CECIMO
Self-Regulation Measure for Metalworking Machine Tools

Methodology

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Foreword

Since 2009, machine tools have been part of the European Commission's work programme to enforce the Ecodesign Directive (2009/125/EC). The European machine tool industry sees ecodesign as a strategic issue which affects its long-term sustainability and global competitiveness. Since machine tools are very specific in various aspects and can hardly be compared to other products covered by the Ecodesign Directive, the European machine tool industry, represented by CECIMO, puts forward an initiative to introduce a self-regulating measure (SRM). This SRM provides a tailor-made way for the industry to achieve the objectives of the Directive.

The CECIMO SRM features a framework structure consisting of two pillars: the self-assessment of the machine tool's energy efficiency by the participating signatories, and the data collection, documentation and management by the 'SRM Administration'. The CECIMO SRM is open to all machine tool manufacturers that are producing for the EU-28 market and it covers all types of metalworking machine tools. It provides the signatories with a suitable solution to maintain their competitiveness, it grants entrepreneurial freedom and guarantees compliance with the EU environmental objectives.

The purpose of the present document is to define the elements forming the SRM, show the underlying methodology and provide clear information regarding its compliance with the legislation in place. It also presents information on the level of ambition to increase energy efficiency and the corresponding scheme to reach it.

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Abbreviations

BAU	Business as usual
EE	Energy efficiency
FU	Functional unit
GA	General Assembly
GSRM	Guidelines on the self-regulation measures
HOR	Head of Operations of the SRM Administration
II	Independent inspector
MT	Machine tool
RAUT	Real average use time
RBM	Rule based measure
SC	Steering Committee
SRM	Self-regulation measure

I) Overview of the CECIMO SRM

1 About CECIMO and the machine tool industry

CECIMO is the European Association representing machine tool industries. Founded in 1950, it brings together 15 national associations[1] of machine tool builders, which represent approximately 1500 industrial enterprises in Europe, over 80% of which are SMEs.

CECIMO's mission is to promote and defend the interests of the European machine tool sector to maintain Europe's position as the world leader in technology and innovation. We serve as a platform to identify and promote key strategic initiatives to improve the global competitiveness and leadership of the European machine tool industry. Working with various organisations, we are also contributing to development and promoting the use of standards.

The machine tool sector is a supplier of high technology manufacturing equipment and products to the European and international manufacturing industries, including automotive, aerospace, ship building, power generation, capital goods, medical goods and general engineering. Machine tools are highly customised products, tailored to the customers' needs.

Machine tools are complex systems dedicated for industrial use in manufacturing and assembly plants, and user behaviour plays a major role in their energy consumption. Machine tools produce parts and equipment used in other sectors so, in most cases, their products are not only end products but also key elements in consumer goods. In order to remain competitive, they become more complex and offer more functionalities which increases the number of factors impacting the energy use. The machine tool manufacturers also have to keep up with their customers' productivity, accuracy and reliability requirements and also meet increasing energy efficiency demands.

2 General Approach

The European machine tool industry shows a very heterogeneous structure, featuring a large diversity of companies, product structures, and application scenarios.

There is a political will to establish an ecodesign regulation for machine tools in accord with Directive 125/2009/EC. But, as it has been proven by the preparatory study, the MT sector is not suitable for imposed universal implementing measures[2].

As early as 2009, the European MT industry, represented by CECIMO, has expressed willingness to elaborate and adopt a self-regulating measure. There are various reasons why the MT manufacturers of Europe believe that a SRM is the best alternative to set up ecodesign regulation:

- The sector is very fragmented and the manufacturers are mostly SMEs, for which the organizational effort of regulation has to be kept low.

[1] CECIMO member associations are in Austria (FMMI), Belgium (AGORIA), Czech Republic (SST), Denmark (DAAM), Finland (Federation of Finnish Technology Industries), France (SYMOP), Germany (VDW), Italy (UCIMU), the Netherlands (VIMAG), Portugal (AIMMAP), Spain (AFM), Sweden (MTAS), Switzerland (SWISMEM), Turkey (MIB) the United Kingdom (MTA).

[2] Schischke K. et al.: Energy-Using Product Group Analysis - Lot 5 - Machine tools and related machinery – Final Version, Fraunhofer IZM, August 2012 – Executive Summary

- A one-size-fits-all approach to ecodesign requirements might not be effective enough and in some cases counter-productive.
- The expertise to invent and evaluate measures is only available within those MT companies themselves.
- MTs are capital-intensive investment goods. All new product features need to withstand market forces that are a balanced equilibrium between specialized manufacturers and no-less-specialized end-users.
- MT are sold on a B2B basis, there cannot be a comparison with consumer goods.

So, to ensure that the machine tool industry reaps the benefits of the Ecodesign legislation, CECIMO is of the opinion that the best approach could be manufacturer self-declaration based on a scheme of acknowledged base cases, identified and certified through a central SRM Administration.

3 The CECIMO SRM framework

The CECIMO SRM framework consists of two pillars “Self-assessment” by participating signatories and “Management” by an umbrella institution, called “SRM Administration”. These two pillars guarantee that objectives will be achieved, documented and independently monitored.

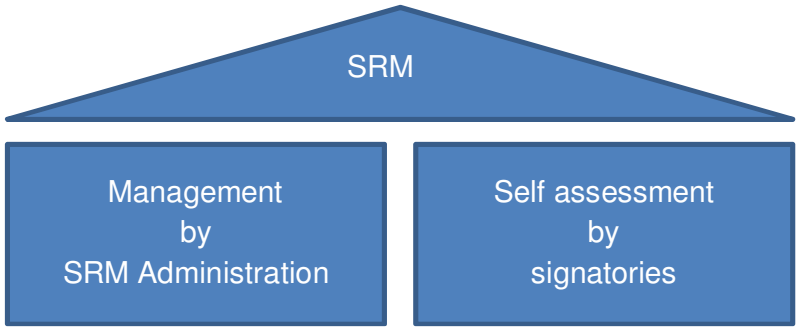

Figure 1. Pillars of CECIMO SRM

3.1 SRM Administration

The SRM Administration ensures operation of the CECIMO SRM and is in charge of all administrational affairs. It is assembled and represented equally by the EC/stakeholder and signatories.

It provides the guidelines “How to assess a machine tool with respect to energy efficiency” and “How to document the energy efficiency assessment”.

The SRM Administration is the central collecting point of all product and company data necessary to:

- Verify the compliance of a machine tool (product) with the energy-efficiency requirements;
- Verify the compliance of signatories with the SRM guidelines;
- Prove the energy efficiency effectiveness of the MT sector;
- Establish a data base for energy efficiency measures;
- Evaluate the effectiveness of single energy efficiency measures and find average means;
- Transfer the assessment of energy efficient measures from individual evaluation to a rule based system by publishing RBMs.

Duties of the SRM Administration are described in detail in Section 10.

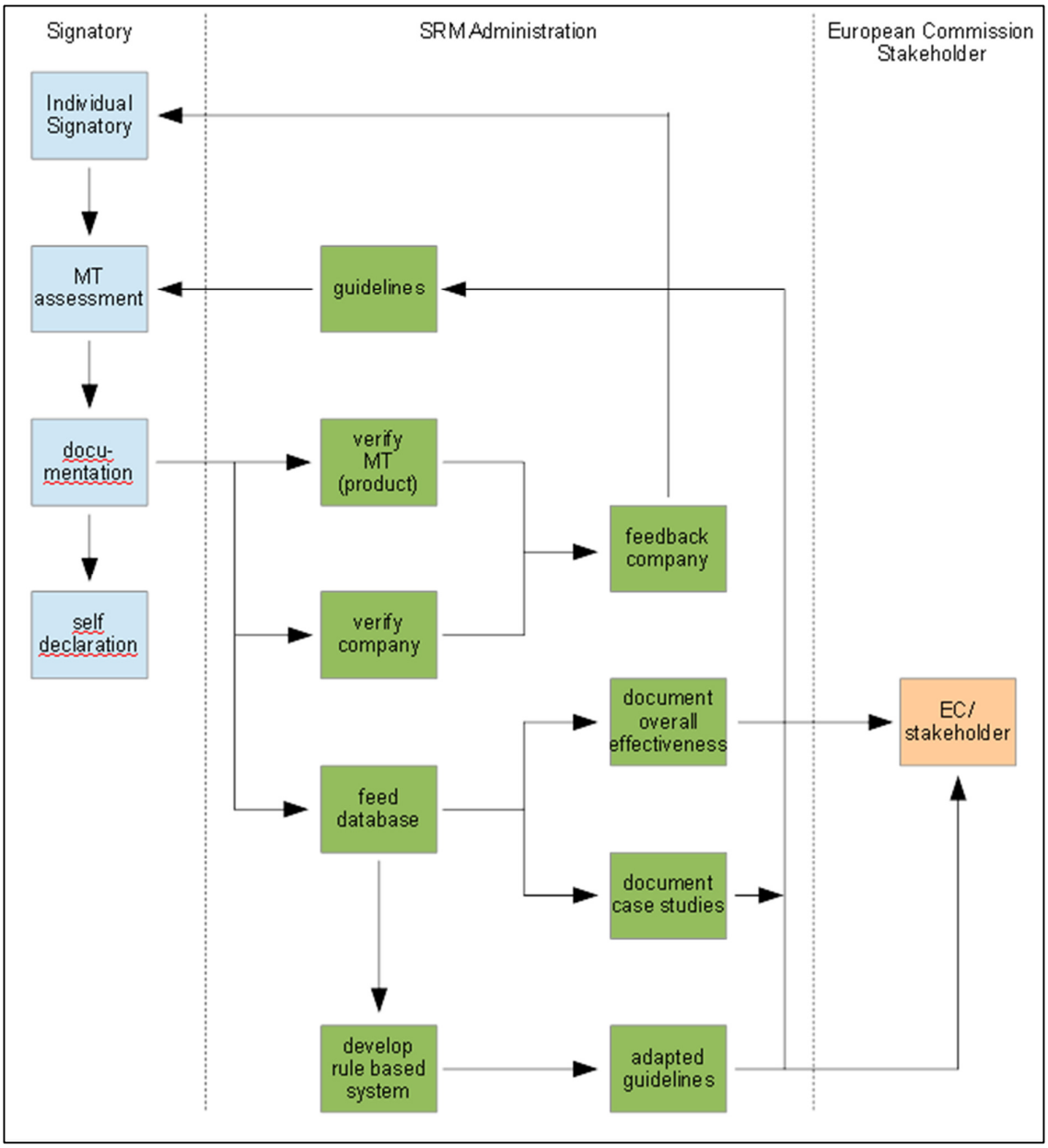

Figure 2: Overview of CECIMO SRM

3.2 Self-assessment by signatories

All signatories are obliged to assess the environmental performance of their machine tools.

For machine tool manufacturers, immediate influence over the energy efficiency of a machine tool is given during the design phase of the MT. The development of a machine tool itself is always under direct control of the manufacturer.

Process and environment of the MT in use is not necessarily known, but could affect the energy-efficient design of a machine tool.

During the use phase, machine tool user can save energy by operating the machine tool in an efficient way and by not wasting energy and resources.

Therefore the assessment consists of three parts:

1. Analysis of EE of the machine tool itself during the development/design phase (mandatory).
2. Reflection about the process and environment of machine tool during the development/design phase (if applicable).
3. Support of machine tool user/continuous improvement during the use phase (additional).

Detailed information about how those requirements are fulfilled is given in Section 8.1.

3.3 Development over time

Over time, the established data base will contain enough reliable data to come to testimonial statements that could lead to a rule based system, i.e. RBMs. Together with standards being developed on basis of the found testimonial statements, this will lead from individual quantification to a system based on rules and reference values. The guidelines will be adapted accordingly and continuously.

A timeline and the development of energy savings of the CECIMO SRM is provided in Figure 3. Additionally, the figure illustrates the expected increase in energy efficiency in accord with Section 8.2. The business as usual (BAU) scenario is normed to be 100% for every year, not readjusting to the slight growth scenario introduced in the preparatory study[3]. The total energy consumption of metalworking machine tools is estimated to be from 75 to 110 TWh/year (base year 2007)[4]. The CECIMO SRM aims at improving the EE by 12% for the first ten years. Therefore, the energy savings due to the increased EE driven by the CECIMO SRM can be calculated to be from 9 to 13,2 TWh after ten years[5].

[3] Schischke K. et al.: Energy-Using Product Group Analysis - Lot 5 - Machine tools and related machinery – Final Version, Fraunhofer IZM, August 2012 – Task 1, pp. 56, Task7, Fig. 7-2 and following

[4] Schischke K. et al.: Energy-Using Product Group Analysis - Lot 5 - Machine tools and related machinery – Final Version, Fraunhofer IZM, August 2012 –Task 1, pp. 56, Task7, Fig. 7-2 and following

[5] The Preparatory Study does not assume any increase in EE for BAU

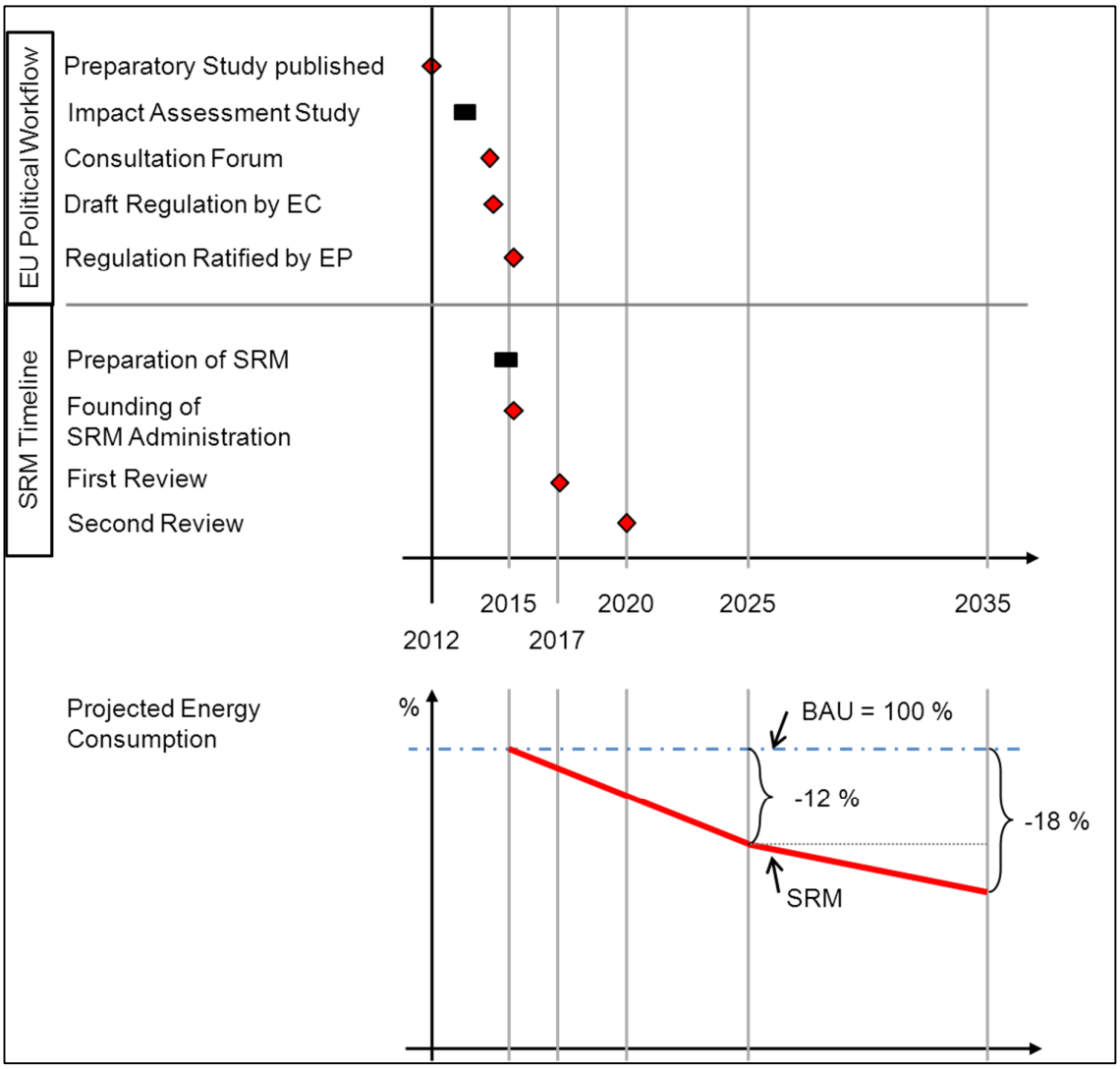

Figure 3: Timeline and development of energy savings of the CECIMO SRM

4 Challenges

Setting up a SRM for the machine tool sector presents challenges due to its peculiarities but offers some possibilities too.

The machine tool sector differs from other sectors considered by the ErP Directive with respect to a number of peculiarities, such as:

- Heterogeneity of the sector
- Requirements of a B2B business
- Compatibility of energy savings and energy efficiency increase
- Availability of statistical data with regard to EE
- Limitations due to international business
- Marketing aspects

The following section aims at illustrating those particularities, indicating the related possibilities and explaining their consequences for the CECIMO SRM.

4.1 Heterogeneity of the sector

The machine tool sector is extremely heterogeneous in terms of company structure and use of machine tool products.

The companies' size varies from small to large. Therefore their management and business capabilities also differ greatly. Machine tools may be distinguished by their use, taking into account the batch size and complexity of production.

This heterogeneity has to be taken as a fact[6]. It exacerbates the definition of measures valid for all MT types. This conclusion is in accordance with the preparatory study: *"In general, there is no single option with a large environmental improvement potential…"*[7]

Therefore, the CECIMO SRM allows a variety of measures to reach the objective of maximum energy efficiency, what is also stated in the preparatory study: *"A Voluntary Agreement [yields a total saving of] 9% compared to BAU."*[8]

Hence, the CECIMO SRM implements the necessary mechanism to save the full potential by giving the real experts – each individual machine tool builder – broad possibilities and a whole catalogue of measures to design energy efficient machine tools for the specific needs of his customers and use.

4.2 Requirements of a B2B business

The machine tool sector is an exclusive B2B business.

It is almost impossible to run machine tools outside industrial environments, because a machine tool produces other products or parts used in other sectors. Other indicators for this exclusive B2B Business are the geometrical size of MT's, their weight (typically several tons), and the complex infrastructural requirements (three-phase current, compressed air, etc.), and last but not least, the highly skilled operators required to make the machines work.

The user of a machine tool can be considered as an expert, making his decision for a machine tool subject to qualified and objective criteria. As customer requirements are very different from application to application quite a variety of design variations exists. Therefore, a lot of design know-how is concealed in the machine tools and manufacturers want to keep it confidential.

To consider the peculiarity of a B2B business, a SRM requires a specific structure. Furthermore, the CECIMO SRM respects the confidentiality requirements for individual solutions.

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[6] Annacondia E., Reines, R.: Essay on peculiarities of an extremely complex industrial sector, CECIMO, Brussels 2014

[7] Schischke K. et al.: Energy-Using Product Group Analysis – Lot 5 – Machine tools and related machinery – Final Version, Fraunhofer IZM, August 2012 – Executive Summary

[8] Schischke K. et al.: Energy-Using Product Group Analysis – Lot 5 – Machine tools and related machinery – Final Version, Fraunhofer IZM, August 2012 – Executive Summary

4.3 Compatibility of energy savings and energy efficiency increase

The aim to prove the effectiveness of energy saving measures is easy to fulfil when the market is saturated and the product features a stationary point of operation (e.g. television sets).

A saturated market implies that the number of products remains constant and, in consequence, an energy savings measure leads to less energy used. A stationary point of operation ensures that an energy saving measure always leads to less energy used, as the result achieved with this product is always the same.

For the above case, it is sufficient to calculate the energy savings by summing up the individual savings multiplied with the number of sold products.

Machine tools, on the other hand, have always provided the customers with solutions to increase efficiency and reduce waste in a great variety of applications. This means machine tools cannot be considered to have a stationary point of operation. Additionally, considering the necessity of continuous growth in today's economic structure, to keep jobs in manufacturing within Europe implies the necessity of a growing market.

Hence, to introduce a method of calculation of energy savings to show the effectiveness of the CECIMO SRM would distort the result.

A machine tool producing higher output with the same amount of resources must be considered as more energy efficient, even if this is not shown in summing up just the amount of energy needed.

If a market is growing faster than the realized energy savings, the total amount of energy used will increase despite the fact that each unit got more energy efficient.

This is why the CECIMO SRM focuses on an energy efficiency increase, measuring energy savings per machined part.

Another, even more complex, aspect is a reduced use of primary resources due to a more energy consuming production. For example, a higher level of finishing of combustion engine crankcases can lead to a significant reduction of fuel consumption of every engine machine, which far exceeds the additional amount of energy required in the machining process.

4.4 Availability of statistical data with regard to EE

CECIMO traditionally provides extensive statistics with regard to the worldwide market data of MTs and their core customer industries.
However, there is a fundamental lack of data on the EE aspect:

- Figures on the installed machine population within EU-28 are not available[9].
- Comprehensive insight into potential measures to increase EE is not existent. There are research projects that provide punctual insights, and the standardization expert group working on ISO 14955 series has compiled a widely accepted list of such measures.
- The impact of single measures onto the average increase in EE lacks statistical data as it can only be quantified based on a large number of proven realisations.

[9] The respective data compiled in the Preparatory Study, [Schischke K. et al.: Energy-Using Product Group Analysis – Lot 5 – Machine tools and related machinery – Final Version, Fraunhofer IZM, August 2012 – Task 2] presents calculations that are based on educated guesses

- A connection between MT builders, their product range, the size and cost of the products, the average energy consumption of any given product type, and the potential of the respective EE improvements cannot be made.

A core aim of the SRM is to gather the crucial data to evaluate the EE improvement of the sector, mainly within the first three years after installation, but also refining it further in the course of operation.

4.5 Special limitations due to international business

Despite the fact that the majority of its industries are SMEs, the machine tool market is not Europe-centric. The globalization added to domestic and traditional markets (USA, Japan, Australia) new ones such as India, China, the Far East, South America and others. In 2012 emerging Asian countries consumed about 57% of all machine tools in the world. European machine tool industry shipped machines in total value of 10.4 billion euro in 2012 outside the economic union. In other words almost 53% of EU machine tool production is exported to non-EU countries. Therefore, machine tools are produced for a global market, where in some case Europe is not the main source for sales.

ErP Directive is not enforced in extra-EU markets but, because of their size, most European machine tool manufacturers could hardly design differentiated machines, targeted to EU and extra-EU markets, in terms of energy efficiency.

If these aspects are not taken into account, the risks are:

1. European machine tool manufacturer would neglect the EU market as the burden to design energy-efficient MTs is disproportionally high;
2. European metalworking industry would suffer of lack of new/innovative machine tools and/or increase their costs connected to the acquisition of new machines;
3. As the majority of markets move extra-EU, the most important machine tool manufacturers would move their operations to more attractive/less penalizing extra-EU markets with depletion of European industrial performance and innovation level.

4.6 Marketing aspects

The CECIMO SRM is designed to provide benefits beyond the scope of energy efficiency for all participating signatories. Ideally, they can use their participation with the voluntary SRM to demonstrate their role as a market leader. So the SRM could become a very welcome marketing incentive which, in return, would boost the participation and acceptance of the CECIMO SRM.

II) Compliance with the "Guidelines on the self-regulation measures"

This section addresses the compliance of the CECIMO SRM with the requirements of the "Guidelines on the self-regulation measures concluded by industry und the Ecodesign Directive 2009/125/EC" (GSRM), draft version dated 11 September 2013.

It needs to be noted that some requirements of the GSRM are in conflict with the expected participation of the CECIMO SRM, especially regarding the multitude of signatories and variety of products. In those cases, alternative procedures have been proposed.

5 Objective

CECIMO recognizes the EU's efforts to reduce waste of resources, increase energy efficiency and raise the amount of regenerative energy as described in the EU's 2020 agenda.

As it has been stated before, machine tools are complex systems dedicated for industrial use in manufacturing and assembly plants, and user behaviour plays a major role in their energy consumption. In order to remain competitive, they become more complex and offer more functionality, which increases the number of factors impacting the energy use. The machine tool manufacturers are keeping up with their customers' productivity, accuracy and reliability requirements and also meet increasing energy efficiency demands.

That is why there is no simple measure applicable to generate a wide-spread impact on the energy efficiency of all machine tools[10]. Also, it is not suitable to cut out segments of products to make a measure applicable to all.

Therefore, the overall objective of reducing the environmental impact of metalworking machine tools with respect to energy efficiency can best be reached by the proposed SRM, which follows the following objectives:

1. Quick start. Get regulation under way as soon as possible. The SRM can be implemented within nine months after the regulation of the EC is adopted.
2. Broad involvement. The SRM is designed in a way that any machine tool builder can reasonably aim at fulfilling the requirement of self-assessment of the machine design.
3. Entrepreneurial freedom. This is reached by the openness of the SRM with regard to the specific measures that signatories can select in best accordance with their product.
4. Mandatory action. While being free in the measures taken, every signatory has to comply with the SRM and commit to a level of ambition that exceeds the potential of business as usual
5. Floating Baseline. Machine tools have long design cycles. Therefore, MTs are in the market for a very long time (sometimes more than 10 years) before undergoing fundamental re-design. A complete re-design of all products would put a great burden on SMEs. Therefore, the reference to prove EE increase is always the MT generation in the market at the time of the re-design.
6. Learning curve. The complexity of the machine tool sector makes it impossible to evaluate any possible measure for any type of machine tool up front. Research to identify the most suitable measures would take years, if even feasible. The quantification of an average EE improvement for the entire sector is possible only on the basis of broad statistical data. This

[10] Schischke K. et al.: Energy-Using Product Group Analysis – Lot 5 – Machine tools and related machinery – Final Version, Fraunhofer IZM, August 2012 – Executive Summary

data can easily be provided in the course of the SRM, so the impact will increase over time as more and more signatories provide and get access to best practices.

7. Universality. The potential of future measures not even yet identified by research and design needs to be included into the SRM to reap the most benefits. By self-declaration, companies can quickly make use of new developments, and their use will be spread via the SRM Administration without going through a complex process of accreditation.

6 Signatories and market coverage

According to an inquiry conducted by CECIMO in 2013, at least 40% of large companies would certainly be willing to be involved in the SRI and contribute experts in standardisation to the process. Another 40%, i.e. in total, over 80% would participate in the SRM, depending on conditions introduced.[11]

The companies interviewed in the SRI inquiry were selected to provide market coverage of about 75% of EU-28 machine tool production. Therefore, it can be concluded that with an attractive and innovative SRM design, the response and adoption by MT manufacturers will exceed 80% market coverage.

The SRM is open to all machine tool manufacturers that are producing for the EU-28 market. As it is not suitable to cut out single segments of products (e.g., milling machines, presses, laser cutting equipment), the SRM will, from the start, cover all types of metalworking machine tools.

The requirement that the SRM covers at least 90% of the products of every signatory can be met. However, it will not be within at least five years after the SRM is implemented because machine tools usually have design cycles of 5-10 years. Concerning the SME-structured sector, forcing a full redesign of all products within a very short time would put an immense burden on the manufacturers. With the proposed SRM, little changes that can be easily adopted in the course of “face-lifting” the product may also be claimed and contribute to the success of the SRM.

7 Scope

The machine tools in the scope of this SRM are all metal working machine tools.

The focus is on CNC (cutting and forming) and laser cutting machines, as energy savings of non-CNC metal working machine tools were identified as not substantial[12] and as most non-CNC machine tools feature simply electric motors, pumps or other ancillary equipment that is already regulated and is covered by other ErP Lots.
However, non-CNC machines shall not be ruled out, if a signatory manufacturing that type of machines would like to join the SRM.

Wood working machine tools and welding equipment are not covered by the CECIMO SRM.

[11] Report on energy-efficiency of machine tools in the EU, CECIMO, June 2013

[12] Schischke K. et al.: Energy-Using Product Group Analysis – Lot 5 – Machine tools and related machinery – Final Version, Fraunhofer IZM, August 2012 – Task 4, p. 135, Table 4-87

8 Requirements

The requirements of the CECIMO SRM need to be divided into two categories:

1. Technical requirements to be fulfilled by the signatories in order to be compliant with the SRM
2. Levels of ambition to be achieved by the SRM as a whole to be compliant with the EU regulations.

8.1 Technical requirements

Every signatory is obliged to carry out a self-assessment of the energy efficiency of its products. It consists of the three aspects introduced in Section 3.2:

1. Analysis of EE of the machine tool itself during the development/design phase (mandatory)
2. Reflection of process and environment of machine tool during the development/design phase (if applicable)
3. Support of machine tool user/continuous improvement during the use phase (additional)

It needs to be noted that the signatory ideally reports on all three aspects in parallel. However, answering to the first aspect is mandatory in any case.

8.1.1 Analysis of EE of the machine tool itself

The analysis of the EE of the machine tool itself during the development/design phase is mandatory. It is the core of the assessment, as it can always be carried out by the manufacturer and has an immediate influence.

The procedure is as follows:
First, analyse if a certain measure is feasible and contributing to EE. Measures are recommended by the guidelines, for example ISO 14955-1 Annexes A and B, but are not limited to it. Secondly, evaluate the amount of energy savings potential with the catalogue value (if available), the qualified estimation (calculation /simulation/ measurement) or the reference value (which will be developed over time by the SRM Administration and transformed into guidelines).

Over the course of the SRM, reference values will be identified by the SRM Administration. Those values will be based on the reporting during the SRM. If feasible, those reference values will be put into the guidelines or checklist assembled by the SRM. The checklist will provide the most suitable measures and reference values in order to support any SRM signatory on its way to the EE improvement of its products. Also, the checklist will provide a feedback from SRM signatories on the selected measures. The checklist will be revised annually.

Summing up the savings potential of all realized measures and calculation of the energy efficiency increase by referencing to the previous version (of the machine tool) or machine tool designed with standard components/functions will lead to the overall result.

8.1.2 Reflection of process and environment

Reflection of process and environment of a machine tool during the development/ design phase depends on whether this information is available or not. It is therefore optional, to be employed only if a reference to a given process setup or environmental conditions can be exploited to increase EE.

To reflect the process, the following aspects have to be analysed and optimized in respect to:

- Tooling technology, optimization of cutting data
- Optimization of work piece handling
- Processing strategy

If the environment of a machine tool is known, comprehension of factory resources such as heat management, mist extraction, centralized compressed air supply, re-cooling and lubrication shall be taken into account.

Summing up the savings potential of all realized measures and calculation of the energy efficiency increase by referencing to a version without exploiting factory resources and optimized processes will lead to the overall result.

8.1.3 Additional support for the machine tool user and improvement during the use phase

Support of the machine tool user and continuous improvement during the use phase are additional requirements, aiming at reducing waste during the operation of the machine tool, which is under customers' responsibility.

An end-user of a machine tool with a clear understanding of the coherences between the operation of the MT and environmental aspects can lead to increased energy savings.

As some machine tools are typically in use for more than 10-20 years, there seems to be a further potential for energy savings over time, e.g., if repairs are upcoming.

Possible measures are:

- Information in the user manual, on how to operate the MT in the best energy efficient way
- Visualization of energy consumption on the screen
- Customer training that includes aspects of energy efficiency
- Checklist for employees that perform maintenance and services
- If repair is needed, state-of-the-art (most energy efficient) component will be introduced to machine tool
- Service personnel points out waste of energy and resources and assists to find optimized parameters (pressure, coolant and lubrication, etc.)

8.2 Levels of ambition

The CECIMO SRM has the ambition to increase the average energy efficiency of the entire metalworking MT sector by:

- 6% within the first five years after the SRM becomes operational (Tier 1)
- 12% within the first ten years after the SRM becomes operational (Tier 2)
- 15% within the first fifteen years after the SRM becomes operational (Tier 3)

Those figures are results of an analysis explained in Appendix B.

The levels of ambition have been set taking into account the following aspects:

- Base case:
    - Design and application of MTs are very heterogeneous

    - It is not feasible to define general base cases even for single groups of machines[13].
    - During the self-assessment and reporting process, the MT manufacturer will define an individual base case for every machine.
    - All reports are scrutinised by the SRM Administration.
    - If feasible, the SRM Administration can define obligatory base cases if, over the course of the SRM, a convergence of individual base cases is identified.
- There is no obligation to report a minimum level of energy efficiency increase for signatories. This is due to the fact that the MT sector is too heterogeneous to prescribe general levels of ambition for each product. The success of the CECIMO SRM will be judged on the basis of the overall average improvement of the entire sector.
- State-of-the-art:
    - It is not possible to define a specific state-of-the-art of MT design at any given point of time because of the broad range of customer needs.
    - It is not possible to establish a state-of-the-art design that has to be realized by all signatories.
    - Over the course of the SRM, especially within the first three years, the data gathered will allow to distinguish different developments and maybe define thresholds for some types of machines.
    - If some measures have been discovered to be widely implemented, they may be defined to be obligatory.
- Base line: As there is no definite state-of-the-art available, it is also not possible to define a base line regarding measures or levels of energy efficiency or energy use.
- Base year:
    - As machine tools are products with long life and design cycles, it is not possible to define a fixed baseline valid for all machine tools.
    - The base year of the SRM is the year in which the SRM becomes operational.
    - The base year for the MTs reported under the SRM is 2009, as this was the year in which the regulatory process started and MT builders reacted proactively[14] to the upcoming regulation by applying EE measures on MTs.
    - The machine design that was on the market in 2009 is to be taken as the reference against which the improvement of the new machine design has to be evaluated.
    - However, if a MT builder has been an early adopter and has already included special features for EE improvement into his machine design before that base year, he can ask the SRM Administration to have these measures recognized. An application has to be filed within the first two years of SRM operation.
    - Over the course of the SRM's first three years, data will be collected as to which measures have been state-of-the-art at the time the SRM became operational. Then, the SRM Administration can evaluate if the measures for which the MT builder applied are specifically for EE improvement and not BAU, and credit them.
- "Generations" of machine design
    - Machine tools have long design cycles, sometimes more than 10 years before a fundamental re-design takes place.
    - A fundamental re-design means that the core structure of the machine (bed, frame, table, kinematics, etc.) is newly designed. This specifies a "new" generation of a MT, even though its basic mode of operation can be the same as the "old" generation's.

[13] Schischke K. et al.: Energy-Using Product Group Analysis – Lot 5 – Machine tools and related machinery – Final Version, Fraunhofer IZM, August 2012 – Task 4, pp. 48: e.g. the base case defined for CNC 4-axis multifunctional milling centre (Table 4-17) is based on assumptions that cannot be taken as an average for all milling centres

[14] This can be seen from initiatives as Blue Competence or Blue Philosophy and also, the standardization process for the ecodesign of machine tools under ISO 14955 series that started in 2009.

Moreover, a MT featuring newly integrated multi-process capabilities is also a “new” generation.

- Machine tools incorporate many components that are already regulated with regards to the EE, notably motors and pumps. New components will certainly be applied if available, leading to a technical “update” of a machine generation without leading to a “new” machine generation.
- Every EE improvement of a MT design shall be reported and considered within the SRM.

9 Reporting on the compliance with the self-regulation measures

9.1 Self-assessment

9.1.1 Self-declaration of energy efficiency claims

Energy-efficiency achievements are quantified for specified functional units. A machine tool may be considered to be one functional unit. However for practical reasons, it is more appropriate to treat it a composition of several functional units, when considering a machine tool as one functional unit, a complex and costly comparison must be made and it is only valid for this type of machine. If smaller, less complex functional units are defined, comparison is easier and results are applicable for all machine tools integrating the same functional unit. For example: if a functional unit is embodied by a particular peripheral device, the claim regarding this functional unit is valid for each machine tool integrating this specific peripheral.

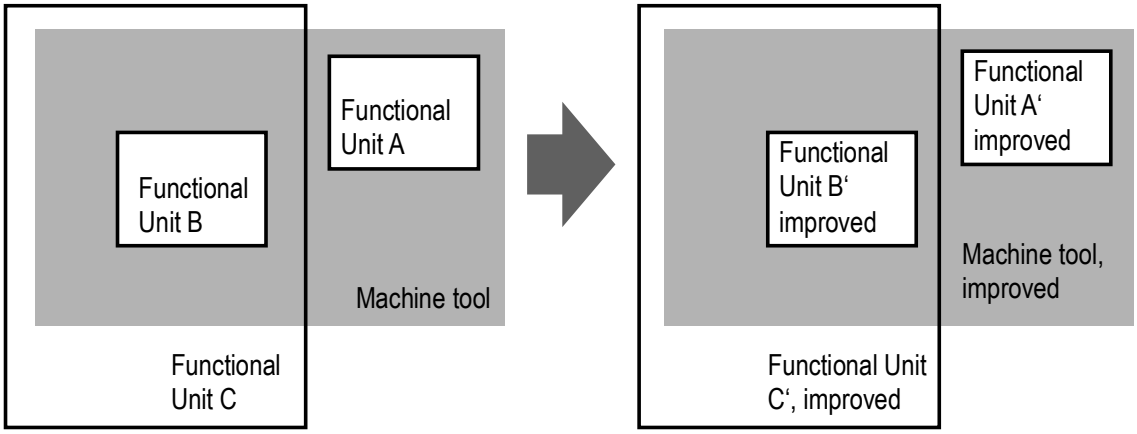

Figure 4: Definition of functional units for comparison. Consolidation of claims regarding functional units A and C, or A and B is possible, whereas consolidation of claims for B and C is not possible.

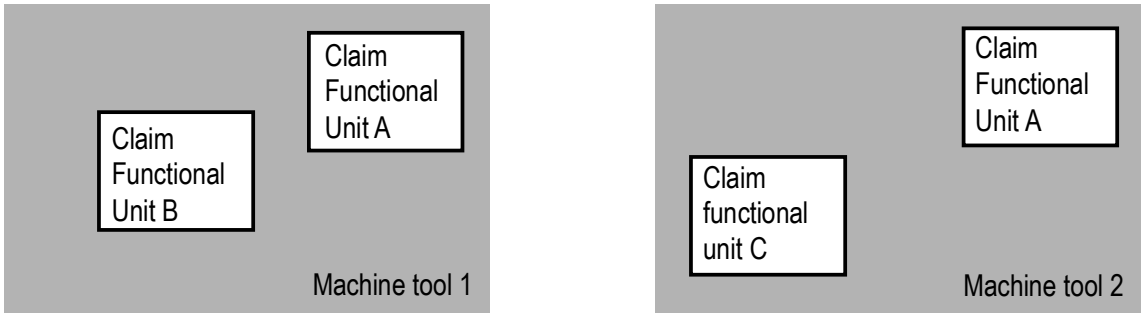

Figure 5: Transfer of claims for functional units being part of various machines. Claim regarding functional unit A is transferable from machine tool 1 to machine tool 2.

Efficiency improvement claims, henceforth “claims”, quantify the efficiency improvement for a functional unit by comparison with a previous state-of-the-art of the same functional unit. Claims may be stated on various grounds:

1. **Manufacturer claims**: Manufacturers develop their own claims based on case studies, and quantified them by measurement, calculation or estimation. A claim regarding a functional unit common to several products may be quantified for one case, and then be transferred to others. Initially, all claims are manufacturer claims. The manufacturer is obliged to produce evidence for the claim upon request. Example: stand-by management for product family A reduces energy consumption by x%.
2. **Supplier claims**: Suppliers of subsystems or peripherals can improve their competitive situation by developing claims regarding their machinery. Example: Mist extraction system B has in increased efficiency of x% compared to previous version.
3. **Third party claims**: Third parties such a research institutes or service organisations can produce claims upon request or as voluntary contribution to the SRM. Example: Institute C shows that general productivity gain in milling operations of x% per year lowers energy per part produced by y% per year.
4. **Standard claims** are based on common ground knowledge, such as rule-based measures, or general trends. The type of evidence enabling a standard claim is part of the claim definition. Standard claims are listed and published by the SRM Administration. They result from a consolidation from manufacturer claims. Example: Implementation of IE2 instead of IE1 motors increases motor efficiency by x%.

Manufacturers can produce their own claims by their own means. They have to be documented following SRM procedures, which guarantees utmost transparency. Additionally, the SRM Administration may investigate doubtful claims at any time.

For all other types of claims, MT manufacturers need to rely on data provided externally. Suppliers usually provide this data in a standardized way (product catalogue, or other). When supplied components are already under EE regulation (motors, pumps, etc.), those claims are not questionable.

In the long run, it would be desirable to rely mostly on standard claims that need to be produced on the basis of experience of all manufacturers, suppliers and third parties. Additionally, this would also facilitate the participation of SMEs within the SRM as they could orient themselves along existing “best practices”. Nonetheless, the development of standardized claims needs time and a reliable data base. Furthermore, standardized claims may still not be generally applicable.

The machine tool product declaration lists the claims of functional units applicable to the machine tool and the share of energy of each functional unit for this machine tool. Impact assessment at machine tool level involves multiple steps, as depicted in the following figure. The point of departure is a claim on a functional unit, which is multiplied with the share of this functional unit of the MT energy rating, leading to a weighted claim. The sum of weighted claims for a MT represents the MT product claim.

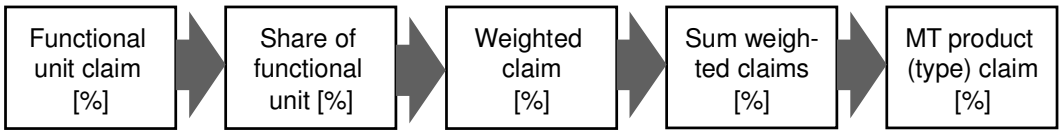

Figure 6*:* Derivation of MT product claim

9.1.2 MT energy rating

The energy consumption of a MT varies from less than 5'000 kWh/a to more than 200'000 kWh/a. This wide range necessitates the declaration of an energy rating for each product. Energy efficiency improvements on products with a high rating have a bigger overall impact than those on products with a low rating and shall be targeted with priority.

9.1.3 Rules for self-declaration

Due to the initial nonexistence of standard supplier or third party claims, manufacturers will be the first ones to develop their own claims. Claims shall be developed according to a guideline issued by the SRM Administration and documented by means of a declaration template. The guideline will refer to common standards such as ISO 14021 or ISO 14955 if applicable in order to ensure coherence with global approaches and industrial applicability. The claims shall fulfil the "3 Cs" as basic requirements:

1. **Compliance**: Claims must comply with all requirements defined by the SRM. Compliance covers legal conformity, not from the market and customer's perspective.
2. **Clearness**: Clearness results of a definition of the functional unit, a summary technical description of the measure and a value for the efficiency improvement. Clearness is important from a customer perspective too, in order to understand the consequences of the implemented measures.
3. **Correctness**: Each claim is expected to be correct, but the requirements for correctness in a scientific sense may depend on the scope of the claim. A claim for a small improvement of a niche product may be based on estimation only, whereas the SRM will require calculations or measurements for an important claim for a product with a high energy rating and sold in large numbers.

9.1.4 Reporting obligation for SRM signatories

All products covered by the SRM product definition and sold by SRM signatories are subjected to reporting. For each unit sold, reporting has to be made at latest 90 days after delivery, containing:

- SRM signatory name
- Machine tool type and serial number
- Listing of functional unit claims and/or reference to standard claims [qualitative]
- Machine tool product claim [%]
- Machine tool energy rating [kWh/a]

If feasible, reduced reporting obligations can be arranged by the SRM Administration for signatories having repetitive sales of the same product.

9.1.5 Type of market

Only products delivered within EU-28 need to be reported.

9.1.6 Format of technical data to be submitted

All data is transmitted by a Web based registration tool from signatories to the SRM Administration.

9.2 Reporting obligation of the SRM Administration

The SRM Administration receives reporting data from signatories at various points during the year. From the data gathered, the SRM Administration, also serving as independent inspector, has to aggregate a consolidated reporting proving the progress and compliance of the overall CECIMO SRM.

The data will be reported as shown in the following scheme:

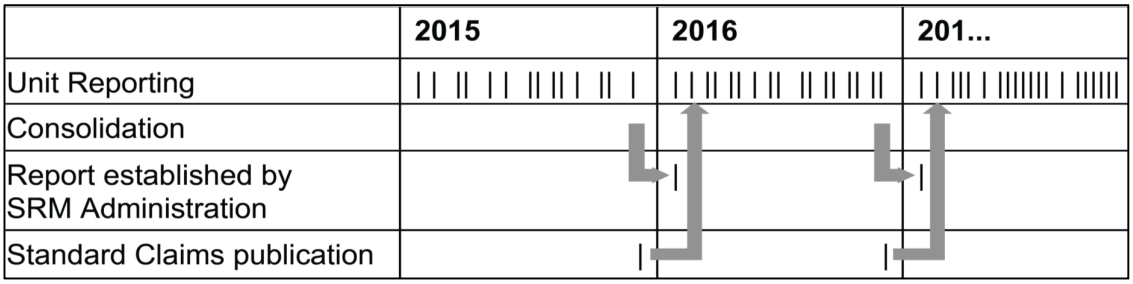

Figure 7: Consolidated Reporting

The consolidated reports will be published by the SRM Administration annually by the end of February of the following year.

The annual reports of the SRM Administration include

- Total number of units sold
- Number and names of reporting SRM signatories
- Distribution of product claims (2% steps)
- Distribution of energy ratings (6 categories)
- Consolidated impact: consolidated energy ratings and consolidated product claims per energy rating
- Standard claims valid in the reporting period
- Confidential information: number and names of SRM signatories failing to report (watch list)

The data consolidation is made in a way to impede identification of product types or manufacturers with respect to numbers and types of products sold, or claims made for a particular product. This information is available upon request by the SRM Administration.

SAMPLE VALUES ONLY																
	Total Number	Consol. Rating	Claim category (in %)												SUM	Contribution to impact per E rating category
	30'365	kWh	<2%	<4%	<6%	<8%	<10%	<12%	<14%	<16%	<18%	<20%	<22%	<24%		
Energy Rating	Share															
<5'000 kWh/a	30%	22'773'750	25%		13%	50%			12%						100%	-1'357'316
<20'000 kWh/a	23%	69'839'500	2%	2%	15%	20%	40%	0%	1%	12%	2%	4%		2%	100%	-6'509'041
<50'000 kWh/a	15%	159'416'250		14%	12%	56%		12%						6%	100%	-12'179'402
<100'000 kWh/a	22%	501'022'500		30%		20%	50%								100%	-34'069'530
<200'000 kWh/a	5%	227'737'500			30%		30%			40%					100%	-23'229'225
>200'000 kWh/a	5%	379'562'500		25%		25%			50%						100%	-34'160'625
			Contribution to impact per claim category													Total impact (kWh)
SUM	100%	1'360'352'000	-70'902	-7'493'475	-4'224'531	-16'324'224	-31'209'147	-300'614	-25'117'624	-14'921'361	-237'454	-530'780	0	-635'539	kWh	-111'505'138

Figure 8: Consolidated reporting scheme (arbitrary sample values only)

Standard claims are published annually and provided to SRM signatories for use in subsequent self-declarations.

Non-compliant signatories will be treated as shown in Section 17.

10 Independent Inspector

The role of the Independent Inspector (II) will be carried out by the head of operation (HOR) of the SRM Administration.

The CECIMO SRM is apt to involve a great number of signatories. Therefore, the supervision and the surveillance of signatories in regards to their compliance with the SRM requirements need experienced and trained staff.

As a consequence, a SRM Administration authority will be created as an independent organisation in the legal form of a non-profit organization under the explicit jurisdiction of the country where it will be registered. The HOR of the SRM Administration will be appointed by the Steering Committee and work on a contract basis similar to the duties of an association's General Manager. That person will be responsible for fulfilling the needs of the SRM Administration, including recruitment and supervision of necessary staff, definition of standard operating procedures, and financing.

The SRM Administration will be financed through a sharing of expenses by the signatories.

The SRM Administration serves the different needs as follows:

1. Coordination
   - Contracts with signatories
   - Guidance
   - Set-up and drafting guidelines
   - Creation of templates (Word, Excel, etc)
   - Training and seminars for self-assessment and SRI participation (administrative questions, organization, etc)
2. Data handling
   - Receiving aggregated data from all signatories
   - Analysing signatories' data for plausibility and compliance with the SRM requirements
   - Establishing and maintaining meta-statistics
   - Gathering background data
3. Communication
   - Creation and publishing annual reports of SRM
   - Creation and maintenance of a website
   - Provide background data to the GA, SC, EC, other stakeholders, interested third parties and the general public
   - Represent the SRM at official occasions
   - Meeting with the EC and stakeholders
4. Marketing
   - Promotion of participation
5. Supervision and audit
   - Checking data provided by companies for plausibility
   - Checking for fraud, misuse
   - Sampling SRI documentation at companies (site visits)
   - Providing answers to requests by the EC or stakeholders
   - Providing data/ material for auditing of EC officials or market surveillance authorities
6. Market surveillance and enforcement
   - Check for misuse of SRM (active role)
   - Gather information about misuse (passive role)
   - Enforce measures or legal action in case of non-compliance

7. Improvement of the SRI
    - Evaluate aggregated data for convergence or saturation effects
    - Adapt SRI rules (e.g., specify “saturated” measures as mandatory)
    - Update guidelines
    - Establish standard claims / rule based measures
8. Reporting
    - Document and report the development of the SRM

11 Compliance reports

The HOR of the SRM Administration will prepare the compliance reports in strict compliance to the requirement by the GSRM.

12 Auditing

As the HOR of the SRM Administration serves as Independent Inspector in terms of the GSRM, he will be entitled to carry out the audits in strict compliance to the requirement by the GSRM. He is also entitled to delegate the audit procedure to a member of the SRM Administration’s staff, retaining full responsibility.

Due to the expected large number of signatories and the large number of products that will be covered by the CECIMO SRM as it gains momentum, the auditing process will have two stages:

1. The SRM Administration will cross-check all reports from signatories for compliance with the SRM requirements and plausibility of the provided results. In case of doubt, the SRM Administration will stage a spontaneous, case-specific audit on the signatory’s premises.
2. Apart from suspicions raised on the basis of the provided documentation, there will be a regular, random auditing of every signatory. There, all the activities of the signatory will be scrutinized by the auditing team on the premises of the respective signatory.

The results of the audits will be reported to the members of the SC in due course, in compliance with the GSRM.

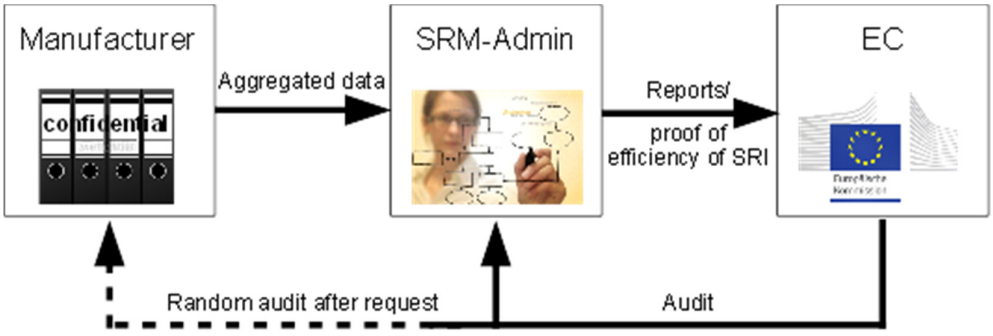

Figure 9: CECIMO SRM Auditing Scheme

13 Monitoring of the effectiveness of the self-regulation measure

Annual reporting according to the above scheme enables direct comparison of the objectives and the current degree of achievement.

Due to the generic procedure based on self-declared claims, the latter are analysed with respect to quality and quantity in order to document progressive coherence amongst different signatories, and conformance with the requirements, in particular with the "3 Cs", compliance, clearness and correctness.
The market coverage is monitored for the part covered by SRM based on the unit reporting on the total market based on statistical material from Eurostat[15], CECIMO statistical toolbox[16] and Oxford Economics[17].

14 Access to background data

The nature of the machine tool industry's B2B business model prohibits full public disclosure of the technical realization of measures undertaken to improve the MT's EE. This is due to confidentiality of the business and questions of intellectual property.

Therefore, the CECIMO SRM follows the idea of self-assessment of the EE by the respective signatory. The full insight into all measures will be provided to the SRM Administration, or, upon request, to other EC officials.

The reporting scheme of the CECIMO SRM, however, comprises a summary of measures and data that will be forwarded to the SRM Administration for evaluation and aggregation. This data sheet will be accessible for any member registered to the SRM's GA, hence all signatories, stakeholders, EC officials and other interested parties.

15 Management of the self-regulation measure

While the SRM operation will be carried out by the SRM Administration, the management of the SRM consists of the following bodies:

- The General Assembly (GA)
- The Steering Committee (SC)

As the number of signatories of the measure is expected to be very large, this means a deviation from the requirements put down in GSRM, aiming at keeping the SC at size fit for working efficiently.

15.1 The General Assembly

The GA shall convene at least every two years. A shorter period or intermediate meetings may be called in if required.

[15] http://epp.eurostat.ec.europa.eu/portal/page/portal/eurostat/home/
[16] http://www.cecimo.eu/site/the-industry/data-statistics/statistical-toolbox/
[17] http://www.oxfordeconomics.com

In its constituting meeting, the GA has to lay down internal regulations, dealing with meeting procedures, responsibilities, protection of minorities, etc.

Participants of the GA are all signatories and all interested stakeholders. It is open to all representatives of member states. Other interested parties and the broader public may have access to the reporting of the GA meetings.

In the course of the GA, both groups of signatories and other stakeholders elect their representatives to the SC.

15.2 The Steering Committee

The SC will be installed in compliance with the GSRM.

The SC will convene at least twice a year, of which one meeting will be in Brussels.

The SC consists of the seven representatives of the signatories, a representative of the EC and a maximum of six more representatives of other stakeholders.
Those delegates elect a Chair and a deputy among themselves.

In its constituting meeting, the SC has to lay down internal regulations, dealing with meeting procedures, responsibilities, protection of minorities, etc.

The SC is furthermore open to any interested stakeholder or signatory, but without a right to vote for decisions.

The SC will, among other duties, appoint the HOR, who will be responsible to manage the SRM Administration and plays the role of the independent inspector.

16 Voluntary withdrawal of a signatory

Any self-regulation signatory may decide to voluntarily withdraw at any time its signatory status by giving thirty days' written notice to the HOR of the SRM Administration.

All rights and obligations of the signatory that withdraws its participation in the measure must cease after thirty days after the written notice.

The HOR must inform the Steering Committee of the voluntary withdrawal of a signatory within seven days of the receipt of the written notice.

Information about the withdrawal of the signatory must be recorded in the minutes of the first following SC meeting and must be posted on the website of the self-regulation measure.

Within sixty days of the withdrawal of a signatory from the self-regulation measure, the remaining signatories must commission a report proving the market coverage of at least 80% of the products placed on the market and/or put into service. This report must be delivered to the EC without unnecessary delay and must be posted on the website of the self-regulation measure. The signatories do not have to commission the report provided that the most recently commissioned report undoubtedly shows that the withdrawing signatory accounted for a small market share and thus after its withdrawal the market coverage will remain well above 80%.

The signatories should be given a chance to reinstate the market coverage to the required level of 80%, particularly if the changes to the market coverage result from the unexpected voluntary withdrawal of signatories.

The market coverage should be reinstated to the level of 80% within six months after the change of market coverage. Otherwise, if the SRM can prove that it still covers a large percentage of the highest energy-using MTs, or that the overall EE increase is significantly higher even though a lesser market share is represented, it shall suffice that the SRM covers only at least 60% of the market.[18] Respective data will need to be gathered during the first years of operation of the SRM (see Section 4.4).

If the voluntary withdrawal of the signatory results in the market coverage below required 80%, the signatories will do their utmost to reinstate the required market coverage within 6 months starting from the moment of the termination of the rights and obligations of the withdrawn signatory. If after those 6 months the market coverage remains under required 80% the Commission will withdraw its recognition and will consider adopting a regulation.

17 Exclusion of a non-compliant signatory

A signatory is deemed non-compliant if it:

1. has not complied with the requirements of the measure as reported in the compliance report and/or in the audit report produced by the HOR of SRM Administration or
2. has not in any way responded to the requests for information required by the HOR of SRM Administration to prepare the compliance report or has not provided to the latter all information required to assess its compliance and to produce the compliance or audit report within given deadlines.

A non-compliant signatory must be subject to an audit performed by the Independent Inspector in the next calendar year.

The participation in the agreement of a non-compliant signatory who for the second time, at any point of time in the duration of the self-regulation measure, meets the conditions defined in the above mentioned points a) and/or b) must be considered withdrawn. Consequently, all rights and obligations of such a non-compliant signatory under the self-regulation measure must cease at the moment when he is found to meet the conditions mentioned in points a) and b).

The HOR of the SRM Administration must inform the Steering Committee, in a written format, about the exclusion of the non-compliant signatory within thirty days following the receipt of the information about the condition specified in the above mentioned points a) or b).

Information about the exclusion of the signatory must be recorded in the minutes of the following SC meeting and must be posted on the website of the self-regulation measure.

Within sixty days following the exclusion of the non-compliant signatory from the self-regulation measure, remaining signatories must commission a report proving the market coverage of at least 80% of the products placed on the market and/or put into service. This report must be delivered to the EC and must be posted on the website of the self-regulation measure. The signatories do not have to

[18] Example: in terms of EE increase, the impact of 80% of the market yielding 7,5% improvement within five year is exactly the same as if 60% of the market yield 10% improvement.

commission the report provided that the most recently commissioned report undoubtedly shows that the excluded signatory accounted for a small market share and thus after its exclusion the market coverage will remain well above 80%.

The market coverage should be reinstated to the level of 80% within six months after the change of market coverage. Otherwise, if the SRM can prove that it still covers a large percentage of the highest energy-using MTs, or that the overall EE increase is significantly higher even though a lesser market share is represented, it shall suffice that the SRM covers only at least 60% of the market.[19] Respective data will need to be gathered during the first years of operation of the SRM (see Section 4.4).

If the voluntary withdrawal of the signatory results in the market coverage below required 80%, the signatories will do their utmost to reinstate the required market coverage within 6 months starting from the moment when the Steering Committee received a written notification from the HOR of SRM Administration about the exclusion of the non-compliant signatory. If after those 6 months the market coverage remains under required 80% the Commission will withdraw its recognition and will consider adopting a regulation.

18 Revision of the self-regulation measures

The SRM shall be continuously reviewed, if it still complies with the requirements of the ErP directive, other EU directives, or the self-ambition of the SRM. Also, technological development will lead to a necessity to re-work or expand the list of potential measures.

Following the time plan to establish the CECIMO SRM, the review cycle shall be set to:

- First revision two (2) years after installation of the SRM. This period marks the end of the time period to get the SRM fully operational. First evaluations of relevant data are available, hence this is the ideal moment to check if the aggregated data proves the SRM to be on track with its objectives and ambitions. Also, it can be evaluated if the first measures may be transformed from individual proof of impact to rule-based.
- Second revision three (3) years after the first revision, i.e., five (5) years after installation of the SRI. By then, the SRM will have widened its body of signatories, the statistical base will have solidified, and a number of measures will have to be transformed to a rule-based basis.
- Thereafter, as the ramp-up of the SRM process has finished, a regular review shall take place every five (5) years.
- Intermediate reviews may be triggered by the GA or the SC, to react to changes in the overarching legislation or to other acute needs.

19 Withdrawal of the recognition of the self-regulation measure by the Commission

The Commission will withdraw its recognition of a self-regulation measure and will consider proposing implementing measures when one of the following situations occurs:

- the signatories have taken a decision to terminate the self-regulation measure,

[19] Example: in terms of EE increase, the impact of 80% of the market yielding 7,5% improvement within five year is exactly the same as if 60% of the market yield 10% improvement.

- the market coverage of the self-regulation measure remains below the required 80% of the products placed on the market and/or put into service for a period exceeding six months,
- the existing recognised self-regulation measure does not ensure compliance with the required 80% market coverage within eighteen months after the adoption of the Guidelines,

The EC informs the SC that in its opinion the measure no longer meets the objectives and the general principles defined in the Directive and that it has therefore decided to withdraw its recognition of the measure.

The EC will inform the HOR of SRM Administration of its decision to withdraw the recognition of the self-regulation measure and will provide the reasons of such decision.

If the SRM can prove that it still covers a large percentage of the highest energy-using MTs, or that the overall EE increase is significantly higher even though a lesser market share is represented, it shall suffice that the SRM covers only at least 60% of the market.[20] Respective data will need to be gathered during the first years of operation of the SRM (see Section 4.4).

The EC's decision to withdraw its recognition of the self-regulation measure should not determine the further existence of the self-regulation measure.

Should the signatories decide to continue their cooperation in the framework of the measure, they cannot consider it anymore compliant with the requirements of the Directive and as an alternative to an implementing regulation. The decision of the signatories to maintain the self-regulation measure should not prevent the Commission from adopting implementing measures for the product group covered by the self-regulation measure.

20 Cooperation with the signatories to other self-regulation measures

The SRM will encourage its signatories to share expertise, experience, information and best practice with the signatories to other ecodesign self-regulation measures and to promote ecodesign self-regulation initiatives among industry representatives.

Within CECIMO and its member associations there already various levels of continuous exchange, which serves as platforms to foster SRM and the improvement of EE

- CECIMO is, on the European level, is connected to various other networks or associations, for example:
  - The Exchange group for Voluntary Agreements (VAEx)
  - The European Engineering Industries Association (Orgalime)
- CECIMO National Associations exchange their expertise and experience often within other national networks, for example:
  - Germany: VDW (German Machine Tool Builders Association) is strongly connected to VDMA (German Engineering Federation)
  - Italy: UCIMU (Italian machine tool, robots, automation systems and ancillary products manufacturers' association) is a member of CONFINDUSTRIA and FEDERMACCHINE
  - Spain: AFM (Association of Advanced Manufacturing Technologies) is a member of CONFEMETAL (Spanish Confederation of Metal Sector)

[20] Example: in terms of EE increase, the impact of 80% of the market yielding 7,5% improvement within five year is exactly the same as if 60% of the market yield 10% improvement.

- France: SYMOP (Association for Manufacturing Technologies) is a member of FIM (French Federation of Mechanical Engineering Industries)
- Austria: FMMI is cooperating with WKO (Austrian Economic Chambers)
- Czech Republic: SST (Association of Engeneering Technology) is an important partner of the Economic Chamber and Confederation of industry of the Czech Republic
- UK: MTA (Manufacturing Technologies Association) is connected with various networks like EAMA (Engineering and Machinery Alliance), CBI (Confederation of British Industries) and Manufacturing Alliance
- Many other associations are themselves member of Orgalime or ECTA (European Cutting Tools Association)

- On the national or European level, initiatives have been installed that explicitly provide platforms for companies to present, exchange and improve their experience especially regarding energy efficiency, for example:
  - Blue Philosophy
  - Blue Competence

Appendix A – Compliance with the Ecodesign Directive 2009/125/EC

This section provides information on the compliance of the CECIMO SRM with the nine criteria specified in Annex VIII of the directive.

A.1 Ecodesign Directive Annex VIII Clause 1: Openness to participation

> *Self-Regulatory Initiatives must be open to the participation of third country operators, both in the preparatory and in the implementation phases.*

The SRM is open to all machine tool manufacturers that are producing for the EU-28 market. The SRM Administration is an independent body open to any applicant willing to join the SRM. As it is not suitable to cut out single segments of products (e.g., milling machines, presses, laser cutting equipment), the SRM will, from the start, cover all types of metalworking machine tools.

A.2 Ecodesign Directive Annex VIII Clause 2: Added Value

> *Self-regulatory initiatives must deliver added value (more than 'business as usual') in terms of the improved overall environmental performance of the product covered.*

The preparatory study already resumed, that a Voluntary Agreement yields an added value of 9% compared to business as usual[21]. As the CECIMO SRM represents the Voluntary Agreement between the relevant market players and the EC, the required benefit is given. Additionally the SRM is more effective than a generic mandatory measure as the measures in SRM are individually adaptable to the specific machine tool. This is proven by the preparatory study, too. See also Section 8.2.

A.3 Ecodesign Directive Annex VIII Clause 3: Representativeness

> *Industry and their associations taking part in a self-regulatory action must represent a large majority of the relevant economic sector, with as few exceptions as possible. Care must be taken to ensure respect for competition rules.*

The companies interviewed in the SRI inquiry[22] were selected to provide market coverage of about 75% of EU-28 machine tool production[23]. Therefore, it can be concluded that with an attractive and innovative SRM design, the response and adoption by MT manufacturers will exceed 80% market coverage.

A.4 Ecodesign Directive Annex VIII Clause 4: Quantified and staged objectives

> *The objectives defined by the stakeholders must be set in clear and unambiguous terms, starting from a well-defined baseline. If the self-regulatory initiative covers a long time-span, interim targets shall be included. It must be possible to monitor compliance with objectives and (interim) targets in an affordable and credible way using clear and reliable indicators. Research information and scientific and*

[21] Schischke K. et al.: Energy-Using Product Group Analysis - Lot 5 - Machine tools and related machinery Final Version, Fraunhofer IZM, August 2012 – Executive Summary

[22] Report on energy-efficiency of machine tools in the EU, CECIMO, June 2013

[23] At the time of the design of the CECIMO SRI Inquiry, which results were presented in the Report on Energy efficiency of machine tools in the EU (June 2013), the draft Guidelines for Voluntary Agreements required a market coverage of at least 70%, which was increased to 80% at a later time when the inquiry was already finished. The process of revising the Guidelines has not been finalised yet.

technological background data shall facilitate the development of these indicators.

Even though the overall baseline is floating with regard to machine tool "generations" and the common design cycles, the baseline for each product submitted by a signatory is clearly defined and reported into the SRM Status Report. See Section 8.2.

A.5 Ecodesign Directive Annex VIII Clause 5: Involvement of Civil Society

With a view to ensuring transparency, self-regulatory initiatives shall be publicized, including through the use of the Internet and other electronic means of disseminating information.
The same must apply to interim and final monitoring reports. Stakeholders including Member States, industry, environmental NGOs and consumers' associations must be invited to comment on a self-regulatory initiative.

The SRM Administration publishes the Self-Regulatory Measures documentation and the annual Status Report dedicated to SRM.

With the SRM Status Report, all stakeholders are comprehensively informed about the Ecodesign activities, successes, and challenges. It is also intended as a basis for dialogue between industry and stakeholders. The SC cordially invites all stakeholders to share their thoughts and encourages comments.

The SRM SC welcomes the participation of Consultation Forum members including representation from Member States, industry, environmental NGOs and consumer associations.

A.6 Ecodesign Directive Annex VIII Clause 6: Monitoring and Reporting

Self-regulatory initiatives must contain a well-designed monitoring system, with clearly identified responsibilities for industry and independent inspectors. The Commission services, in partnership with the parties to the self-regulatory initiative shall be invited to monitor the achievement of the objectives.
The plan for monitoring and reporting must be detailed, transparent and objective. It must remain for the Commission services, assisted by the Committee referred to in Article 19(1), to consider whether the objectives of the voluntary agreement or other self-regulatory measures have been met.

The monitoring and reporting plan for the SRM is presented in detail in sections 9 and 13. The SRM Administration receives reporting data from signatories at various points in the year. From the data gathered, the SRM Administration, also serving as independent inspector, has to aggregate a consolidated report proving the progress and compliance of the overall CECIMO SRM. The consolidated reports will be published by the SRM Administration annually by the end of February of the following year.

A.7 Ecodesign Directive Annex VIII Clause 7: Cost-effectiveness of administering the SRM

The cost of administering self-regulatory initiatives, in particular as regards monitoring, must not lead to a disproportionate administrative burden, as compared to their objectives and to other available policy instruments.

This requirement is directed to the European Commission and Members States to ensure that the costs and administrative burden on machine tools manufacturers and other stakeholders including authorities caused by the SRM is not disproportionate compared to other policy instruments. The CECIMO SRM for machine tools aims at delivering results under a continuous improvement perspective, without putting an unreasonably high burden for participation on signatories.

A.8 Ecodesign Directive Annex VIII Clause 8: Sustainability

> *Self-regulatory initiatives must respond to the policy objectives of this Directive including the integrated approach and shall be consistent with the economic and social dimensions of sustainable development. The protection of consumers' interests (health, quality of life and economic interests) must be integrated.*

The CECIMO SRM ensures that the environmental design targets set under the Initiative are environmentally sound with regard to other environmental aspects of machine tools.
Regarding other elements of sustainability, it is important to note that machine tools are complex systems dedicated for industrial use in manufacturing and assembly plants, and user behaviour plays a major role in their energy consumption. The machine tool manufacturers are keeping up with their customers' productivity, accuracy and reliability requirements and also meet increasing energy efficiency demands. Therefore, machine tools contribute to globally increase the energy efficiency of manufacturing industries.

A.9 Ecodesign Directive Annex VIII Clause 9: Incentive compatibility

> *Self-regulatory initiatives are unlikely to deliver the expected results if other factors and incentives – market pressure, taxes, and legislation at national level – send contradictory signals to participants in the commitment. Policy consistency is essential in this regard and must be taken into consideration when assessing the effectiveness of the initiative.*

Incentives are necessary to support the SRM in achieving its targets. One benefit of such incentives is to raise awareness on energy efficiency issues and encourage installation of energy efficient equipment.

There are various instruments to that end identified at the Member States level. As these schemes are voluntary, Member States need to provide incentives to users to join. These incentives could include deferred legislation, tax rebates, subsidies, or pollution charge substitution.

Results from EU Member State voluntary agreement schemes vary but the JRC 2010 report shows that there can be indirect benefits as well as the more obvious reductions in energy consumption. The purpose is to raise awareness on energy efficiency issues and encourage installation of energy efficient equipment.

Appendix B – Calculation of Estimated Energy Efficiency Improvements

B.1 Methodolody

The estimation of a potential energy efficiency increase is based on taking into account the advancement of energy efficiency from one machine generation to the following.

The core requirement for this is the length of the estimated use of a machine tool. It needs to be remarked that there is no statistical data available as to how large the installed machine stock is within EU-28 (or, in fact, anywhere in the world)[24]. Nor is there statistical data on how much of the MT production per year goes into replacement.

The scenario uses the depreciation periods which have been accepted in Germany by the German Ministry of Finance. Depreciation means that for an investment good, it is not allowed to write down the entire investment in one single year to reduce the tax debt. Instead, the period has to be stretched. For example, linear depreciation over 8 years means that 1/8 of the investment is written down each year.

The depreciation periods have been clustered in accord with the machine categories that are referenced in market statistics. Then, the arithmetic means has been calculated per group. This has been multiplied with the percentage of the market share of that product group, yielding the weighted useful life of the machine tool per category. By summing up all categories, the average useful life of all machine tools is calculated. It is assumed that this average useful life is not true for all applications. There are industries with a faster turnover, e.g., the automobile industry. The will be at the lower end of the average useful life. Other industries will make longer use of the MTs they operate. The consideration of which share of machine tools is in operation for which percentage of the average useful life, leads to the real useful life of MTs in operation.

In the next step, an assumption is made for the maximum possible increase of energy efficiency from one MT generation to the next. Furthermore, it is assumed that only a shared percentage of all machine tools sold can realize that maximum, another share will produce a significantly lower increase in EE.

The third step is to divide the expected total EE increase by the expected real useful life to yield the average EE increase per year.

As periods of use and an estimation of possible EE increase have already been specified in the preparatory study[25], those considerations are included in a reference scenario.

[24] The respective data compiled in the Preparatory Study, [Schischke K. et al.: Energy-Using Product Group Analysis – Lot 5 – Machine tools and related machinery – Final Version, Fraunhofer IZM, August 2012 – Task 2] presents calculations that are based on educated guesses.

[25] Schischke K. et al.: Energy-Using Product Group Analysis - Lot 5 - Machine tools and related machinery - Executive Summary – Final Version, Fraunhofer IZM, August 2012 – http://www.ecomachinetools.eu/typo/reports.html

B.2 Calculation of the periods of use

The periods of use can be calculated as presented below.

Type of Machine tool			Depreciation period [years]	Average [years]	Market share (EU) [%]	Weighted Period of use (EU) [years]	Period of Use (Prep. Study) Task 2, pp 30 [years]	Average (Prep Study) [years]	Weighted Period of Use (Prep Study x Market Share EU) [years]
Machine Tools	**Metal Cutting**								
Turning Machines / Turning Centres				7	13,4	0,938		15,25	2,0435
Turning Machines	Horizontal								
		CNC / NC	6				12		
		without CNC / NC	8				18		
Turning Machines	Vertical								
		CNC / NC	6				12		
		without CNC / NC	8				19		
Drilling and Boring Machines				7,5	3,4	0,255		17	0,578
		CNC / NC	7				16		
		without CNC / NC	8				18		
Milling Machines				7,5	6,6	0,495		16	1,056
		CNC / NC	7				14		
		without CNC / NC	8				18		
Planing, Shaping, Slotting and Broaching Machines							18		
Sawing and Cutting Off Machines					2,5	0		18	0,45
		CNC / NC	6						
		without CNC / NC	9				18		
Grinding Machines				7	8,9	0,623		13,4	1,1926
	Surface	CNC / NC	6				12		
	Cylindrical	CNC / NC	6				12		
	Tool	CNC / NC	6				11		
		without CNC / NC	9				18		
Honing, Finishing, Lapping and Polishing Machines			8				14		
Gear Cutting Machines, Gear Finishing Machines			9	9	3,3	0,297	12	12	0,396
Machining Centres		CNC / NC		6,5	18,2	1,183		12	2,184
	horizontal		6				12		
	vertical		6				12		
Flexible Manufacturing Systems			8						
Transfer Lines			6				12		
Special Purpose Cutting Machines, highly customized or workpiece specific constructions			8	1	1,1	0,011			0
Separating Machine Tools for Metal Working				7,6	6,6	0,5016		15	0,99
Shears									
		CNC / NC	8				13		
		without CNC / NC	10				18		
Punching and Nibbling Machines									
		CNC / NC combined with Lasers	6						
		CNC / NC without Lasers	8				13		
Punching Centres			6						
		with CNC					13		
		without CNC					18		
Metal Forming Machine Tools									
Presses				7,5	6,9	0,5175		19,5	1,3455
	mechanical						20		
	Open Gap		9				20		
	H-Frame		9				20		
Hydraulic Presses		CNC / NC					18		
	Open Gap		6						
	H-Frame		6						

Type of Machine tool		Depreciation period [years]	Average [years]	Market share (EU) [%]	Weighted Period of use (EU) [years]	Period of Use (Prep. Study) Task 2, pp 30 [years]	Average (Prep Study) [years]	Weighted Period of Use (Prep Study x Market Share EU) [years]
Transfer Presses	CNC / NC	6	6		0			0
Bending and Straightening Machines			9,5	10,9	1,0355		15	1,635
	CNC / NC	8				12		
	without CNC / NC	11				18		
Forging Machines and Forging Hammers			9,5	2,2	0,209	18	18	0,396
	CNC / NC	8						
	without CNC / NC	11						
	Rolling Mills							
	CNC / NC	8						
	without CNC / NC	10						
Drawing Machines								
	CNC / NC	8						
	without CNC / NC	11						
Wire Manufacturing Machines			7,5	1,8	0,135	15	15	0,27
	CNC / NC	6						
	without CNC / NC	9						
Special Purpose Forming Machines, highly customized or workpiece-specific constructions		6	6	4,9	0,294	15	15	0,735
Ohter Manufacturing Machines								
Electrical Discharge Machines (EDM)		8	8	2	0,16	14	14	0,28
Laser Technology	CNC / NC		5	2,2	0,11	12	12	0,264
Laser Cutting Machines and Centres		5						
Laser Marking Systems		5						
Laser Systems for Welding		5						
Laser Systems for Hardening		5						
	CNC / NC	6						
	without CNC / NC	8						
			Sums	94,9	6,7646			13,8156

As can be taken from the table, the nominal weighted period of use is calculated to be 6,7 years according to CECIMO considerations. Now the “real average use time” (RAUT) needs to be calculated.

NPFD EU-28 (2012)	6,7646 years		Weighted Period of Use, EU-28 (2012)					
	Now, those are the nominal, weighted periods of use according to fiscal depreciation (NPFD)							
	Assumption 1 is based on the careful consideration that (at least in Germany)							
	40% of all MT are used in automobile industry							
	Automobile industry changes MT's with new generation of car modell what is about 7 years							
	Assumption 1	40%	use their machine as long as the NPFD (real use time RUT = NPFD)					
		30%	use their machine 1,5 x NPFD (RUT = 1,5 x NPFD)					
		30%	use their machine 2,0 x NPFD (RUT = 2,0 x NPFD)					
		=> real averaged use time RAUT = SUM,i (NPFD,i * RUT,i * Percentage,i)						
	NPFD * Factor	NPFD * Factc	NPFD * Factor					
	1	1,5	2	RAUT [yrs]				
RAUT EU-28 (2012)	6,76	10,15	13,53	**9,81**				
	Now, compare this to the average use time from the prep study.			13,82				

As can be seen, the RAUT of the CECIMO scenario is more conservative (faster change of MT stock) than the assumption taken from the Lot 5 Preparatory Study.

B.3 Calculation of the expected increase of energy efficiency

Last, but not least, the expected energy efficiency increase per year can be calculated:

	Assumption 2	The possible improvement of energy efficiency is						
		20%	from one machine generation to the next					
			for the actual generation.					
							Improvement	Weighted Improvement
	Assumption 3	33%	of the machines reach	100%	of max. improvement		20%	7%
		33%	of the machines reach	60%	of max. improvement		12%	4%
		33%	of the machines reach	30%	of max. improvement		6%	2%
						Average Improvement for 1 machine generation		13%
	Average EE increase per yr = Average Improvement / RAUT							
Average EE increase, EU-28 (2012)	1,28%	per year						
	Numbers from the prep study.							
	Average use	13,82	years					
	Improvement	32%	max.					
	Application of Assumption 3:							
							Improvement	Weighted Improvement
		33%	of the machines reach	100%	of max. improvement		32%	11%
		33%	of the machines reach	60%	of max. improvement		19%	6%
		33%	of the machines reach	30%	of max. improvement		10%	3%
						Average Improvement for 1 machine generation		20%
Average EE Increase Prep Study	1,45%	per year						
	Assumption 4	The possible improvement of energy efficiency for the next generation is						
		10%	(after the first generation has reached max. improvement of 20%)					
							Improvement	Weighted Improvement
		33%	of the machines reach	100%	of max. improvement		10%	3%
		33%	of the machines reach	60%	of max. improvement		6%	2%
		33%	of the machines reach	30%	of max. improvement		3%	1%
						Average Improvement for 2nd machine generation		6%
	Average Energy Saving per yr = Average Improvement / RAUT							
Average EE increase, 2nd generation EU	0,64%	per year						

So, the expected energy efficiency increase of the CECIMO scenario is at 1,2 % per year for the first generation with improved EE.

For a second generation, the added maximum increase of EE is considered to be 10%. Hence, the added average EE increase is 0,64% per year. This lower increase is due to the fact that after the first generation of SRM regulated products, all “low hanging fruits” will have been harvested. The first wave of high energy efficiency increase will be followed by a second wave with less potential and slower improvement.

It needs to be noted that the EE increase taken from the preparatory study does not distinguish levels of realization between different MT generations, but gives just a total figure of a maximum possible

EE increase without specifying over which time it can be reached. The referenced 32%[26] present an absolute, optimistic maximum while the CECIMO scenario, adding up to 19% EE increase after two machine generations are considered realistic by the sector. It is also in line with other considerations of the Preparatory Study[27].

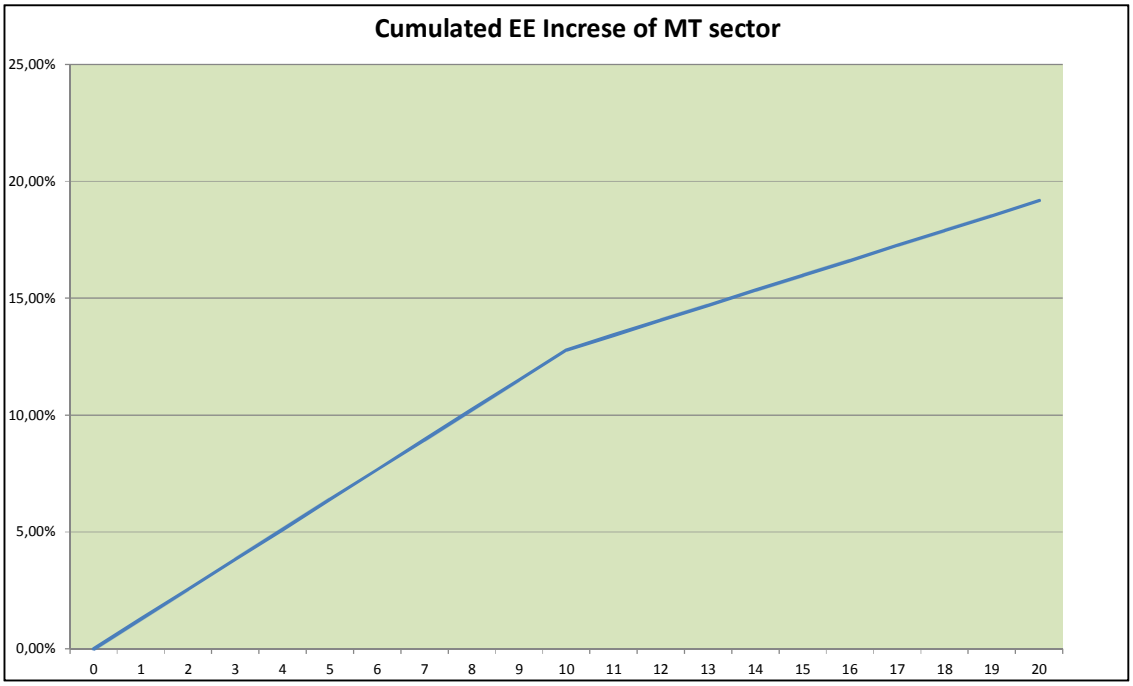

Figure 10: Cumulated EE increase of MT sector after initiation of the SRM

[26] Schischke K. et al.: Energy-Using Product Group Analysis – Lot 5 – Machine tools and related machinery – Final Version, Fraunhofer IZM, August 2012 – Task 6, p. 8, Table 6-1

[27] Schischke K. et al.: Energy-Using Product Group Analysis – Lot 5 – Machine tools and related machinery – Final Version, Fraunhofer IZM, August 2012 – Task 7, p. 51, Table 7-10

Appendix C – Self Assessment of Energy Efficiency

In order to support the signatories in the process of self-assessment of their products, an Excel based tool has been developed. It guarantees utmost transparency of the process and provides exact definition of the data requested to provide for the analysis as well for reporting to the SRM Administration.

While the list of applicable measures needs to be kept as flexible as possible, the SRM Administration will continuously monitor the development of measures and EE claims. If necessary, it will provide more precise instructions on how to handle the tool.

C.1 Functional unit definition

The downstream effort depends greatly on a sensible definition of the FU, therefore its definition is fundamental. Some examples of functional units are shown in Figure 7.

Functional Units Definitions

Please state, if the named functional units are available

Name	Available	Energy source	
Part Handling	no		✗
Part Clamping	yes	hydraulic	✓
Tool Handling	yes	electric	✓
Tool Clamping	yes	hydraulic	✓
Mist collector	no	electric	✗
Low pressure lubricant supply and filtering	yes	electric	✓
High pressure lubricant supply and filtering	no	electric	✗
Main machining function	yes	electric	✓
Main machining function cooling	no	electric	✗
Machine cooling	yes	electric	✓

Figure 11: Functional Units selection and/or determination (spreadsheet screenshot)

Case studies, standards or lists with proposals can facilitate this step. The quantification of time shares, based on a use scenario, and the following determination of the energy rating are supported by the spreadsheet application.

C.2 Time shares

The various MT states must be defined and the respective time shares must be quantified.

Time share of operational states

	TOTAL	Off	Ready	Processing	Source
Fraction of time	✓ 100%	33%	40%	27%	calculation

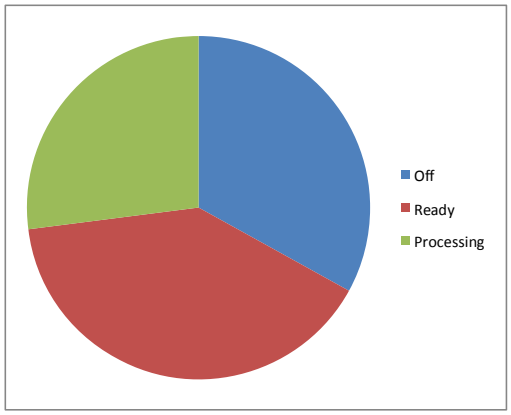

Figure 12: Time shares example (spreadsheet screenshot)

C.3 Energy rating

Energy rating is the annual energy supply to the machine tool, for a defined use scenario, i. e. time shares and respective average power levels.

Average consumption during operational states

	TOTAL	RELATIVE	Off	Ready	Processing	Source
Part Clamping	2'935 kWh/a	7%	0.0 kW	0.5 kW	0.5 kW	measurement
Tool Handling	2'935 kWh/a	7%	0.0 kW	0.5 kW	0.5 kW	measurement
Tool Clamping	2'935 kWh/a	7%	0.0 kW	0.5 kW	0.5 kW	measurement
Low pressure lubricant supply and filtering	1'533 kWh/a	4%	0.0 kW	0.1 kW	0.5 kW	measurement
Main machining function	4'249 kWh/a	11%	0.0 kW	0.2 kW	1.5 kW	measurement
Machine cooling	5'869 kWh/a	15%	0.0 kW	1.0 kW	1.0 kW	measurement
Axis drives	3'066 kWh/a	8%	0.0 kW	0.2 kW	1.0 kW	measurement
Pneumatic supply unit	2'935 kWh/a	7%	0.0 kW	0.5 kW	0.5 kW	measurement
Pneumatics: Seal air functions	6'715 kWh/a	17%	0.8 kW	0.8 kW	0.8 kW	measurement

Figure 13: Calculation of energy rating based on average power levels (spreadsheet screenshot)

C.4 Measures and functional unit claims

Improvements are caused by measures, with an impact on functional units depending on the affected states.

Impact of measures on FUs

Measure	Type	Affected states	Description	Affected FUs	Improvement [%]
IE3 Motors	standard	all	Use of IE3 Motors in all componentes	Main machining function	1%
Freq. Controlled pump	self declared	ready, process	Installation of a FC motor, measurement taken for validation	Low pressure lubricant supply and filtering	20%
Reduction of sealing air	self declared	all	Optimization of sealing air flow, machine specific	Pneumatics: Seal air functions	10%
Automatic shut off	standard	ready	Automatic shutoff after certain time	all	15%
Faster Process	self declared	process	Efficient process design and operation. Leads to time reductions	all	3%
Process gas optimization	self declared	process		Process gas	2%

Figure 14: Example for impact of measures on FUs depending on states (spreadsheet screenshot)

C.5 MT product claim and improvement impact

The MT product claim results from the above calculation method. The MT improvement impact depends furthermore on the MT energy rating.

Results

MT Product Claim

		FUClaim		FUShare		WeightedClaim		MT Prod. Claim
1	Part Clamping	10.2%		7.3%		0.7%		
2	Tool Handling	10.2%		7.3%		0.7%		
3	Tool Clamping	10.2%		7.3%		0.7%		
4	Low pressure lubricant supply and filtering	25.7%		3.8%		1.0%		
5	Main machining function	6.0%		10.6%		0.6%		
6	Machine cooling	10.2%		14.6%		1.5%		
7	Axis drives	5.7%	x	7.6%	=	0.4%	→Σ=	
8	Pneumatic supply unit	10.2%		7.3%		0.7%		
9	Pneumatics: Seal air functions	16.7%		16.7%		2.8%		
10	Electrical cabinet cooling	10.2%		7.3%		0.7%		
11	Control unit / User Interface	10.2%		7.3%		0.7%		11%
12	Process gas	5.0%		2.9%		0.1%		
13								

MT improvement impact

	MT Product Claim		MT energy rating		MT impr. Impact
MT improvment impact	11%	x	40'222 kWh/a	=	4'389 kWh/a

Figure 15: Sample calculation of MT Product Claim and Improvement Impact with arbitrary values (spreadsheet screenshot)