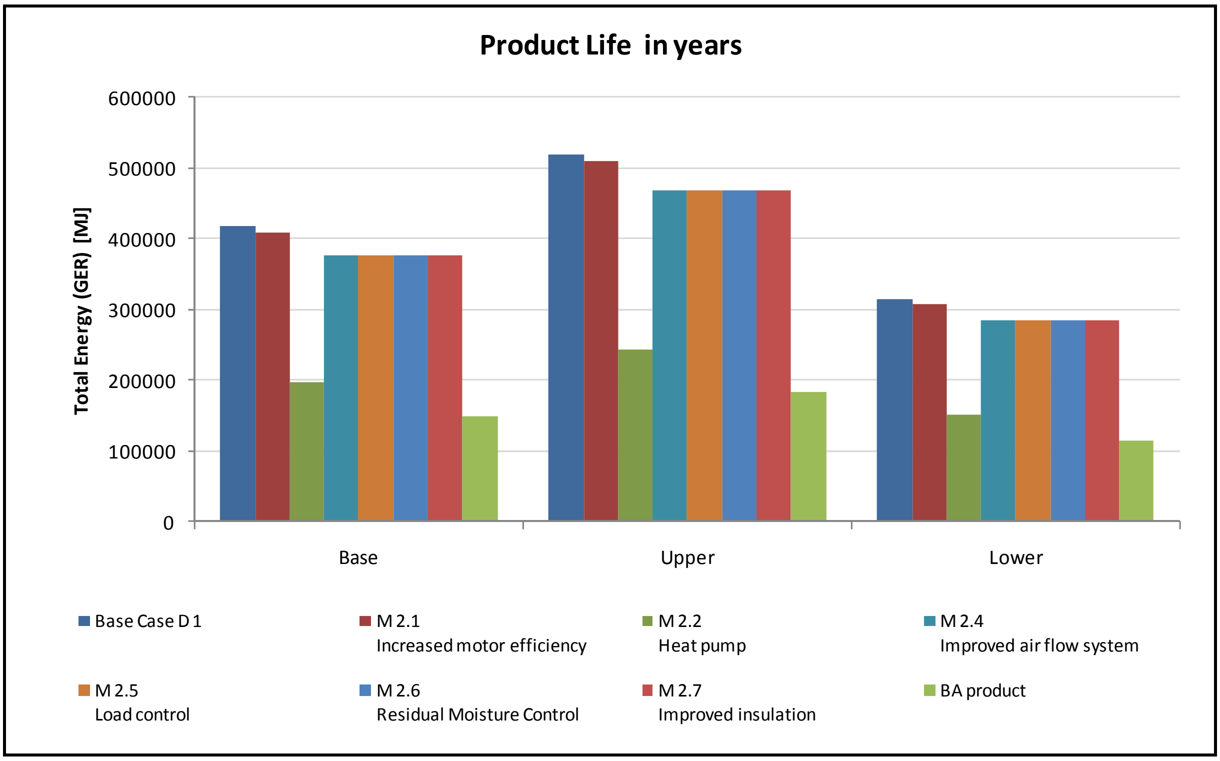

Figure 111 Base case D 1 and improvement options – impact of life time on total energy over life time by product

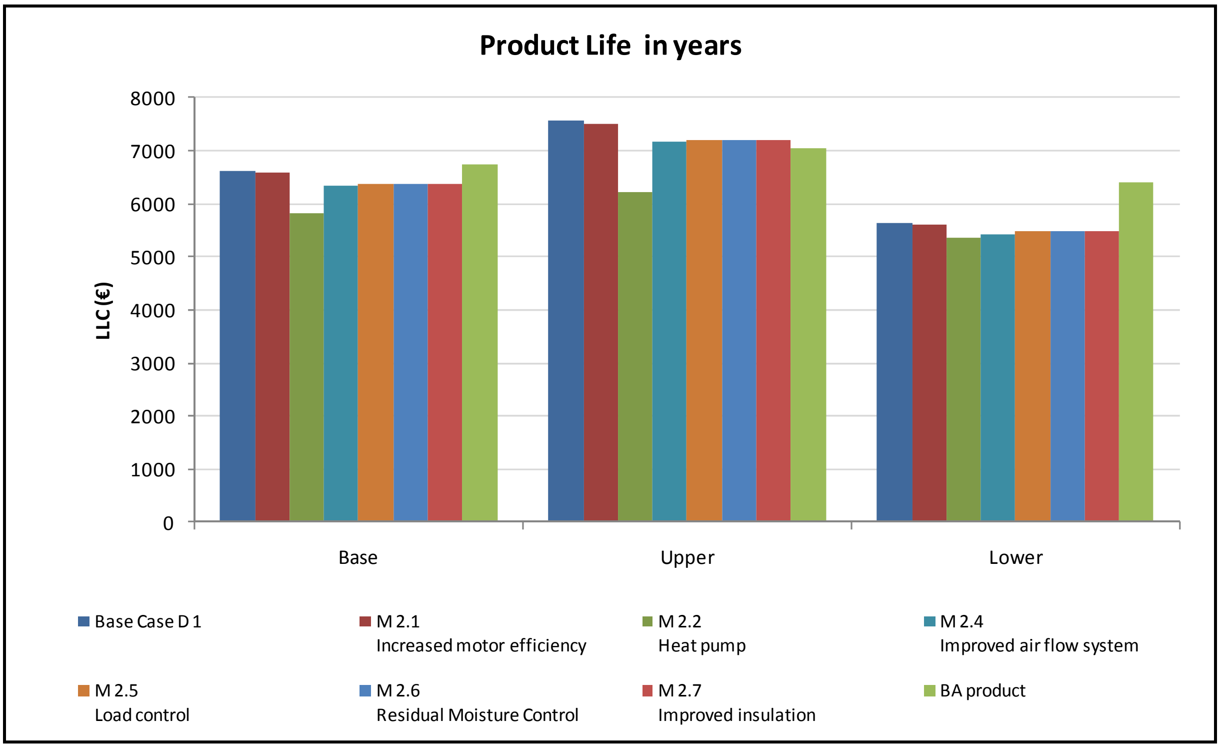

Figure 112 Base case D 1 and improvement options – impact of life time on LCC by product

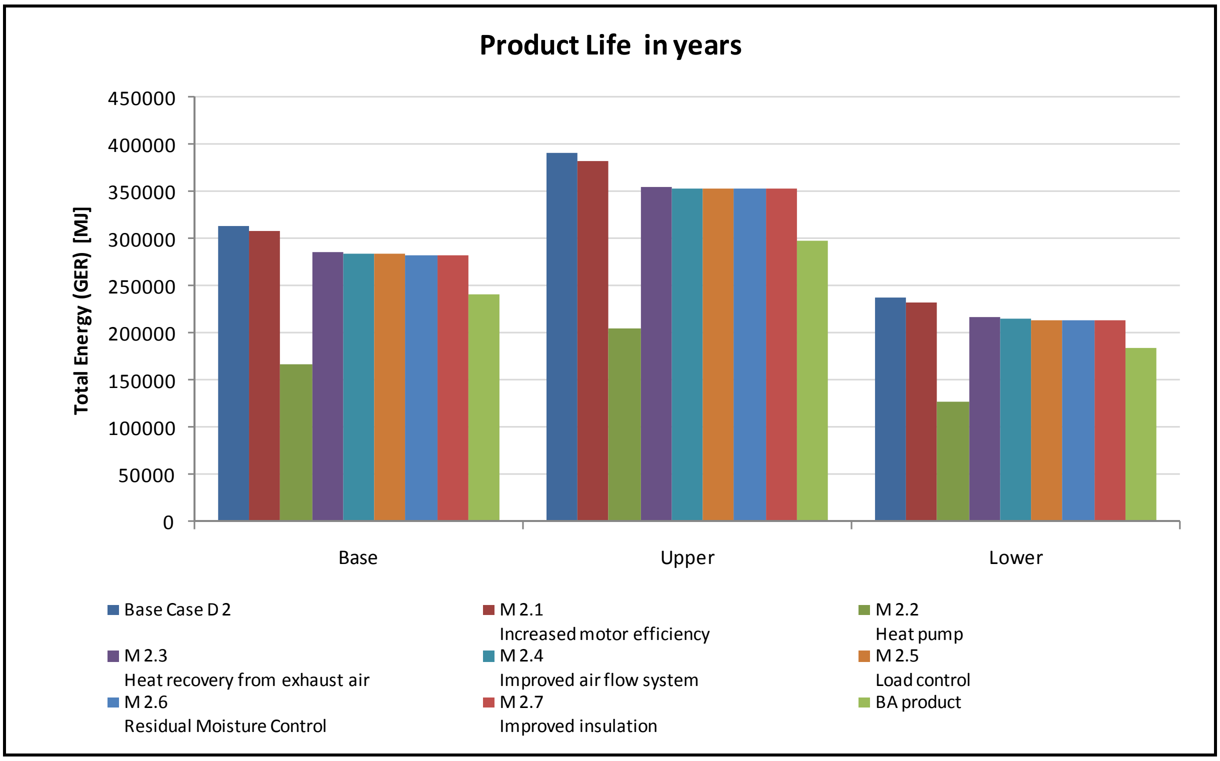

Figure 113 Base case D 2 and improvement options – impact of life time on total energy over life time by product

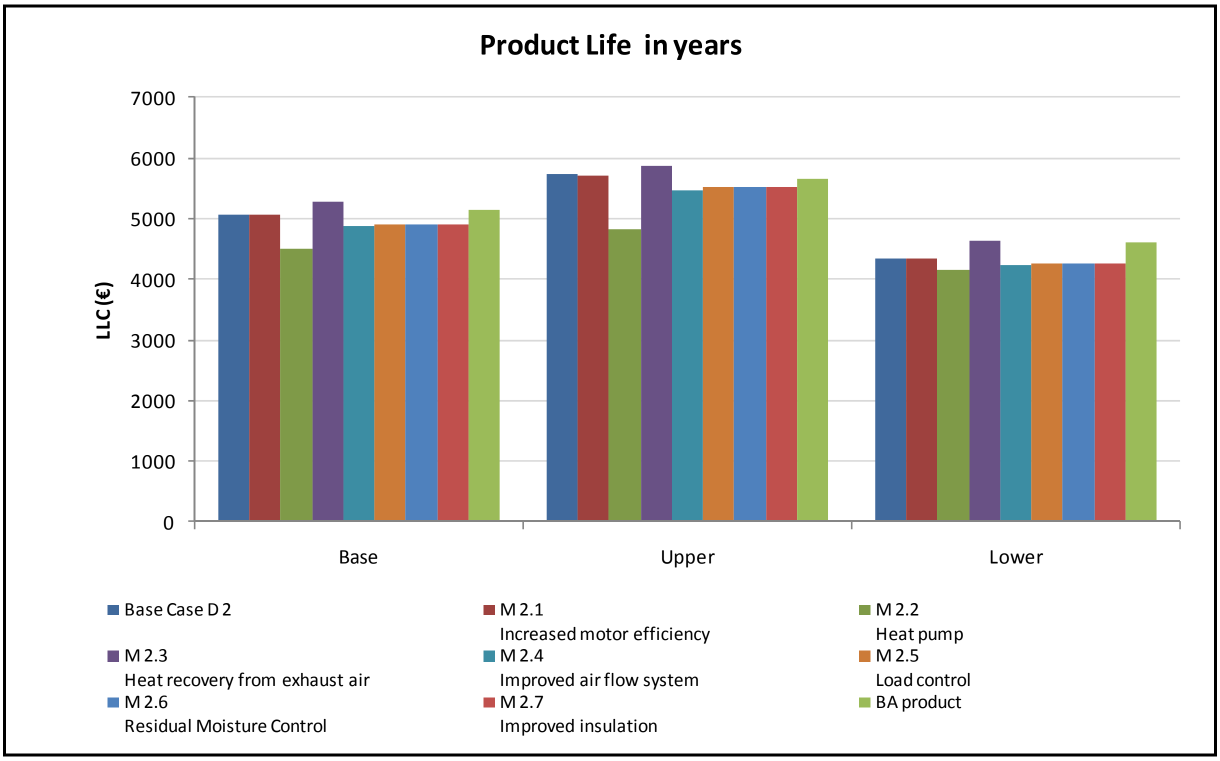

Figure 114 Base case D 2 and improvement options – impact of life time on LCC by product

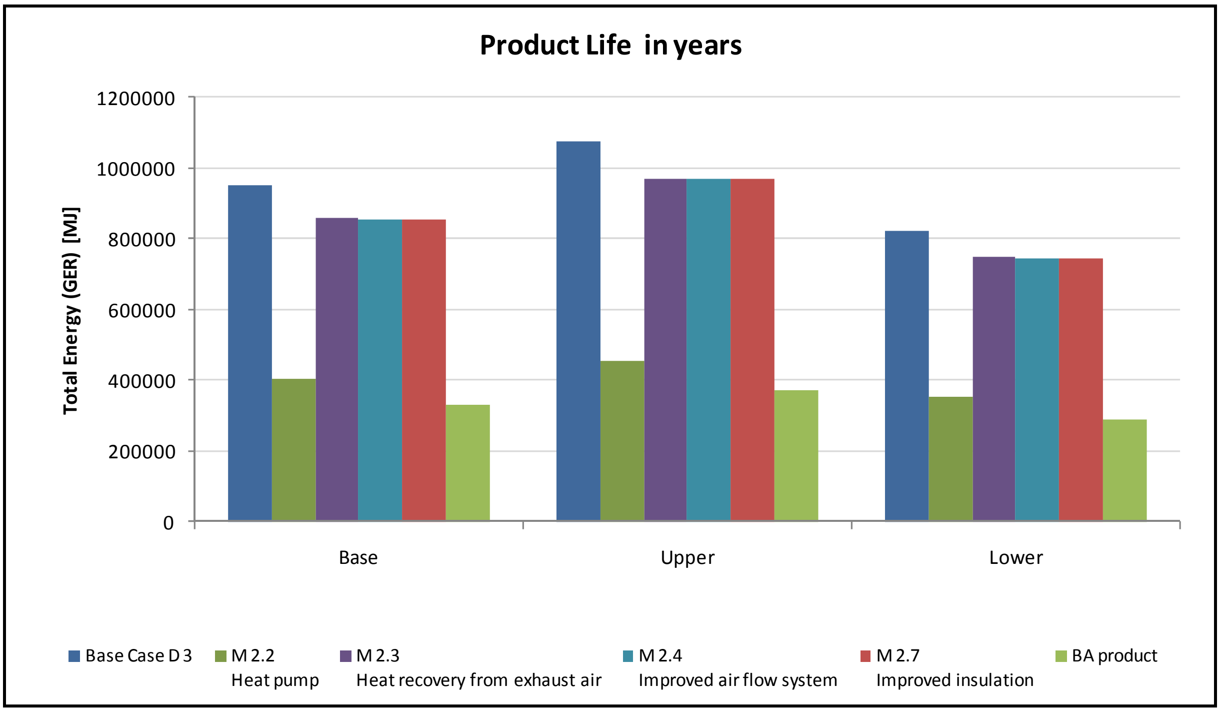

Figure 115 Base case D 3 and improvement options – impact of life time on total energy over life time by product

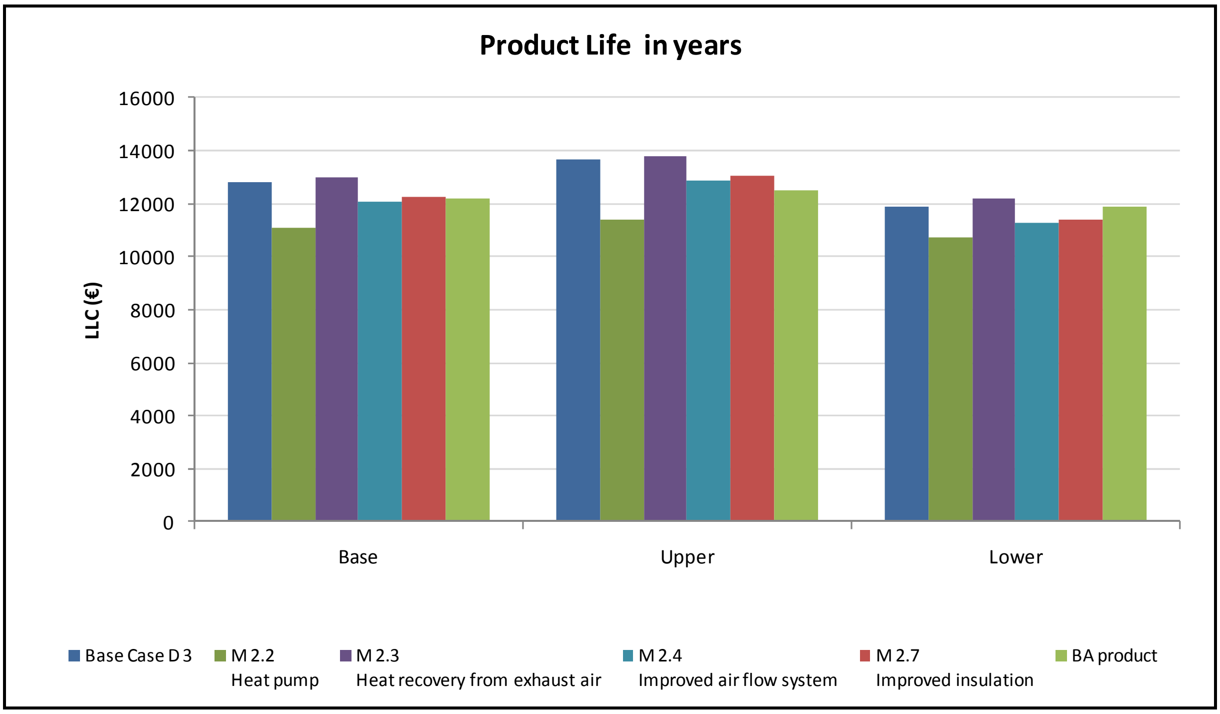

Figure 116 Base case D3 and improvement options – impact of life time on LCC by product

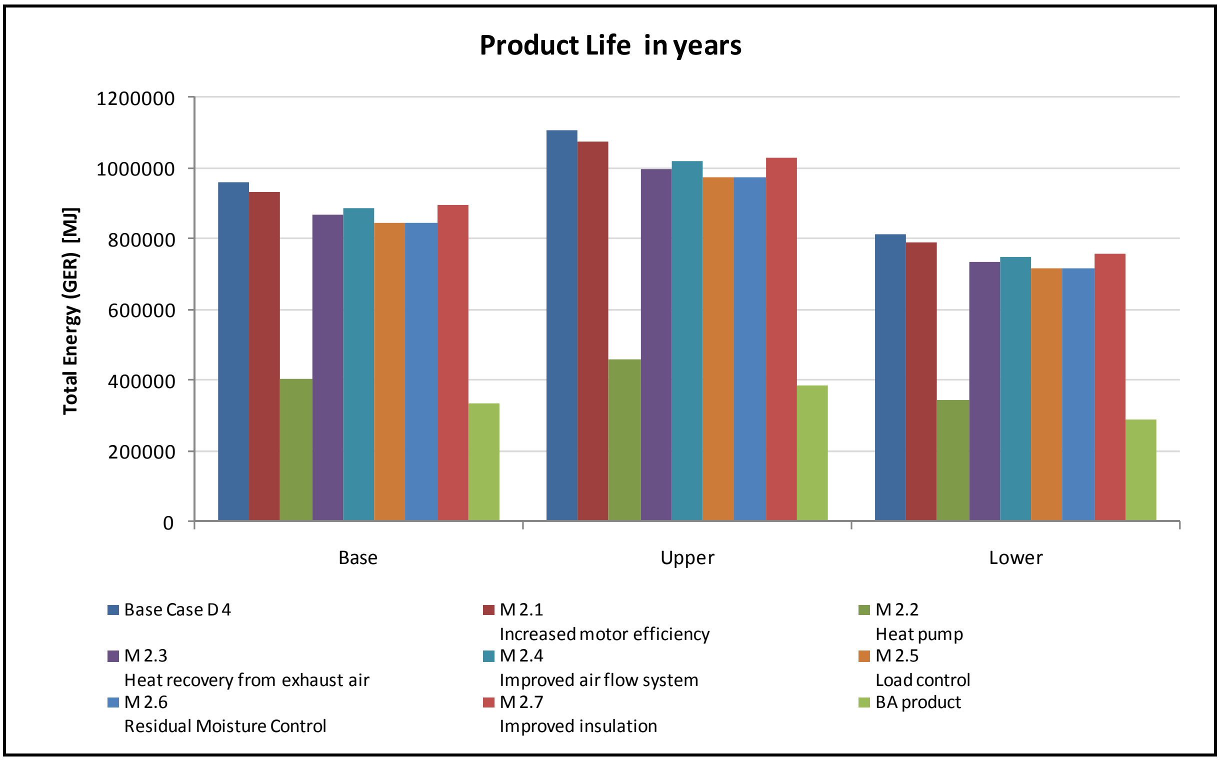

Figure 117 Base case D 4 and improvement options – impact of life time on total energy over life time by product

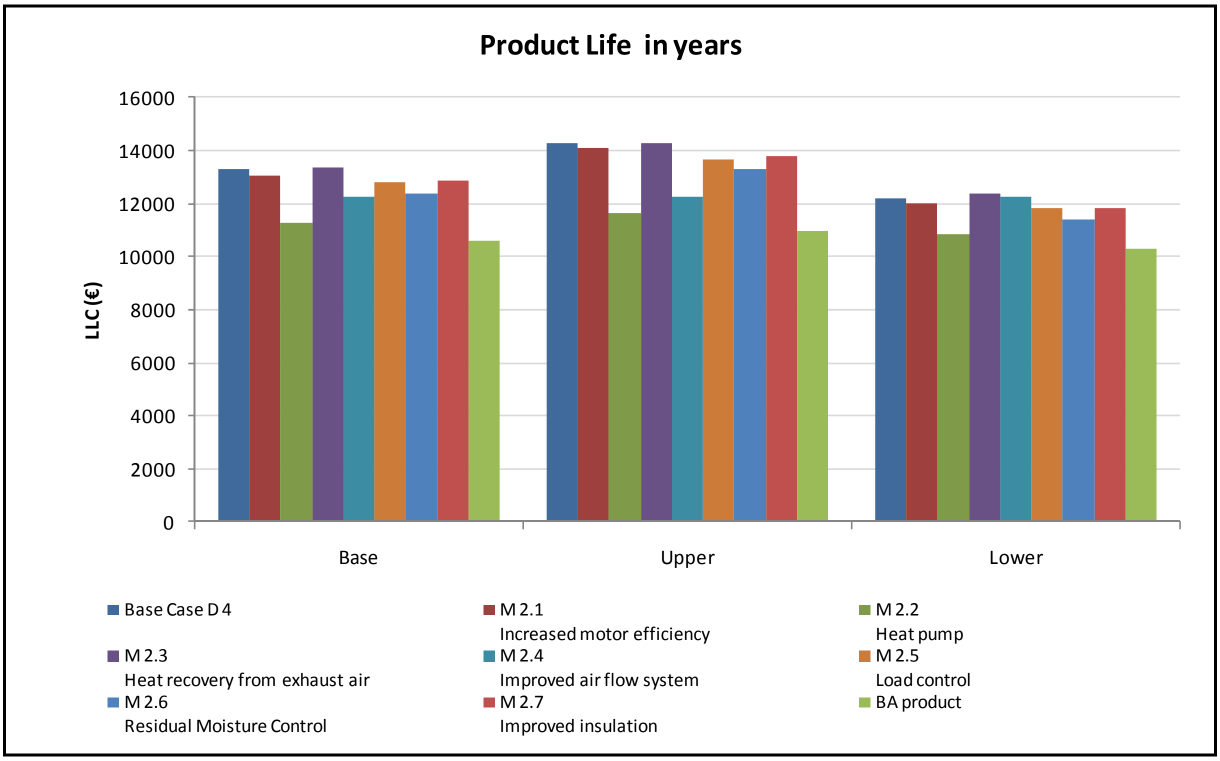

Figure 118 Base case D 4 and improvement options – impact of life time on LCC by product

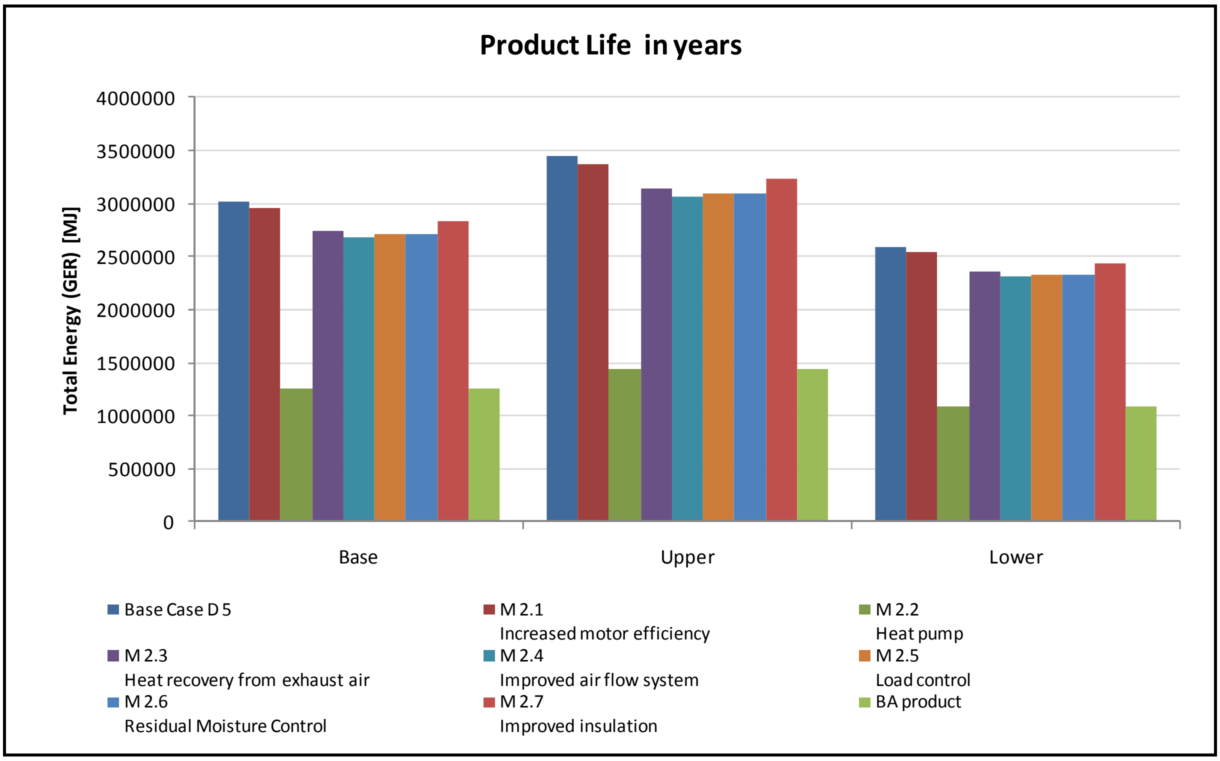

Figure 119 Base case D 5 and improvement options – impact of life time on total energy over life time by product

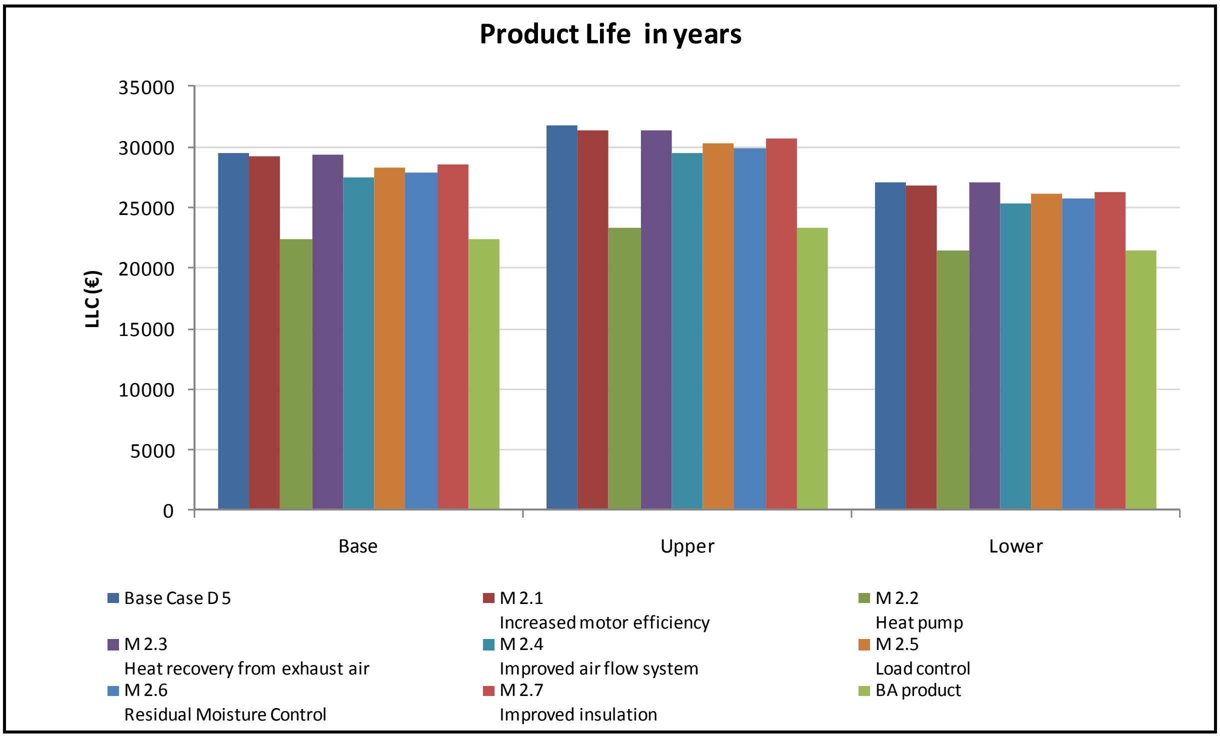

Figure 120 Base case D 5 and improvement options – impact of life time on LCC by product

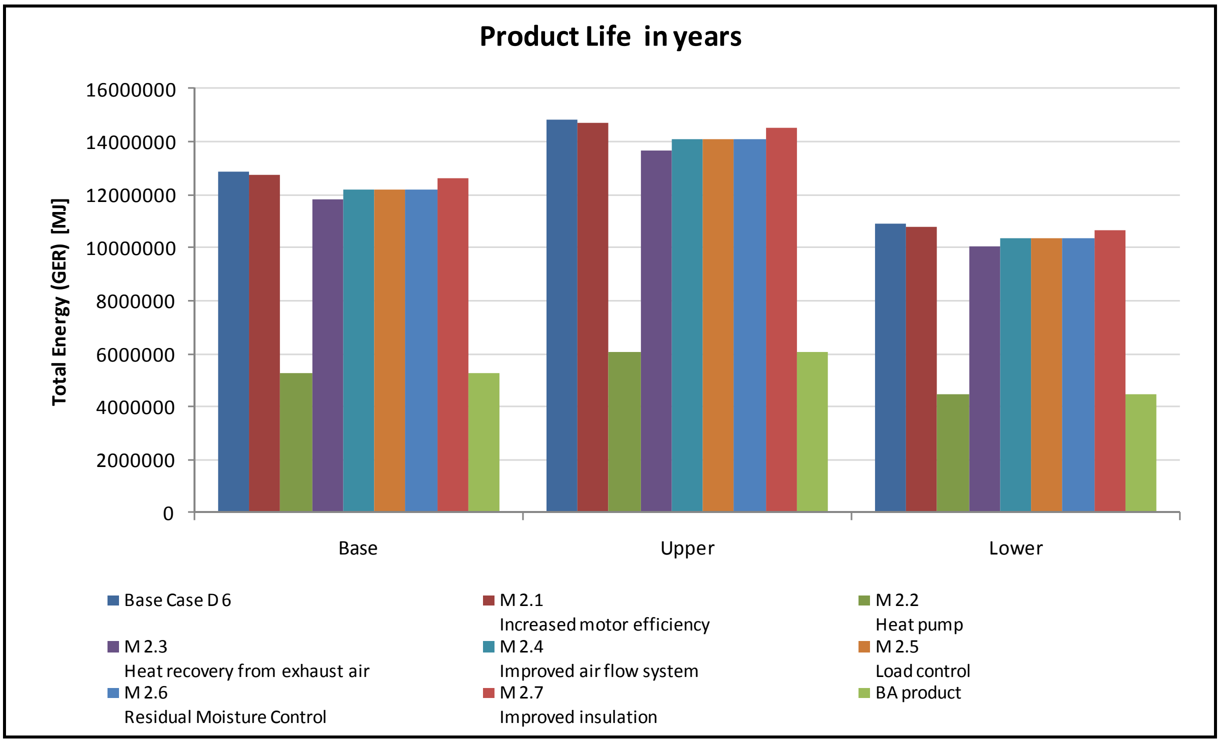

Figure 121 Base case D 6 and improvement options – impact of life time on total energy over life time by product

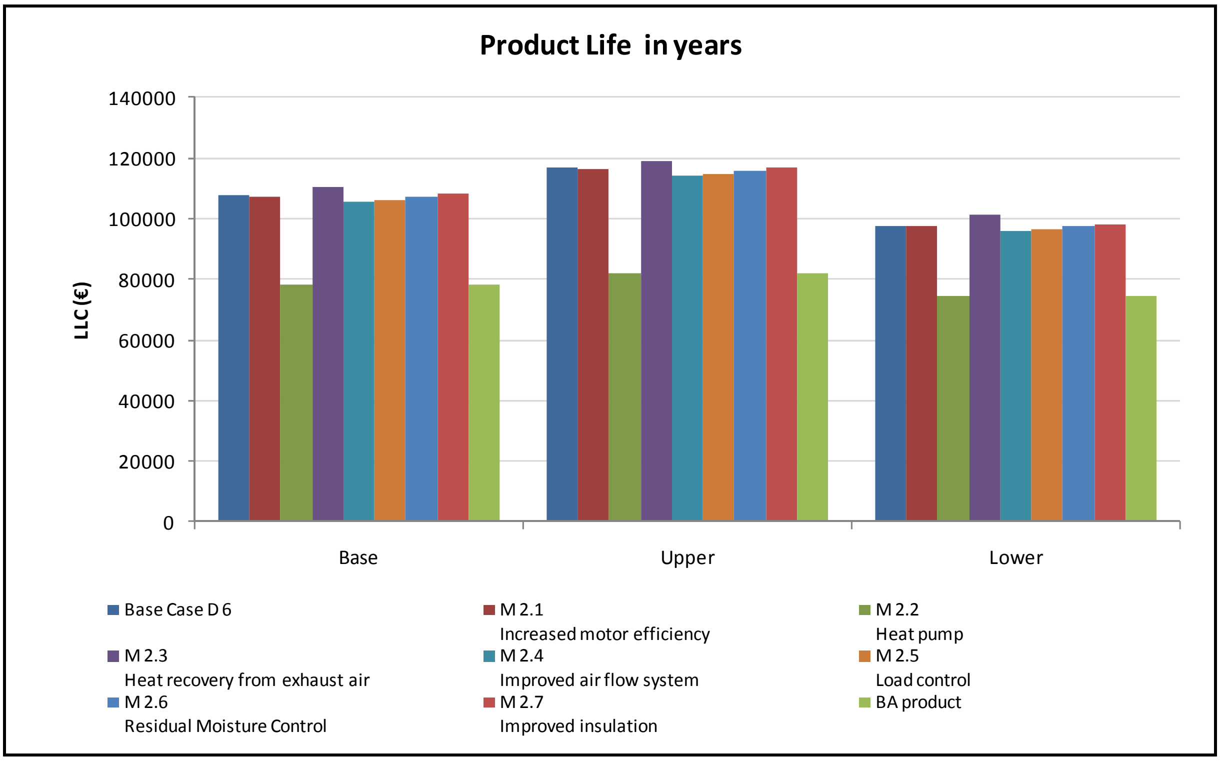

Figure 122 Base case D 6 and improvement options – impact of life time on LCC by product

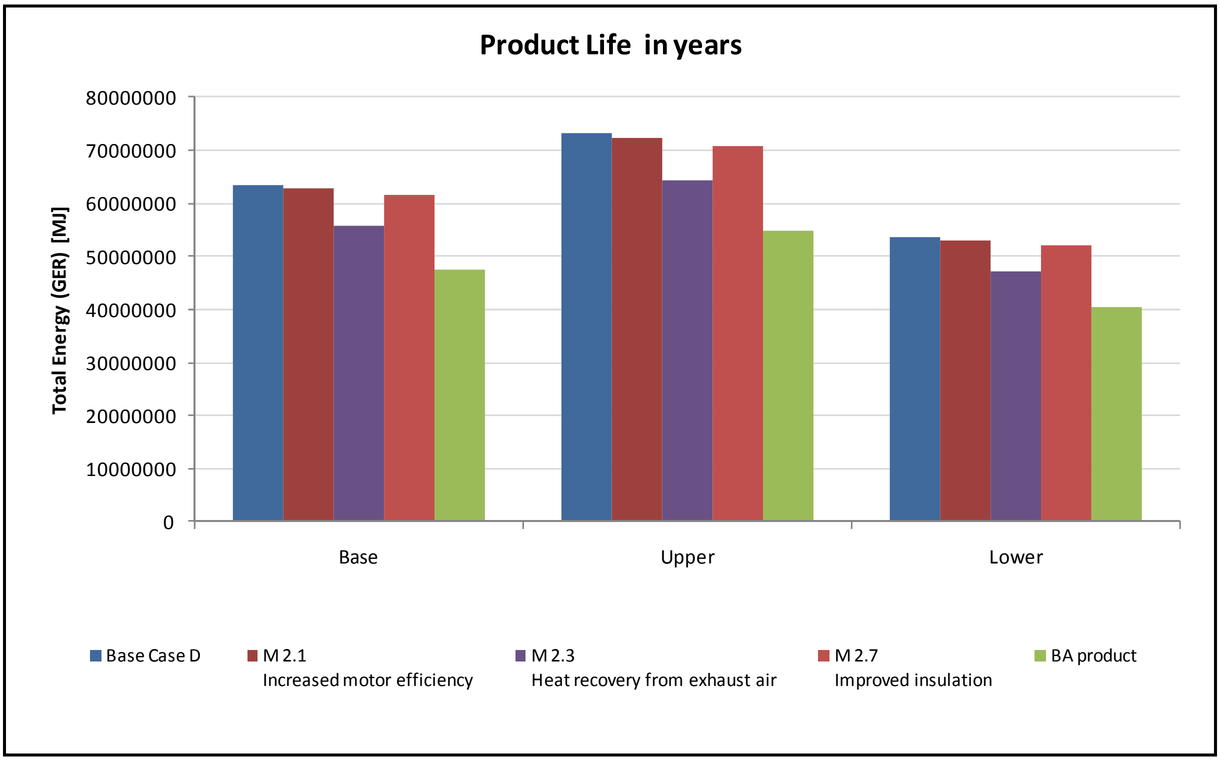

Figure 123 Base case D 7 and improvement options – impact of life time on total energy over life time by product

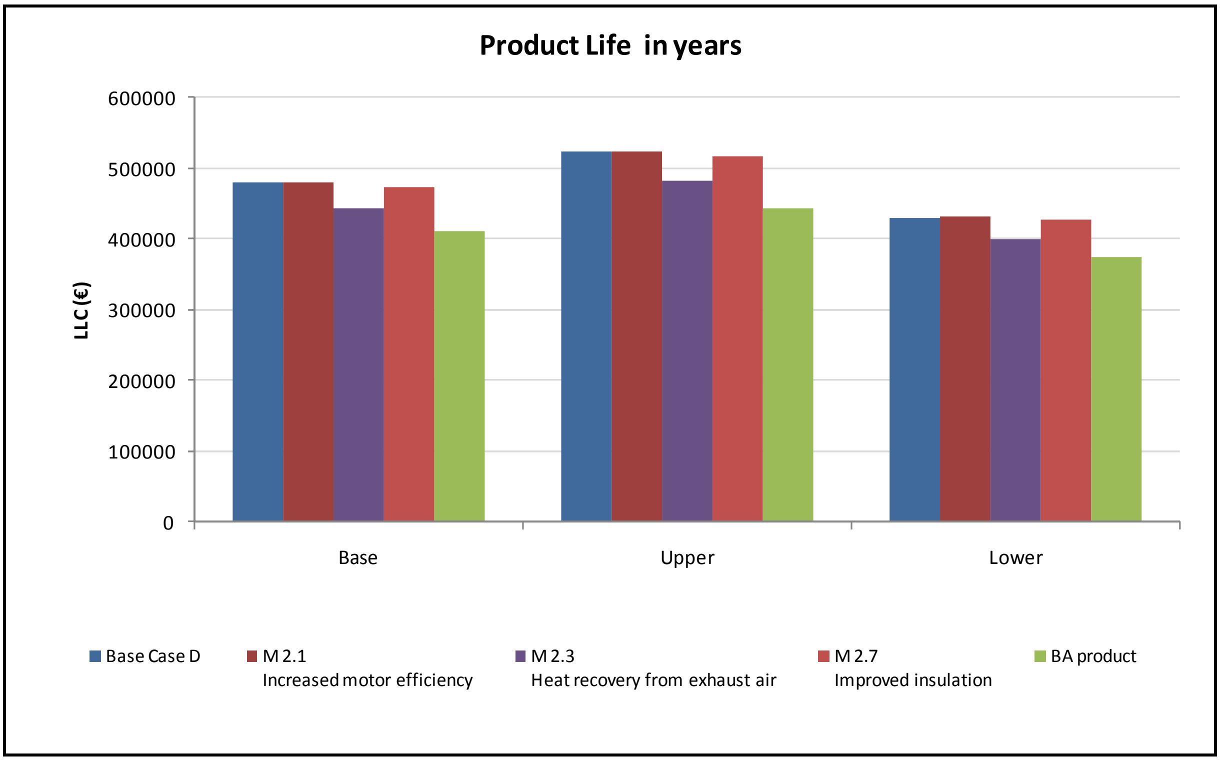

Figure 124 Base case D 7 and improvement options – impact of life time on LCC by product

4.4 Resources and consumable rates

4.4.1 Assumptions

Table 24, Table 25, and Table 26 present the range for the resources and consumables prices that will be used for the sensitivity analysis. These parameters only have an economic influence on the outcomes so that only the influence on LCC is displayed in Figure 125 to Figure 128.

The minimum and maximum electricity and gas values correspond to the extreme values found in Eurostat statistics (see Task 2). Because the base cases products were sometimes a weighted average between different energy sources (electricity and gas), the influence of the energy rates will be studied by changing simultaneously the electricity and the gas rates. For water, they were also extracted from extreme values found during the estimation of the EU average price (see Task 2). For detergent, a wide range was deliberately chosen given the high variability of types of detergent available (see Task 2).

Again, we use average EU prices for all calculations but there are significant differences between Member States.

Table 24 Electricity rate ranges for the sensitivity analysis

Base case	Base electricity rate (€/kWh)	Min	Max
WM 1 - Semi-professional washer extractor WM 2 - Professional washing extractor (<15 kg)	0.138	0.071 (Estonia)	0.185 (Slovakia)
WM 3 - Professional washing extractor (15–40 kg)	0.105	0.059 (Estonia)	0.160 (Cyprus)
WM 4 - Professional washing extractor (>40 kg)	0.090	0.055 (Estonia)	0.144 (Cyprus)
WM 5 - Professional washer dryer WM 6 - Professional barrier washer	0.105	0.059 (Estonia)	0.160 (Cyprus)
WM 7 - Washing tunnel machine	0.090	0.055 (Estonia)	0.144 (Cyprus)
D 1 - Semi-professional dryer, condenser D 2 - Semi-professional dryer, air vented D 3 - Professional cabinet dryer D 4 - Professional air tumble dryer (<15 kg)	0.138	0.071 (Estonia)	0.185 (Slovakia)
D 5 - Professional air tumble dryer (15–40 kg)	0.105	0.059 (Estonia)	0.160 (Cyprus)
D 6 - Professional air tumble dryer (>40 kg) D 7 - Industrial pass-through (transfer) tumble dryer	0.090	0.055 (Estonia)	0.144 (Cyprus)

Table 25 Gas rate ranges for the sensitivity analysis

Base case	Base gas rate (€/GJ)	Min	Max
WM 1 - Semi-professional washer extractor WM 2 - Professional washing extractor (<15 kg)	11.2115	5.5257 (Romania)	14.7633 (Sweden)
WM 3 - Professional washing extractor (15–40 kg)	10.0097	5.5080 (Romania)	13.1448 (Sweden)
WM 4 - Professional washing extractor (>40 kg)	8.7921	5.6072 (Romania)	11.2499 (Sweden)
WM 5 - Professional washer dryer WM 6 - Professional barrier washer	10.0097	5.5080 (Romania)	13.1448 (Sweden)
WM 7 - Washing tunnel machine	8.7921	5.6072 (Romania)	11.2499 (Sweden)
D 1 - Semi-professional dryer, condenser D 2 - Semi-professional dryer, air vented D 3 - Professional cabinet dryer D 4 - Professional air tumble dryer (<15 kg)	11.2115	5.5257 (Romania)	14.7633 (Sweden)
D 5 - Professional air tumble dryer (15–40 kg)	10.0097	5.5080 (Romania)	13.1448 (Sweden)
D 6 - Professional air tumble dryer (>40 kg) D 7 - Industrial pass-through (transfer) tumble dryer	8.7921	5.6072 (Romania)	11.2499 (Sweden)

Table 26 Water and detergent rates ranges for the sensitivity analysis

Item	Base price (for all base cases)	Min	Max
Water	2.64 €/m^3	1.11 €/m^3 (Rome)	4.91 €/m^3 (Berlin)
Detergent	2.0 €/kg	1.5 €/kg	2.5 €/kg

4.4.2 Results

Figure 125 to Figure 166 show the influence of the variation of the resources and consumables rates on the the life cycle costs of the different base cases and associated improvement options.

The option leading to the lowest life cycle costs remain almost always the same for a given base case, whatever the values considered (base, lower or upper). However, this is not the case for:

- Base case D 1, D 2 and D 3 regarding the variation of electricity rate: option M 2.4 becomes the LLCC with the lower values, instead of option M 2.2.
- Base case D 4 regarding the variation of electricity rate: option M 2.4 becomes the LLCC with the lower values, instead of the BA product.

Besides, some relative changes in the rankings of options happen, for instance:

- For base case WM 4, the LCC of M 1.2 option becomes lower than the LCC of the base case with the upper electricity rate values;
- For base case WM 6, the LCC of the BA product becomes lower than the LCC of the base case with the upper electricity rate values;
- For base cases D 1, D 2 and D 3, the LCC of the BA product and option M 2.2 become higher than the LCC of the base case with the lower electricity rate values.

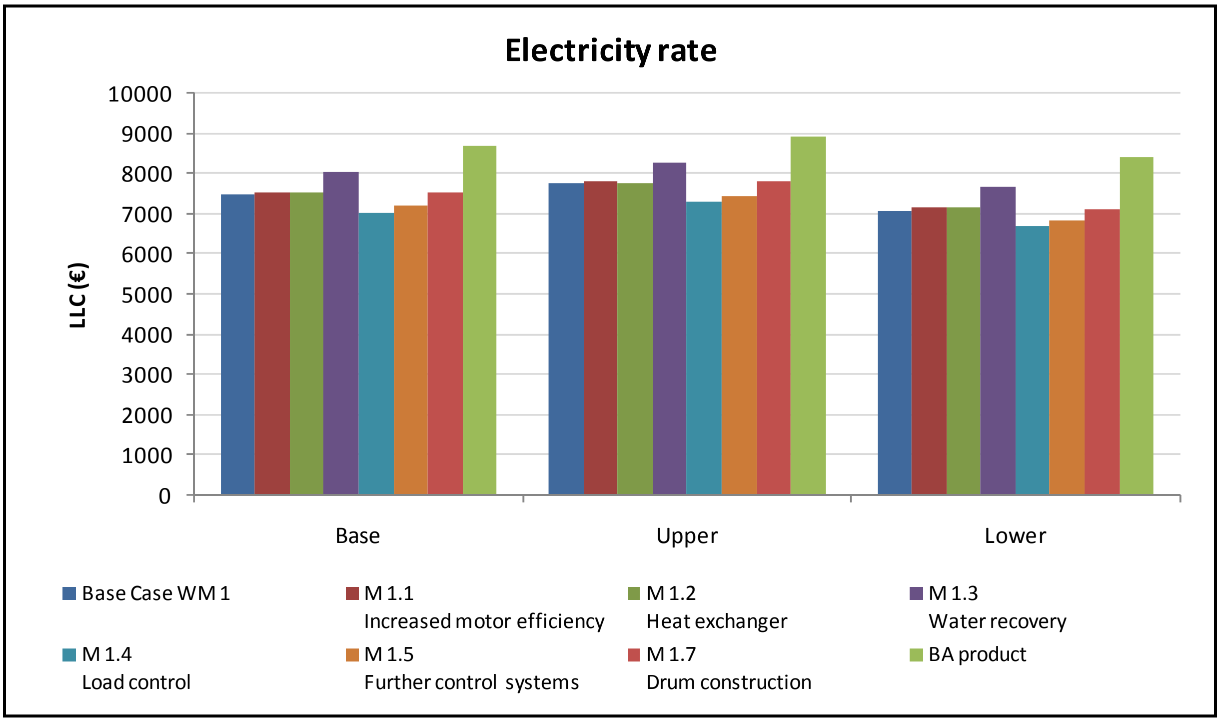

Figure 125 Base case WM 1 and improvement options – impact of electricty rates on LCC by product

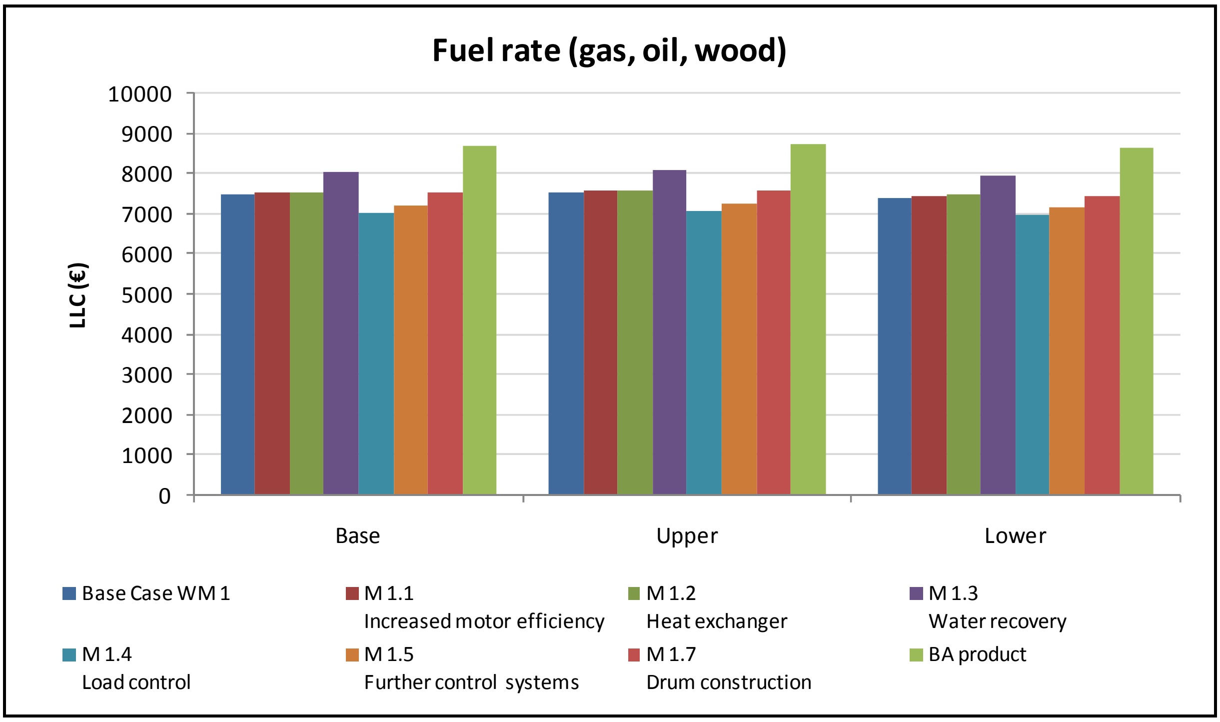

Figure 126 Base case WM 1 and improvement options – impact of gas rates on LCC by product

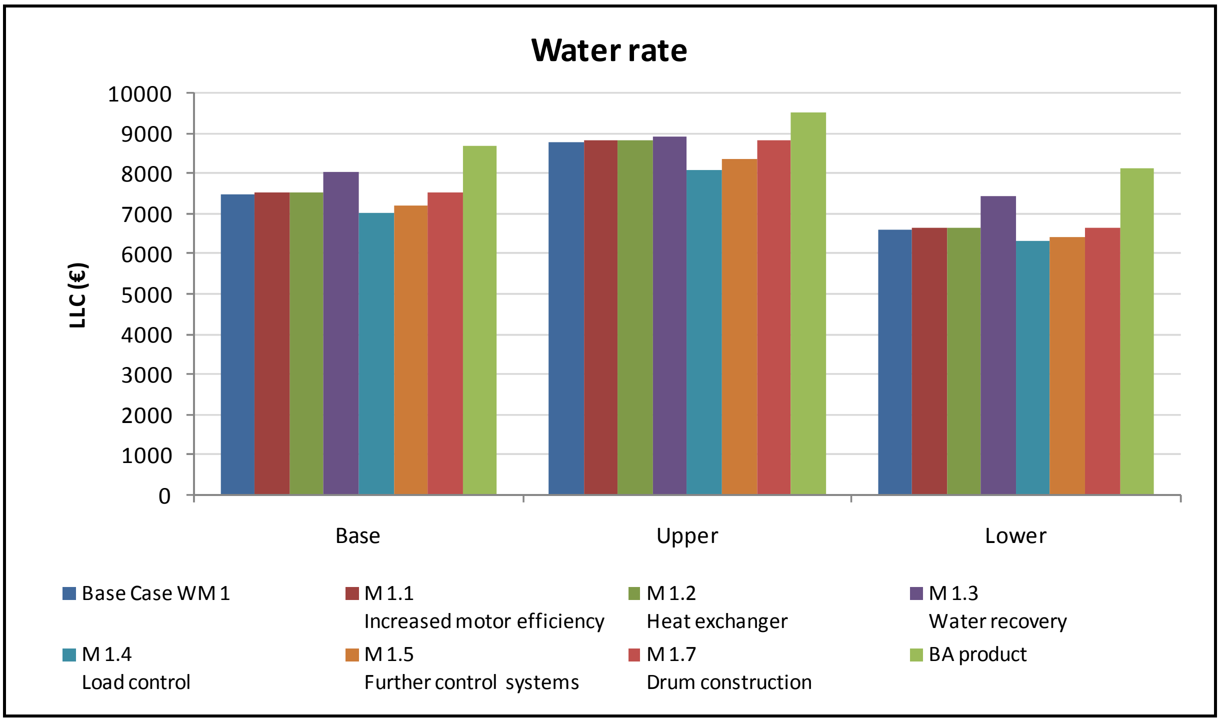

Figure 127 Base case WM 1 and improvement options – impact of water rate on LCC by product

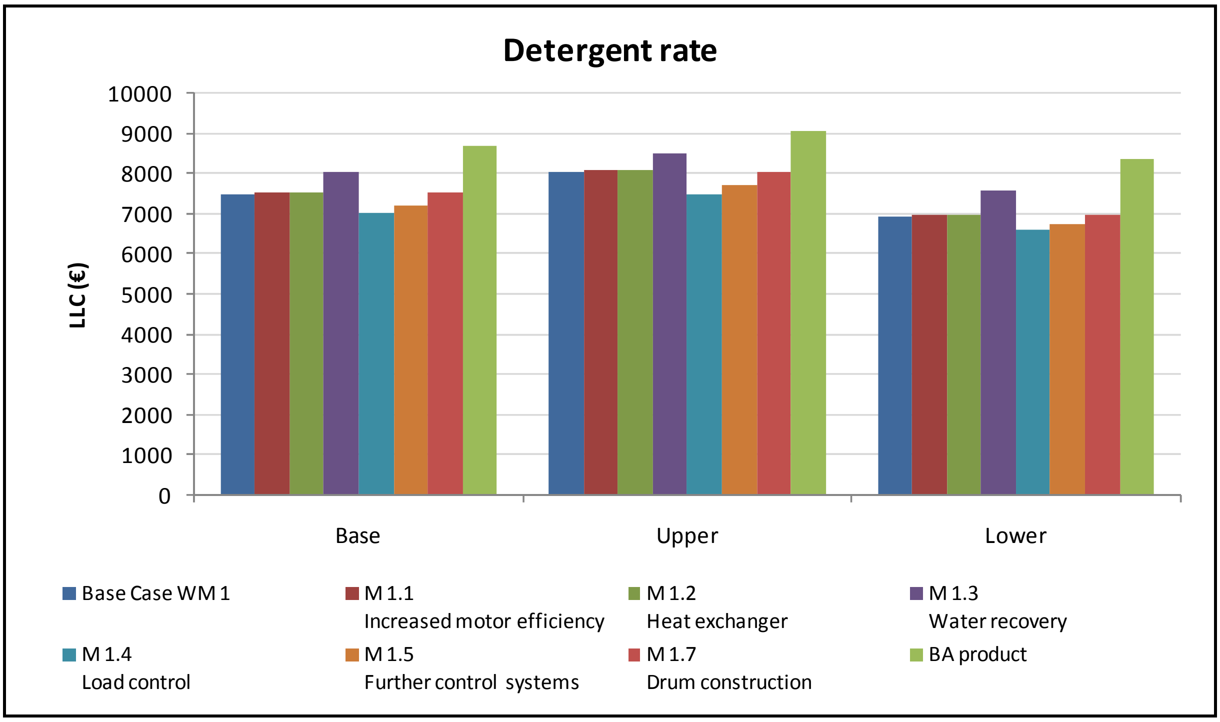

Figure 128 Base case WM 1 and improvement options – impact of detergent rate on LCC by product

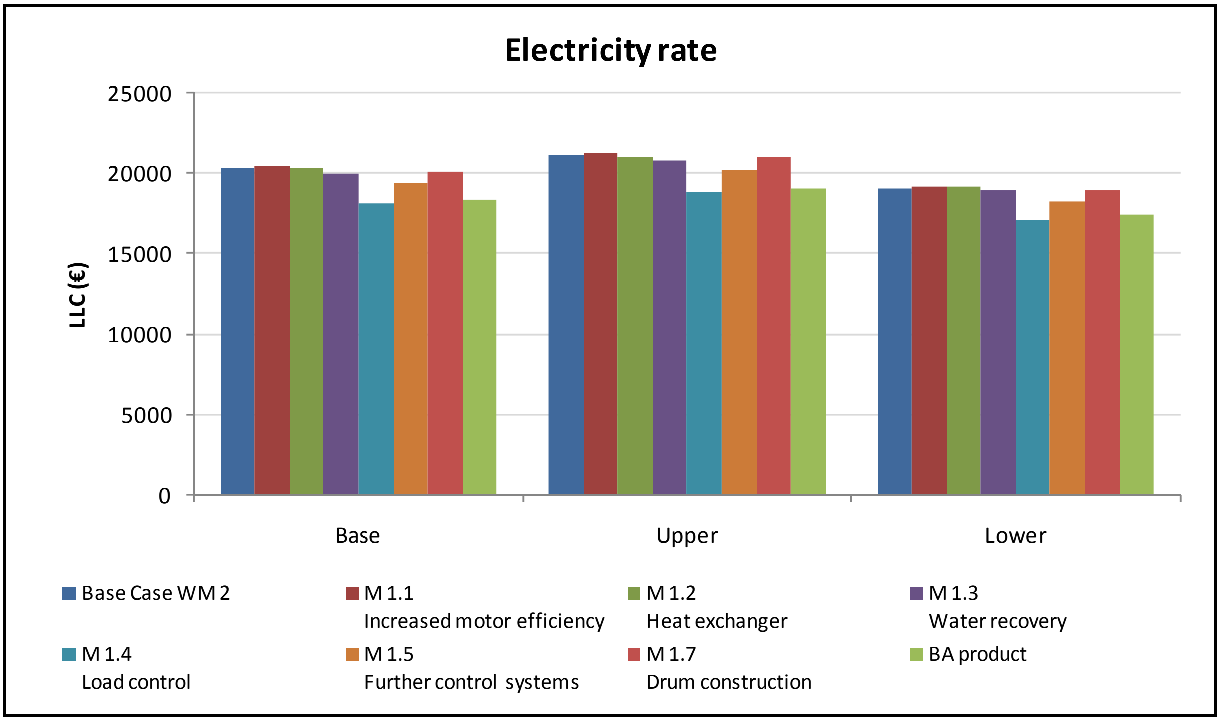

Figure 129 Base case WM 2 and improvement options – impact of electricty rates on LCC by product

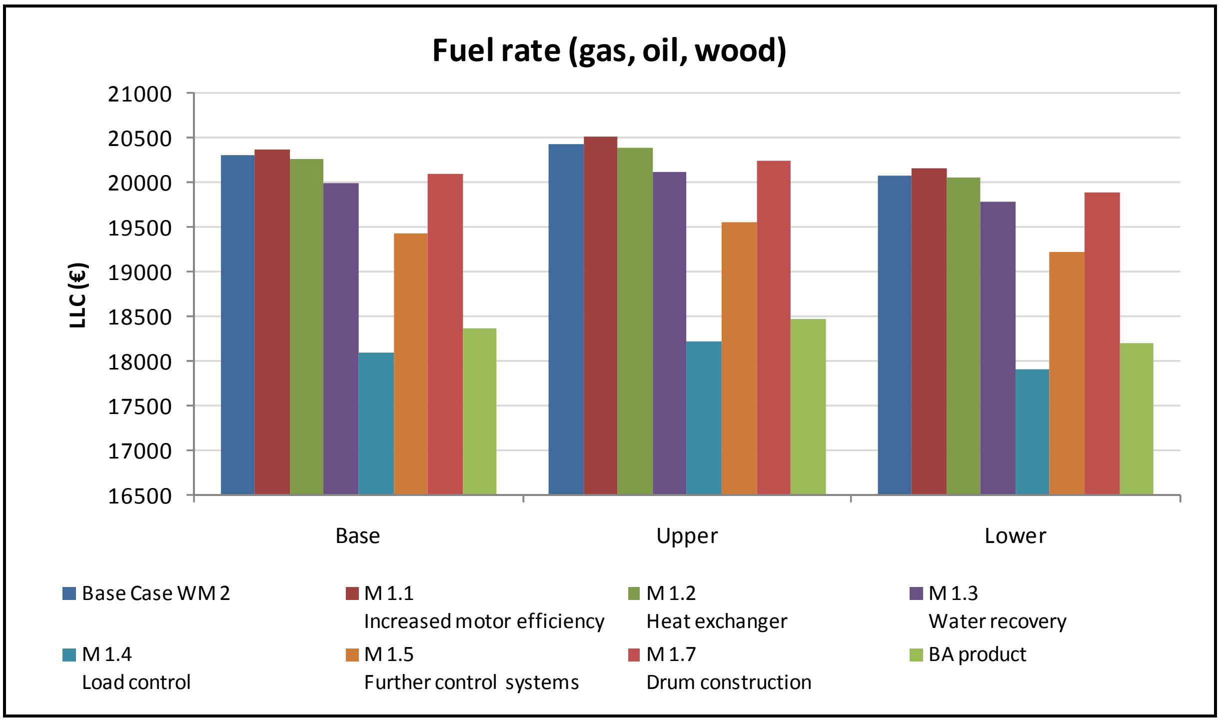

Figure 130 Base case WM 2 and improvement options – impact of gas rates on LCC by product

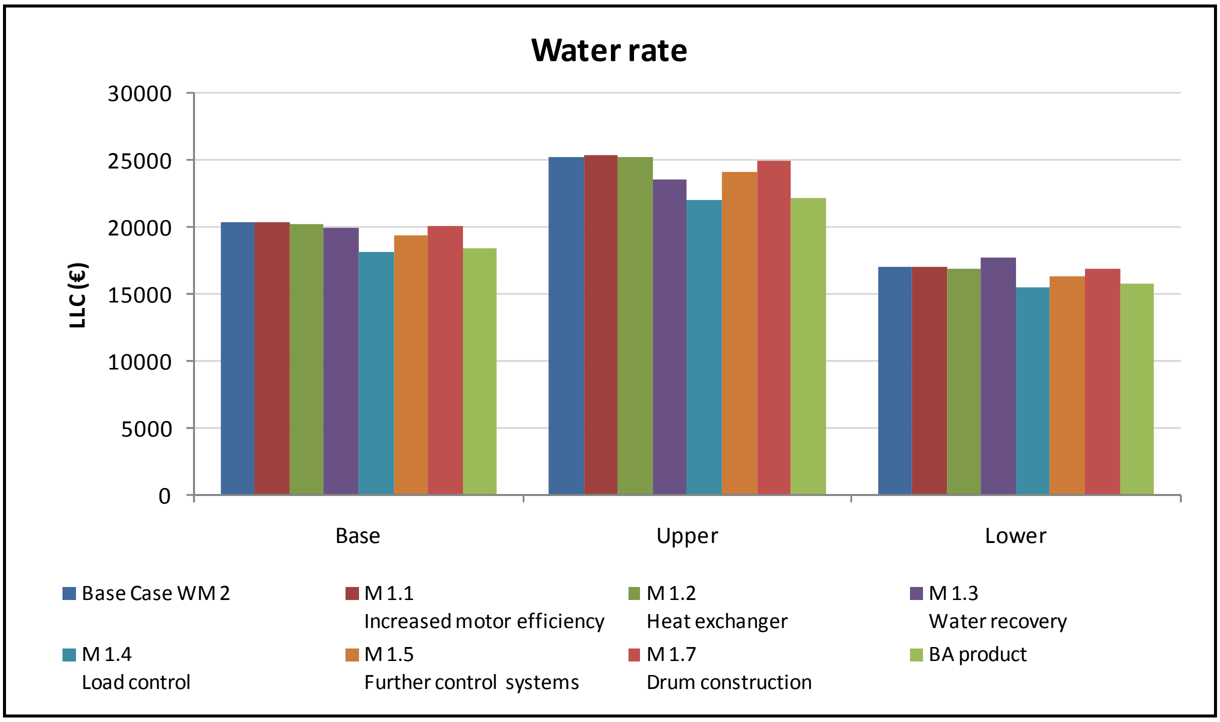

Figure 131 Base case WM 2 and improvement options – impact of water rate on LCC by product

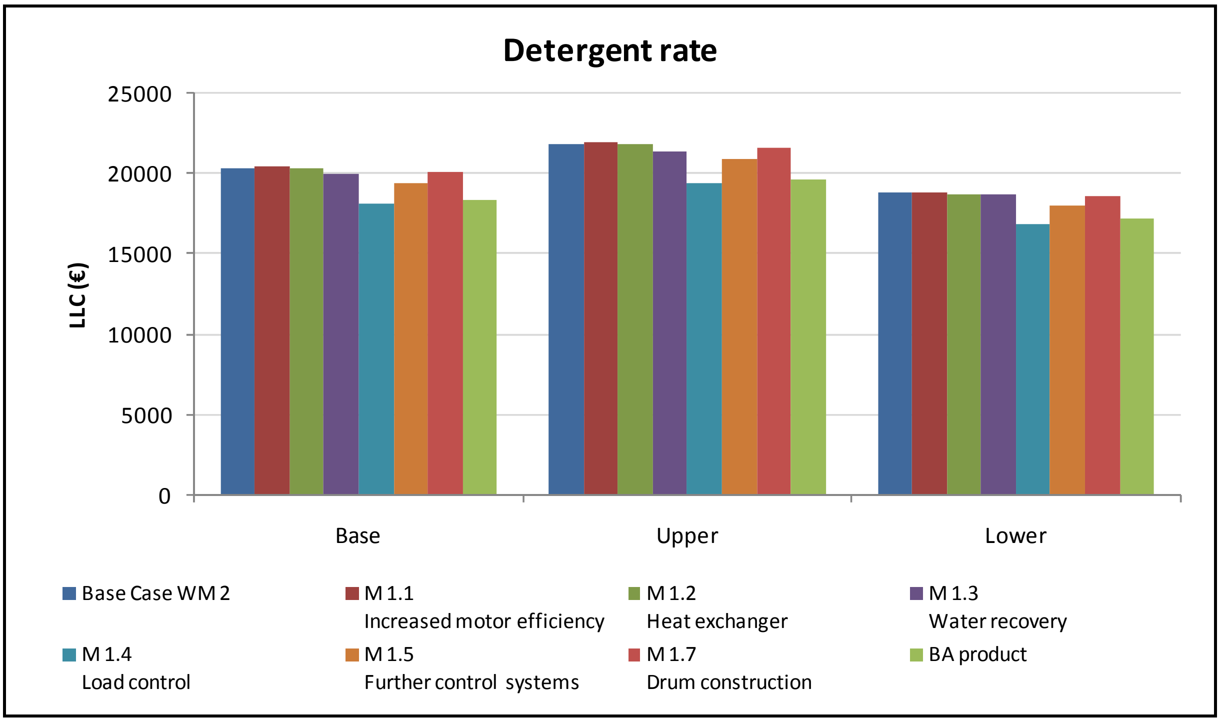

Figure 132 Base case WM 2 and improvement options – impact of detergent rate on LCC by product

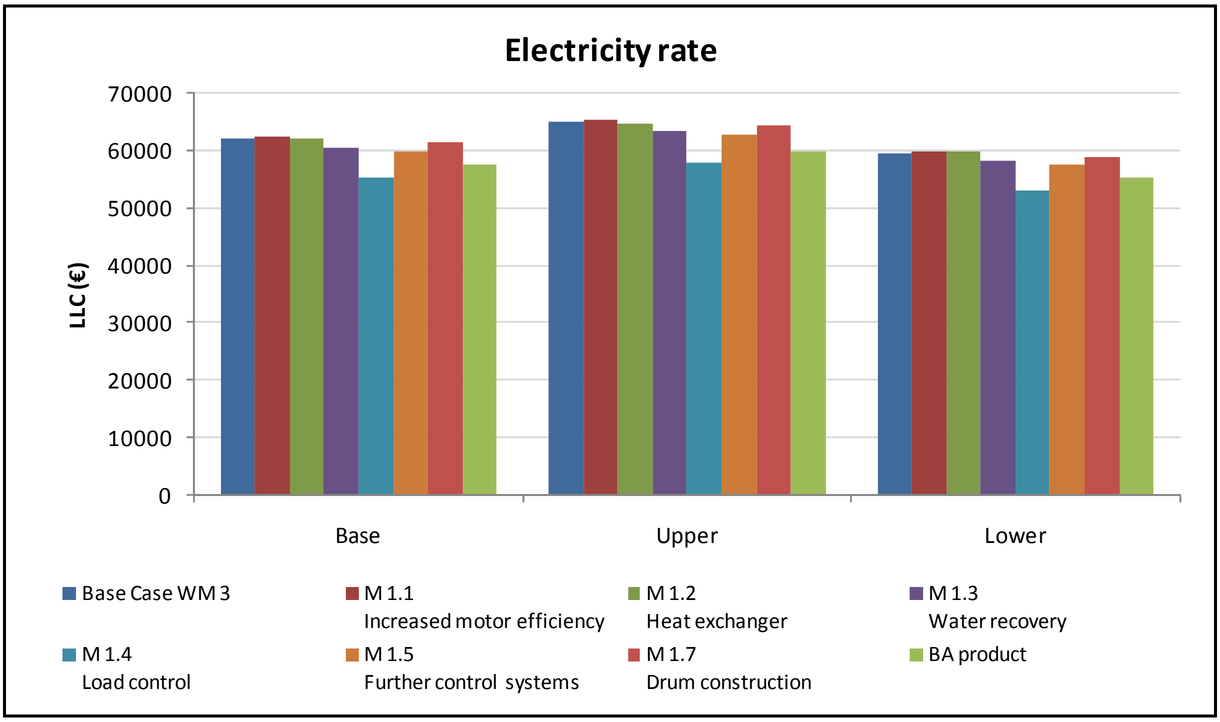

Figure 133 Base case WM 3 and improvement options – impact of electricty rates on LCC by product

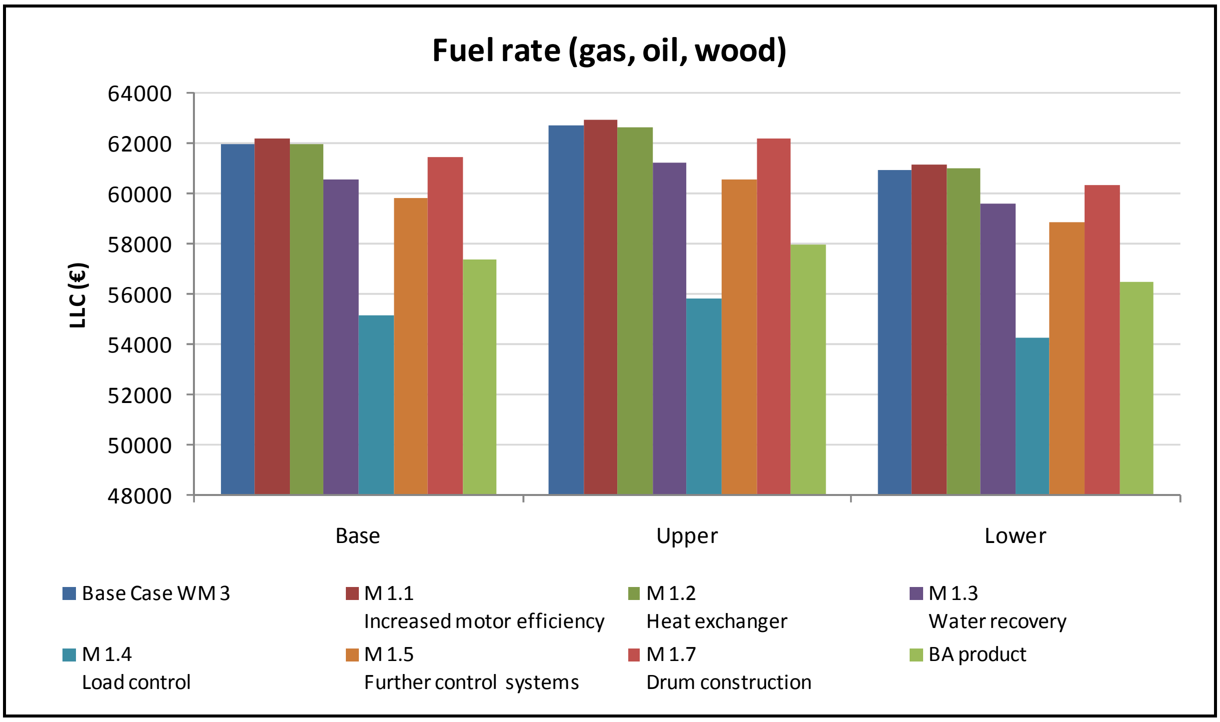

Figure 134 Base case WM 3 and improvement options – impact of gas rates on LCC by product

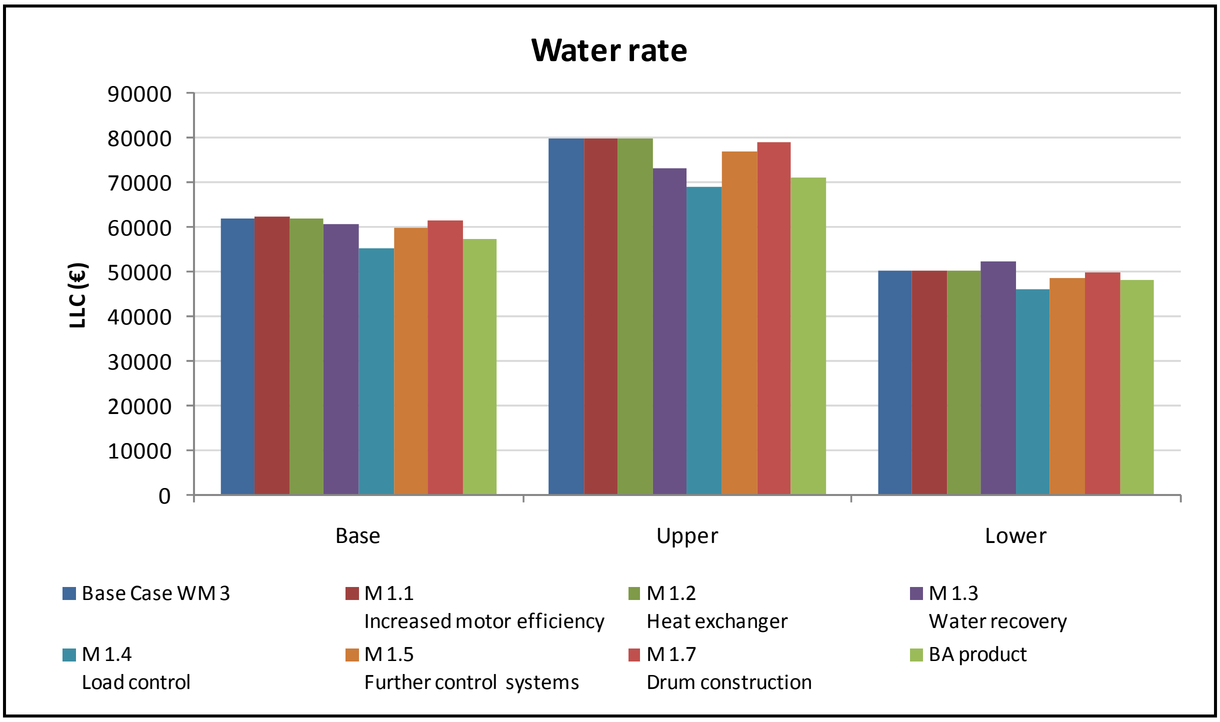

Figure 135 Base case WM 3 and improvement options – impact of water rate on LCC by product

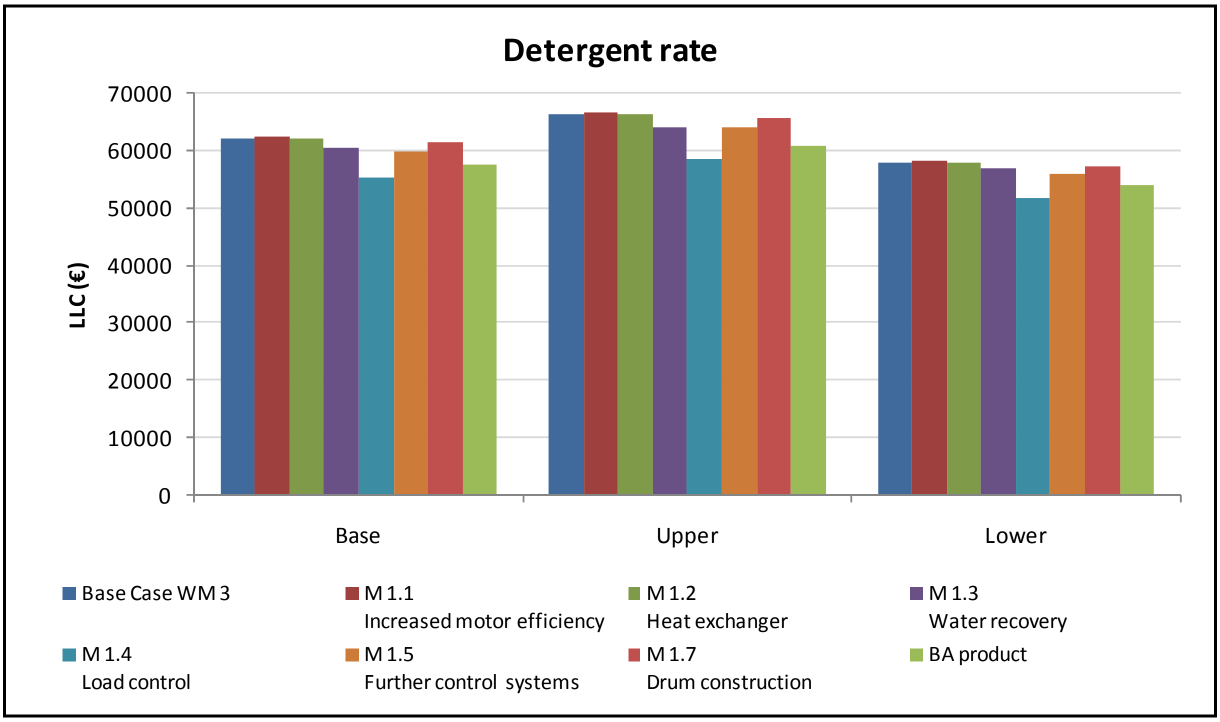

Figure 136 Base case WM 3 and improvement options – impact of detergent rate on LCC by product

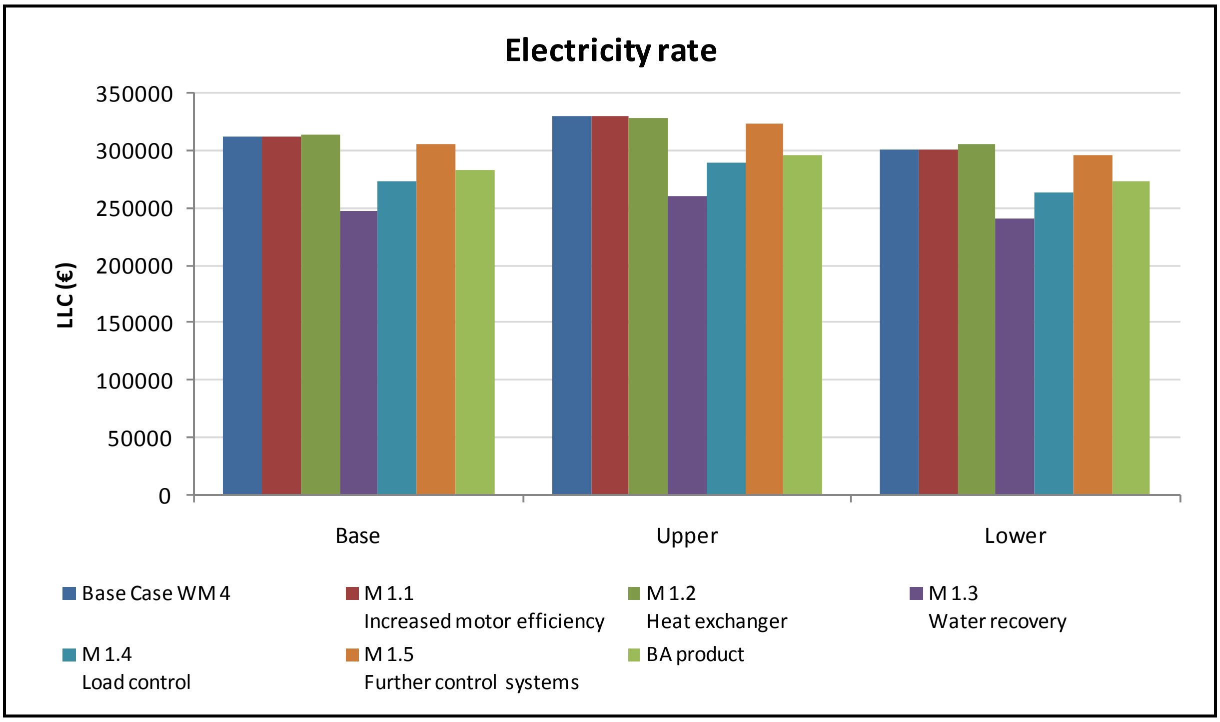

Figure 137 Base case WM 4 and improvement options – impact of electricty rates on LCC by product

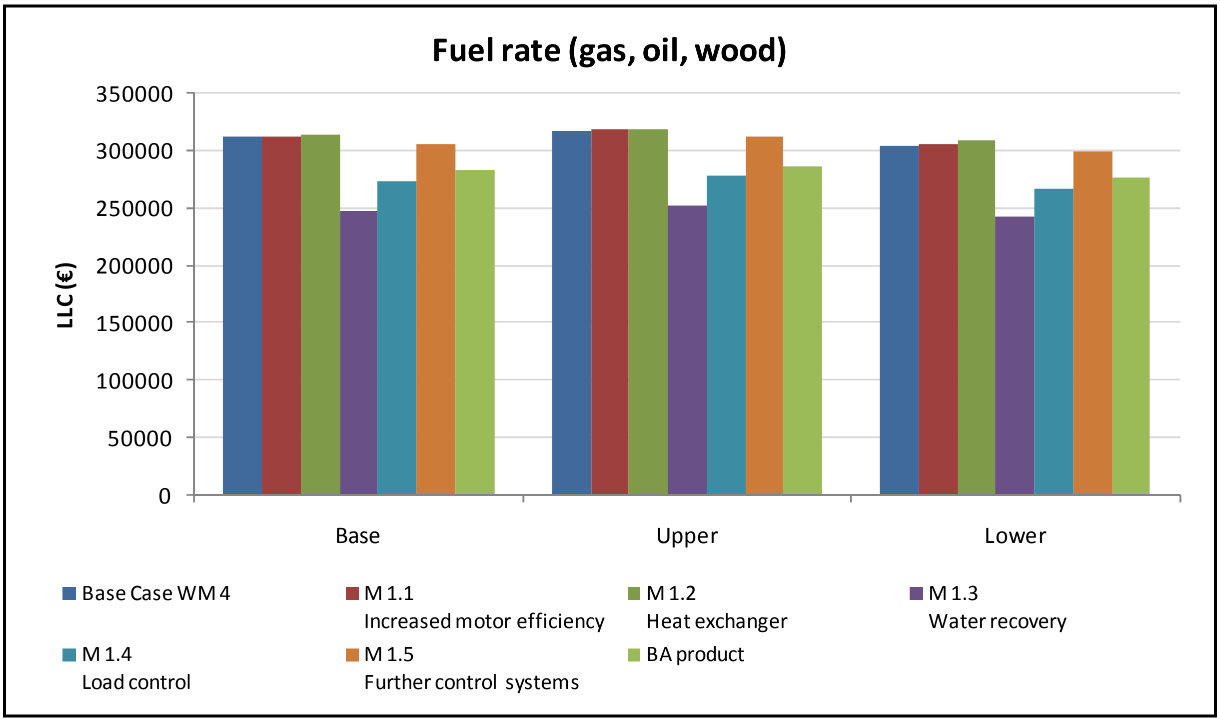

Figure 138 Base case WM 4 and improvement options – impact of gas rates on LCC by product

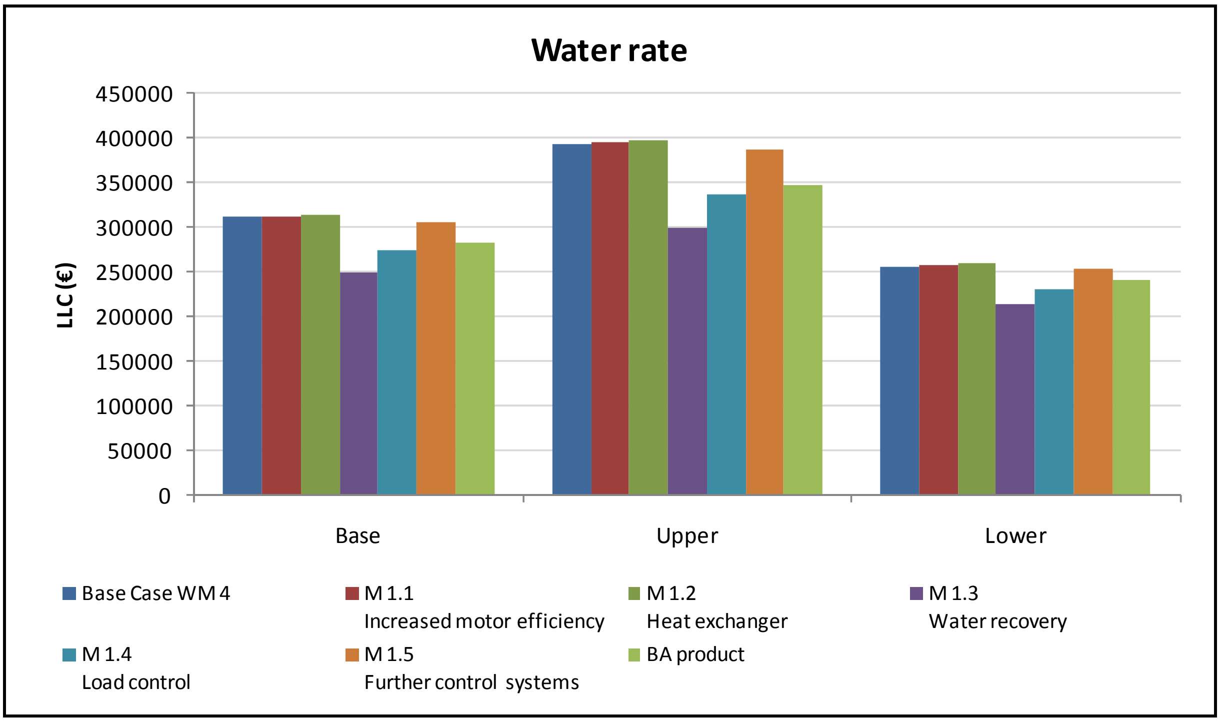

Figure 139 Base case WM 4 and improvement options – impact of water rate on LCC by product

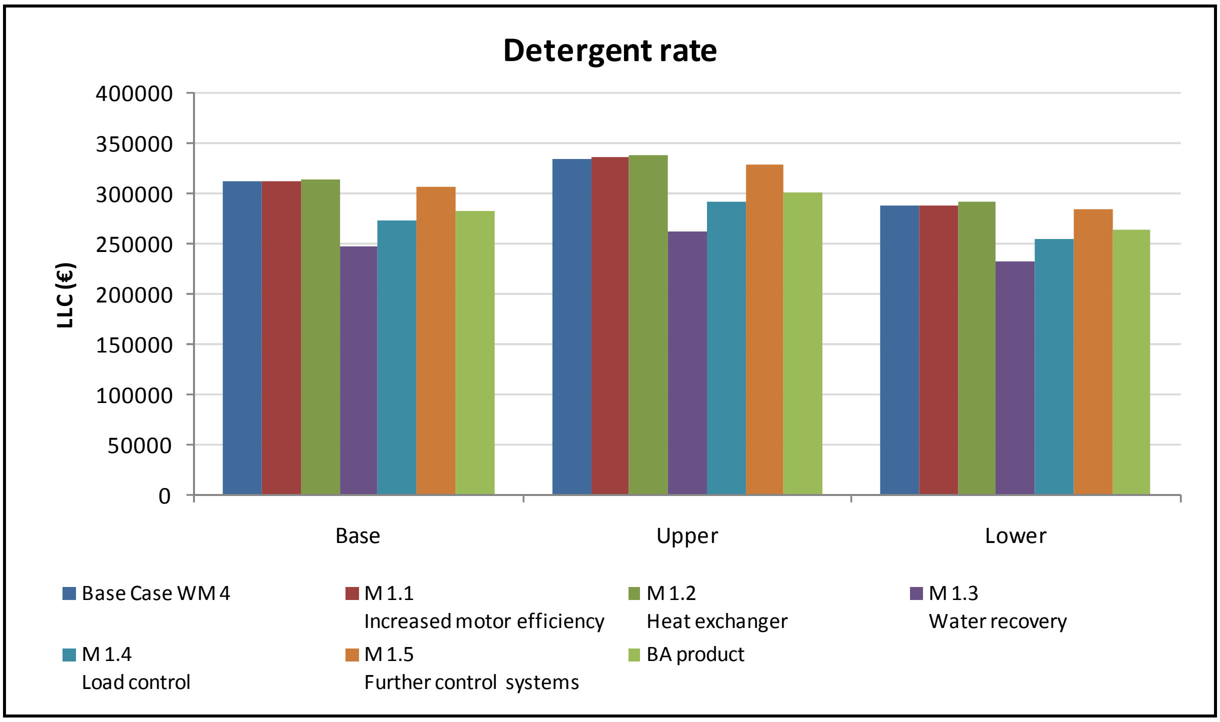

Figure 140 Base case WM 4 and improvement options – impact of detergent rate on LCC by product

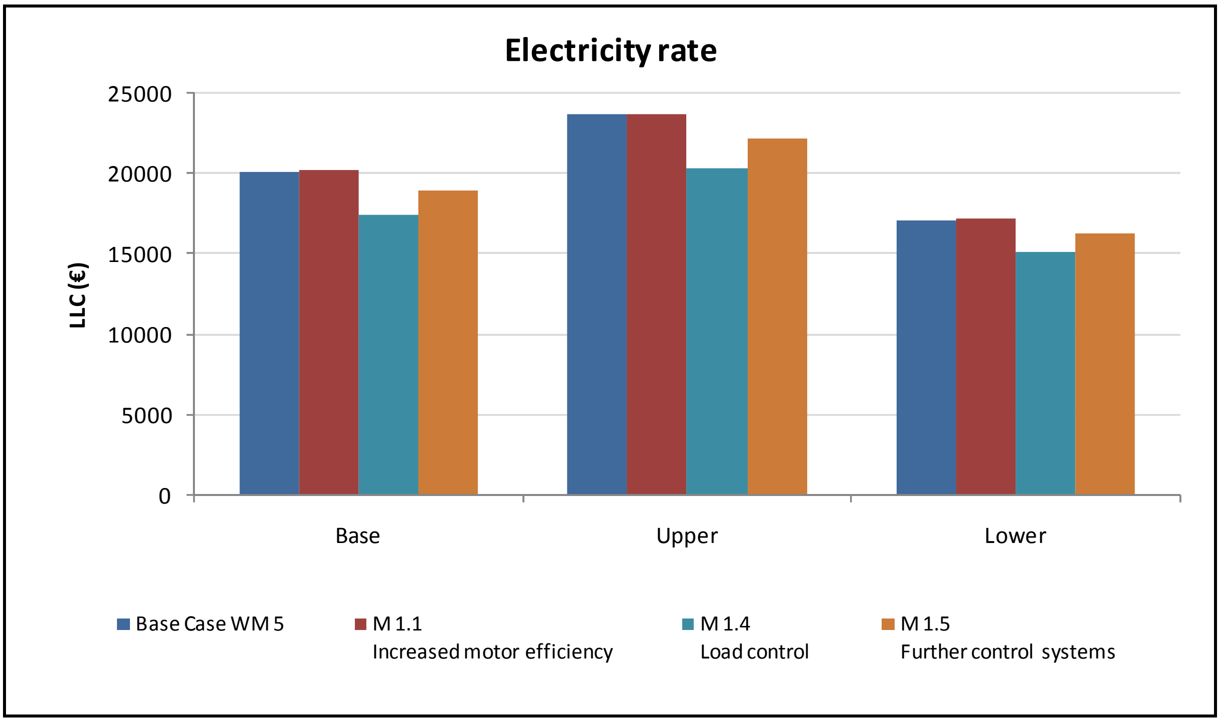

Figure 141 Base case WM 5 and improvement options – impact of electricty rates on LCC by product

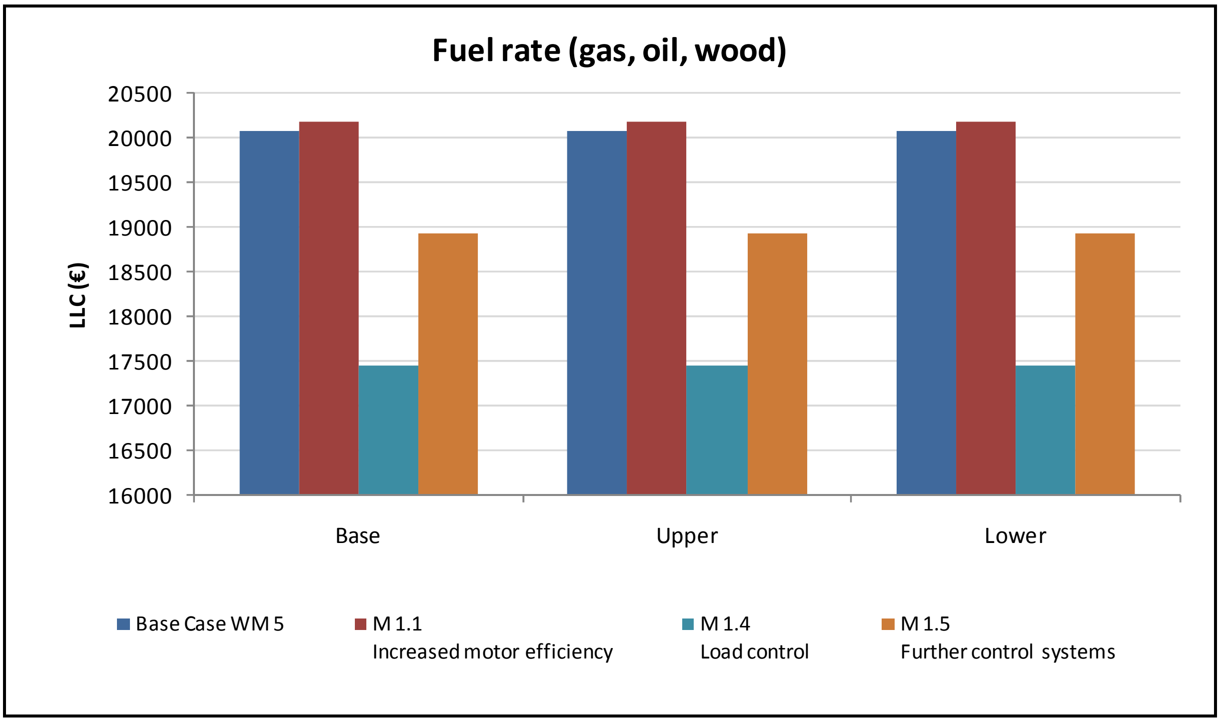

Figure 142 Base case WM 5 and improvement options – impact of gas rates on LCC by product

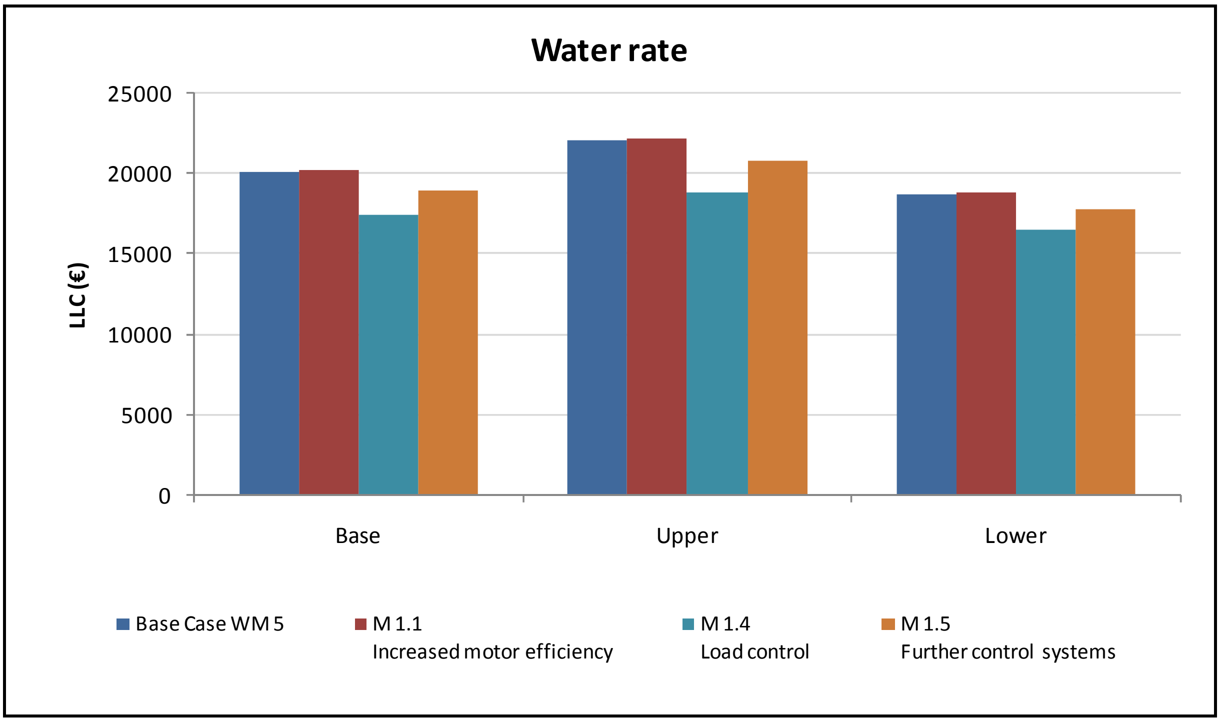

Figure 143 Base case WM 5 and improvement options – impact of water rate on LCC by product

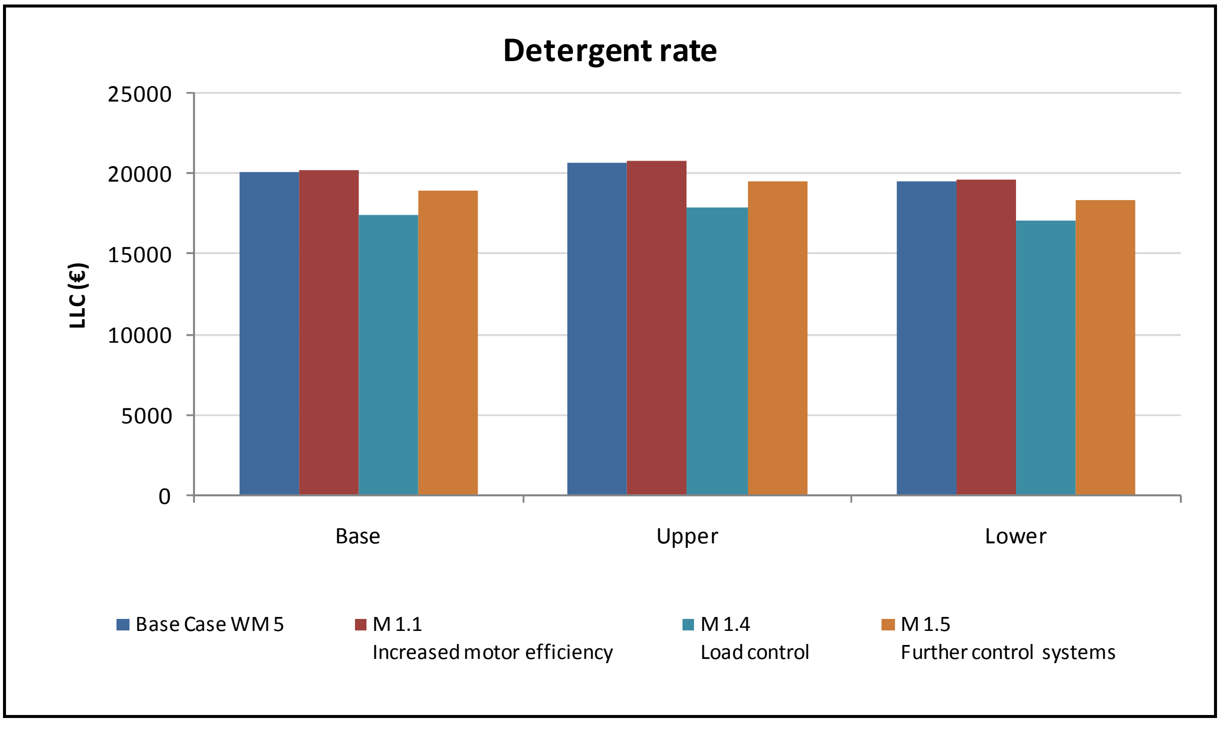

Figure 144 Base case WM 5 and improvement options – impact of detergent rate on LCC by product

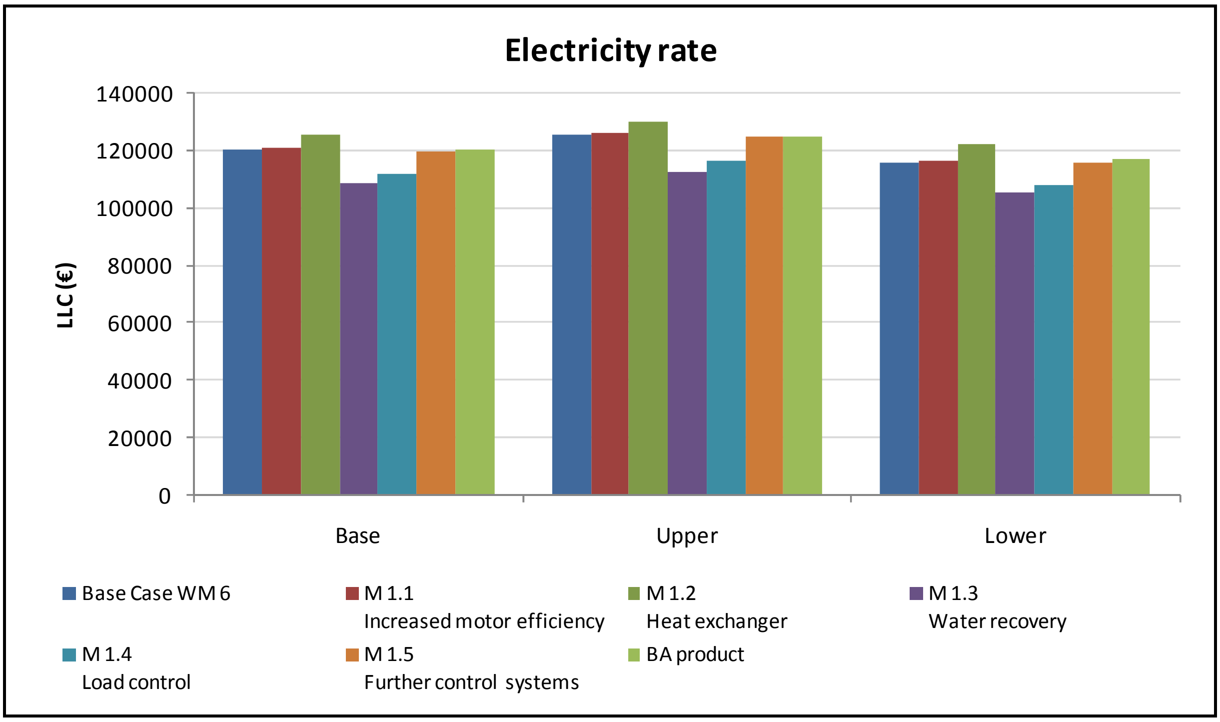

Figure 145 Base case WM 6 and improvement options – impact of electricty rates on LCC by product

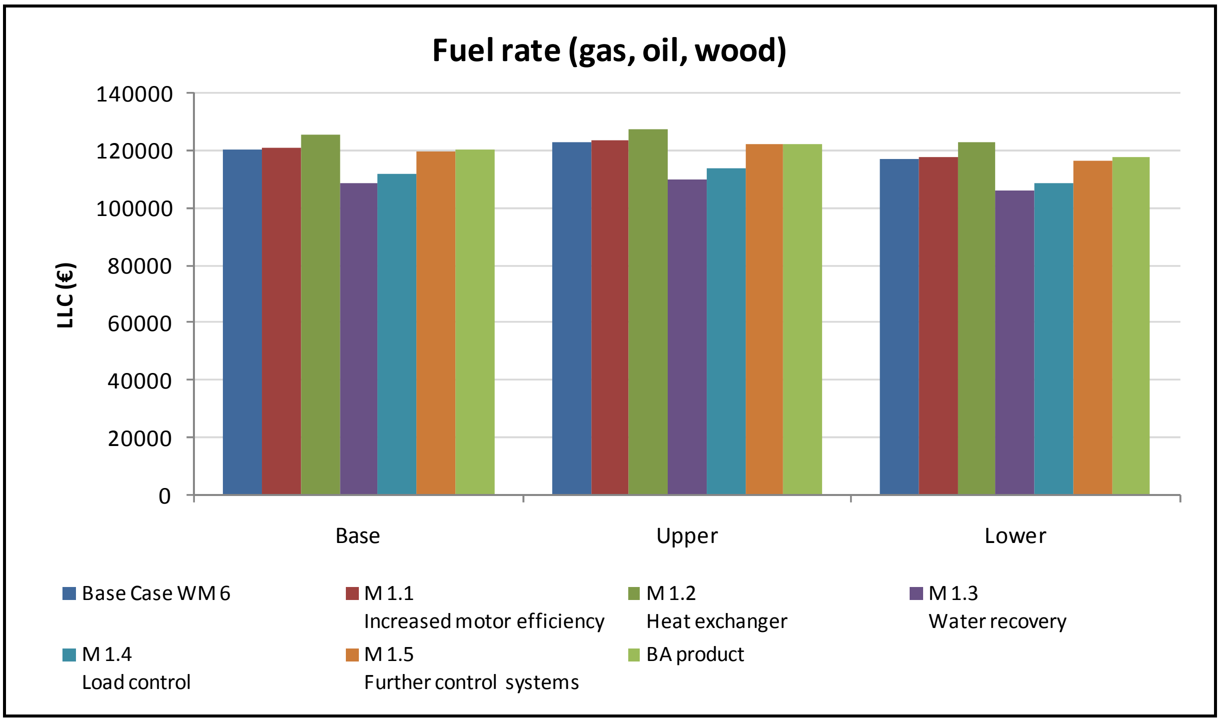

Figure 146 Base case WM 6 and improvement options – impact of gas rates on LCC by product

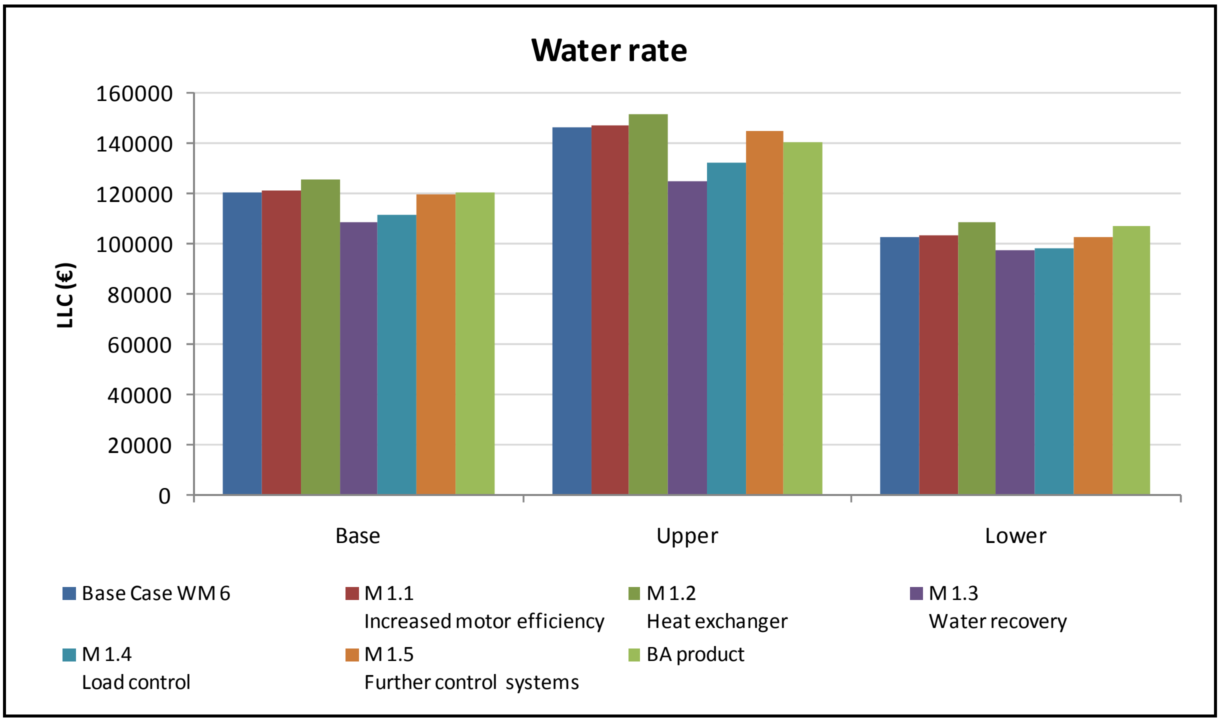

Figure 147 Base case WM 6 and improvement options – impact of water rate on LCC by product

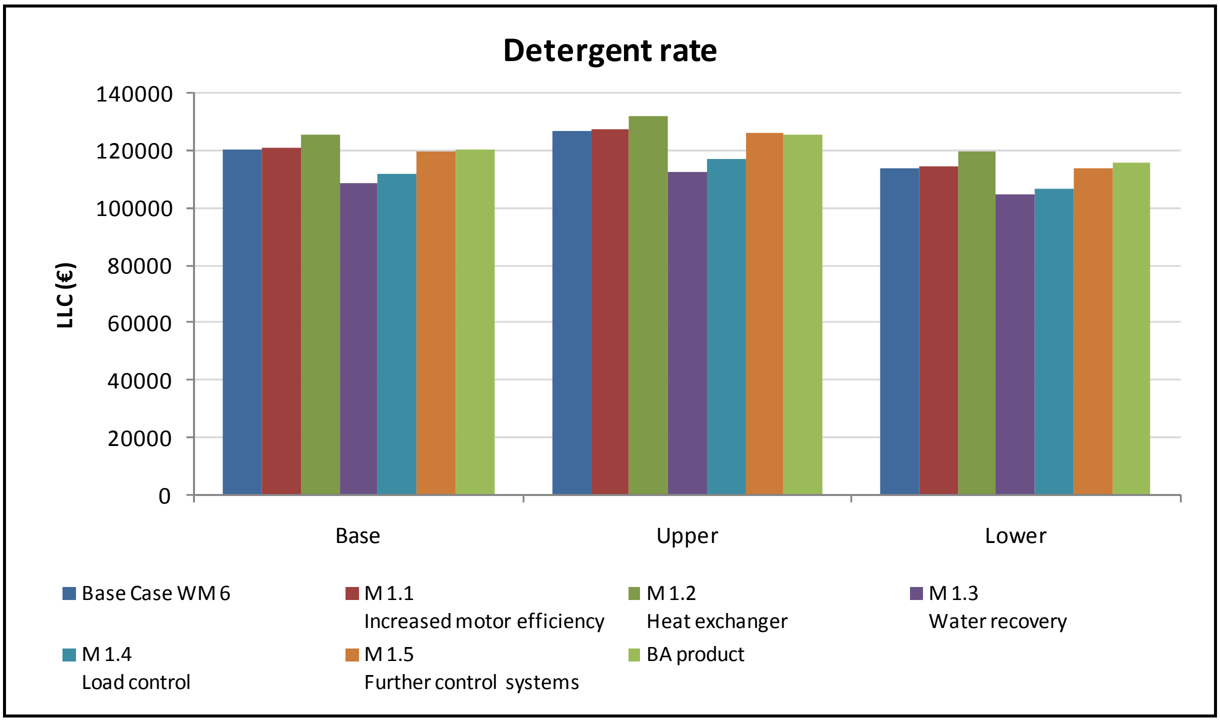

Figure 148 Base case WM 6 and improvement options – impact of detergent rate on LCC by product

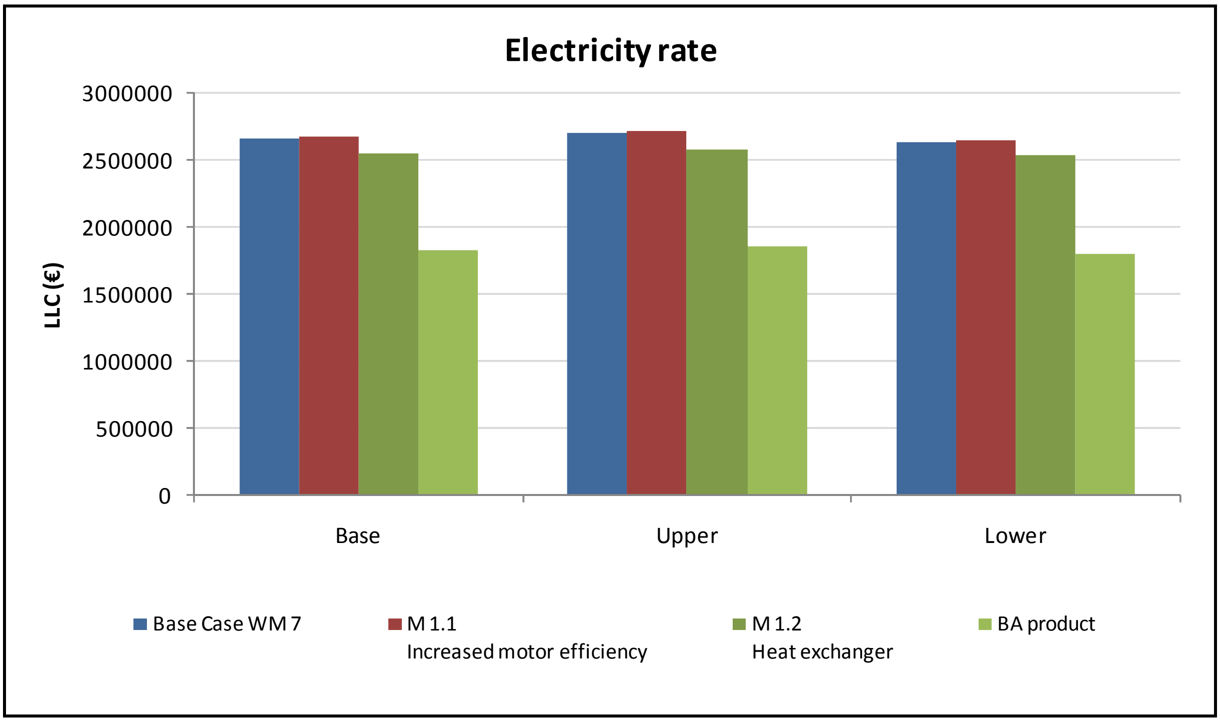

Figure 149 Base case WM 7 and improvement options – impact of electricty rates on LCC by product

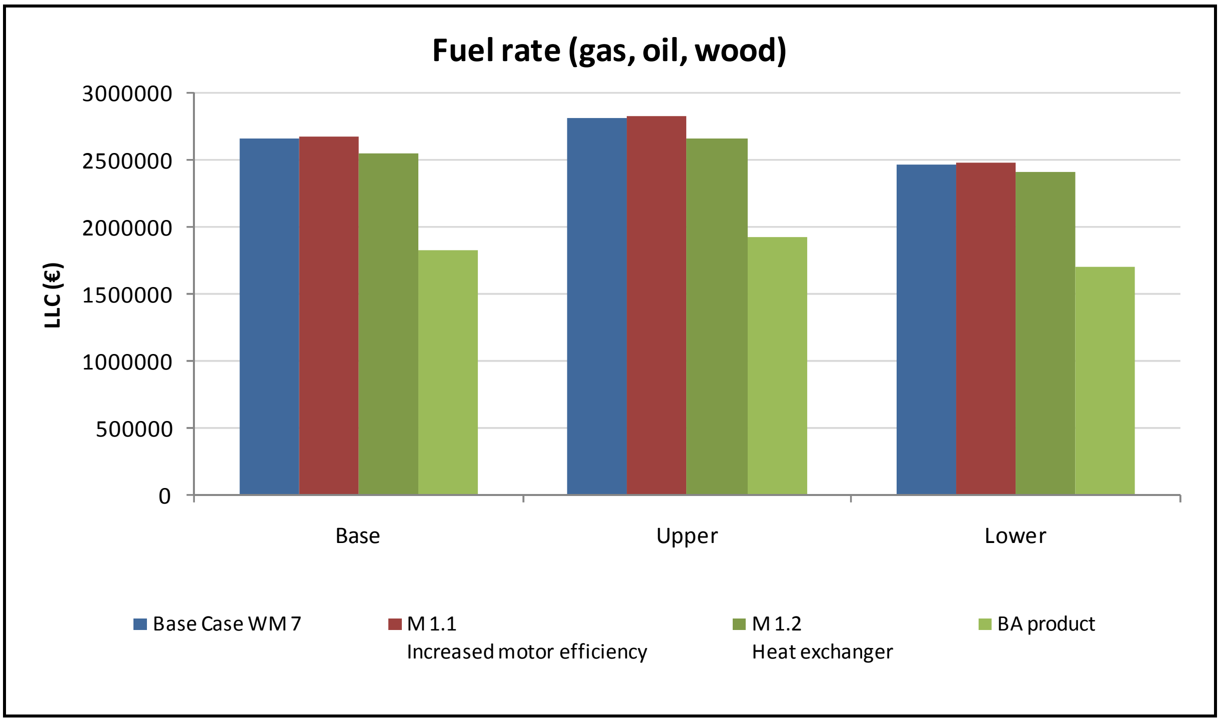

Figure 150 Base case WM 7 and improvement options – impact of gas rates on LCC by product

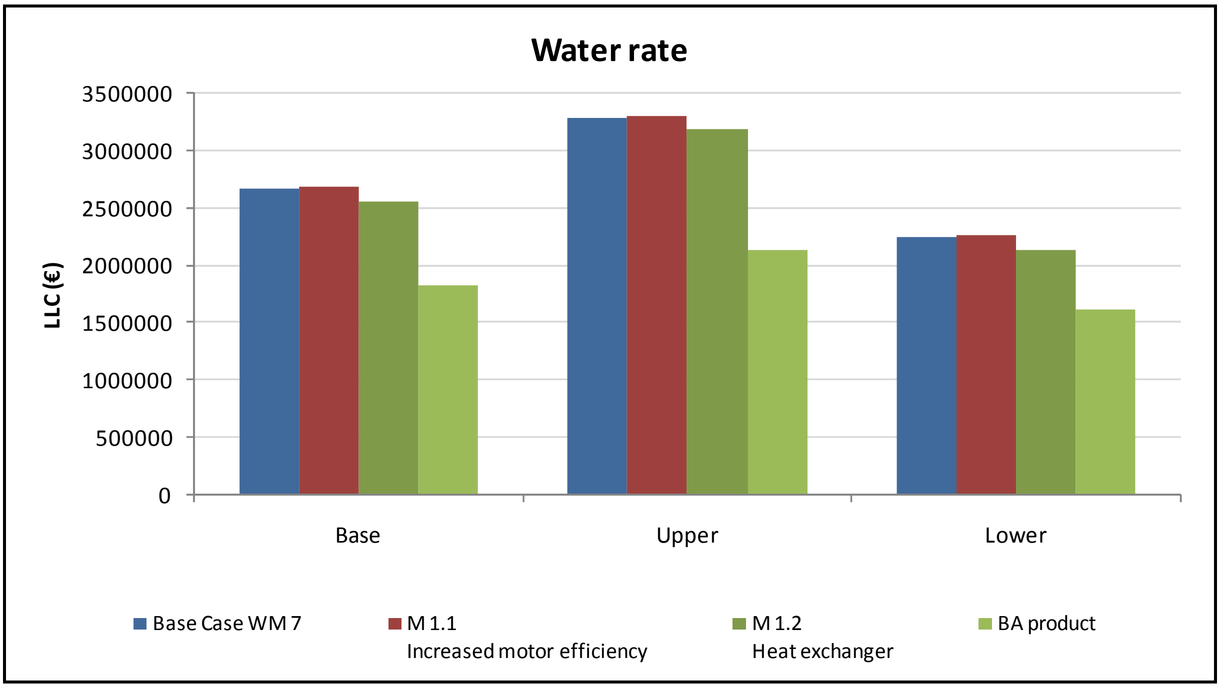

Figure 151 Base case WM 7 and improvement options – impact of water rate on LCC by product

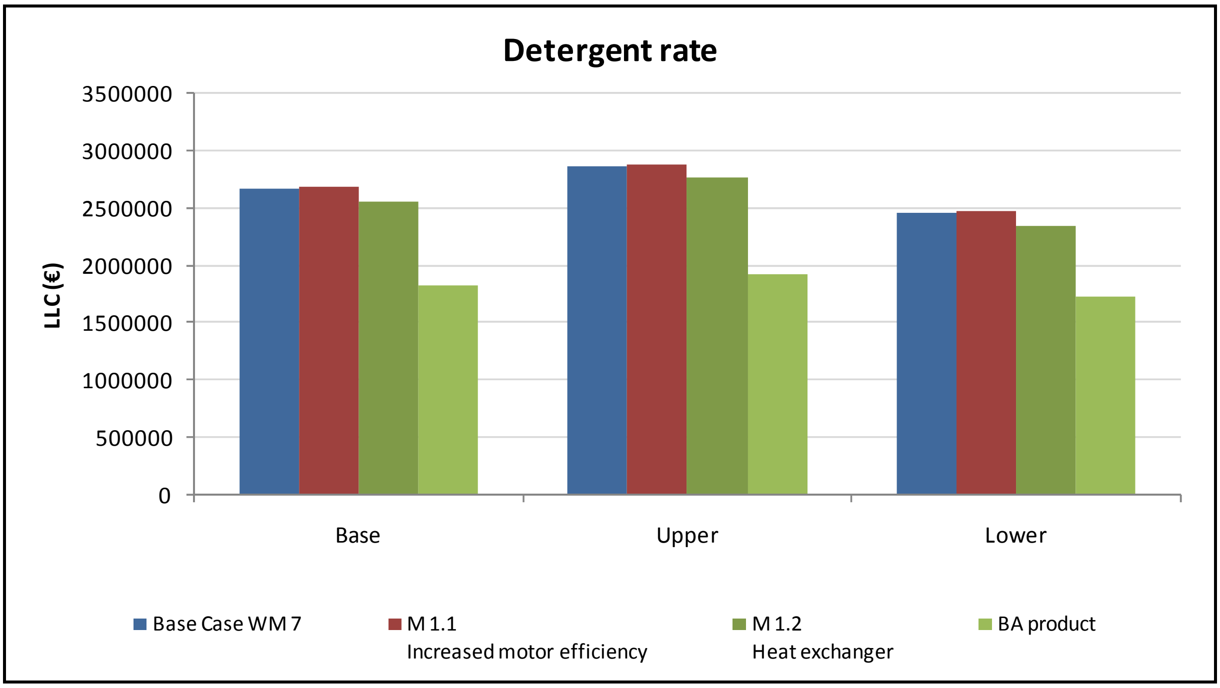

Figure 152 Base case WM 7 and improvement options – impact of detergent rate on LCC by product

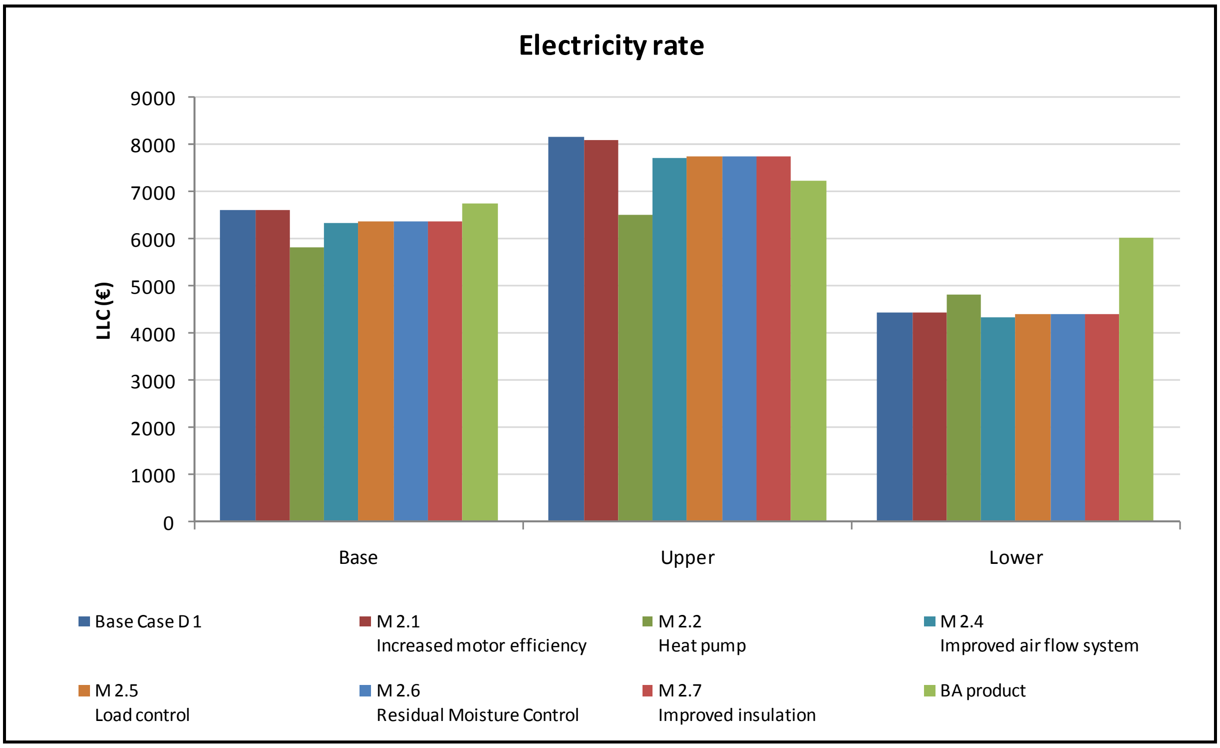

Figure 153 Base case D 1 and improvement options – impact of electricty rates on LCC by product

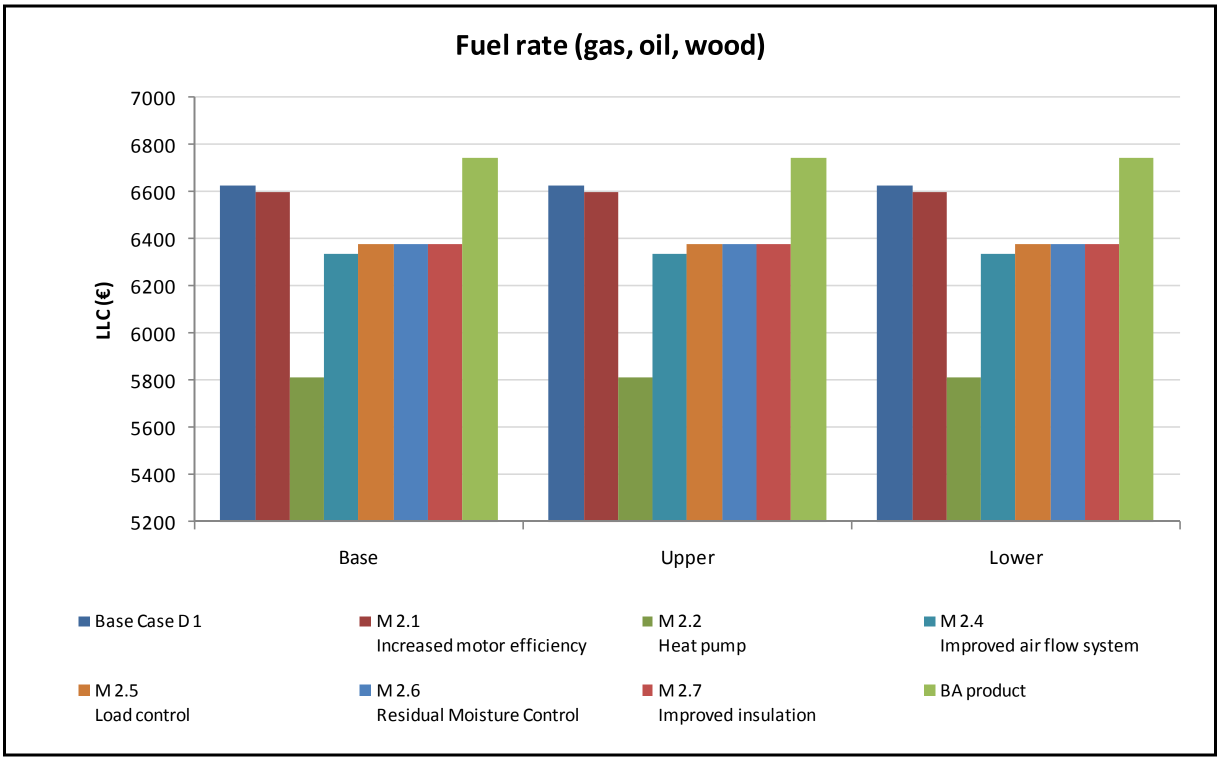

Figure 154 Base case D 1 and improvement options – impact of gas rates on LCC by product

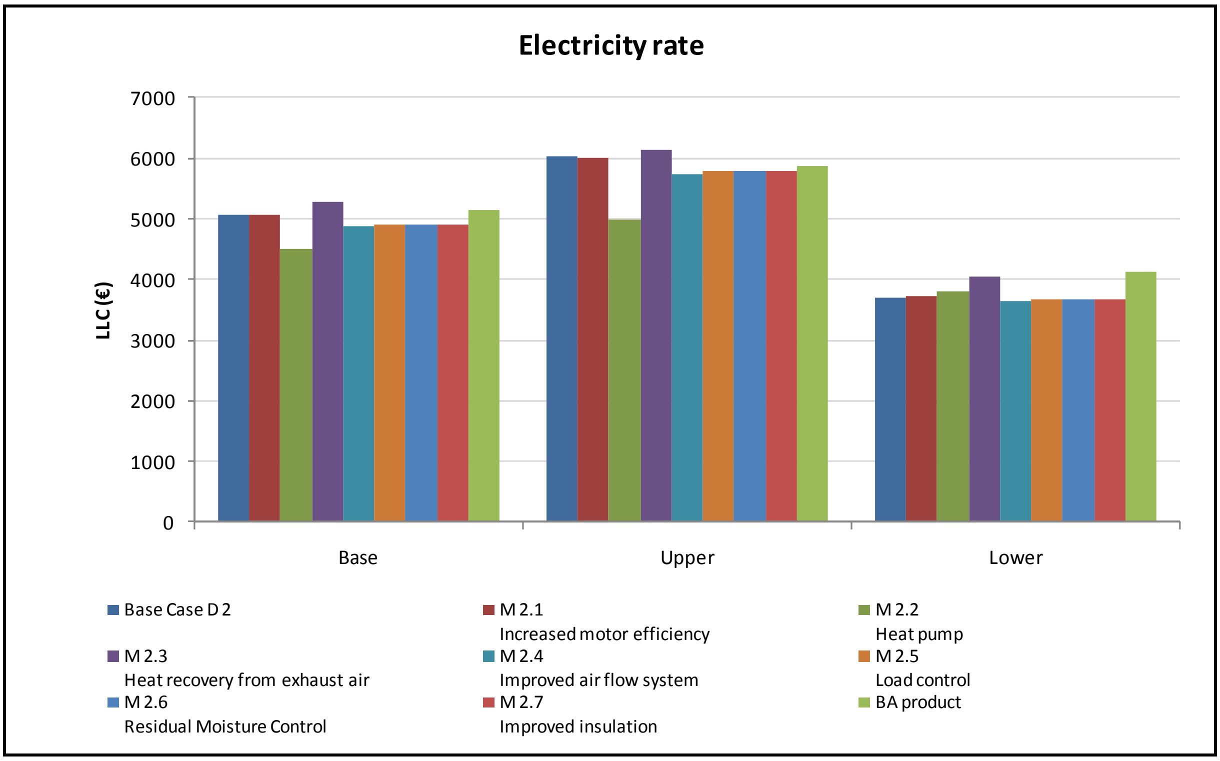

Figure 155 Base case D 2 and improvement options – impact of electricity rates on LCC by product

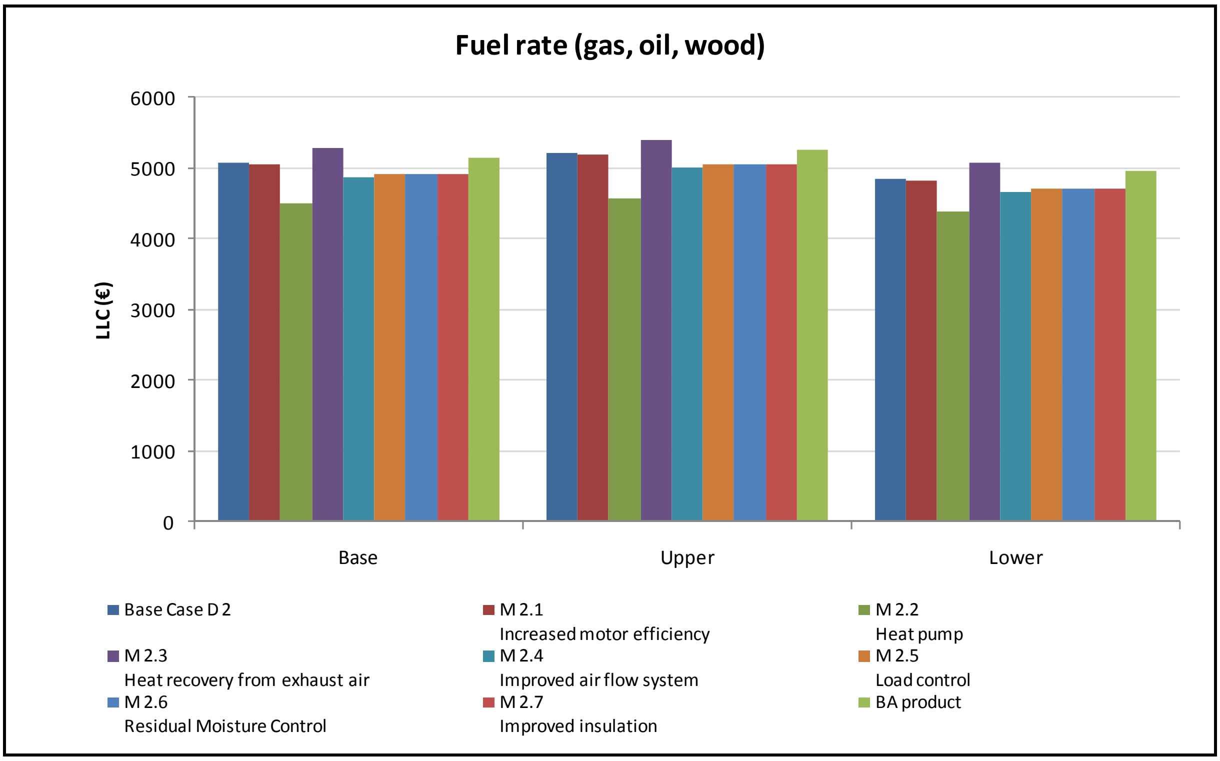

Figure 156 Base case D 2 and improvement options – impact of gas rates on LCC by product

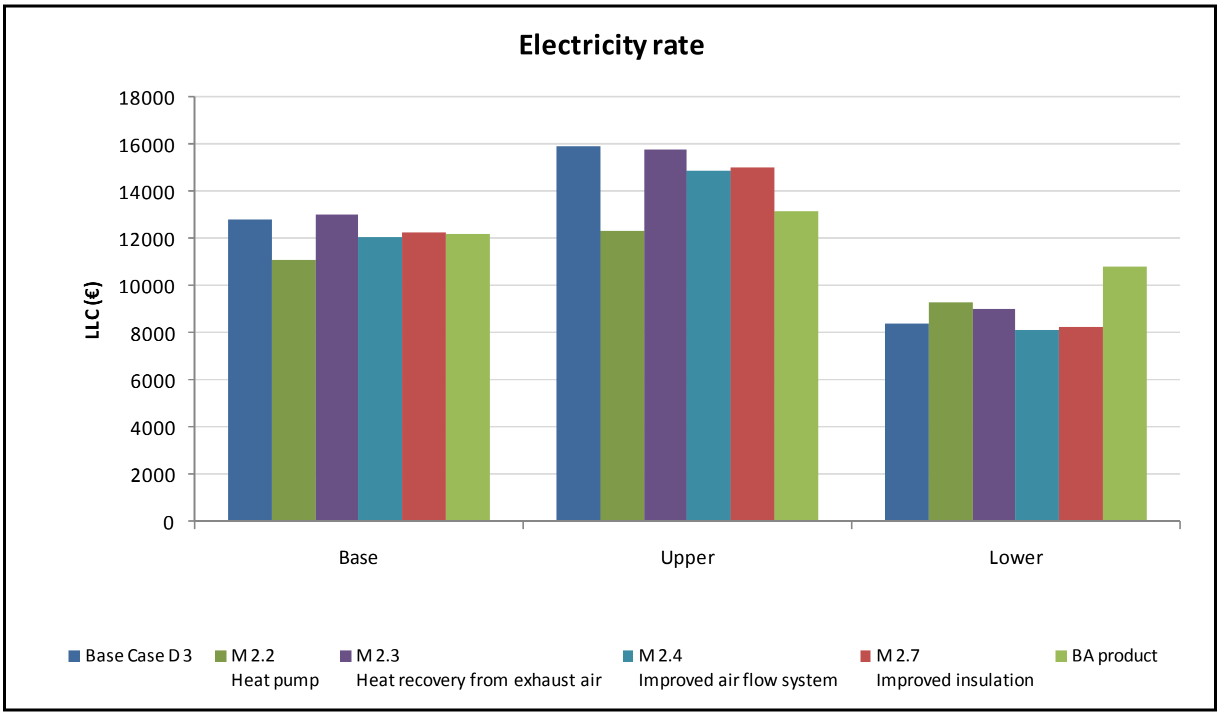

Figure 157 Base case D 3 and improvement options – impact of electricity rates on LCC by product

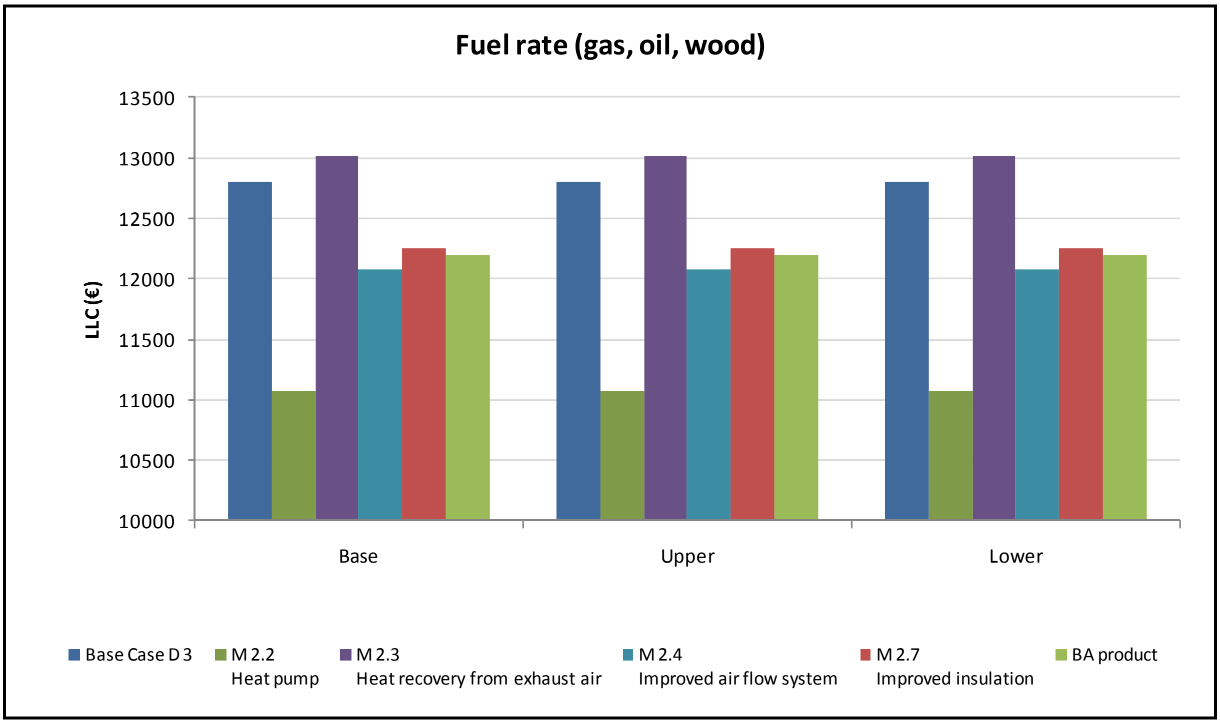

Figure 158 Base case D 3 and improvement options – impact of gas rates on LCC by product

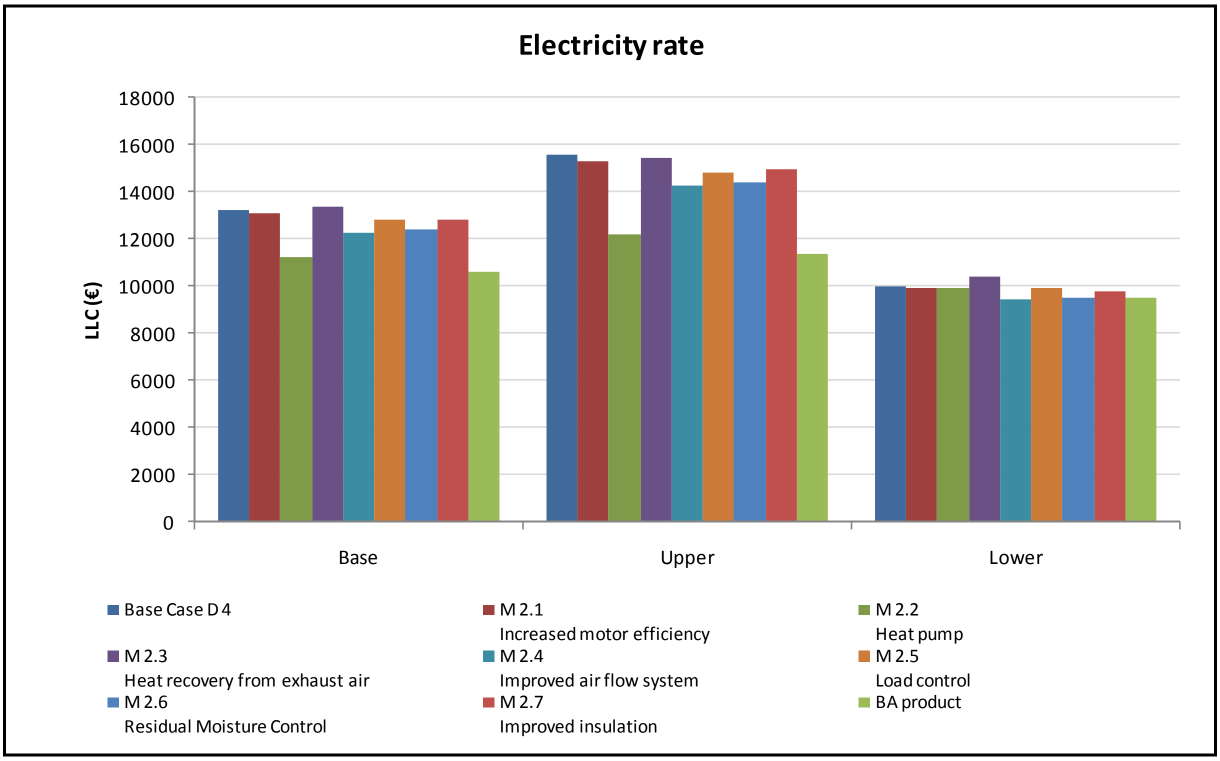

Figure 159 Base case D 4 and improvement options – impact of electricity rates on LCC by product

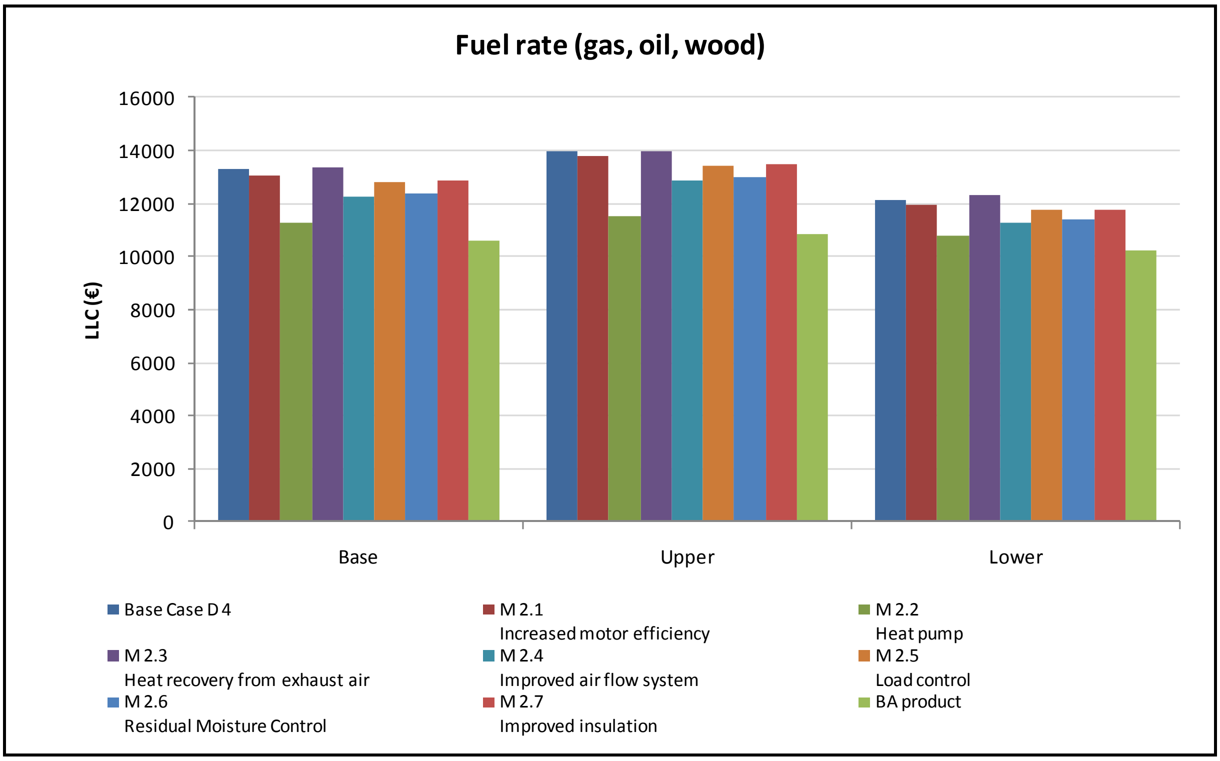

Figure 160 Base case D 4 and improvement options – impact of gas rates on LCC by product

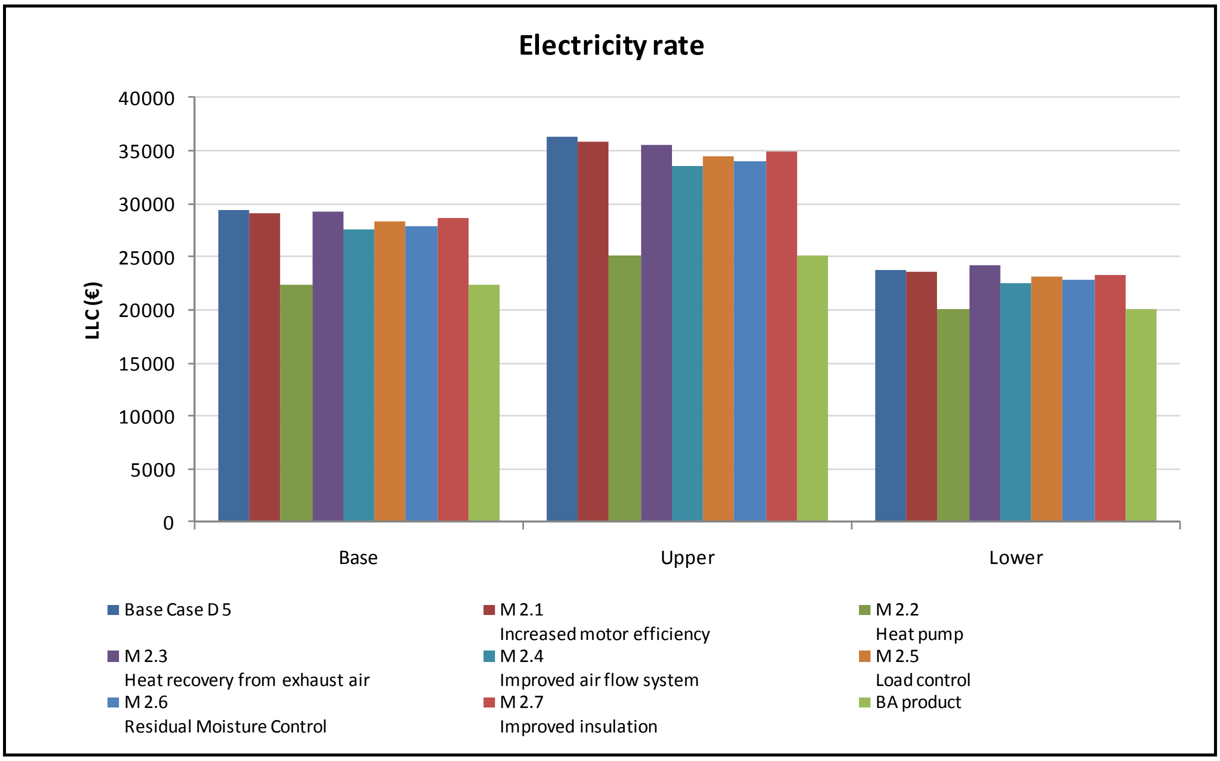

Figure 161 Base case D 5 and improvement options – impact of electricity rates on LCC by product

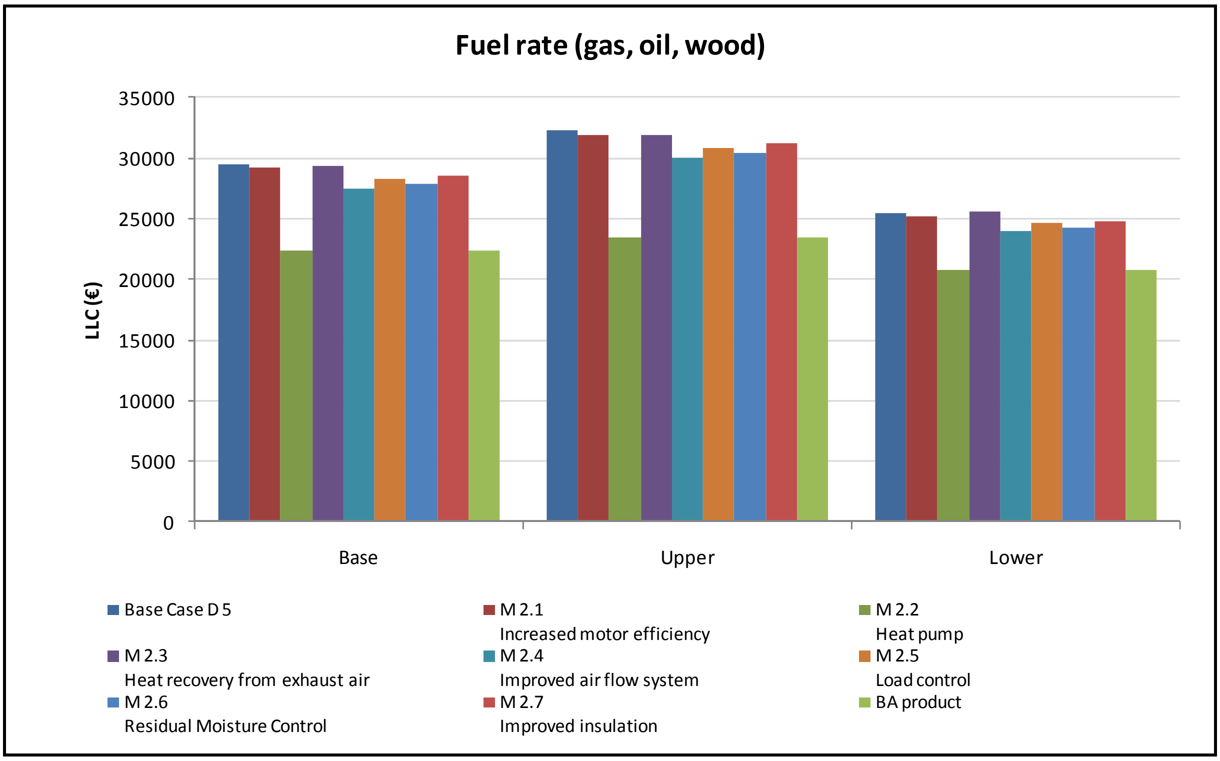

Figure 162 Base case D 5 and improvement options – impact of gas rates on LCC by product

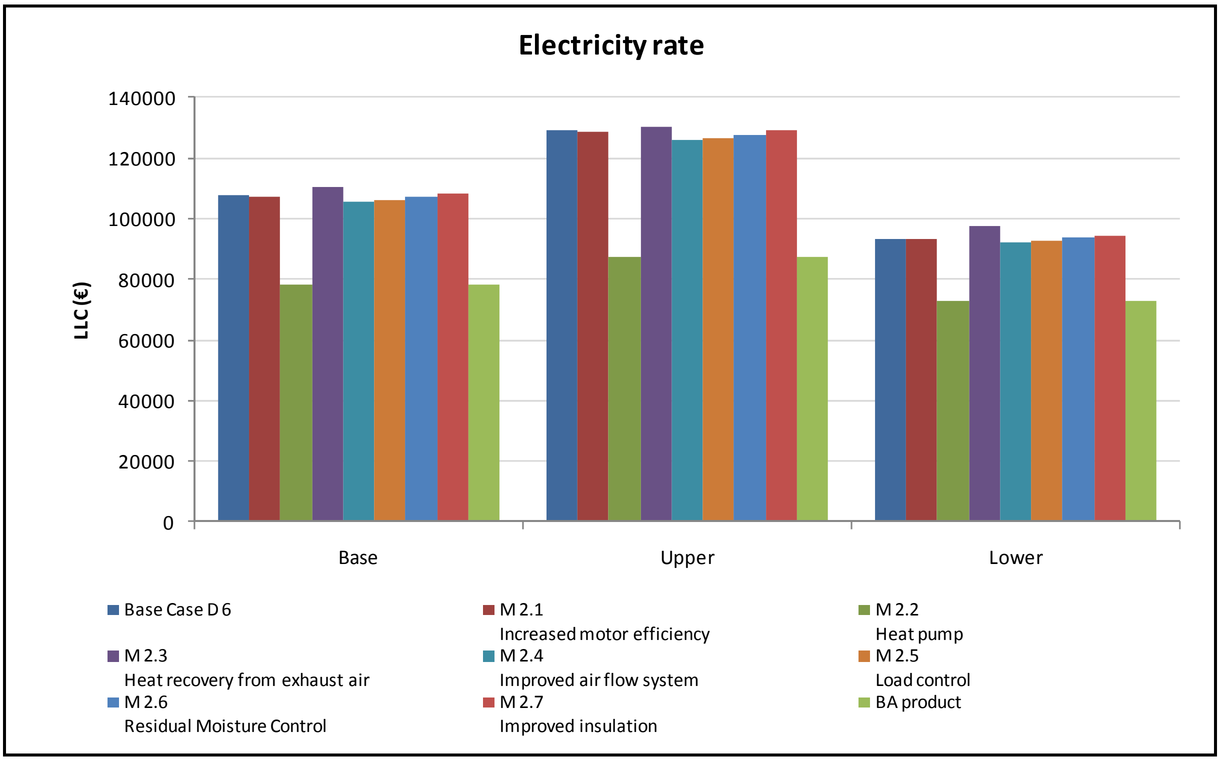

Figure 163 Base case D 6 and improvement options – impact of electricity rates on LCC by product

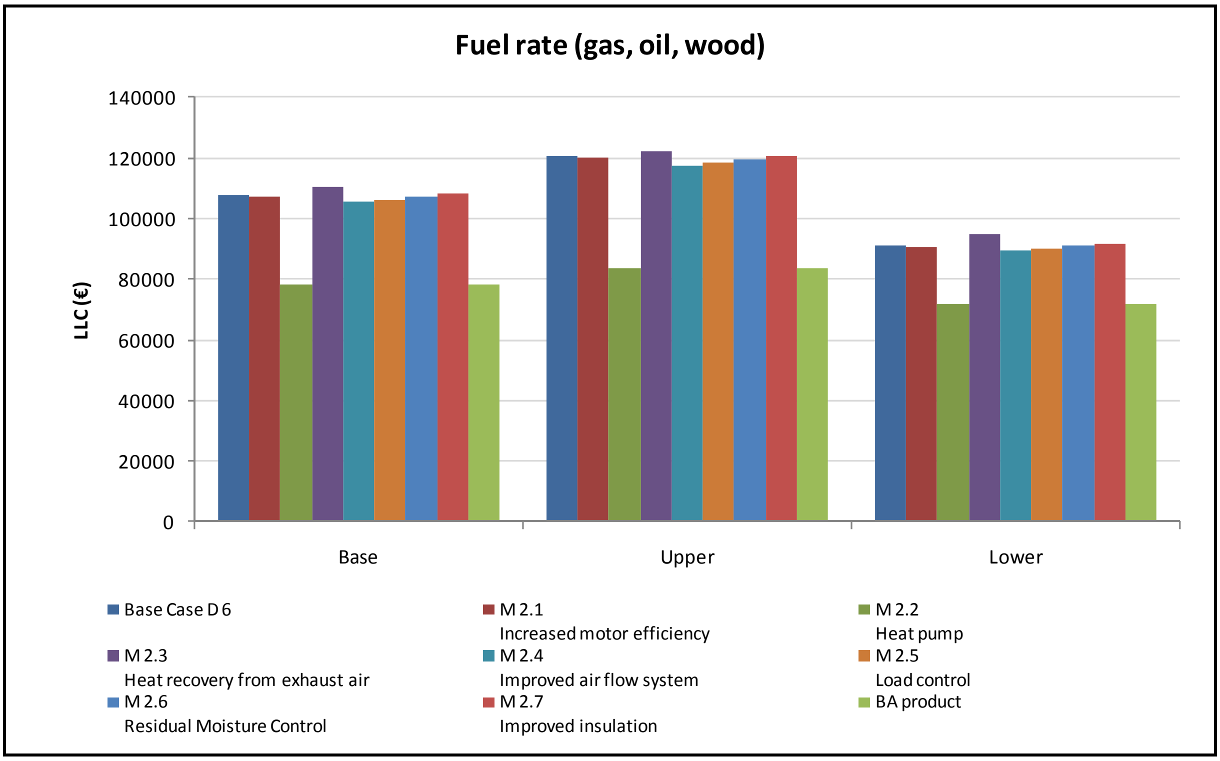

Figure 164 Base case D 6 and improvement options – impact of gas rates on LCC by product

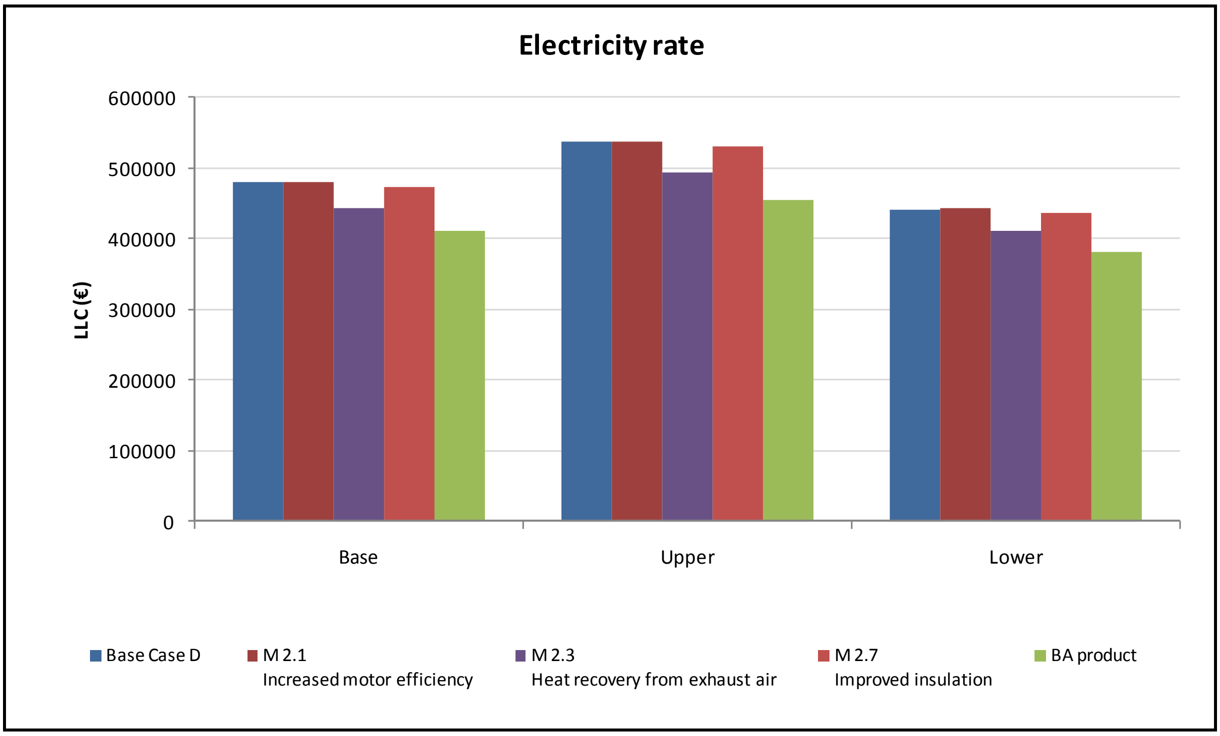

Figure 165 Base case D 7 and improvement options – impact of electricity rates on LCC by product

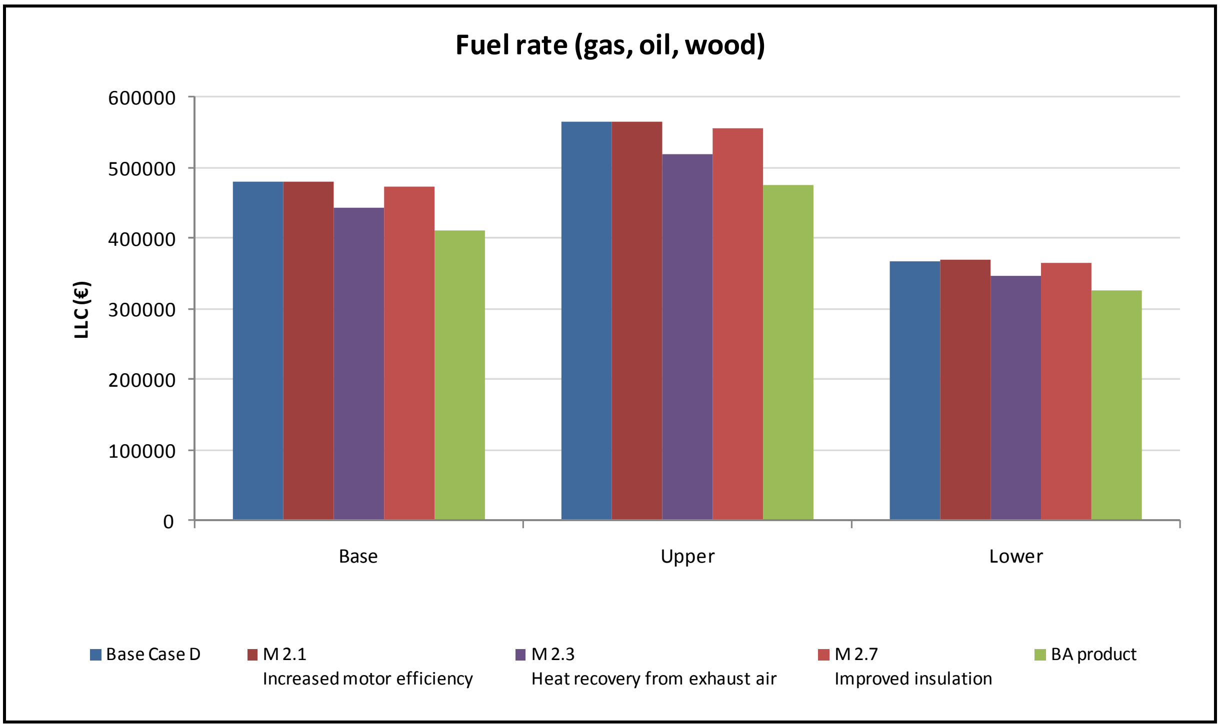

Figure 166 Base case D 7 and improvement options – impact of gas rates on LCC by product

4.5 Product purchase price

4.5.1 Assumptions

The product purchase price is a major parameter for the calculation of the LCC. Table 27 presents the ranges which will be studied for the sensitivity analysis (20% error margin).

As the improved products purchase prices are directly linked to the base case prices, the same error margin is applied to the purchase prices of the improved products.

Table 27 Purchase prices ranges for the sensitivity analysis

Base case	Base purchase price (€)	Min	Max
WM 1 - Semi-professional washer extractor	2 670	2 136	3 204
WM 2 - Professional washing extractor (<15 kg)	5 000	4 000	6 000
WM 3 - Professional washing extractor (15–40 kg)	15 250	12 200	18 300
WM 4 - Professional washing extractor (>40 kg)	58 750	47 000	70 500
WM 5 - Professional washer dryer	8 000	6 400	9 600
WM 6 - Professional barrier washer	38 250	30 600	45 900
WM 7 - Washing tunnel machine	390 000	312 000	468 000
D 1 - Semi-professional dryer, condenser	1 970	1 576	2 364
D 2 - Semi-professional dryer, air vented	1 680	1 344	2 016
D 3 - Professional cabinet dryer	3 500	2 800	4 200
D 4 - Professional air tumble dryer (<15 kg)	4 000	3 200	4 800
D 5 - Professional air tumble dryer (15–40 kg)	7 125	5 700	8 550
D 6 - Professional air tumble dryer (>40 kg)	21 500	17 200	25 800
D 7 - Industrial pass-through (transfer) tumble dryer	62 500	50 000	75 000

4.5.2 Results

Figure 167 to Figure 180 show the influence of the variation of the purchase prices on the life cycle costs of the different base cases and associated improvement options.

The option leading to the lowest life cycle costs always remain the same for a given base case, whatever the purchase price values considered (base, lower or upper). However, a few relative changes in the rankings of options happen, for instance:

- For base case D 1, D 2 and D 3, the LCC of the BA product becomes lower than the LCC of the base case with the lower values.

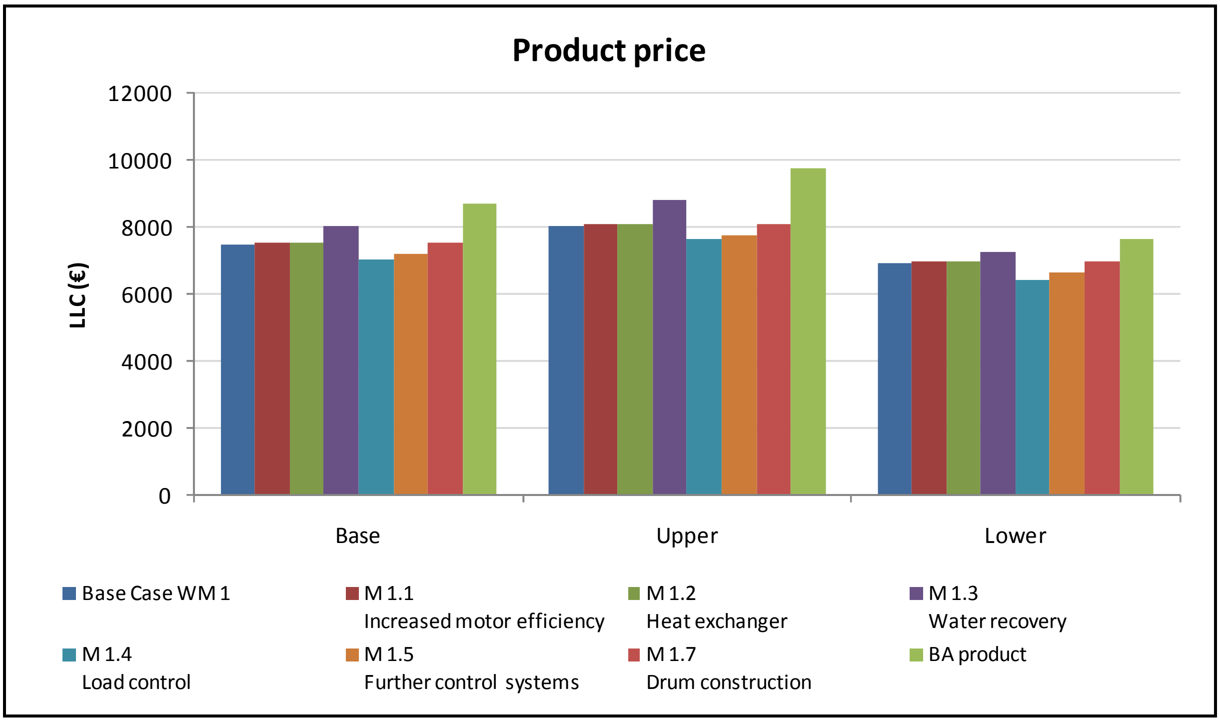

Figure 167 Base case WM 1 and improvement options – impact of purchase price on LCC by product

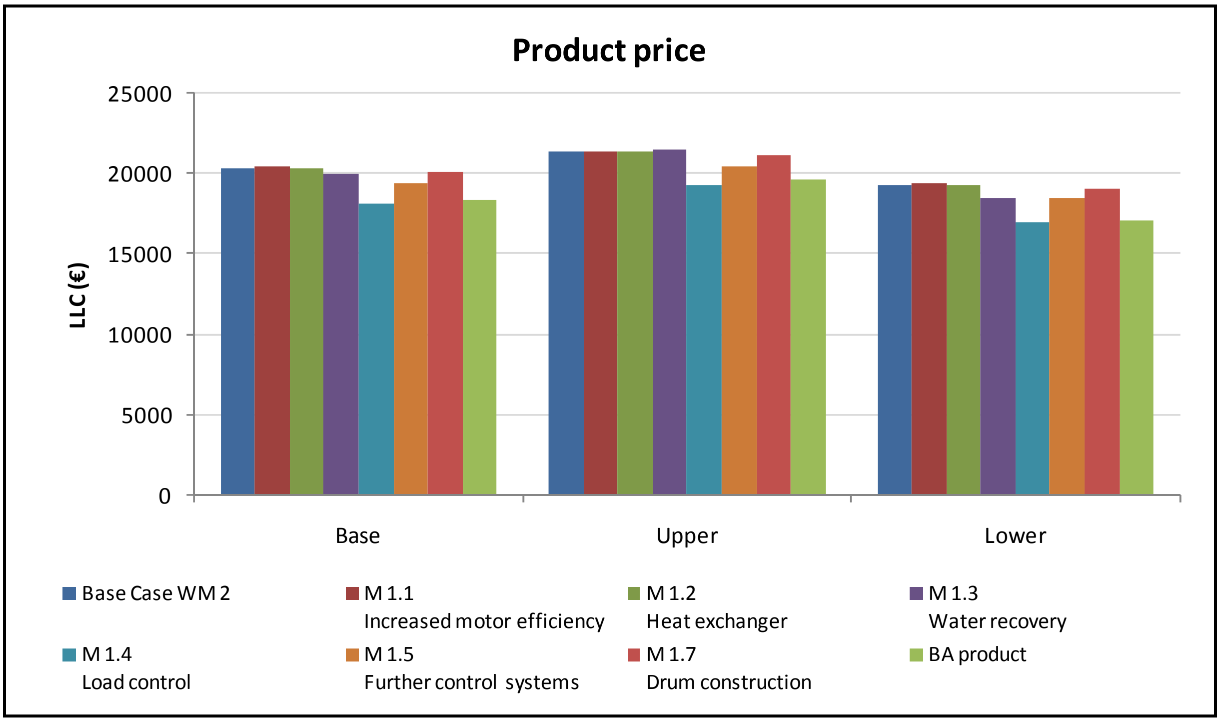

Figure 168 Base case WM 2 and improvement options – impact of purchase price on LCC by product

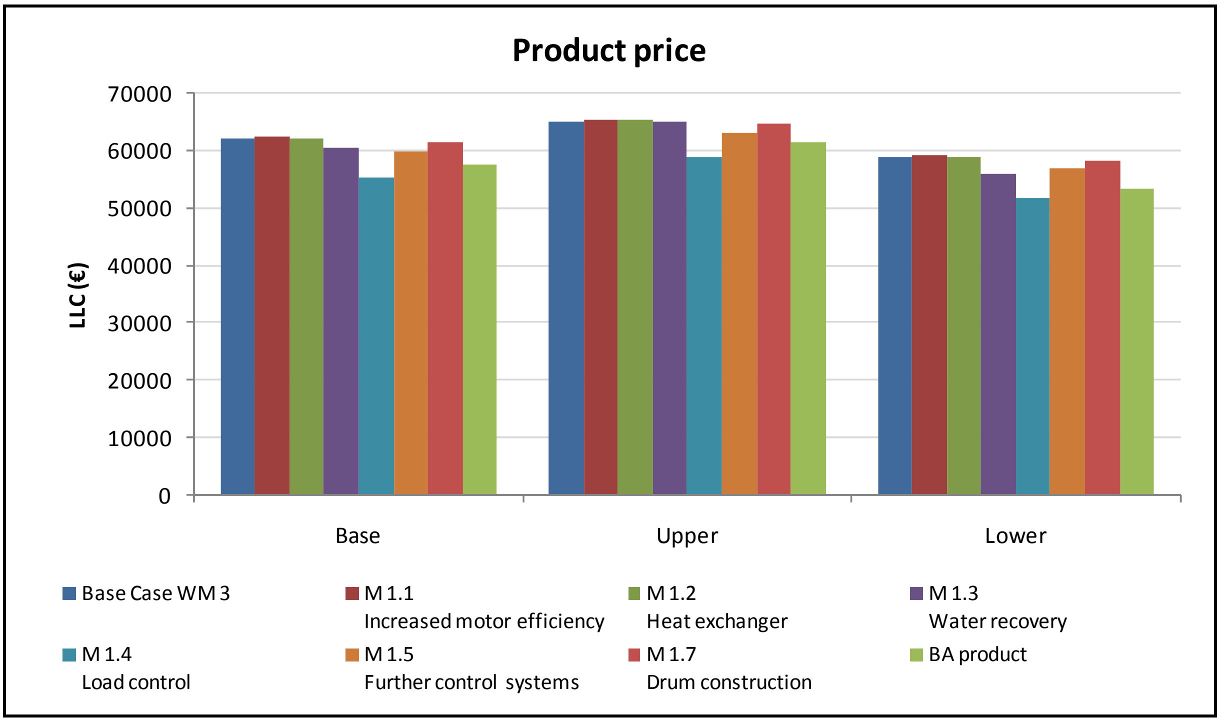

Figure 169 Base case WM 3 and improvement options – impact of purchase price on LCC by product

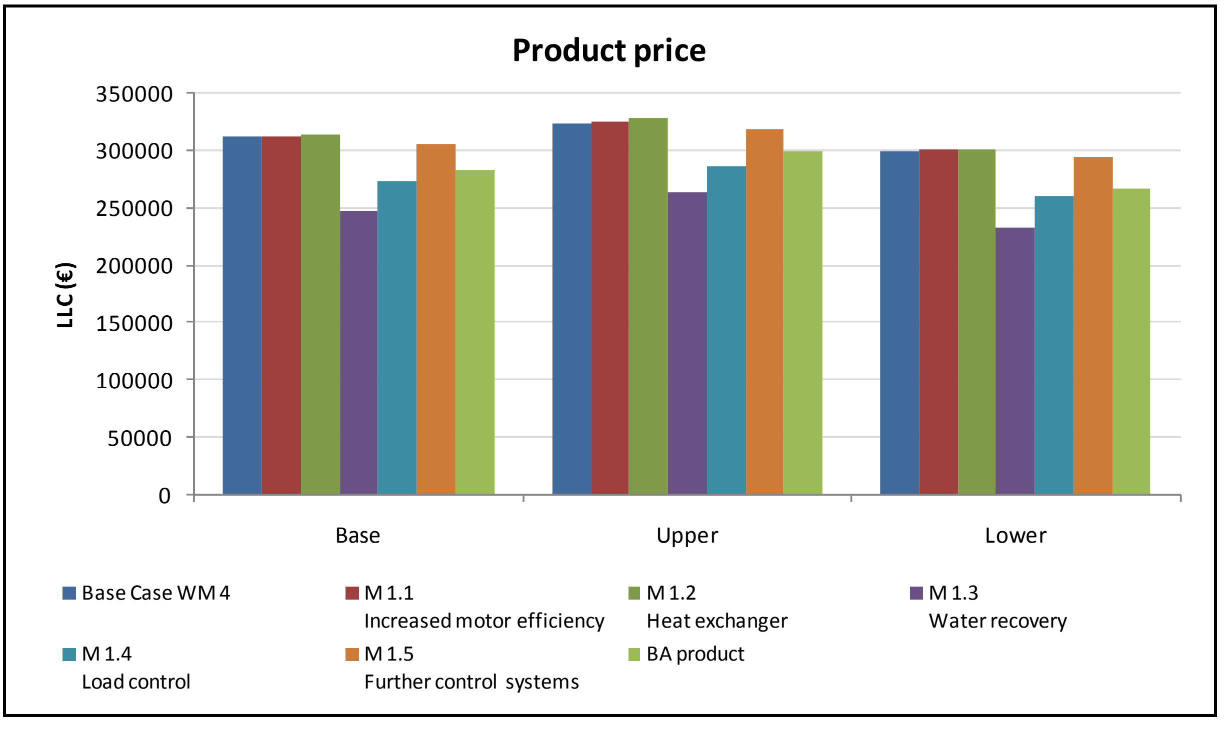

Figure 170 Base case WM 4 and improvement options – impact of purchase price on LCC by product

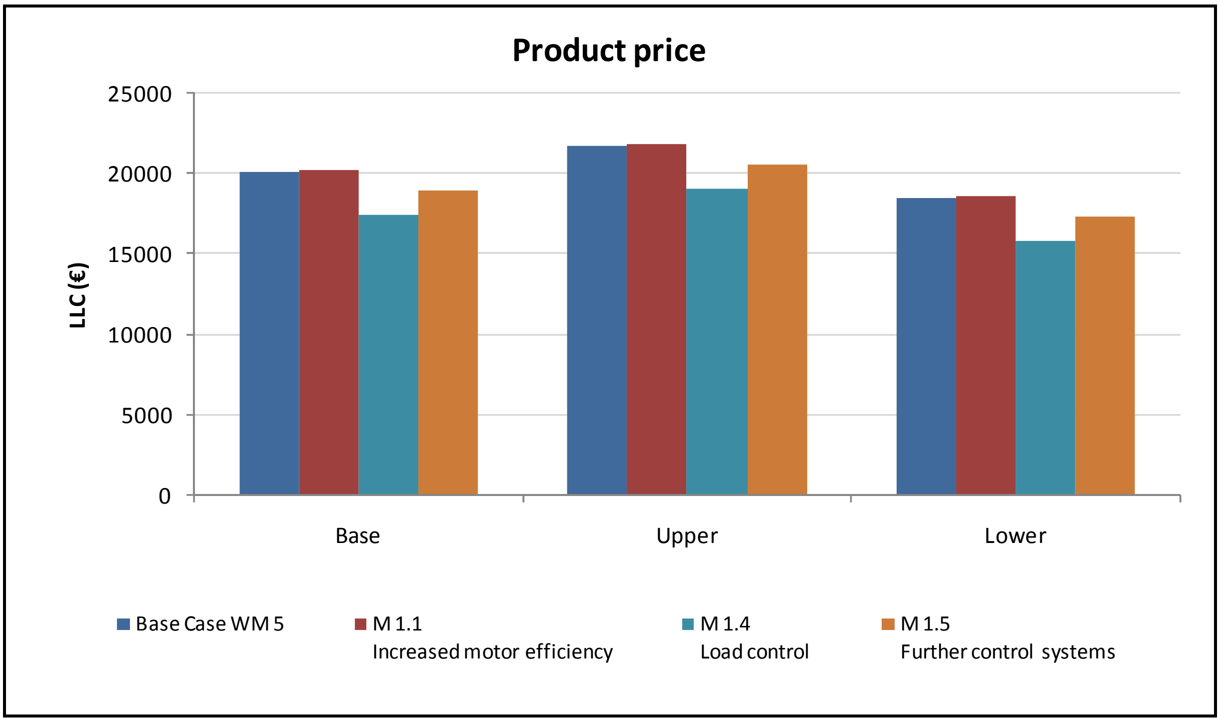

Figure 171 Base case WM 5 and improvement options – impact of purchase price on LCC by product

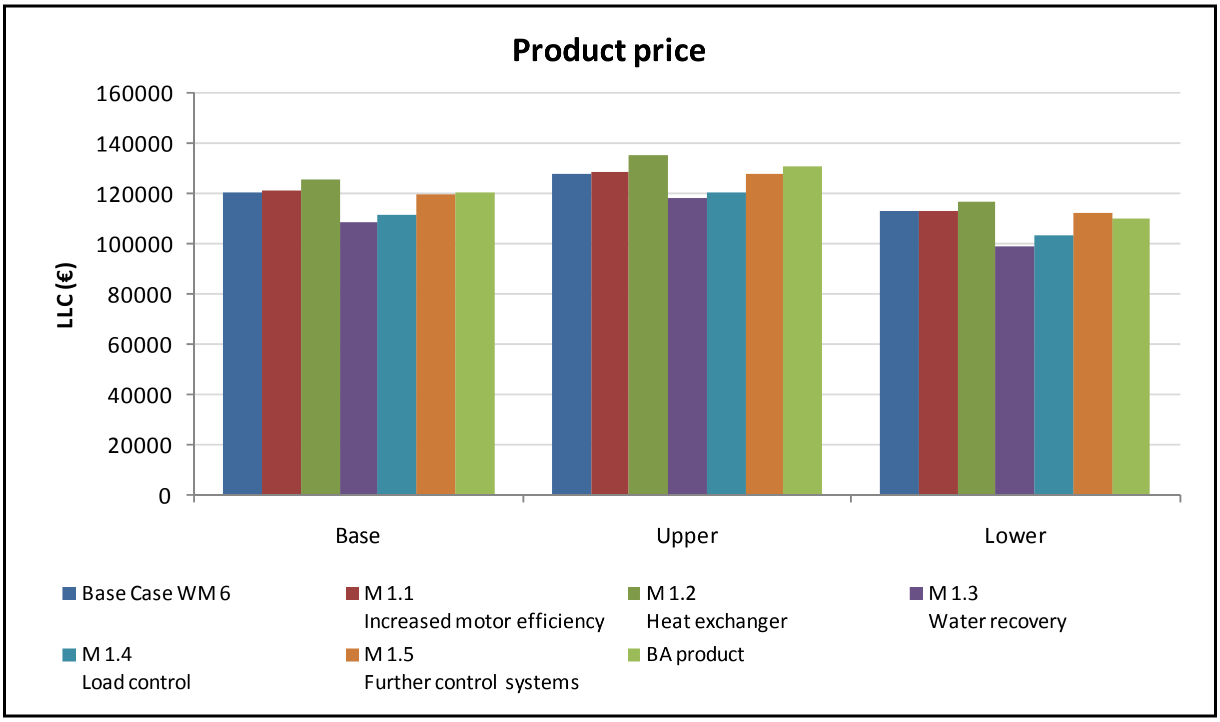

Figure 172 Base case WM 6 and improvement options – impact of purchase price on LCC by product

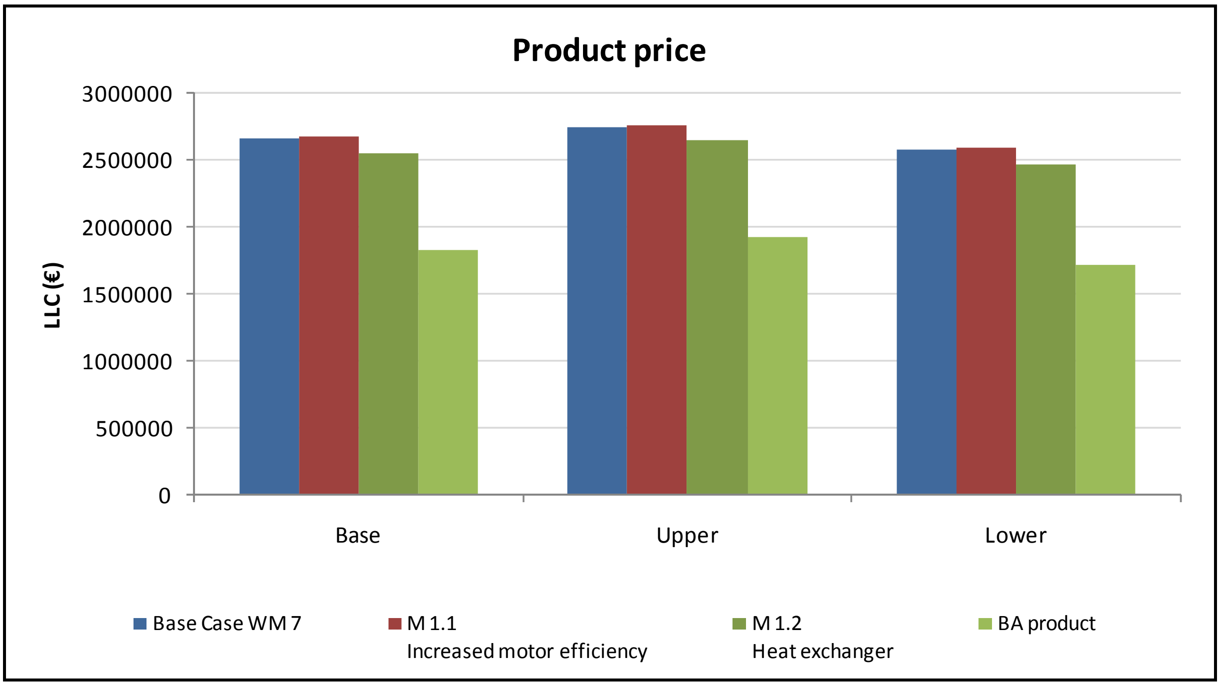

Figure 173 Base case WM 7 and improvement options – impact of purchase price on LCC by product

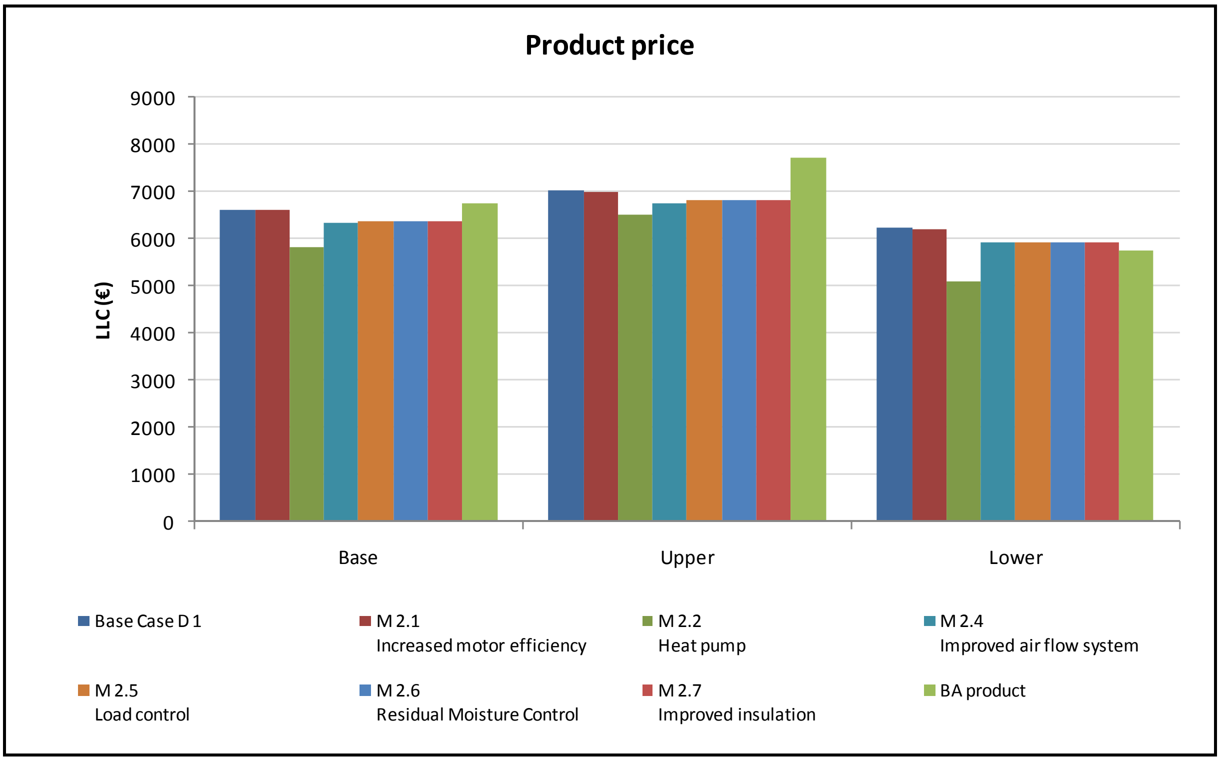

Figure 174 Base case D 1 and improvement options – impact of purchase price on LCC by product

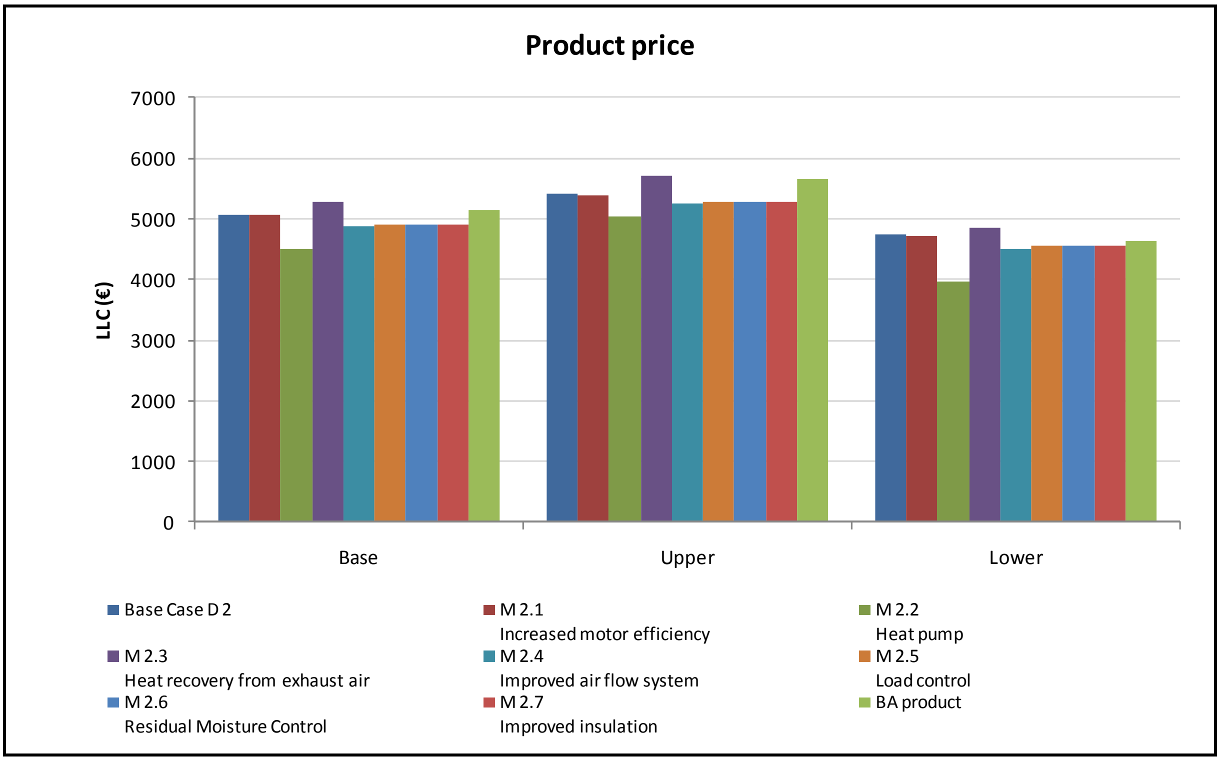

Figure 175 Base case D 2 and improvement options – impact of purchase price on LCC by product

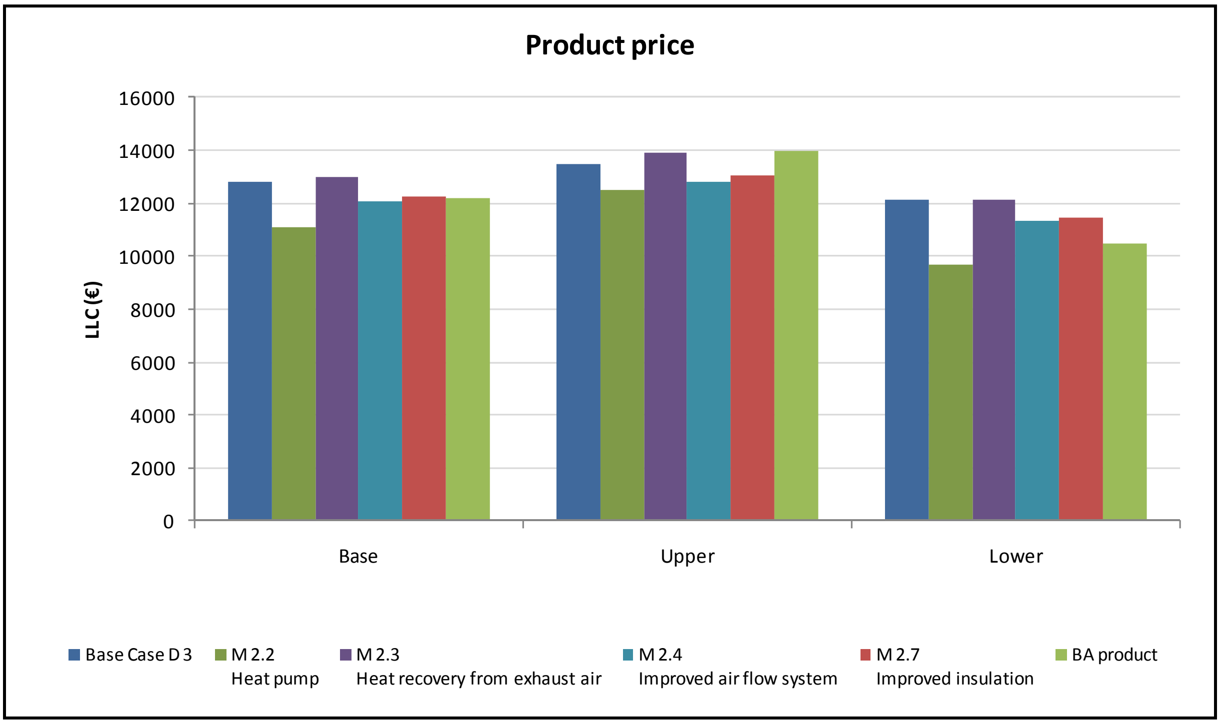

Figure 176 Base case D 3 and improvement options – impact of purchase price on LCC by product

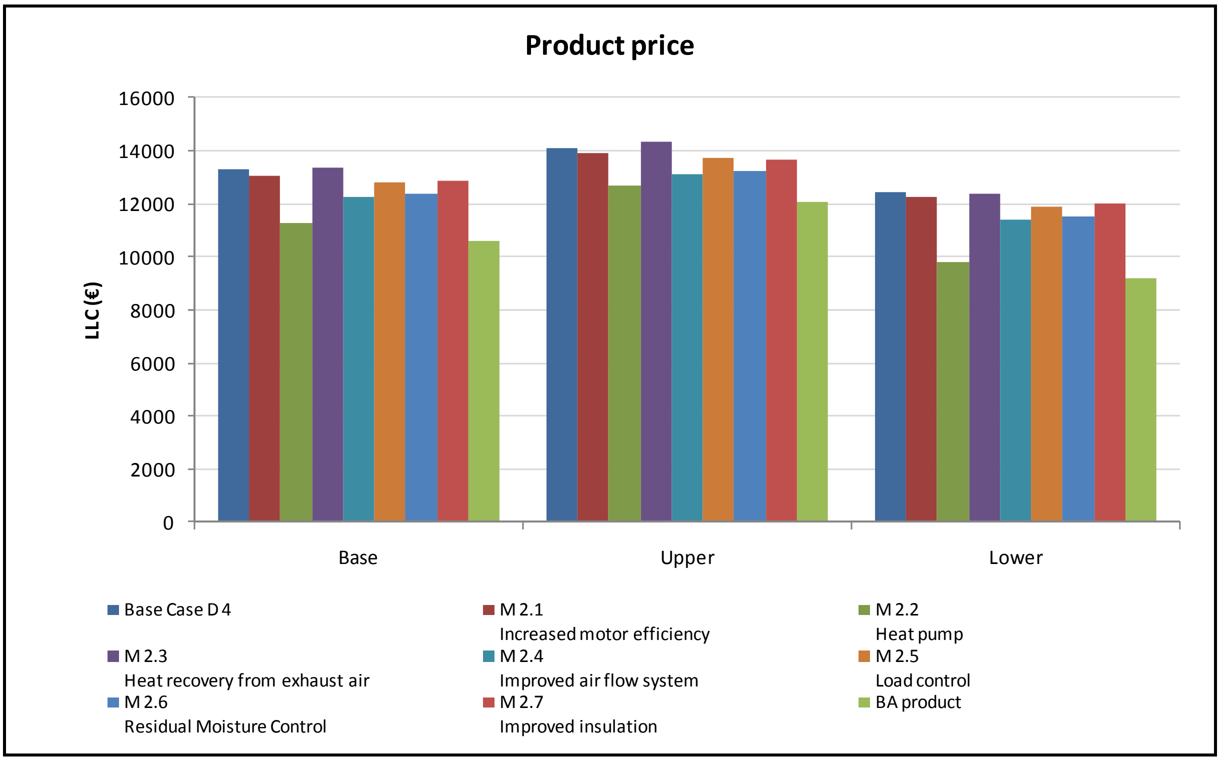

Figure 177 Base case D 4 and improvement options – impact of purchase price on LCC by product

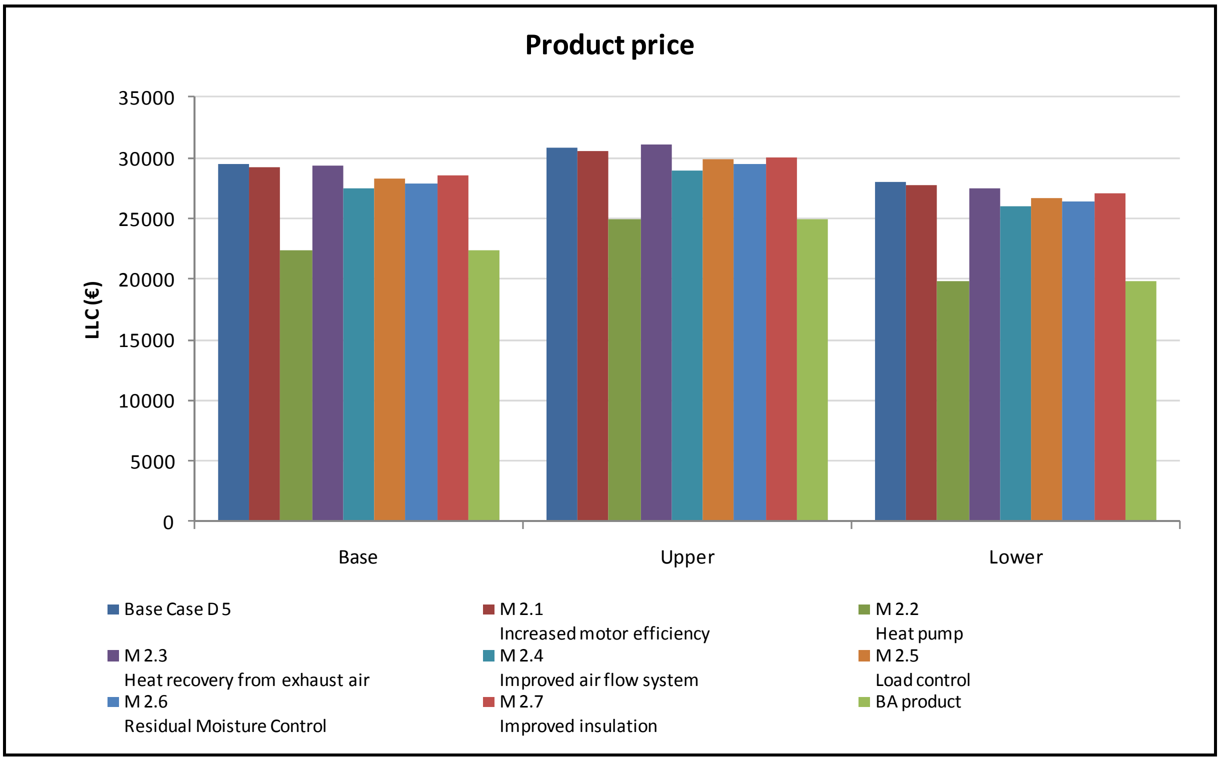

Figure 178 Base case D 5 and improvement options – impact of purchase price on LCC by product

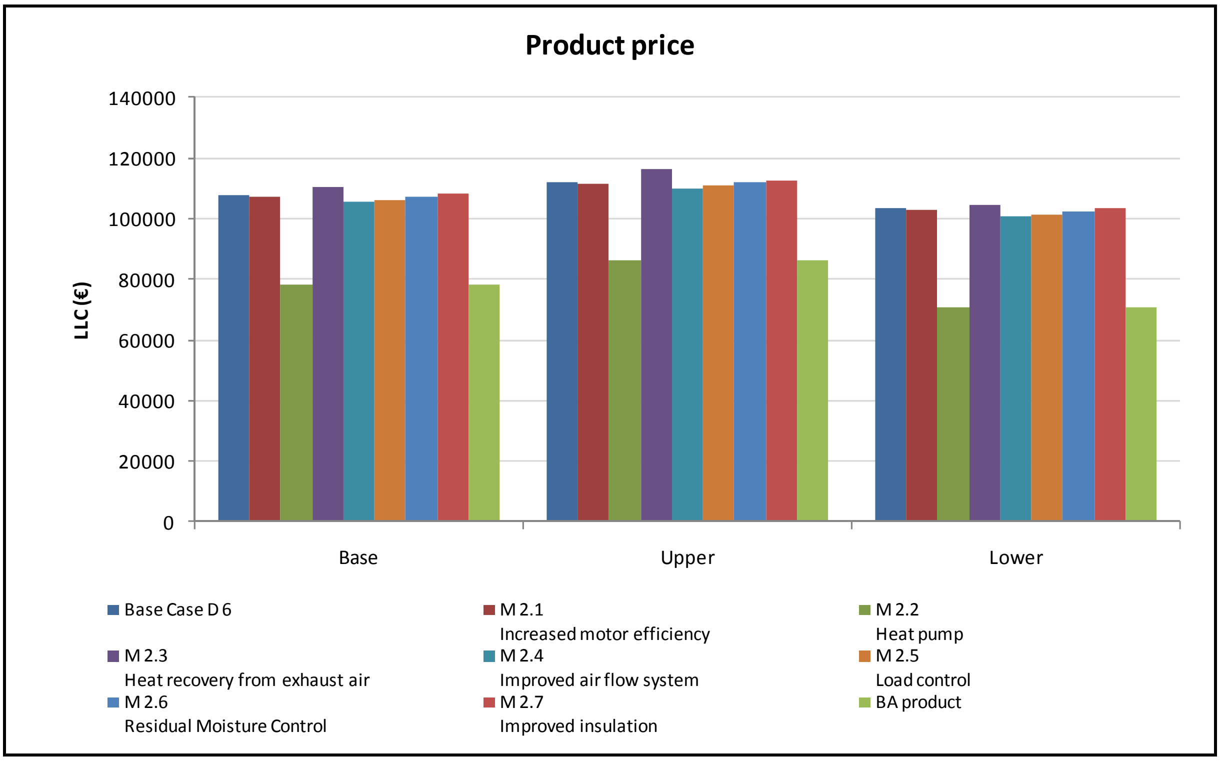

Figure 179 Base case D 6 and improvement options – impact of purchase price on LCC by product

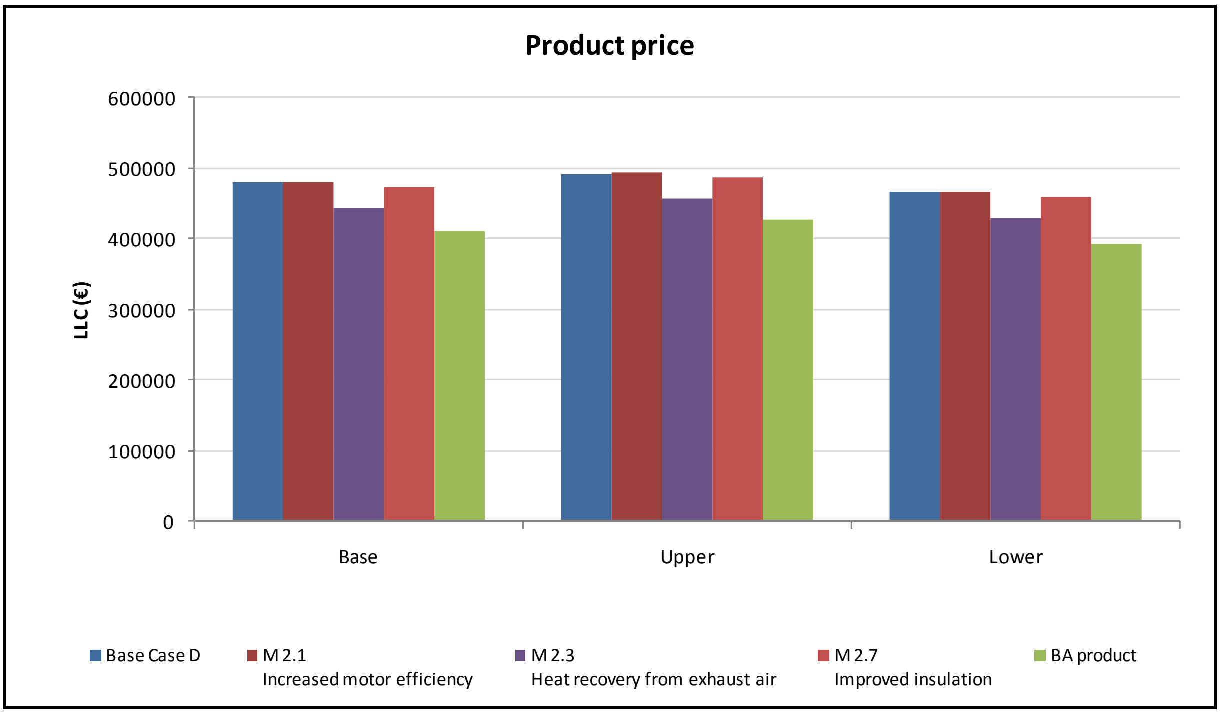

Figure 180 Base case D 7 and improvement options – impact of purchase price on LCC by product

4.6 Discount rate

4.6.1 Assumptions

The discount rate value was provided by the European Commission and the range 2-6% will be studied in the sensitivity analysis.

Table 28 Discount rate range for the sensitivity analysis

Base case	Base discount rate	Min	Max
All base cases	4%	2%	6%

4.6.2 Results

Figure 181 to Figure 194 show the influence of the variation of the discount rate on the life cycle costs of the different base cases and associated improvement options.

The option leading to the lowest life cycle costs always remain the same for a given base case, whatever the discounte rate values considered (base, lower or upper). However, a few relative changes in the rankings of options happen, for instance:

- For base case WM 6 and D 1, the LCC of the BA product becomes lower than the LCC of the base case with the lower values.

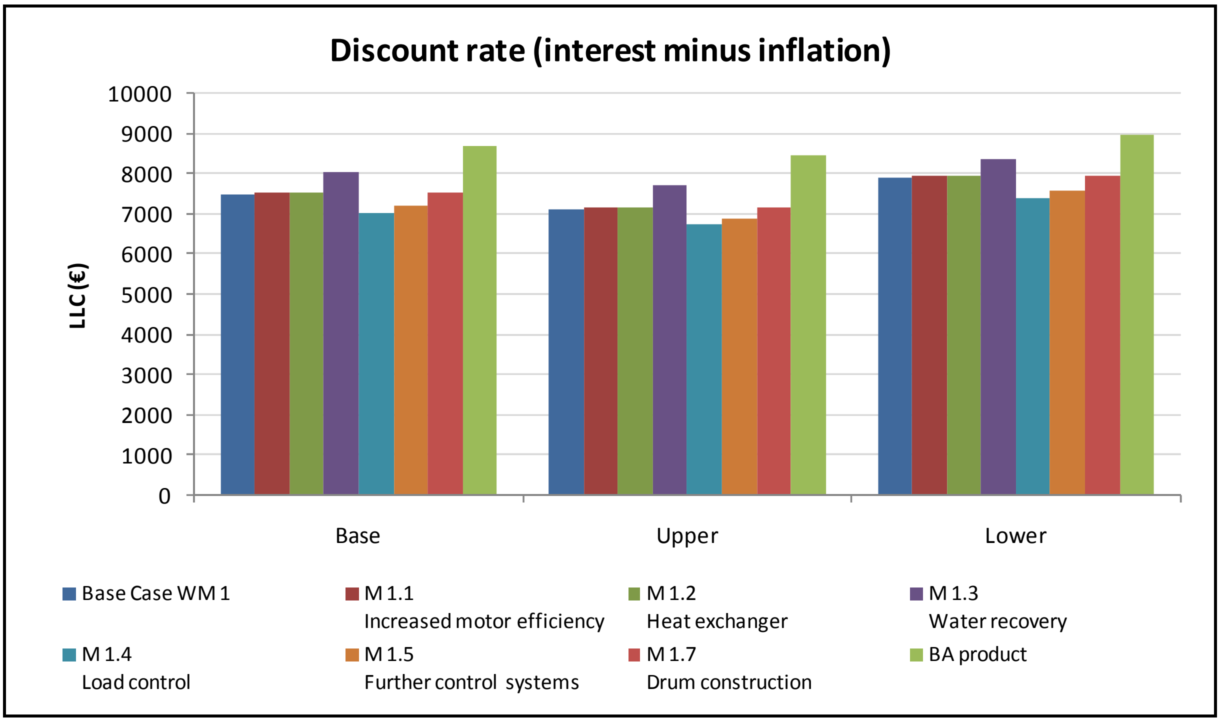

Figure 181 Base case WM 1 and improvement options – impact of discount rate on LCC by product

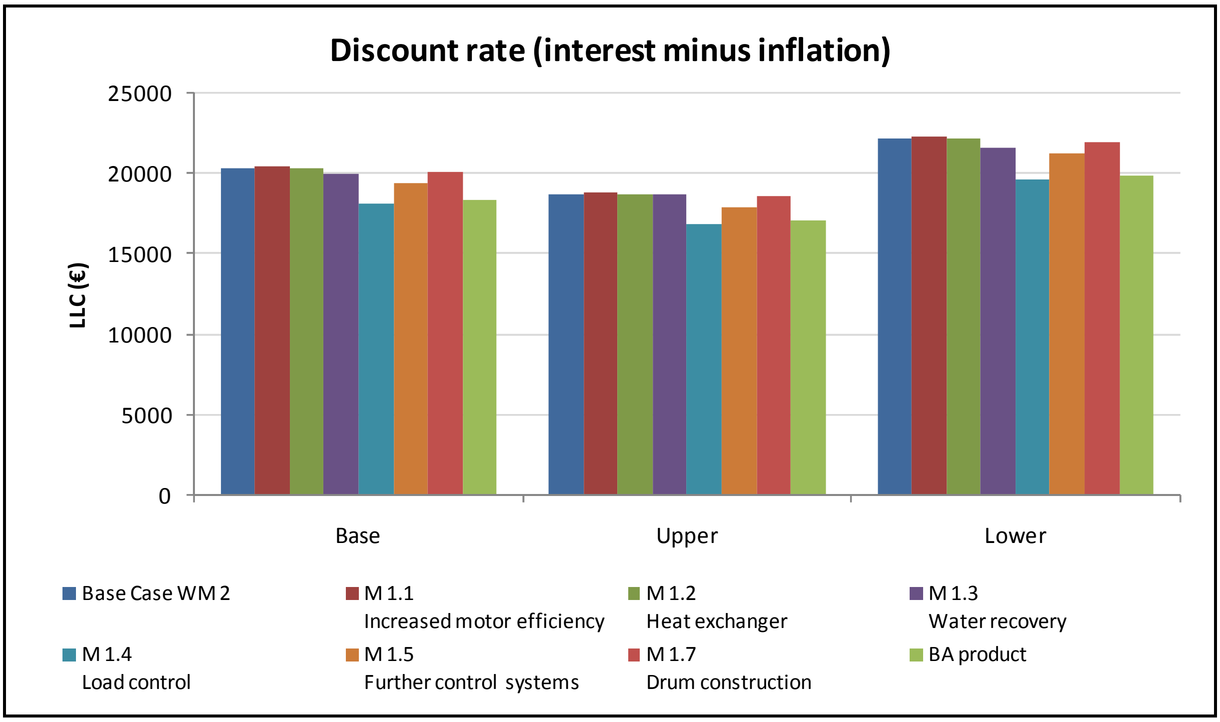

Figure 182 Base case WM 2 and improvement options – impact of discount rate on LCC by product

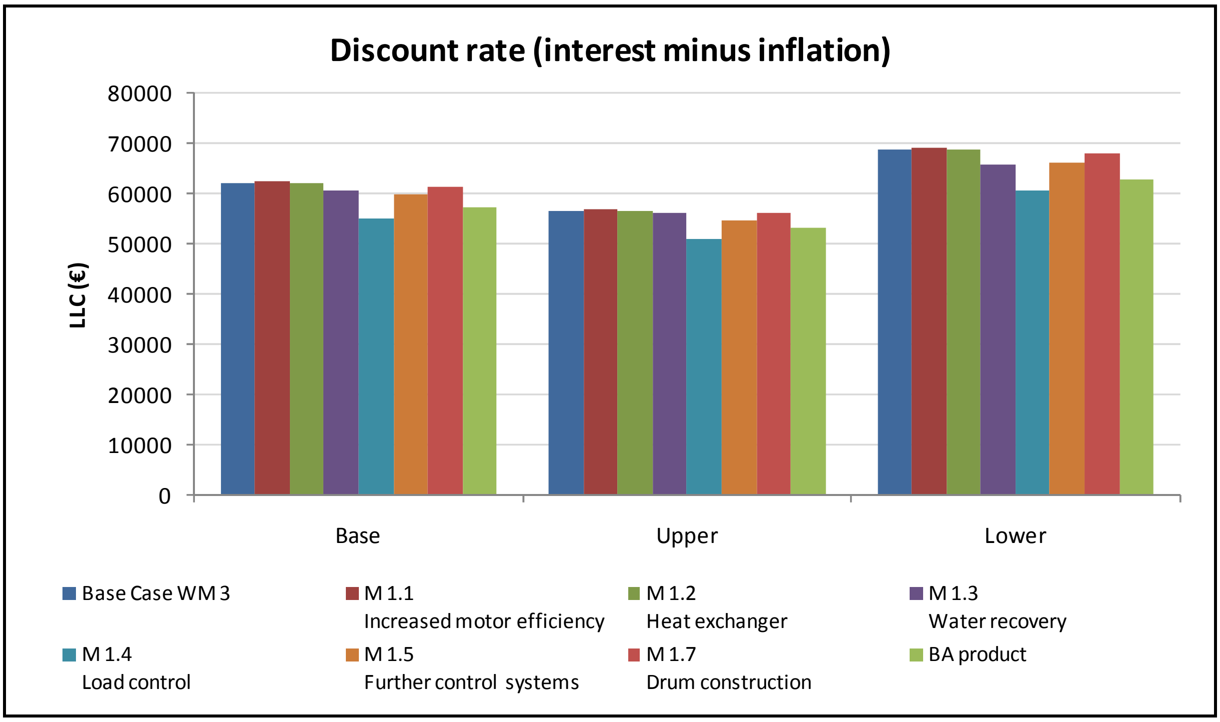

Figure 183 Base case WM 3 and improvement options – impact of discount rate on LCC by product

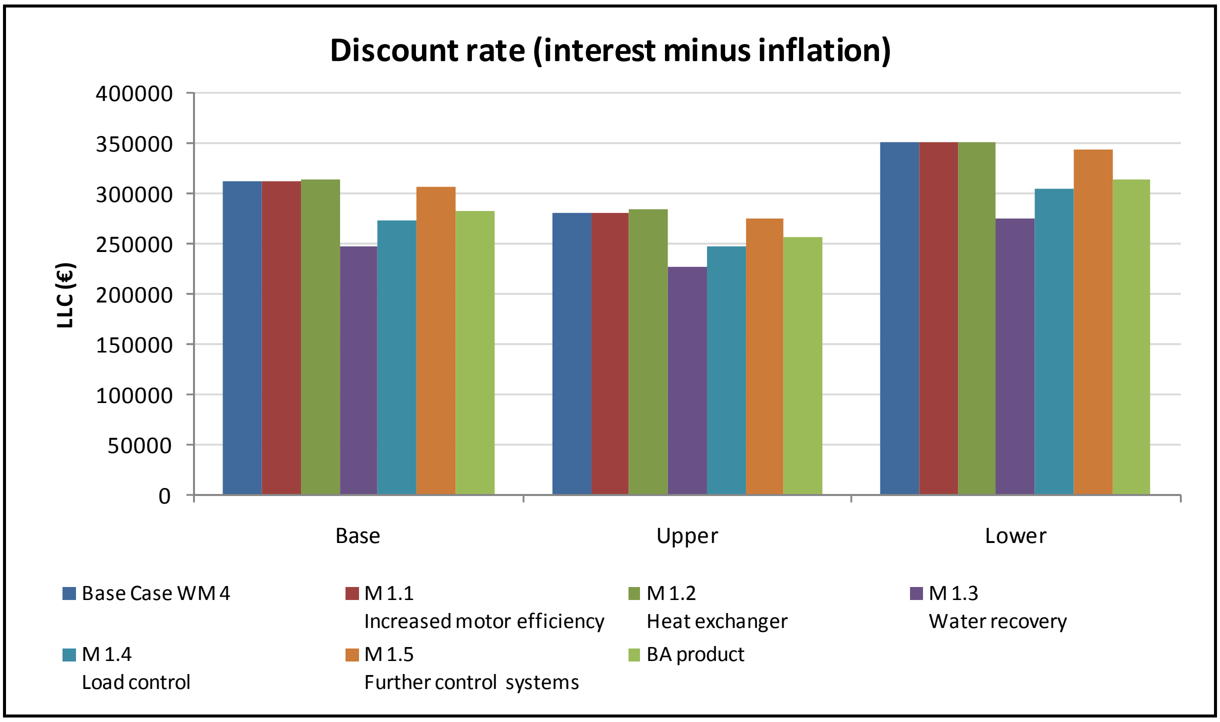

Figure 184 Base case WM 4 and improvement options – impact of discount rate on LCC by product

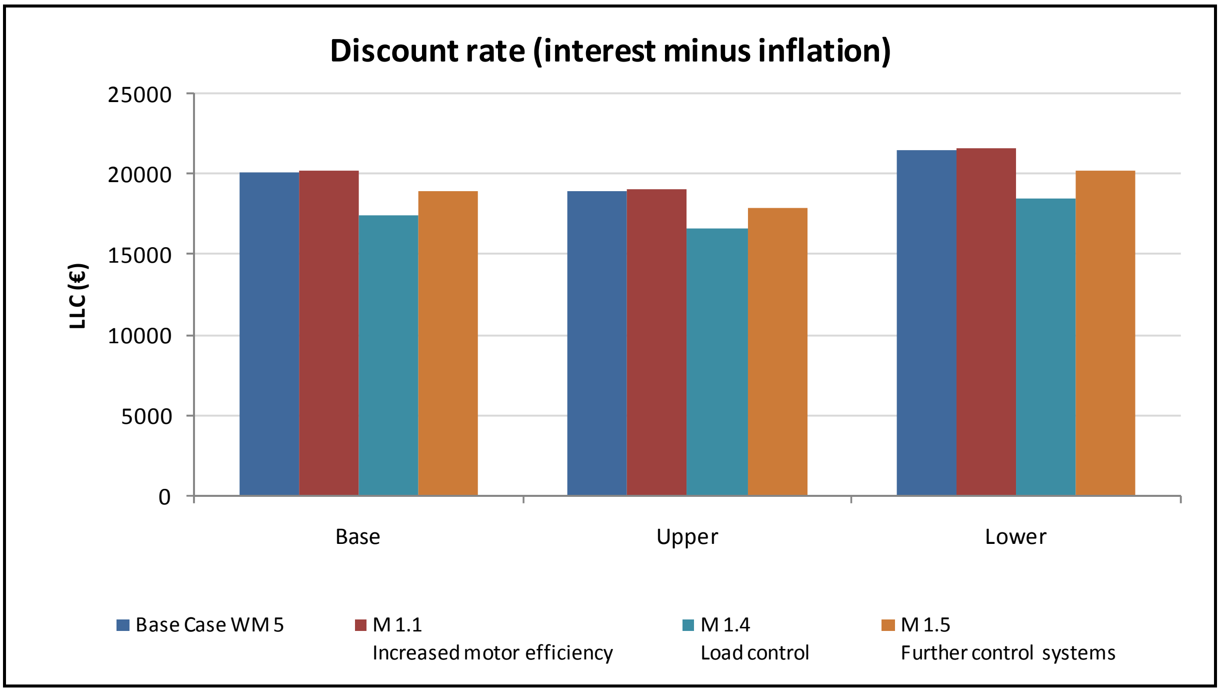

Figure 185 Base case WM 5 and improvement options – impact of discount rate on LCC by product

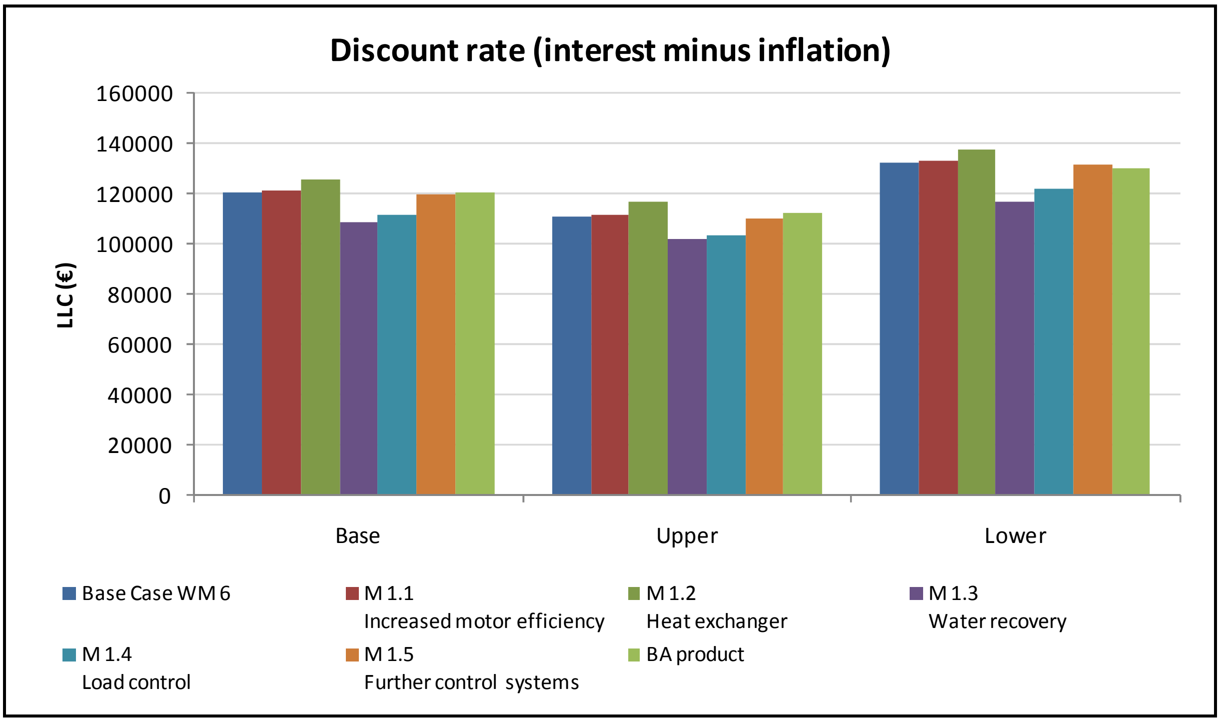

Figure 186 Base case WM 6 and improvement options – impact of discount rate on LCC by product

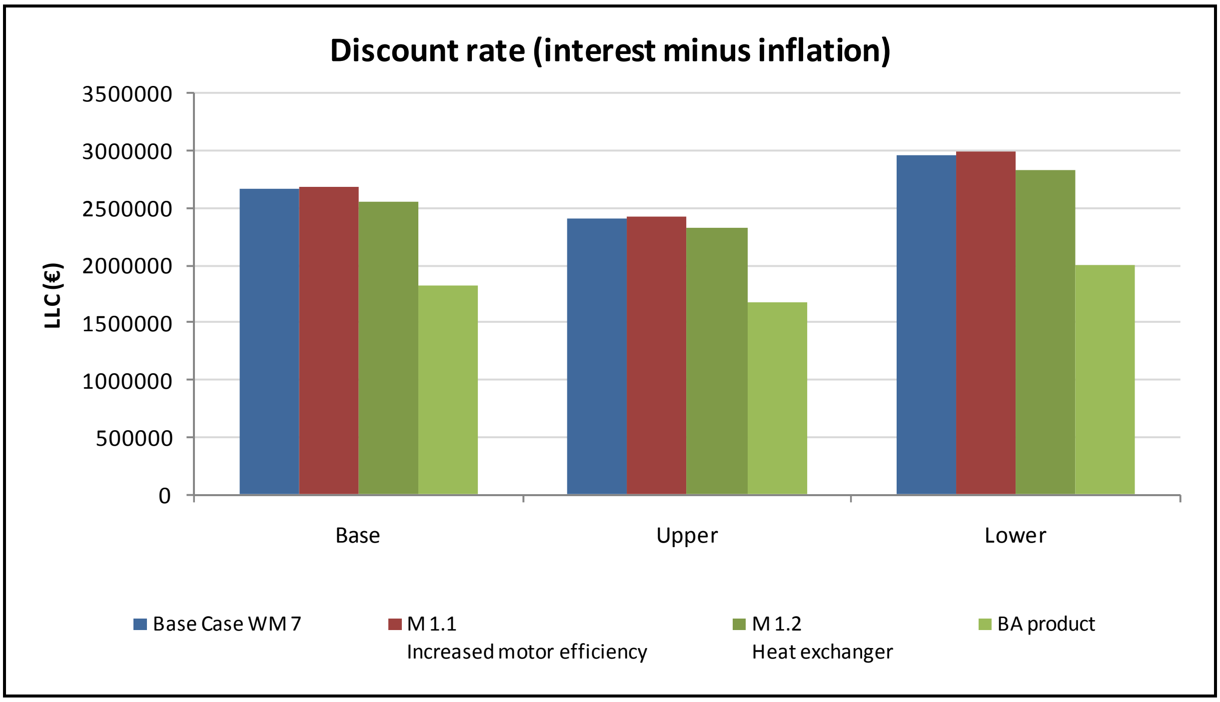

Figure 187 Base case WM 7 and improvement options – impact of discount rate on LCC by product

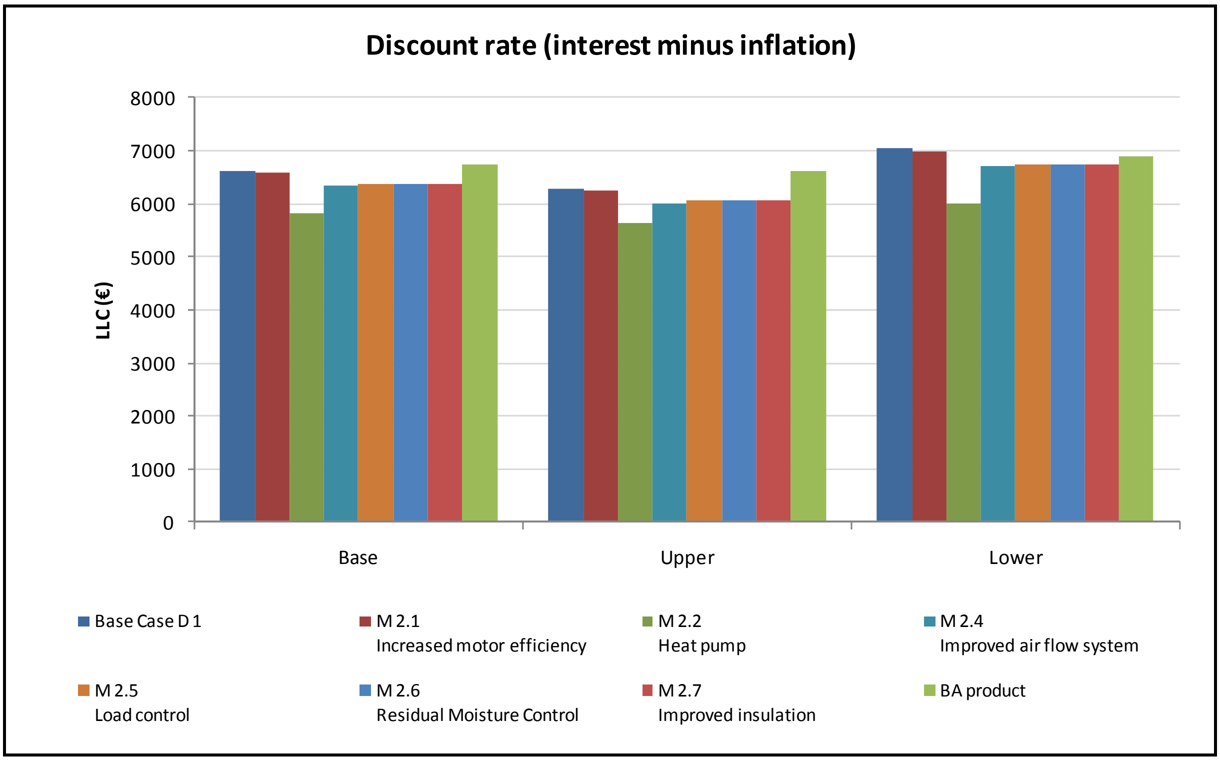

Figure 188 Base case D 1 and improvement options – impact of discount rate on LCC by product

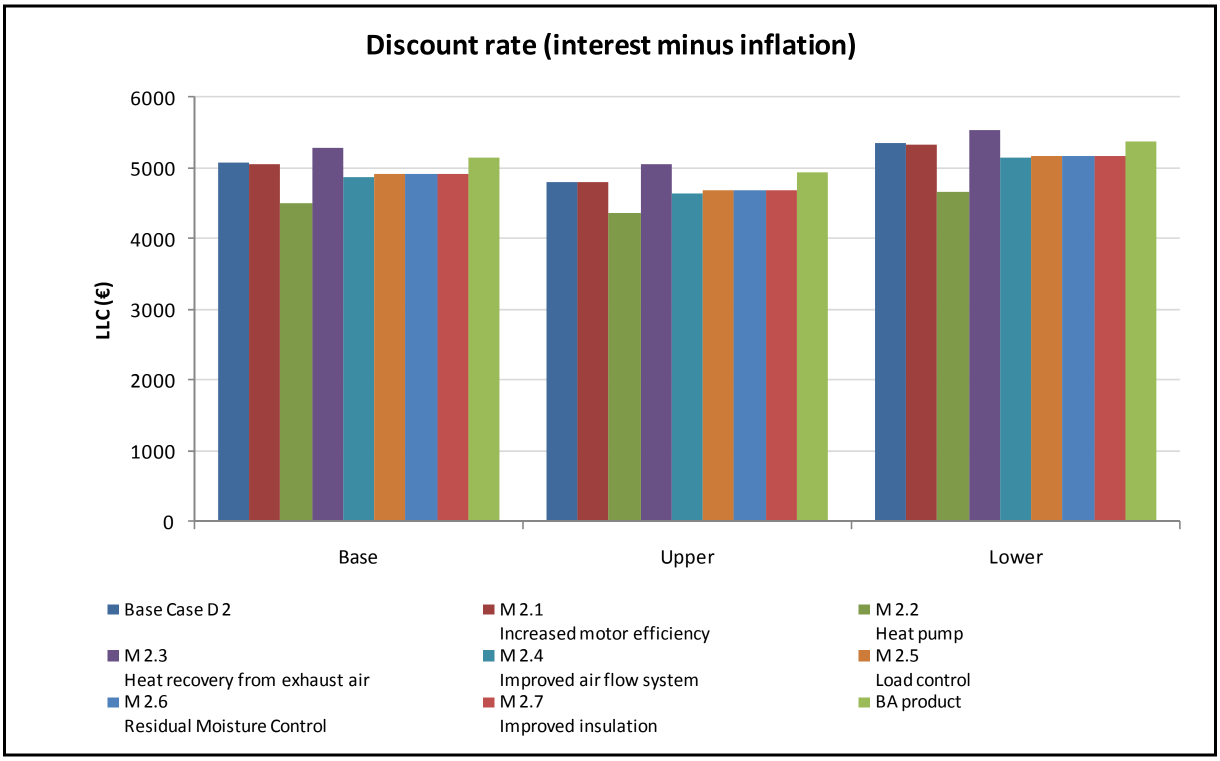

Figure 189 Base case D 2 and improvement options – impact of discount rate on LCC by product

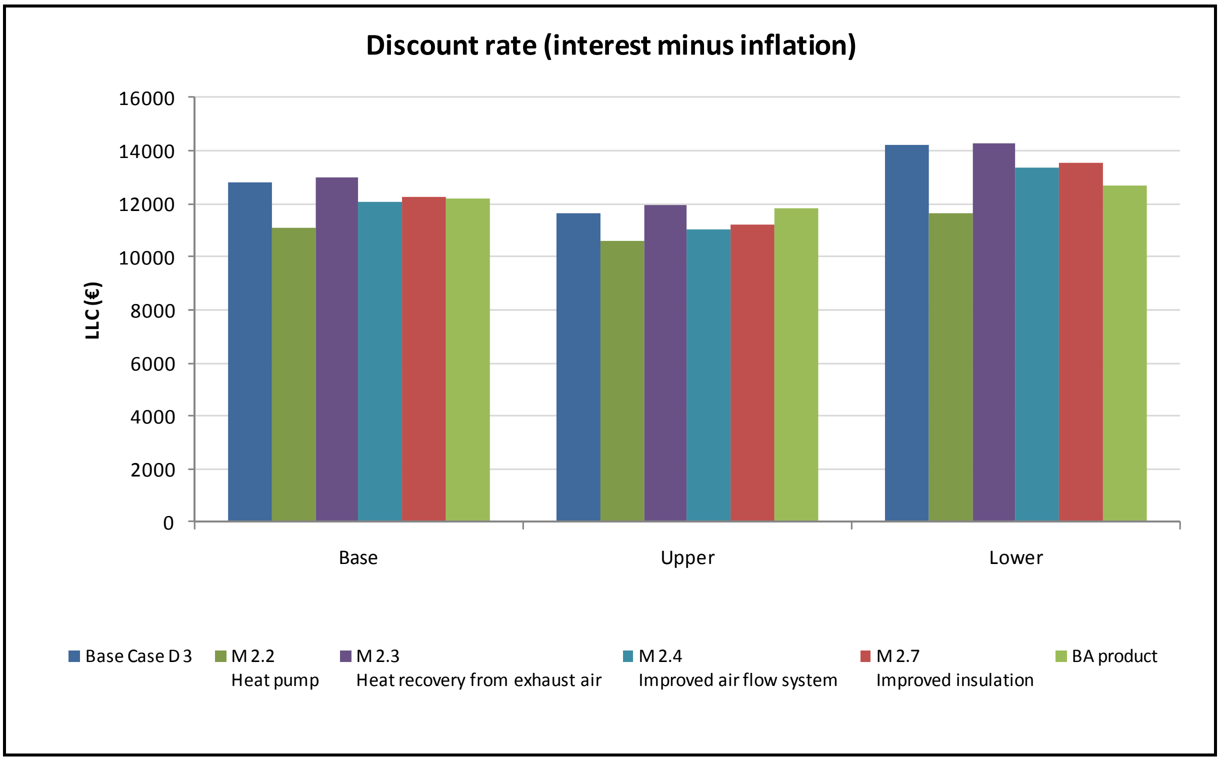

Figure 190 Base case D 3 and improvement options – impact of discount rate on LCC by product

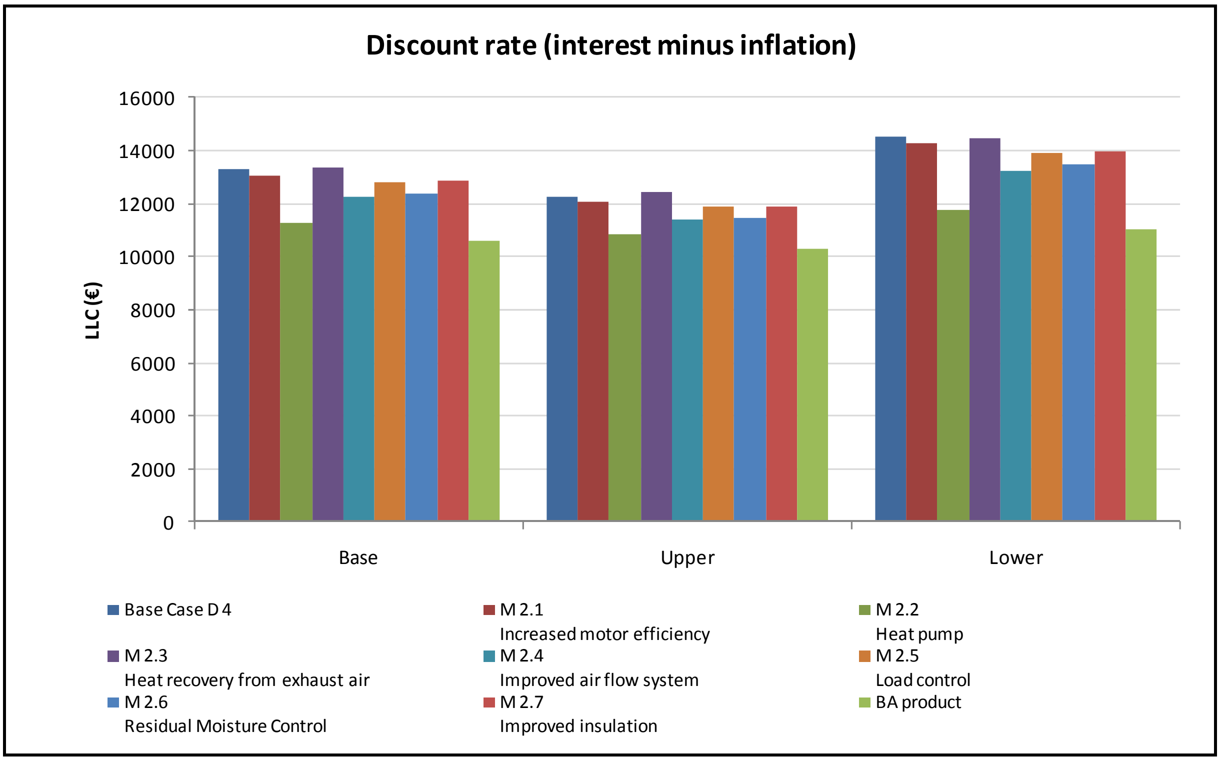

Figure 191 Base case D 4 and improvement options – impact of discount rate on LCC by product

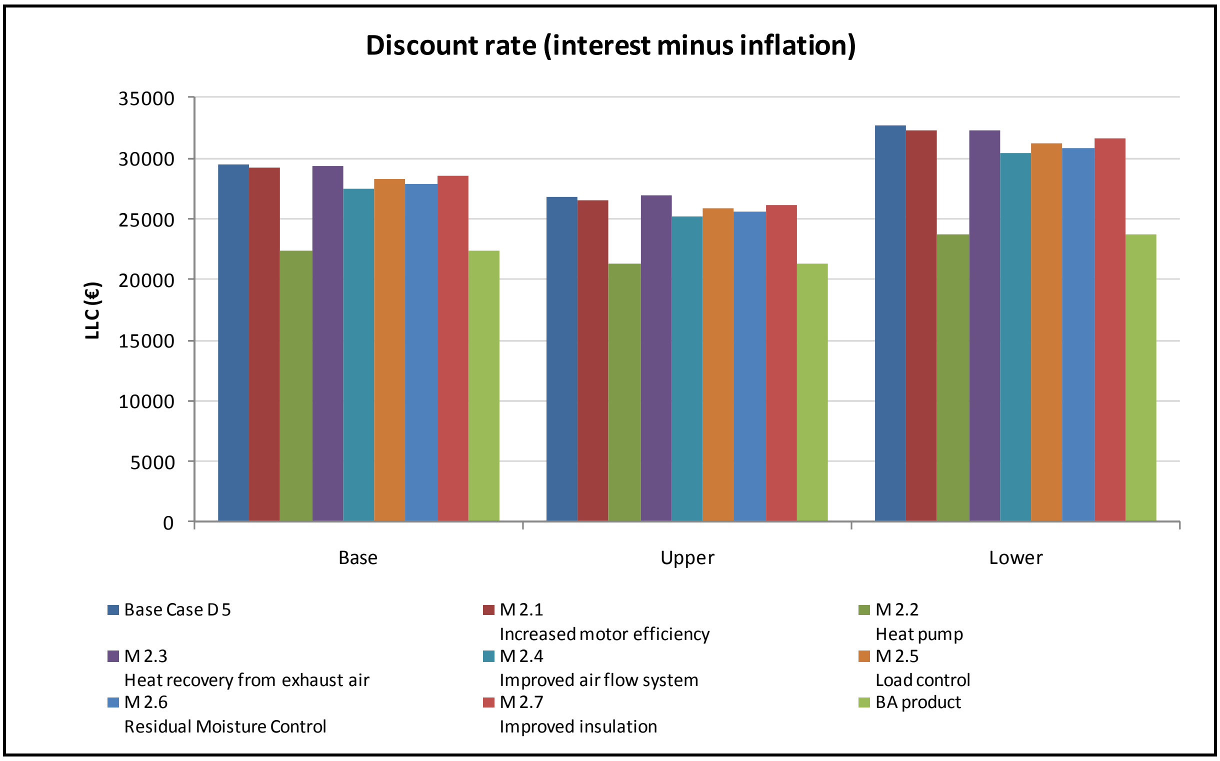

Figure 192 Base case D 5 and improvement options – impact of discount rate on LCC by product

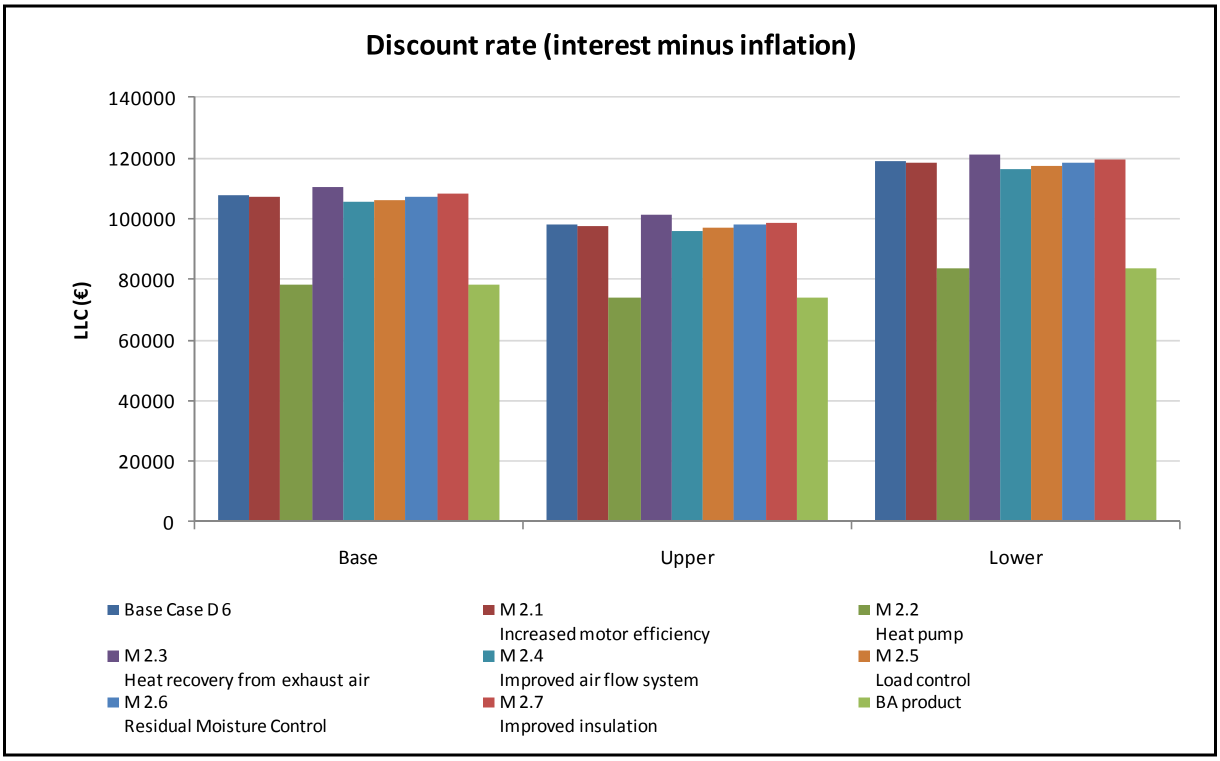

Figure 193 Base case D 6 and improvement options – impact of discount rate on LCC by product

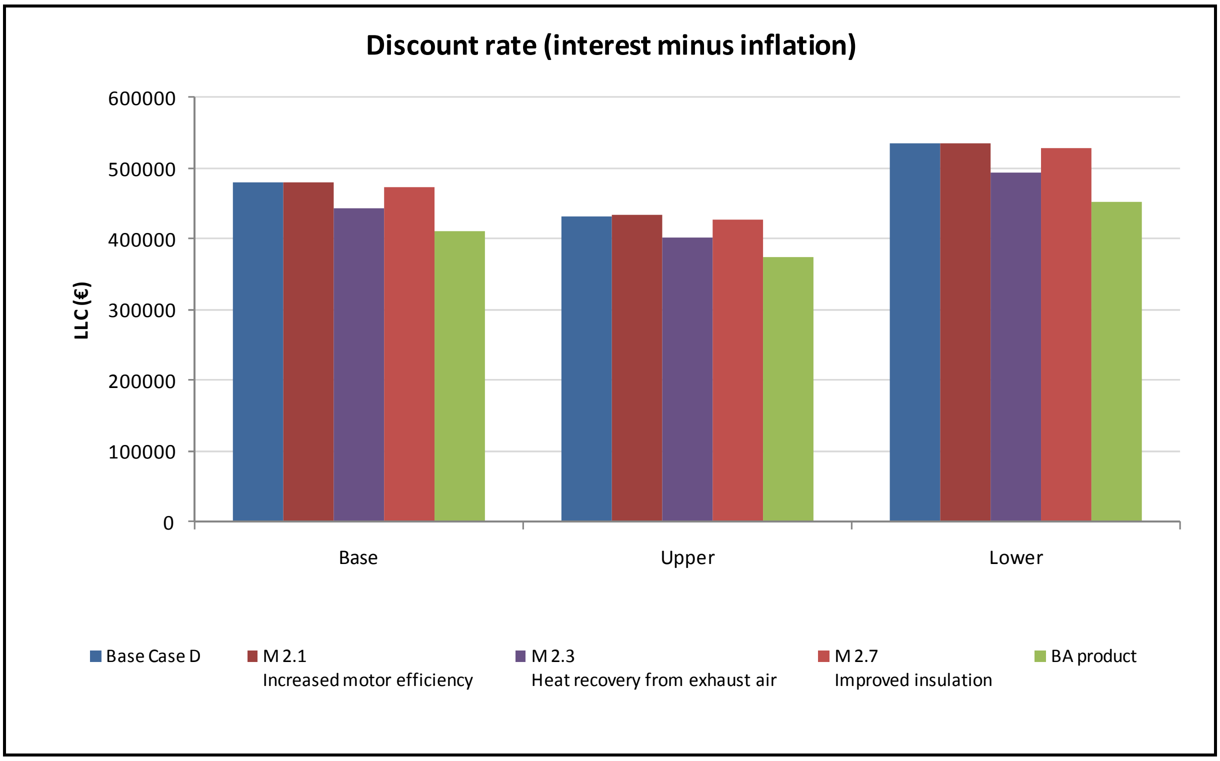

Figure 194 Base case D 7 and improvement options – impact of discount rate on LCC by product

4.7 Combined parameters

4.7.1 Assumptions

In this subsection, all previous parameters will vary simultaneously in a common direction in order to build two extreme sets of parameters:

- the "Minimum" set minimises the importance of the use phase in the life time results: lowest intensity of use, lowest life time, lowest consumables and resources rates, highest purchase price and highest discount rate.
- The "Maximum" set maximises the importance of the use phase in the life time results: highest intensity of use, highest life time, highest consumables and resources rates, lowest purchase price and lowest discount rate.

Table 29 to Table 35 repeat the parameters that will be used for the "minimum" and "maximum" sets. The error margins considered are the same that the ones presented for the sensitivity analysis of separate parameters.

Table 29 Use intensity range for the combined sensitivity analysis

Base Case	Base typical use intensity (kg of laundry per year)	Minimum set	Maximum set
WM 1 - Semi-professional washer extractor	7 000	5 600	8 400
WM 2 - Professional washing extractor (<15 kg)	14 400	11 520	17 280
WM 3 - Professional washing extractor (15–40 kg)	42 200	33 760	50 640
WM 4 - Professional washing extractor (>40 kg)	194 400	155 520	233 280
WM 5 - Professional washer dryer	7 400	5 920	8 880
WM 6 - Professional barrier washer	56 300	45 040	67 560
WM 7 - Washing tunnel machine	3 825 000	3 060 000	4 590 000
D 1 - Semi-professional dryer, condenser	6 500	5 200	7 800
D 2 - Semi-professional dryer, air vented	6 500	5 200	7 800
D 3 - Professional cabinet dryer	6 300	5 040	7 560
D 4 - Professional air tumble dryer (<15 kg)	14 400	11 520	17 280
D 5 - Professional air tumble dryer (15–40 kg)	40 500	32 400	48 600
D 6 - Professional air tumble dryer (>40 kg)	168 000	134 400	201 600
D 7 - Industrial pass-through (transfer) tumble dryer	1 020 000	816 000	1 224 000

Table 30 Product life time ranges for the combined sensitivity analysis

Base Case	Base product life time (years)	Minimum set	Maximum set
WM 1 - Semi-professional washer extractor	8	6	10
WM 2 - Professional washing extractor (<15 kg)	12	10	14
WM 3 - Professional washing extractor (15–40 kg)	14	12	16
WM 4 - Professional washing extractor (>40 kg)	15	13	17
WM 5 - Professional washer dryer	11	9	13
WM 6 - Professional barrier washer	14	12	16
WM 7 - Washing tunnel machine	13	11	15
D 1 - Semi-professional dryer, condenser	8	6	10
D 2 - Semi-professional dryer, air vented	8	6	10
D 3 - Professional cabinet dryer	15	13	17
D 4 - Professional air tumble dryer (<15 kg)	13	11	15
D 5 - Professional air tumble dryer (15–40 kg)	14	12	16
D 6 - Professional air tumble dryer (>40 kg)	13	11	15
D 7 - Industrial pass-through (transfer) tumble dryer	13	11	15

Table 31 Electricity rate ranges for the combined sensitivity analysis

Base Case	Base electricity rate (€/kWh)	Minimum set	Maximum set
WM 1 - Semi-professional washer extractor	0.138	0.071 (Estonia)	0.185 (Slovakia)
WM 2 - Professional washing extractor (<15 kg)			
WM 3 - Professional washing extractor (15–40 kg)	0.105	0.059 (Estonia)	0.160 (Cyprus)
WM 4 - Professional washing extractor (>40 kg)	0.090	0.055 (Estonia)	0.144 (Cyprus)
WM 5 - Professional washer dryer	0.105	0.059 (Estonia)	0.160 (Cyprus)
WM 6 - Professional barrier washer			
WM 7 - Washing tunnel machine	0.090	0.055 (Estonia)	0.144 (Cyprus)
D 1 - Semi-professional dryer, condenser	0.138	0.071 (Estonia)	0.185 (Slovakia)
D 2 - Semi-professional dryer, air vented			
D 3 - Professional cabinet dryer			
D 4 - Professional air tumble dryer (<15 kg)			
D 5 - Professional air tumble dryer (15–40 kg)	0.105	0.059 (Estonia)	0.160 (Cyprus)
D 6 - Professional air tumble dryer (>40 kg)	0.090	0.055 (Estonia)	0.144 (Cyprus)
D 7 - Industrial pass-through (transfer) tumble dryer			

Table 32 Gas rate ranges for the combined sensitivity analysis

Base Case	Base gas rate (€/GJ)	Minimum set	Maximum set
WM 1 - Semi-professional washer extractor	11.2115	5.5257 (Romania)	14.7633 (Sweden)
WM 2 - Professional washing extractor (<15 kg)			
WM 3 - Professional washing extractor (15–40 kg)	10.0097	5.5080 (Romania)	13.1448 (Sweden)
WM 4 - Professional washing extractor (>40 kg)	8.7921	5.6072 (Romania)	11.2499 (Sweden)
WM 5 - Professional washer dryer	10.0097	5.5080 (Romania)	13.1448 (Sweden)
WM 6 - Professional barrier washer			
WM 7 - Washing tunnel machine	8.7921	5.6072 (Romania)	11.2499 (Sweden)
D 1 - Semi-professional dryer, condenser	11.2115	5.5257 (Romania)	14.7633 (Sweden)
D 2 - Semi-professional dryer, air vented			
D 3 - Professional cabinet dryer			
D 4 - Professional air tumble dryer (<15 kg)			
D 5 - Professional air tumble dryer (15–40 kg)	10.0097	5.5080 (Romania)	13.1448 (Sweden)
D 6 - Professional air tumble dryer (>40 kg)	8.7921	5.6072 (Romania)	11.2499 (Sweden)
D 7 - Industrial pass-through (transfer) tumble dryer			

Table 33 Water and detergent rates ranges for the combined sensitivity analysis

Item	Base price (for all case-cases)	Minimum set	Maximum set
Water	2.64 €/m^3	1.11 €/m^3 (Rome)	4.91 €/m^3 (Berlin)
Detergent	2.0 €/kg	1.5 €/kg	2.5 €/kg

Table 34 Purchase price ranges for the combined sensitivity analysis

Base case	Base purchase price (in €)	Minimum set	Maximum set
WM 1 - Semi-professional washer extractor	2 670	3 204	2 136
WM 2 - Professional washing extractor (<15 kg)	5 000	6 000	4 000
WM 3 - Professional washing extractor (15–40 kg)	15 250	18 300	12 200
WM 4 - Professional washing extractor (>40 kg)	58 750	70 500	47 000
WM 5 - Professional washer dryer	8 000	9 600	6 400
WM 6 - Professional barrier washer	38 250	45 900	30 600
WM 7 - Washing tunnel machine	390 000	468 000	312 000
D 1 - Semi-professional dryer, condenser	1 970	2 364	1 576
D 2 - Semi-professional dryer, air vented	1 680	2 016	1 344
D 3 - Professional cabinet dryer	3 500	4 200	2 800
D 4 - Professional air tumble dryer (<15 kg)	4 000	4 800	3 200
D 5 - Professional air tumble dryer (15–40 kg)	7 125	8 550	5 700
D 6 - Professional air tumble dryer (>40 kg)	21 500	25 800	17 200
D 7 - Industrial pass-through (transfer) tumble dryer	62 500	75 000	50 000

Table 35 Discount rate range for the combined sensitivity analysis

Base Case	Base discount rate	Minimum set	Maximum set
All base cases	4%	6%	2%

4.7.2 Results

Figure 195 to Figure 222 show the influence of the variations of several combined parameters on the total energy consumption and the life cycle costs of the different base cases and associated improvement options.

This is clearly the analysis resulting in the most important changes in rankings, especially in the economic analysis:

- Base case WM 1: the base case becomes the LLCC with the minimum set, instead of option M 1.4;
- Base case WM 2: option M 1.5 becomes the LLCC with the minimum set, instead of option M 1.4, while the BA product becomes the LLCC with the maximum set;
- Base case WM 3: option M 1.5 becomes the LLCC with the minimum set, instead of option M 1.4;
- Base case WM 4: option M 1.4 becomes the LLCC with the minimum set, instead of option M 1.3;
- Base case WM 6: the base case becomes the LLCC with the minimum set, instead of option M 1.3;
- Base case D 1: the base case becomes the LLCC with the minimum set, instead of option M 2.2;
- Base case D 2: the base case becomes the LLCC with the minimum set, instead of option M 2.2;
- Base case D 3: option M 2.4 becomes the LLCC with the minimum set, instead of option M 2.2, while the BA product becomes the LLCC with the maximum set;
- Base case D 4: option M 2.6 becomes the LLCC with the minimum set, instead of the BA product.
- Base case D 5: option M 2.4 becomes the LLCC with the minimum set, instead of the BA product.
- Base case D 6: the base case becomes the LLCC with the minimum set, instead of the BA product.
- Base case D 7: option M 2.3 becomes the LLCC with the minimum set, instead of the BA product.

Besides, many changes also occur in the relative rankings between the different options, which demonstrate the high dependency of the economic results toward the parameters assessed.

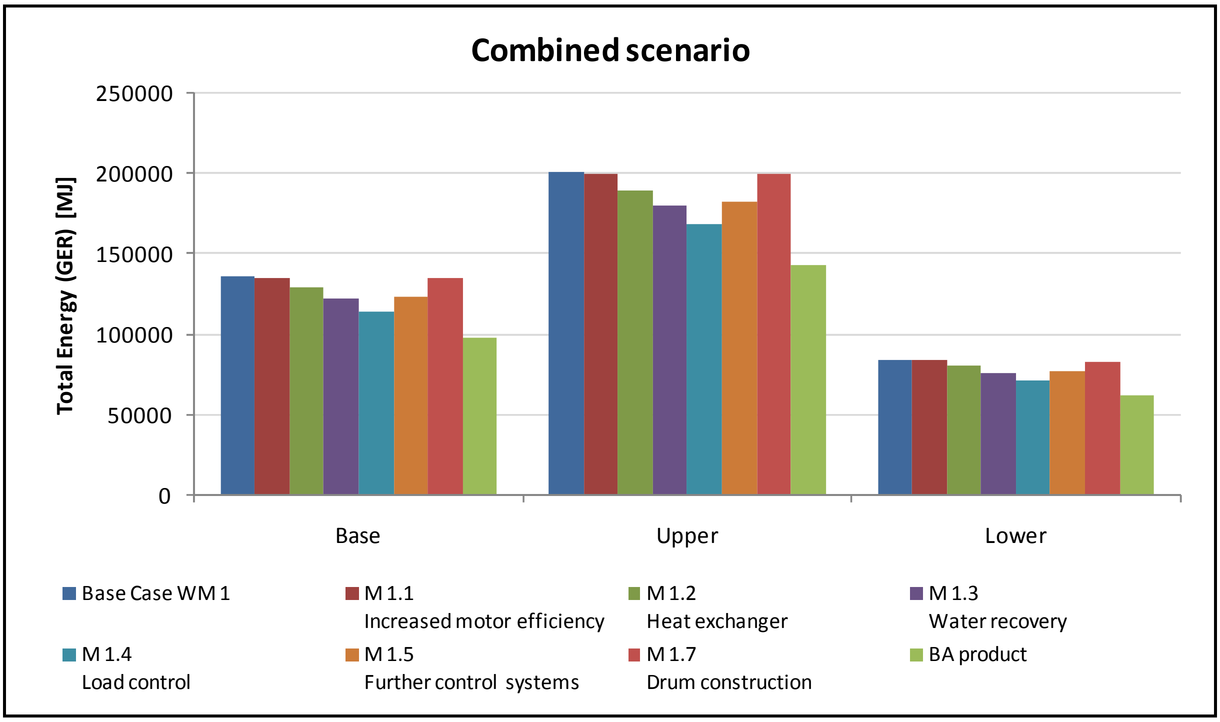

Figure 195 Base case WM 1 and improvement options – impact of combined scenario on total energy over life time by product

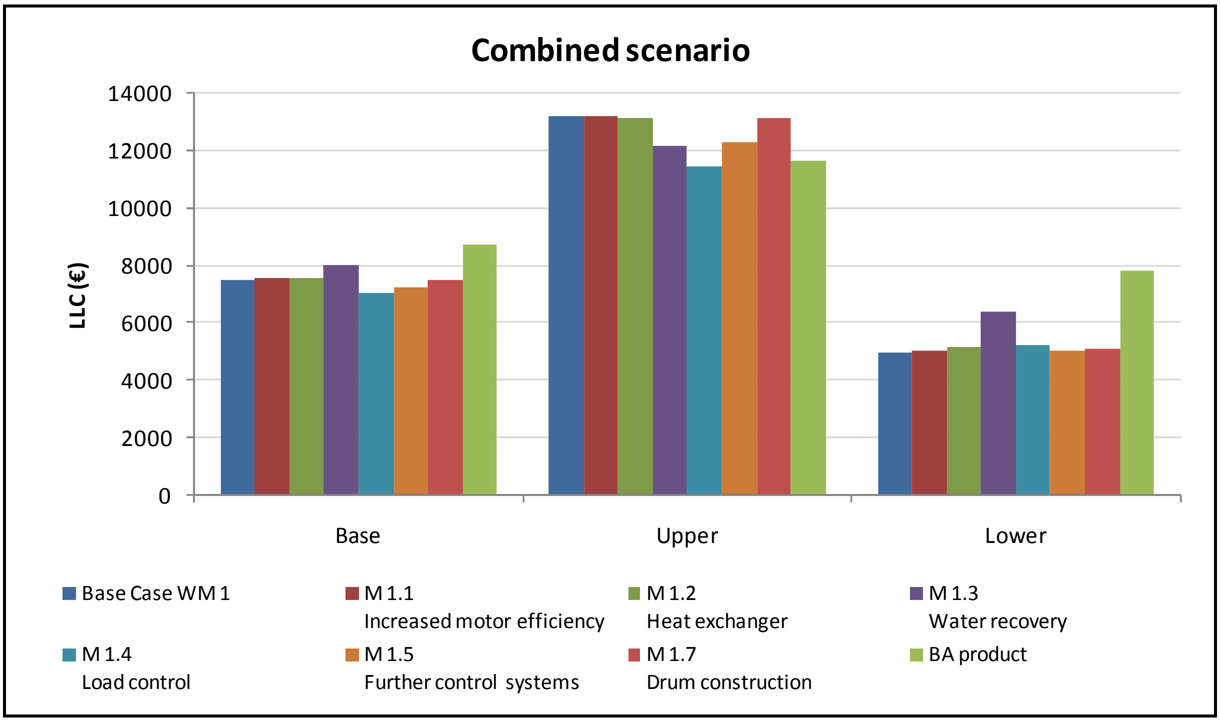

Figure 196 Base case WM 1 and improvement options – impact of combined scenario on LCC by product

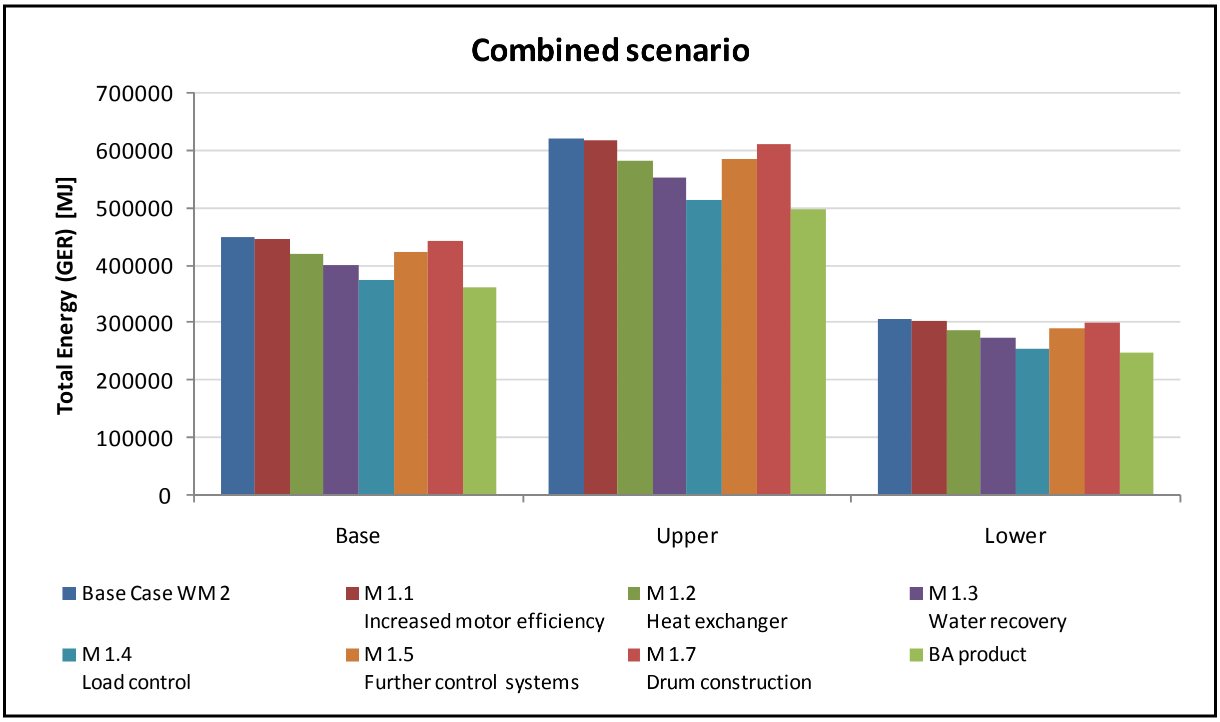

Figure 197 Base case WM 2 and improvement options – impact of combined scenario on total energy over life time by product

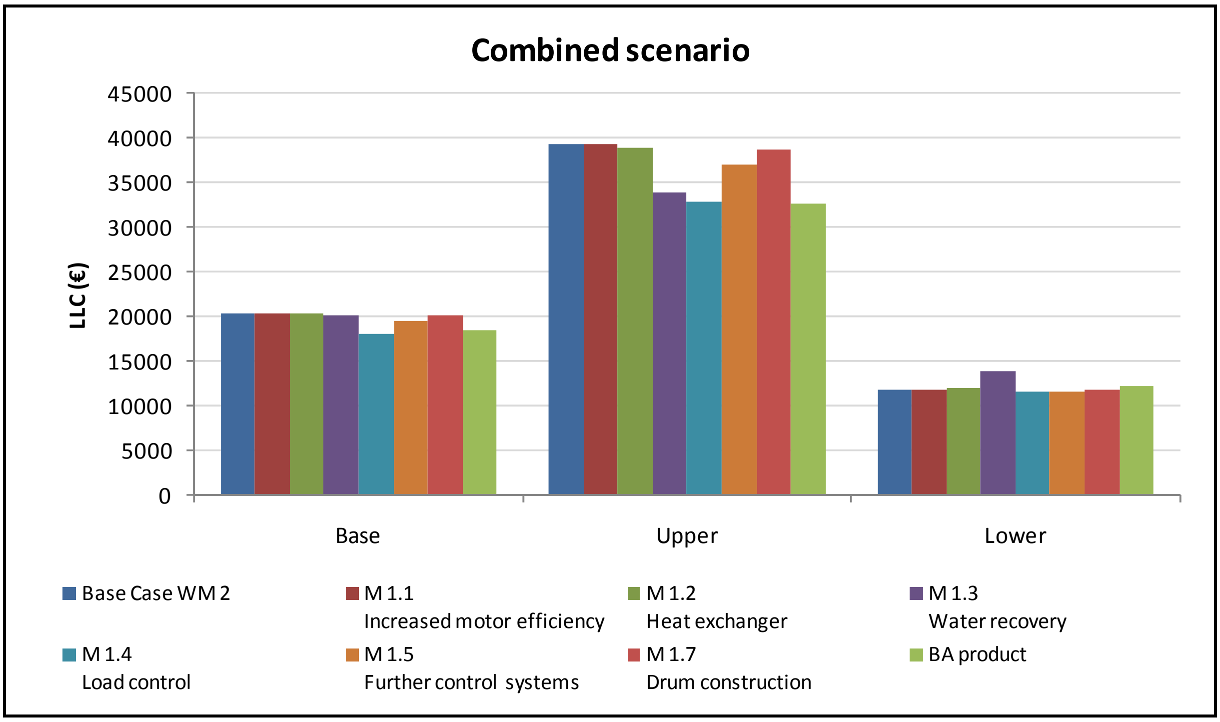

Figure 198 Base case WM 2 and improvement options – impact of combined scenario on LCC by product

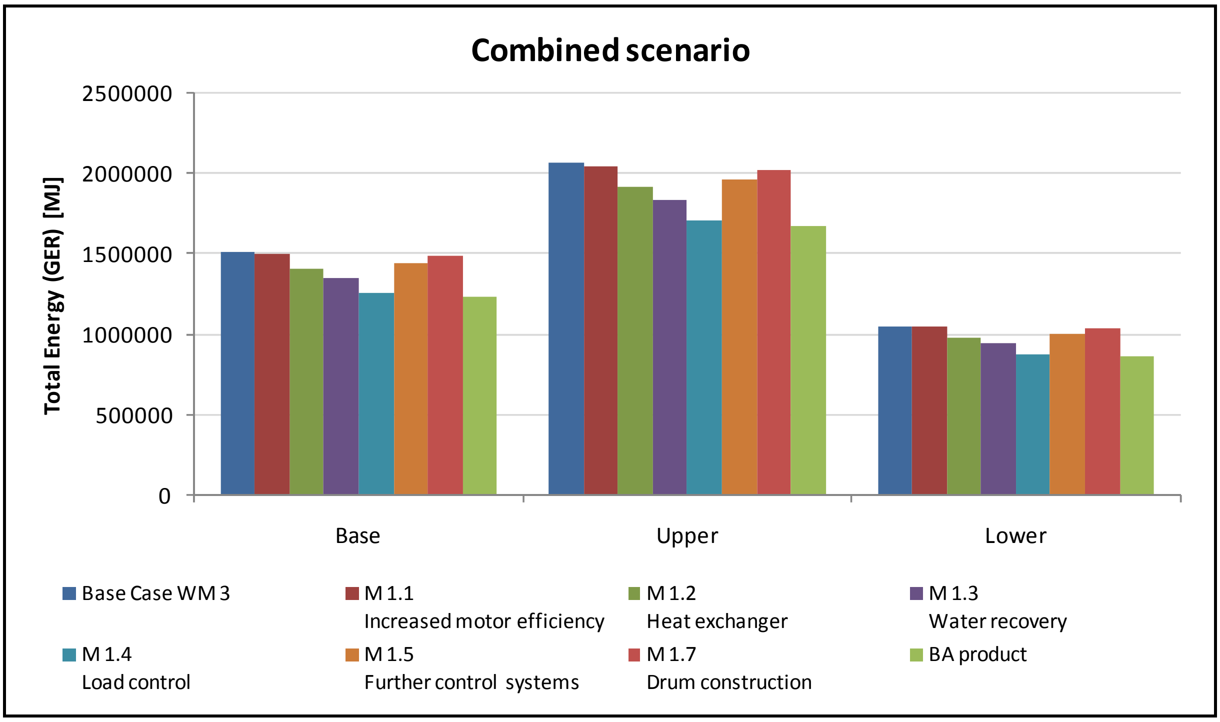

Figure 199 Base case WM 3 and improvement options – impact of combined scenario on total energy over life time by product

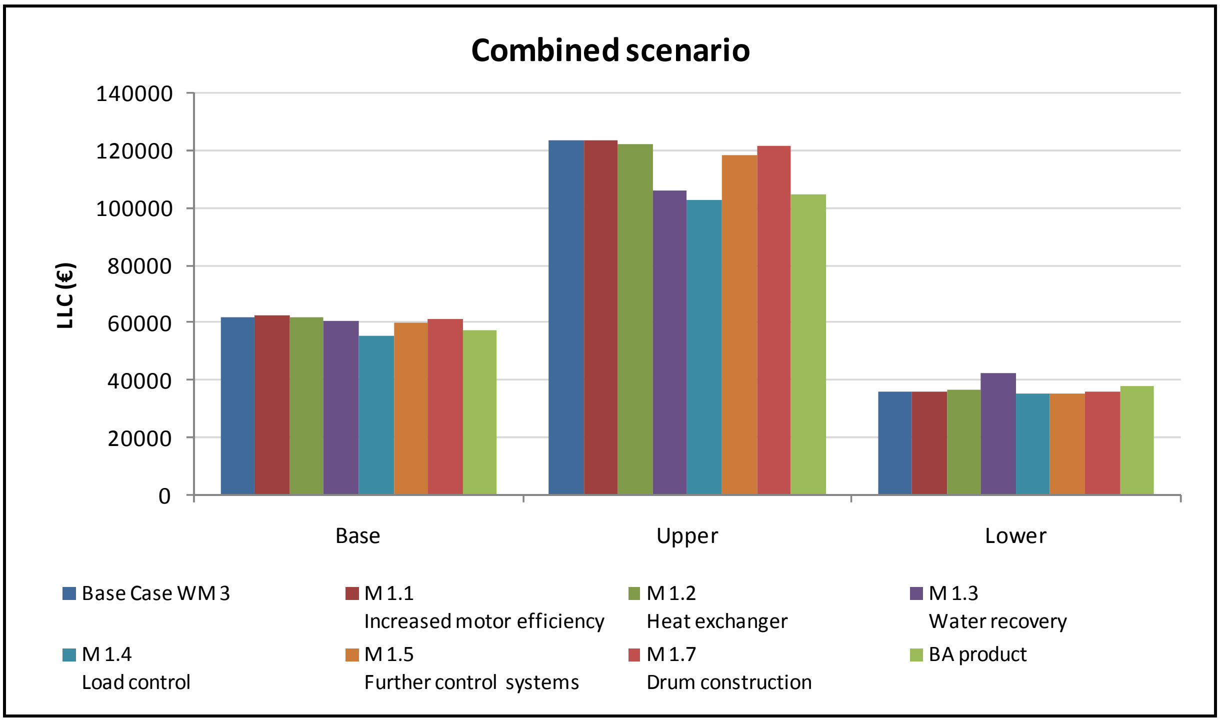

Figure 200 Base case WM 3 and improvement options – impact of combined scenario on LCC by product

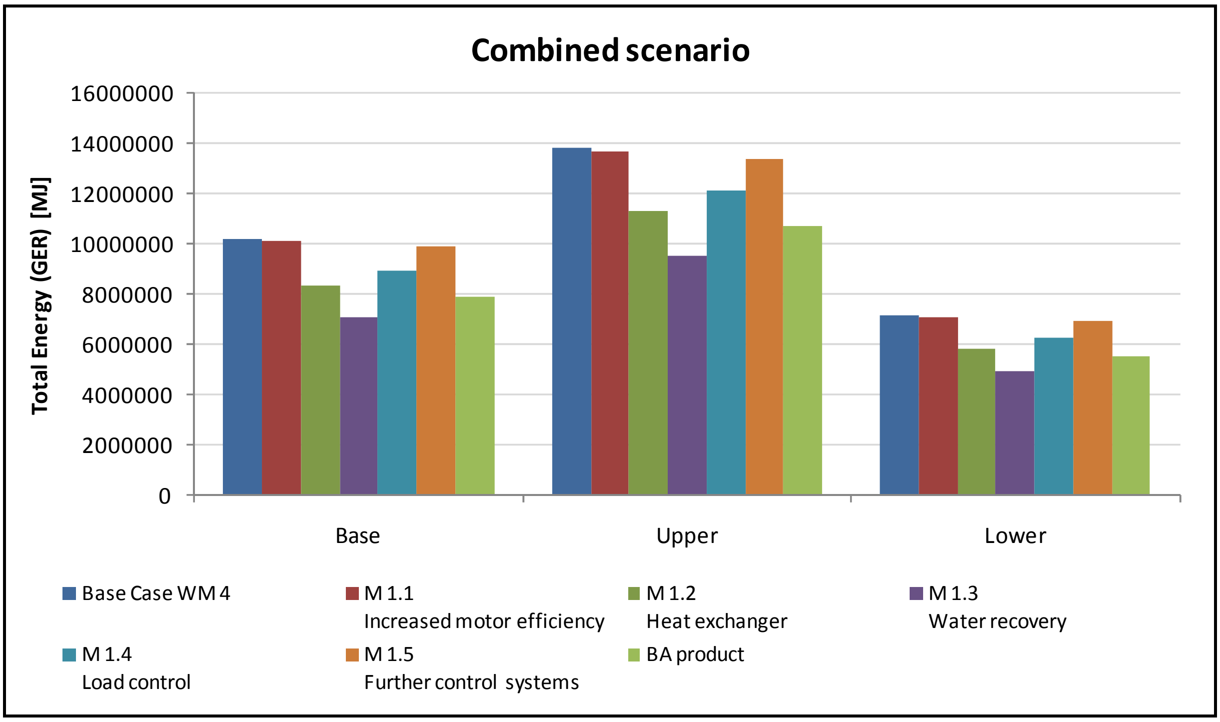

Figure 201 Base case WM 4 and improvement options – impact of combined scenario on total energy over life time by product

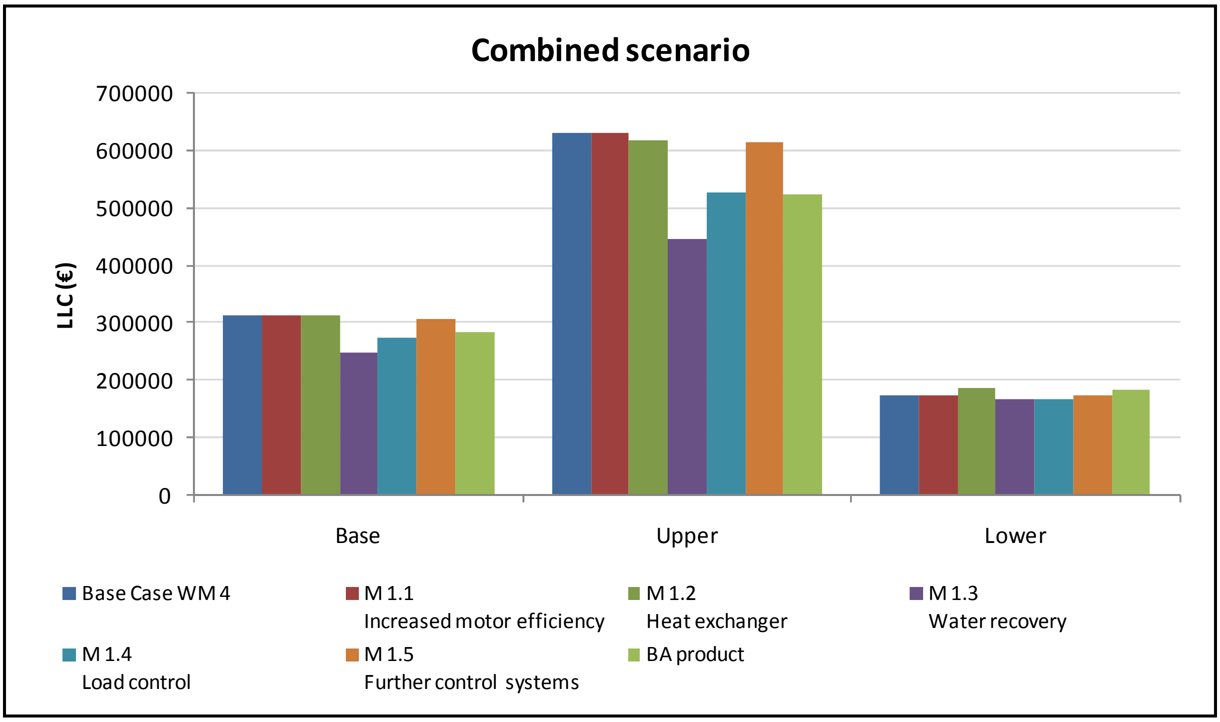

Figure 202 Base case WM 4 and improvement options – impact of combined scenario on LCC by product

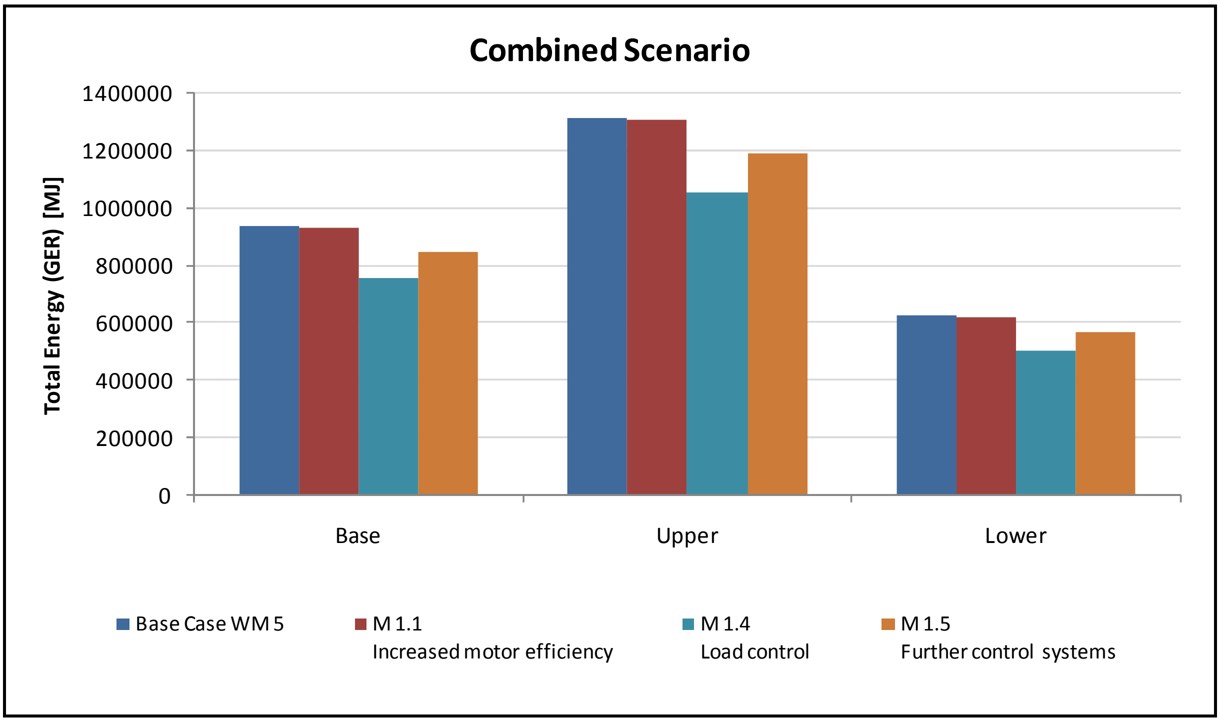

Figure 203 Base case WM 5 and improvement options – impact of combined scenario on total energy over life time by product

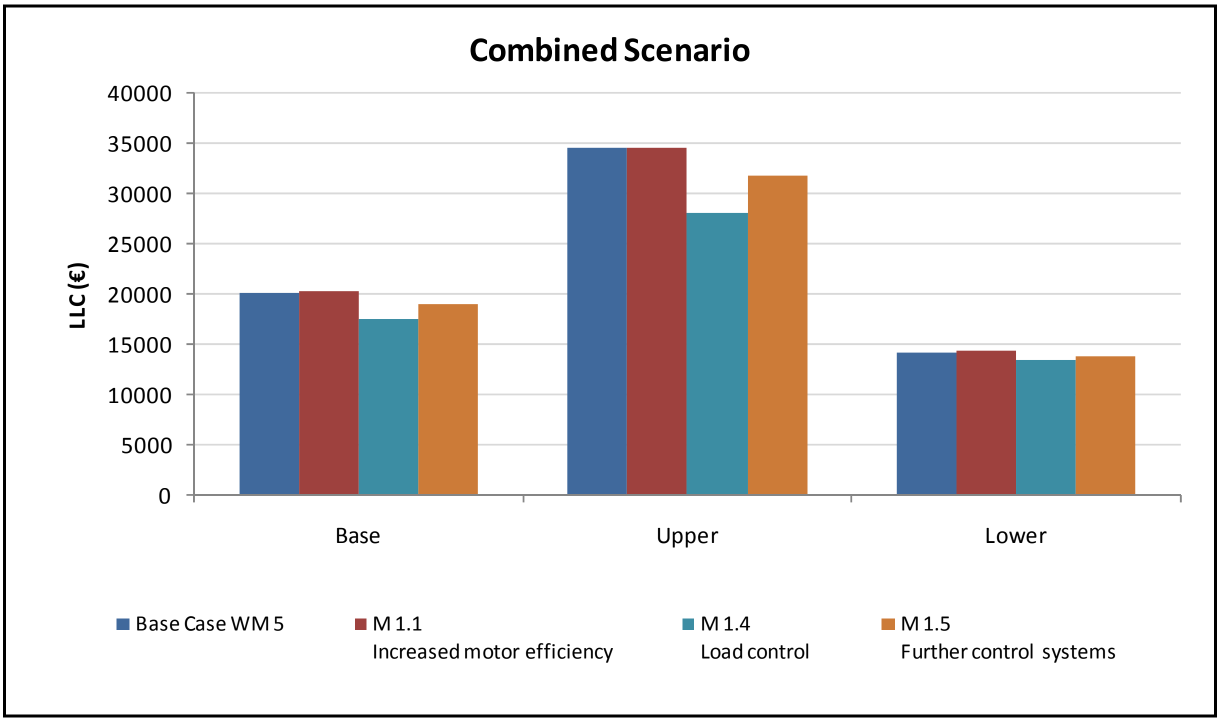

Figure 204 Base case WM 5 and improvement options – impact of combined scenario on LCC by product

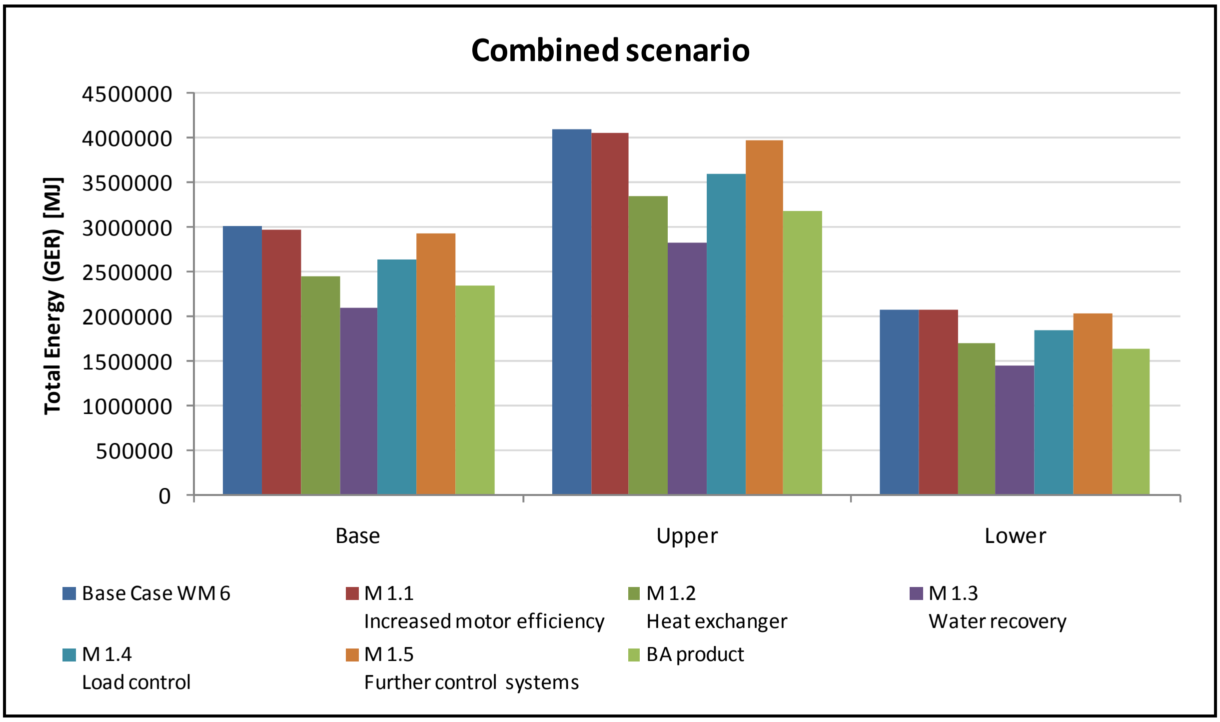

Figure 205 Base case WM 6 and improvement options – impact of combined scenario on total energy over life time by product

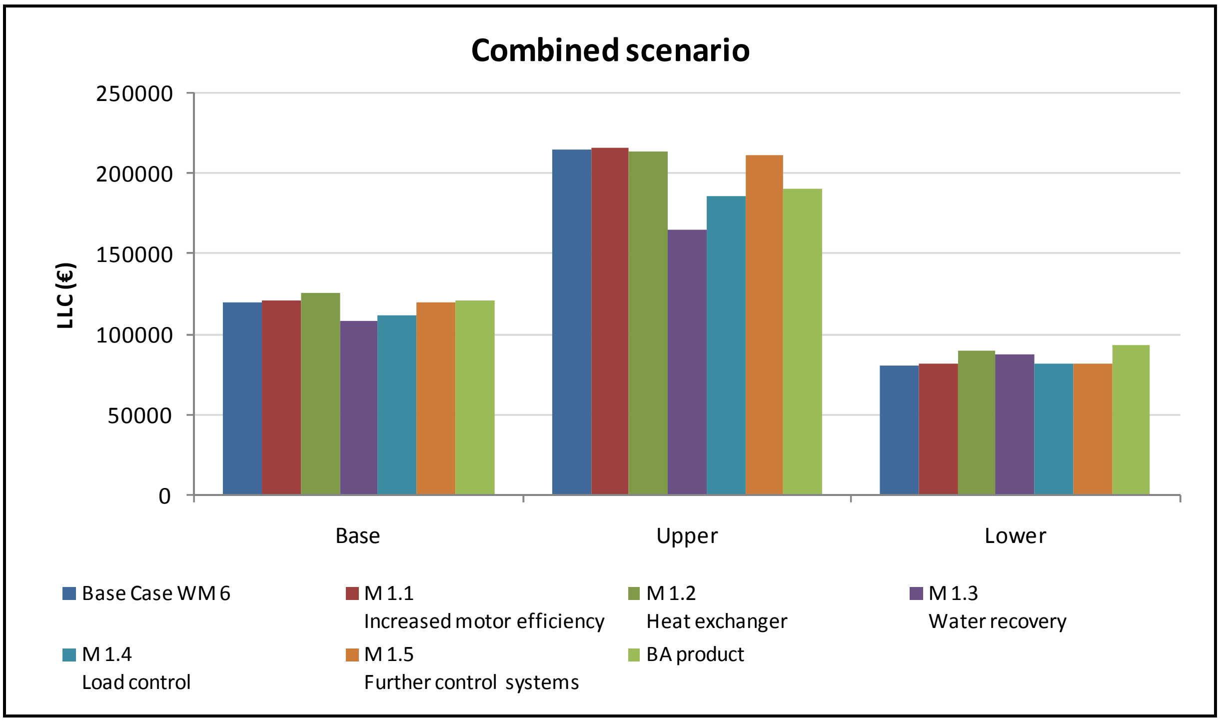

Figure 206 Base case WM 6 and improvement options – impact of combined scenario on LCC by product

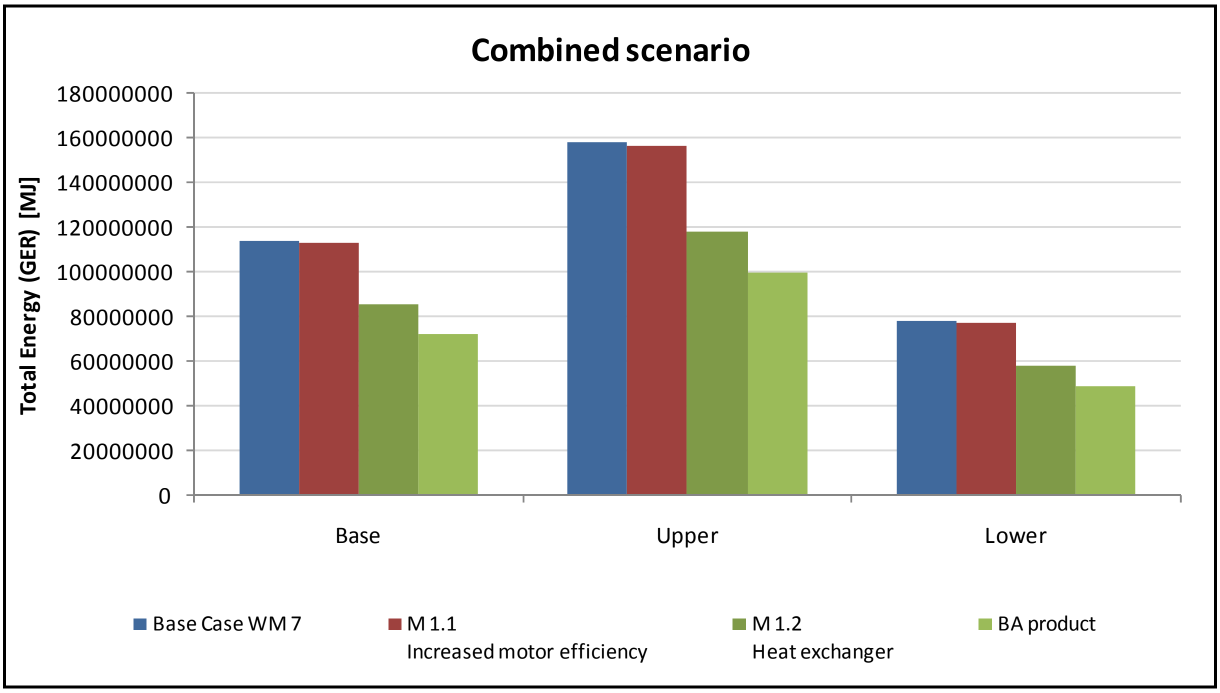

Figure 207 Base case WM 7 and improvement options – impact of combined scenario on total energy over life time by product

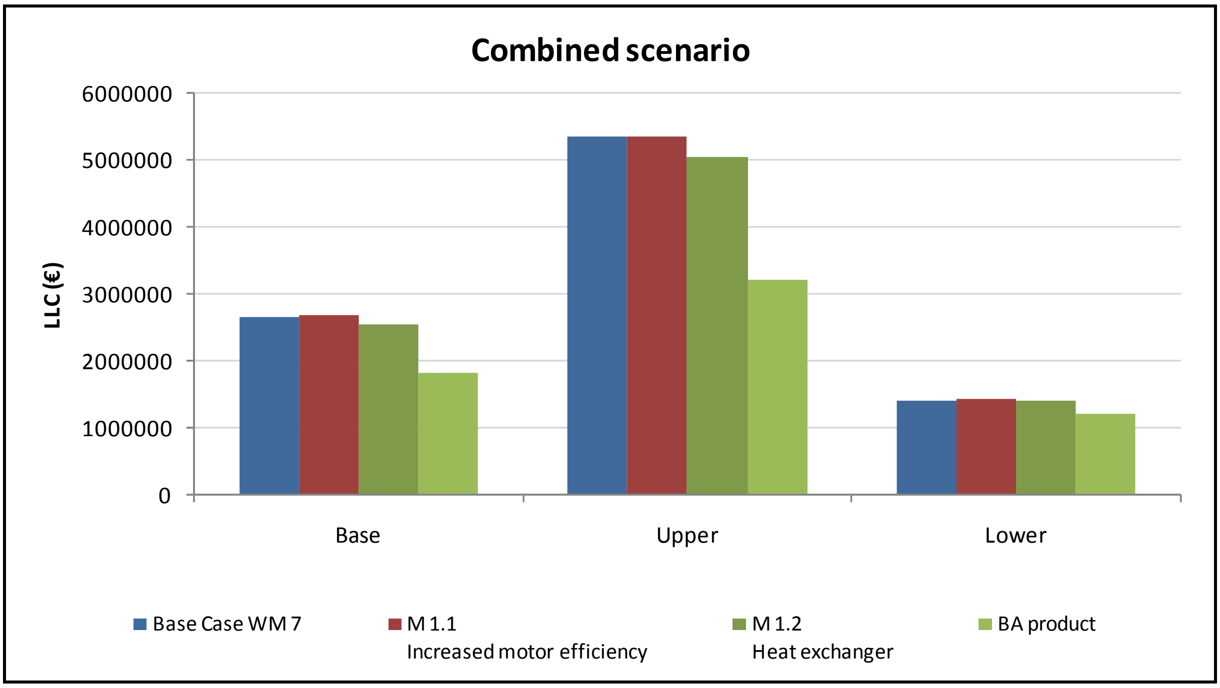

Figure 208 Base case WM 7 and improvement options – impact of combined scenario on LCC by product

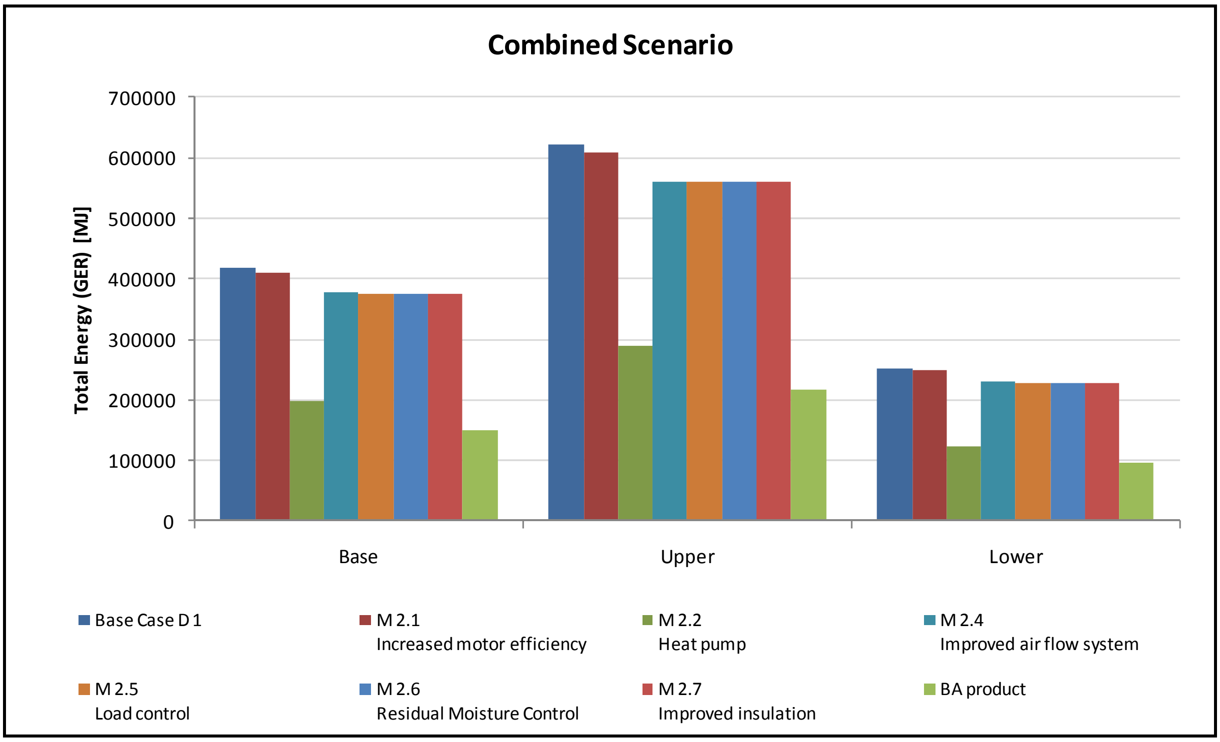

Figure 209 Base case D 1 and improvement options – impact of combined scenario on total energy over life time by product

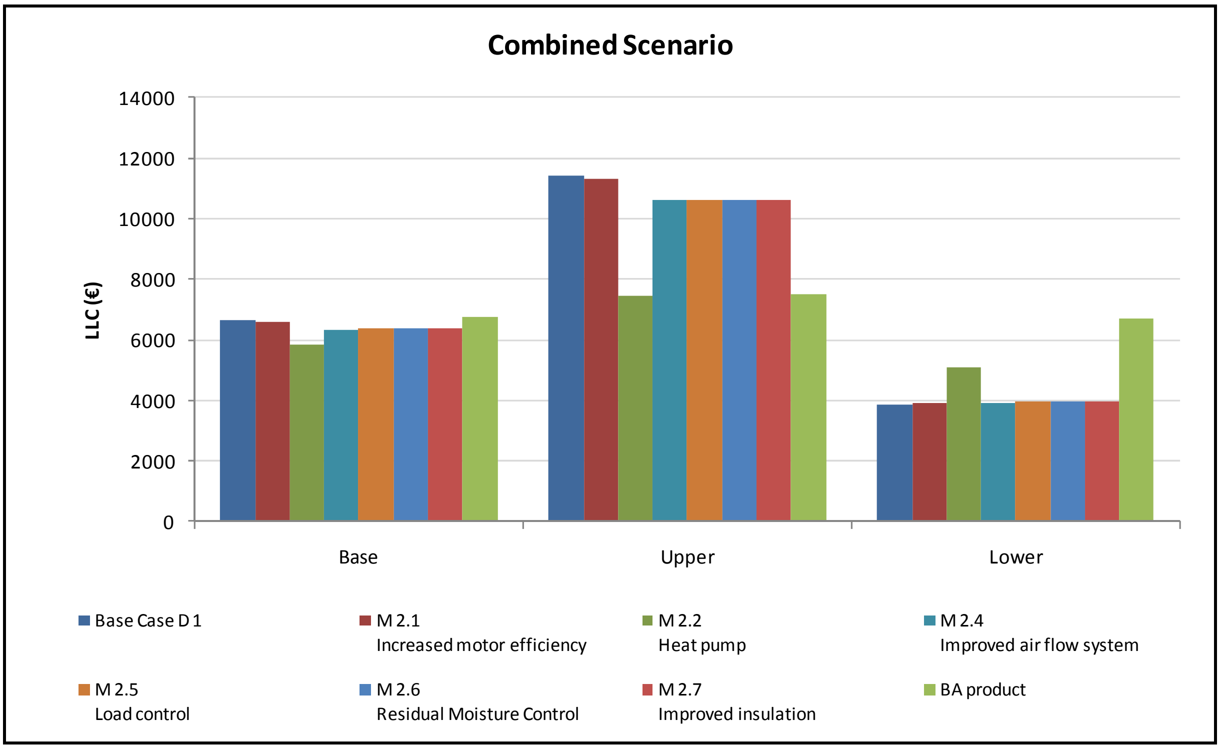

Figure 210 Base case D 1 and improvement options – impact of combined scenario on LCC by product

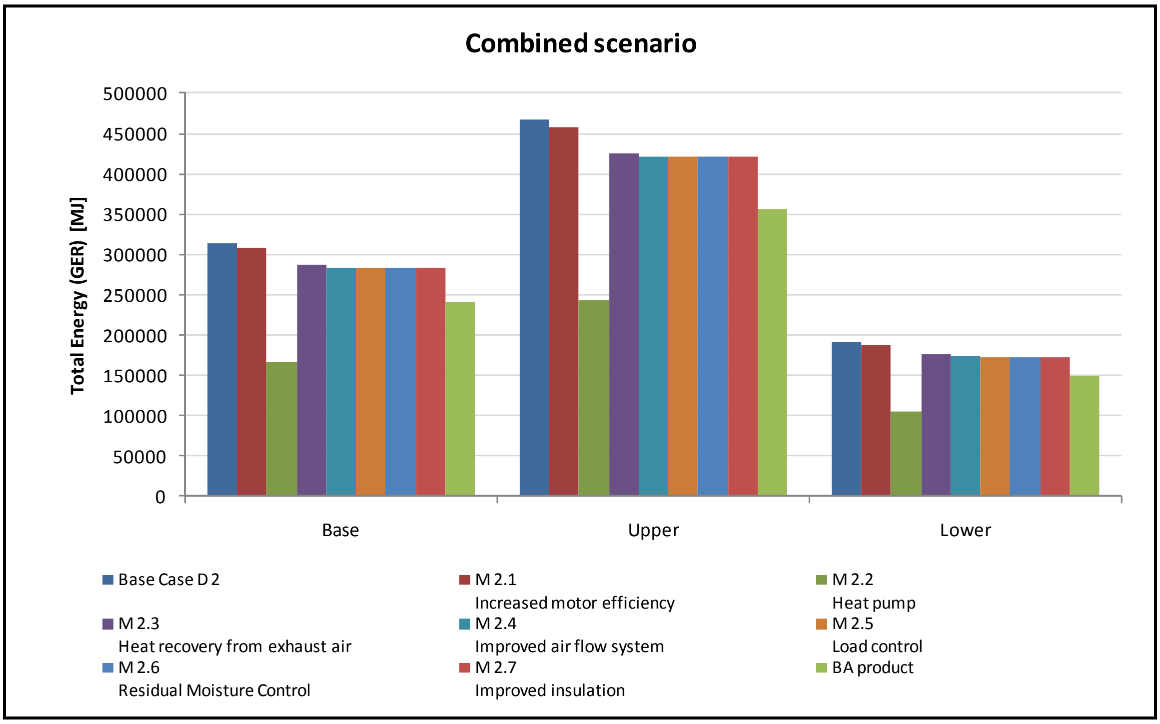

Figure 211 Base case D 2 and improvement options – impact of combined scenario on total energy over life time by product.

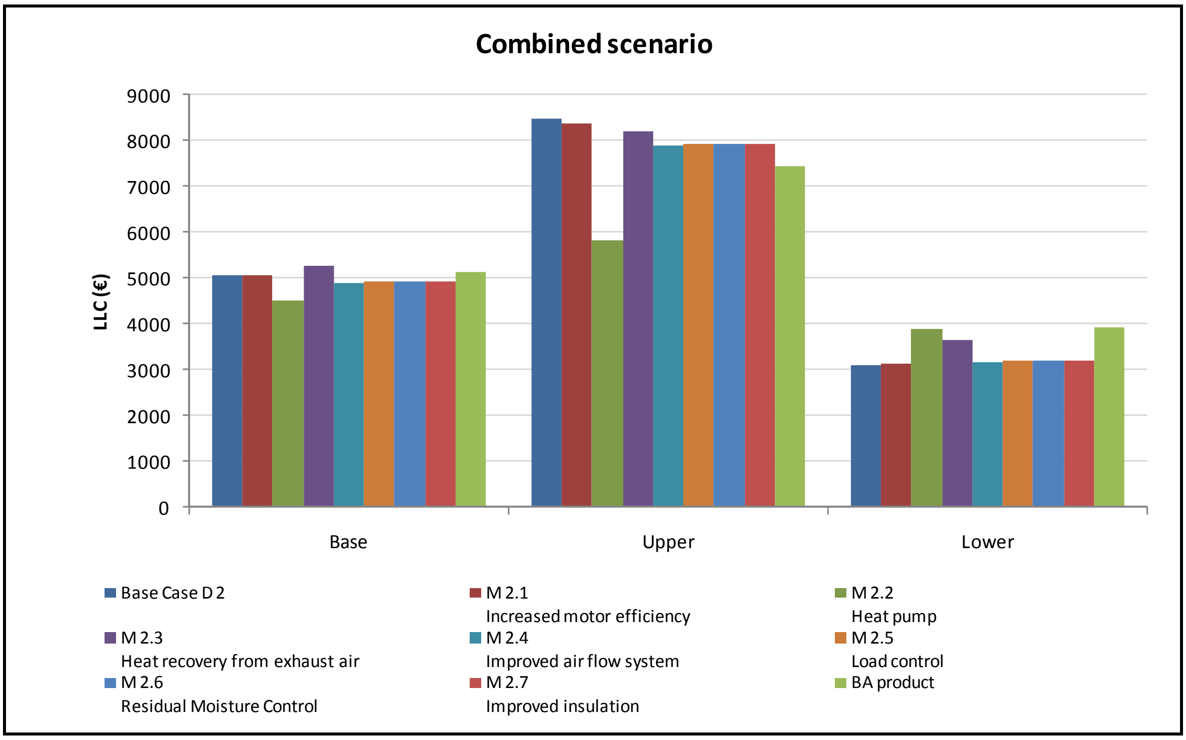

Figure 212 Base case D 2 and improvement options – impact of combined scenario on LCC by product

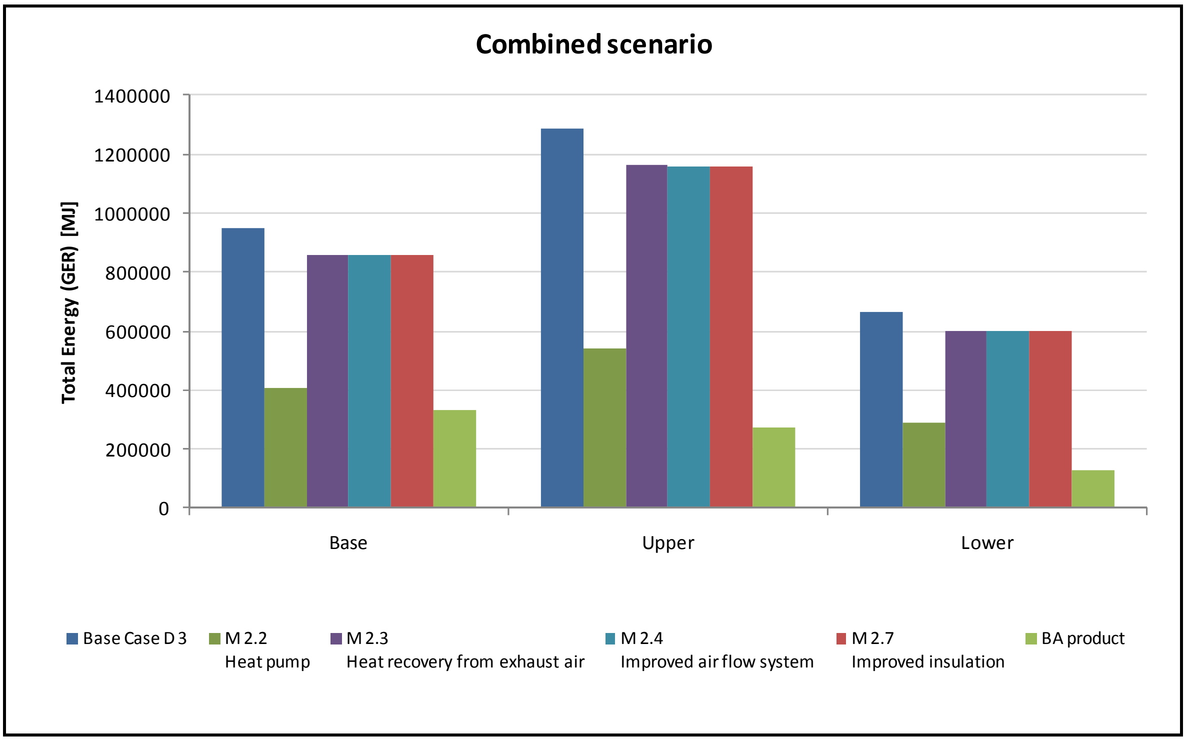

Figure 213 Base case D 3 and improvement options – impact of combined scenario on total energy over life time by product.

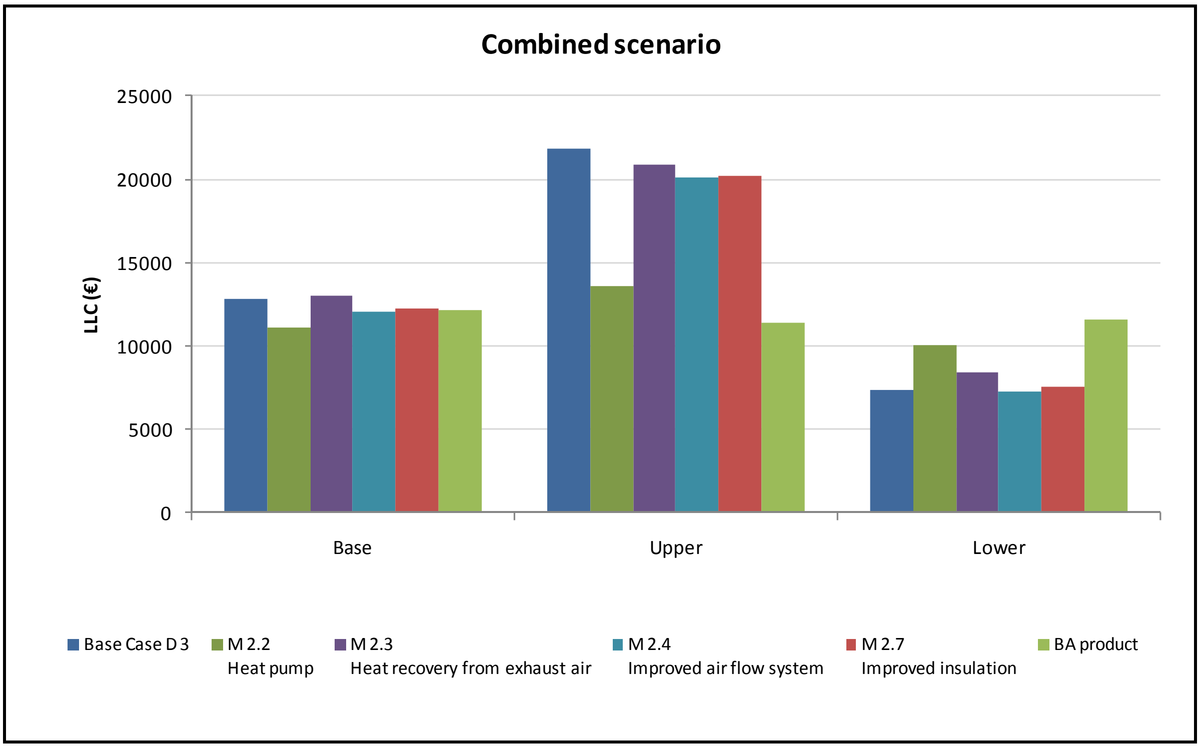

Figure 214 Base case D 3 and improvement options – impact of combined scenario on LCC by product

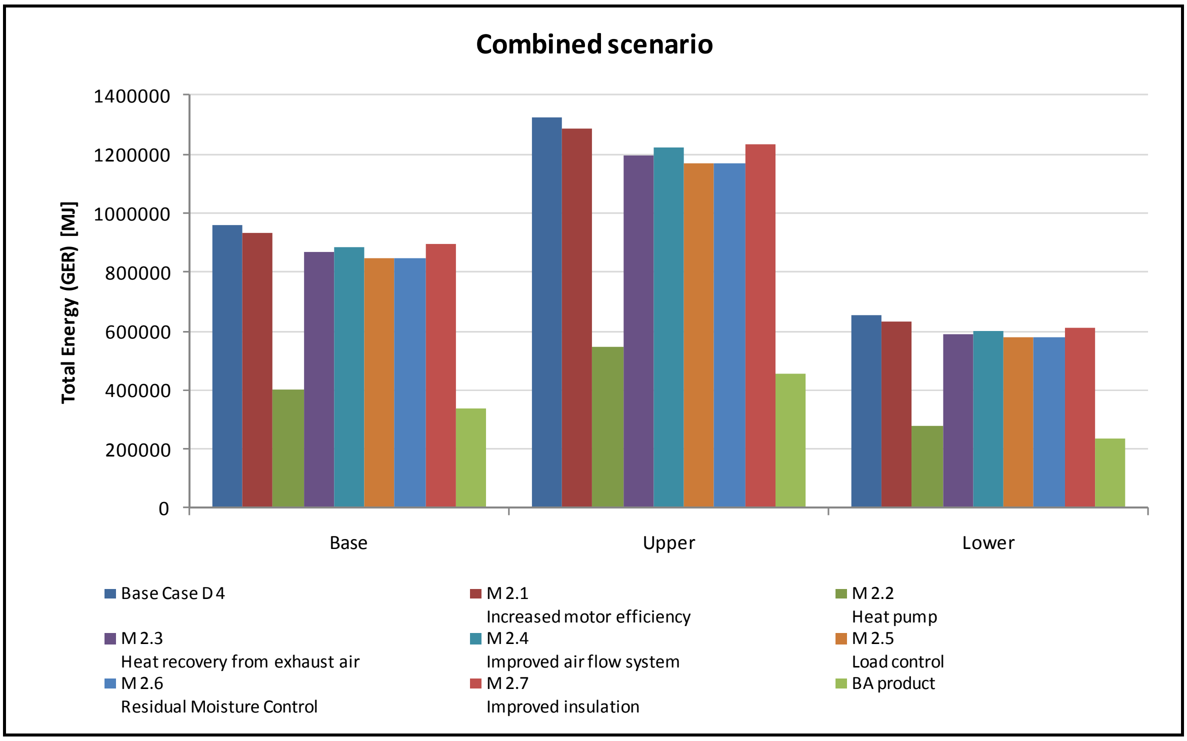

Figure 215 Base case D 4 and improvement options – impact of combined scenario on total energy over life time by product.

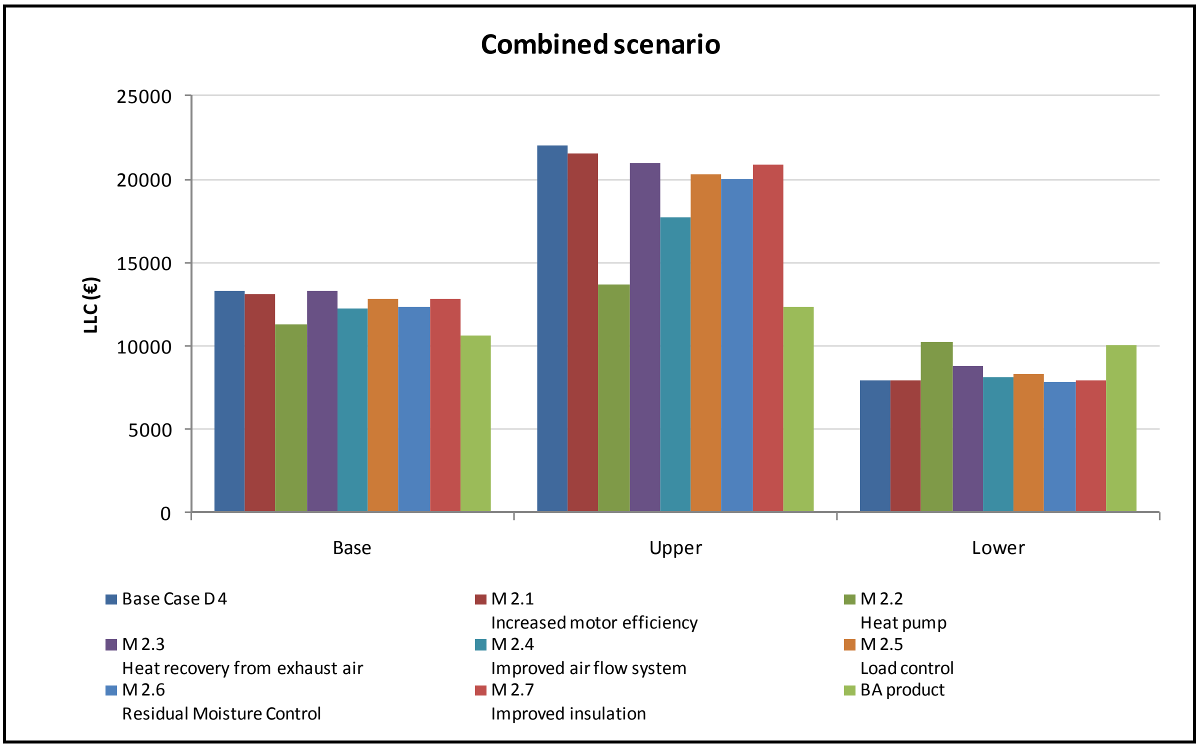

Figure 216 Base case D 4 and improvement options – impact of combined scenario on LCC by product

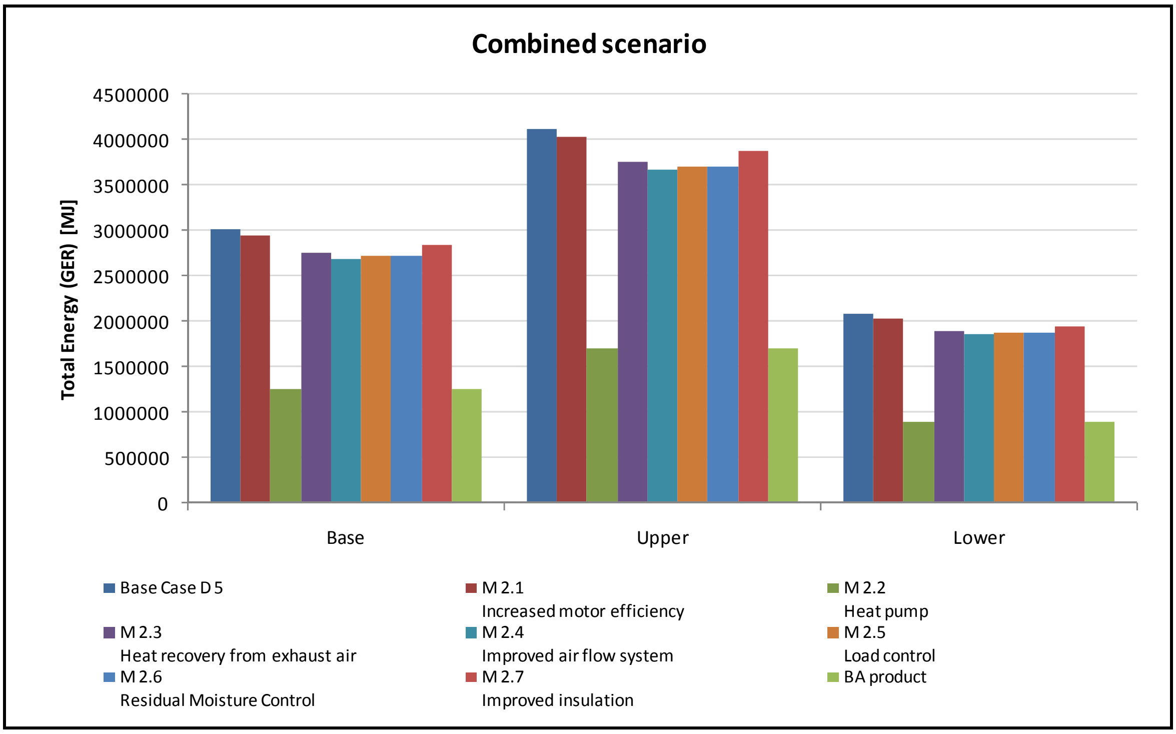

Figure 217 Base case D 5 and improvement options – impact of combined scenario on total energy over life time by product.

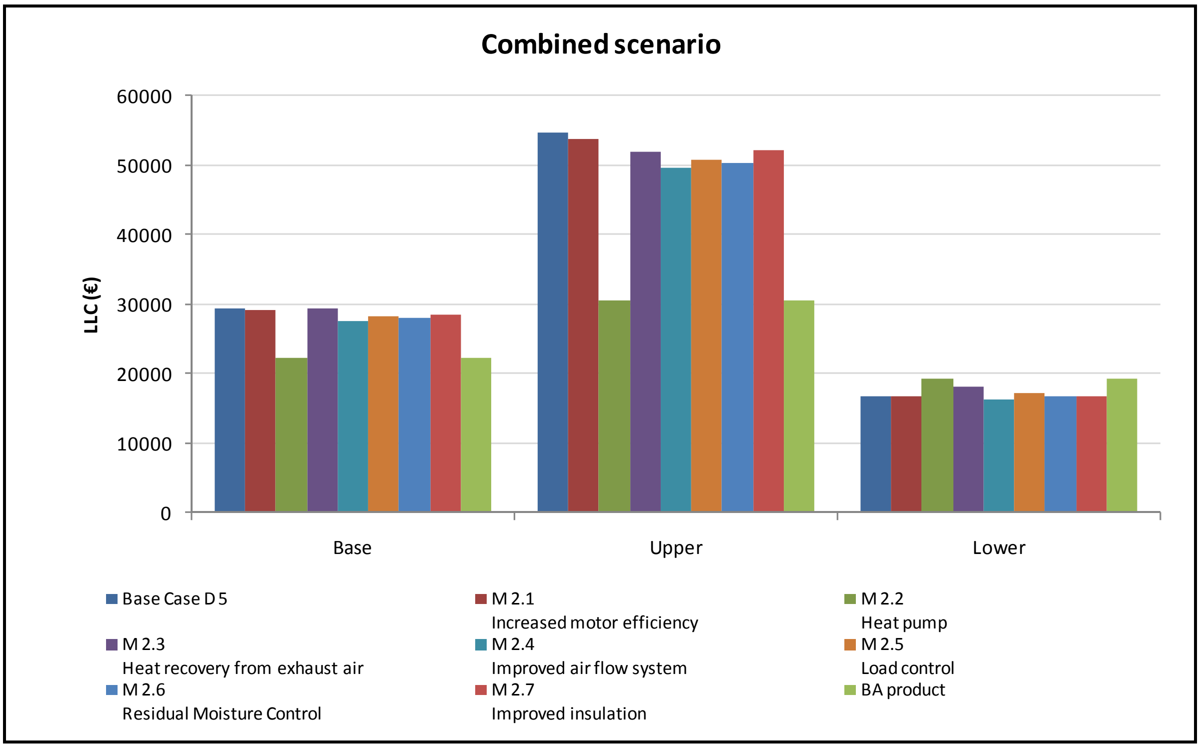

Figure 218 Base case D 5 and improvement options – impact of combined scenario on LCC by product

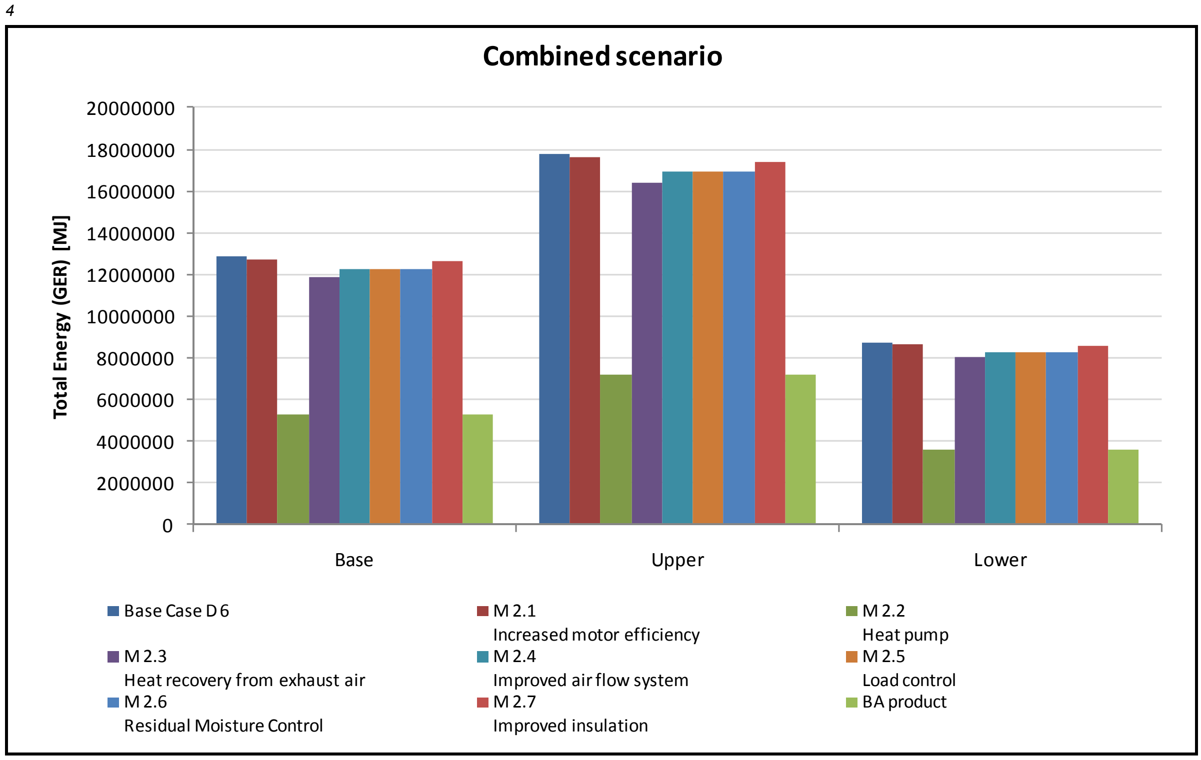

Figure 219 Base case D 6 and improvement options – impact of combined scenario on total energy over life time by product.

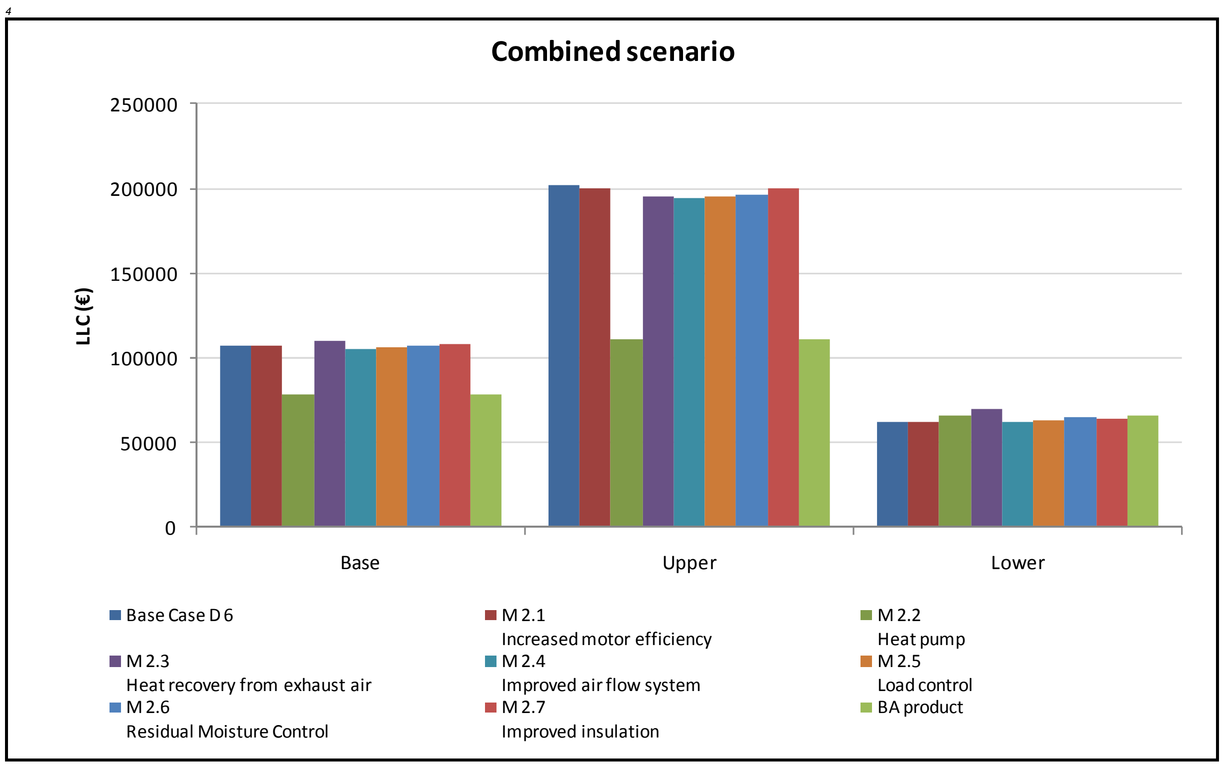

Figure 220 Base case D 6 and improvement options – impact of combined scenario on LCC by product

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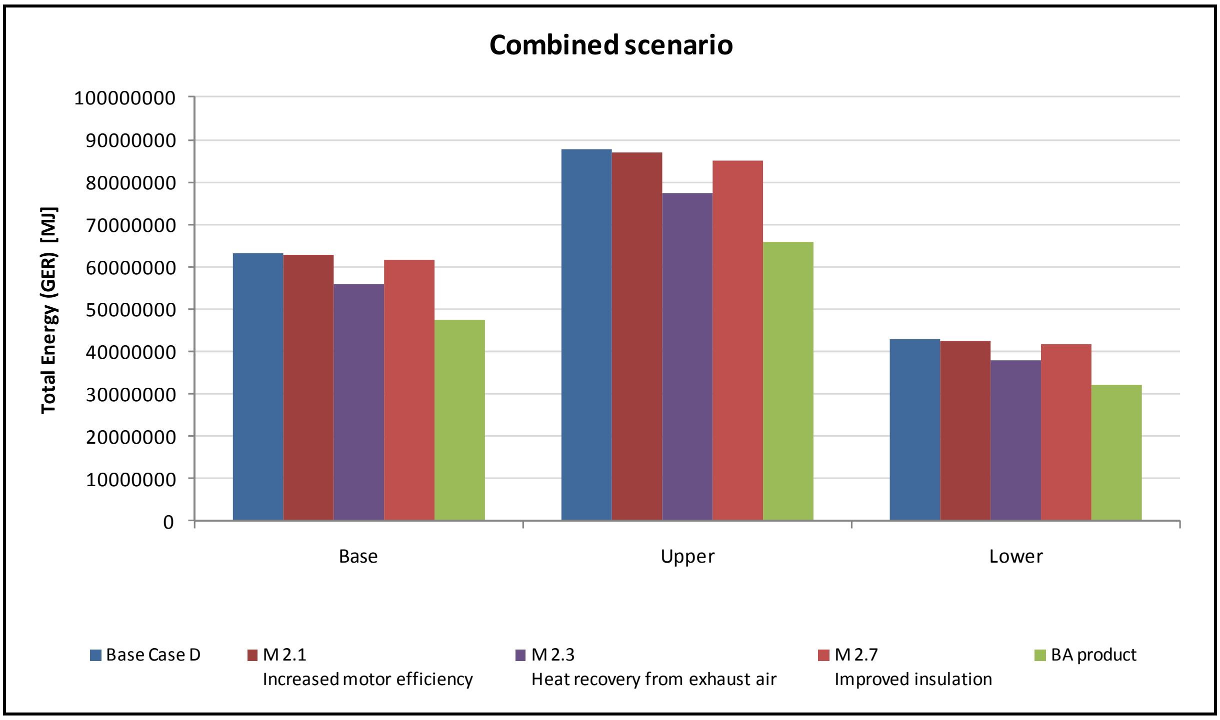

Figure 221 Base case D 7 and improvement options – impact of combined scenario on total energy over life time by product.

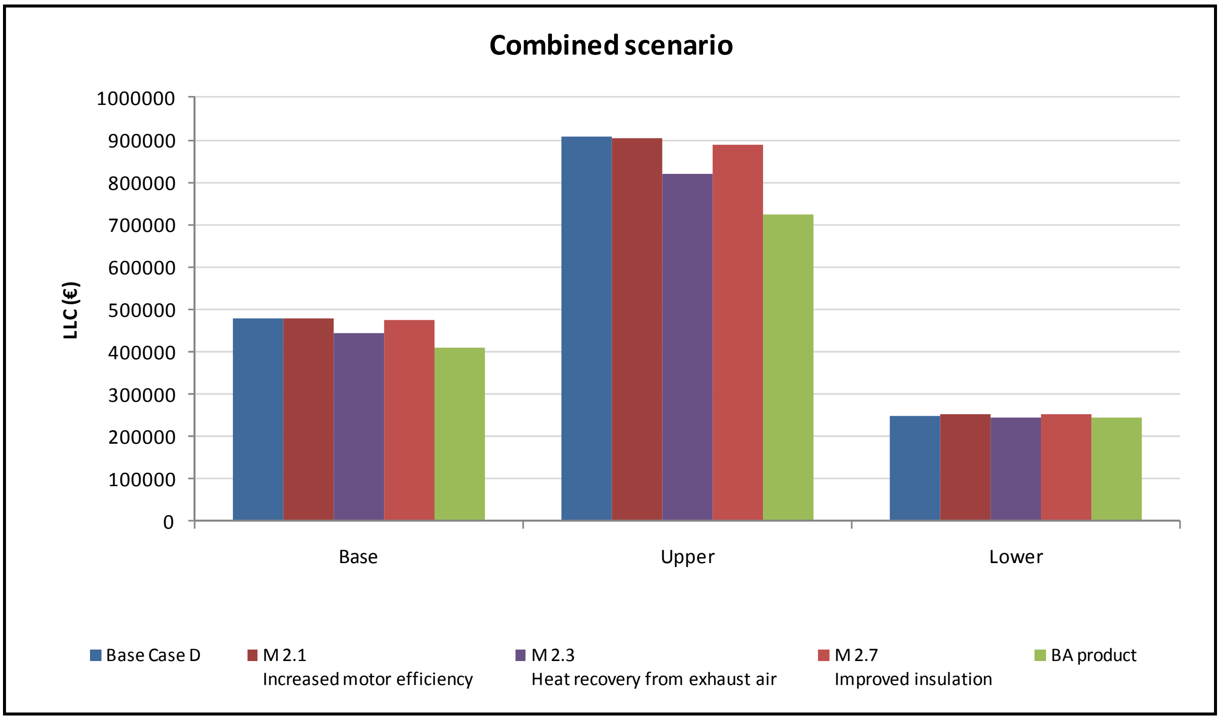

Figure 222 Base case D 7 and improvement options – impact of combined scenario on LCC by product

5 Conclusions

Task 8 summarises the outcomes of the economic and environmental analysis of the study and puts them in the context of policy implementation.

Generic eco-design requirements are proposed, such as the general provision of information related to the performance of different programmes and modes available for a given product. Together with the definition of a 'standard programme' for each laundry appliance category clearly being understandable by the users, the information might help overcoming the additional consumption due to the influence of consumer behaviour. The overall need for harmonised standards for testing and measuring the performance of professional laundry machines and dryers is seen as the most necessary step before implementing any further specific eco-design requirements like a labelling programme, benchmarking values or requirements on energy efficiency in the EU. Based on the combined economic and environmental analysis made in Task 7, specific eco-design requirements on energy and water consumption are suggested, based on the inputs and assumptions considered in the study. Besides, Green Public Procurement could also be used as a tool to drive the market towards the most efficient appliances and GPP eco-design requirements (more ambitious than the specific eco-design requirements on energy and water consumption) are also proposed. Room for improvement in each product category is clearly demonstrated in the study.

In the sensitivity analysis, it is shown that the variation of single or combined parameters can change the ranking of the options in terms of life cycle cost. Thus, for example, an improvement option that is worth implementing in one Member State for a given product and sector might not be a relevant solution in a different situation or location. Task 8 also presents a scenario analysis that compares the environmental and economic outputs of three scenarios: Business-as-Usual (BAU), Least Life cycle Cost (LLCC), and Best Available Technology (BAT). The LLCC scenario would enable to save 23.7% of the primary energy consumption in comparison with the BAU scenario in 2025, i.e. 17.5 PJ. The BAT scenario would enable to save 25.2% of the primary energy consumption compared to the BAU scenario in 2025, i.e. 18.6 PJ.