WHAT PUBLIC POLICIES TO PROMOTE ECONOMIES OF RAW MATERIALS?

Benchmark of public policies to promote economies of raw materials and transposition study in France

Executive Summary
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Quote


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Executive Summary
1 Background

Circular economy is defined as an economy where the value of products, materials and resources is maintained in the economy as long as possible and waste generation is minimized (European Commission, 2015). The concept of circular economy defines a framework within which a material now considered as waste can reintegrate the economic cycle as a resource. This concept recognizes the constraints of access to natural resources and provides an approach to address them and move towards a more economically, socially and environmentally sustainable world.

The current economic system can be described as "linear": natural resources are extracted and used to create products that are then consumed and disposed of. The products used are considered "waste" even though they contain or constitute valuable resources. Our planet is a finite natural resource system in which a linear perspective would eventually reach its limits.

So far, economic growth across countries has been based on the extraction of natural resources (land, mining, fossil fuels, water, etc.). However, it appears that this economic model, global population growth and current patterns of consumption will eventually lead to the depletion of these natural resources. The limits of this model are defined by the amount of resources that we can extract and the amount of "waste" that we can discharge. Moreover, the dependence of modern economies on fossil resources intensifies climate change phenomena. According to ADEME (n. d.), the circular economy is a paradigm shift away from linear economics, with a focus on actions to limit wasteful use of resources and associated environmental impacts, and actions to increase efficiency at all stages of the goods and services production.

The efficiency of resource use, or "material sobriety", is intended to thwart this dependence on the intensive extraction of natural resources. Initiatives encourage material savings at several levels of economic activity. In the context of manufacturing industry and primary transformation, and construction works, they target:

- The final product (product eco-design, packaging optimization, elimination of the use of toxic substances to facilitate reuse processes, design favourable to repair, design strategies to stimulate new consumption patterns...);
- Production processes (purchase of raw material inputs, reduction of waste, reuse of heat, standard exchange practices, etc.);
- The company management system (training staff in environmental practices...). This involves much more than recycling, as far as possible, the materials contained in the products at the end of their use phase.

From an economic point of view, material sobriety allows a reduction in the quantity of materials needed, and therefore a reduction in the risks associated with the volatility of raw material prices and supply instability. The saving of materials also helps to reduce negative externalities related to the environment, as resources will have a longer presence in the economy and less primary resources will be extracted. In addition, there is increased potential for innovation - comparable to what is currently being observed in the renewable energy production and bio-economy sectors - as well as potential for economic growth and job creation.
Box 1 Material efficiency definition

Efficiency is a central concept, which should be explained as far as possible. The material efficiency of a process \( i \) is noted: \( \text{Efficiency}_i = \frac{\text{Production value}_i}{\text{Quantity of material input}_i} \). It is measured in monetary units (euros/tonnes). This is an ordinal criterion (i.e., it allows to classify different options): the material efficiency criterion allows to identify the method or technique that allows the greatest value creation, with a fixed quantity of materials.

Three particularities and limitations of this definition are to be highlighted:

1. Material efficiency is defined at the micro level of the production process and not at the aggregate level;
2. Material efficiency is defined at the level of the process of value production (i.e., increasing the added value by quantity of input material) and not physical service production. Concrete levers for improving efficiency, on the other hand, are found in the production of physical services (i.e., producing a particular component with fewer materials);
3. Only the quantity of incoming material is taken into account, and not its origin (which excludes circularity considerations).

Due to these three limitations, the material efficiency criterion should be handled with caution. An increase in material efficiency can be concomitant with an increase in material consumption, if the decoupling between production and material consumption is insufficient. Similarly, a lower material efficiency in terms of value production can be coupled with an overall decrease in material consumption with a better circularity of raw and secondary materials.

There are many possibilities for saving material. Thus, by its very nature, the systems implemented in France and abroad can also contribute to material savings within economic activities. To promote the economy of materials, government responses are diverse: regulatory, financial, informative and promotional. Systems and policies to promote resource savings at European level operate in different sectors:

- Environment, energy and sustainable development;
- Energy efficiency and renewable energy;
- Raw materials;
- Waste prevention and management;
- etc.

In addition, EU institutions and international organisations such as the United Nations (different agencies such as UN-Environment and UNIDO), OECD and the G7 have developed a number of strategies, policies, platforms and initiatives that fully or partially address the issue of resource efficiency. While EU policies are directly applicable in France, this is not the case for policies and initiatives developed and promoted by other organisations. The country has the choice of participating more or less actively in these initiatives.

2 Lessons learned from the analysis of international experiences

The study identifies 48 measures of material efficiency in eight target countries (Germany, the United Kingdom, the Netherlands, Canada, Japan, South Korea, France, and the United States). The objective is twofold: (i) to
understand the structure and conditions of a national material efficiency policy; (ii) to describe the operational measures that could be transposed in France.

**Box 2 Impact quantification**

In order to carry out an in-depth analysis of international measures, three impact dimensions are taken into account:

- Economic impacts (mainly competitiveness gains for firms with more efficient use of resources)
- Environmental impacts (difference in the production of waste - solid, liquid or gaseous - non-reusable from the initial situation)
- Impacts in terms of material consumption (materials saved as a result of the application of the measure, compared to the initial situation).

In order to assess these impacts, the study refers to reports produced by the lead institutions and information gathered during the various interviews. Unfortunately, for many measures, the impact quantification exercise was not carried out. Thus, the impact measures provided in the rest of the synthesis should be taken with caution, since they are derived from extrapolating the impacts of a small number of measures studied.

**What national guidelines for material efficiency?**

With the exception of Germany, the countries studied do not have a specific material efficiency policy. Nevertheless, some countries have concrete material efficiency objectives. Germany aims to double material productivity between 1994 and 2020. France has a similar objective to improve the ratio between GDP and domestic consumption of materials by 30%. Other countries have waste reduction targets that are indirectly linked to material efficiency targets. All the countries studied use Domestic Material Consumption (DMC) and Material Productivity (PIB/DMC) as the main indicators.

The main drivers of the rational use of materials and resources vary according to the national context. In Germany, environmental concerns are dominant, followed by economic considerations such as independence from raw materials and competitiveness. The main drivers in France and the United Kingdom are very similar to those in Germany. In the Netherlands, because of the long tradition of voluntary agreements, industry self-organization is an important factor. The efficiency of resources and materials is already placed in the context of the circular economy. In the United Kingdom, the fight against climate change is also highlighted as a driving force.

Japan is a country that follows international trends in resource and material efficiency. The debate on energy efficiency has been on the agenda for many years, while material efficiency has recently been the focus of attention. In South Korea, the focus on material efficiency has increased considerably in the context of intensive industrial growth. The small size of the country leads to a situation where waste reduction is the overriding objective, i.e. efforts to improve the efficiency of materials.

In Canada, material efficiency achievements are primarily based on policies in other areas such as the environment, clean energy, energy efficiency, climate change and are not the result of specific policy objectives.

Since there is no national material efficiency policy in the United States, resource efficiency is primarily addressed through programs to conserve natural resources more generally. Advances in material efficiency in the United States are therefore driven by other policies or initiatives such as waste management, clean fuel development, energy efficiency improvements, electronic management policies, etc., that are linked to the environment.
Some of the obstacles to greater material efficiency are common to all countries:

- Lack of internal knowledge and resources within companies;
- Lack of information and behavioural awareness;
- Lack of knowledge about waste streams;
- Vague objectives;
- Lack of a comprehensive strategic approach.

In order to remove the obstacles identified, the European Commission, through DG GROW, has launched a broad policy initiative: the European Centre of Excellence for the Efficient Use of Resources (EREK). EREK’s mission is to become a reference point for companies and intermediaries on leading practices in resource efficiency and thus to raise awareness among SMEs of the potential economies that lie in the transition to more resource-efficient business models. EREK has the following services:

- A self-assessment tool for SMEs, covering the following sectors: Office and Administration, Chemistry and Process Engineering, Construction, Agri-Food, Hotel and Restaurant, Machinery and Equipment Manufacturing, Metal and Plastics Processing, Textile and Clothing, Wood and Carpentry, Waste Management and Recycling, Wholesale and Retail Trade;
- A database of resource efficiency measures, good practices (i.e. real-world case studies) and technologies covering all the above-mentioned sectors and more; the database provides information on investment costs, cost savings and recovery time of these measures; the resources covered are water, energy, waste, raw materials and carbon;
- A database of programmes supporting the efficient use of resources for SMEs in the European Union and in the countries participating in COSME (i.e. the support programmes and financial measures available in each of these countries);
- A network of SME intermediaries (i.e. business support organisations that provide resource efficiency services);
- A collaborative website presenting all the above services and allowing interaction between network members.

The EREK network of resource efficiency business support providers links practitioners and experts at regional, national and international levels. A number of services on leading edge resource efficiency practices and policies are available through the network, including webinars, capacity-building and training workshops, and quarterly reports. The EREK network is actively promoting the tools developed by EREK’s resource efficiency experts for adoption by SMEs.

**What characteristics for operational measures?**

There are a relatively small number of measures that specifically address material efficiency. In general, measures are aimed at reducing environmental impacts, with the secondary effect of including material efficiency.

The measures selected are mainly national, less than 15% regional and only a few local. The vast majority of measures are either cross-sectional or targeted at industry: very few measures are specific to construction and only one - to handicrafts. Generally speaking, a majority of measures concern industry or economic sectors in general. Toolkits, technical measures and mixed measures account for more than half of the measures identified. Regulatory, financial and voluntary measures are also well represented. Very few fiscal, economic and
institutional measures have been identified. Detailed factsheets on the measures are available in the annex to the full report.

In a transversal way, the following lessons inform the reflection on the implementation of material efficiency measures in France.

**Substitution of material efficiency for resource efficiency in the broadest sense**

There is a possible conflict between material efficiency in the literal sense and other objectives concerning the use of material (recyclability, use of renewable raw materials), the circularity of resources or the use of energy. Making a lighter metal alloy can lead to alloy complexity and negatively affect its recyclability. Similarly, the concept of Industrial Symbiosis (IS), which aims to reuse waste in an industrial loop, can be opposed to the material efficiency of a particular industrial process. At the macro level, there is also a potential conflict between energy transition and material efficiency: non-reusable materials are used in the design of ENR plants.

With regard to IS, it is important to aim for an increase in the efficiency of the use of materials in processes generating non-reusable waste, which cannot be integrated into local value chains. It is fundamental to distinguish the systemic material efficiency from the individual material efficiency of each company. The ultimate objective of optimising material flows in the economic activity can be achieved by means other than material efficiency in company-wide industrial processes.

In this respect, the "material efficiency in industrial processes" approach should be abandoned in favour of a global approach to resource efficiency, in order to simplify strategic coordination and communication with companies. This is the international approach. Resource efficiency is defined in this way:

> Resource efficiency means using the Earth’s limited resources sustainably: metals, minerals, fuels, water, land, wood, fertile soils, clean air and biodiversity. Improving the efficiency of resources is essential to ensure growth and employment in Europe. It opens up great economic opportunities, reduces costs and strengthens competitiveness. To do this, we need to find new paths along the entire value chain: improving resource inventory management, reducing inputs, optimizing production processes, management and business methods, improving logistics, changing consumption patterns and minimizing waste.

*(European Commission, 2016)*

Thus, in order to pursue coherent policies, it is necessary to make ex-ante trade-offs between the various issues (energy transition, material efficiency, energy efficiency, etc.) when conflicts are identified. Thus, the subsumption of material efficiency in the notion of resource efficiency allows for the identification of trade-offs on a case-by-case basis. This approach of taking into account resources, materials or energy in a global way is found in the most advanced countries on the subject of material efficiency. ADEME has these skills but suffers from a lack of coordination between its various departments on this "resource efficiency" approach in the broad sense. Nevertheless, ADEME has shown, via the support programmes already carried out (e.g.: « TPE & PME gagnantes sur tous les coûts », « €Entreprises témoin : Energie et matières : gaspillage évité = marge augmentée »), its capacity to superimpose the economic, energy and material consumption stakes. The aim is to translate losses (or inefficiencies) in energy and material flows directly into economic losses in order to activate economic leverage to facilitate adoption by businesses.

**Identify areas for improvement**

The efficiency of resources is a concept with blurred contours and a concrete definition varying according to the actors. Trivial from an economic point of view when it proposes to produce more value with less material, resource efficiency (and material efficiency in particular) is sometimes a difficult principle to apply because it requires a systemic approach to the production process. On the other hand, because of its centrality in the
production process, companies feel that they have been addressing the subject of material efficiency for a long time, and do not perceive the potential scope for improvement.

There are two paradigmatic, non-exclusive explanations for the (non)apparent consideration of the issue of material efficiency by companies:

- The potential benefits (e.g. linked to lower material consumption) are offset by other costs (organizational, training, opportunity, etc.) that are difficult to quantify a priori. Thus, the inefficient use of materials can be rationalized by postulating the existence of economic barriers that make this choice rational. The challenge is then to make the investment in material efficiency more profitable (through faster-depreciation, subsidy for training, etc.);
- Companies are not very aware of material efficiency criteria and do not know the tools. The inefficient use of materials is then the consequence of an information deficit, which should be filled (easily accessible toolbox, institutional communication).

Empirically, the measures with the greatest impact are those that define inefficient use of resources as a private (over)cost. Thus emerges an axis of competitiveness that companies can improve, the role of the State being to support them in identifying and resolving technical barriers.

**Lack of specific indicators for evaluation monitoring**

Companies’ apprehension of material efficiency is complicated, in the absence of dedicated micro indicators. The cost of raw materials is easily quantifiable by companies, but only partially reflects material efficiency (they also depend on the market price of these materials, taxes, waste collection and treatment costs, etc.).

**Box 3 Resource consumption indicators**

Since 2011, Eurostat has been developing resource productivity indicators. The main ones are:

- Domestic Extraction Used (DEU): all mineral and fossil materials, biomass and fishery resources extracted on the national territory;
- The apparent resource requirement of the economy (Direct Material Input, DMI): all resources entering into economic processes (including resource imports);
- Raw Material Input (RMI): DMI expressed in units of raw materials;
- Total Material Requirement (TMR): total resource requirement for the economy, taking into account imported processed material and unused material.

Each indicator has its counterpart in terms of consumption (Domestic Material Consumption or DMC, Raw Material Consumption, Total Material Consumption) obtained by subtracting exports.

The only indicator available for all the countries studied is the "GDP/DCM" which reflects material efficiency at the national level (including, in addition to the material efficiency of industrial processes, recycling, IS, cyclical crises - particularly in the building industry, etc.). The GDP/DCM indicator is problematic in that it does not take into account longer product life (which is an improvement in material efficiency in terms of services rendered, but not in terms of economic value creation) or structural economic changes.

There is currently a lack of evaluation of the actions carried out (notably counterfactual evaluation). Indeed, monitoring and evaluation of material efficiency policies is only possible within a clear empirical framework. The development of material efficiency measurement methodologies should be continued. Proposition de transposition.
**General framework of material efficiency policy**

The success of an effective and efficient policy depends on the implementation and articulation of the various tools and actors that can be mobilised. Figure 1 presents a possibility of articulation between actors and instruments (detailed in the action sheets) for the implementation of a resource efficiency policy in France. It’s there:

- An institution dedicated to the coordination of actors and monitoring of actions to promote resource efficiency. In particular, it is responsible for the creation of a toolbox (or platform) that can be easily understood by economic players;
- A toolkit, based on the EREK model, including a self-assessment questionnaire to guide the company towards the most appropriate environmental technologies, audits and financing;
- A tax credit to support the acquisition of the above-mentioned environmental technologies and a tax on the consumption of raw materials. Both instruments are a strong economic incentive for companies to opt for resource-efficient production techniques;
- Emphasis on business awareness raising, through the organisation of national and local events, training sessions, etc. Communication is the essential element to enhance the value of all technical work carried out upstream.
Recommended public policy instruments

Technical institution dedicated to resource efficiency

A central institution dedicated to resource efficiency has the role of coordinating public policies related to water, energy and materials management. Material efficiency cannot be considered in isolation from the efficiency of other production inputs. The establishment of such an institution therefore presupposes that the strategy at national level on the use of resources is brought into line beforehand, and that trade-offs are made on prioritising resources in the event of conflicts of use (e.g. material vs. energy). This institution is in charge of establishing a link, today very tenuous in France, between all the actors of resource efficiency, including:

- The Ministry of Ecological and Solidarity Transition, in charge of defining the national policy;
- ADEME for expertise on energy efficiency, ecodesign, raw materials and waste management; water agencies for expertise on water management;
- The associative actors (Eco-design and eco-innovation clusters, OREE, etc.) for their expertise on the concrete implementation of resource efficiency by industrialists;
- Chambers of Commerce for their knowledge of local economic constraints and their capacity to disseminate information.

Generally speaking, the pooling of the actions of different actors (and notably within ADEME) involved in the management of resources responds to a need for better use of public money.

As part of its action within the national and European strategic framework, this institution manages, implements, evaluates and improves the tools to encourage resource efficiency in general, and material efficiency in particular. Its technical expertise enables it to influence the definition of production label criteria (especially the European Ecolabel) so that they integrate resource efficiency. Such an institution is intended to draw on expertise and experience that can already be mobilised (in the field of energy efficiency, ecodesign).

It enables knowledge transfer to companies to help them implement resource-efficient production methods. In this respect, the institution is the reference source of information for all stakeholders on the plans:

- **Techniques**, by centralizing and sorting the most efficient production techniques; legal, by allowing simplified access to legislation in force;
- **Economic**, highlighting the observed gains by taking into account material efficiency;
- **Taxation**, describing the various existing tax incentives;
- **Financial**, by listing sources of financing for projects leading to more efficient production;
- **Strategic**, explaining future developments in legislation, its objectives and effects.

Thanks to its central positioning and its link with the government's strategic orientations, the information communicated by the institution will be able to give long-term visibility to economic actors, which is necessary for the transformation of the productive apparatus.

Such a structure requires both human resources, in order to ensure coordination with all stakeholders, and financial resources, in order to support SMEs towards greater resource efficiency. The coordinating institution is responsible for allocating funding to carry out concrete actions for resource efficiency:

- **Scientific support**: socio-economic studies on the impacts of resource efficiency policies and industrial demonstrators of innovative technologies on resource use. The need expressed by economic actors is to have the assurance (or at least a strong conviction) that investing in processes...
that are efficient in terms of resource use is economically beneficial. Scientific support responds to this demand;

- Financing of tools: the institution is responsible for financing and coordinating the tools (grouped in the toolbox).

In the light of international examples (WRAP and the VDI Centre for resource's efficiency), the total budget of such an institution would vary between EUR 25 and 35 million (including the financing of tools), of which EUR 17 to 23 million would come from the reorganization of the internal departments of ADEME.

The impacts and benefits of the central institution dedicated to resource efficiency are structural in nature (i.e. they cannot be directly attributed to economic, environmental or material efficiency gains):

- Definition and integration of material efficiency issues into a national resource efficiency strategy and articulation with European policies;
- Dissemination and prioritization of technical information on resource efficiency issues;
- Raising awareness of SMEs and facilitating their access to resource efficiency tools;
- Communication on good practice;
- Evidence of economic gains related to resource efficiency.

The tools and other mechanisms developed and disseminated under the aegis of the institution have direct and concrete impacts on material effectiveness. These are detailed below.

For example, the overall policy for resource efficiency in Scotland, Resource Efficient Scotland, foresees that its actions will make it possible to avoid the consumption of 100,000 tons/year of resources over the period 2015-2018 (for a GDP representing about 10% of French GDP). This efficiency gain in the use of resources (excluding energy and recycling) corresponds to approximately 0.2% of the CMD in Scotland. Since Scotland is one of the most advanced countries in this field, this figure represents a high point of action based on the dissemination of information and support for businesses, without constraints or structural economic change (both in terms of consumption and production).

**Toolbox**

The toolbox is the key interactive element between SMEs and the central institution dedicated to resource efficiency. Fundamentally, it enables (i) awareness of potential gains in resource efficiency (including material) with a self-assessment tool; (ii) orientation of companies among possible tools and financing to improve their resource efficiency (including material) and (iii) an information platform on the general framework of material efficiency.

The toolkit consists of three tools:

- Self-assessment questionnaire to raise awareness of resource efficiency issues (Tool 1);
- Directory of technical solutions listing, by process, the best technologies according to their performance in terms of resource use and associated economic gains - if possible (Tool 2);
- Directory of funding and human resources available at national and regional level (with the support of DREALs and MTES) for the concrete implementation of an identified solution (Tool 3).

A fact sheet describing the technical solution will contain a number of elements, in particular:
• Descriptive information: description of the technical solution and related technologies;
• Resources: Indication of "resource flows" for which the technical solution is relevant, including materials, energy, water, waste and carbon;
• Profitability analysis: Brief description of the business case for companies to implement the technical solution;
• Key business transactions: List of relevant business transactions that the technical solution can support;
• Business size: relevance of technical solutions for companies of various sizes;
• Sectors: sectoral relevance of the technical solution;
• Key quantitative indicators: data on resource and cost savings, return on investment time;
• Good practice: links to concrete examples of how the described technical solution can be implemented;
• References and further information: references used in the description and other external sources relevant to the technical solution;
• Contact information: contact details of organisations and businesses that can provide support on the implementation of thematic measures.

If these tools are to be self-sufficient, grouping them together in a "toolbox" allows the following sequence of actions for the company:

1. Complete a self-assessment questionnaire (Tool 1) allowing automated identification of probable sources of material efficiency (e.g. industrial processes for which more efficient machines exist);
2. Assign a concrete technical solution, or an advanced way of thinking (via Tool 2);
3. Present an estimate of the economic and environmental gains resulting from the implementation of the technical solution envisaged (via the visualization allowed by Tool 2);
4. Gets orientated towards the financing tools enabling the operation to be carried out financially (through Tool 3);
5. Orientation towards training/advisors to take ownership of any changes (via Tool 3).

When going through this sequence of actions, the objective is to start from a concrete situation (industrial process currently in place in the company) to arrive at another concrete situation (new process that is more resource-efficient).

The major problem for the dissemination and effectiveness of this type of instrument is the lack of demand from companies. Today, in the opinion of the vast majority of European institutions, it is very low, particularly for SMEs, whose daily constraints take them away from this kind of consideration, wrongly having in mind the economic benefits. Thus, the toolkit is only relevant if and only if SMEs are willing to take an additional step towards resource efficiency. Dissemination of the toolkit is a critical strategic point. In this area, it would be highly desirable for Chambers of Commerce and professional organisations representing resource-intensive economic activities to include the Resource Efficiency Toolkit in the existing landscape of their business support activities.

A toolbox mainly generates fixed costs related to the development of the three tools. Based on the contract awarded by the European Commission for the development of the EREK toolkit, we estimate the fixed development costs at EUR 1 and 2 million over two years (benefiting from work already carried out internally or at European level). On the basis of the example "ENWORKS Toolkit", recurring annual costs amount to between
1 and 2 million euros. In addition, it is necessary to ensure technical dialogue at European level and to update the tools according to the innovations identified at national or international level. Tool 3 requires less work, as it can draw on the services of the MTES to populate the funding list. The toolbox could be operational within 18 to 24 months (including the communication dimension), based on the EREK example.

By informing and directing production methods towards a better efficiency of resources, the toolbox is the essential link in the material efficiency policy. The ENWORKS Online Resource Efficiency Toolkit Platform presents a quantitative assessment specifically addressing the use of a toolkit. The results are as follows: 10,600 affected enterprises (SMEs and large public enterprises) out of a total of 522,000 enterprises in the North West England region, representing 1.9% of the total; 43,500 actions carried out, covering the whole spectrum of resource efficiency; 500 million euros saved by companies that have carried out actions, i.e. an average of 11,500 euros per share; 3.5 megatonnes (Mt) of raw materials saved (including recycled material use); 1.2 Mtoe of energy saved; 9.3 Mt of water saved. In terms of cost-effectiveness calculation, 1 euro publicly invested in the ENWORKS platform saved 0.270 t of raw materials, 0.092 toe of energy and 0.717 t of water.

**Fiscal framework for resource efficiency**

The creation of a fiscal framework for resource efficiency aims to improve the relative cost-effectiveness of resource-efficient industrial processes.

Two types of tax incentives are possible:

- Additional depreciation for the acquisition of resource-efficient machines;
- Tax on consumption of raw materials (in addition to the carbon tax).

Like the additional depreciation for productive investments, the company can deduct from its taxable income a certain percentage of the cost of its industrial equipment (in addition to the usual depreciation). The subsidy has a spectrum that is limited to encouraging the renewal of the productive apparatus, and does not "reward" material efficiency actions that do not require new machinery. This type of additional depreciation exists in the Netherlands (MIA), with the exclusion of the tax base of 36% of the cost (40% in the case of over-amortisation for productive investment in France).

The tax improves the relative profitability of SMEs using more conservative techniques. As a structural measure, it can affect many more industrial sectors and types of material use than over-amortization. Any change that reduces material consumption is "rewarded". If it is well calibrated and coupled with better information on low-material techniques, a fee can also encourage a change of machines.

The additional depreciation allows to support SMEs that are taking steps to equip themselves with more efficient machines. This mechanism presupposes an ex ante evaluation of the material efficiency gains that can be achieved in order to identify its use. At European level, the BREFs (The Best Available Techniques Reference Documents) list the best available techniques for a number of sectors. The BREFs could serve as a basis for defining the scope of subsidies. In the Netherlands, the implementing body shall maintain a list of environmental technologies eligible for this measure. This list contains nearly 400 references and is available on the following page: https://www.rvo.nl/subsidies-regelingen/milieulijst-en-energielijst/huidig-jaar/2018. The document "MIA \Vamil Brochure en Milieulijst 2018 " (in Dutch) describes in depth the criteria used. This list must be constantly updated. In summary, in order to be eligible, machinery must:

- Present a clear environmental advantage;
- Be innovative or have a small market share in relation to alternatives;
- Cost more than the non-ecological alternative.

In France, additional depreciation could only be granted for technical solutions listed in the directory (Tool 2 of the toolbox).

The tax must be thought of as an incentive mechanism and has an impact on the competitiveness of enterprises, the objective being to promote the survival of the most efficient SMEs. Compensations can be put in place to
allow the emergence of a double dividend (i.e. benefits in terms of both material consumption and economic/competitiveness gains). On this subject, the CGDD report of November 2017 notes that according to its economic forecasting model, a tax on iron ore and bauxite offset by a reduction in social security contributions would have positive effects on employment and GDP. It should be noted, however, that this result is largely due to the assumption of good substitutability between primary and secondary materials in production processes. The effect of a tax lies not only in the rate and the raw materials included, but also in the use of the funds generated. The CGDD calls for a reduction in the tax burden on labour, but other options are possible: financing of over-amortisation, financing of the toolbox, etc. The CGDD calls for a reduction in taxes on labour.

### Table 1 Tax and additional depreciation comparison

<table>
<thead>
<tr>
<th>Positive points</th>
<th>Negative points</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Additional depreciation</strong></td>
<td></td>
</tr>
<tr>
<td>Political acceptability</td>
<td>Scope restricted to productive investments</td>
</tr>
<tr>
<td>Less risky investment for the company</td>
<td>Uncertain legal framework</td>
</tr>
<tr>
<td>Net gain for enterprises (short-term)</td>
<td>Discretionary mechanism for defining which machines are eligible</td>
</tr>
<tr>
<td></td>
<td>Net loss to the State (short-term)</td>
</tr>
<tr>
<td><strong>Tax</strong></td>
<td></td>
</tr>
<tr>
<td>Wide range</td>
<td>Political acceptability and resistance of professional organisations</td>
</tr>
<tr>
<td>No need for ex ante signposting which can be hazardous</td>
<td>Risk borne by the company if the investments induced do not improve its material efficiency</td>
</tr>
<tr>
<td>The explicit purpose of the tax is to reduce material consumption</td>
<td>Perceived as a loss by businesses</td>
</tr>
<tr>
<td>Market mechanism, which maximizes the mass of information used</td>
<td></td>
</tr>
<tr>
<td>Net gain for the State budget</td>
<td></td>
</tr>
</tbody>
</table>

In the Netherlands, EUR 40 million is dedicated to this budget item. As French GDP is more than 3 times higher than Dutch GDP and the share of industry is more than twice as low, a budget of around 60 million euros can be estimated in France (ceteris paribus). With an over-amortisation amounting to 30% of the price of the machines and assuming a reduction in the taxable base for income tax (with a 28 % rate), the public 60 million euros would generate, as a first approximation, the purchase for 650 million euros of more resource-efficient machines.

The quantitative impacts of a 20 EUR/t tax on iron ore and 12 EUR/t on bauxite were estimated by the abovementioned CGDD report. With an income from the tax recycled exclusively in the reduction of taxes related to labour, the results are as follows:

- 0.003% of GDP;
- 1,400 jobs created;
- 9% consumption of primary metals;
- 6% of recycled metal consumption.

**Secondary measures**

Secondary measures theoretically improve the effectiveness of so-called primary measures. The study identifies two: training on resource efficiency and voluntary agreements on resource efficiency.

The development of training courses on resource efficiency is a complementary measure to the mechanisms presented above (toolbox and tax incentives) and can be supported by the national institution dedicated to
resource efficiency. It is considered a secondary measure because of its dependence on the main measures presented above. Indeed, the demand for expertise on the use of material stems from (i) the awareness of economic gains linked to material efficiency (central institution) and the existence of a repertoire of solutions (toolbox) and/or (ii) a regulatory requirement or profitability materialized by a tax system.

The objective is twofold: (i) to "train the trainers" by means of training courses aimed at design offices or consultants specializing in material efficiency and (ii) to train new practitioners (engineers, company managers, etc.) in the stakes and tools of material efficiency. As a support measure, the assessment of its impacts is highly uncertain as it will depend on the functioning of the entire ecosystem. For the training of practitioners, the effect is immediate. Integrating resource efficiency tools into initial training has a longer-term effect.

Voluntary agreements are commitments involving several stakeholders (industrial, public actors, etc.) to remove regulatory constraints in order to achieve greater resource efficiency. The central institution in charge of resource efficiency policy may be responsible for coordinating such agreements within certain identified channels. However, the final content of these agreements depends on the constraints and goodwill of the actors concerned. Thus, it would be very uncertain to define a precise transposition in France. Nevertheless, international examples are inspiring.

In the United Kingdom, the Courtauld Commitment is an agreement to reduce household waste, packaging and waste generation in the supply chain. Supported by WRAP and covering 95% of the agri-food sector, it has enabled coordination between companies to reduce packaging and food waste and, ultimately, waste without losing national competitiveness. Since 2005, these measures have avoided the generation of 4 Mt of waste and 11 Mt of CO2 and have saved 6.5 billion euros.

In the Netherlands, Green Deal Circular Purchasing promotes the use of secondary materials, which are legally considered waste. Such an agreement is beneficial for the EIT as many potentially reusable materials are excluded from secondary circuits by regulation. These agreements have a limited impact and aim to compensate for a very precise failure.

Key elements of a resource efficiency policy

In the light of international examples as well as interviews with stakeholders, 6 elements make up a policy of resource efficiency (and material efficiency in particular):

- The coherence of the strategy at national level. The aim is to avoid the overlapping of sometimes contradictory obligations. The aim is to bring into coherence all the existing strategies at national level and dealing partially with material efficiency issues. In this respect, the German example is highlighted;

- The communication around the most resource-efficient techniques, gathered in toolboxes. The European initiative EREK (European Resource Efficiency Excellence Centre) led by DG GROW goes in this direction, and it is possible to build on this tool, which was put online in February 2018;

- The economic motivation for the implementation of these resource-efficient techniques, whether through incentives, such as the over-amortization of targeted investments (applied in the Netherlands), or punishments, for example through material taxation (under consideration by the CGDD);

- The adoption of a sensitizing discourse on an economic approach of accessible earnings for SMEs. Companies are more sensitive to economic than environmental arguments, and it is more efficient to demonstrate the financial impact of taking material efficiency into account. The Scottish case is interesting on this point. It should also be noted that ADEME coordinates resource efficiency programmes in this respect (small and medium-sized companies winning on all costs, control companies);

- The mobilization of the regulatory tool, whether for the definition and setting of the material efficiency framework, the implementation of quantified objectives (in France, the LTECV has
already set the guidelines) or the mobilization of specific tools (auditing material efficiency, similar to audits on energy efficiency). This last point is particularly underlined by the stakeholders of the council who wish to support the creation of a demand for expertise on material efficiency;

• Training in the principles of material efficiency, both in initial and continuing training: industrial ecodesign (which should become the dominant design principle) in engineering schools; MFCA methodology in business schools. The German approach is largely based on training in existing tools.
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