Chapter 4
The Circular Economy of Plastics in the Netherlands

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Abstract Production of plastic has grown enormously to over 320 megatons in 2016 and will continue to increase in the future. Most important environmental damage caused by plastic is pollution, especially the plastic soup, and the emission of CO_2, which causes climate change. The depletion of natural resources, oil and gas, is not considered to be an important issue in relation to plastic. Because in the long run, less oil and gas will be used worldwide due to the upcoming of sustainable energy, oil and gas supplies will be sufficient for the production of plastic for several 100 years. At the moment, the environmental benefits of recycling household plastic are limited. It provides no solution to reduce plastic soup or littering. CO_2 reduction is limited to about 0.15% of total CO_2 emission in the Netherlands. Increasing recycling of household plastic will not automatically increase environmental benefits. In this stage, augmenting quality of recycled plastic is to be preferred over increasing the amount. The government could subsidise innovation in this matter and stimulate the quality of recycled plastic in a financial way. Enterprises could alter their strategy by using plastics that cause less problems in recycling. The use of biobased plastic, which refers to plastic made of biomass, is no solution in the field of plastic soup. About three-quarter of all bio-based plastic used worldwide is not biodegradable. Above this, for bioplastic to be biodegradable you generally need an industrial environment. Biobased plastic can reduce CO_2 but net results vary widely due to side effects on the environment. Possible measures to reduce littering and plastic soup would be extending the packaging deposit-refund system, regulation with respect to plastic in cosmetics, innovation in removing plastics from wastewater and measures to reduce plastic in organic waste which is turned to compost.

Keywords Plastic recycling · Biobased plastic · Plastic soup · Packaging deposit-refund system · Environmental benefits

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4.1 Introduction

The circular economy and the policies on the circular economy aim to reduce the use of natural resources, promote reuse and recycling and reduce waste production, in order to reduce the ecological footprint of human activity. The underlying reasoning is that human activity is depleting the planet, both with respect to natural resources and the habitability of the physical environment.

CPB Netherlands Bureau for Economic Policy Analysis studies the economic aspects of a circular economy and related policies. In doing so, it looked at the impact of the circular economy on social welfare. This concept principally includes all matters important to human beings, and also those for which there is no market or market price (e.g. nature, safety, landscape environment).

This publication provides a welfare-economic overview of the circularity of plastics, from raw materials to waste. Plastics are used a lot, worldwide, and their use is still increasing. In addition, the use of plastics comes with substantial environmental problems. Plastics, therefore, are also one of the priorities in the Government-wide programme for a Circular Economy, by the Dutch Ministries of Infrastructure and Water Management, and Economic Affairs and Climate (Ministries of Infrastructure and Water Management, and Economic Affairs and Climate, 2016). In relation to this analysis, all authors visited two organisations: AVR (a waste-processing plant) and SUEZ (a company that collects, separates and recycles waste). The aim of these working visits was to obtain information from people working in the field and to experience the process of burning and recycling of waste ourselves. Useful information received on the recycle-ability of several plastics, on nonusable waste and on different techniques of separating waste.

The purpose of this analysis is to outline the main aspects of the circular economy of plastics, in order to provide a number of perspectives for policy and policymakers. Section 4.2 describes the main findings from the analysis.[1] Section 4.3 contains the policy implications that follow from the analysis. The closing section provides the conclusions (Sect. 4.4).

4.2 Findings

4.2.1 Worldwide Use of Plastics is Greatly Increasing

Since the 1960s, the global use of fossil fuel-based plastics has increased 20-fold (Ellen MacArthur Foundation, 2016). The use of plastics has thus increased much more rapidly than the global GDP. Oil and natural gas provide the resources for the production of fossil fuel-based plastics (so-called *virgin plastics*). The use of such

[1] This paper is published in Dutch (Verrips et al., 2017a). An in-depth analysis is provided in Verrips et al., (2017b).

'virgin plastics' is projected to increase from 320 Mt today, to around 1.1 Gt by 2050. The largest share of plastics used in the Netherlands is for packaging (around 40%). In addition, large amounts are also used in construction (around 20%, mainly in the form of PVC), consumer goods and passenger vehicles.

Alternative ways of producing plastics concern the use of biomass (bioplastics) and recycled plastics (recyclate). The global share of bioplastics is currently around 1%. In the Netherlands, around 10% of plastics are produced from recyclate.

4.2.2 Depletion of Resources for the Production of Fossil Fuel-Based Plastics Will Play a Minor Role in the Coming Decades

Between 4 and 8% of the total demand for oil and natural gas is for the production of plastics (as resource and as fuel). Increasing the sustainability of the transport and industrial sectors is likely to lower the general demand for oil and natural gas. In such a case, there would be plenty of oil and natural gas available for the production of plastics for hundreds of years to come. There are also technical possibilities for using a larger share of the oil and natural gas stocks in the production of plastics. However, production costs would increase, as hydraulic fracturing (or fracking) becomes more expensive as larger shares of oil and natural gas are used in plastics production.

Questions about the security of supply concern two main points of consideration. The first is whether sufficient resources would be available and to what extent we are dependent on countries on whom we would perhaps rather not depend. The other point concerns the prevention of large price shocks that would have a backlash on the real economy. These points are related. A well-developed world market for a certain resource means that there are many competing suppliers and customers who are able to secure their mutual current and future trade positions via liquid financial markets. This does not completely rule out price shocks, but will make them less likely. However, if market access for suppliers is restricted, markets are small (few transactions), or supply is non-contestable in other ways, the slightest rumour may lead to price peaks and market panic whereby countries will close their markets or use their market power.

Oil and natural gas production are spread all over the world. A decline in the demand for oil as a result of CO_2 taxation, together with the emergence of alternatives, would decrease the global market for oil-producing countries. In such a case, oil would increasingly become more of a resource instead of a fuel.

The price of plastics is far less volatile than that of oil. This, first and foremost, suggests that there are more factors determining the costs of plastics production, in addition to the price of the primary resource. Moreover, the production of plastics is spread all around the world. In that sense, there seems to be a well-developed market for plastics sourcing. Guaranteeing supply thus appears less of a strong argument for reducing the use of oil and natural gas in the production of plastics.

4.2.3 Damage to the Physical Environment is the Most Important External Effect

An important external effect relates to litter, which has a negative impact on the landscape, nature and the environment. A fair amount of this litter, consisting largely of packaging, will end up in the oceans. Plastics disintegrate into so-called microplastics, which can damage human and animal health. The so-called *plastic soup* is a major environmental problem that is still increasing.

Another source of microplastics in Dutch waters, besides litter, is wastewater. These microplastics, for example, are released when clothing is washed, or they originate from plastics in cosmetics. Furthermore, rainwater contains wear particles from tyres, microplastics from the wear and tear of paint, rubber granules from artificial grass on soccer fields and plastics from compost that is based on biodegradable waste.

A recent study by the WUR (Speksnijder, 2017) shows that the Arctic Ocean also contains large amounts of microplastics. These microplastics could accelerate the melting of the ice caps and thus speed up the impact of climate change. Moreover, they are located in an area of relatively large biodiversity. An analysis of ocean currents reveals that these microplastics originate particularly from north-western Europe. The external effects of the plastic soup, therefore, have a large international component. For that reason, the solution to this problem requires collaboration between countries.

4.2.4 CO_2 Emissions of Producing, Recycling and Burning of Plastics

Another large external effect is the emission of CO_2. Of all the emissions related to the production of plastics, CO_2 is by far the most important component in the Netherlands. Plastics-related emissions of nitrogen oxide (NO_x), sulphur dioxide (SO_2) and particulate matter (PM_{10}) in Europe are relatively limited because of the implemented emission standards. The most important emission is CO_2, followed by particulate matter (mainly from production processes in certain countries outside western Europe). CO_2 is emitted not only during extraction and production processes, but also during incineration and recycling.

Some of the CO_2 emissions are included under the Emissions Trading System (ETS). However, not all countries are involved: the production of plastics in, for example, China and the United States is not part of the ETS. Nor does the ETS include CO_2 emissions from the incineration of plastics in waste-incineration plants. In the Netherlands, 14% of residual waste consists of plastics. Waste incineration in such plants is also used for generating heat and electricity. If this heat and electricity had been generated in another way, this would have involved the emission of CO_2.

In the current energy mix, these so-called avoided emissions form around one-third of the CO_2 that is emitted during the incineration of plastic waste.

4.2.5 Possibilities of Bioplastics Solving the Plastics Problem are Only Limited

Bioplastics do not seem to be a viable solution to the problems of litter and plastic soup, because they are only biodegradable to a limited degree. Currently, only a quarter of these plastics are biodegradable. Those that are, mostly require an industrial environment of heating in order to biodegrade. This, therefore, will not happen to bioplastics that end up as litter.

Is there anything to gain, in terms of lower CO_2 emissions from the production of bioplastics? The answer strongly depends on the type of biomass used and the location in which it is grown. Production is less efficient than that of using fossil resources. Oil palms are the most efficient crop species, in terms of land use and CO_2 reduction, but this type of cultivation involves deforestation. An alternative would be the use of sugars as the resource for bioplastics; this reduces CO_2 emissions as well as the risk of negative impacts on nature, compared to using vegetable oils. In addition, the negative effects on the environment of the amount of water that is needed in the cultivation of biomass must also be taken into account, as well as the emission of acidifying compounds and nitrous oxide, a very strong greenhouse gas related to the use of artificial fertiliser.

The external effects of biomass production are potentially large. The amount of land required to produce bioplastics from biomass is relatively large. And because land is scarce, there is also competition with food on the basis of price ratios, with nature (landscape and biodiversity) and with the demand for energy. It is uncertain whether the increasing demand for biomass can be fully met by technological development increasing the production per hectare and by second- and third-generation biomass—which involves the use of more waste flows.

4.2.6 Limited Options for the Application of Recycled Plastics, Given Current Technology

Current techniques cannot fully separate plastic waste into homogenous flows of individual types of plastic. For this reason, the largest part of the plastic waste from households after sorting currently consists of mixed materials with a low and sometimes negative market price (called ‘mix’), and for a small part of more homogenous flows of one type of plastic. Some of the ‘mix’ is being exported, but a limited part is stored or ultimately incinerated. The situation for regranulate, originating from homogenous flows, is more positive. There are more applications for this material

and it has a higher market value. Yet, price levels are still below those of virgin plastics. This is partly caused by the lower quality that results from imperfect separation methods. Regranulate from homogenous flows also has its limitations with respect to application possibilities. These limitations refer to regulation around additives and food safety and include the fact that certain plastics retain the odour of the original product.

Recyclate will be more competitive under higher oil and natural gas prices and higher CO_2 prices. Nevertheless, the limitations of the application possibilities for recycled plastics, under the current state of technology, still determine their low market price.

4.2.7 Technological Development is Crucial

Technological developments may, for instance, improve the quality of regranulate, and reduce the cost of recycling. It is debatable at which pace developments will take place and to what degree certain barriers, in practice, could also be overcome with new techniques. An example of a new technique is chemical recycling, during which the original resource material is re-extracted. This could potentially remove important limitations in applications, but currently still involves high costs and a high use of energy. It is as yet unclear whether this process will ultimately result in environmental gains.

Technological development is also very important for other forms of circularity. One example is ecodesign, through which it is easier to recycle products or to extend the lifetime of products and concepts. Earlier CPB research (Noailly & Shestalova, 2013) shows that from the viewpoint of social welfare, the market is not investing sufficiently in innovation in sustainable technologies, compared to the innovation investments in existing techniques.

4.3 Policy Implications

This CPB analysis concerns an inventory of the circular economy of the plastics value chain, from the perspective of welfare across the board. The analysis does not include possible comprehensive policy options in this area, the advantages and disadvantages of those options and the related societal costs and benefits. There is already a large number of policy measures in this field, on European, national and municipal levels. European policy, for example, sets targets for the amount of residual waste. National policy includes, for example, subsidies and regulations, and municipal policy is about the system of waste collection. Furthermore, certain policy involves an important role for industry, such as the covenants that are held by the Packaging Waste Fund. Nevertheless, the findings generally indicate what would be possible promising and less promising policy options for the Netherlands.

The analysis reveals that the most important external effects related to plastics are caused by litter and the 'plastic soup', as well as by CO_2 emissions. Below, a concise description is given of policies that would address these effects to lesser or greater degrees. The description is not exhaustive, an analysis of the costs and benefits of such policy requires additional research.

4.3.1 Reduced Use of Plastics: Lower CO_2 Emission Levels and Less Waste

Less use of plastics also means less litter, therefore less plastic material in the oceans and fewer CO_2 emissions. Ideally, the external effects caused by production, use and waste of a certain product should be incorporated into the price, for example, through taxation. The idea is that such taxation leads to fewer of these polluting products being bought, thus to lower consumption levels and, partly, to a shift towards alternative products and technologies.

Examples of such taxation are the waste collection and processing rates. The collection and recycling of plastic packaging in the Netherlands are funded from the Packaging Waste Fund. This fund is financed by packaging companies. In 2015, the fund incurred around 230 million euros in costs, of which around 200 million was for the collection, separation and recycling of waste. Around three-quarters of this relates to plastic packaging. This causes an increase in the costs for the producers of packaged goods, which in turn provides them with an incentive to reduce the amount of packaging they use or to switch to a substitute material. These costs are partly incorporated into product prices and, therefore, are ultimately paid by consumers. Higher prices lead to consumers buying fewer packaged goods. In this way, some of the external effects of the use of plastics may become internalised in the product price. This analysis has not looked at tax levels, costs, behavioural effects, or the impact of such taxation on the welfare of society.

The external effects that are related to plastic products vary according to the type of plastic and its application. In addition, it is very difficult to estimate what the consequences of the use of plastics will be for the plastic soup. Taxation may lead to the substitution of plastics with other materials, but those are likely to have their own impact on society and the environment. A shift from plastics to other materials will therefore not necessarily lead to environmental benefits.

Another way of reducing the amount of plastic used would be through regulation, which obviously includes a task for the government. The industry itself may also enter into covenants and agreements. Incentives for entrepreneurs to do so include regulations and cost saving (through taxation), but may also be driven by how they would like to be perceived by consumers (sustainable image and corporate social responsibility).

Furthermore, education and information provided to companies and consumers may increase awareness and reduce the negative effects related to the use of plastics.

4.3.2 Policy Related to Litter and Plastic Soup

Plastic soup is an international problem that, to a large extent, calls for internationally coordinated policy. At the same time, as the Netherlands also adds to the plastic soup, litter and plastics in the water are also a national problem.

Expanding the deposit-refund system is a type of policy that directly helps to prevent litter and thus also reduces the plastic soup. Over ninety per cent of plastic litter consists of packaging; expanding the deposit-refund system provides an incentive for users to collect litter instead of discarding it into the environment.[2] The ban on free plastic bags offered in shops is likely to be effective in reducing litter. There are also other types of policy aimed at litter prevention, such as expanding the cleaning capacity for public spaces and enforcing (and sanctioning) anti-litter regulation, as well as providing adequate waste containers in public areas (to prevent litter being blown about).

Litter is an important source of the plastic soup, but not the only source. Government policy could also contribute to combatting other sources. With respect to regulation, this would possibly mostly be in an international context (e.g. to counter the use of plastics in cosmetics). Artificial grass granules end up in the environment via rainwater runoff; regulation could be a viable policy option here. Another starting point is the stimulation of innovation in order to improve techniques for filtering plastics out of wastewater (e.g. caused by washing textiles). The pollution caused by plastics in biodegradable waste that ends up in the environment via compost is discussed later in this section.

The Netherlands could also contribute to reducing the amount of plastics in the oceans by stimulating innovation and, more directly, by helping with the cleanup. The Dutch initiative 'The Ocean Cleanup' of Boyan Slat may successfully contribute to solving this problem.

4.3.3 Question Marks Around Intensifying the Recycling of Separated and Sorted Plastic Waste

It has been found that, currently, most of the plastic waste that is being separated from household waste consists of a mix that has a low market value, due to substantial application limitations. A greater effort in relation to the recycling of plastics, for instance by stricter regulation about the maximum allowed amount of residual household waste, will lead to an even larger flow of product with such limited application possibilities. This may then lead to stock formation or to the already separated waste being incinerated after all. A share of the Dutch 'mix' finds its way to Germany, where it is used in the production of low-quality products, while Germany

[2]CE Delft has studied the costs and impact of a number of variants for expanding the deposit-refund system (CE Delft, 2017).

incinerates part of its own mix with energy recovery (Van der Heijden, 2017). This negatively affects the environmental benefits.

Recycled plastics from homogenous flows know a broader range of applications, but also have their limitations, for example, those related to odour and food safety. Such limitations are likely to be reduced through technological development in separation techniques, as well as by regulation or agreements within the industry about the use of certain types of plastics, additives and colouring agents. Nevertheless, this will be no easy feat because of the many different types of plastics and additives that are needed, due to product characteristics and preconditions around food safety.

4.3.4 More Focus on Quality Rather Than Quantity

According to the Netherlands Institute for Sustainable Packaging (KIDV) and the Packaging Waste Fund, the quality of the recycled plastics—and therefore also their application possibilities and the price could already be improved using currently available techniques. Slowing down the sorting process could improve separation and thus achieve a smaller share of low-quality 'mix' as well as yield a mix of higher quality. This would increase processing costs, though. Current financial incentives, however, are only aimed at the highest possible output, with the precondition of a maximum of 55% 'mix', instead of the highest possible market value. The Packaging Waste Fund pays a fixed tariff for waste collection and separation. Municipalities focus more on quantity because of their objectives to reduce the amount of waste per inhabitant. Organising the set of instruments with a greater focus on quality could improve the environmental benefits of recycling plastic waste. This could be included in this year's framework agreement on packaging (Raamovereenkomst Verpakkingen).

An alternative could be to impose a ban (for the Netherlands or the EU as a whole) on, for example, black plastic packaging and/or other types of packaging that cannot be recycled easily, or a covenant by which companies commit to increasing the recyclability of their packaging.

4.3.5 Reducing Residual Waste Leads to Greater Risk of Polluted Biodegradable Waste, a Source of the Plastic Soup

An additional effect of focusing on the amount of residual household waste is that it increases the chances of polluting the biodegradable waste. Although data are not available, the trend appears visible in everyday practice at waste-incineration plants. Biodegradable waste is turned into compost. Plastics in compost in the Netherlands is a source of the plastics that end up in surface waters.

4.3.6 Effect of Plastics Recycling on CO_2 Emissions Is Limited with Respect to the Effort Taken

There appears to be no direct relationship between the separation of plastic waste by households and a reduction in litter or plastic soup. Recycling of plastics is therefore not the solution to these problems. As stated above, the availability of resources for plastics offers a few starting points for government policy on this subject. Recycling of plastics does lead to a lower emission of CO_2. As an indication of the CO_2 reduction resulting from a specific policy to enhance consumer recycling of plastics, a rough calculation was carried out. In 2015 this reduction on an annual basis was between 1,75,000 and 2,50,000 tonnes of CO_2, which equals 0.1–0.15% of total CO_2 emissions in the Netherlands (around 165 megatonnes), or for example less than 1% of the CO_2 emitted by road traffic in the Netherlands. This seems like a modest result in comparison to the size of the measure.

4.3.7 Reuse, Repair, Extending Product Lifetime and Ecodesign

Reuse, repair, extending product lifetime and ecodesign (products that are designed in such a way that they can be reused or recycled more easily) are possible solutions to reduce the demand for plastics and, thereby, also reduce the amount of plastic waste. Furthermore, a shift from ownership towards utilisation by consumers (e.g. in the 'sharing economy') may also lead to a decline in the use of plastics. The policy aimed at solving the primary problems (resources or waste) could lead to an encouragement of these business models as a solution. However, this is beyond the scope of this study and requires further analysis.

4.3.8 Bioplastics: Quality Criteria for CO_2 Reduction and Side Effects

Bioplastics may contribute to a reduction in CO_2 emissions. The CO_2 benefits vary greatly, depending on crop type and location. The required biomass is in competition with food, energy and nature; the degree of land use is potentially large and there are certain side effects (e.g. nitrogen, phosphates and water). Research by CE Delft shows that quality criteria may be helpful in ensuring the environmental benefits from lower CO_2 emission levels and in preventing as many negative side effects as possible, such as those on nature. This would be a task for national or international governments.

4.3.9 *Stimulating the Technological Development of Sustainable Technologies is Very Important*

Finally, it is important to note that many of the limitations that are mentioned above are a snapshot in time, based on the current state of technology. The government is able to make a contribution towards reducing negative environmental effects involved in the use of plastics by stimulating innovation through subsidies, green deals and/or fiscal measures. This is necessary due to the suboptimal bias towards polluting technologies. Subsidies would accelerate the profitability of sustainable energy technologies, as well as removing the innovation bias (Acemoglu, Aghion, Bursztyn, & Hemous, 2012). This may provide innovative sustainable initiatives from within society with the financial scope they need in order to become established enterprises.

4.4 Conclusions

The reasons for making the plastics value chain more circular include their claim on scarce resources, environmental pollution during resource extraction and production of plastics, and the pollution caused by plastic waste (plastic soup, litter, waste disposal and incineration). The main impact is that of environmental pollution. This publication gives an overview of the plastics value chain, providing insight into the problems described and suggesting policy options. The main conclusions are:

1. Production volumes of plastics, over the past 50 years, have increased more strongly than global GDP. This trend is expected to continue over the coming decades.
2. The depletion of fossil resources for plastics production (oil and natural gas) will play only a modest role over the coming decades, as the global sustainability of the transport and energy sectors will leave sufficient oil stocks for the production of plastics, for a few hundred years to come. Moreover, also the security of supply of oil and natural gas is unlikely to play a major role in the debate around the production of plastics.
3. The use of plastics involves external damage, particularly as a result of environmental pollution: the plastic soup, littering and CO_2 emissions. Particulate matter emissions, NO_x and SO_x, have in western Europe been effectively curtailed through regulation.
4. Bioplastics and the recycling of plastics form only a limited alternative to the fossil fuel-based production of plastics.
    a. Bioplastics, made of biomass, are not expected to be the solution to the problems of litter and plastic soup.
    b. There is a certain benefit with respect to CO_2 emission reduction, but this is set against an intensified claim on natural and agricultural land.

5. Intensifying the separation of plastic household waste for recycling under currently available technologies is not very promising from a welfare perspective. Separating plastic waste in households does not solve the problem of litter or plastic soup. Most of the recycled plastic waste consists of 'mix' (a mixture of different types of plastics) and 'foils' for which the application possibilities are only limited. The market price of the 'foils' and 'mix' is low and sometimes even negative—the latter because discarding them costs money. Recycling plastics from separated household waste is currently still very expensive. The costs of collection and processing of this 'mix' are therefore substantially higher than the market price, which is mostly determined by its limited application possibilities, as well as by the low price of primary plastic (oil price and CO_2 price). Increased recycling, for example, due to a greater focus on the amount of residual waste per household, is expected to lead to an even larger flow of a product with limited market possibilities. This, in turn, may lead to stock formation, or to incineration of the already separated waste material, which has a negative impact on the environmental benefits. Recycling provides no solution to the problems of litter and plastic soup, and at this point only contributes to CO_2 emission reduction to a limited degree.
6. The quality of the recycled plastics, and thus the application possibilities, could be expanded by improving the currently available sorting techniques. However, this will make processing more expensive. Current financial incentives push towards the highest possible output, though, instead of the highest possible market price. Organising the instruments to have a greater focus on quality could improve the environmental benefits of plastic waste recycling. This should be studied more closely.
7. A side effect of a focus on the amount of residual household waste is that this increases the chances of polluting other waste flows, such as biodegradable waste. Plastics in compost in the Netherlands is a major source of the plastics that end up in surface waters and thus, ultimately, in the plastic soup.
8. Expansion of the deposit-refund system is a type of policy that directly links to the prevention of litter and thus to a reduction in the Dutch contribution to the plastic soup. Over 90% of plastic litter consists of packaging. Expansion of the deposit-refund system provides users with the incentive to collect waste instead of discarding it into the environment. The question of whether the related benefits would outweigh the costs was not considered in this study.
9. Government policy may also contribute to combatting other sources of the plastic soup; for example in the field of regulation, possibly mostly in the international context (e.g. banning the use of plastics in cosmetics or artificial grass made of car tyres). Other areas would be stimulating innovation to improve techniques to filter wastewater (e.g. to remove particles from washing textiles) and reducing the pollution of biodegradable waste. The question of whether the related benefits would outweigh the costs was not considered in this study.
10. The main conclusions above were drawn from an analysis based on the current state of technology. Technological developments could, for example, improve the quality and reduce the costs of recycled plastics. The government may contribute

to this process by stimulating innovations through subsidies, green deals and fiscal measures.[3] Another option would be to internalise the external effects into taxes.[4] This last point may provide innovative sustainable initiatives from within society with the necessary financial scope to achieve full development.

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[3] See Acemoglu et al. (2012).

[4] Aalbers, Renes, and Romijn (2016) indicate that the CO_2 price that should be used by the government to achieve the two-degree climate target should be over 60 euros per tonne, for all economic activity. The current CO_2 price within the Emissions Trading System (ETS) is around 6 euros per tonne and applies to part of the economy.

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