Annex 1 Show cases

The show cases will be presented in detail in the following order:

No	Case study	Country
1	Aggregates levy	UK
2	PIUS - Product Integrated Environmental Protection Effizienz Agentur NRW	Germany
3	NISP	UK
4	Aluminium can recycling policies	Sweden/ Belgium
5	Sustainable clothing roadmap	UK
6	Green supplier network	USA
7	Water for the Future - Murray Darling Basin	Australia
8	Food waste reduction	South Korea
9	Basic policy on promoting green purchasing and green purchasing network (GNP)	Japan

Some of the show cases include own annexes with detailed information.

1 Aggregates Levy, UK

Name of policy:	Aggregates levy
Country:	UK
Sector:	Mining and construction
Resource:	Sand, gravel, stone
Instruments:	Levy

1.1 The purpose of the policy

The way aggregates are produced and consumed has wide-ranging positive and negative effects in terms of carbon emissions from extraction, processing and transport, effects of biodiversity and landscape, generation and recycling of waste streams, effects on local communities from extraction and transport.

The Aggregates Levy introduced in April 2002 in Great Britain and Northern Ireland (United Kingdom) is an example of a centralised ad quantum tax (quantity tax) by weight. The aggregates levy, which is understood as a "green tax" in the UK/Northern Ireland, is to address the environmental impacts of the extraction and transportation of the construction materials, including noise, dust, vibrations, visual intrusion, loss of biodiversity, etc. and internalise them. The funds are earmarked for environmental projects used in the construction industry and for compensating the regions. The most important aim of the levy is to maximise the use of alternatives, such as recycled construction and demolition waste, and secondary materials, such as china clay waste, and to encourage the more efficient use of aggregates, a greater resource efficiency in the construction industry, a move away from aggregates by development of a range of alternatives, such as the use of waste glass and tyres in aggregate mixes.

The three main targets of the aggregates levy are:

- To compensate for environmental externalities

- To reduce demand for primary aggregates[1]

- To encourage substitution by alternative materials such as recycling and secondary materials.

The Aggregates Levy is embedded in a set of progressive initiatives and policies in UK that should be taken account of. Those policies are, inter alia, the Strategy for Sustainable Construction, a joint industry and Government initiative intended to deliver benefits to both the construction industry and the wider economy.[2]

Type of benefits

The benefits to the companies are:

- Increasing profitability by using resources more efficiently
- Increased resource efficiency
- Increased process efficiency
- Minimisation of waste and waste charges
- Enhancing company image and profile in the market
- Opportunities for firms which supply recycling and secondary aggregates
- Reduced reliance on non-renewable resources (quarried mineral products)
- Reduced embodied carbon content.

1.2 Characteristics of the context where the policy is implemented

The British aggregates industry is represented by the British Aggregates Association (BAA)[3]. The minerals products industry, which includes the cement, asphalt, concrete, lime, mortar and silica sand industries, is represented by the Minerals Products Association (MPA).[4] According to information on BAA and MPA websites, the industry provides employment for around 40,000 people, mainly in rural communities in around 1,300 quarries, and contributes around GBP 3bn in primary products to the GDP.

1.2.1 Aggregates Levy (AGL)

A tonne of mined "aggregates", which includes sand, gravel and crushed stone (including marine aggregates), was initially taxed at GBP 1.60. This represents approximately 20 per cent of the average raw material price. Since 2009, the rate is GBP 2 per tonne, from 2011 on it will be GBP 2.10.

In the fiscal year 2008/2009 the Aggregates Levy received a total of GBP 334 million in tax revenue (HMRC 2010).

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[1] Sand, gravel and crushed stone

[2] The development of three sector resource efficiency plans prepared and implemented by trade associations has begun by the end of 2008 under the responsibility of the Construction Products Association (HM Government 2008).

[3] http://www.british-aggregates.co.uk/

[4] http://www.mineralproducts.org/

Table 1-1 Revenues from aggregates levy in UK since FY 2002/2003

1.3 Financial Year	1.4 Tonnage (Thousands)	1.5 Total Receipts (million GBP)
2002/03	232,219	247
2003/04	266,584	339
2004/05	264,381	334
2005/06	265,154	326
2006/07	263,303	321
2007/08	273,845	339
2008/09	224,572	334

Source: UK Trade Info https://www.uktradeinfo.com/index.cfm?task=bullaggr

In the Government's view, the levy has been a significant factor in reducing sales of virgin aggregates by about 18 million tonnes between 2001 and 2005.[5]

Two further instruments are important in the context of the Aggregates Levy. A proportion of the revenue that is generated through the Aggregates Levy, approx. 10 per cent, is used to provide a source of funding for research aimed at minimising the effects of aggregate production. This fund, delivered through Defra, is called the Aggregate Levy Sustainability Fund (ALSF). The Landfill Tax (implemented 1996) is a tax on the disposal of waste aiming to encourage waste producers to produce less waste and recover more value from waste through recycling. The tax applies to all kinds of wastes - the standard rate at GBP 48 per tonne (since April 2010). It is charged by weight with two rates while inert or inactive waste is subject to the lower rate, which is at GBP 2.5 per tonne. Although aggregates are usually classified as inactive waste, the landfill tax sets an incentive to produce more resource efficiently. The costs for disposal of construction and demolition waste depend on the type of waste and how well sorted the fractions are. The costs for disposal of well sorted concrete waste at Roseland Aggregates are GBP 13.2 per tonne (Roseland Aggregates, 1 June 2010).

1.5.1 Impact of the levy

The primary effect of the levy is a **decrease in the extraction of aggregates** (of 275 million tonnes of total demand) of around 6 million tonnes in 2005. 68 million tonnes recycling materials are used (equivalent to approximately 25 per cent of all aggregates required) (EEA 2008).

The recycling market has been highly dynamic, while the reduction of the primary extraction is relatively low. This effect is ascribed not only to the tax, but also to measures introduced before, such as the "land fill tax" implemented in 1996. In addition, there has been a general decline in road construction. Technical improvements in the construction industry that allow for a lower intensity of the use of raw materials have reinforced these effects (EEA 2008).

[5] http://www.theyworkforyou.com/debates/?id=2010-03-30a.791.0

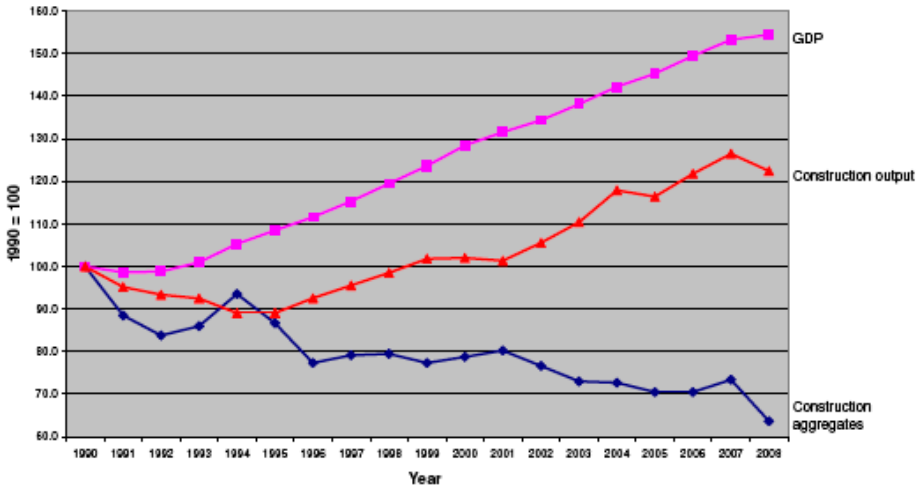
Table 1-2 Production and recycling in four selected European countries

2	Czech Republic	Italy	Sweden	United Kingdom
Companies operating	300	1,796	170	350
Number of sites	520	2,460	1,940	1,280
Total production (mill/tonnes)	50	355	75	275
Total recycled (mill/tonnes)	2.5	3.5	8	68
Recycling rate	5%	1%	11%	25%

Note: Recycling rate is defined as % input in aggregates
Source: EEA 2008

The aggregates sales since 1990 in UK are compared with the construction output and the GDP in the table below.

Figure 1-1 Trends in GDP, construction aggregates sales and construction output since 1990



Source: BDS 2009, p. 6[6]

The market for aggregates in the UK has changed in the last years. The Aggregates Levy has encouraged the **use of recycling and secondary material**, which has led to a decrease of the aggregates output. However, views on the effectiveness of the levy are mixed. Compared with an overall levy cost of over

[6] Much of the rise in construction output by value has been from meeting higher requirements for environmental, health and safety issues.

GBP 400 million a year, the additional one million tonnes of recycled aggregates supplied due to the levy has therefore "cost" GBP 400 of additional taxation.[7] On the other hand, using recycled aggregates means avoiding paying the levy and suppliers offering recycled aggregates are likely to have an increase in business.[8]

Critical points mentioned in the literature are the lack of measurement of the impacts on environment externalities, trade distortion in Northern Ireland, larger transport distances and stockpiling of unsold but locally available lower quality primary aggregates increasing at quarries.[9]

The BDS (2009) published details of all known static aggregates recycling plants in Great Britain, including details of over **650 recycling plants**. Before the introduction of the landfill tax, the number of new plants established each year averaged 16, doubling in the following period. Following the introduction of the aggregates levy, this trend has not stopped, however, and has even accelerated with 39 recycling plants established every year.

Table 1-3 New recycling plants

Period	Average number of new recycling plants established per annum
1990 – 1996	16
1997 – 2001	33
2002 – 2004	39

Source: BDS 2009

The combination of policies has provided a strong incentive to producers to change production methods and practices. Within the triangle of instruments, which includes the aggregate sustainability fund and landfill tax, the aggregate levy forms an important component. The overall effect has been to encourage the substitution of primary aggregates for recycled construction and demolition waste, which have a much lower environmental impact from energy use and carbon dioxide emissions (Legg 2007).

Reduction of material costs

The price of aggregates in the UK at the quarry gate is of the order GBP 5 per tonne (average delivered prices are GBP 8 per tonne) although the price varies depending on quality and volume purchased (Legg 2007). The effect of the GBP 2.10 tax, therefore, is to increase prices by the order of 25 per cent. However, the low elasticity of demand for the product means that much of the burden of the levy can be passed onto the purchasers of aggregates (Legg 2007). Recycled aggregates have prices in the range of GBP 5.50 to GBP 8.00[10] per tonne.

[7] http://www.envirovaluation.org/index.php/2005/02/24/www_letsrecycle_com

[8] http://www.crwplatform.co.uk/conwaste/aggregates-levy/

[9] http://www.british-aggregates.co.uk/documentation/doc118.pdf

[10] http://valerecycling.co.uk/aggregates.htm,

The costs of C&DW material that is recycled depends widely on the quality and content of the material. Derwen Construction is a UK company that produce aggregates from recycled C&DW material. The C&DW material has a negative value. Derwen Construction charges GBP 2.5-7.5 (EUR 3.08 - 9.23) per ton of C&DW they receive. The costs depend on the quality of the material. The market that Derwen Construction operates in is extremely competitive, with a number of gravel plants situated close to the company. The quality of the recycled material does meet the quality of virgin materials. The consumers demand material of a certain quality and choose the type of material that is cheapest. Derwen Construction is able to sell single size aggregates at a price of GBP 7.5 per tonne (EUR 9.23). The quality of this material matches the quality of virgin aggregates of a price of GBP 8 (EUR 9.84). The company is thereby able to sell recycled aggregates at a price that is little lower than the price of virgin materials (Keogh, 30 June 2010).

The price figures are very approximate. According to oral information of the MPA[11], highly diverse kinds and qualities of aggregates make it difficult to provide an average price without reference to specific production/consumption data. Business objectives (e.g., road building requiring lo quality aggregates or private housing construction requiring higher quality aggregates) determine the materials processed and the options to apply recycling or secondary materials. By applying recycled and secondary aggregates companies definitely can save GBP 2.10 per tonne.

Recycled aggregates include, for example, recycled concrete from construction and demolition waste material (C&DW) and railway ballast. Secondary Aggregates are usually by-products of other industrial processes not previously used in construction. Manufactured secondary aggregates are pulverised fuel ash (PFA) and metallurgical slags, natural secondary aggregates include china clay sand and slate aggregate.

A complete recycling of mineral resources is probably not within reach in the medium-to long term. Many natural stone products cannot be dismantled into their raw materials because irreversible processes have taken place in the production processes. Even where a treatment is possible, the original quality can often not be achieved. This is called "down cycling". According to Haefner, the proportional recycling rate to the total consumption can reach 20 per cent at best (Haefner 2006). However, the estimates vary greatly in this issue (between 8% and 28%).

Reduction of disposal costs

Waste is a key issue to the construction industry. Around 400 million tonnes of materials are used every year by the construction industry in UK while at least 90 million tonnes of construction, demolition and excavation inert waste is produced which is about three times the amount of waste generated by all UK households combined. 40 million tonnes (44%) of this was used as recycled aggregate and six million tonnes (6.5%) as recycled soil for landfill engineering or restoration. In addition to the 91 million tonnes, 15 to 20 million tonnes of

[11] John Bullock, Mineral Products Association

non-inert and mixed construction and demolition waste and a further 13 million tonnes of waste is created through material waste that is delivered to the site, unused and then disposed off (WRAP estimations).

The increasing legislation and waste costs, and tougher government and industry targets indicate a necessary reduction of waste to landfill, and, ultimately achieving zero inert waste to landfill. Two issues are involved, the construction waste occurring in building processes and the waste occurring due to demolition. The Government states that by 2012, a 50 per cent reduction of construction, demolition and excavation (CD&E) waste to landfill compared to 2008 should be achieved as a result of reduction, reuse, recycling and recovery (HM Government 2008). The industry has started to move away from waste management to resource efficiency leading to improved economic performance.

2.1 Lessons learned and lessons which may be relevant to transfer or scale up to the EU

The European Aggregates Association (UEPG) represents members in 22 European countries who produce 3 billion tonnes of aggregates per year in 28,000 extraction sites with 350,000 employees (incl. contractors). The average annual aggregates production is approx. 7 tonnes per EU citizen. The European aggregates industry is the largest non-energy extractive sector in the EU. The majority of enterprises of the sector are small and medium sized enterprises. The sector is the main supplier to the construction industry (UEPG 2008-2009).[12]

2.1.1 Assumptions necessary to transfer or scale up results

The use of recycled and secondary materials in the UK aggregates market has increased rapidly, rising from 30 million tonnes per annum in 1990 to over 70 million tonnes in 2007 (MPA 2010)[13]. Today, UK has the highest aggregates recycling rate in Europe, more than twice the levels achieved by France or Germany and is close to its full potential (BDS Marketing Research 2009).. The aggregates levy in the UK is evidently a factor to change behaviour of construction companies towards more input of recycling materials. However, the effect cannot be ascribed to the levy alone. How much of the increasing recycling input can be ascribed to the levy is not documented though. This fact is highly controversial in the industry.

However, large potentials in Europe lie in the increased use of recycling and secondary materials by using construction waste as an important source and

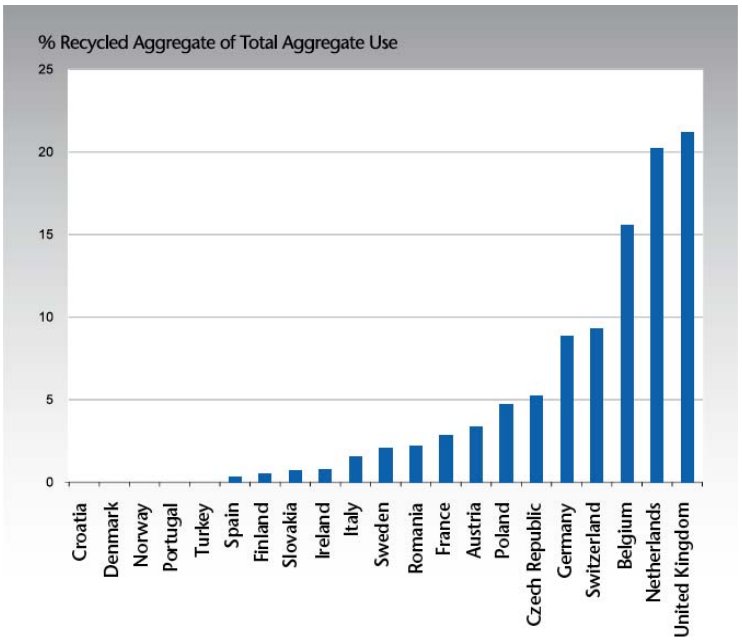
[12] The main end-uses of aggregates are buildings such as a typical new home that uses up to 400 tonnes of aggregates, both end product and concrete, hospitals, schools, bridges, flood protection, roads using up to 30,000 tonnes of aggregates for 1 km motorway, and finally railways as essential as track ballast for Europe's rail network using up to 9 tonnes of aggregates for 1 meter of railway. Costal protection is becoming increasingly important.

[13] http://www.mineralproducts.org/prod_agg_recy01.htm, Mineral Products Association, formerly Quarry Products Association

thus decreasing demand for primary aggregates. The recycling quotas vary considerably across Europe, and they are in most cases very low. According to the BDS, the country proportion of recycled aggregates to total primary and recycled aggregates production turns out to be as follows:

Recycled aggregate are estimated to account to 4 per cent of aggregate use in Europe without UK and 5 per cent including UK (BDS 2009), with significant differences between countries. The greatest users are the United Kingdom, the Netherlands, Belgium, Switzerland and Germany (see following figure).

Figure 1-2 Recycled aggregates of total aggregates use



Source: CSI 2009 after UEPG 2008

However, scaling up the results of the policies pursued in UK (including the aggregates levy) will be afflicted with great uncertainties. Numbers are very rough, and even serious sources provide rather dimensions than concrete estimations.In order to be able to transfer the results from UK, it is necessary to make the following assumptions;

- The resource saving potential is the same in construction across EU27.
- The average division of recycling facilities in the aggregates sector is the same across EU27.
- The administrative costs related to the introduction of an aggregates levy will be the same in all Member States
- The implementation costs are the same in all Member States.

2.2 Transferring results

From 1990 to 2007, the share of the aggregates supplied from recycled and secondary sources in UK has risen from 10 per cent to 25 per cent[14], a rapid increase. The use of recycled and secondary materials in UK is hence close to its full potential. This is not the case in throughout Europe. The following table compares production figures and recycling shares.

Aggregates use

The table below shows the Primary aggregates extraction in EU23 in 2007 and relative recycling shares.

Table 1-4 Primary aggregates extraction in EU23 in 2007 and recycling shares in per cent

Country	Absolute in million tonnes	Recycling share
Austria (a)	54.4	3.2%
Belgium (b)(c)(d)	51.0	16.0%
Bulgaria	28.2	4.0*%
Cyprus	13.1	4.0*%
Czech Republic*	51.2	5.5%
Denmark	68.7	4.0*%
Estonia	15.3	4.0*%
Finland	100.0	0.5%
France	423.4	3.0%
Germany	387.1	9.0%
Hungary	47.8	4.0*%
Ireland*	160.0	1.0%
Italy (a)	297.4	2.0%
Latvia	9.5	4.0*%
Lithuania	15.6	4.0*%
Netherlands	69.2	20.5%
Poland* (f)	170.9	4.8%
Romania*	2.2	2.5%
Slovakia*	21.5	1.0%
Slovenia	35.8	4.0*%
Spain*	500.0	0.3%
Sweden	84.0	11.0%
United Kingdom (e)	235.0	22.0%
Total EU-23	2,841.3	estimated average 4%

Source: EEA 2008, BGS 2009 (extraction data) and BDS 2009 (after UEPG) (recycling data) no data for Greece, Luxembourg, Malta, Portugal

* (Partly) estimated

(a) Sales (b) Deliveries (c) Includes construction sand and silica sand, excludes gravel (d) Includes gravel (e) Includes small quantities for other purposes in Northern Ireland (f) Includes an estimate for small producers

[14] MPA 2010. This figure is different from the recycling rate of 22% announced by the BDS 2009. For further estimations we use the 22% share which is more conservative.

Aggregates saving potential

Assuming that a 22 per cent share of secondary/recycling aggregates was possible in Europe, the results show that there is a huge unharnessed potential. The following table gives an impression of possible savings for the largest eight producers.

Table 1-5 Saving potential of the largest eight producers considering current recycling figures

Country	Extraction of primary aggregates absolute in million tonnes	Share of recycling aggregates	Absolute without realised savings	Extraction of primary aggregates absolute with 22% share of recycling aggregates (in million tonnes)	Saving potential in million tonnes
Spain	500.0	0.3%	501.5	391.2	**108.8**
France	423.4	3.0%	436.5	340.5	**82.9**
Germany	387.1	9.0%	425.4	331.8	**55.3**
Italy	297.4	2.0%	303.5	236.7	**60.7**
Poland	170.9	4.8%	179.5	140.0	**30.9**
Ireland	160.0	1.0%	161.6	126.1	**33.9**
Finland	100.0	0.5%	100.5	78.4	**21.6**
UK	235.0	22.0%	301.3	235.0	0.0
Total	2273.8		2409.8	1879.6	394.2

Source: Own calculations

The average price of a tonne of aggregates is reported to be about GBP 8. If this price is assumed to be similar all over Europe, the reduction in primary aggregates extraction would be equivalent to GBP 3.1 billion.

The following table shows the different applications of aggregates. The public sector pays most of the aggregates levy. This fact is often critically referred to as “recycling cash from one government department to another” (BDS 2009).

Table 1-6 Estimate of aggregates usage and the importance of the UK public sector

Sector	% use of aggregates
Road maintenance	17%
Road construction	12%
Schools and hospitals	14%
Public housing	2%
Other publically financed schemes	10%
Total public	**55%**
Private housing	14%
Industrial	8%
Commercial	14%
Other private	9%
Total private	**45%**
Total	**100%**

Source: BDS 2009

Assuming that the proportion of the public to the private sector is similar in Europe, the above figure of material cost reduction would correspond to savings of GBP 1.4 billion in the private sector and GBP 1.7 billion in the public sector. A rough calculation of the revenues from a tax with a range similar to the UK Aggregates Levy implemented in all European Member States would generate the following results:

Table 1-7 Potential revenues of an aggregates levy on the basis of tonnes produced in 2007

Country	Potential revenue in million € (for 2€/tonne)	Revenues from private sector
Spain*	1000.0	450.0
France	846.8	381.1
Germany	774.2	348.4
Italy	594.8	267.7
United Kingdom	470.0	211.5
Irish Republic	320.0	144.0
Poland	341.8	153.8
Finland	200.0	90.0
Sweden	168.0	75.6
Denmark	137.4	61.8
Netherlands	138.4	62.3
Hungary	95.6	43.0
Austria	108.8	49.0
Czech Republic	102.4	46.1
Belgium	102.0	45.9
Slovenia	71.6	32.2
Slovakia	43.0	19.4
Bulgaria	56.4	25.4
Lithuania	31.2	14.0
Estonia	30.6	13.8
Cyprus	26.2	11.8
Latvia	19.0	8.6
Romania	4.4	2.0
Total EU-23	5,682.6	2557.2

* estimated 45% of expenditures on construction

Source: Own calculations

Due to the great importance of aggregates in the economic system of almost all European Member States and since the **demand for construction minerals is relatively inelastic**, a plausible option for resource taxes could be the European-wide taxation or charging of construction minerals. Such a scheme could contribute to a long-term restructuring of the tax system: the establishment of a two-pillar tax system with less weight on wage taxes culminating in a strong pillar of material input and land use taxes in future decades (EP 2009).

2.3 Literature

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http://www.sustainableaggregates.com/

http://aggregain.wrap.org.uk/more_information.html

3 PIUS-Check, North Rhine-Westphalia, Germany

Name of policy:	PIUS-Check
Country:	Germany
Sector:	SME Production
Resource:	All
Instruments:	Subsidised consultants

3.1 The purpose of the policy

The Effizienz-Agentur NRW (EFA) initiative was launched by the North Rhine-Westphalia (NRW) Ministry in 1998. The EFA initiative is aiming at promoting cleaner production methods in SMEs. The EFA has developed a toolbox with a range of consulting services for SMEs. The purpose is to help SMEs improve their resource efficiency through avoiding pollution and improving resource conservation in the production process.

The toolbox of services includes counselling on clean production processes, eco-design (optimisation of product development process), resource cost accounting and acquisition of funding. The EFA has been particularly successful in assisting SMEs with adapting clean production processes. The EFA offers a PIUS-Check, which is an audit where the relevant material flows and current level of production technology are analysed and recommendations for possible improvements are made.

The EFA have experiences from projects in a range of sectors, including the automotive industry, chemical industry, food processing industry, metal processing, paint production and application, paper industry, surface cleaning and finishing, textile industry and the furniture industry.

3.1.1 PIUS-Check

The EFA has a team of 10-20 engineers who makes the initial audit where areas for potential resource efficiency measures are identified. External process ex-

perts are used to conduct the technical audits and make suggestions for potential changes. The total costs of conducting an audit are EUR 10-15,000. Up to two-thirds of these costs can be covered by the national clean production programme Verbesserung der Materialeffizienz (VerMat) organised by Demea[15] under the Federal Ministry of Economics and Technology. The EFA assists SMEs in applying for funding. The funding procedures are complex, and this service is a great help to small companies that do not have the necessary resources and competences to make such application. The total time spent on the PIUS-Check from the initial meetings to planning of potential measures is six to nine months.

Since the PIUS-Check was initiated in year 2000, more than 500 PIUS-Checks have been conducted. 216 of the companies involved have implemented measures (which corresponds to more than 40 per cent).[16] 75 per cent of the companies have less than 250 employees.[17] The EFA presents the potential of the programme through public platforms. The EFA promotes the PIUS-Check to companies in the relevant sectors. Information on the programme is available at EFA's website. The EFA approaches companies that may benefit from the PIUS-Check. One of the means to get in contact with companies is through industrial organisation but, many projects are initiated by companies that approach the EFA. The share of projects being initiated by EFA initiatives and companies respectively is approximately 50/50 (Interview Graf, 21 April 2010).

Type of benefits

The benefits to the companies that arise from participating in the programme are:

- More cost-effective production
- Increased resource efficiency
- Increased process efficiency
- Minimisation of waste
- Efficient waste and environmental management
- Increased employee motivation
- Improved company image.

The environmental benefits include:

- Lower resource consumption
- Reduced pollution levels
- Improved environmental awareness in industry (http://www.efanrw.de/index.php?id=19&L=1; 10 May 2010).

[15] Deustche Materialeffizienzagentur

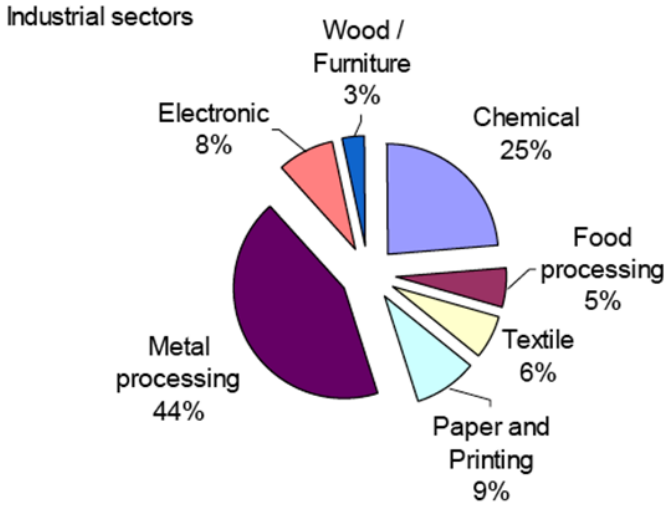
[16] http://www.efanrw.de/index.php?id=40&L=1

[17] Most of the 25 per cent of companies that went through the PIUS -Check employ between 300 and 600 employees.

3.2 Characteristics of the context where the policy is implemented

The total number of SMEs in the NRW is 600,000.[18] 12,000 of these companies are engaged in industrial production. As reflected by the figure below, the largest sectors are metal processing, chemical, electronic, paper and printing, electronics and the food sector.

Figure 3-1 Breakdown of SMEs in the NRW by industrial sector



Source: Jahns (2008)

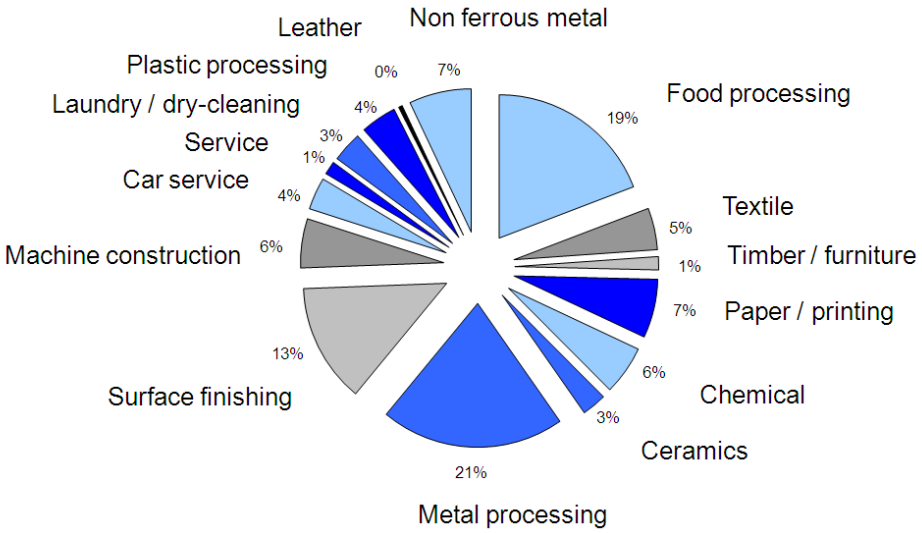
The industrial production in the NRW entails a wide range of environmental impacts. Of particular importance is energy and water consumption, but a wide range of resources are used in the production, including metals(ferrous and non-ferrous), plastics, food, liquids, solvents, etc.

3.3 Lessons learned and lessons which may be relevant to transfer or upscale to the EU

The sectoral share of the companies that have had a PIUS-Check is shown in the figure below.. The PIUS-Check has been particularly successful in introducing cleaner production methods in the metal processing, the metal finishing and the food processing industries (Interview Matthias Graf, 21 April 2010). Around 65 enterprises in the surface finishing industry, 95 companies in the food processing industry and 105 companies in the food processing industry have had the PIUS-Check made. There is significant overrepresentation of companies in the food processing industry among the PIUS-Checked companies (19 per cent) compared to the sector's share of all SMEs in NRW (5 per cent).

[18] SMEs are in this context defined as companies with 20-500 employees.

Figure 3-2 Sectoral share of 'PIUS-Checked' companies



Source: Graf (2009)

The amortisation period for investments should not exceed two years, as the SMEs are reluctant to make investments with longer time horizons. Around 50 per cent of the companies that go through the PIUS-Check would also have done so without financial support. In around 70 per cent of the PIUS-Checks, the suggested measures include implementation of new production equipment. In the remaining 30 per cent of the PIUS-Checks, the suggested measures include organisational changes (Walbaum, 2007). The EFA assists companies in applying for financial support to implement the proposed measures. The EFA uses the available funding mechanisms, including low interest loans. The available funding schemes are an important driver for companies to implement cleaner production methods.

The aggregate results of the PIUS-Checks are shown in the table below.

Table 3-1 Investments and realised saving after PIUS-Checks

	Total	Per SME
Investments (EUR)	36 million[a]	167,000[d]
Annual savings in the production processes (EUR)	10.4 million[a]	50,000 [d]
Savings of water/wastewater (m^3/y)	1.169 million[a]	6,000 [b]
Annual energy savings	50.5 GWh[b]	300 MWh[b]
CO_2 reduction (tonne)	20,000[c]	113[c]

a) Based on data from 2010; b) Based on data from 2009; c) Based on data from 2008; d) Own calculations

Source: http://www.efanrw.de/index.php?id=40&L=1; Graf (2009); Jahns (2008)

Of the approximately 500 companies that went through the PIUS-Check, 216 enterprises have implemented measures (which correspond to more than 40 per cent) (http://www.efanrw.de/index.php?id=40&L=1). In approximately 90 per cent of PIUS-Checks, measures that will be cost-effective to implement by the company are identified (Interview Andreas Kunsleben, 3 May 2010). The investments made and the saving achieved varies significantly from company to company. None of the participating companies are, however, are constituting a significant share of the total investments or economic savings achieved.

With respect to resource saving performance, the companies that participate in the PIUS-Check are at an average level compared to all SMEs in the respective sectors. Hence, the average company that goes through the PIUS-Check neither among the best performing companies, nor among the worst. It is therefore possible to assume that the results of the PIUS-Checks can be scaled up to include all companies in the respective sectors in the NRW.

The PIUS-Check's assessment of production optimisation is based on best available technology (BAT) in sectors that are included by the IPPC Directive, and where BAT Reference documents (BREFs) exist, these BREF documents can be used to identify the best available technology, and this is the case in the metal finishing industry (Interview with Flemming Dahl, 3 May 2010).

3.3.1 Resource saving potentials in companies that went through the PIUS-Check

The resource savings mentioned below are rough estimates based on PIUS-Check consultants' experiences (Interview Mathias Graf, 7 May 2010).

3.3.2 Resource savings in the metal finishing industry

The primary resource saving potential in the metal finishing industry involves process chemicals, water and energy. An estimate of the water saving potential in the metal finishing companies in NRW is 30-40 per cent of the water consumption. The average, realised water savings in the metal finishing enterprises amount to approximately 20-30 per cent of the water consumption. The performance of German metal finishing companies with respect to limiting water consumption is leading in Europe. The Danish metal finishing companies are at the same level as the German companies. An estimate of the cost-effective water saving potential in Danish metal finishing companies is around 20-25 per cent of the water consumption (Interview Flemming Dahl, 3 May 2010).

Box 3-1 Results of PIUS-Check in metal finishing company

Muschert + Gierse Galvanik GmbH in Neuenrade is a metal finishing company with 50 employees. By changing the production line, the water efficiency of the rinsing process was improved and the consumption of process chemicals was reduced. The discharge of wastewater was reduced by 1,300 m3 annually, which corresponds to 40 per cent, and 50 per cent fewer chemicals was used for treatment of the wastewater. The total annual savings amounts to EUR 75,000 annually. The total investment costs were EUR 300,000.

Source: Effizienz-Agentur NRW (2005)

The potential water savings in galvanisation plants can be realised by reducing water consumption in the rinsing processes. The potential water savings are highest where new production lines are established. In existing production lines, it is often difficult to find the space needed for adding the optimal number of rinsing baths. The economic savings are particularly related to the reduction of costs of wastewater discharge. The wastewater discharge rates are relatively high in Germany compared to the rest of the EU. The wastewater discharge costs in the NRW are in the magnitude of EUR 5-12/m^3, the cost of tap water is around EUR 1-2/m^3.The economic potential for resource savings largely depends on the individual company's context, i.e. the size of the company, the quality of the existing production line, and the kind of metal finishing performed.

Box 3-2 Results from PIUS-Check in metal finishing company

A small metal finishing company, Fritsch GmbH Galvanische Metallveredelung with 10 employees has through improved processing, process monitoring and training of employees, reduced the consumption of chemicals by 3,600 kg annually, which corresponds to 40 per cent or EUR 11,000. Additional savings of EUR 4,460 are secured by reducing the consumption of anode material (1,200 kg/y), reducing the metal hydroxide sludge (3,600 kg/y) and the use of precipitation chemicals (1,200 l/y). The total investments costs were EUR 3,000.

Source: Effizienz-Agentur NRW (2009a)

3.3.3 Resource savings in the food industry

The main resources that can be saved in the food production industry are energy and water, but resource savings also arise from reduced consumption of chemicals. Water consumption in the German food industry is quite high. Strict regulation of the food production industry entails that the water demand for meeting the sanitation standards is high. A rough estimate of the potential water savings in the average enterprise is around 20 per cent. This potential is normally achieved by the companies implementing the measures identified in the PIUS-Check.

Box 3-3 Results from PIUS-Check in food processing company

Windau GmbH & Co. KG made a new production plant in 2006. A new production line was made where water savings from improved management of the rinsing process were realised. The annual water consumption was reduced by 9,720 m^3, which corresponds to a reduction of 72 per cent. The total yearly cost savings including savings of cleaning chemicals amount to EUR 137,000. Windau made investments of EUR 250,000 in the new production plant.

Source: Effizienz-Agentur NRW (2006)

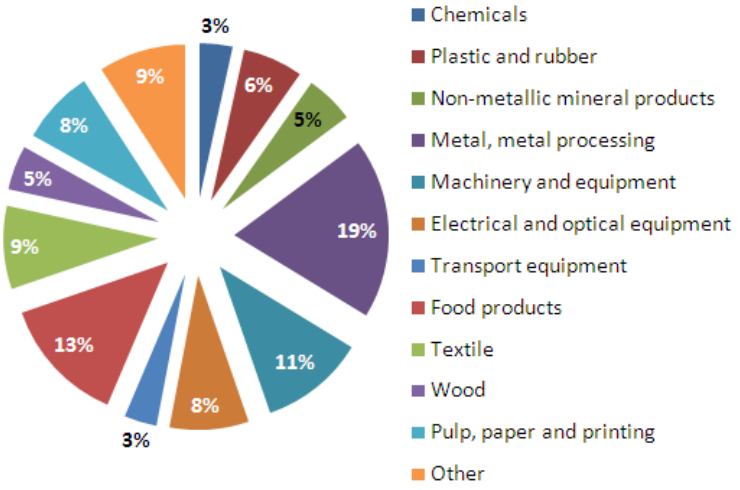
3.3.4 Resource savings in the metal processing industry

The major resource saving potential in the metal processing industry arises from energy savings and savings of raw material for the production process. A rough estimate of the saving potential for raw materials is 5-10 per cent. The costs of raw material constitute a considerable share of the total production costs for SMEs in the metal processing industry. In some companies the costs for raw material constitutes around 40 per cent of the company's turnover. A company with a yearly turnover of EUR 60 million and with raw material costs of EUR 25 million annually, can realise a yearly saving of EUR 1.3-2.5 million or between 2-4 per cent of the company's annual turnover.

3.3.5 Geographical relevance

As this policy addresses SME in different sectors and is not exclusive in any way, it will be relevant to transfer the results to all SMEs in EU27. The composition of the industrial sectors varies across the EU.

Figure 3-3 Breakdown of SMEs in the EU by sector



Source: Eurostat, data is from 2007.

The distribution of SMEs in the EU by sector is shown in Figure 3-3The total number of SMEs in the manufacturing industries in the EU is 215,442 (Euro-

stat). The sectors that have the largest share of SMEs in the EU are metal and metal processing, food products, pulp, paper and printing. These companies also make up the largest number of companies in the NRW. A much larger share of SMEs in NRW is engaged in the metal processing industry compared to SMEs in the EU as a whole, and the chemical industry is significantly better represented in the NRW than in the EU. When comparing the share of 'PIUS-Checked' SMEs by industrial sector with the composition of SMEs across the EU, the share of PIUS-checked companies in the food production/processing industry is close to the sectoral share of SMEs in this sector in the EU. The data on the metal processing industry in the EU include the metal finishing industry. The metal finishing industry is therefore overrepresented in the 'PIUS-Checked' companies compared to the EU as a whole.

The resource efficiency performance (i.e. how well enterprises use resources) is not lower in German companies than the average of companies in the same sectors in EU27. The German environmental regulation is at a higher level and is more strictly enforced than the average in EU27. Moreover, in order to increase competitiveness, German companies have traditionally applied cost-effective resource saving measures. Therefore, it is assumed that the resource saving potential is not lower in an average EU SME than in SMEs in the NRW.

3.3.6 Potential for resource savings

The Effizienz Agentur NRW has analysed the resource efficiency impacts of the programme at an aggregated level. The resource savings collected across sectors concern energy and water. As energy savings it is outside the scope of the study, findings on that topic will not be further investigated.

With regard to the water saving potential, the average, annual water saving potential in SMEs for the metal processing, metal finishing and the food processing sectors are shown in the table below. It is assumed that the average resource saving potential in SMEs in these sectors across EU27 will not be lower than the 'PIUS-Checked' companies.

Table 3-2 Resource saving potentials in selected sectors

Sector	Saving potential		Other resources
Metal finishing	potential water savings	35%	potential chemical savings factor 3 of the cost saved on water
	achieved	20-30%	
Food processing	potential water saving	20%	n.a.
	achieved	20%	n.a.
Metal processing	potential saving of metal input	5%	n.a.
	achieved	5%	n.a.

Source: Based upon Graf (7 May 2010).

3.3.7 Assumptions necessary to transfer or scale up results

In order to be able to transfer the results from Germany (NRW), it is necessary to make the following assumptions.

- The average division of SMEs by sector is the same across EU27
- The cost of carrying out the PIUS-Check will be the same in all Member States
- The administrative costs related to the PIUS-Check will be the same in all Member States
- The share of SMEs choosing the PIUS check and the share not choosing it is the same across EU27
- The resource saving potential is the same in each industrial sector across EU27
- The implementation cost are the same in all Member States
- There are 215,442 similar SMEs in EU27 compared to 12,000 in the NRW.
- The investment period is 10 years, and savings will be achieved in the same period
- A calculation rate of 5 per cent is used, deemed reasonable for alternative investments.

These assumptions relate to how SMEs operate in the different countries. As Europe is an open market, and as many of the SMEs import and export goods, there is reason to believe that the assumptions are valid and will provide reliable results that can be used as general estimations.

3.4 Result of resource saving potential

Scaling up the results of the PIUS policy pursued in the NRW will lead to the following surplus of the SMEs in EU27. It is in this result assumed that only a number of all SMEs will have the PIUS check done. (The percentage is the same as for the NRW). The net-present value (NPV) is estimated based upon a discount rate of 5 per cent and a 10-year investment horizon.

The potential economic benefit of offering the PIUS-Check to all SMEs in EU27 is EUR 776 million, see **Error! Reference source not found.**. The assumption of the calculation is that the share of SMEs in EU27 that go through the PIUS-Check is similar to the share of SMEs in the NRW (4.2 per cent of companies).

Table 3-3 Potential economic benefit from PIUS-Check of a proportional share of SMEs in EU27

Net Present Value (NPV)	million Euro
NPV of cost in EU27	657
NPV of the savings in EU27	1,594
NPV of surplus in EU27	776

Source: Own calculations

If all SMEs go through the PIUS-Check, and if the share of companies that implement the proposed measures equals the share of PIUS-Checked companies in the NRW, the potential economic benefit of the PIUS-Check across EU27 is EUR 22.5 billion, see table below.

Table 3-4 Potential economic benefit from PIUS-Check of all SMEs in EU27

Net Present Value (NPV)	million Euro
NVP of cost in EU27	15,759
NPV of the savings in EU27	38,254
NPV of surplus in EU27	22,495

The average economic benefits to companies from participating in PIUS-schemes is estimated based upon a persistence of 10 year of the savings achieved from participation in the programme. The economic savings over 10 years are estimated to EUR 500,000. The average costs for companies that have the PIUS-Check carried out and implement the suggested technical and organisational changes amubnt to 172,000. Thus, the estimated economic benefits for SMEs of participation in PIUS-Check or a similar scheme is estimated to EUR 333,000, see Table 3-5.

Table 3-5 Estimated average economic benefits to SMEs participating in the PIUS-programme, with a 10 year persistence of the achieved cost savings

Indicator	Euro
Cost to PIUS-Check	5,000
Investments	167,000
Total costs	172,000
Savings achieved over 10 years in the production processes	500,000
Economic benefit over 10 years	333,000

3.5 Literature

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Interview Andreas Kunsleben, Effizienz Agentur NRW, 3 May 2010

Interview Mathias Graf, Effizienz Agentur NRW, 7 May 2010

4 National Industrial Symbiosis Programme, UK

Name of policy:	NISP
Country:	UK
Sector:	Various
Resource:	Waste
Instruments:	Industrial symbiosis

4.1 Policy description and purpose

The National Industrial Symbiosis Programme (NISP) is a free (to business) advice and networking programme. NISP's approach uses industrial symbiosis to identify sustainable resource management solutions for business. The fundamental approach of the programme is to help identify and broker ongoing resource exchanges between companies. Typically, these exchanges involve one company taking a process-by-product from another company and utilising it within their own process. This brings benefits to the company producing the by-product in terms of avoided waste disposal costs and brings benefits to the company taking the product in terms of avoided raw material and energy costs. The concept has similarities to the more widely known 'waste exchange' concept – where one company's waste becomes another company's raw material, but has the important distinction that it seeks to link processes rather than discrete waste management. This has important implications in terms of the scale and persistence of the benefits, as it is processes that are linked, the benefits are larger and longer lasting than when material classified as waste is reused.

NISP is a national programme, applied at the regional level across the UK. Each of the UK regions has a team of dedicated industrial symbiosis practitioners working closely with businesses in their area to recruit members to the programme and help them form symbiotic relationships with each other.

NISP originated as a regional pilot scheme in Scotland in 2003. Further regional pilots were then supported in the West Midlands and other regions of England. In 2005, with the injection of funding through Defra's Business Re-

source Efficiency and Waste Programme, the programme was expanded across the whole of England.

4.1.1 NISP - How it works and participation rates

NISP was originally developed and delivered by International Synergies Ltd (ISL), and this company still delivers much of the UK programme and is leading on the international expansion of NISP.

In the UK, NISP works directly with businesses of all sizes and sectors. A programme advisory group, consisting of key industry representatives, assists each of the regional teams to ensure the programme is driven by genuine business requirements and that the strategic direction is relevant for each region.

The data[19] presented in this case study describe what the programme achieved over its first four years of UK wide operation with an estimate of year 5 made based on data gathered for the first two quarters of that year, taking into account seasonal effects reported in previous years. However, it should also be noted that the programme was not fully functional in year 1 as NISP was in the early stages of funding and was 'ramping up' operations.

The unique industrial network developed by NISP has been built up over the last five years. This network is the channel through which NISP identifies and facilitates profitable transitions or synergies between member companies, often across traditional sector boundaries. As of May 2010, membership of NISP exceeded 13,400 companies of all sizes[20], including FTSE 100 multi-nationals and individual entrepreneurs. Small and medium-sized enterprises and micros make up over 90 per cent of the membership.

It has to be acknowledged that so far only 40 per cent of the members have actively been involved in at least one synergy project.

There are 60 facilitators (Industrial Symbiosis Practitioners) working in the UK organised in regional teams, the majority of whom come from industrial backgrounds. The practitioners' knowledge and relationship which they build up with NISP members is a key factor of the success of the programme.

All NISP facilitation costs are covered by the government hence the members do not pay any fees.

4.2 Programme achievements

An independent review of the seven Key Performance Indicators (KPIs) for NISP over the past five years for the English regions gave the following im-

[19] Data is based on the "Economic valuation report", Scott Wilson Business Consultancy, October 2009 and "NISP The Pathway to a low carbon sustainable economy, by Peter Laybourn and Maggie Morrissey, International Synergies, 2009

[20] Breakdown of membership per sector can be found in annex 1.

pressive highlights. The first row of each of the tables 1 to 5 shows the savings achieved in each year, the second row shows the cumulative total. This assumption of accumulation is a key point in measuring the benefits of the programme as it is assumed that the benefits achieved in year one carry on into year two and year three and on into the future for as long as the processes and companies involved continue to operate. The benefit figures also assume that all of benefits are attributable to the NISP intervention, i.e. the figures are gross figures:

More than 7 million tonnes of waste have been diverted from landfill (including 0.363 million tonnes of hazardous waste). This represents around 7 per cent of total Industrial and commercial waste sent to landfill between 2004 and 2008.[21]

The Landfill Directive (formally known as the EC Landfill Directive 1999/31) came into force in England and Wales in 2002 and has had a significant impact on the way waste is managed through restricting the types and amounts of waste that can be sent to landfill. This directive works in conjunction with the landfill tax, which acts as a major incentive for businesses to tackle waste through a more efficient use of resources. This legislative position has been an important factor in raising companies' interest in the issue and convincing them to take part.

The annual diversion of waste from landfill achieved by the NISP programme to date is as follows:

Table 4-1 Total Landfill Diverted

[21] Figures from DEFRA - Environment in your pocket 2009. In 2008 England landfilled a total of 58 million tonnes of waste, with commercial and industrial waste accounting for 19 million tonnes of this total

	Year 1	Year 2	Year 3	Year 4	Year 5	Total
Landfill Diverted (million tonnes)	0.86	0.93	1.60	1.83	1.80	7.02
Cumulative total (end of year)	0.86	1.79	3.39	5.22	7.02	

Source: NISP Economic Valuation, Final Report October 09

5.1.1 Carbon dioxide (equivalent) savings of over 5 million tonnes;

The NISP programme helps its participating companies reduce their CO_2 emissions in a number of ways, as follows:

Input savings: lower embedded energy in processing recycled materials than virgin row materials.

Process savings: savings in gas, electricity or other fuel use by one of the synergy partners principally through innovation

Fuel substitution: replacement of fossil fuels with other non fossil fuel sources in industrial processes

Transport savings: reduction in transport directly associated with synergies

Disposal savings: reduction in biodegradable material sent to landfill

Energy savings: production of energy through, for example, anaerobic digestion and utilisation of waste heat.

The annual breakdown of these savings is as follows:

Table 4-2 Total CO_2 Equivalent Reductions

	Year 1	Year 2	Year 3	Year 4	Year 5	Total
CO_2 Equiv. Reduction (million tonnes)	0.33	1.69	2.41	0.81	0.80	6.04
Cumulative total (end of year)	0.33	2.02	4.43	5.24	6.04	-

Source: NISP Economic Valuation, Final Report October 09

5.1.2 Virgin materials of around 9.7 million tonnes saved

Virgin material displacement is a measurement in tonnes per year of raw materials saved or offset by increased efficiencies or a change to a more sustainable,

renewable material. An example of a virgin material saved is mined coal 'saved' when a waste material is used as a substitute fuel for power generation or combustion in a manufacturing process, such as in cement kilns.

Table 4-3 Total Virgin Materials Saved

	Year 1	Year 2	Year 3	Year 4	Year 5	Total
Virgin Materials (million tonnes)	-	4.06	1.93	1.96	1.75	9.70
Cumulative total (end of year)	-	4.06	5.99	7.95	9.70	-

Source: NISP Economic Valuation, Final Report October 09

This is the highest performing environmental metric in absolute terms with savings of around 9.7 million tonnes of virgin material over the first five years of the programme. After an initially high reported saving in year 2, the past three years have reported consistent savings of between 1.75 and 1.96 million tonnes per annum.

5.1.3 Water saved of 9.5 million tonnes.

NISP's record to date has seen two type of synergies unfold that bring about water savings. In the first instance, water is saved through an improvement in resource allocation between two entities, which indirectly brings about a more efficient system of water usage. This type of synergy has been increasingly overtaken by a more direct method of water saving for which water is the essential good which matches two companies together in the process of industrial symbiosis. An example of this type of synergy is a brewery and a water processing company that get together to help the brewery implement a more efficient system of water usage and disposal of processed water through know-how brought about by the water processing company.

Table 4-4 Total Water Saving

	Year 1	Year 2	Year 3	Year 4	Year 5	Total
Water (million tonnes)	0.26	2.24	6.71	0.25	0.10	9.57
Cumulative total (end of year)	0.26	2.50	9.21	9.46	9.57	-

Source: NISP Economic Valuation, Final Report October 09

Water savings amounted to just over 9.5 million tonnes through NISP synergies. Recent initiatives in broadening the scope of water savings across the in-

dustry have seen NISP engage in the potential for industrial symbiosis of water reuse with both the food and drink sector and the metal finishing sector[22]. These sectors are quite significant industrial water users and present the potential for further symbiosis work in the re-use of wastewater. However, it is worth noting that the projection for year 5 is lower than any previous year.

The value of engagement with NISP is evidenced by the high levels of attribution of benefits reported by participating companies. Moreover, the feedback indicates that programme support persists over the long term, and does not necessarily diminish over time. The benefits to the companies that arise from participating in the programme are additional sales and cost savings:

5.1.4 Additional sales

'Additional sales' represent the value of sales directly resulting from engagement in a NISP synergy and thus new business generated different from normal sales development. An example of additional sales is the sale of goods produced from plastic, where waste plastic is diverted from landfill and reprocessed into granules which are then used as a primary input in plastic extrusion.

Additional sales by organisations contribute to an increase in the profitability of an organisation and thus feed through to additional corporate tax revenue to the exchequer (surplus in the case of third sector organisations).

Table 4-5 Total Additional Sales

	Year 1	Year 2	Year 3	Year 4	Year 5	Total
Sales (EUR m[23])	19.8	97.7	30.48	33.2	30	211.3
Cumulative	19.8	117.5	148.0	181.2	211.3	-

Source: NISP Economic Valuation, Final Report October 09

The gross amount of additional sales, reported by companies, is in excess of EUR 211 million for the first five years of the NISP programme. The second year of operations reported the highest increase in sales with EUR 97.7 million, while the last three years (years 3, 4 and 5) all consistently reported additional sales greater then EUR 30 million.

5.1.5 Cost savings

The most common means of cost savings are related to avoided disposal costs for waste materials, and reduced purchasing costs as a result of sourcing products and materials through the synergy.

[22] Project funded by a regional development authority (RDA)

[23] The exchange rate used is £1 = EUR 1.20. This rate will have varied during the lifetime of the project but this issue has been ignored to aid simplicity.

Normal firm behaviour would, in the short term, transmit part of the cost savings into increased profits. Over a longer time period it is expected that a cost base reduction may be passed on to consumers in the form of a price reduction. Depending on the demand elasticity of the underlying products, it is expected that there may be an increase in demand and thus the impact of the cost savings (which would go straight to the ‘bottom line’) has significant implications for profitability and potentially provides for a long-term sustainable investment for growth.

Table 4-6 Total Cost Savings

	Year 1	Year 2	Year 3	Year 4	Year 5	Total
Cost Savings (EUR m)	43.7	41.2	39.8	32.8	30.0	187.4
Cumulative	43.7	84.9	124.6	157.4	187.4	598

Source: Own calculations

The first five years of Defra funding of NISP have yielded just over EUR 187 million of cost savings. Annual figures show that cost savings have consistently been between EUR 30 million and EUR 44 million per annum.

5.2 Impacts

In the evaluation of the impact of the programme, the impacts were calculated based on an assessment of future persistence of five years, from the five year cumulative total and zero per-cent allowance for decay in impact. As mentioned above, this appears to be a realistic assumption given that the intervention (synergy) leads to a process change, rather than a behavioural change and process changes should not decay over time in the way that behaviour changes might do, as they are not subject to issues such as staff changes and reverting to previous habits.

In terms of NISP's role in facilitating a synergy, an average figure of 60 per cent percent attribution was used, i.e. it was assumed that 40 per cent of the idea (and therefore subsequent benefit) originated from the companies taking part. For example, for the landfill diverted metric the calculation was 7.02 million tonnes (the cumulative ongoing annual saving after 5 years) x 0.6 (the assumed contribution of NISP to achieving the synergy) x the total accumulative savings for the period. This led to a calculation of the net impact of NISP activity as follows:

Table 4-7 Total Output for each of the seven NISP KPIs

Output metric	Net for 5 years
Landfill diverted (t million)	10.,97
CO_2 reduction (t million)	10.84
Virgin materials (t million)	16.62
Hazardous Mat. (t million)	1.09
Water (t million)	18.6
Sales (EUR million)	406.68
Cost savings (EUR million)	358.8

Source: NISP Economic Valuation, Final Report October 09 and own calculations

Table 8 presents the value for money of the NISP programme. Under the assumption of equal resource allocation between the seven KPI metrics, a value for money indicator can be derived as a relative measure of the cost-effectiveness for each metric. The total amount of direct Defra funds invested into NISP for the five years of operations (2005/06 to 2009/10) is (£27,650,000) EUR 33,180,000[24], an average of EUR 6,636,000 per year. For the last year, discussions with NISP indicated that 93 per cent of the budget was spent on staff costs with the remaining 7 per cent covering premises, administration, IT, telephones, etc.

Therefore, the figures presented in Table 8 give an indication of the cost of each unit of the NISP KPI. This is calculated as follows, the total cost of the programme for five years was EUR 33.2 million, which was divided across the seven output measures to give EUR 4.74 million per output area. The EUR 4.74 million is then divided by each of the output measures based on the assumptions used in table 7, e.g. for landfill, the total saving over five years is 10.97 mt, which gives a cost per tonne saved of EUR4.74/ 10.97 mt = 0.43 EUR/t while for example on cost-savings the total amount of money saved over five years is EUR 358.8 million which gives a cost for unit in EUR saved of EUR 4.74/EUR358.8m = 0.008 (EUR/EUR).

Table 4-8 Value for Money

Output metric	EUR per Unit Output
Landfill diverted (EUR/t)	0.43
CO_2 reduction (EUR/t)	0.44
Virgin materials (EUR/t)	0.29
Hazardous Mat. (EUR/t)	4.34
Water (EUR/t)	0.25
Sales (EUR?EUR)	0.012
Cost savings (EUR/EUR)	0.013

Source: NISP Economic Valuation, Final Report October 09 and own calculations

5.3 Transferring and scaling up NISP to the EU27

Given the relatively small number of companies involved[25], particularly in terms of percentage of the total, it could be assumed that if the NISP programme was replicated elsewhere in the EU, the following assumptions would apply:

[24] NISP, the Pathway to a Low Carbon Sustainable Economy, 2009

[25] An average of 40 per cent of the 13 400 members of the NISP programme participated actively in at least one synergy

- The limiting factor is the number of advisers (and funding) available rather than the number of companies.

- The same amount of money (and therefore advisers) in each Member States would be able to engage the same amount of companies and achieve savings of the same scale and nature as has been achieved in the UK.

- However, given the difference in scale between Member States it was decided that a simple multiple of 27 would not be appropriate. E.g. some Member States would be too small to support a direct copy of the UK scheme while some are much larger and could support a larger version. We have therefore constructed a simple scenario multiplying the costs and benefits of the programme (over the first five years) by 7.53 to reflect the percentage of GDP that the UK represents for the EU 27. In 2009, the GDP for the EU 27 was reported by EUROSTAT as being EUR 11,808,717 thousand million. For the UK the figure was EUR 1,566,740.70 thousand million .

- We have assumed that over the first five years of operation of a NISP equivalent in each Member State, the scale of savings achieved would be the same as the gross savings achieved by the UK scheme.

-

This is shown in the following table:

Table 4-9 Potential costs and savings of a replication of the programme in EU 27 based on a accumulation of the five years

Output metric	UK	EU 27
Programme costs (EUR million)	33.1	249.4
Landfill diverted (million tonnes)	7.02	52.9
CO_2 reduction (million tonnes)	6.04	45.5
Virgin materials (million tonnes)	9.7	73.0
Hazardous Mat. (million tonnes)	0.363	2.73
Water (million tonnes)	9.57	72.1
Additional Sales (EUR m)	211.3	1,591.1
Cost savings (EUR m)	187.4	1,411.1

Source: Own calculations

These figures become interesting for example if we consider the contribution they would make towards achieving the EU 2020 target of reducing CO_2 emis-

sions by 20 per cent, or the contribution to industrial competitiveness they would represent. The 45.5 Mt of CO_2 savings that an EU wide replication of NISP would achieve, per year, by the end of five years operation, equate to almost 0.9 per cent of the CO_2 emissions of the EU in 2008[26].

5.4 Conclusions

The industrial sectors that have contributed most to the overall output of the programme are Manufacturing, followed by Real Estate, Renting & Business Activities, Construction, Wholesale & Retail Trade; Repair of Motor Vehicles Motorcycles & Personal & Household Goods (for a complete overview of the outputs achieved per sector please refer to Annex B). These sectors are well represented by SMEs across Europe and it is therefore reasonable to suggest that the programme could be successfully replicated in every other EU Member States.

It is worth pointing out that the key success of the NISP is the cross-sectoral synergies between industries. In addition, the variety of sectors present in the programme can lead to new cross sectoral synergies.

A potential additional positive from replicating the NISP programme across Europe can be drawn from the lessons to date. The current synergy model could be improved by better utilisation of the knowledge held by the Central Resource for Industrial Symbiosis practitioners (CRISP), the data monitoring system and data analysis tool managed by the NISP. This database holds information on the resources that each NISP member holds and could make available to other members. As the size of the network grows, the number of potential synergies will increase, which suggests that an EU wide network has the potential, subject to obvious transport restrictions, to be even more successful than the English network has been to date.

5.5 Literature

Written sources

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Scott Wilson Business Consultancy, NISP Economic Valuation, Final Report October 09

The environment in your pocket **2009,** Key facts and figures on the environment of the United Kingdom, Defra

[26] In 2006, total greenhouse gas emissions in the EU 27, excluding net CO_2 removals from land-use, land use change and forestry (LULUCF), were 5 143 Mt CO_2 equivalent. EEA. http://www.eea.europa.eu/publications/eea_report_2008_5/at_download/file

Annexes A and B include the data kindly provided by Industrial Synergy Ltd

Annex A Case study 3: Breakdown of membership

Breakdown of membership per sector

SIC Category (2003)	Category Description	Number Of Members In Category	Percentage
A	Agriculture, Hunting & Forestry	892	6.65
B	Fishing	20	0.15
C	Mining & Quarrying	146	1.09
D	Manufacturing	3,279	24.45
E	Electricity, Gas & Water Supply	113	0.84
F	Construction	754	5.62
G	Wholesale & Retail Trade; Repair of Motor Vehicles Motor-cycles & Personal & Household Goods	968	7.22
H	Hotels & Restaurants	89	0.66
I	Transport, Storage & Communication	201	1.5
J	Financial Intermediation	111	0.83
K	Real Estate, Renting & Business Activities	1,624	12.11
L	Public Administration & Defence; Compulsory Social Secu-rity	282	2.1
M	Education	156	1.16
N	Health & Social Work	187	1.39
O	Other Community, Social & Personal Service Activities	631	4.71
P	Private Households Employing Staff & Undifferentiated Pro-duction Activities of Households for Own Use	21	0.16
Q	Extra-territorial Organisation & Bodies	11	0.08
NULL		23	0.17
		3,901	29.09
Grand Total		**13,409**	**100**

Annex B – case study 3: Breakdown of outputs per sector

SIC Category	Description	Jobs Created %	Jobs Safe Guarded %	CO2 Reduction %	Hazardous Waste %	Landfill Diverted %	Water %	Virgin Materials %	Additional Sales %	Cost Savings %	Private Investment %
A	**Agriculture, Hunting & Forestry**	10.38	0.67	6.21	0.99	3.78	0.02	1.69	5.62	3.85	0.71
B	**Fishing**	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.07	0.00
C	**Mining & Quarrying**	2.03	0.00	3.96	0.01	13.76	6.39	16.06	2.62	3.47	0.10
D	**Manufacturing**	27.09	51.58	38.11	27.47	15.34	54.81	16.87	24.77	35.23	23.37
E	**Electricity , Gas & Water Supply**	2.53	2.02	2.51	4.14	12.38	0.22	7.14	6.04	5.24	1.97
F	**Construction**	4.56	4.32	4.19	3.13	21.11	0.35	15.55	12.13	12.88	0.80
G	**Wholesale & Retail Trade; Repair of Motor Vehicles Motorcycles & Household Goods**	13.16	7.62	10.35	0.85	5.21	20.00	14.94	18.36	8.37	1.07
H	**Hotels & Restaurants**	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
I	**Transport, Storage & Communications**	0.51	0.14	1.54	1.08	3.10	0.73	7.28	1.06	3.38	0.36
J	**Financial Intermediation**	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
K	**Real Estate, Renting & Business Activities**	23.92	23.74	26.07	61.09	19.13	5.54	16.23	9.51	19.26	62.74

SIC Category	Description	Jobs Created %	Jobs Safe Guarded %	CO2 Reduction %	Hazardous Waste %	Landfill Diverted %	Water %	Virgin Materials %	Additional Sales %	Cost Savings %	Private Investment %
L	**Public Administration & Defence; Compulsory Social Security**	8.86	3.03	1.70	0.00	1.34	2.49	0.90	7.98	2.76	4.66
M	**Education**	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.00	0.01
N	**Health & Social Work**	0.00	0.00	0.01	0.00	0.00	0.09	0.00	0.00	0.02	0.00
O	**Other Community, Social & Personal Service**	5.70	6.68	3.81	0.03	1.13	0.61	0.49	10.41	1.97	2.45
P	**Private Households Employing Staff & Undifferentiated Production Activities of Household for Own Use**	0.00	0.00	0.03	0.00	0.44	0.00	0.19	0.00	0.09	0.00
		1.26	0.20	1.51	1.21	3.28	8.75	2.66	1.49	3.41	1.76
Grand Total		**100 %**	**100 %**	**100 %**	**100 %**	**100 %**	**100 %**	**100 %**	**100 %**	**100 %**	**100 %**

** All CRISP Outcomes Where Match ID = Complete & Outcomes Document = Complete*

** Standard Industrial Classification (SIC) 2003 used in analysis*

** Data representative where a valid SIC code has been entered*

6 Sustainable Clothing Roadmap, UK

Name of policy:	Sustainable Clothing Roadmap
Country:	UK
Sector:	Textile
Resource:	Fibres
Instruments:	Road map/action plan

6.1 The purpose of the policy

Product roadmaps

The Sustainable Clothing Roadmap is coordinated by the Department for Environment, Food and Rural Affairs (Defra), UK. As part of Defra's Sustainable Consumption and Production (SCP) programme, Defra is piloting product roadmaps to help improve the environmental performance of ten priority products[27] with the aim of:

- identifying the impacts that occur across each product's life cycle,
- identifying existing actions being taken to address those impacts and
- developing and implementing a voluntary action plan to address any gaps.[28]

What is sustainable clothing? Ideally this is clothing that maximizes positive and minimizes negative environmental, social and economic impacts along its supply and value chain. Clothing that is sustainable does not adversely impact people or the planet in its production, manufacture, transport, retail or end of life management.

Clothing road map

The ten products were selected due to their high impact on the environment at both domestic and international levels. According to the EU-25 study, "The environmental impact of products", four product groupings account for 70-80 per cent of all environmental impacts. In EU-25, clothing and textiles account for approximately 5-10 per cent of the environmental impacts (the

[27] Milk, fish and shellfish, passenger cars, TVs, domestic lighting, electric motors, window systems, WCs, plasterboards and clothing.

[28] Defra homepage, data extracted 2nd June 2010.

Textile Recycling Association). The sustainable clothing roadmap was established in 2007 to increase sustainability along the clothing supply chain, thereby maximising reuse and recycling of fibres. Almost all textiles can be respun into new fabric or recycled and used for filling materials or cleaning cloths.

Stakeholders involved

The clothing roadmap is a voluntary clothing industry initiative involving over 300 companies along the clothing supply chain. Through the road mapping process, it is the intension that business, government and other stakeholders should reach a voluntary action plan for their products containing actions to improve sustainability performance, thereby obtaining environmental improvements and economic benefits to the industry. (Defra 2009) This requires that businesses identify key impacts and agree on priority areas where actions will be most effective, primarily within five areas targeted for maximum improvement potential[29]:

1 Improving Environmental Performance across the Supply Chain

2 Consumption trends and behaviour

3 Awareness, media, education and networks

4 Creating market drivers for sustainable clothing

5 Instruments for improving traceability along the supply chain (ethics, trade and environment.

Clothing sector

The clothing sector is the second biggest economic activity for intensity of trade at global level, worth over GBP 500 billion, employing approximately 26 million people.

In the UK the clothing industry employs approximately 170,000 people, due to 90 per cent of clothing and textiles being imported (worth GBP 11 billion) and 10 per cent being exported (GBP 3 billion). The UK textile and clothing industry is small in comparison to the global industry, accounting for approximately 0.78 per cent of the UK GDP.

Table 6-1 Key figures

GDP	0.78% of UK GDP
Employment UK	170,000 (clothing)
Import	90% (1.7 million tonnes) (textiles & clothing) £11 billion

[29] (Defra 2009)

Export	10% (281,000 tonnes) (textiles & clothing) £3 billion
UK Consumption	2 million tonnes per annum (textiles & clothing) £38 billion

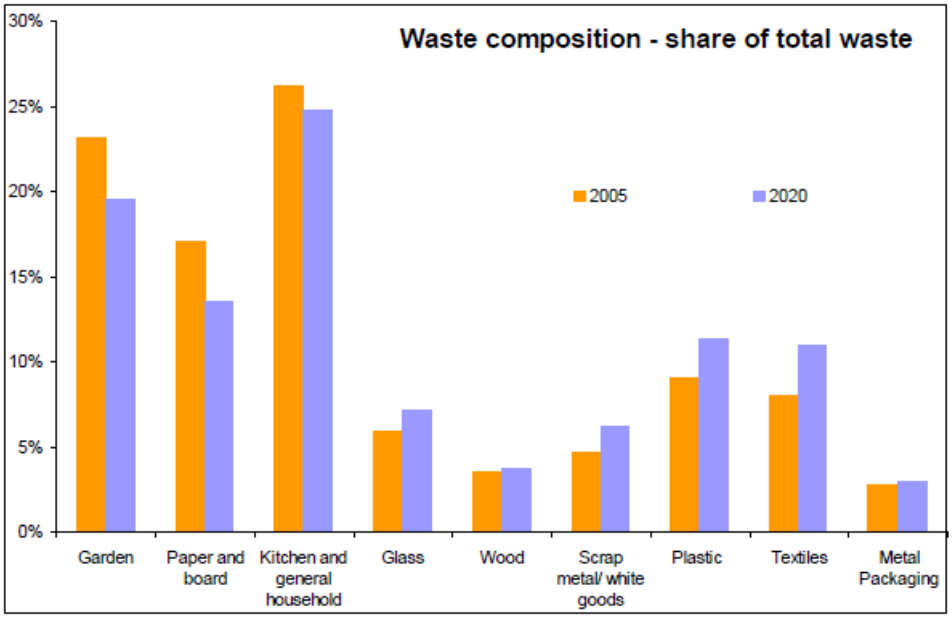
Source: Defra 2008

A general trend observed in the UK is that clothing producers are relocating activities to the developing world. The vast majority of clothing consumed in the UK today is produced in other countries with the highest import volumes from China, Turkey, Italy, India, Bangladesh and Sri Lanka. Overall, clothing imports to Western Europe are estimated at 42 per cent of the global market.

Clothing waste

Due to several parameters such as discount clothing etc., the total share of clothing and textiles waste is forecasted as the fastest growing household waste stream from 2005 to 2020 as illustrated below.

Figure 6-1 Household waste composition in 2005 and 2020 split by waste category



Source: Maunder, A. et al (2006) „Modelling the Impact of Lifestyle Changes on Household Waste Arisings."

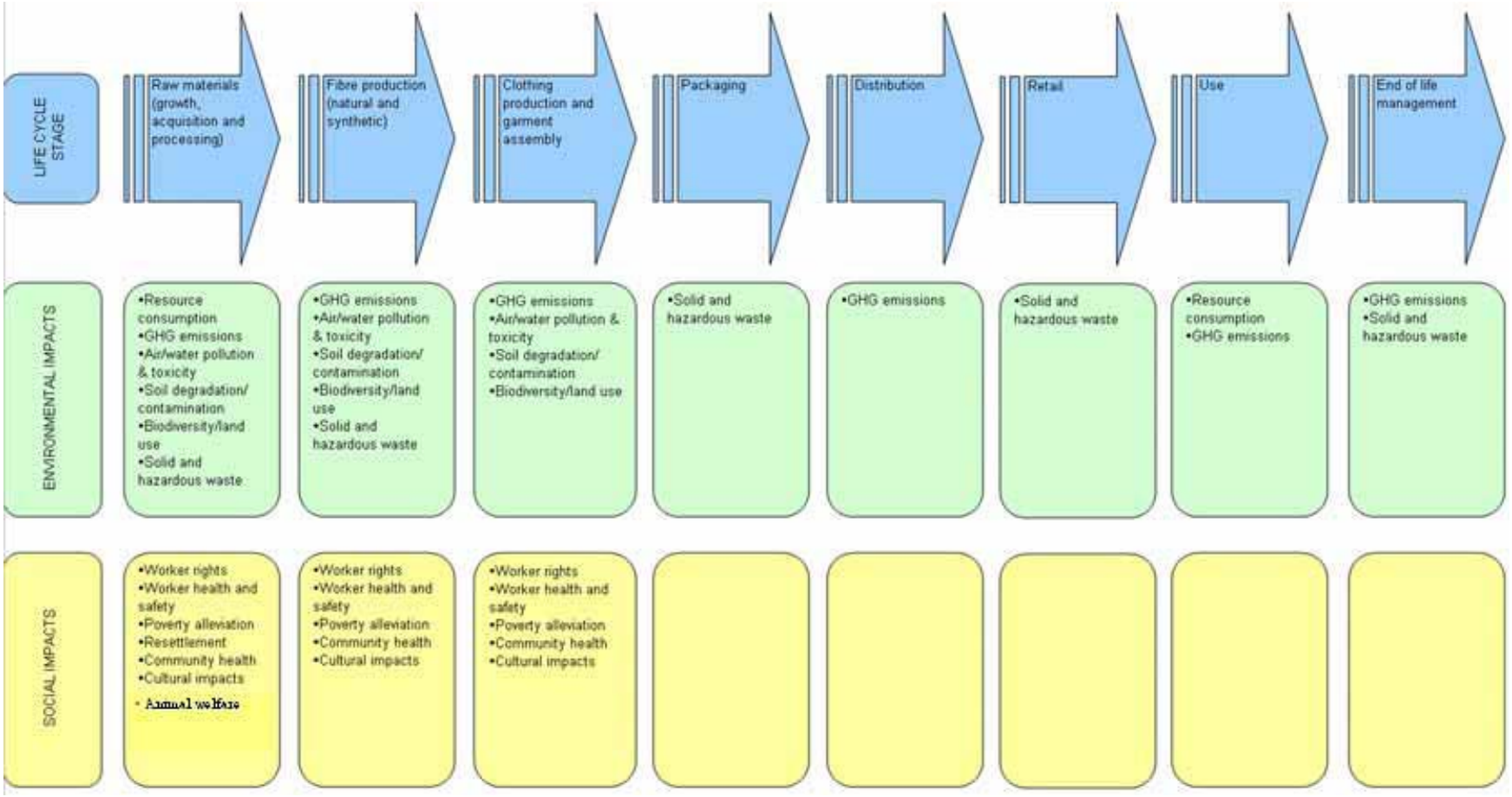
Environmental impacts in clothing lifecycle

The textile fibres used in clothing are manmade fibres[30], natural fibres[31] or composites with a varying environmental impact depending on the type of fibre. The impact varies for each fibre type and at each life cycle stage as outlined below (Defra 2008).

[30] Natural polymers e.g. viscose or synthetic petrochemical based e.g. polyester

[31] Cotton, wool, silk, hemp, flax

Figure 6-2 Main Environmental and social impacts per clothing lifecycle stage



The figure above summarises the main environmental and social impacts per clothing lifecycle stage. The most significant environmental impacts include:

- Energy use and generation of greenhouse gas (GHG) emissions throughout the entire lifecycle, but especially from washing (water heating) and drying of clothing. There is great difference between the different types of fibres, cotton in particular requires longer drying times compared to synthetics such as polyester.

- Significant water use, toxicity from fertilizer, pesticide and herbicide use. Organic and GM cotton reduces the toxicity related impacts, however other GM impacts are currently unclear.

- Solid and hazardous waste and effluent associated with production stage pre-treatment chemicals, dyes and finishes as well as solid waste at other stages of life cycle.

As 90 per cent of UK clothing is imported, many of the significant impacts are occurring overseas.

Environmental and economic benefits
Recycling of clothing provides both environmental and economic benefits:

- Reduced need for landfill space
- Reduces pressure on virgin resources
- Less import
- Less pollution and energy savings
- Savings of water and chemical dyestuff-.

Reduced need for landfill space

By reducing the amounts of solid waste, the need for landfill space is reduced. Textiles make up 12 per cent of landfill sites and present particular problems in landfill as synthetic (man-made fibres) products will not decompose, while woollen garments do decompose and produce methane, which contributes to global warming.

The landfill tax of GBP 14 per tonne in the beginning of 2004 for waste going to the landfill in the UK has been historically low compared to other EU countries. This was changed and through a rapid increase, the landfill tax is foreseen to reach the EU level of GBP 35 per tonne increasing with GBP 3 per tonne a year. (Waste online 2010)

Reduces pressure on virgin resources

By recycling and thereby substituting a large amount of virgin resources with used textiles and clothing, the pressure on virgin resources is reduced.

Aids the balance of payments as we import fewer materials for our needs
This is only relevant if old clothing is reused as clothing, thereby answering to the need for clothing, leading to less import.

This is not relevant if the used textiles and clothing are put into production with the aim of producing rags, filling and padding, hence this does not substitute the need for new clothing and does not lead to less import.

Less pollution and energy savings

Recycling involves less pollution and energy savings, as fibres do not have to be transported from abroad. Energy savings depend on the specific case. Diverting clothing from incinerators may result in energy savings and Co^2 emissions as recycling of clothing uses less energy than production of clothing based on virgin materials. Recycling textiles can save up to 15 times the energy recoverable by incineration (the textile recycling association). However, the transportation of used clothing has shown to be quite significant in some cases, e.g. the company Patagonia that collects and stores clothing in Canada and ships it to either Italy in case of cotton clothing or Japan in case of polyester clothing.

Incineration is not as widely used in the UK with around 8 per cent of municipal waste being incinerated to produce energy compared to some of the Scandinavian countries with around 50 per cent in Sweden and Denmark. (Waste online 2010).

Saving of water and chemical dyestuffs

An estimate has been made by the Wallisian enterprise Antur Waunfawr Cyf on savings of water and chemical dyestuff based on the situation where each person in the Wales buys one recycled garment each year. This would lead to an average saving of 371 million gallons of water and 480 tonnes of chemical dyestuff leading to substantial economic savings depending on market prices.

6.2 Assumptions necessary in order to transfer or scale up the policy initiative

Assumptions

It is necessary to make several assumptions for the transfer or scaling up of the Sustainable Clothing Roadmap to the wider EU:

- Recycling of clothing is financially profitable for the recycling industry.
- Estimates of resource efficiency are based on the assumption that the existing recycling companies have the capacity to produce new fibres from the used clothing.
- A market of buyers exists to buy the recycled fibres, cloths and padding produced from the used clothing.

Recycling financially profitable

If recycling is done solely to gain a green image, less companies will enter the recycling business and recycling will not be sustainable in the long term. Recycling of clothing needs to be financially profitable to be able to compete with the financial benefits of producing clothing from virgin materials.

Sufficient capacity of recycling industry

Estimates of resource efficiency are based on the amounts of textiles and clothing currently going to landfill. The goal of collecting this unused resource and

increasing the recycling of clothing requires that there are sufficient recycling companies to produce new fibres based on the used clothing.

Market exists

If the recycling industry is to increase its production based on the current unused resources of clothing going to the landfill, it is a prerequisite that a market of buyers exists to buy the recycled fibres, cloths and padding produced from the clothing.

6.3 Result of resource saving potential in the UK

Resource saving potential in the UK

By using the UK sustainable clothing roadmap as a case, it has become evident that there are environmental and economic benefits of the recycling of clothing to the clothing industry - and that there is a rather substantial potential for additional resource efficiency due to unused clothing resources currently being deposited at landfill.

Estimations show that more than 1 million tonnes of textile waste is produced every year in the UK. Only 25 per cent of this is reused or recycled, and the rest is thrown away and deposited at landfill.

At least 50 per cent of the textiles thrown away are recyclable[32]; hence there are still 375,000 tonnes unused resources annually with a recycling potential. This includes various economic savings, such as savings on landfill taxes and savings on the production of recycled textiles into new fibres.

Landfill taxes

For solid waste going to landfill in the UK, there is a savings potential in several areas; waste going to landfill is taxed by the Landfill Tax rate for active waste, which will increase in the next two years to GBP 35 per tonnes; a rate which will bring the UK a par with other European countries. (Waste online 2010) Thus, a total of (375.000 tonnes * 35 £) 13,125,000 £/year can be saved on landfill taxes in the UK alone.

Savings from recycling production

It has not been possible to obtain specific financial figures from companies recycling fibres/rags or filling produced from old clothing and textiles. It is clear, though, that the main financial savings relate to energy and water savings in the production. This has to be weighed against collection and transportation of the recycled clothing to the production site, which has often turned out to be done over long distances.

The Wallisian enterprise Antur Waunfawr Cyf's own estimates show that 50 per cent less energy is used in the production of fabric using recycled fibre[33].

[32] These are Defra's own figures and must be considered conservative compared to the Textile Recycling Association's estimates by which up to 95 per cent of the textiles that are sent to landfill could be recycled.

[33] http://www.anturwaunfawr.org/English%20site/clothes_recycling.htm Data extracted the 8th June 2010

6.4 Result of resource saving potential in the EU

Resource saving potential in the EU

At EU level, approximately 3.8 million tonnes of textile waste were generated in 2006. Of these, approximately 1.2 million tonnes were recovered, leaving an unused resource of 2.6 million tonnes of textiles disposed of as waste (interview with the Copenhagen Resource Institute).

Considering Defra's estimates that at least 50 per cent of the textiles thrown away are recyclable; there are still 1.3 million tonnes unused clothing and textile resources each year, which potentially can be recycled.

Landfill taxes

Within the solid waste stream going to landfill in the EU, there is also a savings potential relating to landfill taxes. Landfill taxes differ across EU Member States, but a range of countries lie in line with the UK of GBP 35 per tonnes (Waste online 2010). Based on this figure, a total of (1.3 million tonnes * 35 £) 45,500,000 £/year can be saved on landfill taxes in the EU.

EU countries with high level of textile and clothing waste

The issue of clothing recycling is relevant at EU level as clothing represents an increasing amount of total waste. According to the latest Eurostat figures, some countries have an exceptionally high volume of textile waste compared to the rest. By focusing at countries producing more than 1 million tonnes of textile waste per year, four countries stand out by representing 75 per cent of the EU-15 countries' textile waste: France, Italy, Portugal and the UK. These four countries amount to to 913,388 thousands of tonnes of textile waste compared to a total of 1213,050 thousands of tonnes of EU-15.

Table 6-2 Textile waste/thousands of tonnes: (Eurostat)

Country	2004	2006
European Union (15 countries)	:	1213,050
Belgium	:	10,028
Bulgaria	3,733	2,626
Denmark	0,000	0,001
Germany (including ex-GDR from 1991)	108,827	68,270
Estonia	0,351	0,059
Ireland	10,677	7,372
Greece	4,351	8,517
Spain	126,810	79,414
France	388,000	388,000
Italy	243,845	264,385
Cyprus	0,000	0,000
Latvia	0,000	0,000
Lithuania	1,517	1,205
Luxembourg (Grand-Duché)	0,000	0,000
Hungary	2,275	0,666
Malta	0,000	0,000
Netherlands	78,270	91,502
Austria	120,247	34,437

Country	2004	2006
Portugal	55,958	143,624
Romania	4,098	3,686
Slovenia	:	:
Slovakia	9,770	3,201
Finland	0,088	0,121
Sweden	0,000	0,000
United Kingdom	284,157	117,379
Croatia	0,063	:
Turkey	212,244	0,535
Iceland	1,000	:
Norway	11,005	12,920

Source: Eurostat

It would be recommendable to introduce a sustainable clothing roadmap in France, Italy and Portugal and to further develop it in the UK, Countries such as Denmark, Estonia, Hungary, Finland and Turkey have a very small amount of textile waste.

Lastly, it can be concluded that the economic benefit for the producer experienced when down-cycling waste textile into e.g. rags, fillings etc, is not evident when a company recycles waste textiles into new fibres for clothing. In this last case, recycling waste textile into new clothing is based on other motivation as for example branding etc. rather than economic perspectives.

6.5 Literature

Written and Internet sources

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Measurement Evaluation Learning (MEL 2009), *Oakdene Hollins Desktop Textile Waste Study & Compositional Analysis*, December 2008& and January 2009.

Tucker, Arnold et el. (2006), *The environmental impact of products" (EIPRO)* Analysis of the life cycle environmental impacts related to the final consumption of the EU-25, Technical Report EUR 22284 EN, printed in Spain.

Waste Online 2010:
http://www.wasteonline.org.uk/resources/InformationSheets/WasteDisposal.htm

Stakeholder consultation

Stakeholder consultation
The collection of data for the analysis of this case study has been based on a combination of literature review, e-mail exchange and telephone interviews with relevant stakeholders. The following stakeholders have been contacted:

Authorities	Sean Smith, Policy adviser, ***Department for Environment, Food and Rural Affairs*** (Defra).
Business association, businesses, NGOs	Christian Fischer, Chief consultant, ***European Topic Centre on Sustainable Consumption and Production***. A non-profit consultancy conducting studies and analyses for private and public clients within the field of sustainable consumption and production.
	Textile Recycling Association and Recyclatex**, UK,** is a member-based association with the objective of promoting textile recycling and the second hand clothing/shoe recycling industry. http://www.textile-recycling.org.uk
	Waste Watch is the leading environmental charity dedicated to the reduction, reuse and recycling of household waste. The WasteOnline website is managed by Waste Watch and has been funded by the New Opportunities Fund Digitise project. http://www.wasteonline.org.uk/index.aspx

7 Recycling of aluminium cans, Belgium and Sweden

Name of policy:	Recycling of aluminium cans
Country:	Sweden and Belgium
Sector:	Metal industry
Resource:	Aluminium
Instruments:	Deposit/Green dot scheme

The Packaging and Packaging Waste Directive (Directive 94/62/EC) requires the producer to take responsibility for packaging waste. There are various approaches to ensuring recycling of cans in the Member States. Two of the most common approaches are deposit schemes and Green Dot schemes.

The deposit schemes are based on a deposit on cans, which gives the consumer an incentive to reclaim the deposit.

In countries that are using Green Dot schemes, certain companies are entitled to take over companies' responsibility for recycling their packaging waste. The producers and distributors of aluminium beverage cans pay a contribution to the company that is organising the collection and recycling of the packaging waste. The producers and distributors are entitled to provide their packaging with the Green Dot symbol, indicating that the company takes responsibility for the recovery and recycling of its packaging waste.

Recycling rates vary significantly between countries. Two Member States, Sweden and Belgium have been successful in achieving high recycling rates of aluminium cans. Sweden applies a deposit scheme, and Belgium uses a Green Dot scheme.

7.1 The Swedish deposit scheme

The Swedish deposit system for beverage containers was introduced in 1884, with a deposit scheme for glass bottles. The first aluminium beer cans were introduced on the Swedish market in 1955. In 1982, the Swedish government decided to establish a deposit scheme for aluminium beverage cans. The deposit

scheme was introduced in March 1984. At that time, recycling rates for all purchased aluminium cans were 63 per cent. The purpose of the Swedish deposit system for beverage containers is to increase recycling rates of used bottles and aluminium beverage cans (http://www.returpack.se/).

Producers of canned beverage and importers of metal beverage cans for the Swedish market are required to join an approved deposit-based recycling system.[34] The Swedish deposit scheme for metal cans is organised by AB Svenska Returpack (http://www.notisum.se/Pub/Doc.aspx?url=/rnp/sls/lag/20050220.htm). Since 1994, Returpack has also been handling a deposit system for plastic bottles (PET-bottles) (http://www.returpack.se/).

The Swedish government's target is 90 per cent recycling of aluminium beverage cans (Naturvårdsverket, 2010).

7.1.1 Characteristics of the context where the policy is implemented

The consumers pay a deposit for every aluminium beverage can purchased. The deposit fee is SEK 0.50 (EUR 0.052[35]), which is refunded to the consumer when he returns the can to a retailer. The cans are subsequently collected and transported to Returpack's factory in Norrköping where the cans are counted, sorted and compressed. Afterwards, the cans are transported to a plant where they are melted into aluminium that is used for production of new beverage cans.

The producers and/or retailers of beverages included in the deposit system pay an annual fee of SEK 10,000 (EUR 1,040) for inclusion in the scheme[36]. The Swedish Board of Agriculture is responsible for controlling that producers and retailers of beverages have actually joined the deposit scheme. The costs of control are financed through the annual fee (Görsberg, 11 June 2010).

In 2009, 1,128 million aluminium cans were sold on the Swedish market. The total weight of these cans was 18,042 tonnes. The aluminium content of Swedish cans is 97.25 per cent. Through Returpack's recovery system, 826 million cans included in the deposit scheme were recovered. Privately imported aluminium beverage cans are not covered by the refund system. In 2009, 49 million such privately imported cans were collected through Returpack's beverage collection containers (Returpack, 2010).

The majority of privately imported aluminium beverage cans are collected through public containers where private households separate metal packaging waste from other waste fractions. The Swedish organisation REPA is paid by

[34] Dairy products, products based on vegetables, fruit and berry may be exempted from the system.

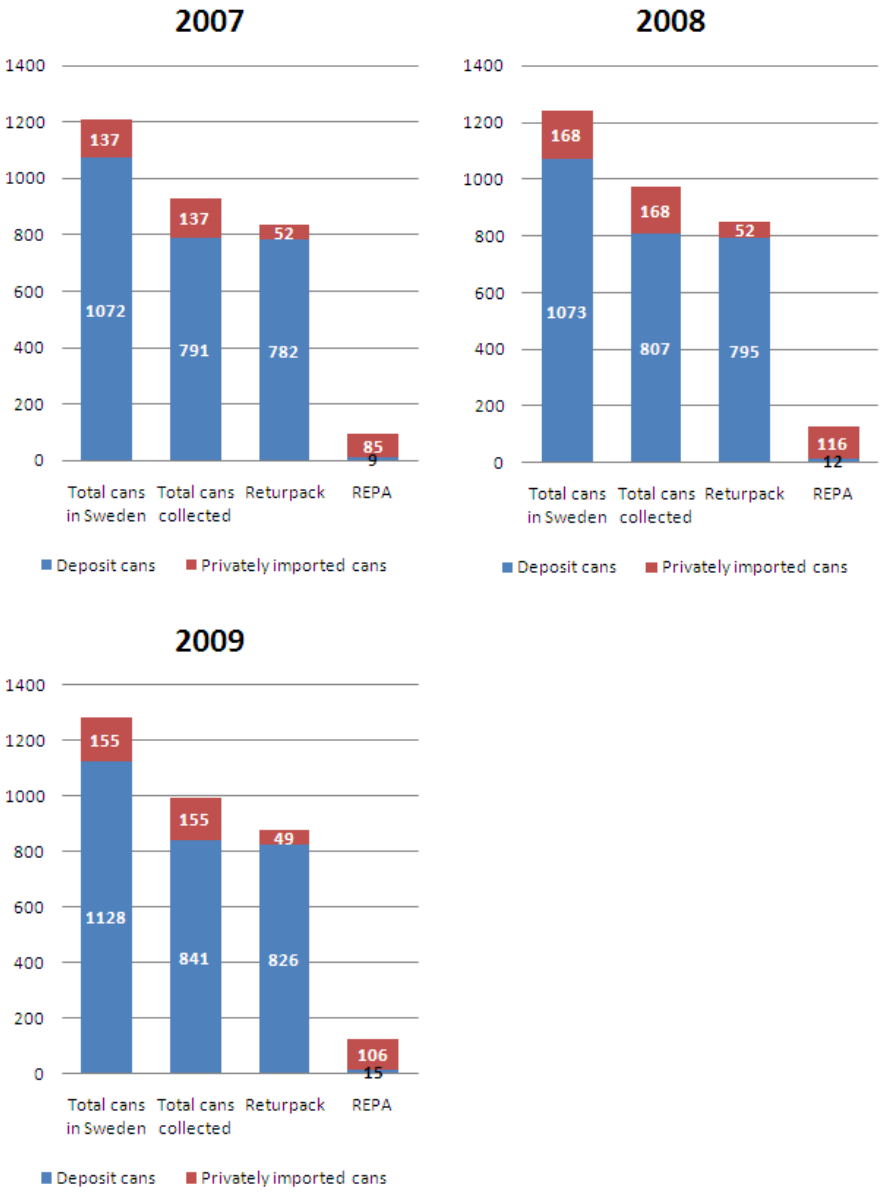
[35] Exchange rate SEK 1 = EUR 0.104, 18 May 2010.

[36] The fee is independent of the number of different products sold on the Swedish market

the producers to take over the responsibility for collection and recycling of packaging waste. The privately imported aluminium beverage cans are, however, not included in REPA's Green Dot system.

In 2009, REPA recovered 106 million privately imported aluminium cans (primarily from Germany) and 15 million cans covered by the Swedish deposit system. The total weight of the 121 million aluminium cans was around 1,940 tonnes (Returpack, 2010; Nilsson, 1 June, 2010). There are no data on the number of aluminium beverage cans privately imported to or exported from Sweden (Nilsson, 1 June, 2010; Mattson, 3 June 2010).

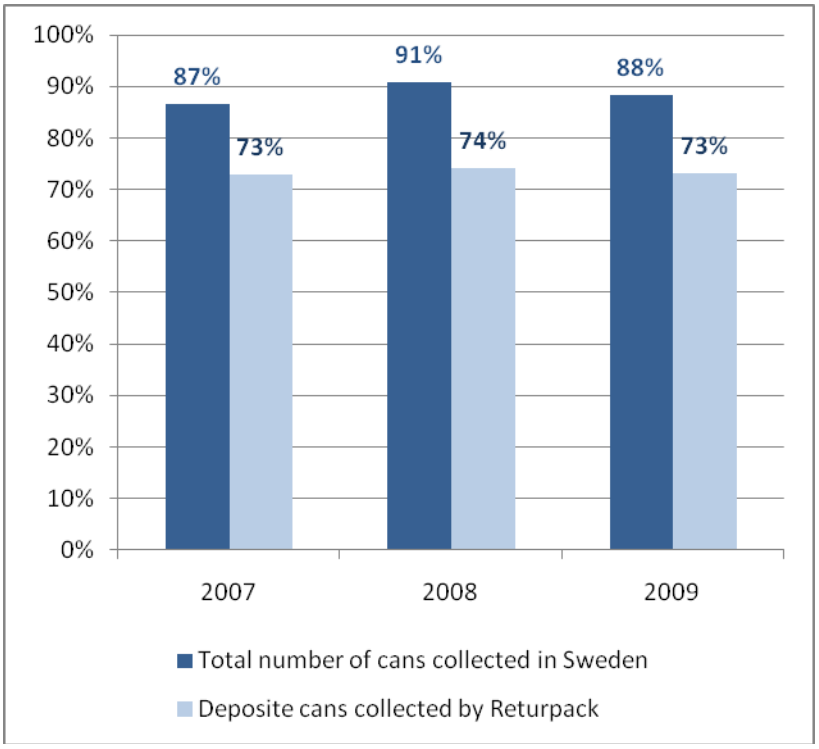
Figure 7-1 Aluminium cans on the Swedish market and number of collected cans in 2007-2009 (in million)



Source: Returpack (2008; 2009; 2010)

In 2009, the total number of aluminium cans in Sweden was 1,283 million units. This includes the 1,128 million units covered by Returpack's deposit scheme and the 155 million privately imported cans collected by REPA and Returpack. Between 2007 and 2009, the number of aluminium deposit beverage cans sold on the Swedish market increased by 5.2 per cent. In the same period, the number of deposit cans collected by Returpack increased by 5.6 per cent, see **Error! Reference source not found.**. It is here assumed that the 155 million privately imported cans collected constituted the total number of privately imported cans in Sweden. The total number of cans collected covers the number of cans collected by Returpack and REPA.

Figure 7-2 Recycling rates for aluminium beverage cans in Sweden (2007-2009)

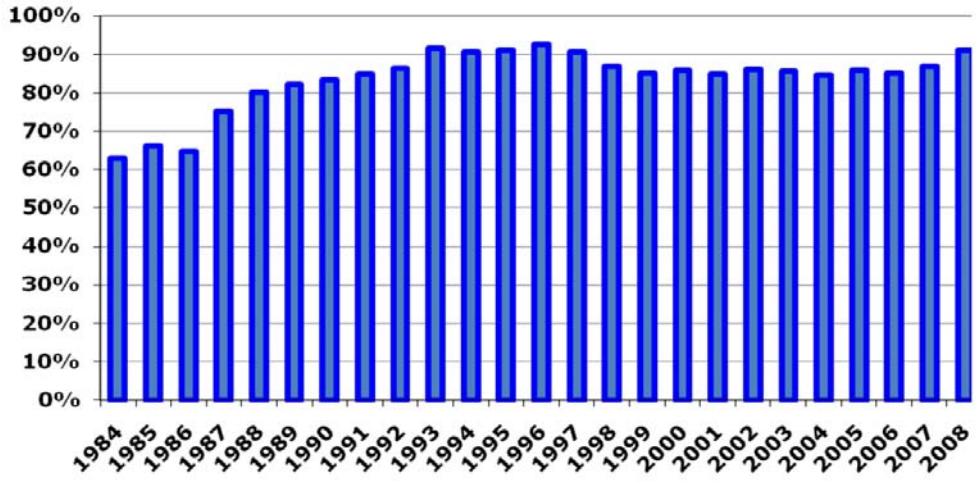


Source: Own calculations.

Official statistics of recovery of aluminium cans in Sweden are based on the total number of cans collected in Sweden as a percentage of the units of aluminium deposit beverage cans sold on the Swedish market. For 2009, this gives a recovery rate of 88 per cent. This figure, however, does not reflect the actual recovery rate considering the total number of aluminium deposit cans sold on the Swedish market. The recovery rate of aluminium deposit cans through Returpack's recovery system remained stable at 73 to 74 per cent from 2007 to 2009; see the figure below. In comparison, the Danish recycling rates of deposit cans is based on the aluminium deposit cans collected as the share of deposit cans sold on the Danish market. Since 2006, the Danish recycling rates of aluminium beverage cans have remained stable at 84 per cent (http://www.danskretursystem.dk).

The development in the official Swedish recycling rates of aluminium beverage cans is shown in the figure below. After a modest decline in recycling rates between 1996 and 2007, recycling rates are now again above 90 per cent.

Figure 7-3 Annual recycling rates for aluminium canes in Sweden 1984-2008



Source: "Fakta om Returpack", http://www.returpack.se

The Swedish deposit scheme is based on cooperation between the distributors, breweries and the packing industry. Returpack is owned by the Swedish Breweries (Sveriges Bryggerier AB) (50 per cent), the Swedish trade association for retail trade (Svensk Dagligvaruhandel) (25 per cent) and the Swedish trade association for food retail (Livsmedelhandlarna) (25 per cent). The Swedish deposit scheme has been a source of inspiration to similar systems in Norway, Finland, Denmark, Estonia, the Netherlands and Iceland (www.returpack.se).

Returpack continuously strives to maintain and increase recycling rates. Efforts include information campaigns and product promotion, the target group primarily being end consumers. Returpack also assists retailers in setting up and maintaining well-functioning equipment for returnable deposit cans (www.returpack.se).

Returpack has been successful in reducing handling costs of beverage containers by integrating the management of aluminium beverage cans and PET-bottles (Labberton, 11 June 2010).

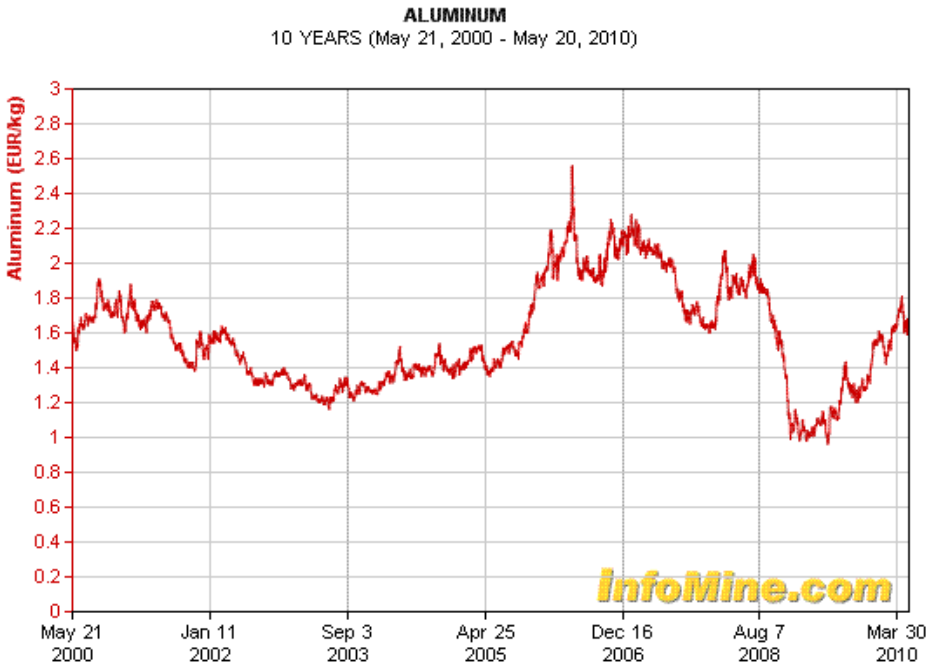
7.1.2 Prices of aluminium scrap

The prices of aluminium scrap from cans included in deposit schemes differ depending on the degree of sorting. The price of aluminium scrap is set as a percentage of the market price. The better sorted, the higher the price. The price of mixed aluminium scrap is therefore lower than the price of aluminium from can deposit schemes. There are substantial differences in the quality of aluminium scrap collected through deposit schemes and aluminium collected through mixed metal household waste. The aluminium collected through deposit schemes can be used for the production of new aluminium cans. Mixed alumin-

ium scrap from households are not suited for production of new aluminium cans, but is used for production of aluminium ingot instead. The ingot is used for casting of engine blocks, building facades, bicycles, etc. (Staxhammar, 3 June 2010). The quality of aluminium ingot produced from recycled aluminium is similar to the quality of ingot from primary production of aluminium. Hence, the value of the aluminium is the same (Frankila, 3 June 2010).

The value of recycled aluminium depends heavily on the world market prices of aluminium. The average market price of aluminium from spring 2008 to summer 2010 was EUR 1,775 per tonne (http://www.lme.com/aluminium.asp). The value of aluminium scrap is set as a share of the market price of aluminium. The world market prices of aluminium vary between EUR 1,000-EUR 2,500, see below

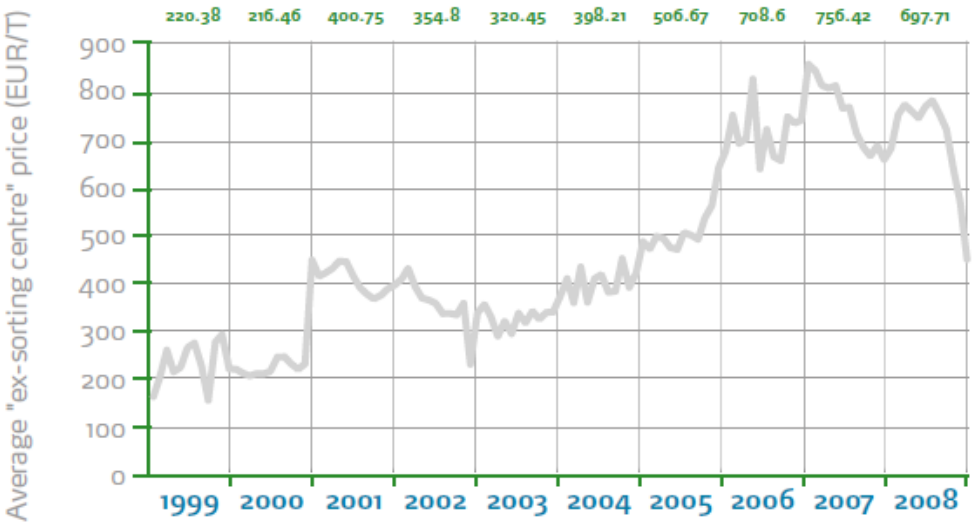
Figure 7-4 Aluminium prices 2000-2010



Source: http://www.infomine.com.

The figure below shows the development in the price of the aluminium fractions, expressed by the prices obtained by Fost Plus (the Belgian company responsible for collection of metal household waste, aluminium scrap between 1999 and 2008. Recession in the construction and motor industries caused the prices to drop end of 2008 (Fost Plus, 2009; Goethals, 1 June 2010).

Figure 7-5 Prices of scrape aluminium from mixed household waste in Belgium



Source: Fost Plus, 2009

In June 2010, the price of aluminium scrap from mixed aluminium household waste was approximately EUR 600 per tonne (Staxhammar, 3 June 2010).

It has not been possible to obtain data that show the difference between the prices of aluminium scrap from can deposit schemes and the price of mixed household aluminium scrap as the price is considered confidential information by the aluminium industry (Kellin, 4 June 2010).

It is not possible to recover 100 per cent of the aluminium when melting aluminium scrap. Using the best available production facilities, 97 to 98 per cent of the aluminium content of an aluminium can is recovered (Kellin, 4 June 2010).

7.1.3 Economic benefits from the Swedish deposit fee system

In the period 2006 to 2008, Returpack-Burk Svenska AB (the branch of Returpack handling aluminium beverage cans) had a yearly average financial result after financial items and tax of EUR 4.92 million, see Table 7-1.

Table 7-1 Financial result for Returpack-Burk Svenska AB (in SEK million)

	2006	2007	2008	2009	Average (2006-2009)
Financial result before financial items and taxes	7.61	7.90	9.95	6.97	8.11
Financial result after financial items and taxes	4.33	4.42	5.79	5.15	4.92

Source: Returpack (2007; 2008; 2009; 2010)

Returpack's income from selling metal scrap is not explicitly shown in the annual accounts. The average financial result (after financial items and taxes) generated by Returpack is EUR 520 per tonne of aluminium scrap.

Table 7-2 Weight of aluminium scrap from beverage cans

	2007	2008	2009	Average (2007-2009)
Weight of aluminium scrape (tonne)	14,909	15,622	15,929	15,587

Source: Returpack (2008; 2009; 2010)

Between 2007 and 2009, the value of the average annual deposit not reclaimed consumers amounted to EUR 15.1 million, see Table 7-2. No data on are available on the use of the deposits from beverage containers not returned by customers (Popovici, 11 June 2010). It is assumed that the deposits not recovered accrue to Returpack. The amount of deposit not reclaimed by customers is quite stable from year to year. It is unclear how the deposit is included in Returpack's annual accounts.

Table 7-3 Deposit not reclaimed for aluminium beverage cans in Sweden (in EUR million, 2007-2009) [37]

	2007	2008	2009	Average (2007-2009)
Deposit fee not redeemed	15.1	14.5	15.7	15.1

Source: Own calculations

The economic benefits arising from the Swedish deposit system seem to depend heavily on deposits not reclaimed by consumers. Without deposits from not returned beverage containers, it appears that the Swedish deposit system for

[37] Based on (number of aluminium beverage deposit cans sold in Sweden - number of deposit cans recovered by Returpack)* SEK 0.50 per can (deposit fee). The deposit cans collected by REPA are not included in the calculation, as it is unclear whether deposit fee for these cans have been reclaimed.

aluminium beverage cans would yield a deficit before financial items and taxes of around EUR 7 million. In comparison, the Danish deposit system including glass bottles, plastic bottles and aluminium beverage cans generated a profit from not recovered deposits of DKK 126 million (EUR 16.9 million) in 2008 and DKK 192 million (EUR 25.7 million) in 2009. The majority of the profit[38] was used to maintain and improve the Danish deposit system (Dansk Retursystem, 2010).

On an annual basis, Returpack pays SEK 1.6 billion (EUR 166.4 million) to the Swedish beverage retailers. This amount includes disbursement of the deposit that the retailers have paid to consumers for returned cans and PET bottles and compensation for the work of handling the reverse vending machines (http://www.returpack.se/). Based on the figures from 2008, the deposit fee paid to customers amounts to EUR 120.9 million.[39] The compensation that Returpack paid to beverage retailers is estimated to EUR 45.5 million.[40]

It has not been possible to get access to data on Returpack's costs of collection, transport and sorting of aluminium cans as this information is considered confidential (Hjalmarsson, 26 May 2010).

7.2 The Belgian Green Dot scheme

In 1996, the Walloon Region, the Flemish Region, and the Brussels-Capital Region entered into a Cooperation Agreement on prevention and management of packaging waste[41]. In accordance with the Packaging and Packaging Waste Directive (Directive 94/62/EC), every company that packages or arranges for the packaging of products sold in Belgium is liable to collect used packaging material to achieve the prescribed recovery and recycling rates. The recovery rate is 90 per cent, and the recycling rate is 80 per cent. In addition to the take-back obligation, the companies are requested to provide information detailing the type of packaging the recovery and recycling rates achieved (http://www.fostplus.be/).

7.2.1 Characteristics of the context where the policy is implemented

In Belgium, either companies can set up their own system for recovery and recycling of packaging waste or they can join an accredited body. With respect to household packaging waste, Fost Plus is the only accredited organisation to assume responsibility for the take-back and information obligations of a com-

[38] DKK 3 million was used annually for social programmes (Dansk Retursystem, 2010).
[39] In 2008, Returpack handled 795 million metal cans and around 510 million PET bottles (corresponding to a recycling rate of 85 per cent of the 600 million PET bottles sold in Sweden. Source: http://www.returpack.se/). The deposit for approximately half of the PET bottles that Returpack recovers is SEK 1 and the deposit fee for the other half of the bottles is SEK 2. The deposit fee for cans is SEK 0.50.
[40] Based on SEK 1.600 million - SEK 1.162,5 million = SEK 437.5 million
[41] The agreement was revised in 2009.

pany. Fost Plus is a private organisation that promotes, coordinates and finances the selective collection, sorting and recycling of household packaging waste (http://www.fostplus.be). Fost Plus has always been able to meet government requirements to recovery and recycling rates. The recycling rate of aluminium beverage cans reached 93 per cent in 2008. One of the reasons for the high recycling rate is that Belgians are very good at separating the PMD fraction (plastic bottles and flasks, metal packaging and drinking cartons) from other waste types. Moreover, all of Belgium is covered by Fost Plus's collection schemes, and the PMD fractions are collected twice a month door-to-door in 'blue bags' (Goethals, 1 June 2010). Fost Plus's management of the collected waste is very efficient; among other things because Fost Plus is very good at informing the public and their collaborating companies about sorting and management of waste. Quality control is made of the collection of the waste sorting, e.g. through visual inspections of the contents of the transparent 'blue bags' where wrongly sorted PMD waste is refused (Labberton, 11 June 2010).

The companies that join Fost Plus pay a contribution to Fost Plus. This contribution is based on a specific rate for the type of packaging material in question. This contribution rate is known as a Green Dot rate, as the companies that pay contributions to Fost Plus are entitled to label packaging material with a Green Dot. The Green Dot also is a label that reflects the company's commitment to the environment. The level of the Green Dot rate is decided by Fost Plus. The contributions are used by Fost Plus to organise the recovery and recycling of the packaging waste (http://www.fostplus.be; Labberton, 11 June 2010).

Fost Plus cooperates with all stakeholders involved in waste management issues in order to achieve the legally required recovery and recycling rates. Fost Plus also conducts campaigns on selective collection, sorting and recycling of household waste with the purpose of increasing consumer awareness.

Metal packaging waste is collected in special-purpose waste containers. Beverage cans are collected together with metal packaging waste from food tins, boxes, top, caps and lids of jars and bottles, aluminium plates, dishes and trays, cosmetics and food sprays.

The collected metal packaging waste is sorted, and aluminium is separated by the use of a process known as 'edit current'. The aluminium scrap is subsequently crushed and melted (http://www.fostplus.be).

The number of recorded Fost Plus members was 5,644 by 31 December 2008. In 2008, the total contribution of these companies amounted to EUR 66.6 million. In 2009, the Green Dot rate for aluminium in household packaging with a minimum content of 50 per cent aluminium was EUR 36.9 per tonne. In 2007, the Green Dot rate was EUR 150.8 per tonne, the decline in Green Dot rate from 2007 to 2009 was 75.5 per cent (Fost Plus, 2009). In comparison, the Green Dot system rate for aluminium cans covered by the REPA collection scheme in Sweden is EUR 218.4 per tonne or almost 6 times higher than the Green Dot rate in Belgium (Nilsson, 1 June 2010). Compared to other European deposit systems, the Belgium scheme for collection and handling of alu-

minium waste from household packaging is very well organised (Labberton, 11 June 2010).

Fost Plus' costs of sorting aluminium cans are not calculated separately. In 2008, the costs of collection of PDM packaging[42] was EUR 193.99 per tonne, and the costs of sorting (incl. transfer and transport costs) was EUR 173.52 per tonne (Goethals, 1 June 2010). As a result, the total costs of collecting and sorting of PDM packaging were EUR 367.51 per tonne (Fost Plus, 2009). It is estimated that the collection and sorting costs related to aluminium beverage cans is the same as those related to the PDM fraction.

The effectiveness and costs of the selective packaging waste collection system depend on the correct sorting of waste. Despite the efforts made by most Belgian households to separate the waste correctly, recyclable items are occasionally mixed with non-recyclable waste (http://www.fostplus.be).

No public data are available on the weight of aluminium cans sold on the Belgian market and included by the Fost Plus Green Dot system, as such information is considered confidential (Labberton, 11 June 2010). In 2006, the consumption of aluminium beverage cans was 27 units per capita in Belgium. The weight of aluminium beverage cans sold in Belgium is estimated to 4,644 tonne[43]. With a recycling rate of 93 per cent, the weight of aluminium recovered from aluminium beverage cans in Belgium is 4,319 tonnes.

7.2.2 Economic benefits from the Belgian Green Dot system

The costs of handling aluminium scrap are compiled in Table 7-4. The unit cost of handling aluminium scrap is estimated to EUR 367.51 per tonne. The total annual costs of handling scrap from all aluminium cans in Belgium are estimated to EUR 1.587.

Table 7-4 Costs of handling aluminium scrap and Green Dot rate, in EUR

Estimated collection costs for aluminium cans (EUR per tonne)	193.99
Estimated sorting and transportation costs for aluminium cans (EUR per tonne)	173.52
Total handling costs (EUR per tonne)	367.51
Estimated weight of aluminium cans (tonne)	4,319
Total costs (EUR million)	1.587

Source: Own calculations

[42] Plastic bottles and flasks, metal packaging and drinks cartons.

[43] Based on a Belgian population of 10.75 million inhabitants in 2009 and the average weight Belgian aluminium cans being the same as recycled aluminium beverage cans in Sweden, i.e. 16 gram per can (15,622 tonnes aluminium/976 million cans) (http://epp.eurostat.ec.europa.eu/tgm/table.do?tab=table&language=en&pcode=tps00001&tableSelection=1&footnotes=yes&labeling=labels&plugin=1; Returpack, 2009).

The income generated from selling the scrap depends heavily on the value of the aluminium scrap. Based on a market price of aluminium scrap of between EUR 400 and 600 per tonne, the total income from selling aluminium scrap from aluminium beverage cans is estimated to EUR 1.727-2.591 million.

Table 7-5 Annual income from handling aluminium beverage cans

Green Dot fee for aluminium cans (EUR per tonne)	36.9
Income from Green Dot fee (EUR million)	0.171
Estimated weight of aluminium cans sold in Belgium (tonne)	4,644
Price of aluminium scrap (EUR per tonne)	400-600
Estimated weight of scrap from aluminium cans (tonne)	4,319
Estimated income from used aluminium cans (EUR million)	1.727-2.591
Total income from Green Dot rate and scrap aluminium from beverage cans (EUR million)	1.899-2.763

Source: Fost Plus

The annual financial result of Fost Plus's handling aluminium cans is estimated to be between EUR 0.312 and 1.175 million. Investments are not included. This corresponds to a financial gain of EUR 72-272 per tonne of aluminium scrap from beverage cans collected. It is thus profitable for Fost Plus to handle used aluminium cans. Without the income from the Green Dot fee, the financial result of handling used aluminium beverage cans would be between EUR 0.140-1.004 million.

7.2.3 Environmental impacts of primary aluminium production

Production of primary aluminium is extremely energy consuming and makes up two per cent of the electricity generated worldwide. The production of primary aluminium is based on bauxite. Each tonne of primary aluminium produced requires five tonnes of bauxite ore. One of the major environmental impacts of primary aluminium production is habitat loss arising from strip mining and the building of large hydroelectric plants that supply primary smelters (Gitlitz, 2006).

The production of aluminium from used cans only consumes 5 per cent of the energy needed for primary production of aluminium[44].

7.3 Lessons learned and which lessons can be relevant to transfer or upscale to EU

Financial gains are achieved from the aluminium beverage can recycling systems applied in both Sweden and Belgium. The two recycling systems are compared below.

[44] http://www.returpack.se

Table 7-6 Comparison of Belgian and Swedish recycling systems

	Advantages		Disadvantages	
	Sweden	**Belgium**	**Sweden**	**Belgium**
Handler of used aluminium cans	Higher unit price of aluminium scrap Potential low sorting and transportation costs Income from non-recovered deposit	Income from Green Dot fees	Costs to retailers of handling used cans	Cost of lower unit price of aluminium crap
Beverage producers and importers	Do not have to pay Green Dot rate	Possibility of using Green Dot as marketing	Have to pay annual waste sorting contribution	Have to pay Green Dot rate
Beverage retailers	Receive economic compensation for handling cans	Do not have to receive cans	Costs of implementing and maintaining of reverse vending machines	
Customers	Economic incentive for recycling cans	Used cans picked up at homes	Not all deposit fees are recovered Cans have to be returned to beverage retailers	No economic incentive for recycling cans
Externalities	High recovery rate Aluminium usable from can-to-can	Very high recovery rate	n.a.	n.a.

Source: Own analysis

Due to lack of information of the sorting and transportation costs of beverage aluminium cans in Sweden, it is not possible to compare the sorting and transportation costs in the two systems.

The sorting of aluminium beverage cans in the deposit scheme is primarily done by the consumers, and the consumers return the deposit cans at reverse vending machines at retailers. Reverse vending machines at retailers are able to sort the different fractions of beverage packages. Compared to the Belgian system, the Swedish deposit scheme holds a potential for low sorting costs. In terms of transportation, the deposit beverage cans are collected from the retailers in Sweden. Compared to the Belgian system, which involves collection of waste from all households, Returpack may potentially have low transportation costs. In the Swedish system, considerable costs paid to compensate retailers for handling of the cans.

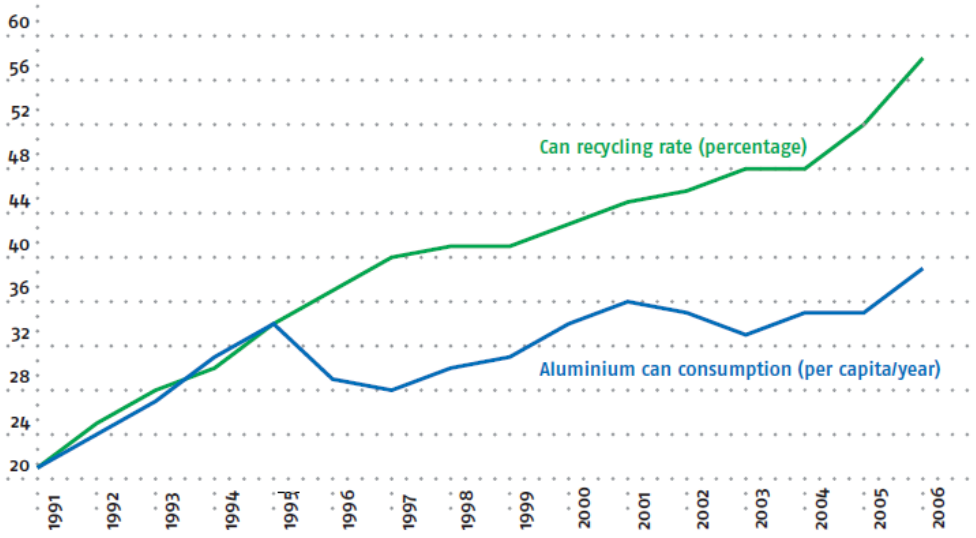
The deposits not reclaimed by consumers seem to make up an important part of the income of the operator of the Swedish deposit scheme. A very successful recycling rate therefore entails a significant reduction in the potential income of the operator of the scheme.

The major advantage of the Belgian system is probably the convenience to the households. This ensures very high recycling rates. However, high recycling rates are also achieved by the deposit scheme in Sweden.

7.3.1 Geographical relevance

In 2008, the recycling rates of aluminium beverage cans in Europe reached 63 per cent. This was a 3 per cent increase compared to 2006. In 2008, the total number of aluminium beverage cans in Europe was 34 billion units. The development in recycling rates and consumption of aluminium beverage cans in Western Europe is shown below.

Figure 7-6 Aluminium beverage recycling rates and can consumption in Western Europe 1991-2006



Source: EAA (2008b)

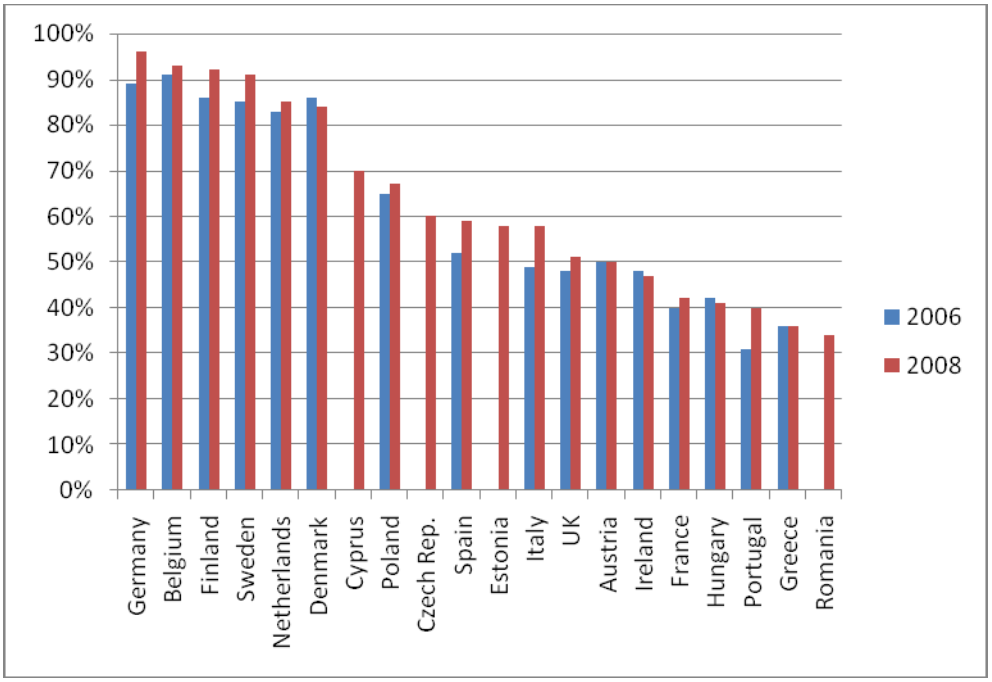
Deposit schemes for aluminium beverage cans are applied in Denmark, Estonia, Finland, Germany and Sweden. Except for Estonia, the countries using deposit schemes have been successful in achieving recycling rates above 80 per cent. Estonia has a reported recycling rate in 2008 of 58 per cent, whereas Germany achieved 96 per cent.

Green Dot schemes have been introduced in e.g. Austria, Belgium, Bulgaria, the Czech Republic, Cyprus, France, Greece, Germany, Ireland, Romania, Portugal and Spain (http://www.pro-e.org/; EAA, 2010). The recycling rates for countries using Green Dot schemes vary significantly. The lowest recycling rates are found in Romania and Greece with recycling rates below 40 per cent, whereas the recycling rates in Belgium and the Netherlands is above 85 per cent.

Other types of recycling systems are also applied. Incentive-based collection systems are for instance used in Poland and Hungary where collectors of aluminium cans are compensated by scrap dealers based on the weight of the col-

lected aluminium (Labberton, 11 May 2010). In the UK, Packaging Recovery Notes trading is used, and in Switzerland the collection of aluminium cans is based on a levy system. **Error! Reference source not found.** shows the rates recycling rates for selected EU Member States. Recycling rates have increased in most Member States in the period from 2006 to 2008.

Figure 7-7 Beverage can recycling rates for selected EU Member States



Note: Data for Belgium includes Luxembourg, data for Czech Republic includes Slovakia and data for Romania includes Bulgaria.

Source: EAA (2008a) and EEA (2010)

Metal beverage cans are made either by aluminium or by steel (Labberton, 11 June 2010). The share of beverage cans made of aluminium varies from 17 to 100 per cent across Europe, with the highest share in the Nordic countries, and the lowest share in the Netherlands and Spain.

The average consumption of aluminium beverage cans in Europe is 42 cans per capita per year (EAA, 2008a). However, consumption patterns vary significantly between EU Member States.

7.3.2 Assumptions necessary in order to scale up results

The following assumptions were made in order to scale up the results:

- The same recycling rates for aluminium beverage cans can be achieved throughout Europe by converting existing recycling systems into systems similar to those of Sweden and in Belgium.

- Companies using similar recycling schemes as the ones used in Belgium and Sweden are able to generate the same profit as is achieved in these countries.

- The aluminium beverage recycling rates can be improved to 74 per cent by implementing a well-functioning deposit system.

- The aluminium beverage recycling rates can be improved to 93 per cent by implementing a well-functioning Green Dot scheme.

- The economic benefit harvested by implementing a system similar to the Swedish deposit scheme is EUR 520 per tonne of aluminium scrap from beverage cans collected.

- The economic benefit harvested by implementing a system similar to the Belgian Green Dot scheme is EUR 72-317 per tonne of aluminium scrap from beverage cans collected.

- The costs of handling aluminium scrap from used beverage cans are the same across Europe.

- The average recycling rate in EU27 is equal to the average recycling rate in wider Europe, i.e. 63 per cent.

- The average consumption of aluminium beverage cans in EU27 is equal to the average recycling rate in wider Europe, i.e. 42 units per capita annually.

- The population in EU27 is 501 million.

- The average weight of an aluminium beverage can is 16 gram.

7.4 Result of resource saving potential

The annual potential economic benefit to operators of aluminium recycling systems in EU27 of introducing a recycling system similar to Swedish recycling system is estimated to be EUR 19.6 million. The potential economic benefit of implementing a recycling system similar to the Belgian Green Dot scheme is estimated to be in the magnitude of EUR 7.4 - 28 million.

The costs of improving the European recycling systems depend widely on how the collection and handling of used beverage cans is managed presently. The development of a deposit scheme similar to the Swedish system involves considerable investments in infrastructure, including reverse vending machines. Similarly, considerable investments may be needed to establish the infrastructure necessary to operate a system similar to the Belgian recycling scheme, including costs of establishing an efficient PDM waste sorting equipment.

To increase recycling rates of aluminium beverage cans, it is necessary to motivate consumers to recycle used cans. Deposit schemes provide such an incentive. The success in motivating the European population to increase recycling rates depends highly on the convenience of the system. The Belgian beverage can recycling system has been able to establish a system that is convenient to the consumers.

Table 7-7Potential savings

Total weight of aluminium beverage cans consumed in EU27 (tonne)	342,700
Weight of aluminium beverage cans presently recycled (tonne)	215.914
Potential recycling through introduction of system similar to the Swedish deposit scheme (tonne)	253,612
Achieved increase in recycling through introduction of system similar to the Swedish deposit scheme (tonne)	37,699
Potential economic benefits harvested from introduction of system similar to the Swedish deposit scheme (EUR million)	19.6
Potential recycling through introduction of system similar to the Belgian Green Dot scheme (tonne)	318,729
The achieved increase in recycling through introduction of system similar to the Belgian Green Dot scheme (tonne)	102,816
Potential economic benefits harvested from introduction of system similar to the Belgian Green Dot scheme (EUR million)	7.4 - 28

Source: Own calculations

7.5 References:

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8 Green supplier network, US

Name of policy:	Green supplier network
Country:	United states
Sector:	Manufactoring
Resource:	Cross-cutting
Instruments:	Subsidies and platform

8.1 The purpose of the policy

The Green Suppliers Network (GSN) is a collaborative programme run by a combination of industry, the U.S. Environmental Protection Agency (EPA) and the U.S. Department for Commerce's 'National Institute of Standards and Technology Manufacturing Extension Partnership (NIST MEP). The GSN works specifically within the manufacturing sector, in particular large manufacturers to assist them in engaging their SME suppliers through low cost technical reviews that use 'Lean and Clean' methodologies to increase productivity, reduce waste, and boost profitability.

The programme came into operation in February 2001 with General Motors and the Saturn Corporation the first two participants. The programme was scaled up in December 2003 and has been steadily expanded into other manufacturing sectors.

8.1.1 Green Suppliers Network: How it works and participation rates

The GSN aims to empower companies to combine 'lean and clean' manufacturing methods. A technical review seeks to optimise resources (labour and materials), identify opportunities to maximise return on investment and eliminate waste. To achieve these aims GSN adopts a top down approach initiated by building strong relations with large multinational corporations (such as Johnson & Johnson) who are committed to improving supplier performance, with 'environmental sustainability' considered a fundamental factor in this performance.

The network is operated by five full time equivalent staff within the EPA and NIST MEP but the technical reviews are undertaken by members of a large

network of NIST MEP / Environmental Protection Agency associate staff spread across North America. Given the size and geographic spread of the SME sector across the US, this structure assists to minimise cost. The GSN performs a number of functions in the implementation of an industry specific, one to one technical review at each manufacturing facility. The support offered by NIST MEP aims to provide business focused solutions to industry processes that overcome environmental concerns.

It is free to join the GSN but the project has indicated that a typical review costs USD 7,500 per facility. The EPA contribute USD 2,000 to this cost. The review takes up to 4 days to complete and is completed by the GSN review team (NIST MEP and state environmental experts). The review process involves a half day pre-visit - to identify improvement targets and issues of concern, followed by a 2-3 day visit to perform the review. Following the visit, a technical review identifies environmental and cost improvement opportunities, and NIST MEP conduct 'on-going' follow up sessions to chart suppliers' implementation progress. The Network supports the SMEs in identifying funding resources to assist in implementing the recommendations. A training credit grant of USD 1,000 is offered through NIST MEP to help the beneficiary companies to implement the project recommendations within 3 months of completing the review. If this training grant is taken up the net cost to the company of participating in the programme is USD 4,500 (EUR 3,516).

The Green Suppliers Network welcomes all USA manufacturers to participate in the network, with preference given to SMEs . Effectively the GSN approach seeks to capitalise on the 'top – down' pressure influenced over supply chains by large multinational corporation on SMEs. SMEs will be referred to GSN by their large customers and this provides the leverage for the EPA and NIST MEP to engage small businesses in constructive conversation over undertaking a technical review and the benefits / impact this will provide. Useful comparisons can be made with the experience of some large European corporations encouraging SMEs to adopt environmental management systems (e.g. EMAS, ISO 14001), quality systems (e.g. ISO 9001) and accreditation schemes (e.g. FSC). These examples of industry recognised quality systems / marks have become increasingly vital for SMEs to achieve if they wish to continue to operate within their supply chain. However, the benefits for the company can be adversely affected by the time, resources and administrative burden which is required to achieve accreditation to these 'systems'.

What sets the GSN programme apart from any known comparative approach in Europe is the integration of environmental management within LEAN manufacturing reviews. The USA experience has demonstrated that these are mutually reinforcing principles and for SMEs it is a 'win win' opportunity. The limitation for GSN is capacity of staff and the vast numbers of SMEs across the country. The US definition of SMEs, independent companies having fewer than 500 employees, includes larger companies than the EU definition.

As of May 2010, 162 company members of the GSN had completed a Technical Review. The GSN team confirmed that of the 162, five are in the process of completing their review and ten are waiting for the plans to be finalised. The

GSN have provided examples of the manufacturing sectors from which companies have undertaken reviews, these include aerospace, automotive, healthcare, and office furniture. The GSN team were not able to provide a breakdown of firms engaged by industrial sector.

The interview and literature analysis highlights that the Green Suppliers Network measures traditional lean manufacturing metrics alongside environmental wastes as part of programme implementation. These metrics include:

- Higher run hours per production machine.
- Reduced schedule bumping.
- Increased inventory turns.
- Reduced inventory stocks relative to cost of goods sold (COGS).
- Improved on-time deliveries.
- Improved set-up reduction.
- Operating margin benefit – improved efficiency.
- Reduced operating costs.
- Reduced employee turnover.
- Reduced days receivables.
- Lower scrap and rework expense relative to COGS.

The environmental measures which GSN reviews measure against are as follows:

- Energy, water or raw materials used in excess of what is needed to meet consumer needs.

- Pollutants and material wastes released into the environment, such as air emissions, wastewater discharges, hazardous wastes, and solid wastes (trash or discarded scrap).

- Hazardous substances that adversely affect human health or the environment during their use in production or presence in products.

8.2 GSN Programme Achievements

The view of the GSN is that undertaking a technical review increases profitability as well as assisting in improving the environmental performance of the company reviewed. The GSN has recorded that the impact for an individual SME is attributed on the basis of 60 per cent from improvements in LEAN manufacturing, with the remaining benefits accruing from reduced energy requirements, waste reduction and more effective environmental management processes.

Key Project Outcomes

No independent evaluation of the Green Suppliers Network has been undertaken that can provide a robust and objective assessment of the impacts resulting from the programmes activities since 2003. The figures presented in the tables below (presented in more detail in Annex one) have been provided by the network. This internal evaluation report has not been made available in the

public domain. The calculations are estimates and were produced as part of an intern's three month cycle within the EPA.

Table 8-1 Outcomes of Green Suppliers Network

	Programme Total (1000 EUR[45])
Environmental Savings Identified (to date)	27,944
Lean Savings Identified (to date)	31,555
Other Cost Savings (to date)	893
Total Potential Impact Identified (to date)	**60,392**

Source: https://www.greensuppliers.gov/gsn/page.gsn?id=program_results

In order to convert these savings to date into typical savings per company per year we have divided the total by 162 (the number of companies that have been recruited).

Table 8-2 Average Impact per Project

	Per SME (1000 EUR)
Annual Average Environmental Impact	40.1
Annual Average Lean Savings	45.3
Annual other Cost Savings	1.3
Total annual Savings	86.7
One-Time Lean Impact Opportunities*	45.5

Source: Green Suppliers Network

* It has been assumed that these one time impacts relate to a one off process change. However it could be argued that if a comparison is made with the position of the company prior to the advice then these one off savings will continue to provide ongoing benefits.

These average annual savings per company (EUR 86,700) appear very attractive when compared to the cost to the company of participating (EUR 3,515). This excludes the capital costs of implementing any measures, as this information has not been collected by GSN. However given this average saving an average capital outlay of EUR 255,500 (plus the EUR 3,515 to participate in the programme) would still result in a payback of three years. The environmental benefits of the programme to date are presented below. The average annual saving per company has been calculated on the same basis as the savings, i.e. divided by 162.

[45] Exchange rate, 3/9/10: EUR 1 = USD 1.28

Table 8-3 Environmental Outcomes of Green Suppliers Network (to date)

	Programme Total	Average annual saving per company
Energy Conserved (GWh)	867	1.34
Water Conserved (m^3)	252,872	390.23
Air Emissions Reduced (tonnes)	20.048	0.03
Solid Waste Reduced (tonnes)	4,582	7.07
Hazardous Waste Reduced (tonnes)	22.7	0.04
Toxic/Hazardous Chemicals Use Reduced (tonnes)	82.2	0.13
Water Pollution Reduced (m^3)	5,521	8.52

Source: https://www.greensuppliers.gov/gsn/page.gsn?id=program_results

Based on the results and the views offered by the GSN the following qualitative lessons have been summarised from the analysis of programme, including those of relevance to its potential application in Europe. If the GSN approach were to be replicated across Europe or by individual member states these learning points would need to be understood in more detail, and much more detailed impact data would be required, if it was to be expected that comparable levels of outputs, costs and benefits were to be delivered by a similar programme.

- Corporate commitment and involvement of large multinationals is absolutely essential to the viability of the programme. This relates to the programme mechanism that relies on large companies requiring their suppliers to carry out their reviews in order to retain their business.

- Application of the GSN approach to Europe would require a 'public / governmental' intervention mechanism if a similar programme were to be replicated. Because without a resource to operate the programme and a subsidised team of advisors many companies, particularly SMEs, would be unlikely to meet the full costs.

- The involvement of a manufacturing specialist like NIST MEP is absolutely critical and the programme will not operate without it.

- Participation rates are unpredictable and the network has struggled to expand (due to staff capacity constraints) beyond its current foundations.

- No company has ever stated that the investment to undertake the technical review has been too expensive or not worthwhile.

- The majority of the savings achieved are as a result of management and process review, however some require a capital investment. The levels of capital investment made have not been recorded.

In addition, the interview with GSN identified that an American corporation called Steelcase had asked if the network if it could explore undertaking techni-

cal reviews for its suppliers based in France. GSN met with OECD and investigated this opportunity but it materialised that whilst 'in principle' this was a good idea the reality was that capacity, alternative SME structures, and different government structures / regulatory requirements meant that it wasn't possible to implement the GSN approach with French suppliers

Economic Environmental and social benefits of GSN

The benefits to the companies that arise from participating in the network can be summarised in terms of:

- Economic:
  - More cost-effective production.
  - Increased resource efficiency.
  - Increased process efficiency.
  - Minimisation of waste.
  - Increased employee motivation.
  - Improved company image.
  - More efficient environmental management systems.
- Environmental and social benefits:
  - Reduced pollution levels.
  - Reduction in water use.
  - Improved wastewater treatment.
  - Improved corporate social responsibility.

8.2.1 Resource saving potential in companies that went through the Green Suppliers Technical Review

The resource savings mentioned below are based on a series of case studies presented on the Green Suppliers Network website.

Metal Finishing

The text box below contains the results of the GSN review in metal finishing company

Text box 8-1 Results of a GSN review in metal finishing company

Har-Conn Chrome Company (Har-Conn) is an independently owned metal-finishing company specializing in aerospace and high technology applications of electroplating and related coatings. Like any company competing in today's low-cost world, Har-Conn looks for cost savings wherever it can find them—which is why Har-Conn's president, Tim Backus, has teamed with the Green Suppliers Network. CONNSTEP, the Connecticut MEP centre, worked with Har-Conn to conduct a top-level assessment of the company. CONNSTEP identified on-time delivery, lead times, energy usage and external and internal rework as well as areas where Har-Conn can make significant improvements that can save the company up to USD 424,500 annually. To date, the Har-Conn/CONNSTEP team has completed training in Lean/Clean awareness and Value Stream Mapping and has begun working on the following improvement opportunities (which represent an example of the total savings potential identified):

- Improve management of boiler fuel (annual cost savings of USD 36,008) and recover compressor waste heat (annual savings of USD 2,601). Since undergoing a Green Suppliers Network Review, Har-Conn has also completed an energy audit that identified a 16 percent reduction in energy bills.
- Install rinse water flow controls (annual cost savings of USD 13,353) and determine optimal water setting on rinse tanks to promote cleanliness and ensure the continued integrity of the plating.
- Track internal rework with immediate feedback to the floor.
- Develop a process to encourage staff to readily impart existing knowledge and cross-train on the best practices and standard work procedures.

Source: https://www.greensuppliers.gov/gsn/page.gsn?id=harconn

Manufacturer of Cable and Wire Products

The text box below contains the results from GSN in a cable company

Text box 8-2 Results from a GSN in a cable company

In October 2007, Georgia Governor Sonny Perdue asked industries across the state to voluntarily cut water use by 10 percent to mitigate a drought of exceptional proportion. In response, **Southwire**—a leading North American manufacturer of residential, commercial, industrial and utility wire and cable products—began searching for opportunities to reduce its water use at the company's Utility Products Plant in Carrollton, Georgia. During this same year, Southwire launched a sustainability campaign and established companywide goals to reduce water use by 15 percent and its overall carbon footprint by 10 percent by the end of 2010.

Situation
Pacific Gas and Electric (PG&E) contacted Southwire in late 2007 about participating in a Green Suppliers Network review. As one of PG&E's key suppliers, Southwire welcomed the opportunity to participate in the Green Suppliers Network, which would complement its ongoing efforts to meet companywide sustainability goals. Southwire was already incorporating the fundamentals of lean manufacturing into its daily operations. With the help of the Green Suppliers Network, the review would help the company capitalize on the connection between its lean manufacturing initiative and its path toward environmental sustainability.

Bob Hitch, Bill Ritsch, and Tom Sammon of Georgia Tech Enterprise Innovation Institute, and P.J. Newcomb of the Pollution Prevention Assistance Division of the Georgia Department of Natural Resources, conducted Southwire's review in February 2008. Southwire's review team—consisting of plant managers, engineers, materials managers and production personnel—developed comprehensive current and future state value stream maps of its 600-volt cable line. This line was chosen because most manufacturing processes situated at the facility take part in producing the 600-volt cable. Southwire can transfer improvements to this line to many other similar lines throughout the facility.

Solution
Georgia Tech Enterprise Innovation Institute's final report confirmed some of Southwire's initial investigation and helped prioritize the opportunities available to the company. More importantly, the Green Suppliers Network review helped operations managers justify capital investments by estimating the

associated cost savings. Jill Morgan, director of operational perfection at Southwire, shared that "having an outside set of eyes look at our processes is one of the benefits of the Green Suppliers Network. They helped us validate our efforts and confirm that we set our priorities appropriately." Following the review, the facility implemented a water-looping system that recycled process water without affecting the quality of the wire. Southwire added a filtration system that allowed water to be reused several times. Southwire also added energy efficiency opportunities to the expanding focus of its operational perfection culture. Since the review event, the company has retrofitted its Carrollton facility with high-efficiency light fixtures.

Results
As a result of implementing process-water recycling, Southwire reduced its publicly-supplied water use at the Carrollton Utility Products Plant by more than 9 million gallons annually, which reduced the facility's demand on Georgia's water resources by more than 90 percent—far exceeding the governor's request and saving more than USD 70,000 annually. Retrofitting the facility with high-efficiency fluorescent light fixtures allowed the facility to cut its electricity use for lighting in half and take steps forward toward meeting the company's carbon footprint goals.

Southwire's Carrollton facility also reduced scrap from its processes by 30 percent, following the Green Suppliers Network review. While some scrap reductions can be attributed to improved order management through better planning, Emory Barber, the Carrollton plant manger, states that there are no low hanging fruit when it comes to reducing scrap rates. He said the facility now tracks scrap rates by the hour, focuses on the details when filling orders, and proactively makes adjustments to production to optimize efficiency and reduce scrap wastes.

Source: https://www.greensuppliers.gov/gsn/page.gsn?id=southwire

8.3 Transferring the GSN Approach to the EU27

It is not easy to make an assessment of the potential to replicate the GSN approach in the EU. Although the network appears to address SMEs in different sub-sectors of manufacturing and does not seem to be exclusive in any way – there is limited quantitative information and no external evaluation to verify the programme and be confident of the level of **costs** and **benefits** of replicating this project in member states.

In addition, the SME population and diversity in the United States is not directly comparable to that in the EU – EU defines an SME as a company with 250 employees or less, whereas the US definition is any company with less than 500 employees. Therefore, it could be assumed that to achieve the same outputs and impacts in the EU Member States then a replicated GSN programme would need to work with large corporations (as well as SMEs). On this basis it could reasonably be expected to deliver similar benefits for similar costs as those reported for the United States. This assumes that cross member state border trading between suppliers and major companies at the head of supply chains would not lead to significant extra transaction costs, e.g. because the costs and access routes to the networks of advisers varies between member states.

According to the GSN operators the programmes growth has been constrained by a lack of resources, rather than a lack of willing companies. Data is therefore not available on the total potential of the programme in the US, and hence, it is not possible to estimate the total potential of a similar programme in the EU. It does, however, seem reasonable to suggest that an EU equivalent would be able to achieve the same level of take up for the same programme expenditure.

Costs:

5 FTE staff – no costs have been made available but it is reasonable to assume EUR 36,000[46] per staff member. Giving a total cost of EUR 180,000.

162 company audits, with a typical cost of USD 7,500 to each company. The total true cost of the revues is not known but the following costs have been reported:

- Training grant: USD 1,000
- Cost to EPA: USD 2,000

So in terms of public expenditure there is a known cost to each audit of USD 3,000. However it was also reported that the cost of the EPA / NIST MEP time in completing the reviews is not covered in the USD 2,000. The exact cost to the companies is not known, because although the majority of savings are achieved through process review and better management some involve a capital cost and the GSN programme has not collected data on these capital costs.

For 162 companies the total known public cost would therefore be: EUR 180,000 + ((162 x $3,000)/1.28) = EUR 559,687.

Benefits

As per table 1.3 above, if it is assumed that the same expenditure would attract the same number of companies the benefits could also be assumed to be at the same level as those achieved, as follows.

Table 8-4 Environmental Outcomes of Green Suppliers Network

	Total – 162 companies – over 9 years	Average annual saving per company
Energy Conserved (GWh)	867	1.34
Water Conserved (m^3)	252,872	390.23
Air Emissions Reduced (tonnes)	20.048	0.03
Solid Waste Reduced (tonnes)	4,582	7.07
Hazardous Waste Reduced (tonnes)	122.7	0.04
Toxic/Hazardous Chemicals Use Reduced (tonnes)	82.2	0.13
Water Pollution Reduced (m^3)	5,521	8.52

Source: Own calculations

[46] On the assumption that the skills and knowledge required would command a salary of this level

8.4 Conclusions

The GSN programme has produced very impressive environmental and economic benefits for those companies which have taken part in it. Many of these savings are related to process improvements brought about by 'lean manufacturing' techniques.

Much of the cost of delivering the programme is accounted for by other public expenditure as it relies on the existence of a network of advisers for whom the GSN is not their only activity. As such it is difficult to accurately assess the cost effectiveness of the programme, though even with a relatively conservative interpretation of the data which does exist it appears to offer a very cost effective process for the companies involved.

There is a lack of detailed data available on the costs and benefits of programme participation which means that quantitative comparison with other programmes is not possible with any degree of confidence.

The participating SMEs are brought to the programme via the influence of their important customers – who are large corporations.

The manufacturing sector has gained most from the outputs of this programme. Whilst SMEs are well represented in this sector across Europe, the lack of an independent evaluation to quantify the achievements of the GSN make it difficult to estimate how well the programme could be replicated across the EU.

However, there are two key points of interest to any member states considering adopting the GSN approach:

- 1. Identification of large EU corporations who are committed to embedding environmental management systems within their supply chain is key to the success. Very large supermarket chains were suggested as a good example for the EU, as they have a broad range of suppliers who would be expected to meet stringent criteria in their supply chain contract. The key lesson here is that GSN have found without top down pressure on supply chains, SMEs won't seek assistance on 'greening' their business.

- A partnership of public / governmental organisations that can provide the expertise and capacity to SMEs in how to improve their internal systems and procedures is also key. The NIST MEP involvement is vital to GSN – the system which undertakes the GSN technical review is incorporated as part of a NIST MEP product which has an annual operational cost of USD 100 million. Whilst EU member states would not have to make that kind of investment, as many already have existing networks of this nature, it demonstrates the capacity of partners needed to role out a similar type of approach

9 The Murray-Darling Basin, Australia

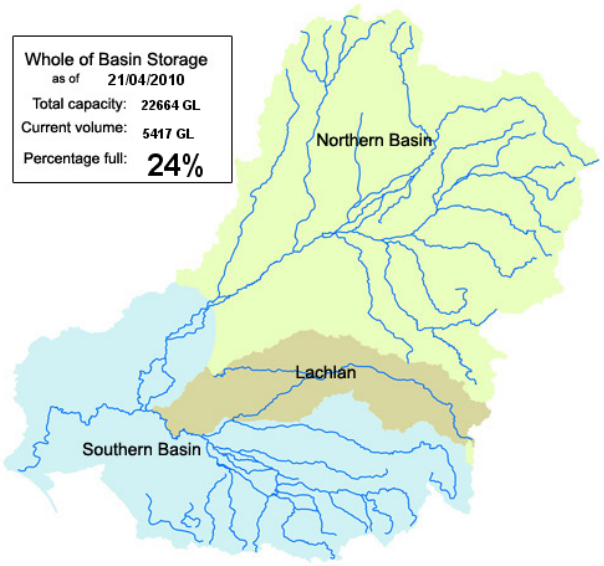
Name of policy:	Water for the Future
Country:	Australia
Sector:	Agriculture
Resource:	Water
Instruments:	Purchase of water rights

Introduction

The Murray-Darling Basin is a region of national significance covering 14 per cent of Australia (Australian Bureau of Statistics, media release 2008). It is the catchment for three of Australia's longest rivers: the Darling, the Murray and the Murrumbidgee and their many tributaries. The area extends from north of Roma in Queensland to Goolwa in South Australia, thereby including three-quarters of New South Wales and half of Victoria. In total, there are 23 river valleys in the Basin, covering over 1 million square kilometres combined with important groundwater systems (twice the size of Spain).[47]

[47] Murray-Darling Basin Authority: http://www.mdba.gov.au/water/about_basin, extracted 26th April 2010

Figure 9-1 Whole of Basin Storage



Source: http://www.mdba.gov.au/water/waterinstorage (Extracted 26th April 2010)

9.1 The purpose of the policy

The reason for the introduction of the policy

The Murray-Darling Basin is under great stress from the combined impacts of historical over-allocation of water for consumption, severe drought, and the early impacts of climate change. Water use in the Basin has increased five-fold in less than a century, and pressures are expected to increase even further with growing population and anticipated reduction in water availability in the future. This means that it is imperative to put water use on a sustainable footing, having regard to human needs and the needs of the environment across the Basin (Australian Government 2009). The overuse of the resource and consequently severe environmental damage has been the primary reason for recent water reforms.

The history behind the policy

Historically, in Australia and in the Murray-Darling Basin, access and use of water is governed by statutory water rights that are specified through water allocations. Water allocations is the specific volume of water allocated and distributed by governments through water access entitlements in a given season, defined according to rules established in the relevant water plan (NWC 2009). Water entitlements represent the rights for land owners to receive a share of the consumptive pool within an area. The expected quantity of water available for a season is allocated to holders of entitlements on an annual basis. The amount of water available varies according to e.g. precipitation. Therefore, the allocation of water between holders of entitlements also varies according to the level of the entitlement's reliability. An entitlement with high reliability, e.g. 90 per cent, ensures full allocation 90 per cent of the time (Grafton 2010).

As a response to concerns about overuse of water, and as a first step in the development of a comprehensive policy response, a limit to the overall diversions of water generally known as "the CAP" was introduced. Under the CAP, it was agreed to limit the future diversions within the Murray-Darling Basin to the level of 1993/1994 (Connell and Grafton 2008). Any new allocation should thus be met by a proportional reduction somewhere else in the Basin. Various limitations of the CAP have been identified due to only including surface water, which is varying according to seasonal conditions and being based on fixed long-term maximum extraction levels of water from the Basin. Thus, the amount distributed to the environment declines with the inflow of water despite the CAP, because water allocated for the environment is typically treated as a residual after allocation for water divisions. Thus, the CAP does not ensure environmental sustainability. (Grafton 2010).

Figure 9-2 The Murray Darling area

The Australian water market

The Australian water market is the buying and selling of water, which, if the trading is effective, gives entitlement holders the flexibility they need to respond to drought and climate change. By involving the transfer of water access entitlements or the trade of water allocations, water trading provides opportunities for water resources to be allocated among competing uses. In the Murray–Darling Basin, the Australian government is buying back permanent water entitlements directly from irrigators in order to restore the balance between water for human use and for the environment. The Australian water market is characterised by each state and territory maintaining responsibility for legislative and administrative arrangements for water trading.[48]

The need for transferring water allocations among users raised the need for unbundling the water access entitlements from the land property titles and the creation of a national market for a water trading system in which water entitlements are traded independently of land (Quiggin 2006).

[48] http://www.nationalwatermarket.gov.au/about/index.html

The water reform

A review of the CAP in 2000 and increasing concerns about the environment (e.g. the fact that the Murray River no longer reaches the sea) prompted the government to implement a water reform resting on three pillars: the National Water Initiative, the Water Act 2007 and the 2007 National Plan for Water Security.

The National Water Initiative was the beginning of a comprehensive water reform still ongoing. The National Water Initiative is a set of principles on water use and governance agreed upon by the governments of all states present in the Murray-Darling Basin. Together with the Water Act 2007 it provides the framework for achieving the goal of the Water Reform in the Murray-Darling Basin, while financial incentives are to be found in the 2007 National Plan for Water Security (Grafton 2010). A key aspect of the Water Act 2007 is the creation of the Murray-Darling Basin Authority, who is charged with developing and implementing a Basin Plan. The plan will set sustainable diversion limits for the entire Basin and its catchments and will be implemented from 2011 or when the existing state water resource plans expire.

Water for the Future

The National Plan for Water Security was revised in 2008 and the new plan, Water for the Future, is run by the Department of Environment, Water, Heritage and Arts (DEWHA) under the Australian government. The plan has four priority areas: tackling climate change, supporting healthy rivers, using water wisely and securing water supplies (AG 2009). Water for the Future builds on the National Plan for Water Security, but is focusing on a 10-point plan over 10 years with AUD 10 billion of funding[49]. Most of the funding was allocated for two purposes: the ***Sustainable Rural Water Use and Infrastructure*** Programme with subsidies for infrastructure to improve water use efficiency both off and on-farm (AUD 5.8 billion) and ***Restoring the Balance in the Murray-Darling Basin*** for the purchase of water entitlements to reduce the over-allocation of water and to increase environmental flows (AUD 3.0 billion[50]). (Grafton 2010)

With the purpose of identifying resource efficiency policies, the two policies within Water for the Future are the focus of this case study as they represent potential water resource savings within the Australian water reform.

The Sustainable Rural Water Use and Infrastructure (SRWUI) programme

The Australian government's AUD 5.8 billion investment aims at upgrading irrigation systems under the Sustainable Rural Water Use and Infrastructure (SRWUI) programme, which is expected to reduce the volume of water required by irrigators to produce a given level of output. The programme will assist in offsetting the impact of the buyback on water availability for irrigation.

Water savings purchases are used in the Sustainable Rural Water Use and Infrastructure (SRWUI) programme, where water for the environment is purchased by subsidising the capital cost of infrastructure or technologies designed to produce water savings. The SRWUI is designed to deliver substantial and lasting returns for the environment and secure a long-term future for irrigation

[49] Revised to AUD 12.9 in 2008

[50] Revised to AUD 3.1 in 2008

communities while delivering 'value for money'[51]. Water savings from these infrastructure initiatives will be shared between irrigators and the government including AUD 650 million of SRWUI-funding committed to projects put forward by private irrigation infrastructure operators (Productivity Commission 2006).

Restoring the Balance in the Murray-Darling Basin

AUD 3.1 billion has been allocated by the Australian government to purchasing water entitlements for the environment under the Restoring the Balance in the Murray-Darling Basin programme. The objective of the programme is to secure a permanent re-balancing of water available for the environment and water used for irrigated agriculture.

In restoring the balance in the Murray-Darling Basin, the government uses the principles of the market buybacks by purchasing entitlements or water allocations, entering the existing market using a set-price tender, or by using a competitive tender, thereby seeking to obtain water for the environment from willing sellers, i.e. irrigators in the Basin. The Australian government is likely to be a significant buyer in most water markets, but buyback leaves the decision of whether to use, sell or conserve water by investing in water saving technologies for irrigators (Productivity Commission 2006).

The buyback is likely to reduce the volume of water available for irrigation, which can lead to an increase in the price of water entitlements, which will in turn create an incentive for irrigators to sell water or to invest in more efficient irrigation technologies (Productivity Commission 2006).

Moreover, improving water efficiency may reduce environmental flows because water losses in irrigation are not only due to transpiration and evaporation, but also due to water that would otherwise be returned to the hydrological system via seepage or other means (Productivity Commission 2006). Thus, investments that increase water efficiency, and consequently reduce return flows, could potentially reduce environmental flows (Connell and Grafton 2007).

Of the 1800 giga litres (GL) of registered entitlement trade in Australia in 2008-09, 1643 GL were traded in the Murray-Darling Basin, and 1534 GL were the type of entitlement products that were purchased under the Restoring the Balance in the Murray-Darling Basin programme. (Australian Water Markets Report 2008-09). Thus, the potential for increasing the government purchases for environment is present.

9.2 Characteristics of the context where the policy is implemented

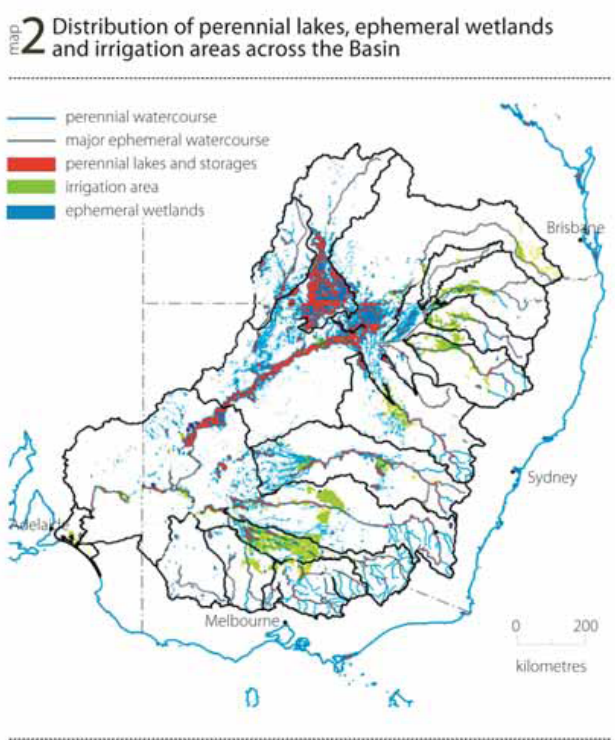
Water users

Water usage in the Murray-Darling Basin is dominated by the fact that the area is Australia's most important agricultural area, producing over one-third of

[51] http://www.mdba.gov.au/water/river_operations

Australia's food supply (MDBA[52]). Consequently, the Murray-Darling Basin represents an important water resource with 83 per cent of the water used by agriculture, which represents around 65 per cent of Australia's total agricultural water use (Australian Bureau of Statistics: Media release 2008).

Figure 9-3 Distribution of perennial lakes, ephemeral wetlands, and irrigation areas across the Basin



About 85 per cent of all irrigation in Australia takes place in the Murray-Darling Basin, which supports an agricultural industry worth more than AUD 9 billion per annum (DEWHA, webpage). The highest shares of agricultural water use in the Basin are made up by cotton (20%), dairy farming (17%), pasture for other livestock (17%) and rice (16%) (Australian Bureau of Statistics: media release 2008). Comparing to the size of irrigated land use, the largest activities were pasture (717,000 hectares), cereals (329,000 hectares) and cotton (247,000 hectares). In 2005-06, the gross value of irrigated agricultural production in the Basin was around AUD 4.6 billion, which is around 44 per cent of the total value of irrigated agricultural production in Australia (AUD 10.5 billion) (Australian Bureau of Statistics 2010).

The remaining 17 per cent of the water in the Murray-Darling Basin is used by other industry and households, distributed on 13 per cent by the water supply industry (mostly lost in delivery systems), 2 per cent by households, 1 per cent by manufacturing and 2 per cent by other industries (Australian Bureau of Statistics 2010).

[52] Murray-Darling Basin Authority; http://www.mdba.gov.au/water/waterinstorage, extracted on 3rd May 2010

The people of the Murray-Darling Basin

The Murray-Darling Basin is home to more than 2 million people, which is 10 per cent of Australia's population. 39 per cent of the population live in New South Wales and 29 per cent in Victoria. However, three million Australians inside and outside the Murray-Darling Basin are directly dependent on its water (Australian bureau of Statistics[53].

In 2006, 10 per cent of all people employed in the area of the Murray-Darling Basin worked in agriculture, compared to 3 per cent Australia-wide. This means that over a third (38%) of Australia's farmers reside in the Basin. Figures from 2008-09 show that the Murray-Darling Basin (MDB) accounted for 38 per cent of Australia's irrigating agricultural businesses, 53 per cent of all irrigated agricultural land and 54 per cent of irrigation water applied (Australian Bureau of Statistics 2010). In Australia, irrigated land represents 0.6 per cent of total agricultural land. This figure is more than three times as high in the Basin, with 2 per cent of agricultural land. The Basin thereby includes 65 per cent of Australia's irrigated agricultural land (MDBA[54]).

Employment in other industries is distributed on 14 per cent in retail, 11 per cent in health and community services, 10 per cent in government administration and defence, and 9 per cent in manufacturing. The mean equivalised household income of people is lower in the Murray-Darling Basin area, with AUD 675 per week compared to AUD 732 per week for Australia as a whole[55].

Environmental importance of the Murray-Darling Basin

The Murray-Darling Basin is very important due to its biodiversity, and many of the natural resources are of high environmental value. Its wetlands perform essential hydrological, biological and chemical functions, which support and maintain the productivity and health of the river systems (MDBA: http://www.mdba.gov.au/water/about_basin). The Basin contains more than 30,000 wetlands, including 16 internationally significant ones that provide habitats for migratory birds.

Environmental impact

The degradation of the wetlands has resulted in the extinction of at least twenty mammal species since 1900, and the Murray Cod, Australia's largest freshwater fish, which was once widespread, is now in severe decline. Many other species that once were common are now rare and listed nationally for protection under the *Environment Protection and Biodiversity Conservation Act 1999*. The deteriorated ecological health is a clear indication of an insufficient amount of water to maintain the Basin's natural balance and ecosystems.[56]

[53] http://www.abs.gov.au/ausstats/abs@.nsf/mf/4610.0.55.007

[54] http://www.mdba.gov.au/water/about_basin

55 Australian bureau of Statistics: http://www.abs.gov.au/ausstats/abs@.nsf/mf/4610.0.55.007

56 Australian Government, Department of the Environment, Water, Heritage and the Art:

http://www.environment.gov.au/water/locations/murray-darling-basin/index.html

9.3 Lessons learned and lessons which may be relevant to transfer or upscale to the EU

Lessons learned

Though the Australian government will not meet the main goal of the National Water Initiative to deal with over-allocation by 2010, important progress has been made under difficult conditions. Water trading has been a success, and the existence of a well-functioning water trading market has increased water efficiency on farms and provided better flexibility in responding to drought and climate change.

Increased water efficiency on farms

The *Australian Water Markets Report 2008-2009* shows that 60 per cent of entitlement trade (1080 GL) and 81 per cent of water allocation trade (1739 GL) took place within the southern connected Murray-Darling Basin. High-reliability entitlements in the basin averaged AUD 2000/ML in the period, while allocation prices were far less volatile, peaking around AUD 500/ML when scarcity was highest and levelling out around AUD 300 - 350/ML at the end of the year (Australian Water Markets Report 2008-09). This development was supported and enhanced by governmental buybacks of water entitlements under e.g. the *Restoring* the Balance in the Murray-Darling Basin programme and the Sustainable Rural Water Use and Infrastructure (SRWUI*)* programmes.

Water savings under SRWUI

The AUD 5.8 billion investment in upgrading irrigation systems under the SRWUI programmes made by the Australian government will make up for some of the impact of the buybacks on water availability for irrigation and is expected to reduce the volume of water required by irrigators to produce a given level of output[57]. Studies have shown that buyers of water are generally more efficient, use more advanced irrigation technology, are more likely to have a 'whole of farm' plan, and have better drainage practices[58].

Water savings under the SRWUI programme to date[59] leads to a total of 141.1 GL. According to International Team Leader in the Water Strategies Section of the Dept. of the Environment, Water, Heritage and the Arts, Siobhán Denniss, irrigators' water use depends, among other matters, on the entitlements they hold, the annual allocation they receive against the entitlement, the crops they are irrigating, and the technology they are using to water. Irrigators can respond to varying water supply by trading or changing their technology or crop.

The Sustainable Rural Water Use and Infrastructure (SRWUI*)* Programme aims to improve the efficiency and productivity of rural water use and management. Siobhán Denniss further underlines that this is a major step toward sustaining the productivity of irrigated agriculture in the face of reduced future water supplies and that this programme has reduced the volume of water required by irri-

[57] Assessing the future impact of the Australian government's environmental water purchase programme, ABARE research report April 2010

[58] Interview with International Team Leader in the Water Strategies Section of the Dept. of the Environment, Water, Heritage and the Arts, Siobhán Denniss

[59] June 2010, source: Interview with International Team Leader in the Water Strategies Section of the Dept. of the Environment, Water, Heritage and the Arts, Siobhán Denniss

gators through saving water by upgrading out-dated and leaky irrigation systems.

Since 2005-06, the area irrigated and the volume of irrigation water applied in the Murray-Darling Basin has decreased by 44% and 53%, respectively. In comparison, the irrigation water use outside the Murray-Darling Basin fell by 11% from 2005-06 to 2008-09 and the area irrigated by 7% in the same period.

11,000 agricultural businesses reported that they had made one or more changes to their irrigation practices in 2008-09 in the Murray-Darling Basin. The most commonly reported changes included the adoption of more efficient irrigation techniques (38% of irrigators making one of more changes), reducing the area under irrigation (35%), and purchasing extra water (31%)[60].

Economic impact for the irrigation farmers

Based on the recent report *The impacts of water trading in the southern Murray-Darling Basin – an economic, social and environmental assessment*, released on the National Water Commission's website on 10 June 2010 (www.nwc.gov.au) Siobhán Denniss, International Team Leader in the Water Strategies Section of the Department of the Environment, Water, Heritage and the Arts, underlines the recent findings of water trading as an instrument with financial benefits for the irrigation farmers of the Murray Darling-Basin.

The analysis in the report includes Computable General Equilibrium (CGE) modelling, which shows that water trading reduces the economic impacts of drought by allowing water to move to higher value uses. Water trade is allowing Australian irrigators more flexibility to manage their irrigation businesses. The report shows that water trading is being used by irrigators to better manage external factors affecting their business such as drought and changes in commodity prices.

On-Farm Irrigation Efficiency Program

According to Debora Kerr from the National Farmers' Federation/National Irrigators' Council, an example of a success story is the AUD 300 million allocation by the Australian government to the On-Farm Irrigation Efficiency Program as part of Water for the Future. The programme aims to assist irrigators on more than 550 farms in the Lachlan and southern connected system of the Murray-Darling Basin in modernising on-farm irrigation infrastructure and returning water to the environment. The first round, worth AUD 100 million, is estimated to save as much as 60 billion litres over a year, savings that will be shared between irrigation farmers and the environment[61]. The round will be conducted in partnership with organisations, including irrigation providers, peak industry groups and catchment management authorities.

Hydrological integrity

One of the important lessons to be learned from the process of implementing the National Water Initiative is that the entitlements and the water allocation

60 http://www.abs.gov.au/ausstats/abs@.nsf/Latestproducts/4618.0Main%20Features52008-09?opendocument&tabname=Summary&prodno=4618.0&issue=2008-09&num=&view=

61 http://www.climatechange.gov.au/minister/wong/2010/media-releases/March/20100319.aspx

regime must be designed in a way that has hydrological integrity, including clearly and transparently specified water plans. The aim is a regime that can autonomously adjust to climatic shifts, changes in prices and changes in technology without compromising environmental objectives (Young and McColl 2009).

9.3.1 Geographical relevance

Geographical and meteorological limitations

There are some distinct geographical and meteorological characteristics that affect the situation in the Murray-Darling Basin and that should be taken into consideration when considering transferring the policies to a European setting.

The policies build on a situation where the water volume in an important basin area is declining and becoming a scarce resource due to desertification, drought and overuse. The Murray-Darling Basin is furthermore experiencing irregular rainfalls, which makes it difficult to predict the water sources available for agricultural use. Consequently, the policies are most relevant in the areas of the EU where large, irrigated, agricultural production areas depend on scarce and unpredictable water resources within an important water basin area. Potential regions in Europe for implementation are identified in the following, based on desertification and drought data.

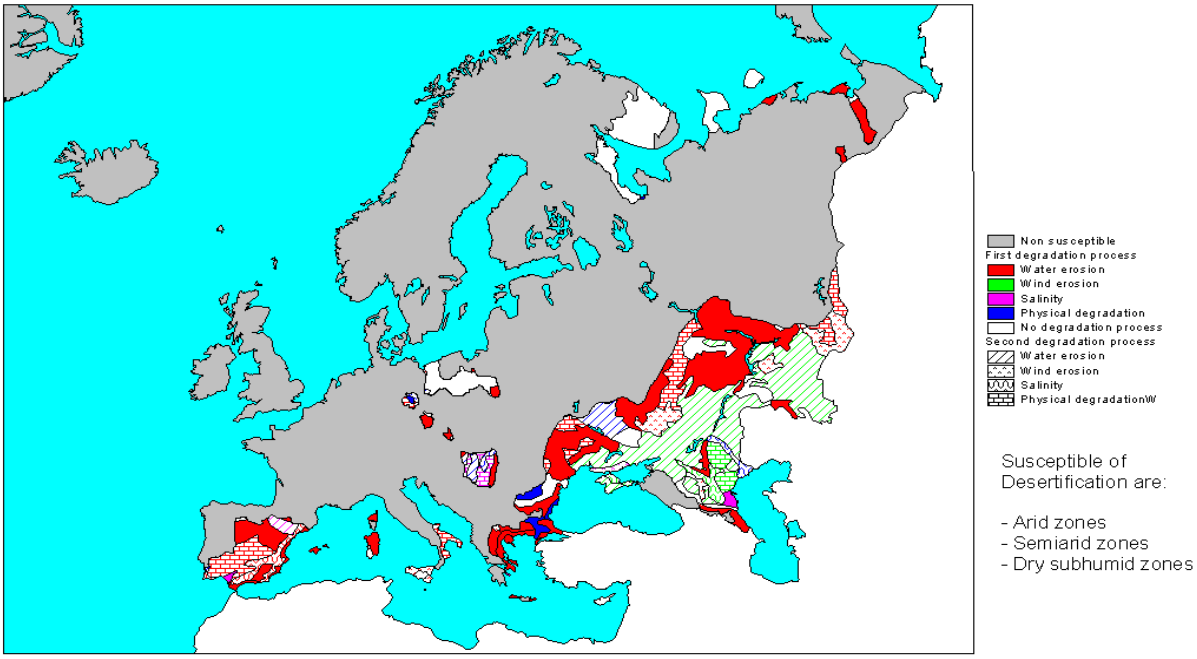
Average annual rainfall in the Murray-Daring Basin

The average annual rainfall in the Murray-Daring Basin is 530,618 giga litres (1,000 times the volume of Sydney Harbour). Of this, 94 per cent evaporate or transpire through plants, and 2 per cent drain into the ground, leaving only 4 per cent as runoff (http://www.mdba.gov.au/water/about_basin)

EU countries affected by desertification

According to the United Nation Convention to Combat Desertification, 15 out of the 27 EU Member States have declared themselves affected by desertification. These include the northern Mediterranean countries and countries in Central and Eastern Europe (Portugal, Spain, Italy, Greece, Malta, Cyprus, Bulgaria, the Czech Republic, Hungary, Lithuania, Latvia, Poland, Romania, Slovakia and Slovenia).

Figure 9-4 Extent of Desertification in Europe

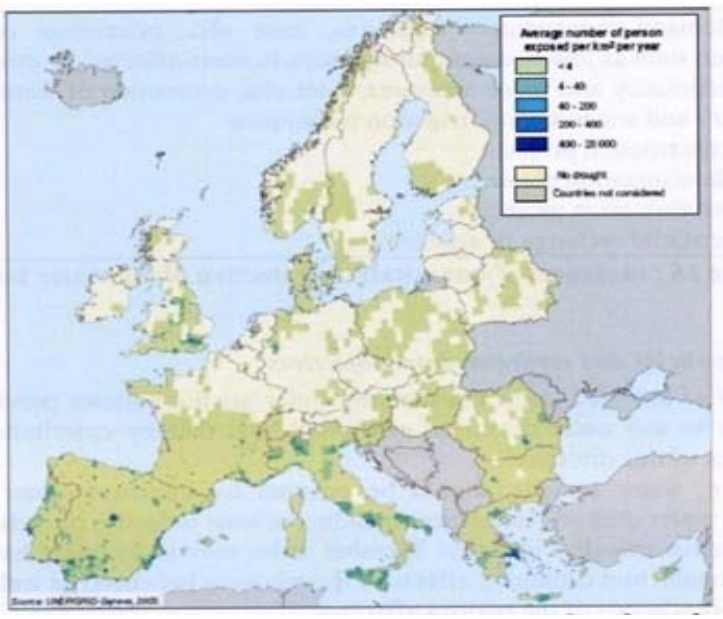


Source: Rubio, JL., Andreu, V., Esteban, H. and Pateras, D. (n.d.) Desertification in Europe

EU countries affected by drought

Though just 15 EU Member States have reported to the UNCCD that they are affected by desertification, drought affects most countries in the EU. However, the number of people affected varies significantly, Southern and South-Eastern Europe being most affected as illustrated below.

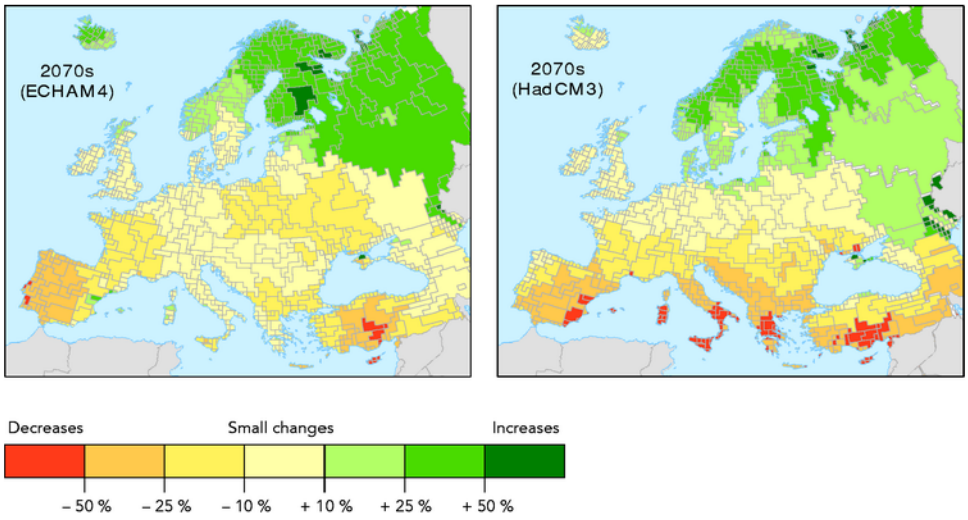
Figure 9-5 Average number of people affected by drought



Source: EEA, European Environment Agency (2009)

Areas prone to droughts and desertification are often correlated with areas with low natural runoff such as southern parts of Spain and Italy, eastern parts of Greece and Bulgaria and Romania as some of the driest areas in Europe. Climate models predict more frequent and intense droughts across most of Europe over the coming years, as illustrated in the figures below. The number of consecutive dry days (defined as days with less than 1 mm of rain) is projected to increase significantly in Southern Europe, while in Central Europe the longest dry period is prolongated by one week (EEA, European Environment Agency (2009).

Figure 9-6 Change in annual average river discharge for European river basins in 2070 compared with 2000 as simulated by two different climate models.



Source: Lehner, B., Henrichs, T., Doll, P. and Alcamo, J. (2001)

EU countries most relevant for the transfer of policies based on geographical limitations

Surface water and groundwater basins most prone to droughts and desertification are found in southern parts of Spain and Italy and eastern parts of Greece, Bulgaria and Romania, as these are some of the driest areas in Europe and due to climate change are expected to become even dryer. The European regions that are affected by desertification and drought are therefore the ones relevant for the potential implementation of the policies described in this pilot study.

In conclusion, it could be relevant to implement policy measures similar to those of Australia in Spain, Italy, Greece, Bulgaria and Romania.

9.3.2 Assumptions necessary in order to transfer or scale up results

Assumptions

The following assumptions are necessary to transfer or scale up results:

- Existence of a water market including a tradable water entitlement system
- Water rights through entitlements - historically bound
- Water basin point of departure for water allocation, transboundary
- Potential for investments.

Existence of water market

A well-functioning water market is a prerequisite for government purchases of water entitlements. In itself, a water market can be seen as an efficiency initiative since water trading allows scarce water resources to be transferred to their most productive uses. This includes responding to changing availability of water, commodity prices and environmental conditions in the river system and groundwater resource, variations where reallocation of water resources can be profitable[62].

Water rights through entitlements

In Australia, the water is allocated on the basis of an entitlement system. A similar quota system, by which a limited quantity should be made available to the irrigators and other industry, would be necessary to establish. While the Australian system is based on historical rights inherited through land ownership, a newly implemented system in Europe would have to decide on a satisfactory way of distribution in the first place. For this to become a success, it is very important that individual water access entitlement holders are able to trade water quickly and easily, thus contributing to a more productive and efficient use of the water resource.

Water basin point of departure for water allocation

Another significant requirement is the natural specifications of the water resource. Management of surface and groundwater basins should not be restricted by administrative borders. As the five affected states being part of the Murray-Darling Basin have surrendered sovereignty to the Australian commonwealth government, a similar surrender would have to take place on regional or European basis.

Potential for investing

The potential for investing in and subsidising infrastructure projects also needs to be considered. If the water infrastructure is already modernised, there is little potential of using this policy instrument to achieve the desired objective. If investments in infrastructure do not meet basic cost-benefit criteria, they will simply maintain dependence on external support, delaying the adjustment these communities will inevitably face (Productivity Commission 2010). Thus, regions in Europe with well-developed technological irrigation solutions would not benefit from implementing this policy in the long run.

9.3.3 Resource saving potential

Saving potential in monetary terms

The Australian government plans to spend AUD 1.5 billion on purchasing water entitlements for the environment in an ongoing process over three years from 2008-09 to 2010-11 as part of Restoring the Balance in the Murray-Darling Basin. In 2007-08, the government paid AUD 2300/mega litre, and if the average yield adjusted price paid for these entitlements is similar to this price, the government can expect to acquire around 6 per cent of surface water entitlements in the Murray-Darling Basin. These entitlements would be expected to yield on average around 630 giga litres of water a year[63]. The results suggest that purchasing 6 per cent of surface water entitlements across

[62] www.nwc.gov.au

[63] The expectations have been revised and are now expected to deliver, on average, approximately 539GL of water a year for the environment.

the Basin will lead to a relatively modest 2.4 per cent decline in the gross value of irrigated agricultural production (ABARE 2010).

In Restoring the Balance in the Murray-Darling Basin programme 766 giga litres of water entitlements, worth over AUD 1.2 billion, had been purchased[64]. The Australian government is spending AUD 3.1 billion on purchasing water entitlements within the Murray-Darling Basin. As a rough guide, the programme has currently allocated around half of its total budget. Based on these figures, the following assumptions are made:

- The water price of AUD 1,566/mega litre will be stable throughout the programme period.
- The decline of 2.4 per cent in the gross value of irrigated agricultural production due to the purchasing of 6 per cent of water entitlements will be appropriate for the Murray-Darling Basin.
- 1,643 giga litres were traded in the Murray-Darling Basin due to efficiency measures in the irrigated agricultural production introduced through the SRWUI. [65] It is more cost-efficient for the farmer to trade water entitlements than to increase water consumption.
- All allocated AUD 3.1 million are used for purchasing water entitlements.
- The water saving potential in the Murray-Darling Basin is comparable with the water saving potential in EU countries with water scarcity.

Cost

The total cost allocated to the programme is AUD 3.1 billion, which will enable a total purchase of 12 per cent of water resources. Further, the cost for the SRWUI of AUD 5.8 billion is additional to the programme, and the initiatives should be seen as an integrated part due to the savings the farmer can make by introducing water saving measures. Overall, the total expenses of the authorities amount to AUD 8.9 billion.

According to the International Team Leader in the Water Strategies Section of the Department of the Environment, Water, Heritage and the Arts no study has been released that quantifies the economic benefits of the water purchasing programme. However, it is expected that the value to the environment of each entitlement purchased is at least equal to the cost of purchase.

Agricultural production loss

With 12 per cent of water resources to be purchased by the authority and therefore not extracted from the Murray-Darling Basin, the loss in the gross value of irrigated agricultural production per year will be of 4.8 per cent. With the value of the agricultural sector of AUD 9 billion per year in the Murray-Darling Basin, this will result in an annual loss of AUD 0.4 billion.

[64] http://www.environment.gov.au/water/publications/mdb/restoring-balance.html
Figures from 31 December 2009

[65] Data do not indicate how farmers use the water savings achieved through implementation of water saving measures.

From the irrigation farmers' point of view, the agricultural loss in the production is compensated for by the sale of entitlements. In total, the irrigation farmers will sell water entitlements to the government worth over AUD 3.1 billion compared with an annual loss of AUD 0.8 billion in the agricultural production. This leaves a surplus of AUD 2.3 billion to the irrigation farmers in the Murray-Darling Basin.

Decreased water use for irrigation

Figures from the Australian Bureau of Statistics (Australian Bureau of Statistics 2010) indicate that, despite an decreased volume of water applied to agricultural land in the Murray-Darling Basin of 11 per cent in 2008-09, the area of agricultural land irrigated in the Basin continued to decrease by 3 per cent from 2007-08. Since 2005-06, the area irrigated and the volume of irrigation water applied in the Murray-Darling Basin has decreased by 44 per cent and 53 per cent, respectively.

9.3.4 Transferring of results

It has been argued that it could be relevant to transfer the results of the Murray-Darling Basin to Spain, Italy, Greece, Bulgaria and Romania.

Water use

The use of water is illustrated in the table below. As can be seen, the use of water for irrigation in Greece and Spain is very high, just as in the Murray-Darling Basin, whereas Bulgaria and Romania use significantly less water for irrigation. Data are not available for Italy. The explanation may be found in the size of the agricultural sector in the various countries or in the tradition and the kind of crop and animals farmed.

Table 9-1 Abstraction of water 2006

	Total abstraction of water (mill. m³/year)	Abstraction of water used for irrigation (mill. m³/year)	Area (1000 km2)
Murray-Darling Basin	Approx. 20,000	n.i.	Approx. 1,000
Bulgaria	6,555	585	111
Greece	9,447	8,455	132
Spain	33,760	19,651	504
Romania	5,301	176	239

Source: Eurostat

Water saving potential

By transferring the method of water saving that has been realised in the Murray-Darling Basin to Bulgaria, Greece, Spain and Romania, the total water saving potential for these countries is around 6,600 million m^3 annually, see the table below

Table 9-2 Water saving potential by introducing a similar policy in the EU in mill m³/year

9.4 Country	9.5 Water saving potential
Bulgaria	787
Greece	1,134
Spain	4,051
Romania	636

Source: Own calculations

The water saved constitutes an economic value, whether it is used to increase industrial or agricultural production, to protect ecosystems or for other purposes. Water prices vary significantly across the EU, and it is therefore not feasible to estimate the value of the water saved.

Value of agricultural sector

The table below shows the value of agriculture as the value of basic prices. As can be seen, there is more or less direct correlation between the value of the agricultural production and the population size (see *Characteristics of context*). However, Greece has a particularly high production value of agricultural products.

Table 9-3 Value of agriculture in million euro in 2009

Bulgaria	Greece	Spain	Italy	Romania
28,085	92,871	321,313	307,158	101,261

Source: Eurostat

Loss in the agricultural sector

Based on the experiences from the Murray-Darling Basin, the countries will experience losses in the gross value of irrigated agricultural production of 4.8 per cent annually.

Table 9-4 Potential loss in the agricultural sector in million euro

Bulgaria	Greece	Spain	Italy	Romania
1,348	4,458	15,423	14,744	4,861

Source: Own calculations

Benfits in the agricultural sector

Based on an annual agricultural production loss of 4.8 per cent annually and an estimated cost of implementing the policy in the EU, the calculations have shown a surplus of 23.5 per cent for the EU irrigation farmers if entering a policy initiative as the one introduced in the Murray-Darling Basin. The 23.5 per cent has been calculated based on comparison with the Murray-Darling case, showing that the benefit for the irrigation farmers are equivalent to 23.5 per cent of the total cost of the policy intervention.

Cost of implementing the policy in EU

Calculating a unit cost for the investment necessary by the authorities to save water will enable this estimate to be transferred to the EU. A unit cost for making the investment by the authorities will be EUR 5.5/m^3 water.[66] In the table, estimates of the total cost of implementing these policy measures in the countries are given.

Table 9-5 Cost of implementation measures in million euro

Bulgaria	Greece	Spain	Italy	Romania
4,328	6,037	22,280	n.i.	3,498

Note: Unit cost is multiplied by the estimated saving potential.
Source: Own calculations

9.6 Conclusions

There is a significant potential for achieving water savings in EU countries that have water scarcity through the combined use of a water quota system and financial support for implementation of water efficiency measures.

The total potential water savings for Bulgaria, Greece, Spain and Romania by applying policies similar to those of the Murray-Darling Basin is estimated at around 6,600 million m^3 annually.

The costs of implementing a water policy in the EU are estimated at 3.9 EUR/m^3 water. The total cost of implementing the policy in Bulgaria, Greece, Spain and Romania is estimated at approximately EUR 36 billion.

The potential loss of production in the agricultural sectors of Bulgaria, Greece, Spain and Romania is also estimated to be around EUR 26 billion.

However, the actual water saving potentials depend widely on the technologies used (e.g. for irrigation and water transportation), the types of crops farmed, and the possibilities of replacing crop types with other types.

9.7 Results of stakeholder consultation

Stakeholder consultation

The collection of data for the analysis of this case study has been based on a combination of literature review, e-mail exchange and telephone interviews with relevant stakeholders in Australia. Through the courtesy of the Danish Embassy in Australia contacts were provided to relevant stakeholders. The following stakeholders were interviewed:

[66] Calculation: the total trade of water entitlement after full implementation of infrastructure programme is estimated at 2,054 million m^3 (=1,643/0.8, as 80% of the programme is presently implemented).

Authorities	• Siobhán Denniss, International Team Leader, Water Strategies Section in the Water Policy Branch of the Australian government's ***Department of Environment, Water, Heritage and Arts (DEWHA)***

The DEWHA develops and implements national policy, programmes and legislation to protect and conserve Australia's environment and heritage and to promote Australian arts and culture[67]. Among other things, the DEWHA deals with water policy and resources and manages the national Water for the Future programme, which contains a range of programmes such as Sustainable Rural Water Use and Infrastructure and Restoring the Balance in the Basin (water entitlement buyback).

- Marcus Walters; Basin Plan Stakeholder Engagement, ***Murray-Darling Basin Authority (MDBA)***

The MDBA is responsible for developing the Basin Plan to return consumptive use of the Murray-Darling Basin's water resources to sustainable levels of take. Mr Walters helped clarify the respective roles and responsibilities of the Murray-Darling Basin Authority and the Department of Environment, Water, Heritage and Arts regarding water policies and reform programmes. Further, he provided information about the purpose and progress of the Basin Plan.

- Peter McLoughlin; ***The National Water Commission (NWC)***

The NWC is responsible for driving the water reform progress towards sustainable management and use of the water resources and advises the Council of Australian Governments (COAG) and the Australian government on national water issues and the progress of the National Water Initiative. The Commission has an ongoing function to audit the effectiveness of the implementation of the Murray-Darling Basin Plan and associated water resource plans and an assessment role for National Partnership Payments[68].

Business association, businesses	• Debora Kerr, Manager of Natural resource Portfolio; ***National Farmers' Federation/National Irrigators' Council***

The National Farmers' Federation (NFF) is the peak national body representing farmers and, more broadly, agriculture across Australia. The NFF's core functions are lobbying on behalf of Australian farmers at both national, political (Australian government and parliament) and community levels through national and international representation and advocacy.

The National Irrigators' Council (NIC) is the peak national body for irrigators in Australia, providing a policy and political voice for those who use water for commercial agricultural or horticultural purposes across the country. The NIC was created in 2008 to represent the interests of irriga-

[67] http://www.environment.gov.au/

[68] http://www.nwc.gov.au/www/html/93-roles-and-functions.asp

tion entitlement holders across Australia and aims to develop projects and policies to ensure the efficiency, viability and sustainability of Australian irrigated agriculture and the security and reliability of water entitlements[69]

Ms Kerr provided specific information and data about the Water for the Future programme, hereunder Sustainable Rural Water Use and Infrastructure and Restoring the Balance in the Basin (water entitlement buyback). The AUD 300 million On-Farm Irrigation Efficiency Program, aimed at assisting irrigators to modernize their on-farm irrigation infrastructure while returning water savings to the environment, was presented as an example of the policy framework.

Experts

- Rupert Grafton Quentin; the Australian National University, Centre for Water Economics, Environment and Policy. Mr Grafton is Professor of Economics at the Crawford School of Economics and Government at the Australian National University (ANU) and Honorary Professor in the Department of Economics at the University of Otago. Presently, he is Co-Chair of the ANU Water Initiative and director for the ANU Centre for Water Economics, Environment and Policy[70]. He has published several articles about the Australian water reform in renowned periodicals, several of which have been used for this study (e.g. D. Connell and R.Q. Grafton (2008), Grafton (2009) and Grafton (2010).)

Mr Grafton shared his insights into the history of division of water entitlements, the implementation of CAP and explained how the situation of over-allocation and overuse has arisen. Moreover, he provided expert consultancy regarding cost-effective measures of governments' purchase of water entitlements. Mr Grafton is advocating a change in the balance between subsidies to water infrastructure and buybacks for the environment in the policy package for the current water reform

[69] http://www.irrigators.org.au/

[70] http://www.crawford.anu.edu.au/staff/qgrafton.php

10 Food waste reduction, South Korea

Name of policy:	Food Waste Reduction Policy
Country:	South Korea
Sector:	Food sector
Resource:	Food
Instruments:	Campaigns of food waste reduction practices, Food waste-to-energy policy, direct landfill of food waste forbidden

10.1 The purpose of the Food Waste Reduction Policy

Reduction of food waste within the overall Policy framework

Policies for solid waste in South Korea have been developed through three phases starting before the 1990s, where waste policies were focused at expanding facilities for the post treatment of waste generated; hence the primary goal of local governments was how to enhance their capacities for treating waste by means of expanding disposal facilities. (Park 2009)

During the 1990s, the focus shifted from expansion of waste treatment facilities to reducing waste volume before it was generated. In 2002, Korean waste policies experienced yet another shift from waste reduction to cover resource efficiency issues in addition to recycling the waste and construction of a resource recirculation society (Park 2009), which was reflected through the National Framework Plan in the 2nd Comprehensive National Waste Management Plan (2002~2011) outlined by the Ministry of Environment. With the goal of "*firm establishment of a sustainable and resource circulating socio-economic foundation*" waste was viewed as a resources to be explored and no longer as waste to be disposed. Several policy areas were strongly promoted in order to reach the goal of the National Framework Plan consisting of:

- promotion of waste reduction policy,
- greater utilization of waste resources,
- the safe treatment and strengthened management of waste materials (Lee 2009).

Within the first policy area: *promotion of policies of waste reduction* the Food Waste Reduction Policy is found.

Table 10-1 Development of waste policies in Korea

	-1990s	1990s	2003-
Paradigm	Service Supply	Demand Control	Resource Recirculation
Goal	Expand Treatment Capacity	Reduce waste Increase recycling	Enhancing recyclability of products
Tools	Fixed Rate Waste Fee	Volume Rate waste fee Deposit-Refund Waste Charge	Pro-environmental traits of products Enforcement of Resource Recirculation Act

(Source: Park 2009)

Food waste reduction instruments

The Food Waste Reduction Policy contains different food waste reduction programmes, which have been implemented by the Korean government with the aim of promoting an environment-friendly food culture in order to reduce the amount of food waste. These include:

- A large variety of campaigns such as changing table setting tradition with appropriate amount of foods and targeted campaign programmes for women, religious and civic bodies for encouraging their participation in the dissemination campaign of food waste reduction practices. The campaigns are voluntary-based agreements among local governments, food businesses, and NGOs. (Park 2009)

- Food waste-to-energy policy; the government required developers of building lots and tourist spots to install food waste-to-energy facilities by revising the Enforcement Decree of the Promotion of Installation of Waste Disposal Facilities and Assistance, etc. to Adjacent Areas Act in December 1997. In September 1998, under the food waste to energy master plans, the following measures were taken: "*reducing discharge of food waste by more than 10% and recycle more than 60% of discharged food waste as resources until 2002*". (Ministry of Environment 2010)

- Use of food waste for fodder and compost. Food wastes separated and discharged for recycling are also reused as feed for livestock or compost after undergoing treatment. (Ministry of Environment 2010) Currently, 95 per cent of grain and materials for fodder is imported.

- Direct landfill of food waste was forbidden in 2005. Not only did it motivate the recycling rates of reduction of food waste, but it did also help overcome landfill problems.

South Korean economy

Since the 1960's, South Korea has experienced an extremely rapid economic growth with per capita GNP of only USD 100 in 1963, which has grown to USD 20,000 today. In comparison, the World Bank Development Indicators published in July 2006 with the EU-25 and their corresponding GNP per capita based on global purchasing power parity (PPP) indicated an average of GNP of USD 25,000.

Korea's economy has changed from being centrally planned, government-directed, to becoming more market-oriented, resulting in Korea having become the 13th-largest economy in the world. (U.S. 2010) The economic growth is reflected in the economic buying power of its population and consequently in the growing amount of waste.

Definition of food waste
Food waste includes uneaten portions of meals discarded by households or restaurants, any food substances discarded in the process of sales or distribution, trimmings from food preparation activities in kitchens and cafeterias, and food products that are thrown away due to degradation in their quality, damage, rot or the passing of its expiry date.

The largest amount of waste among household food wastes are derived from fruit and vegetable peelings (70.6%), followed by rotten food (10.7%) and leftover side dishes (10.6%). (Ministry of Environment 2010)

Stakeholders involved in the Food Saving Policy

The main stakeholders of the Food Saving Policy are: the central government, municipal governments, Korea Food Recycling Association and companies that collect/deliver/process food waste. Of the private organisations mentioned by the Ministry of Environment, Resource Recirculation Bureau, the following are involved: Resource Recycling Association, Korea restaurant Association, Consumer Association, Korean Dietetic Association and National Council of Homemakers' Classes (interview, Ministry of Environment, Resource Recirculation Bureau).

Population density

The food waste reduction programmes are included in a National Framework Plan directed at South Korea's population of almost 50 million. The total land size of Korea is 99,646 $km^{2,}$ which is equivalent to 0.002 km^2 per capita. The country thereby has one of the highest population densities of the world (490 persons per $km^{2,}$ Sang-Hun Lee). Combined with accelerated economic growth, this has resulted in an excessive household waste per unit area (480 kg/km^2, day) (Park 2009).

Environmental impact

The environmental impact of food waste is biggest in the process of incineration or landfill treatment. Due to the shortage of land space for constructing facilities and waste treatment infrastructure combined with high population density, South Korea has faced serious problems in discarding waste.

10.2 Lessons learned and which lessons can be relevant to transfer or scale up to the EU

Major successes of the food waste reduction policies

The amount of food waste discarded daily nationwide in South Korea accounts for 11,397 tonnes, which is equivalent to the 1400 truck loads by a 8-tonne dump truck (Ministry of Environment 2010). Faced with these figures, the Ministry of Environment, Resource Recirculation Bureau states that the expected savings are around KRW 5 trillion every year if the goal of 20 per cent reduction of food waste is accomplished by 2012 (interview, Ministry of Environment, Resource Recirculation Bureau).

Relevant factors for transfer to European context

No specific geographical limitations have been identified nor other limitations resulting in the food waste reduction policies not being relevant at European level. On the contrary, the level of food waste is increasing in general in Europe, which is why the food waste reduction policy must be regarded relevant to transfer to an EU setting.

The following factors have been regarded especially relevant in order to transfer the food waste reduction policies to European countries:

Demographic relevance

The policy is of high relevance in countries with high population densities, facing shortage of land space for constructing facilities and infrastructure for waste treatment. Monaco[71] and Malta are the only two European countries with a higher population density than South Korea, whereas the Netherlands and Belgium follow very closely.

Text box 10-1 Population density (inhabitants per km^2)

Country	2006 (Eurostat data[72])	2007 (Eurostat data)	2009
Monaco	16,923.00[73]	-	16,205.00[74]
Malta	1281.2	-	1,261.08
South Korea	-	-	490 (Park 2009, Lee 2009)
Netherlands	483.8	485.3	395.11
Belgium	347.8	350.4	339.71

Source: Eurostat and worldatlas

[71] Monaco not being part of the EU-27

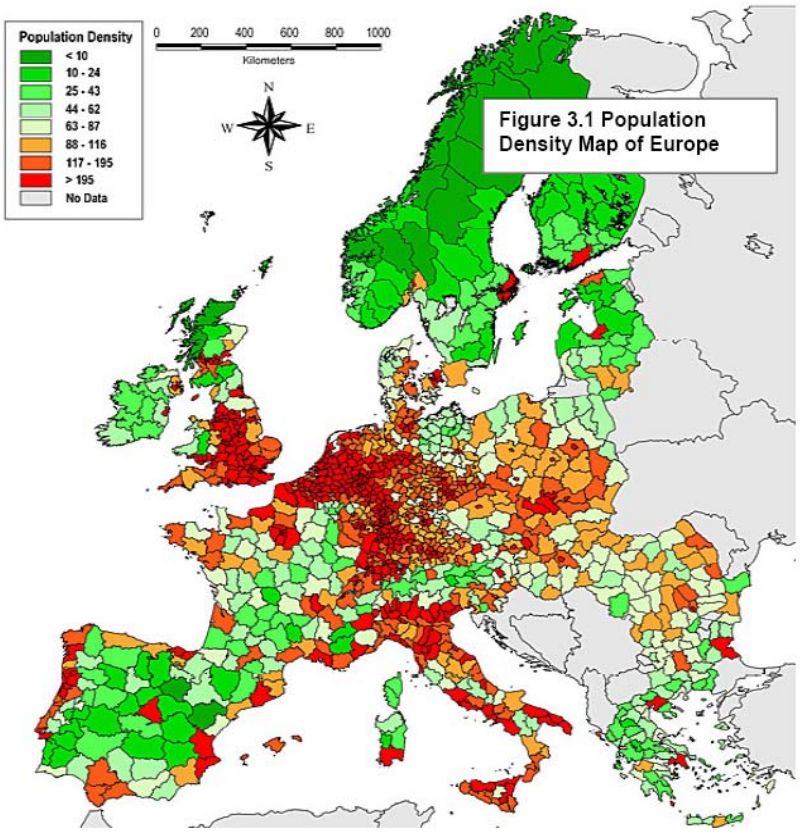
[72] http://epp.eurostat.ec.europa.eu/portal/page/portal/population/data/database

[73] Source: Wikipedia, but the Monaco government uses a smaller surface area figure resulting in a population density of 18,078 per km^2

[74] Source for year 2009 for all the European countries in the table: http://www.worldatlas.com/aatlas/populations/ctydensityh.htm

In terms of population density, the rest of the European countries are not relevant at national level, but population-dense regions in the countries have been identified. These areas are relevant not only due to potentially facing shortage of land space for constructing facilities and infrastructures for waste treatment, but also due to the mere reason that densely populated areas generate a higher level of food waste.

Figure 10-1 Population density map of Europe



Source: Eupedia[75]

Based on this rationale Malta, the Netherlands and Belgium are relevant EU-27 countries for transfer of the food waste reduction policy together with densely populated areas in e.g. the UK and Germany.

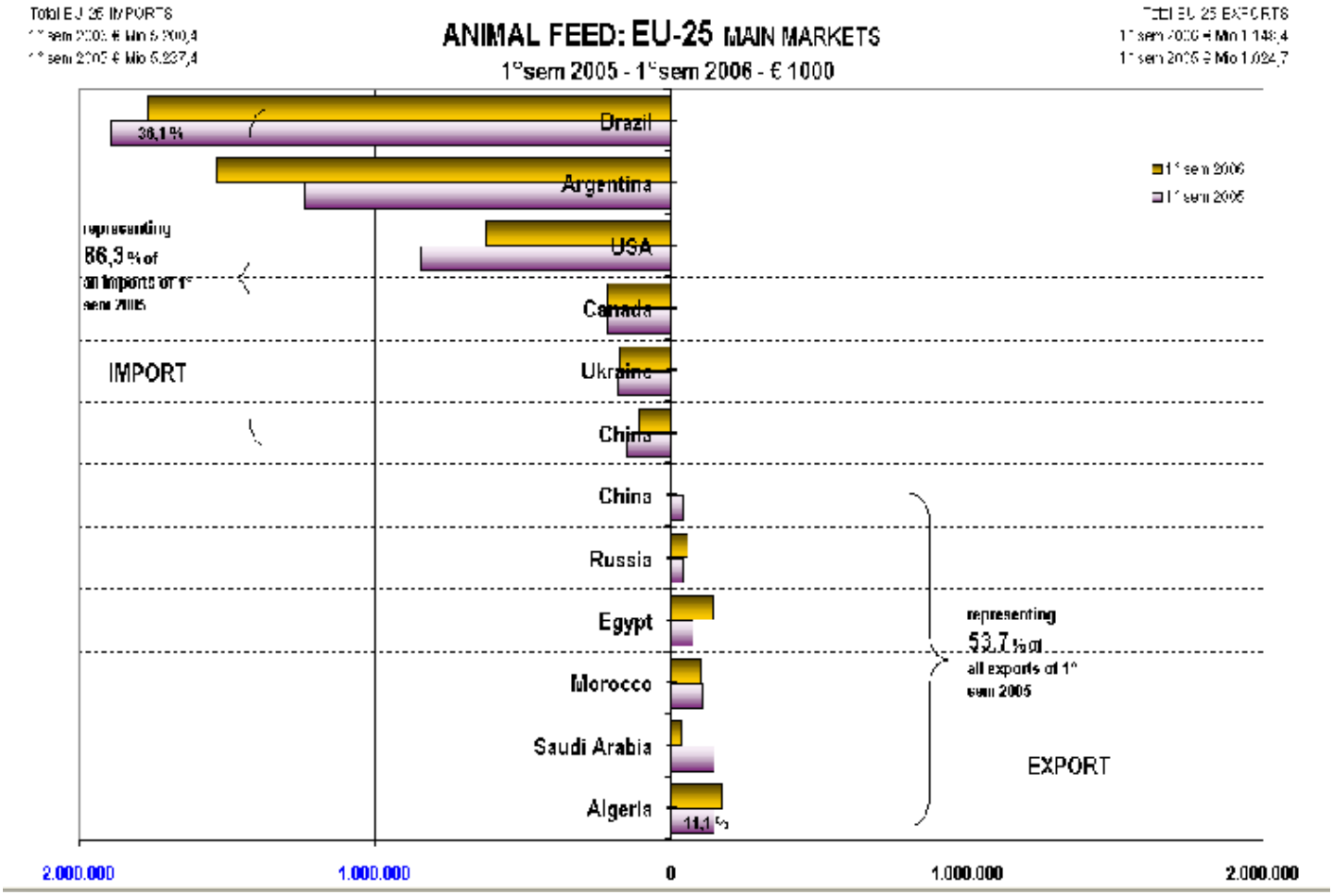
High level of import of grain and fodder

The food waste reduction policy has been identified to be of relevance in countries with high import of grain and materials for fodder, which can be replaced with food waste. In South Korea, 95 per cent of the materials used for fodder are imported. Countries reflecting the same import pattern can make a better use of food waste as useful resources and at the same time save expenses on import of grain and materials for fodder.

[75] http://www.eupedia.com/europe/maps_of_europe.shtml#density_population

At EU-25 level the figure below shows that the total import of animal feeds in first semester of 2006 was EUR 5.200 million compared to a total export of EUR 1.148 million. Assuming that the total amount of import can be substituted by food waste, a potential of EUR 10.400 million can be saved annually.

Figure 10-2 Animal Feed – EU 25 main markets



Source: The agricultural trade statistics of the European Commission[76]

As seen in the table below, the majority of countries representing densely populated areas and thereby potential for a high level of food waste, have a high level of livestock production (except Malta and Belgium). The Netherlands, the UK and Germany coincide in representing some of the biggest markets in the EU for animal feed and fodder as well as being potential producers of large amounts of food waste for substitution of import of animal feed and fodder.

[76] http://ec.europa.eu/agriculture/agrista/tradestats/gra_eu25_main_markets/page_005.htm

Table 10-2 Livestock: Number of farms and heads by size of farm (UAA) and LFA status

10.3 GEO/TIME	10.4 2007
Belgium	3787770
Bulgaria	1245980
Czech Republic	2052810
Denmark	4582160
Germany	17985170
Estonia	313200
Ireland	5918340
Greece	2626560
Spain	14380700
France	22543650
Italy	9900670
Cyprus	246660
Latvia	487870
Lithuania	1030890
Luxembourg	160820
Hungary	2409330
Malta	49630
Netherlands	6415200
Austria	2473240
Poland	11117920
Portugal	2030050
Romania	6041720
Slovenia	553590
Slovakia	747210
Finland	1152090
Sweden	1784810
United Kingdom	13944250
Norway	1267600

Landfill of food waste forbidden

Direct landfill of food waste was forbidden in 2005 in South Korea as a consequence of lack of land space. The food waste reduction policies must be regarded of special relevance in European countries with the same regulations or countries considering enforcing such kind of landfill regulations.

EU Landfill Directive

In Europe, the separate collection of food waste is determined both at European level by European legislation as well as at individual country level through national waste policies. The EU Landfill Directive (99/31/EC) set targets for the reduction of biodegradable municipal waste sent to landfill; targets that cover all member states:

- By 2010. to reduce the amount of biodegradable municipal waste going to landfill to 75 per cent of that produced in 1995.

- By 2013, to reduce the amount of biodegradable municipal waste going to landfill to 50 per cent of that produced in 1995.

- By 2020, to reduce the amount of biodegradable municipal waste going to landfill to 35 per cent of that produced in 1995. (University of Plymouth 2005).

Although the EU Landfill Directive provides a single standard for reduction of biodegradable municipal waste, the EU Regulation 1774/2002 allows member states to use different approaches to meet the targets. These are either regulatory instruments such as banning landfilling of specific waste types (e.g. food waste) or market-based instruments, such as landfill tax[77]. Both instruments encourage recycling of food waste in the EU.

Assumptions

The following assumptions have been made:

- Food waste are produced and transported under such conditions that it is viable to use as feed and fodder for animals. Among others, this requires that the food waste contains the right composition of material to serve as feed and fodder for animals, and the food waste should not be transported long distances to avoid rotting.

- The estimate of import substitution of animal feed and fodder is based on an assumption that the total amount of import can be substituted by food waste, a potential of EUR 10.400 million a year. This is a best-case scenario and difficult to reach, whereas the exact figure will depend on the interventions of each individual Member State.

10.5 Resource saving potential

Budget for food waste energy

The food waste reduction has been prioritised by the South Korean government, which is reflected in an increasing budget during recent years:

In 2008:

- With the objective of promoting food waste-to-energy systems, KRW 144.8billion (USD118 million) was provided to 248 places to install food waste-to-energy facilities and purchasing automobiles by the end of 2008

- In addition, among recycling industry promotion fund, KRW 731billion (USD596 million) was offered to 2,013 places for developing waste-to-energy technology and installing facilities. (Ministry of Environment 2010)

- A total of KRW 875.8 billion (USD714 million) was allocated to food waste to energy systems in 2008.

[77] EEA homepage: http://www.eea.europa.eu/highlights/how-can-waste-policy-become (Data extracted 19th June 2010)

Food waste recycling rate

Due to a continuous effort to separate and discharge of food waste, installation of waste to energy facilities and strict regulations on recycling, food waste recycling rates in South Korea have likewise increased during recent years:

Table 10-3 Food waste recycling rate

	1998	2000	2004	2007
Food waste recycling rate in %	21.7%	45.1%	81.3%	92.2%
Food waste recycling rate in tonnes/day	n.i	5,200	9,316	14,452

Source: Ministry of Environment of Korea 2010

In 2007, 92.2 per cent of all food waste generated was recycled as fodder and compost. (Ministry of Environment 2010)

Resource saving potential

As food waste recycling rates are only available until 2007, we have chosen to use these to estimate savings and comparing them to the 2008 budget. We estimate that the recycling rate figures for 2008 have remained the same as the year before, though being aware of the fact that recycling rates have been increasing each year. Hence, the resource saving potential found must be regarded as the minimum achievable potential.

A total of KRW 875.8 billion (EUR 581 million[78]) was provided to save 14,452 tonnes of food waste per day in 2008. This means that a total of 5,274,980 tonnes of food waste were saved in 2008 at a price of EUR 581 million - or put in other words, the Korean government paid more than EUR 1.5 million each day to save 14,452 tonnes of food waste per day.

The expected outcome of the food waste policy is a 20 per cent reduction in the volume of food waste by 2012 compared to that of year 2010. Still, it is difficult to estimate the potential financial savings of this reduction, but in the case of Jeonju City, the city reduced managed a 12 per cent reduction in food waste volume and saved KRW 1.1 billion of processing costs after introducing a RFID Tag Recognition system (interview, Ministry of Environment, Resource Recirculation Bureau)

10.6 Conclusion

By transferring and scaling up the food waste reduction policy to the EU, substantial savings can be reached in the agricultural sector by replacing the current import of animal fodder with fodder nationally produced from food waste.

Potential resource savings in the EU

Based on the rationale of population density, Malta, the Netherlands and Belgium are relevant EU-27 countries for transfer of the Food waste reduction policy together with densely populated areas in e.g. the UK and Germany which also represent areas with high food waste production. These countries also have livestock production, and especially the Netherlands, UK and Germany has a

[78] Exchange rate 26 May 2010; 1 USD = 0.813794 EUR

high level of livestock production, hence an internal market for production of fodder based on food waste.

At EU-25 level, the total import of animal feeds in the first semester of 2006 was EUR 5.200 million, hence, potentially, internal production of animal feed and fodder substituting the current import could lead to a saving of EUR 10.400 million a year for livestock holders in the agricultural sector.

From the government's point of view, the potential savings from the reduced processing costs should be added and the costs of implementing the food waste reduction policy should be set off. These figures are difficult to estimate as they depend on the potential for reducing the amounts of food waste in the countries taking into account also current use of food waste. The current use of food waste has been difficult to estimate individually in all Member States.

10.7 Literature

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World Bank 2010 and International Finance Corporation, Bussiness environment snapshot. http://rru.worldbank.org/besnapshots/

Interviews and personal correspondence

Contact has been made to each of the following stakeholders and experts to obtain information on the food waste reduction policies of South Korea.

Authorities	• Ministry of Environment, Resource Recirculation Bureau
	• Korea Environment & Resources Cooperation, ENVICO. Sang Hun Lee, General Manager, International Policy Research Center
Business association, businesses, NGOs, organisations	• Resource Recycling R&D Center
	• KOWASTE, Korea waste association, Research Information Division
	• The Korean Institute of Resources Recycling
	• Korea Recycling Corporate Coalition
	• Korea Society of Waste Management
	• NGO, Local Sustainability Alliance of Korea (SD Korea). Mr Se-Hong Yun, Executive Director
	• Korea4expats
Academia	• University of Minnesota, Industrial ecology lab. Prof. Sangwon Suh
	• University of Seoul, Center for Biowaste Recycling Research, Prof. Dong Hoon Lee and Prof. Sung Hwan Kwon
	• Korea University. Dr Yongsung Cho, Division of Food and Resource Economics

11 Policy on promoting green purchasing, Japan

Name of policy:	Promoting Green purchasing
Country:	Japan
Sector:	Cross-cutting
Resource:	All types
Instruments:	Green procurement

11.1 The purpose of the policy

Objectives

The objectives of the green public procurement are to contribute to reducing environmental impacts by buying eco-friendly goods and services.

The basic principles for procurement of eco-friendly items as outlined in the Basic Policy on Promoting Green Purchasing are as follows:

- Consideration of environmental attributes in addition to price and quality considerations
- Consideration of:
  - products that contribute to the formation of a socio-economic system through an environmentally sound material cycle
  - products that contribute to reducing greenhouse gases.
- Reduction of environmental impacts throughout the product's lifecycle, from manufacture to disposal.
- Long-term use, efficient utilisation, and appropriate disposal of procured goods and services (separation into appropriate waste streams).

Type of benefits

The benefits to the companies are:

- Increasing profitability by using resources more efficiently
- Increased resource efficiency
- Minimisation of waste and waste charges
- Enhancement of company image and profile in the market
- Innovation effects
- Contribution to greening the supply chain
- Boosting of the market for eco-friendly products.

11.2 Characteristics of the context where the policy is implemented – Basic Policy on Green Purchasing

Japan has been one of the most active countries in green procurement activities. The government provides a comprehensive policy framework that requires all public sector organisations to develop policies and implement green procurement. In addition, the private sector is encouraged and actively involved in green procurement activities, and the B2B procurement of environmentally sound products is driving the development of the green market. Green procurement has been considered one of the most successful environmental initiatives in Japan (Machiba et al. 2007).

The Act on Promoting Green Purchasing was passed in May 2000 and enforced in 2001. It required the national government to set up a Basic Policy on Green Purchasing, which was first released in 2001 and has the goal to outline the basic direction of public procurement of eco-friendly products[79]. The main target group is the public sector, and according to the law, it is obligatory for ministries, agencies, the Diet (parliament), courts and other independent administrative institutions to follow green procurement guidelines. However, local authorities, private companies and individuals are also requested to increase purchases of environmentally sound products and services. The process of implementing green procurement requires all ministries, departments and agencies to draw up annual "procurement policies" as well as to establish procurement targets every fiscal year based on the Act on Promoting Green Procurement taking into consideration its budget and planned projects and activities. Each institution is also required to announce the result of green procurement efforts and report it to the Minister of the Environment at the end of every fiscal year. The law gives the Minister of the Environment the authority to request the head of each ministry or agency to take measures that are deemed particularly necessary to promote the procurement of eco-friendly goods (Machiba et al. 2007).

The mandatory nature of the Green Purchasing Act dramatically contributed to the dissemination of products covered by the law to in governmental sectors but also in to companies. At the same time, the EU RoHS Directive accelerated corporate green procurement activities through the supply chain. This contributed to the development that requires businesses increasingly to supply eco-products, eco-components, and eco-services for customers throughout the supply chain (Sato 2006).

[79] last updated in February 2010

11.2.1 Green Purchasing Network (GPN) and the Japan Eco-mark Label

The **Green Purchasing Network (GPN),** a non-profit organisation that works with the industrial, governmental, academic and private sectors, was established in February 1996 with the purpose of promoting the concept and practice of Green Purchasing in Japan. As of January 2008, the network has 3,036 members covering organisations including businesses, local governments, consumer groups, environmental NGOs, and cooperative associations. The GPN draws up the purchasing guidelines for various products, maintains the extensive product database, holds seminars as well as study meetings, and awards commendation to organisations that develop and implement innovative Green Purchasing programmes.[80]

The principles of green procurement and procurement guidelines for each type of product (19 product categories and more than 11,000 products as of January 2007) are established through discussions among GPN members and supported by external consultations. Since 1997, the GPN has published a "data book" of quantitative and qualitative environmental information on each product in accordance with the procurement guidelines. The information provided through the GPN online database is widely used and records more 300,000 page views per month (Machiba et al. 2007). The Japan Environment Association (JEA) serves as the secretariat to the GPN.[81]

The GPN Database[82] provides users with detailed product information of designated environmental aspects, certification of eco-labelling, conformity to the Law criteria, retail prices and other major functions. It does not certificate/recommend specific products but is updated quarterly enabling purchasers to compare the products of many producers from various environmental perspectives.

Another instrument worth mentioning is the Japanese Eco-Mark Programme[83], which was launched in 1989. Products that have been certified as contributing to environmental preservation can be included in the programme. It contributes to facilitating environmentally friendly product choices. Certification Criteria for every product category have to take into account the product's life cycle (resource extraction, manufacture, distribution, use, disposal, recycling). Currently, about 47 product categories and 4,500 products are Eco-Mark labelled (ISO14024) (MoE 2009).

The activities described above started before the implementation of the Green Purchasing Act. They significantly contribute to spreading eco-friendly products to the private sector and to promoting the whole market of green products. Cooperation between the three green procurement actions in Japan has helped accelerate the success of the policy (MoE 2009). Japan can be considered the

[80] Green Purchasing Network (GPN), http://www.gpn.jp/English/

[81] Japan Environment Association (JEA), http://www.jeas.or.jp/english/activ/07_green.html

[82] GPN Database, http://www.gpn-eco.net/, in Japanese only

[83] Eco Mark Office, http://www.ecomark.jp/english/

international leader in green purchasing of office equipment and electronics (Oosterhuis 2008).

1.1.1 Designated procurement items

There are 246 procurement items in 19 categories designated in the Basic Policy on Promoting Green Purchasing as of 2010.

Table 11-1 Product categories according to the Basic Policy on Promoting Green Purchasing

Product	Numbers of items	Examples
Paper	7	Copier paper, printer paper, toilet paper, etc.
Stationary	82	Ballpoint pens, scissors, glue, etc.
Office furniture	10	Chairs, desks, shelves, etc.
Office automation machines	17	Copiers, printers, fax machines, etc.
Mobile telephones	2	Cellular-phone, PHS
Home electronic appliances	6	Electric Refrigerators, etc.
Air conditioners, etc.	3	Air conditioners, gas heat pump air conditioners, space heaters
Water Heaters	4	Electric hot water supply system, gas cooking appliances, etc.
Lighting	5	Fluorescent lighting equipment, fluorescent light bulbs, LEC lighting equipment, etc.
Vehicles, etc.	5	Vehicles, ETC adaptable car accessories, VICS adaptable car accessories, tire, engine oil
Fire extinguishers	1	Fire extinguishers
Uniforms and work clothes	2	Uniforms, work clothes
Interior fixtures and Bedding	10	Curtains, carpets, blankets, comforters, etc.
Work gloves	1	Work gloves
Other fibre products	3	Tents, tarps, safety nets
Facilities	6	Solar power generation systems, garbage disposals, etc.
Emergency goods	6	Water in plastic bottles, preservative precooked rice, biscuits, canned foods, pouch-packed foods and canned fuel
Public works projects	62	Portland blast furnace cement, pavement material, flushable toilets, greening of rooftops, etc.
Services	14	Printing, cafeterias, automobile repair, etc.
Total: 19 categories	246	

Source: MoE 2010

The requirements for each item to be classified as a procurement item are ambitious. The same holds for the evaluation criteria, which are very precise and prescriptive.

11.3 Impact of the GPP policy on business

The GPN guidelines and data books naturally have an influence on industries. On the one hand, they constitute a decision basis for responsible purchasers; on the other hand, they are a kind of benchmark in terms of the products that are categorised. The GPN is regarded as politically neutral; however, companies and academics that represent the network are considered able to influence national politics.

The **market size of environmental business** in Japan is forecasted to be rapidly increasing from JPY 29.9 trillion in 2000 up to JPY 47.2 trillion in 2010 and JPY 58.4 trillion in 2020 (Sato 2006).

A 2005 survey conducted by the Ministry of Environment (MoE) among 2,524 respondents of large-sized companies showed that 57 per cent of **private businesses have implemented green purchasing guidelines,** 25 per cent consider introducing them and 18 per cent do not contemplate introducing green purchasing guidelines (Sato 2006).

According to the annual report of the Ministry of the Environment (2009), the target is that 30 per cent of the (large, medium-sized and small) private companies apply green purchasing principles. The following companies are known to have implemented green procurement schemes:

- Sony, Canon, NEC, Fuji Xerox, Ricoh, Honda, Toyota, Nissan, Matsushita Electric Industrial (now: Panasonic), Nippon Steel, Seiko Epson, Hitachi, Toshiba, Mitsubishi Corp., JT, Suntory, Kikkoman, Tokyo Gas, Development Bank of Japan, NTT, JR, Tokyo Electric Power, etc.

11.3.1 Greening the supply chain

Findings from a survey conducted by GPN in 2002 show that

- 51 per cent of responding companies have written policies on green purchasing
- 36 per cent of them have adopted green purchasing policies on parts and materials.
- 52 per cent of them consider suppliers' EMS and other environmental activities.

Sony

Sony is a large producer of electronic equipment, such as video cameras, televisions, information and communications equipments, and electronic components. The annual consolidated sales and operating revenue in 2009 encompassed JPY 7,214,000 million.

The Sony Group uses a green procurement system for office and other supplies. Under this system, the Sony Corporation not only uses green procurement in the selection of suppliers, but also creates Green Partner Guidelines in order to

form partnerships with suppliers of parts, devices and raw materials that enhance the level of their environmental performance. The system provides a catalogue containing a considerable number of recommended items to be used by Sony companies. As of September 2006, the catalogue distributed in Japan lists approximately 8,200 items bearing the "eco" mark, serving as an effective tool in speeding up the procurement of green products (Sony 2010).[84]

Toyota

Toyota has made it mandatory for business partners to acquire external certification on their environmental management systems, such as ISO 14001. For products that become a component of Toyota's products or are to be used in the manufacturing processes, the procurement system requires the business partners to submit in advance a non-use declaration of prohibited substances as well as data on substances of concern, including a report on the substances contained in parts.

Toshiba

The Toshiba Group administers the use of specified chemical substances in its procurement items and evaluates suppliers' consideration of environmental aspects using the "supplier greenness" measure. In addition, the Toshiba Group gives preference to the procurement of environmentally conscious office equipment and supplies (Toshiba Corporate Social Responsibility Report 2009).

11.3.2 Green product design

Another strand of accelerating resource efficiency development is eco-friendly product design.

Fujitsu Group

Fujitsu Group is a leading provider of ICT products headquartered in Tokyo. Fujitsu Limited reported consolidated revenues of JPY 4.6 trillion (USD 50 billion) for the fiscal year ended 31 March 2010.

Fujitsu started implementing voluntary environmental assessments in 1993 and is now in stage V (FY 2007 to 2009) of its approach towards eco-friendly products. The target is to have at least 20 per cent of new developments to be Super Green Products with an eco-efficiency factor of 2; 32 products were developed in the fiscal year 2007 (Takayama et al. 2009).

11.4 Lessons learned and lessons which may be relevant to transfer or scaled up to the EU level

From the year 2000, government procurement activities (including ministries and agencies) have increased from 79.2 per cent to 100 per cent in the year 2007. According to Harada (2006), the goal for FY 2010 was to systematically

[84] http://www.sony.net/SonyInfo/procurementinfo/green.html

implement green purchasing for all local governments and about 50 per cent of listed companies[85] and 30 per cent of private (unlisted) companies.[86]

- All central government ministries practice green purchasing, i.e. the potential is fully tapped.
- 100 per cent the 47 prefectural governments and 17 designated cities Osaka, Nagoya, Fukuoka, Sendai, Sapporo, Yokohama, etc.) are engaged in green purchasing
- 44 per cent of 700 cities systematically implement green purchasing (MoE 2009).

In the EU, green public procurement has not gained the same strong as in Japan because GPP is a voluntary instrument in most countries.

The percentage of (public) central and non-central organisations, for which green purchasing is part regular planning and control, system ranges from 12 per cent (Germany) to 52 per cent (UK). Compared to the Japanese figures, the seven European countries still have unexploited potentials.

Table 2 Percentage of organisations in which green procurement is part of the regular Planning & Control cycle

Country	Central	Non-central	Total
Austria	53%	14%	15%
Denmark	39%	41%	41%
Finland	31%	34%	34%
Germany	17%	12%	12%
The Netherlands	26%	21%	21%
Sweden	37%	38%	38%
United Kingdom	100%	49%	52%
Total	43%	30%	31%

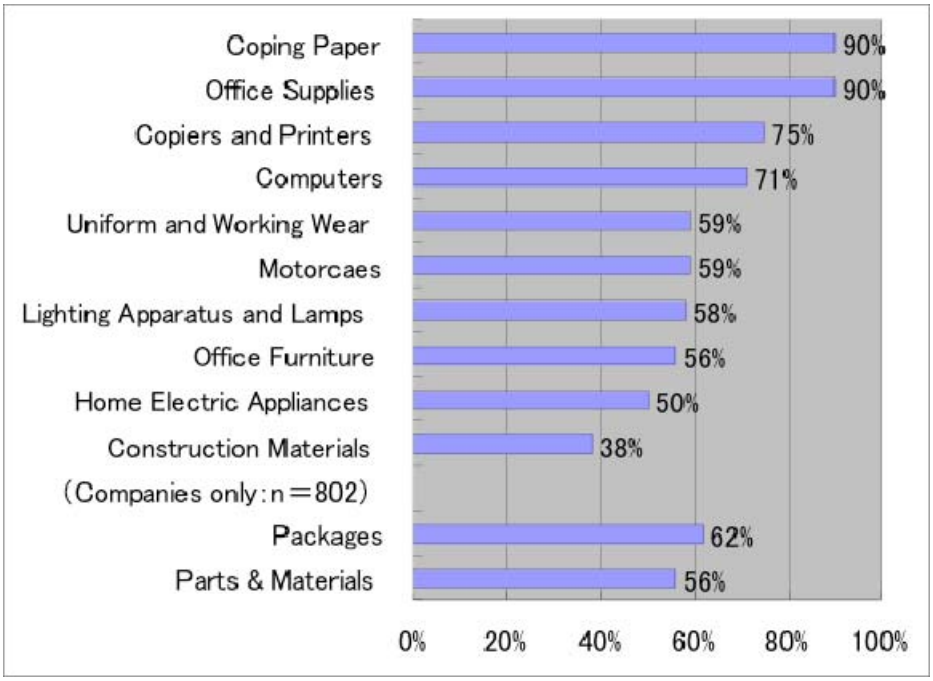
Source: PricewaterhouseCoopers et al. 2009

The quantity of products with reduced environmental impacts disseminated in the market has continuously increased since implementation of the Japanese Basic Policy on Green Purchasing. In the areas of copying paper and office supplies, 90 per cent of the institutional purchasers practice green procurement.

[85] Listed companies in the First and Second Sections of the Tokyo Stock Exchange, Osaka Securities Exchange and Nagoya Stock Exchange

[86] Unlisted companies with 500 or more employees, and business establishments

Figure 2 *Product areas where Japanese institutional purchasers practice green purchasing*



Source: Sato 2007

The public expenditure on the item furniture and fixtures (transactions valued at purchasers' prices) of Japan, derived from input-output tables, are as follows in the year 2000:

Table 3 *Public expenditures for furniture and fixtures in Japan (2000)*

ure and fixtures	ion yen
Public administration	79,073
Education	48,966
Research	46,345
Medical services and health	95,602
Social security	52,967
Nursing care	15,758
Other public services	69,472
Total	408,183*

Note: *equivalent to about EUR 3.6 billion
Source: Ministry of Internal Affairs and Communication, http://www.stat.go.jp/english/data/io/io00.htm

Assuming that the annual demand for furniture and fixtures in the public sector has remained constant, the share of green procurement was JPY 230,000 mil-

lion (56%, Sato 2003) which is about 10 per cent of the total value of manufactured goods of the furniture and fixtures sector.

In 2003, office furniture accounted for 10 per cent (equivalent to EUR 8.9 billion) of the overall production volume of furniture in Europe (EU 15; by value Öko-Institut/ICLEI). The overall scores of product groups in Europe display that certain product groups, such as transport and gardening, show large shares of non-green procurement (82% and 74% respectively), whereas others such as (office) furniture and paper show a major share of green purchasing (82% and 77% respectively).

*Table 4 Overall scores per product group in seven European countries**

Indicator	Core green	Comprehensive green	Non-green
Cleaning	15%	33%	52%
Construction	19%	18%	63%
Electricity	63%	17%	20%
Catering	43%	0%	57%
Gardening	12%	14%	74%
Office IT	57%	3%	41%
Paper	5%	72%	23%
Clothing	40%	7%	53%
Transport	19%	0%	81%
Furniture	82%	0%	18%

Note: * Austria, Denmark, Finland, Germany, the Netherlands, Sweden, United Kingdom
Source: PricewaterhouseCoopers, 2009

11.4.1 Assumptions necessary to transfer or scale up results

Due to lack of empirical data, a general assessment of the effectiveness of the Japanese GPP policy is difficult. In general, ex-post evaluations of GPP policies are scarce (Johnstone 2003). There are no figures showing how many resources that are saved by GPP policies for the various products groups. As shown above, general data are available on the shares of institutions that purchase green products and services.

11.4.2 Transferring of results

The **purchasing power of the public organisations** is immense, and they have considerable market influence. According to information from the Green Purchasing Network of 2003, public purchasing in Japan encompasses JPY 58 trillion (76 per cent governmental procurement and 24 per cent procurement by local authorities) corresponding to 17.6 per cent of the total GDP (Sato 2006).

In Europe, public spending amounts to EUR 1.5 trillion, equal to about 16 per cent of the European GDP (ICLEI Procura+ Campaign 2010).[87]

Example office furniture

The purchasing guideline for office furniture (GPN-GL 11) was published in 1999 and revised in 2004. There is no specification concerning the recycling quota that has to be included.

Guidelines for office furniture:

- The manufacturer provides full maintenance service in order to make long-term use feasible
- Designed to facilitate recycling and re-use of component parts, and conserve resources
- The manufacturer provides infrastructure for collection, reuse, and recycling of the used products
- Made with a large amount of recycled material
- Low release levels of formaldehyde
- Low release levels of toluene, xylene, and p-dichloro benzene

In 2007, the total number of establishments manufacturing furniture and fixtures summed up to 8,215 employing 124,447 persons. The business sector had a total value of manufactured goods shipment of JPY 2,270,000 million in 2007. The Gross Domestic Product (GDP) amounted to JPY 560,517.5 billion, of which the share of government final consumption expenditure is JPY 97,051.6 billion (approx. 20%) (Statistics Bureau).[88]

The Japanese Green Procurement Scheme seems to be effective due to the mandatory requirements of public green procurement and the detailed requirements for green products developed by the Green Purchasing Network.

Based on the available data, it is not possible to estimate the economic benefits to companies arising from the policy. The demand for green products, however, gives strong incentives to product manufacturers to develop and produce green product. The Japanese green procurement policy has contributed to create a demand among private companies for green products. The magnitude of economic benefits to businesses that would emerge from transposing the Japanese green procurement policy into a European context is highly uncertain.

[87] http://www.procuraplus.org/index.php?id=4594

[88] http://www.stat.go.jp/english/data/handbook/pdf/t3_1.pdf

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