TOOL #59. METHODS TO ASSESS COSTS AND BENEFITS

Different methodological approaches can be used to estimate costs and benefits ex ante (within impact assessment work) or ex post (in retrospective evaluation/fitness check work). The most appropriate choice will depend on several factors including the nature of the initiative and the availability of data. The calculation of costs and benefits is an important element of impact assessments and evaluations which allows the merits of different policy options to be compared or the efficiency of existing interventions to be evaluated.\(^{706}\)

| Costs |

1. **HOW TO ASSESS COMPLIANCE COSTS**

Direct costs are those costs linked to the needs to divert resources to carry out the direct consequences of a regulatory option\(^ {707}\). **An important category of direct costs are the so-called compliance costs**, i.e. those costs incurred by businesses and other parties in undertaking the actions necessary to comply with the new regulatory requirements.\(^ {708}\)

Compliance costs are often the aggregate of all direct costs generated by legislation: over time, they have become the subject of specific assessment methods in various countries. However, it is often useful to analyse (and estimate) compliance costs on the basis of their individual components.

<table>
<thead>
<tr>
<th>Compliance cost components</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Charges</strong></td>
</tr>
<tr>
<td>Regulation often affects businesses and consumers by imposing the payment of fees, levies, or taxes on certain stakeholders. These costs are often easy to calculate, as their extent is by definition known. What is sometimes more difficult to assess is who will bear those costs, as this might depend on the extent to which these costs are passed-on to entities other than those targeted by the legal rule. For example, copyright levies might be passed-on downstream on end consumers in the form of higher prices for certain hardware devices.</td>
</tr>
</tbody>
</table>

| **Administrative costs** |
| That is the costs of complying with information obligations stemming from policy option under consideration. |

| **Substantive compliance costs** |
| These are the incremental (i.e. non-business as usual) costs to the target group of complying with regulation other than fees and administrative costs. |

\(^{706}\) See Tool #57 on *Analytical methods to compare options or assess performance*.

\(^{707}\) *Assessing the Costs and Benefits of Regulation; CEPS (2013)* a study prepared for the European Commission.

They can be one-off or recurrent and *can be broken down in further sub-categories*\(^{709}\):

<table>
<thead>
<tr>
<th>Category</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Implementation costs</strong></td>
<td>The costs regulated entities incur in familiarising themselves with new or amended regulatory compliance obligations, developing compliance strategies and allocating responsibilities for completing compliance-related tasks. In large part, therefore, they are short-term one-off costs.</td>
</tr>
<tr>
<td><strong>Direct labour costs</strong></td>
<td>The costs of staff time devoted to completing the activities required to achieve regulatory compliance. Only the costs of staff directly involved in undertaking these activities should be included: the costs of staff supervision/management are included in the overhead cost category (see below). Direct labour costs include two main elements the cost of wages paid non-wage labour costs.</td>
</tr>
<tr>
<td><strong>Overheads</strong></td>
<td>The costs of rent, office equipment, utilities and other inputs used by staff engaged in regulatory compliance activities, as well as corporate overheads, such as management inputs, that are attributable to compliance activities</td>
</tr>
<tr>
<td><strong>Equipment costs</strong></td>
<td>Those costs incurred by businesses whenever they need to purchase items of capital equipment to comply with a regulation. This can include both machinery (e.g. equipment to treat the emissions from a production facility to conform to new emissions standards) and software (e.g. programs required to undertake real-time monitoring of actual emissions).</td>
</tr>
<tr>
<td><strong>Material costs</strong></td>
<td>The incremental costs incurred in changing some of the material inputs used in the production process in order to ensure regulatory compliance (thus, they are sometimes called “input costs”). They are therefore ongoing costs.</td>
</tr>
<tr>
<td><strong>Cost of external services</strong></td>
<td>The cash cost of payments made to external suppliers providing assistance in achieving regulatory compliance. For example, faced with more stringent emissions controls, a firm may hire consulting engineers to advise on the available means of reaching compliance and their relative costs and benefits.</td>
</tr>
</tbody>
</table>

An alternative, more aggregate, subdivision of compliance costs would differentiate among capital / fixed costs (CAPEX), operating and maintenance costs (OPEX) and financial costs\(^{710}\).

Generally speaking, *different methodological approaches can be used to estimate different types of compliance costs*. All have limits. *You should pick the one that is most appropriate, given:*

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\(^{709}\) The categorization proposed in the OECD Regulatory Compliance Cost Assessment Guidance is presented below.

- The expected magnitude of compliance costs: the higher the expected cost or the more the scope of the analysis to yield different outcomes in terms of comparison of options, the more resources should be invested in estimating compliance costs.

- The availability of data: the greater the availability of data, the more compliance costs should be quantitatively estimated.

- The nature of the initiative: when compliance can be broken down to a relative precise set of activities to be carried out, compliance costs can more easily be estimated adding up the various costs of these activities for a typical party. Conversely, the more qualitative or a top down, rather than a bottom up, estimating approach may be more appropriate in the case of complex policy proposals, where the range of starting positions across regulated entities is wide and/or there are potentially numerous different ways to achieve compliance.

When making methodological choices, you will frequently have to accept compromises, focussing on major cost drivers and relying on simplifying assumptions (extrapolating data from some economic actors or member states to others etc.). You should, however, always start by aiming, as far as possible, for a comprehensive and precise estimation and be ready to justify transparently all key methodological choices. Perhaps more importantly, you should always flag the limitations of any estimated result and take them into due account when using the results to compare options. When appropriate, you should subject your results to sensitivity analysis.\footnote{See Tool #57 on Analytical methods to compare options or assess performance.}

### Methods to estimate compliance cost components

CEPS (2013) and OECD (2013) both provide useful references to existing methods which extend the standard cost model from administrative cost to compliance costs more generally. The following provides a short summary.

#### Charges

(1) Estimate the population of stakeholders that will have to comply with the obligation to pay charges.

(2) Estimate the frequency of the payment (1 = once a year; 2 = twice a year; 0.5 = once every two years, etc.).

(3) Estimate the unit cost (cost of the fee, license, and permit).

(4) Multiply the three parameters.

For example, if you expect that 2,500 enterprises will have to pay a licence fee of €500 twice a year, your total on a yearly basis will be (2,500 x 500 x 2) = €2.5 million.

#### Administrative costs

See later section on the Standard Cost Model

#### Substantive compliance costs

(1) **Identify substantive duties (SDs)**

These are all the activities necessary to comply but for those linked to the provision of
information (dealt with above). Please distinguish between one-off and recurrent duties.

| (2) | Estimate the population of stakeholders that have to comply with each SDs for each of the alternative options. |
| (3) | Estimate the mode of compliance with each SD by a “normally efficient business”, an “ordinary citizen” or a “normally efficient administration”. |

This might change depending on the regulatory alternative at hand, and will certainly change according to the different segment of the population you have identified. The concept of “normal efficiency” is needed in order not to factor into the analysis the inefficiency of some of the targeted companies: in order to assess ex ante how long it would take for businesses to comply. This means that you will have to assess the “reasonable” amount of time that it will take for businesses or citizens to comply with the obligations stemming from legal rules: this implies the assumption that regulated entities handle their administrative and substantive tasks neither better nor worse than may be reasonably expected.

| (1) | Estimate the “BAU” factor for each SD and each of the alternatives, based on direct assessment or empirical data. |

The business-as-usual (BAU) factor is often obtained by consulting targeted stakeholders or experts: its estimation is often the result of assumptions as regards the share of costs that would not be avoided if the legislative measure containing the obligation were repealed. In some cases, the BAU factor can be estimated directly by looking at the share of costs associated with a substantive obligation that are borne by similar entities that are not targeted by specific legislative provisions: when this is the case, you can observe the level of compliance costs for the “regulated” entities and the “unregulated” ones, and take the difference as the relevant portion of compliance costs to be considered in your estimate. You should be aware of the fact that the BAU factor might differ depending on the territory and the segments of the population you have identified.

| (1) | Consider segmenting the population by creating “case groups” differentiated according to size (micro, small, medium, large enterprises) or other dimensions (level of government for public administrations, availability of Internet connection for citizens, etc.). |

If different case groups can be established, you might consider adopting different notions of “normal efficiency” and BAU for each of the groups.

| (2) | Estimate the compliance cost associated with each SD for each segment and each alternative. |

Useful guidance on this can be found in chapter 3 of the OECD (2013)

| (3) | Assess whether compliance costs are likely to change over the life of the proposed legislation. |

In particular, you should assess whether, as a result of entry/exit of businesses, technological innovation, “learning by doing” or any other relevant factor, the impact of the costs identified is likely to change over time. For example, assume your analysis today leads to establishing two case groups depending on whether a SD is complied with through a digital solution (20% of the population) or through a more traditional solution (80%). The percentage of businesses that rely on the digital solutions is likely to change over time, such that the percentages in 5 years from now might even be reversed. This should be taken into account in a prospective analysis or regulatory costs,
and – if possible – coupled with sensitivity analysis on the assumptions behind the evolution of costs over time.

\[\text{(1) Sum up and extrapolate all compliance costs to reach a total estimate for each of the alternative options considered.}\]

The accuracy of these methods depends significantly on the extent to which resources are devoted to data collection. **Without significant data availability, results can only considered broadly indicative.**\(^{712}\) They can be useful indicators of the relative magnitude of compliance costs across different alternative options but cannot be considered reliable estimates of actual cost.

2. **ASSESSING ADMINISTRATIVE COSTS (THE STANDARD COST MODEL)**

Administrative costs are defined as the costs incurred by enterprises, the voluntary sector, public authorities and citizens in meeting legal obligations to provide information on their action or production, either to public authorities or to private parties. Information is to be construed in a broad sense, i.e. including labelling, reporting, registration, monitoring and assessment needed to provide the information. In some cases, the information has to be transferred to public authorities or private parties. In others, it only has to be available for inspection or supply on request.

Whenever a measure is likely to impose significant administrative costs on business, the voluntary sector or public authorities, the EU Standard Cost Model presented in Appendix 2 should be applied. The main aim of the model is to assess the net cost of information obligations imposed by EU legislation (net costs = costs introduced by a proposal if adopted, minus the costs it would eliminate at EU and/or national level). You are also invited to apply the model on a tentative basis for assessing costs imposed on citizens. The possibility and need for monetisation in this case is left to your discretion. A separate tool describes the how the standard cost model should be applied in practice.

In principle it is sufficient to measure the administrative burden only for the preferred option. However, if information obligations are at the core of the proposal (e.g. changing labelling or reporting requirements) then the administrative burden should be assessed for all policy options considered.

3. **HOW TO ASSESS IMPLEMENTATION AND ENFORCEMENT COSTS**

Implementation and enforcement costs are those costs direct borne by public authorities in implementing, administering and enforcing regulatory requirements.

\(^{712}\) This is because of the extreme nature of some of the methodological assumptions required, even when adapted on the basis of survey results. This applies to the “normally efficient business” concept, the assessment of the BAU factor, the importance of learning curves suggesting compliance costs are likely to decrease with time and the various methodological decisions such as the level of overhead, the specific allocation of given personnel and human resources to specific substantive obligations, the allocation of fixed and common costs etc.
They can include the cost of publicising new requirements, establishing licencing or permit systems, dealing with queries and applications, implementing inspections and audits to verify compliance and sanctioning non-compliance\textsuperscript{713}.

These costs can vary significantly from option to option and from Member State to Member State. Measuring methodologies are less developed and less commonly used than for other direct costs.

In principle, implementation and enforcement costs can be estimated following a similar bottom up approach to the one described in for compliance costs: first defining the activities required to implement and enforce legislation, then estimating their frequency and their cost taking into consideration the BAU factor and possibly distinguishing between different case groups as appropriate. Implementing and enforcement authorities may be in a position to provide good unit cost estimates for different types of activities.

In reality, however, estimating these costs ex ante at the stage of Commission policy design may be particularly complex. First, data are rarely available. Second, implementation and enforcement activities often cannot be defined (and thus costed) since they are to be decided by Member States at a later stage.

When this is the case, you should still aim to provide a qualitative assessment. This would help avoiding any significant underestimation of direct costs and taking into account any trade-offs between business (or citizens) compliance costs and implementation and enforcement costs\textsuperscript{714}. To this end, it is suggested to:

\begin{itemize}
  \item Assess whether some or all of the related policy options would require the creation of new enforcement mechanisms, or whether they would rely on existing enforcement mechanisms.
  \item Describe whether enforcement costs are likely to vary significantly across different policy options.
  \item Assess whether the magnitude of enforcement costs is so significant that it might tilt the balance in favour of one policy option over other alternatives.
  \item If this is the case, assess what factors would be essential in determining the magnitude of enforcement costs (e.g. monitoring costs, inspection costs, etc.) and provide comments on the critical nature of enforcement costs in the choice of the preferred alternative. These comments would be useful for policymakers in making an informed choice.
\end{itemize}

\textsuperscript{713} For a list of possible implementation and enforcement activities, see p. 63 in OECD (2013).

\textsuperscript{714} Thus, an option that provides greater flexibility in the ways in which business can comply with the regulatory requirements may minimise costs to firms, but may increase the costs of administering the regulation, since verifying compliance will be more complex and involve a higher degree of professional judgement. Total direct costs may well be higher than under a less flexible regulatory option. Total costs would of course also depend on indirect impacts such as impacts on business competitiveness, innovation, the ultimate goal of the regulation etc.
4. **How to Assess Cumulative Costs**

**Every policy proposal should be assessed on its own merits.** For this reason, impacts are assessed against a baseline, meaning that only incremental costs and benefits need to be estimated. When standard cost-benefit analysis is the methodology of choice, it is the sign of the net change in costs and benefits that matters for policy decision, not the aggregate (or cumulative) level of regulatory costs and benefits.

Consideration of costs from the point of view of a particular economic sector, typically undertaken in a Cumulative Cost Assessment, is a backward-looking exercise which can be useful when defining a baseline scenario. This is a partial approach which does not by definition look at benefits. The costs are the regulatory costs that affect the sector only stemming from different regulations. For example, unlike in an impact assessment or evaluation, investment costs would be included by estimating the costs of financing (which depends on the approach for financing them) and at the time when those financing arrangements were made.

**It is advisable to take into consideration cumulative impacts to the extent that this may be possible and proportionate**

<table>
<thead>
<tr>
<th>Assessing Cumulative Impacts</th>
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<tbody>
<tr>
<td>Why?</td>
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<tr>
<td>Because it helps avoiding redundant requirements (for instance, reporting ones) and/or highlights opportunities to simplify legislation. Cumulative assessments can also help in defining better the baseline scenario.</td>
</tr>
<tr>
<td>Because a good assessment of indirect impacts may depend upon a good understanding of cumulative impacts.</td>
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<tr>
<td>Thus, for instance, the impacts on sectoral competitiveness of an increase in regulatory cost depend upon the sector overall cost structure vis-à-vis international competitors. Cumulative regulatory costs may be an important component of aggregate cost for the industry.</td>
</tr>
<tr>
<td>Assessing costs resulting from sector-relevant EU legislation including direct and indirect costs and administrative burdens.</td>
</tr>
<tr>
<td>How and when?</td>
</tr>
<tr>
<td>During the process of public consultation when stakeholders could usefully be invited to discuss interactions between a proposed initiative and the existing body of legislation.</td>
</tr>
<tr>
<td>When designing policy options when the lead services and the IAWG should check the proposed measures and the existing body of legislation (across the sector and policy areas) for possible redundant requirements, overlaps etc. In doing so, the results of existing retrospective evaluation should provide a useful source of information.</td>
</tr>
<tr>
<td>When assessing impacts and, notably indirect impacts and impacts on micro and small enterprises. No generally recognised standard methodology...</td>
</tr>
</tbody>
</table>

715 Direct costs stem from substantive obligations under the legislation; investments costs to finance the required investments (e.g. pollution control equipment), financial costs (interest charged), and operational costs.
exists for the consideration of cumulative impacts. However, a growing number of studies are generating data by sector and type of enterprise. The methodologies used can also provide useful models for new specific estimations.

A prominent tool for making CCAs is the Dutch Compliance Cost Assessment tool ("CAR model") which was conceived essentially for retrospective analyses of existing legislation.\(^{717}\)

<table>
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<tr>
<th>Benefits</th>
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5. **APPROACHES TO QUANTIFY BENEFITS**

The classification of benefits is not as well-developed as for costs not least because they are often the objective of the initiative, are initiative specific and are difficult to classify. They can, however, be direct or indirect in nature meaning that they can affect the same stakeholders targeted by the initiative or go beyond the target group and even become diffuse societal benefits.

Direct benefits can be expressed in terms of:

1. **Improved market efficiency**

   This might include improved allocation of resources, removal of regulatory or market failures or cost savings generated by new initiatives/regulation. Within this category, cost savings can be mapped using the same classification as for costs (e.g. reductions in administrative burden or compliance costs);

2. **Additional citizens’ utility, welfare or satisfaction.**

   Such non-market benefits are often valued using techniques which capture the sum of individual preferences which are themselves modelled using techniques such as willingness to pay or, alternatively, via simulated experiments observing what people would actually do in different future situations as opposed to what people think they will do.\(^{718}\)

Indirect benefits include:

3. **Spill over effects related to third party compliance with new legal rules ("indirect compliance benefits").**

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\(^{716}\) See Tool #22 on *The SME test.*

\(^{717}\) See The Study on Assessing the costs and benefits of Regulation prepared by the Centre for European Policy Studies (December 2013); pp 70 for description of the model and its strengths and weaknesses in relation to impact assessments and evaluations.

\(^{718}\) See Tool #31 on the Health impacts, Tool #32 on Consumers, Tool #35 on Resource efficiency, Tool #29 on Employment working conditions income distribution social protection & inclusion, Tool #30 Education and training culture and youth etc. which cover a wide range of social and environmental benefits (impacts).
These are benefits which accrue to individuals or business that are not the direct addressees of the initiative but who enjoy positive effects due to the compliance of others who are directly addressed (e.g. societal health care costs due to strategies to reduce obesity or tobacco smoking);

(4) **Wider macroeconomic benefits such as an increase in GDP, improved competitiveness or productivity** (e.g. programmes to reduce administrative burdens may increase GDP);

(5) **Other non-monetisable benefits** such as the protection of fundamental rights, social cohesion, international stability etc.

There are specific tools in this chapter which provide much more information on the identification of benefits such as those in the social, consumer, employment and environment fields.

6. **HOW TO ASSESS COST SAVINGS**

Not all regulatory proposals lead to direct cost increases. At times, the very aim of a regulatory proposal is to reduce existing regulatory costs either by simplifying existing EU legislation or by harmonizing regulations across Member States and thus generally reducing compliance costs for businesses operating across the single market.

7. **SIMPLIFICATION PROPOSALS**

<table>
<thead>
<tr>
<th>Methods to estimate direct cost savings</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Whenever a policy option leads to a reduction in regulatory charges</strong>, you could follow the same approach as suggested in chapter 4 of this Tool to estimate the value of the reduction.</td>
</tr>
<tr>
<td><strong>Whenever a policy option leads to a reduction in compliance costs</strong> (both substantive compliance costs and administrative burdens), you should follow the same approach as in chapter 4 of this Tool and in chapter 5 on administrative burdens to estimate the value of the reduction.</td>
</tr>
<tr>
<td><strong>Whenever a policy option leads to a reduction in implementation and enforcement costs</strong> you should follow the same approach as in chapter 6 of this Tool to estimate the value of the reduction (or at least assess its relevance qualitatively).</td>
</tr>
</tbody>
</table>

All the usual caveats applying to bottom up estimation approaches apply to the above. In particular, it is very important to complement any such estimation with an assessment of indirect costs and of direct and indirect benefits. This is to make sure that cost savings do not reduce regulatory benefits (or at least do not reduce them in a manner which worsens both the effectiveness and the efficiency of an existing policy). It is also necessary to take into account possible trade-offs among different categories of costs. The following offers a checklist of such possible trade-offs using administrative obligations as an example.

<table>
<thead>
<tr>
<th>Verifying the effective nature of cost savings</th>
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<tbody>
<tr>
<td><strong>A reduction proposal may lead to lower administrative burdens, but at the same time increase other compliance costs for the same targeted businesses.</strong> Administrative burdens (Abs) constitute only a subset of costs imposed on businesses by legislative...</td>
</tr>
</tbody>
</table>
acts. For example, the implementation of an e-government or any other IT-enabled solution can reduce the amount of time related to compliance with the information obligation. At the same time, however, it may require a degree of investment in upgraded IT equipment and training of employees, which would not be considered as ABs, but fall generally in the category of compliance costs. Similarly, a proposal that reduces ABs may increase public expenditure in monitoring and enforcement (see below): these costs may be recovered by the government through higher tax burdens, thus increasing direct charges. Finally, a proposal may reduce burdens by requiring structural changes in the production process, which would guarantee a certain level of product safety without any need for burdensome certifications: in this case too, burdens are reduced, but costs may increase.

A reduction proposal may reduce administrative burdens, but at the same time increase administrative burdens of a different origin. In the context of multi-level governance, the reduction of ABs achieved by eliminating some information obligations at a certain level of government – say, at the EU level – may require the introduction of new information obligations at the lower level – say, at the national or regional level.

A reduction proposal may reduce administrative burdens, but at the same time increase costs for other private actors (businesses and/or citizens, workers). For example, reducing labelling obligations for products may increase information costs borne by consumers, who would need to collect their information from other sources in order to make an informed choice of what products are most likely to fit their preferences.

A reduction proposal may lead to lower administrative burdens, but at the same time increase monitoring and enforcement costs for public authorities. This is often the case whenever the information obligations eliminated involve the keeping and reporting of information available to businesses, but not to public authorities. For example, the provision of information on the respect of hygiene standards or the reporting of large exposures by banks is typical instances of highly burdensome activities for businesses that comply with these requirements. These information obligations are vital for public authorities, as they ensure that more informed businesses provide information that would otherwise not be readily available to public authorities. Absent the provision of this information, public authorities would have to deploy more resources to obtain the information, which is likely to lead to more inspections and enforcement costs – in our two examples, more hygiene inspections and more investigations into the riskiness of banks’ exposure vis-à-vis certain clients.

8. SINGLE MARKET JUSTIFICATION

A specific case of savings can occur whenever you are dealing with options that have an impact on the Single Market, especially when such options entail the harmonization of national legislation. Savings might emerge whenever national legislation is fragmented and inconsistent and EU legislation is adopted to harmonise it. This is due to the fact that when legislation in Member States is fragmented, companies wishing to engage in cross-border trade have to incur “adaptation costs”, such as:

- **Having to change contracts or other practices to comply with differing national legislation.** Monetizing these costs is normally possible. One way of doing it is to collect data directly from companies and validate them with experts. For example, in the case of
national rules that are stricter than Article 102 TFEU\textsuperscript{719}, legal costs were estimated by some companies in the range between €12,000 and €20,000.

- **Having to modify standards or equipment, or train personnel to deal with differing national legislative requirements.** These costs are easily monetised by referring to market prices, and (in the case of equipment) depreciating these assets over time (for example, over five years).

- **Incur additional administrative burdens due to the fact that national legislation contains different information obligations,** which have to be complied with and which would not be incurred if the company refrained from entering the national market. In this case, you have to estimate the time that would be spent complying with the additional information obligations, and convert this into a monetary value by using data on labour costs for the specific country you are looking at (normally available at Eurostat), for the job profile of the person that would have to perform the relevant administrative activities.

A number of caveats should be kept in mind when performing these calculations. First, adaptation costs might not be incurred by companies if they keep internal compliance programs that apply to one or more countries: for example, if a company adopts an internal antitrust compliance program that is tailored to the most restrictive country, this will automatically mean that the company also complies with legislation in less strict countries. Also, the magnitude of administrative burdens should be gauged against the so-called “BAU” factor, \textit{i.e.} the extent to which the activities performed to comply with national legislation would be performed anyway even if they would not be required by law.

Finally, cost savings are only one category of benefits one has to deal with when looking at harmonization of legislation. Indirect benefits may emerge due to market efficiency impacts. Estimating these benefits is normally not prohibitively difficult but for accurate monetization you need data on demand and supply functions and demand elasticity\textsuperscript{720}. It is suggested to seek expert guidance for this type of estimation\textsuperscript{721}. For further guidance see the tool on impacts in the internal market.

### 9. Non-Market Benefits

Social Cost Benefit Analysis seeks to assess the net value of a policy or project to society as a whole (see related Appendix 3 on the use of discount rates). Monetisation of non-market benefits is easiest when the values can be linked to market prices. For example, air pollution damage to crops might reduce crop yields, thus allowing for relatively straightforward monetisation. However, the full value of many goods (benefits) such as health, the

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\textsuperscript{720} In the US, dedicated databases are available, which make it easier to estimate the response of supply and demand curves to a given change in price or in the quality of products. See, for example, [http://www.ers.usda.gov/data-products.aspx#UnUkoZTk-Es](http://www.ers.usda.gov/data-products.aspx#UnUkoZTk-Es) and in particular the section on commodities and food elasticity’s. In the economics literature, several estimates of elasticity are available, which could be collected into a single dataset made available to the desk officers wishing to perform CBA. See for example in relation to air transport, [http://www.iata.org/whatwedo/Documents/economics/Intervistas\_Elasticity\_Study\_2007.pdf](http://www.iata.org/whatwedo/Documents/economics/Intervistas\_Elasticity\_Study\_2007.pdf)

\textsuperscript{721} For a general presentation see CEPS (2013), p. 178-182.
environment, or educational success cannot readily be inferred from market prices but this does not mean that these important social impacts can be ignored in policymaking. The valuation of non-market impacts is challenging but should be undertaken wherever possible.

Alternative or complementary tools exist to compare the merits of policy options where quantitative/monetary information may be limited (such as multi-criteria analysis)\(^{722}\).

Economists try to determine a monetary value for non-market goods by looking at their impact on utility i.e. the satisfaction a person derives from consuming a particular good or the change in welfare or well-being. Utility is difficult to observe directly and is generally inferred by observing the choices people make within related or hypothetical markets.

9.1. **Market based approaches: Stated preference and Revealed preference**

The preferred method of estimating the change in utility is to simulate the market in order to estimate people's willingness to pay (WTP) or willingness to accept (WTA) a policy's impacts. WTP is the maximum amount of money an individual is willing to give up in order to receive a good. WTA is the minimum amount of money they would need to be compensated to forego or give up a good. The amount consumers are willing to pay depends on the levels of income available to them so valuations are usually obtained by averaging across income groups. The market based approaches to determine utility changes comprise "Revealed Preference" and "Stated Preference" methods\(^ {723}\).

<table>
<thead>
<tr>
<th>Box 4. &quot;Revealed Preference&quot; vs &quot;Stated Preferences&quot; vs &quot;Experiments&quot;</th>
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<tbody>
<tr>
<td><strong>Revealed Preference</strong> techniques involve inferring the implicit price placed on a good by consumers by examining their behaviour in a similar or related market. For example the value of house prices and its relationship to ambient noise or the travel costs incurred by individuals who wish to enjoy the amenity offered by a forest or other recreational site.</td>
</tr>
<tr>
<td><strong>Stated Preference</strong> techniques use specially constructed questionnaires to describe a hypothetical choice within a hypothetical market in order to elicit estimates of the willingness to pay or willingness to accept. When using stated preferences, the main choice is between contingent valuation and choice modelling. The former elicit WTP or WTA via direct questions on the amounts they would be prepared to pay to receive a particular good while the latter present respondents with a series of alternatives and asking for their preference.</td>
</tr>
<tr>
<td><strong>Experiments</strong> are different to revealed or stated preference surveys, as subjects in experiments make incentivised choices, and may accrue benefits and incur losses. In revealed and stated preference surveys, these types of incentives are not present.</td>
</tr>
</tbody>
</table>

Revealed preference methods are generally perceived to be more reliable and should be used where the information can be inferred. However, such techniques cannot estimate the value placed on an asset by people who make no use of it and stated preference techniques should then be used. In any event, consistency of results can be checked by using both techniques.

\(^{722}\) See Tool #57 on *Analytical methods to compare options or assess performance.*

The approaches described above can be used to estimate the value of improved health outcomes (such as from reduced air pollution), reduced road congestion, reduced road fatalities and injuries, disamenity (e.g. from waste disposal and quarrying) and recreational amenity (e.g. forests).

It may be difficult to judge the reliability of estimates emerging from a single study using a single method. Responses to questionnaires may be unreliable, inconsistent or biased or studies may not adequately take into account budget constraints. Robustness may be better from using different methods or aggregating results of different studies from different researchers. In any event, a range of values should be used to indicate the sensitivity of the ultimate decision to a particular valuation of benefits.

**In the absence of an existing reliable and accurate monetary valuation of an impact, a decision should be made whether to commission a study, and if so, how much resource to allocate to the project.** Factors to consider include (i) whether further research is likely to yield a robust valuation; (ii) whether the results will be useful for future IAs; (iii) how accurate does the valuation need to be in relation to the assessment at hand; (iv) the political importance/magnitude of the policy initiative and the expected impacts.

The technique of benefit or cost transfer (usually just called ‘benefits transfer’) can also be used to estimate values of impacts that do not have market prices. In this technique, values obtained in one study are transferred to a different study. For example, estimates of the costs of preventing a motorway accident in one Member State might be used to estimate the costs in other Member States. Using this technique increases the uncertainty of the estimated values, but can be helpful to give an order of magnitude of likely impacts, or if there are time and money constraints. Databases of valuation studies have been developed to make the technique of benefits transfer easier. You can find an evaluation of the possibility of adapting one such database for use in the EU on the Europa website.

When valuing impacts, the proportionality principle applies, as in all parts of Impact Assessment: don’t devote a lot of energy to putting a value on non-marketed impacts if they are a very small part of the overall impacts. In addition, there may always be significant impacts that cannot sensibly be monetised and these should be presented in non-monetary units (e.g. weighted emissions of greenhouse gases) or in more qualitative terms. Where material costs cannot be valued in monetary terms they should still be clearly taken into account in the impact assessment. Alternative techniques such as multi-criteria analysis may be helpful (see below). It is suggested that you consult your impact assessment support unit for further guidance.

**9.1.1. Illustrative examples**

**(a) Revealed preference: the value of life or avoided injury**

Suppose that a particular safety feature of a car (such as an airbag) reduces the risk of fatal injury by 50% in the case of an otherwise fatal accident and that the likelihood of having such an accident is 0.1% for the average driver (meaning that statistically one out of 1,000 drivers will have such an accident). If the price for an airbag is 500 Euros and 70% of the cars are equipped voluntarily with an airbag, this means that 70% of the drivers are willing to pay 500 Euros for this feature to avoid the risk of a fatal accident.

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724 See Tool #31 on Health impacts.
Euros for a 0.05% reduction of the likelihood of having a fatal accident. This in turn means that the value the drivers of these cars attach to a life is at least $2,000 \times 500 = 1$ million Euros on average. This illustrative example also shows that the valuation of risk differs between individuals. While 30% of the drivers (those not fitting the car with an airbag) implicitly attach a lower value (given their budget constraint), some of the drivers buying the additional safety feature may attach a substantially higher value to their life but still only have to pay 500 Euros for the airbag.

(b) Stated preference: Disamenity impacts

An example from the UK illustrates how activities including the transport and disposal of waste and the quarrying of minerals and aggregates (for road building) can give rise to undesirable impacts on the public’s enjoyment of an area used for recreation.

<table>
<thead>
<tr>
<th>Case study site</th>
<th>£/tonne of aggregates</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hard rock</td>
<td>0.34</td>
</tr>
<tr>
<td>Sand and gravel</td>
<td>1.96</td>
</tr>
<tr>
<td>Quarries in national parks</td>
<td>10.52</td>
</tr>
</tbody>
</table>

The willingness to pay for early closure of quarries were as follows:

National average amount which individuals were willing to pay for the early closure of all types of quarry sites weighted by type was calculated as £1.80 per tonne.

(c) Market and non-market benefits: Air pollution

The analysis supporting the updated strategy for air pollution was able to estimate direct benefits in terms of reduced economic costs to society arising from reduced use of medicines, visits to hospitals, lost work days from air-pollution and reduced yields of agricultural crops

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as well as estimated benefits associated with reduced incidences of acute and chronic mortality due to exposure to air pollution (fine particles).\textsuperscript{726}

\begin{table}[h]
\centering
\begin{tabular}{|l|}
\hline
\textbf{Box 6. Monetised impacts of air pollution}  \\
\hline
\textbullet Concentrations of individual air pollutants across the EU are measured and can be predicted based upon emissions inventories and complex atmospheric models. \\
\textbullet Research over many years has allowed exposure-response relationships to be derived for many health end points (short-term/long term mortality, and sickness) as well as for the damage on crop yields and buildings. \\
\textbullet Direct benefits have been determined for the improvements in air pollutant emissions by calculating the changes in air pollutant concentrations and changes in health endpoints and crop/buildings damage. This also allows indirect benefits to be calculated such as lost production due to employment incapacity etc. \\
\textbullet For non-market impacts such as premature mortality, willingness to pay studies have provided financial values for each of year of life lost given from the exposure response relationship. \\
\textbullet In 2010, air pollution was estimated to be responsible for 400,000 annual premature deaths with health-related external costs of between €330-940bn per year, including direct economic damages of €15bn from lost workdays, €4bn healthcare costs, €3bn crop yield loss and €1bn damage to buildings. \\
\hline
\end{tabular}
\end{table}

10. \textbf{OTHER METHODS USED WHEN ESTIMATING COSTS AND BENEFITS}

Economic models are often used in the preparation of impact assessments but these are generally complex models which are unlikely to have been developed by DGs or services. The JRC has established a competence centre on modelling which can provide information about the available models and help and assistance in using such models. A separate tool exists in relation to the use of analytical models and methods and covers issues such as data quality, sensitivity analysis etc.

10.1. \textbf{Partial equilibrium analysis}

In many policy proposals, the impact of the policy proposal goes beyond a single sector and actually results in interaction across many sectors or even economy wide. Such analysis of costs and benefits can usually not be done based on a bottom up analysis or spreadsheet calculations but requires specific tools such as economic models which cover core interactions between several elements, sectors and actors and try to represent real world behaviour. Depending on their scope, economic models can also be able to assess several cost and benefit dimensions simultaneously. For instance a partial equilibrium model that looks at the functioning of the energy system at large can look simultaneously at issues such as investment costs, operational and fuel savings, emissions fluctuation and implications for energy security.

The use of partial equilibrium analysis assumes that the effects of the regulation on all other markets will be minimal and can either be ignored or estimated without employing a model of

\footnote{SWD(2013) 531.}
the entire economy. This means, in most cases, that indirect impacts will be less significant than direct impacts, and will be confined to the passing-on of certain costs and benefits to downstream markets. This section presents some simple diagrams to show how social cost can be defined in a partial equilibrium framework. For the sake of simplicity, we refer to a market context: however, the problem of whether to focus on the sector directly affected by the regulation or also to a number of other more indirectly affected sectors or domains can also occur in cases where there is no market context to refer to.

Figure 1(a) shows a competitive market before the imposition of an environmental regulation. The intersection of the supply (S0) and demand (D) curves determines the equilibrium price (P0) and quantity (Q0). The shaded area below the demand curve and above the equilibrium price line is the consumer surplus. The area above the supply curve and below the price line is producer surplus. The sum of these two areas defines the total welfare generated in this market: the net benefits to society from producing and consuming the good or service. In this market, assume that the imposition of a new environmental regulation raises firms’ production costs. Each unit of output is now more costly to produce because of expenditures incurred to comply with the regulation. As a result, firms will respond by reducing their level of output. For the industry, this will appear as an upward shift in the supply curve. This is shown in Figure 1(b) as a movement from S0 to S1. The effect on the market of the shift in the supply curve is to increase the equilibrium price to P and to decrease the equilibrium output to Q1, holding all else constant.

As seen by comparing Figures 1(a) and 1(b), the overall effect on welfare is a decline in both producer and consumer surplus. Compliance costs in this market are equal to the area between the old and new supply curves, bounded by the new equilibrium output, Q1. Noting this, a number of useful insights about the total costs of the regulation can be derived from Figures 1a and 1b. First, when consumers are price sensitive — as reflected in the fact that the demand curve is downward sloping — a higher price causes them to reduce consumption of the good. If only direct costs are estimated and this price sensitive behaviour is not taken into account (i.e., the estimate is based on the original level of output (Q0) compliance costs will be overstated.

A second insight derived from Figures 1a and 1b is that compliance costs are usually only part of the total costs of a regulation. The “deadweight loss” (DWL) shown in Figure 6b is an additional, real cost arising from the regulation. It reflects the foregone net benefit due to the reduction in output. Moreover, unlike many one-time compliance costs, DWL will be a component of social cost in future periods. Under the assumption that impacts outside this market are not significant, then the social cost of the regulation is equal to the sum of the compliance costs and the deadweight loss (shown in Figure 1b). This is exactly equal to the reduction in producer and consumer surplus from the pre-regulation equilibrium (shown in Figure 1a). This estimate of social cost would be the appropriate measure to use in an impact assessment of the regulation.
Third, Figure 1(b) above also shows that, depending on the elasticity of the demand and supply curves, legal rules can also produce unintended effects on stakeholders that are not those who are through to be directly affected by the rule. This is typically the case whenever firms that are subject to regulation through, say, the introduction of a stricter environmental or product standard are able to pass-on (and thus recover) part of the corresponding “compliance cost” on downstream actors or end consumers. Estimating the degree of passing-on is not always easy, and requires that those that carry out impact assessment are aware of the likely elasticity of demand and supply. However, while performing an *ex ante* impact assessment the degree of precision required may not always be extreme: in some circumstances, awareness of the possibility that a minimal, significant or very substantial part of the increased cost might be passed on downstream or upstream can in any event lead to a better understanding of the consequences of adopting a given regulatory measure.

The preceding discussion describes the use of partial equilibrium analysis when the regulated market is perfectly competitive. In many cases, however, some form of imperfect competition, such as monopolistic competition, oligopoly, or monopoly, may better characterize the regulated market. Firms in imperfectly competitive markets will adjust differently to the imposition of a new regulation and this can alter the estimate of social cost. If the regulated market is imperfectly competitive, the market structure can and should be reflected in the analysis.

10.2. **Multi-market analysis**

In certain situations, *when the effects of a regulation are expected to impact a limited number of markets beyond the regulated sector*, it still may be possible to use a partial equilibrium framework to estimate social cost. Multi-market analysis extends a single-market, partial equilibrium analysis of the directly regulated sector to include closely related markets. These may include the upstream suppliers of major inputs to the regulated sector, downstream producers who use the regulated sector’s output as an input, and producers of substitute or complementary products. Vertically or horizontally related markets will be affected by changes in the equilibrium price and quantity in the regulated sector. As a consequence, they will experience equilibrium adjustments of their own that can be analysed in a similar fashion.
10.3. **General equilibrium analysis**

In some cases, the adoption of a new legislative measure might bear significant effects in many markets, including markets that are far from those that are directly subject to the regulation. As the number of affected markets grows, it becomes less and less likely that partial equilibrium analysis can provide an accurate estimate of costs and benefits. Similarly, it may not be possible to accurately model a large change in a single regulated market using partial equilibrium analysis. In such cases, a general equilibrium framework, which captures linkages between markets across the entire economy, may be a more appropriate choice for the analysis. These models are appropriate in particular when indirect impacts are likely to be the most significant ones in terms of magnitude of expected impacts. For example, a significant increase in energy prices due to the introduction of some new environmental regulation can have widespread impacts across the whole economy (e.g. increased energy poverty of households due to higher energy prices).

General equilibrium models are able to simulate the shifts in supply curves and corresponding demand changes that can result from any change in the economy, from a price shock in raw materials to a new form of price regulation. Accordingly, they are able to model the links between connected markets in a way that shows the ultimate impact on outputs and consumption of goods and services in the new market equilibrium; and they can also determine a new set of prices and demands for various production factors (labour, capital, land). As a final result, they can also provide indications and estimates as regards macroeconomic changes, such as GDP, overall demand, etc.

11. **FURTHER INFORMATION**

- Study prepared by the Centre of European Policy Studies on [the assessing the costs and benefits of regulation](#).
- [OECD Regulatory Compliance Cost Assessment Guidance](#).
- Unit C2 of the Secretariat General can provide advice on the content of this tool via its functional mailbox [SG-C-2@ec.europa.eu](mailto:SG-C-2@ec.europa.eu).
Appendix
Illustrative examples on how to quantify costs and benefits

All relevant impacts should be assessed quantitatively if possible as well as qualitatively when preparing impact assessments, fitness checks and evaluations. Similarly, impacts should be monetised whenever possible. However, whether quantification can be undertaken depends on whether a sound methodology exists and if the required data exist and can be collected without disproportionate cost.

In particular, quantification should accompany REFIT initiatives in order to meet the commitment of the May 2015 Better Regulation Communication.

In case of any significant amendments introduced by the co-legislators to the original Commission proposal, the Commission should also consider working with the European Parliament and Council to update estimations presented in the initial impact assessment.

Example 1: Annual material costs of a new obligation requiring the use of winter tyres in certain weather conditions (snow and ice).

In practice vehicle owners do not just change to winter tyres once, but revert to summer tyres in spring. The costs for this second change are directly related to the provision and must therefore be taken into account when identifying and presenting the compliance costs.

There are 56 million registered vehicles and it is assumed that:

- Vehicles owned by public authorities are already fitted with winter tyres.
- 70% (39.2 million vehicles) have their tyres changed in autumn and spring due to different reasons (recommendations by driving organizations and economic considerations such as wear and tear, fuel consumption).
- A further 20% (11.2 million vehicles) are driven all-year round with all-weather tyres or are not driven at all during wintry road conditions.
- The remaining 5.6 million vehicles, which have only used summer tyres to date, therefore represent the calculation basis. Their owners will have to purchase winter tyres for the first time and change them regularly in the following years (frequency 2 per annum, number of vehicles: 5.6 million, number of cases = 11.2 million vehicles).

<table>
<thead>
<tr>
<th>Cost type</th>
<th>Annual material costs</th>
</tr>
</thead>
<tbody>
<tr>
<td>3.36 million private cars which change tyres twice per year with a unit price of €20 at a garage</td>
<td>€134.4 m</td>
</tr>
<tr>
<td>2.24 million private cars where the owner changes the tyres twice per year</td>
<td>€0</td>
</tr>
</tbody>
</table>

himself/herself at zero material cost.

3.36 m. private cars changing tyres every 6 years (frequency 0.17 per annum) with an additional cost relative to summer tyres of €100. \[3.36 \times 0.17 \times 100\] € 57.1

2.24 million private cars changing tyres every 6 years (frequency 0.17 per annum) with an additional cost relative to summer tyres of €100. \[2.24 \times 0.17 \times 100\] €38.1

**Example 2: Material costs incurred by a company due to the introduction of an IT-process (fictitious), here: identification of the average annual material costs per company.**

<table>
<thead>
<tr>
<th>Average material cost per company</th>
<th>Annual</th>
<th>One-time</th>
</tr>
</thead>
<tbody>
<tr>
<td>4000 companies need to buy new software licences and IT support at unit cost of €800 [4000 \times 800 \text{ euro}]</td>
<td>€3.2 m</td>
<td></td>
</tr>
<tr>
<td>4,000 companies purchase new hardware and incur costs for its installation of €2500 [4,000 \times 2,500]</td>
<td></td>
<td>€10 m</td>
</tr>
<tr>
<td>Total:</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>€3.2 m</td>
<td>€10 m</td>
</tr>
</tbody>
</table>

**Example 3: Employees must be trained to operate new equipment that is required by a new law.**

The new proposal leads to one-time costs for the first ‘wave’ of training courses and ongoing costs for annually required training courses. The following are assumed:

- 19 euro per hour are taken as basis for the labour costs of the employees to be trained,
- The training takes 12 hours.
- The hourly wage rate is €19.
- 45,000 employees are trained during the first year.
- It is assumed that 4,500 new employees, i.e. 10% of staff, are newly recruited and trained every year.

<table>
<thead>
<tr>
<th>Personnel costs (in euro)</th>
<th>Annual</th>
<th>One-time</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Ongoing costs per case</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Number of new employees per annum x (frequency of training) x (hourly wage rate) x (duration of training) [4500 \times 1 \times 19 \times 12]</td>
<td>€1.0 m</td>
<td></td>
</tr>
<tr>
<td><strong>One-time costs per case</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Number of existing employees to receive one-off training x (hourly wage rate) x (duration of training) [45,000 \times 19 \times 12] = 10,260,000</td>
<td>€10.3 m</td>
<td></td>
</tr>
</tbody>
</table>

Example 4: Modernising VAT obligations for cross-border e-Commerce

As part of the Digital Single Market initiative and the Action Plan for the modernisation of VAT, the Commission adopted a proposal for a reform of VAT on cross-border e-Commerce. This is a REFIT initiative with simplifications brought by the application of the 'destination principle' and the mini one stop shop (MOSS). The impact assessment\(^\text{729}\) used a systematic approach for the quantification of impacts by covering both economic costs and benefits and administrative burden for businesses and public authorities. The impact assessment estimated that the preferred option would generate an annual increase in VAT revenues of €7 billion and reduce annual compliance costs for businesses by 55% (i.e. an annual saving of €1.9 billion). It would also increase e-Commerce by 0.3% with negligible e-Commerce price increases of the order of 0.7%. The table below illustrates the combination of qualitative and quantitative tools used for these calculations of impacts.

<table>
<thead>
<tr>
<th>Impact</th>
<th>Approach used</th>
<th>Analytical tools</th>
<th>Key assumptions</th>
<th>Key sources</th>
</tr>
</thead>
<tbody>
<tr>
<td>Impacts for Member States’ revenues, costs and benefits for Member States to implement the Option</td>
<td>Quantitative analysis Qualitative analysis</td>
<td>Standard Cost model (SCM)</td>
<td>Costs similar to the MOSS Different scenarios for e-Commerce growth Compliance monitoring based on risk profiling</td>
<td>Member States’ interviews and questionnaires Stakeholder workshops Desk research</td>
</tr>
<tr>
<td>Impacts on administrative burden for businesses</td>
<td>Quantitative analysis SCM</td>
<td>Impacts of OSS similar to those of MOSS Number of businesses Number and behaviour of micro-businesses engaged in cross-border e-Commerce</td>
<td>Businesses interviews Stakeholder workshops Business online survey</td>
<td></td>
</tr>
<tr>
<td>Impacts on competition and growth</td>
<td>Quantitative analysis CGE model</td>
<td>Different scenarios for e-Commerce growth Number of businesses Number and behaviour of micro-businesses engaged in cross-border e-Commerce</td>
<td>Consumer survey SCM Desk research</td>
<td></td>
</tr>
<tr>
<td>Impacts on compliance</td>
<td>Quantitative analysis Qualitative analysis Projections</td>
<td>Different scenarios for e-Commerce growth</td>
<td>Member States’ interviews and questionnaires Stakeholder workshops Desk research Mock purchases</td>
<td></td>
</tr>
</tbody>
</table>

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\(^{729}\) Insert reference and link to IA

The emissions abatement compliance costs, emissions monitoring costs and administrative costs were estimated for the large number of medium-sized combustion installations in the EU to meet stricter emissions limits.

The approach involved the compilation of a detailed inventory of combustion plants compiled by size category, fuel and combustion technology. To this, the impacts of imposing new emissions limits (control technologies) were estimated.

Example 6. The impacts of a Standard VAT return [SWD(2013) 427]

Some 30 million companies file 150 million VAT returns annually at a cost of €30 bn annually. 0.2% of these are from big businesses; 6.6% from SME and 12.2% micro-SME (130 million). 13% of companies must submit such a VAT return in more than 1 Member State.

Detailed studies from Deloitte and PWC allowed data to be collected on the different VAT declarations used across the EU, the different types of information required to be filled-in and to make informed assumptions about the time needed to fill out returns, average wage levels and the use of consultants (in a limited number of Member States).

Example 7. Proposal for a Regulation on binding annual greenhouse gas emission reductions by Member States from 2021 to 2030 [SWD(2016) 247 and 248].

A suite of models was used to assess the impacts in the EU’s energy system and key economic sectors including transport and the land using sector (LULUCF). These models include PRIMES, GAINS and GLOBIOM-G4M-CAPRI. Key aspects of the modelling approach include:

- **Emissions**: CO₂ emissions from energy and processes (PRIMES), CH₄, N₂O, fluorinated greenhouse gases (GAINS), CO₂ emissions from LULUCF (GLOBIOM-G4M), air pollution SO₂, NOₓ, PM2.5-PM10, ground level ozone, VOC, NH₃ (GAINS).
- **Emission reduction and removals**: structural changes and technologies in the energy system and industrial processes (PRIMES), technological non-CO₂ emission reduction measures (GAINS), changes in land use (GLOBIOM-G4M-CAPRI).
- **Time horizon**: 1990 to 2050 (5-year time steps).
- **Geography**: individually all EU Member States, EU candidate countries and, where relevant Norway, Switzerland and Bosnia and Herzegovina.
- **Impacts**: on energy, transport and industry (PRIMES), agriculture, forestry and land use (GLOBIOM-G4M), atmospheric dispersion, health and ecosystems (acidification, eutrophication) (GAINS), macro-economy with multiple sectors, employment and social welfare.

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730 Land Use, Land Use Change and Forestry.