Öko Kauf Wien®

Protecting our climate and our environment

www.oekokauf.wien.at

Green Public Procurement in the City of Vienna
Impact Analysis

30 April 2014

MA 22 Mit unserer Umwelt

KLIP WIEN
KLIMASCHUTZPROGRAMM WIEN

UMWELT MUSTERSTADT WIEN

City of Vienna
Vienna is special.

Contracting Authority
Municipal Department MA 22 (Environmental Protection)
Vienna City Administration
Dresdner Straße 45
1200 Vienna

e-mail: oekokauf@ma22.wien.gv.at

This text version is based on the report of the impact analysis of the “ÖkoKauf Wien” procurement programme. Project number by Con plus ultra as of 30 April 2014. The content of the original report was slightly adapted by “ÖkoKauf Wien”, changes were agreed upon consultation with the authors.

Contractor
ConPlusUltra GmbH
Burggasse 116
1070 Vienna

Project team
Brigitte Hatvan
Andreas Karner
Astrid Buchmayr
Zoltan Szemler
Thomas Zemansky

List of Contents

1 Executive Summary

1.1 Main results of the impact analyses

The ecological procurement programme of the Vienna City Administration, "ÖkoKauf Wien" celebrates its 15th anniversary. An impact analysis was commissioned on the occasion. The objective was to provide an overall assessment of the programme's performance and impacts, as well as those of public procurement at the City of Vienna.

The primary **basis** for the assessment consisted in data and information provided by the City's procuring offices, which had established **more than 20 working groups** to work out binding criteria lists, guidelines and further results for ecological procurement.

This **impact analysis** gives a **conservative expert opinion** on the programme impacts. It is based on a systematic analysis of procurement data provided by the client and on a secondary analysis of relevant studies. As agreed with the client the impact analysis comprises **quantitative assessments of defined impact indicators including a qualitative description of the programme impacts.**

Main results:

The ecological procurement programme "ÖkoKauf Wien" achieves **comprehensive impacts in terms of improving ecological, social and economic sustainability indicators** with procurement of products as well as construction and other services offered by the City of Vienna. "ÖkoKauf Wien" has compiled comprehensive criteria lists and tools for procurement, such as databases, position papers and guidelines (https://www.wien.gv.at/umweltschutz/oekokauf/ergebnisse.html).

The expert team in charge categorised the results as set out below:

1. "Eco-friendly working in Vienna"
2. "Eco-friendly building in Vienna"
3. "Eco-friendly living in Vienna"

Ad 1. "Eco-friendly working in Vienna"

The "ÖkoKauf Wien" criteria lists prepared by the working groups on electrical and office equipment, paper, cleaning agents and vehicles, as well as the disinfection database WIDES ensure the **procurement of environmentally friendly products and services** in the aforementioned fields of the Vienna City Administration. "ÖkoKauf Wien" thus significantly boosts **resource efficiency, while reducing damage to the environment and human health** in the departments of the City of Vienna and acting as a **role model** for its employees regarding the environmentally sound use of devices and products.

Ad 2. "Eco-friendly building in Vienna"

Comprehensive criteria lists and tools provided by the "ÖkoKauf Wien" programme ensure that **building projects commissioned by the City of Vienna are implemented with environmentally friendly products and building methods**. An increasing number of other municipalities, institutions, private planners and builders also follow the ecological procurement criteria of the "ÖkoKauf Wien" programme. The programme **significantly enhances climate protection,** as well **as a healthy working and living environment** by reducing damage to the environment (e.g. construction site traffic, air pollutants indoors and outdoors). Procurement of modern, resource efficient building technology saves great quantities of energy and water as well as the **high costs** entailed.

Ad 3. "Eco-friendly living in Vienna"

The "ÖkoKauf Wien" programme and its findings provide the basis for the procurement of regional and seasonal **organic food for kindergartens, schools, hospitals and retirement homes operated by the City of Vienna** as well as for environmentally friendly waste disposal at these facilities. This is a significant contribution to a **good quality of life and a healthy diet, as well as to a reduction of greenhouse gases**. "ÖkoKauf Wien" criteria lists are also the basis for **environmentally friendly organisation of events** in the city. These and many other measures ensure that **the Vienna City Administration implements environmentally friendly procurement and environmentally conscious behaviour. They also hold enormous benefits for people and businesses, enhancing their environmental awareness**.

Selected examples of quantitative impacts of the "ÖkoKauf Wien" programme

- Important contribution to climate protection by saving approx. **15,000 t of CO_2 per year**
- **Saving costs of approx. 1.5 million € per year** by using modern building technology and energy efficient appliances
- Protecting employees and reducing damage to human health by using environmentally friendly disinfection and cleaning agents – achieving **a 40 percent reduction in the amount of cleaning agents with the same cleaning effect**
- **More than 4,000 kg of harmful solvents are avoided each year** by procuring environmentally friendly building products.
- Reducing air pollutants and particulate matter by procuring low-emission municipal vehicles and reducing construction site traffic amounts to an **economic benefit of 300,000 € per year.**

Currently available data are not sufficient to compile all impacts relevant to the environment and human health. Therefore it can be assumed that **the actual programme impacts are significantly higher than the quantitative assessments** above reveal.

Some impacts of the programme can only be compiled **qualitatively** due to the kind of effect they have, e.g. **awareness-building** effects.

Selected examples of qualitative impacts of the "ÖkoKauf Wien" programme

- **Integration and pioneering role** at the national and the international level, e.g. regarding the harmonising of ecological building standards in German speaking countries.
- Programme results such as the WIDES database and the activities of KAV as pioneer in the procurement of sustainable cleaning agents have **highly been recognised nationally and internationally** and are considered **pioneers** in ecological procurement.
- Implementing the "ÖkoKauf Wien" criteria lists in prominent **key projects** (e.g. greening of events like the performance show of the Austrian Armed Forces on Austria's main national holiday) make them visible in Vienna and beyond. This has important **awareness building impacts** among people and sets standards for future projects.
- Several **media campaigns** (e.g. on nanotechnological coatings or disinfectants in households) made the results of the "ÖkoKauf Wien" programme public outside the Vienna City Administration.
- In addition to ecological sustainability criteria the **social aspects of procurement** have been worked out, e.g. by the Working Group Textiles.

Being a major consumer and procurer of great volumes, the City of Vienna has been able to **influence the product range favourably in many instances to the benefit of consumers and businesses in Vienna and beyond, and has managed to draw more attention to environmentally friendly products**.

All results of the "ÖkoKauf Wien" programme including user-friendly **product databases are available to the public on the internet** (www.oekokauf.wien.at). **Communication measures and further cooperation with environmental initiatives in Vienna and Austria** make the programme and its results widely known.

Many services of the programme, including the internationally unique Viennese database for disinfectants, WIDES, as well as the programme's contribution to harmonising ecological procurement standards at the national and the international level emphasise **international visibility and the programme's pioneering role**. This is reflected in the many awards granted to the "ÖkoKauf Wien" programme in recent years: e.g. the **International Dubai Award for Best Practices in Improving the Living Environment (UN-HABITAT 2010)**, the **European Public Sector Award (EPSA 2011)**, the **Guangzhou International Award for Urban Innovation (2012)** and the **Austrian Supply Excellence Award 2013 for a special pioneering solution in public procurement with a high impact on the environment and costs.**

A **comparative assessment of the programme results of "ÖkoKauf Wien" on the basis of current, international studies** on programmes of "Green Public Procurement" (GPP) shows that "ÖkoKauf Wien" covers all important aspects of public ecological procurement.

Internationally, the "ÖkoKauf Wien" programme stands for the fact that **compliance with the procurement criteria** has been **compulsory** since 2003. Without this, a comprehensive collection of quantifiable impacts would not be possible. The analysis of non-mandatory programmes is usually limited to the implementation degree of the procurement criteria and to individual case studies. The "ÖkoKauf Wien" programme is one of the first mandatory GPP programmes and clearly takes a **pioneering role in sustainable procurement**.

According to the team conducting the impact analysis, one of the significant strengths of the "ÖkoKauf Wien" programme lies in its broad scale of impacts and the interaction between the defined focuses and working groups.

The following tables comprise a summary of the results of the impact analysis in the individual working fields of the programme.

Figure 1: *impact analysis "eco-friendly working", source: City of Vienna*

		Ecological Impact		Social Impact	Economic Impact
		savings of resources reduction of damage to the environment	**savings of GWP in CO_2 equivalents**		
Eco-friendly working in Vienna	**Electrical office equipment, household and commercial appliances**	► energy savings: 630 MWh p.a. ► water savings: 1,500 m³ p.a. ► avoiding eco-unfriendly coatings	126 t p.a.	► Increased comfort through better performance of appliances ► promotion of environmentally sound behaviour of users	► reduction of energy and water costs: 113,000 € p.a.
	Paper, print, office supplies and office furniture	► 300 t office paper p.a. through double-sided printing/copying ► eco-friendly purchase on the basis of emission limits ► use of recycled products	1,060 t p.a.	► sustainable use of the raw material wood ► promotion of economical behaviour	► influence on supplier market (certifications required)
	Disinfection	► elimination of persistent substances toxic to the environment	-	► improved working quality and reduced sick leaves ► public relations through WIDES data base ► media campaign on awareness building, e.g. "no disinfectants in private households" ('Nein zur Desinfektion im Haushalt')	► high-quality products and yet no cost increase ► influence on the market by public availability of WIDES database
	Cleaning	► -37 % procured cleaning agents ► reduction of substances harmful to the environment ► chemical-free cleaning	-	► improved working quality and reduced sick leaves ► participation in "ÖkoRein" data base	► cost reduction of central purchase: 28,250 € p.a.
	Textiles	► reduction of chemicals in textiles	-	► improved working quality by reduced chemical substances in textiles ► socially fair procurement criteria	► influence on supplier market (responsibility for total supply chain)
	Vehicle Fleet	► reduction of air pollutants: 9 t NO_x p.a. 76 t CO p.a. 25 t NNHC p.a. 0.6 t particulate matter p.a.	-	► reduction of air pollutants: 113,000 of external costs p.a. ► improvement of air quality	► pioneering role in procurement
Total			**1,186 t p.a.**		**141,250 € p.a.**

Figure 2: *impact analysis "eco-friendly building", source: City of Vienna*

		Ecological Impact		Social Impact	Economic Impact
		savings of resources reduction of damage to the environment	**savings of GWP in CO_2 equivalents**		
Eco-friendly building in Vienna	**Interior Work**	► reduction of solvents: 4,100 kg p.a. ► reduction of additional emission of hazardous substances from chemical building products	37 t CO_2 p.a.	► creation of a healthy and pleasant indoor climate ► awareness building through "information sheets" and calculation tools like Ö.B.U.S. ► listing of products acc. to "ÖkoKauf Wien" criteria in cooperation with baubook.at/oea ► setting up and harmonising of ecological building standards	► important contribution regarding the protection of employees ► ecological impact on producers ► influence on supplier and processor market
	Building Construction	► greening of construction work ► reduction of emission of hazardous substances			
	Technical Services – Efficient lighting	► energy savings: 7,200 MW_h p.a.	1,400 t CO_2 p.a.	► awareness building and promotion of environmentally conscious behaviour in users ► pioneer in resource efficient building technology and facility management	► reduction of energy costs: 1,250,000 € p.a.
	Technical Services – Water Saving Sanitary Installations	► energy savings: 650 MWh p.a. ► water savings: 88,000 m³ p.a.	88 t CO_2 p.a.		► reduction of energy costs: 31,000 € p.a. ► reduction of water costs: 47,000 € p.a.
	Green and Open Spaces	► Additional criteria for selection of floor	-	► guideline on façade greening for the improvement of the urban micro climate	-
	Environmentally sound Construction Site Logistics and Civil Engineering	► efficient use of resources ► application of quality compost ► avoiding and recycling of waste ► reduction of HGV transport trips, e.g. Seestadt Aspern: 1.568 t CO_2	315 t CO_2 p.a.	► reduction or air pollutants: 179,000 € of external costs ► reduction of construction site traffic, noise and dust emissions ► provision of quality compost as natural fertiliser	► costs of construction site logistics and environmental management are compensated by improved resource balance ► use of locally available resources
Total			**1,840 t p.a.**		**1.328,000 € p.a.**

Figure 3: *impact analysis "eco-friendly living", source: City of Vienna*

		Ecological Impact		Social Impact	Economic Impact
		savings of resources reduction of damage to the environment	savings of GWP in CO_2 equivalents		
Umweltfreundliches Leben in Wien	**Food**	► procurement of less energy and resource intensive organic food ► reduction of "synthetic" input into the eco-system	11,700 t CO_2 p.a.	► increased quality of food in the facilities of the City of Vienna ► awareness building through numerous information campaigns ("natürlich gut Teller", purchase of eggs, fish, genetically modified organisms in food etc.) ► role model effect through application of these procurement criteria	► promotion of organic, regional and seasonal food ► promotion of regional organic farmers
	Events	► promotion of resource savings and environmentally sound organisation of events ► savings through returnable beakers: 100 kg CO_2 per event (1,000 beakers)	2 t CO_2 p.a. (returnable beaker)	► cleanliness of event venue ► role model effect for event guests	► savings of costs through returnable beakers and dishes ► influence on the market through listing of eco-friendly suppliers
	Prevention / Disposal	► food waste for Vienna's biogas plant (2,100 MWhth of district heat and 788 MWhel of electricity)	-	► role model effect of waste management facilities, also internationally	-
	Nanotechnology	► impact on different product groups	-	► contact point for inquiries regarding the latest nanotechnological products ► effect on different product groups ► awareness building and education regarding opportunities and risks of different nanotechnologies	► media campaign shows influence on supplier market
	PVC	► promotion of recyclable alternative products ► reduction of damage to the environment (in connection with production and disposal of PVC)	-	► improvement of working environment (indoor air quality) ► elimination of hazards to human health (in childcare articles, toys and in neonatology) ► elimination of risks in case of fire	-
Total			**11,702 t CO_2 p.a.**		

2 Basic information of the impact analysis

2.1 Background information

On 13 September 2013 the management responsible for "ÖkoKauf Wien" at Municipal Department 22 (Environmental Protection) commissioned ConPlusUltra GmbH to perform an impact analysis of the "ÖkoKauf Wien" programme.

Following up on the environmental sustainability and climate change strategy of the City of Vienna, "ÖkoKauf Wien" was established as early as 1998 as a competence network of representatives of different departments of the city administration and is one of the earliest initiatives for the promotion of sustainable public procurement worldwide.

The programme, which was awarded the European Public Sector Award (EPSA) in 2011, has been an integral part of Vienna's Environmental Protection Department (MA 22) since 2012.

2.2 Objectives – "ÖkoKauf Wien"

The "ÖkoKauf Wien" programme regularly prepares and updates criteria lists and additional findings relevant for the environmental compatibility of individual procurement groups, which are binding for the persons in charge of procurement at the City of Vienna when establishing ecological requirements according to the procurement regulations. It is a consulting and awareness-raising programme, addressing its target groups by publishing information and position papers on various topics of sustainable procurement.

In addition to reducing emissions and taking other environmentally friendly measures, the City of Vienna endeavours to be a role model and a pioneer in environmental protection and sustainable development. The City of Vienna buys about € 5 billion worth of products and services each year providing it with a market power which can be used to influence suppliers and producers.

Because of its clearly defined goals and systematic work in many areas of public procurement, "ÖkoKauf Wien" has become a pioneer internationally too. This explains why the programme is in demand worldwide as reflected by regular inquiries, invitations (e.g. World Bank, 2012) and awards (e.g. European Sector Award, 2011).

In 2008 the first internal evaluation of the programme "ÖkoKauf Wien" was conducted by means of measured values the results of which were shown as savings in CO_2 emissions and costs. These results constitute the basis for the assigned impact analysis. Picking up on the goals of the Austrian and European strategies on sustainable public procurement the aim of this analysis is to show a comprehensive picture of the programme's quantitative and qualitative effects and what potential it has to develop even further in the future.

2.3 Objectives of the impact analysis

On 18 July 2013 ConPlusUltra GmbH submitted a concept the contents and methods of which are geared towards evaluating extensively all relevant components of the programme's impact at several levels. The objective of the assigned study on the analysis of the impact of the "ÖkoKauf Wien" programme is to investigate the quantitative, as well as the qualitative results of the programme's activities with regard to sustainable procurement and the awareness building it entails. It also seeks to evaluate the different effects the programme has (ecological, economical, awareness raising) and identify potentials for its further development.

Based on the programme documents provided by "ÖkoKauf Wien", research and secondary analyses, the evaluation team of ConPlusUltra comprised the analyses and results presented in detail below.

The results of the impact analysis of "ÖkoKauf Wien" are thus to be seen as an expert assessment aimed at further development of the performance of the "ÖkoKauf Wien" programme with regard to implementation.

All tasks were fulfilled as agreed in close coordination with the executive team of "ÖkoKauf Wien" and the team leaders of the individual working groups within the programme who were involved in the presentation and discussion of intermediate results of the impact analysis throughout.

2.3.1 Planning and implementation of the project

The following diagram shows the most important items and phases of the project's implementation up to issuing the draft report on the results of the impact analysis. For discussion, completion and finalisation of the report a post-project phase until the end of February 2014 was agreed upon.

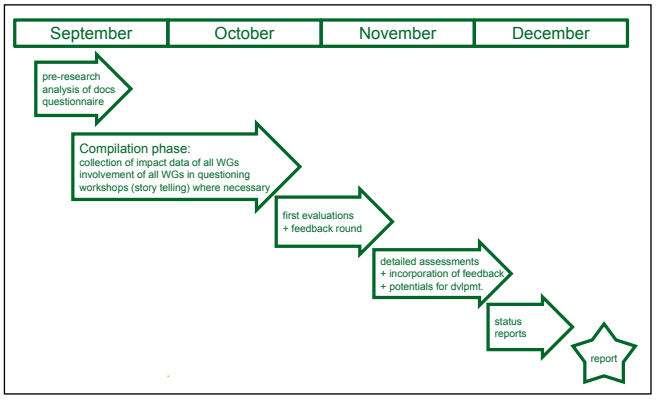


Figure 4: *impact analysis project implementation*

The aforementioned working procedure allowed for efficient exchange of information and intensive discussions with the respective persons in charge of individual topics, preparing the ground for the data evaluation and bilateral agreement phase.

Working on the programme and its effects in detail brought about qualitative and quantitative result descriptions plus many aspects regarding different processes within the programme and perspectives of future development. Direct dialogue with the people involved in the programme produced a comprehensive description of development potentials.

The joint analysis of the programme's future potential examined both the development of the programme's content, and questions of current monitoring and communication of the programme results and successes. The outcome of this potential analysis can thus be seen as a contribution and a basis for further developing the strategy of the "ÖkoKauf Wien" programme as one of the driving forces for environmental policies of the City of Vienna.

2.3.2 Evaluation concept

The objectives, procedures and results of the impact analysis are summarised in figure 5 of the evaluation concept.

ConPlusUltra was commissioned with the present impact analysis of the programme "ÖkoKauf Wien" based on their "evaluation logic" developed for the tasks given. This "evaluation logic" distinguished between three relevant levels essentially required for conducting a programme evaluation. The interdependence of these levels are indicated by arrows:

- The **result level** where programme results are analysed as to how they contribute towards achieving the objectives. In the case of the "ÖkoKauf Wien" programme the objectives are described as creating a basis for implementing sustainable procurement of products and services and as purchasing environmentally friendly products and services at the departments of the City of Vienna and other target groups.
- The **process level** directed towards analysing the operational programme implementation and identifying optimisation potential. In this context the strategic potentials of the programme development, as well as possible approaches for the implementation of accompanying programme monitoring as a tool of programme steering – a major item within the present analysis – will have to be discussed along with issues concerning operational programme management.
- The **structural level** addressing the strategic embedding of the programme as well as the framework conditions and resources needed to implement the objectives of the programme. As agreed with the client it is primarily the approaches for national and international integration of the programme which are rel-

Basis of assignment EVALUATION LOGIC	EVALUATION LEVELS ->	RESULT LEVEL						PROCESS LEVEL			STRUCTURAL LEVEL		
	PROGRAMME LEVELS -> "ÖkoKauf Wien"	sustainability			awareness building			programme management			basic conditions		
		ecology	economy	society	addressing target groups	intensity interaction	impact on behaviour	continuous processing	continuous monitoring	further dvlpt.	superior strategies	resources	integration
STARTING POINT	INTERNAL EVALUATION 2008	x	x		x								
implementation of IMPACT ANALYSIS 2013	METHODOLOGY	* background research regional environmental analysis * interviews WG leaders * collection of procurement data * definition of impact indicators / baselines * quantification / qualitative assessment						* background research studies / guidelines internat. * interviews with WG leaders * reflexion process impact analysis			* background research studies / guidelines internat. * interviews WG leaders * reflexion process impact analysis		
	RESULTS	x	x	x	x	x	x	x	x	x	x	x	x
		quantitative programme impacts success stories						recommendations			recommendations		

Figure 5: *overview of evaluation logic and impact analysis, source: author's diagram*

evant here. Integration into superior strategies, as well as issues of resource allocation were not defined as a focus of the impact analysis, however, they were addressed in connection with the strategic development of the programme.

The results of an internal programme evaluation performed in 2008 were made available to ConPlusUltra providing valuable input and source material. Working with this material added a cross-cutting task to the impact analysis: to scrutinise the internal evaluation of the programme, to ensure the continuity of the methodology of the previous analysis and, where necessary, to adjust the methodology or calculate anew.

In general the assessment framework was expanded with the present impact analysis. The internal evaluation of 2008 focused on saving resources (energy, water), reducing CO_2 and cutting costs. The impact analysis of 2013, on the other hand, focuses on a balanced view of all programme performances including quantitative and qualitative assessments. Therefore social aspects of the programme (protection of employees, improved quality of life through healthy working environment, etc.) are treated as core elements in the following chapters, as are impacts of the programme regarding awareness building and changing behaviours towards environmentally friendly living which were hardly taken into account in the previous internal analysis. In the overview diagram (Figure 5) the impact fields not previously taken into account are highlighted in orange.

The methodical procedure used for implementing the given tasks as agreed with the client in the inception phase of the project is listed below:

- Thematic research by ConPlusUltra
- Interview series with leaders of the "ÖkoKauf Wien" working groups
- Obtaining procurement data from the WG leaders
- Defining of working group specific impact indicators and baselines
- Quantitative / qualitative analysis of programme information
- Current feedback to WG leaders and programme management team
- Results

Methodical processing of the results from different working groups is described in detail in the following report and in the annex.

As shown in the overview diagram (Figure 5) in the column "results impact analysis" (in green), the collection of data on the impacts of the programme were extented to all defined fields of activity. The results of the impacts of the programme are illustrated by quantitative assessments and/or by success stories. Results of individual working groups and topics are comprised in chapters 4, 5 and 6, and chapter 7 gives a summary of all results. A description of methodical details of individual working groups is available in the annex to the report.

2.3.3 Impact indicators

A main concern of the impact analysis was to define a set of indicators, none of them too extensive, but focused and universally applicable to all programme results where possible. They should also be suitable for various report requirements and communication activities of the programme without simply highlighting individual impacts (e.g. "only" CO_2 reduction or "only" cost reduction).

Therefore the texts of the existing criteria lists and the frequency of mentioning specific criteria were analysed so as to evaluate the current status of defined impact dimensions. This analysis revealed the first differences between individual topics.

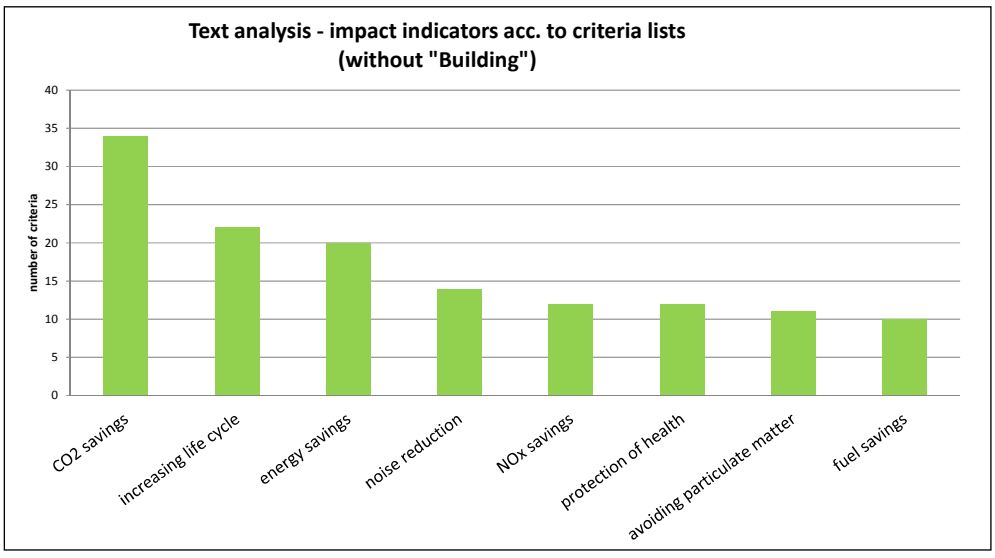


Figure 6: *frequency of mentioning impact indicators acc. to criteria list (without "Construction and Engineering"), source: author's diagram*

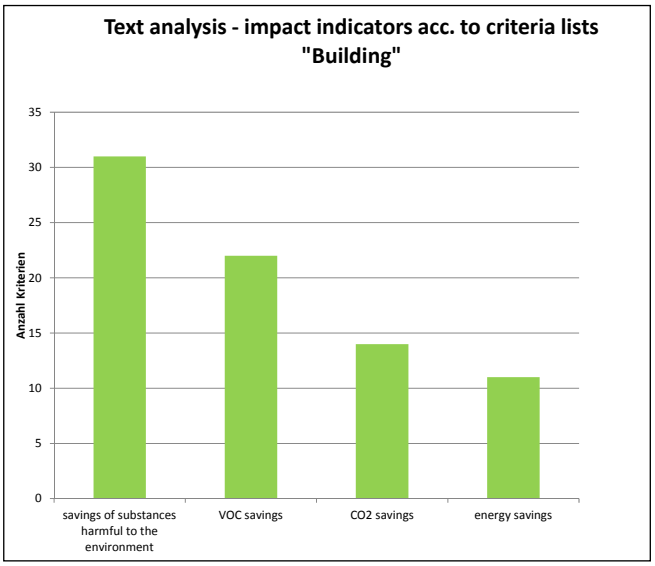


Figure 7: *frequency of mentioning impact indicators acc. to criteria list, "Construction and Engineering", source: author's diagram*

While the list of ecological criteria for "environmentally friendly building construction" focuses on reducing substances which are harmful to human health and the environment, solvents in particular, the emphasis in other areas is placed on ecological requirements such as energy efficiency, reduction of air pollutants and greenhouse gases, repair reliability, reduction of noise emissions and reduction of packaging. As a result a standard set of impact indicators were defined fulfilling the following functions as coordinated with the client:

- Illustration of all aspects of the intended impacts of the "ÖkoKauf Wien" programme
- Applicability on all programme results
- Sufficiently detailed distinction regarding the content of the collected impacts
- Suitability for continuously establishing objectives and further strategic development of the programme
- Congruity with indicators of comparable programmes and guidelines1 where applicable

The standard set of impact indicators defined in coordination with the client to be applied to all topics relevant to "ÖkoKauf Wien", breaks the three main sustainability aspects down into several sub items which allow a differentiated assessment of the programme's impact at the level of individual programme results and working groups:

Ecological impacts:	Saving on resources Avoiding damage to the environment Contributing to climate protection
Social impacts:	Improving working and living environment Promoting environmentally conscious behaviour – developing a demand market Strengthening initiatives for environmentally sound procurement
Economic impacts:	Reducing costs Influencing the supply market Promoting regional producers of environmentally sound products and services

The evaluation of the impact analysis is conducted along the lines of this set of impact indicators at the level of the individual working areas of the programme, aiming at quantifying the identified impacts where possible. Individual chapters will discuss the respective available data and identified potential for further quantitative evaluations in detail.

At the same time the analysis provides an adequate qualitative description of the programme results. Depending on the characteristics and the requirements of the different topics this methodical approach to the impact analysis is applied to take into account the diversity of the programme activities through narrative evaluations ("story telling")).

Therefore this result report can be seen both as a sufficiently comprehensive collection of results and impacts of the "ÖkoKauf Wien" programme that can be illustrated in different ways and a first step towards the systematic pursuit of programme progress envisaged.

Clustering of topical focuses

Currently 15 "ÖkoKauf Wien" working groups are in place, continuously setting up and further developing the criteria lists and working on additional results. Other working groups either participate in these active working groups according to the current programme development status or have sufficiently worked out their topic at an earlier stage and no further programme activities are therefore necessary on their part from today's point of view.

To conduct the impact analysis the topics for the working groups were divided into three content groups and with a view to the most significant user groups of the "ÖkoKauf Wien" results. Each topic was assigned to several working groups.

[1] cf. e.g. Superefficient.org (2013), SEAD Guide for Monitoring and Evaluating Green Public Procurement Programs

- The focus **"eco-friendly working in Vienna"** comprises several working groups on the procurement of commodities and consumer products, as well as services required for working at the City of Vienna. The departments involved include those with mainly office work, health facilities of the City of Vienna and the municipal vehicle fleet, amongst others.
- The focus **"eco-friendly building in Vienna"** comprises several working groups engaged in different aspects of the procurement of building material and services according to the phases and subtasks of public building projects and is targeted at suppliers of building services and producers of building material and chemical building products entitled to participate in tenders of the City of Vienna on the basis of the "ÖkoKauf Wien" procurement requirements.
- The focus **"eco-friendly living in Vienna"** comprises several working groups unlike each other at first sight. What they do have in common is the direct effect the implementation of their results has on the different aspects of living in Vienna (e.g. events, environmentally sound food, etc.) The topics are often very complex. They e.g. combine inputs from different programme activities and are sometimes also part of other initiatives of the City of Vienna. This topical focus plays a very important role in awareness building and in how the citizens of Vienna perceive the "ÖkoKauf Wien" programme.

The following chapters 3, 4 and 5 analyse the results of the clustered working groups on the three aforementioned topics as to their contribution to the programme's impact. Each topical focus is preceded by a summary of the results and a discussion of the specific contributions and potentials of development.

3 Impact analysis focusing on "eco-friendly working in Vienna"

This chapter comprises the results of the following "ÖkoKauf Wien" working groups for the impact analysis:

- Electrical office equipment, household and commercial appliances
- Paper, printing, office supplies and office furniture
- Disinfection
- Cleaning
- Textiles
- Vehicle fleet

The activities of the relevant departments of the city administration reflected in the results of "ÖkoKauf Wien" cover three big areas of activity:

- Departments with mainly office work (IT-/electrical devices, paper, etc.)
- Health facilities of the City of Vienna (cleaning and disinfection agents, textiles)
- Vehicles used for the city (vehicle fleet)

The following conclusions can be drawn from the impact analysis of the focus "eco-friendly working in Vienna":

- All analysed working groups have worked out comprehensive programme results. All working groups focused on "eco-friendly working in Vienna" develop important social impacts beyond their ecological impact. These are relevant on the one hand for the protection of employees and avoidance of anything harmful to the health of citizens and, on the other hand, for building awareness and providing information on sustainable behaviour to employees and citizens alike.
- Quantifiable impacts can be determined for the working group office equipment and household appliances, paper and vehicle fleet. The reduction of resources achieved, however, is only partly an indicator of direct monetary savings for the City of Vienna. Generally speaking it is fair to say that for this focus and others to follow additional data provided by the departments would prove the presently assumed underestimations of the programme's impacts wrong.
- Avoiding air pollutants and emissions into the sewage as typical parameters for vehicle related matters, as well as for paper production causes impacts mainly apparent through external effects. The assessment of largely local impacts through eco-friendly vehicles was conducted according to an EU Directive. Looking at the ecological impact of sustainably produced paper one needs to discuss if and to what extent national and international external impacts should be taken into account for future programme evaluations.
- The pioneer function and the scientific work provided while working out the criteria lists on health and health related topics, especially concerning the area disinfection (WIDES) and cleaning, reveals the sophistication of objectives for "ÖkoKauf Wien" and the programme implementation. However, quantifying the impact of the programme results on health and health related matters such as disinfection, cleaning and textiles is not feasible in this analysis due to the presumable complex and long-term impact mechanisms.
  Taking disinfection (see item 3.3) as an example provided that the used products are sufficiently effective and do not cause any relevant extra costs, it was shown that it is possible to do without hazardous substances persistently toxic to the environment, poisonous, allergenic, carcinogenic and teratogenic during routine disinfection.
  It is recommended to work out a concept for a long-term study in every-day, real life operation of hospitals together with health care experts in order to investigate which health related effects (e.g. fewer sick leaves) could be achieved by adhering to the procurement measures of "ÖkoKauf Wien" and to implement the findings in a comparative study.
- As seen with the example of the textile criteria list it is possible to apply both the social and the ecological aspect of sustainability in some procurement areas on the basis of the "ÖkoKauf Wien" programme.

The impact analysis identified the following important impacts and potentials of the programme:

ECOLOGICAL IMPACTS:

Saving energy and resources with electrical office equipment, household and commercial appliances, paper and cleaning

- Efficient electrical office equipment, household and commercial appliances save approx. 350 MWh per year of energy, about two thirds of which through office equipment (average value from 2008 to 2012). In addition approx. 280 MWh per year were saved by standby management of office equipment between 2008 and 2012. Water consumption was reduced thanks to efficient household appliances.

- Paper consumption was reduced by one third by regulating the use of paper (double-sided printing/copying).
- Current tenders on the part of KAV (Vienna Hospital Association) (2013) showed significant savings regarding the procurement volume of cleaning agents (approx. 37 percent).

Avoiding emissions of pollutants through eco-friendly cleaning and disinfection agents, low-emission vehicles and environmentally friendly produced paper and office supplies

- The WIDES database for ecological assessment of disinfectant components is internationally unique and scientifically recognised as a programme to effectively reduce the volume of persistent substances damaging to the environment when procuring disinfectants.
- Because of the strict content limits for cleaning agents acc. to "ÖkoKauf Wien", damage to the environment was significantly reduced in this product group, especially regarding emissions to waste water.
- Stricter exhaust emission standards for HGVs acc. to the criteria lists have been instrumental in reducing air pollutants (NO_x, NMHC) known for their damage to the forests and as precursors for the development of low-level ozone.
- Procuring eco-friendly produced paper promotes paper production with reduced emission to water and air. Further reductions of hazardous substances can be achieved by procuring office supplies from eco-friendly production.

Contributing towards climate protection regarding paper, electrical office equipment, household and commercial appliances

- An average of 1,060 t CO_2 equivalent per year are avoided by procuring sustainably produced office and hygienic paper, as well as by double-sided printing and copying, boosting the CO_2 balance in this area by more than 50 percent compared to procuring conventionally produced paper products which do not meet the requirements of the sample folder and criteria lists.
- Using efficient electrical office equipment and household appliances has helped to save approx. 70 t CO_2 equivalent per year recently, a total approx. 340 t CO_2 equivalent since 2008. In the same period a further 280 t CO_2 equivalent was saved through standby management.

SOCIAL IMPACTS:

Improving the working/living environment through pollutant reduction and resource savings

- Fewer skin-irritating, allergenic, toxic, carcinogenic and teratogenic ingredients in cleaning agents and disinfectants improves working and living standards for the employees using these substances on a regular basis, for children in Vienna's schools and Kindergartens, as well as for people in hospitals or other health facilities of the City of Vienna.
- Reducing emissions from municipal vehicles, and consequently also air pollutants including particulate matter harmful to human health through strict exhaust emission standards also contributes to better air quality in the City of Vienna.
- Sustainable use of wood as a raw material and resource efficient paper production using recycled paper contribute to a well-functioning eco system and a healthy living environment far beyond Austrian borders.
- Fewer chemicals in work clothes make for a better and healthier working environment for employees of the City of Vienna. In a global context this measure also contributes towards improving the working and living conditions for people working in the textile industry in low-wage countries.

Promoting environmentally conscious behaviour – developing a demand market

- In general all working groups with focus on "eco-friendly working" aim at making the programme results suitably available to the general public, i.e. beyond the target groups in the departments.
- The principles of the "ÖkoKauf Wien" criteria lists applied for procuring IT and electrical devices have an awareness-building impact on municipal employees even in their private lives (demand for efficient electrical devices, etc.) and support initiatives to improve market transparency for sustainable products (e.g. topprodukte.at). Standby management of IT and electrical devices provides further potential for directly involving users of the procured products.
- Awareness-building measures with use of paper, e.g. double-sided printing and copying, directly address users, promoting more efficiency and lower resource consumption.
- Procurement of disinfectants at the City of Vienna has been raised to a new quality level with the help of the product and ingredients database WIDES. The market power of major buyers like KAV (Vienna Hospital Association) has made this programme item instrumental in making product adjustments and forming a new kind of market cooperation. At the same time "ÖkoKauf Wien" deliberately involves citizens in media campaigns such as "no disinfectants in private households" ('*Nein zur Desinfektion im Haushalt*') and thus supports utilisation of programme results in private households.
- Cooperation between "ÖkoKauf Wien" and the database "ÖkoRein" has helped to make the wide range of

cleaning agents for institutions and private persons more transparent.
- Purchasing eco-friendly vehicles has made the City of Vienna a pioneer and role model, a fact suitable for communicating the programme and its awareness-raising measures to the people.

Strengthening initiatives for environmentally sound procurement
- Cooperation between "ÖkoKauf Wien" and PUMA, the programme for environmental management in Vienna, amongst other eco initiatives in the city, as well as networking among municipal and national institutions, have made Vienna more visible as a role model for environmentally friendly procurement in different areas of work and have helped to raise awareness among the broad public (e.g. buying paper through the campaign "smart shopping for school" ['Clever einkaufen für die Schule']).
- The programme results for ecologically safe disinfectants, especially the Viennese database for disinfectants (WIDES) and the activities of KAV as a pioneer in the use of eco-friendly cleaning agents, have become visible nationally and internationally, endorsing the programme's role as a pioneer and role model in this area. "ÖkoKauf Wien" does a lot of networking at national and international conferences and meetings. In the long term, developing WIDES with the assistance of institutions in other European countries could become a step towards establishing an international standard based on the programme results.

ECONOMIC IMPACTS:

Reducing costs, especially with electrical office equipment, household and commercial appliances, cleaning agents and HGVs
- In the period under review, between 2008 and 2012, a total of approx. 326,000 € were saved in operational costs (electricity, water) due to purchasing more efficient electrical office equipment and household appliances and a further 239,000 € were saved because of effective standby management. This adds up to savings of 113,000 € per year on average.
- Purchasing fewer cleaning agents for KAV (Vienna Hospital Association) resulted in savings of 28,850 € p.a. High-quality disinfectants with significantly lower risk potential were purchased for KAV without a significant increase of costs.
- When acquiring HGVs acc. to the strictest exhaust emission standards the economic benefit of fewer exhaust emissions harmful to the environment and to human health can be assessed on the basis of an EU Directive. Reduction of external costs caused by exhaust emissions due to the procurement of low-emission HGVs for Municipal Department 48 average at approx. 113,000 € per year (price basis 2007) between 2010 and 2013.

Impact on the supply market, especially regarding disinfectants/cleaning agents, textiles and paper
- The WIDES database caused suppliers to react by adjusting the product compositions. Broad recognition of WIDES as a reference has triggered more cooperation willingness on the part of the industry.
- The programme has increased transparency on the cleaning agent market ("ÖkoRein" database), pulling its weight to influence the supplier market and provide better information for both institutional procurers and private customers.
- Obligatory certification acc. to OEKO-TEX® standard 100 and stricter socially relevant procurement criteria envisaged for the future promotes suppliers with certified and transparent supply chains.
- Regarding the procurement of paper the obligatory certification acc. to FSC (Forest Stewardship Council) and PEFC (Programme for the Endorsement of Forest Certification Schemes) ensures that the primary wood originates from sustainable forestry.

Promoting regional producers of environmentally sound products and services
- Publicly available databases like WIDES or "ÖkoRein" provide a platform also for smaller producers of ecologically advantageous products and specialities to present their eco-friendly products.
- Reparability and recyclability as required by the "ÖkoKauf Wien" criteria lists for electrical devices and vehicles ensure that products are given a longer life, making sure that regional providers too can offer their repair services.

By way of concluding the programme impacts on "eco-friendly working" they are notable for being so widely efficient. Along with energy and resource saving, avoiding and reducing pollutants harmful to the environment and human health are a major concern.

A scientifically grounded compilation of the programme impacts on disinfectants, cleaning agents and textiles is likely to show a lot of impact potential. The pioneering role responsible persons at the City of Vienna have taken by working out the criteria lists and bases for decision making processes such as the WIDES database could be highlighted by a suitable investigation into the long-term effects of the programme results. This would further increase visibility of "ÖkoKauf Wien" at a national and international level, spreading programme results and quite likely setting internationally recognised standards.

3.1 Electrical Office Equipment, Household and Commercial Appliances

PROGRAMME IMPACTS ON ELECTRICAL OFFICE EQUIPMENT, HOUSEHOLD AND COMMERCIAL APPLIANCES – AN OVERVIEW

ECOLOGICAL IMPACTS

Reducing resources:
Annual energy savings of approx. 350 MWh on average two thirds of which are accounted for IT and office equipment between 2008 and 2012. In addition, approx. 280 MWh per year were saved by standby management of office equipment between 2008 and 2012.
Water consumption was reduced through efficient household appliances.

Avoiding damage to the environment:
Impact is focused on energy saving.

Contributing to climate protection:
In total approx. 340 t CO_2 equivalent since 2008, most recently due to technical improvements approx. 70 t per year. Additional savings of about 56 t per year regarding office equipment and stand-by management. Savings in total are approx. 126 t CO_2 equivalent per year.

SOCIAL IMPACTS

Improving the working and living environment:
Partly through better performance of newly purchased electrical appliances. Prolonging the life cycle through better quality and reparability.

Promoting environmentally conscious behaviour – developing a demand market:
Little market influence due to the mass market for electrical appliances, however, awareness-building effect among employees of the City of Vienna for private consumption (asking for efficient devices, etc.).

Strengthening initiatives for "environmentally sound procurement":
Including the issue in environmental management of the City of Vienna. Connection between departments, making Vienna visible as a role model for eco-friendliness.

ECONOMIC IMPACTS

Reducing costs:
In the period under review, between 2008 and 2012, a total of 326,000 € in operational costs (electricity, water) and 239,000 € of standby consumption were saved (113,000 € per year).

Influencing the supply market:
To a limited extent only due to the mass market, procurement of the most efficient device at the time of purchase, visible pioneering role in this energy efficient market segment.

Promoting regional producers of environmentally sound products and services:
Few impact opportunities due to a mass market dominated by international producers.

Challenges and objectives with electrical office equipment, household and commercial appliances
When procuring electrical appliances the state of the art of which is rapidly changing permanent market monitoring and regular adjustment of comparative measures are essential. Since the early 1990ies - which includes the "ÖkoKauf Wien" activities launched in 1998 – energy consumption of electric appliances has dropped significantly due to technological improvements, i.e. up to 80 percent of savings have been achieved. Private households or public institutions still using old devices require twice as much energy as users of efficient electrical appliances only.[2] However, the energy needed to produce these devices (grey energy) and the total use of resources need

[2] cf. http://www.test.de/Energieverbrauch-von-Haushaltsgeraeten-Bis-zu-80-Prozent-sparen-4316375-0/, as of 10 February 2014

to be taken into account when calculating the ideal life cycle.

The following diagram by Stiftung Warentest illustrates the energy savings achieved in the last two decades.[3]

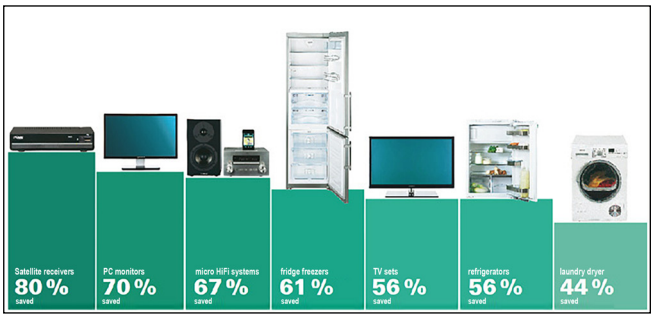


Figure 8: *energy savings with household appliances since the 1990-ies*
(source: ***Stiftung Warentest****, www.test.de)*

Procurement of electrical office equipment, household and commercial appliances under the "ÖkoKauf Wien" programme comprises several device groups (office equipment, white goods and commercial appliances) with a wide variety of different device types. The challenges posed by this dynamic market environment are reflected by the short update intervals of the "ÖkoKauf Wien" criteria lists.

The "ÖkoKauf Wien" working group regularly evaluates devices available on the market, e.g. by comparing them with eco-friendly products on the website topprodukte.at (direct link on the programme website under criteria lists for WG04). The criteria lists are used to assess energy efficiency, avoidance of eco-unfriendly coatings as well as reparability of the devices procured to prolong their life.

However, not every new bought device or appliance automatically saves costs or resources. With some devices increasing the technical capacity means increasing energy consumption (e.g. laser printers compared to ink-jet printers).[4] Therefore, in addition to the technical criteria of the devices procured, awareness building for resource-saving user behaviour (efficient standby management, printer settings, etc.) becomes relevant.

With regards to IT equipment inventory figures of the City of Vienna show a permanent rise in the numbers of PCs, notebooks and printers in the departments. This is largely due to the extension of IT services related to the introduction of e-government, amongst others.[5]

PCs have a major impact on energy consumption, since these devices are frequently kept switched on during the whole working day.[6]

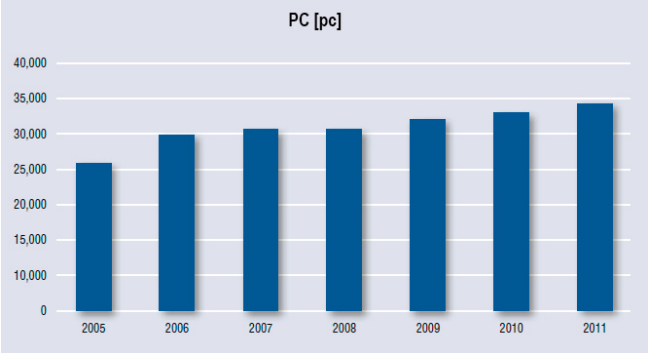


Figure 9: *number of PCs in the Vienna City Administration (source: PUMA activity report 2005-2011)*

The number of notebooks is also increasing, albeit at a lower level than PCs.

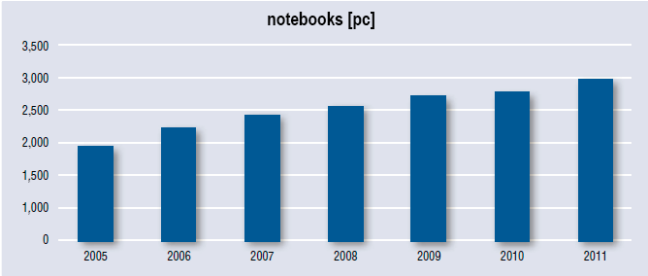


Figure 10: *number of notebooks in the Vienna City Administration (source: PUMA activity report 2005-2011)*

Applying the "ÖkoKauf Wien" criteria lists when procuring IT devices helped to continuously reduce energy consumption of new office equipment. PCs procured for the Vienna City Administration in 2012 require only about half the energy (on-mode, standby mode) of 5 years ago.[7]

Furthermore all procurement areas take into account energy efficiency plus long life and repairability, as well as the "grey energy" aspect when renewing devices and appliances.

Individual areas have achieved significant reductions and savings by buying different types of appliances or devices (see success story industrial dishwasher).

Base data of the impact analysis for electrical office equipment, household and commercial appliances

The following basic information was analysed for electrical office equipment, household and commercial appliances for municipal departments:

- Criteria lists acc. to the "ÖkoKauf Wien" website as of October 2013 and older versions provided by WG04
- Interview and related correspondence with working group leader WG04, Dominik Schreiber / Vienna Ombuds Office for Environmental Protection

[3] ibid.
[4] cf. PUMA activity report 2005-2011, p. 24
[5] cf. PUMA activity report 2005-2011, p. 23
[6] ibid.
[7] cf. PUMA activity report 2005-2011, p:23

- ► Basic data/assessments from the 2008 internal programme evaluation
- ► Complementary information from the evaluation results of the Urban Energy Efficiency Programme (SEP) of the City of Vienna, as well as from the progress reports on the implementation of the Vienna Climate Protection Programme (KliP)
- ► Reports and studies from other relevant institutions as quoted in the text

Procurement situation in Vienna

The City of Vienna procures a wide range of electrical office equipment, household and commercial appliances for many different departments and requirements. As a rule appliances are procured in small numbers to cover current needs, on the rare occasion individual device types are procured en bloc or all are replaced at the same time.

In recent years IT devices for different departments and industrial dishwashers for Viennese Kindergartens were procured in large quantities.

Evaluation methodology / calculation base

During the internal evaluation of "ÖkoKauf Wien" in 2008 first assessments of energy and water saving efficient electrical appliances were conducted for WG04. The calculation methodology used for ecologically and economically relevant reductions and savings at that time was further developed for the present impact analysis and applied to actual procurement volumes up to 2013.

Due to the well-developed data and the work already done in the internal evaluation in 2008 it was possible to work out a detailed analysis tool for individual types of appliances during the impact analysis and to calculate the measured values of three device groups, i.e. white goods, office equipment and commercial appliances for the period between 2008 and 2012. The values of the 2008 evaluation were used as a basis for comparison.

Potential impacts of awareness-building measures on user behaviour (standby management) were also investigated during the impact analysis.

A detailed description of the calculation methodology is available in the annex.

The results in detail

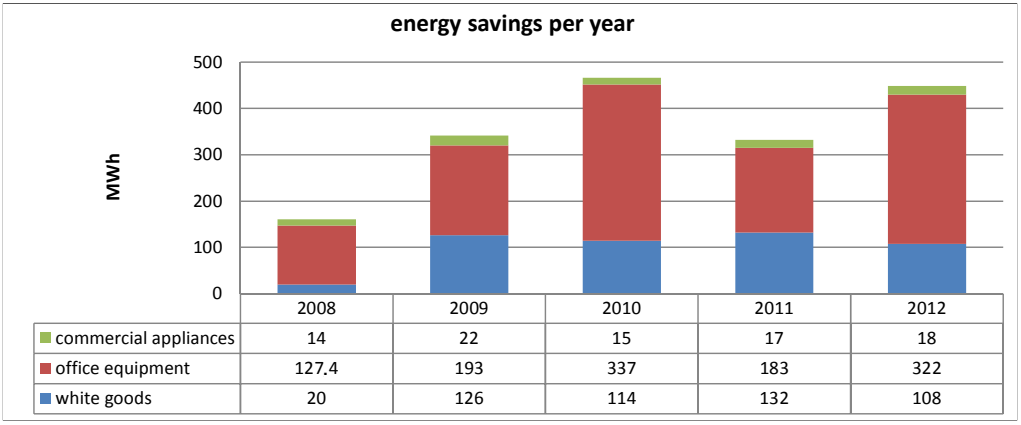
Permanent reduction of energy consumption can be achieved by procuring efficient appliances. Annual energy savings in the different device groups illustrated in the following only reflect concrete procurement projects between 2008 and 2012 to show the annual efficiency increase. In the period under review the focus for procurement in 2009 was on PCs and notebooks and in 2010 and 2012 on flat screens for the departments of the city administration.

Between 2008 and 2012 average annual energy savings were 350 MWh, of which on average approx. two thirds were accounted for by IT and office equipment.

Further reductions and savings of 1,500 m3 p.a. on average were made possible by household appliances using less water and procured according to "ÖkoKauf Wien".

Using the energy and water prices valid in respective years a basis of calculation, a total of approx. 326,000 € of operative costs were saved by this measure between 2008 and 2012.

In the period under review, i.e. 2008 to 2012, procurement of electrical office equipment, household and commercial appliances contributed to achieving the climate mitigation target set by the City of Vienna, that is to reduce the CO_2 equivalent by a total of approx. 340 t, which is the equivalent of 70 t per year.



	2008	2009	2010	2011	2012
commercial appliances	14	22	15	17	18
office equipment	127.4	193	337	183	322
white goods	20	126	114	132	108

Figure 11: *energy savings generated by efficient electrical office equipment, household and commercial appliances, source: author's diagram (based on data provided by Municipal Department MA 14)*

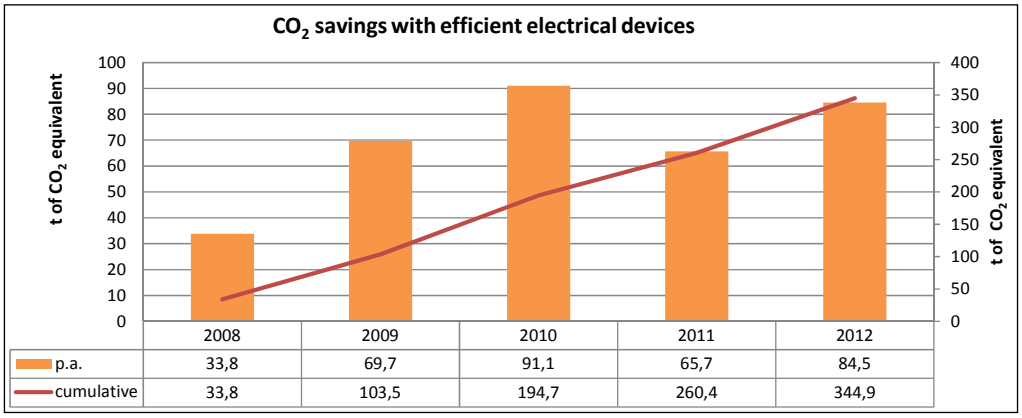


Figure 12: *reduction of CO_2 equivalent due to efficient office equipment and household appliances, source: author's diagram (based on data provided by Municipal Department MA 14)*

Success story: industrial dishwasher for Kindergartens

Between 2008 and 2012 a total of 153 industrial tank dishwashers in compliance with the requirements of the "ÖkoKauf Wien" criteria lists were procured to replace conventional dishwashers in Viennese Kindergartens.

This measure alone saves about 0.5 MWh per dishwasher per year, equalling a total of 85 MWh and approx. 16 t CO_2 equivalent since replacement started.

The new tank dishwashers save energy and water and are efficient in daily use. Annual savings in operational costs of approx. 3,500 € ensures rapid amortisation of this replacement project.

Conclusion: Replacing conventional dishwashers with industrial dishwashers shows how re-assessing present solutions can bring about relevant ecological benefits even for individual products.

Summary of the impact analysis of the activities of the Working Group Electrical Office Equipment, Household and Commercial Appliances

Criteria lists and available data

Working Group WG04, Electrical Office Equipment, Household and Commercial Appliances is concerned with a wide range of procurement products used in different departments of the Vienna City Administration, i.e. it has to apply many different criteria lists .

Both procurement data for the different products and the different versions of criteria lists were widely available for the impact analysis.

Assessments and impacts

Reductions in energy consumption and CO_2 equivalent as well as lower water consumption of efficient household appliances are clear evidence of the impacts. Further reductions and savings were achieved through strict standby-mode management of office equipment.

The excellent data quality made it possible to comprise all assessments in an Excel tool now available as a basic reference for future monitoring.

3.2 Printing, Paper, Office Supply and Office Furniture

PROGRAMME IMPACTS ON PAPER PRINTING OFFICE SUPPLY AND OFFICE FURNITURE - AN OVERVIEW

ECOLOGICAL IMPACTS

Reducing resources:
Greening paper procurement, campaigns for double-sided printing and conscious choice of office supply brought about a reduction of energy and material consumption in this procurement area.

Avoiding damage to the environment:
Concerned with intensive use of chemicals in paper production, „ÖkoKauf Wien" stipulated clear criteria and limit values for the procured types of paper to make purchase of paper eco-friendlie.

Contributing to climate protection:
Conscious procuring according to the ÖkoKauf sample folder and the criteria lists helped to reduce CO_2. Both in office and hygienic paper an annual reduction of 1,060 t CO_2 on average was observed (incl. double-sided printing/copying) equalling an improvement of the CO_2 values of more than 50 percent compared to the procurement of conventional paper products which do not meet the requirements of the sample folder or the criteria catalogues.

SOCIAL IMPACTS

Improving the working and living environment:
Sustainable use of wood as a raw material and protection of this resource through paper recycling contribute to a functioning eco-system and healthy living environments beyond the Austrian borders.

Promoting environmentally conscious behaviour – developing a demand market:
Awareness building measures in the area, e.g. paper consumption for printouts and copies addresses users directly and makes them act more efficiently and less wasteful of resources.

Strengthening initiatives for "environmentally sound procurement":
The WG printing, paper, office supply and office furniture supports procurement initiatives with similar impacts (Austrian Ecolabel, "smart shopping for school"). Intensive cooperation boost the impact of all initiatives in this field.

ECONOMIC IMPACTS

Reducing costs:
Cost reductions due to double-sided and economical printing were not defined.

Influencing the supply market:
Compulsory certification acc. to FSC and PEFC guarantees that primary wood comes from sustainable forestry.

Promoting regional producers of environmentally sound products and services:
Seeing as the paper industry has a clear international focus there is little potential in this respect. Regional providers of office supply and office furniture can only be influenced to a small extent.

Challenges and objectives for Printing, Paper, Office Supply and Office Furniture

Austria is a major user of paper products with an average consumption of 240 to 260 kg of paper per inhabitant and year.8 Statistics show that paper consumption in industrialised countries is above average compared to an international level. Africa, for instance, consumes only 8 kg paper on average per capita.9 77 percent of the paper produced worldwide is consumed by industrialised countries.[10]

The primary raw material for paper production is wood. Cellulose fibres are separated from wood by applying energy and intensive chemical processes. Once the fibres are retrieved they can be used up to six times thanks to recycling.

Approx. 60 percent of the wood required for paper production comes from domestic forestry. In recent years, however, there has been a notable increase in imports. Austropapier, the association of the Austrian paper industry, also reports an increase in imports from Scandinavia, the Baltic states, Russia and the Ukraine, as well as from the West of France and from overseas accounting for a share of 25 percent of total imports.11

What matters most in eco-friendly paper procurement, therefore, is not just the recycling of waste paper but the origin of the primary raw materials which has an impact on the total balance of the end product. CO_2 emissions in the production process and the use of chlorine bleach are also relevant from the ecological point of view.

With office supply, too, using sustainable raw materials is of the utmost importance while making sure that all materials used are recyclable. This includes procurement of products with a high share of waste paper and without substances harmful to the environment.

Base data of the impact analysis for Printing, Paper, Office Supply and Office Furniture

Regarding procurement of printing, paper, office supply and office furniture for departments of the Vienna City Administration the following basic information was analysed:

- "ÖkoKauf Wien" criteria lists for procurement of paper, printing, office supply and office furniture acc. to the "ÖkoKauf Wien" website as of December 2013
- Interview with WG03 working group leader, Irene Geiger / MA 54,
- Database provided by Municipal Department MA 54 on procurement volumes for office paper and hygienic paper
- Complementary information from the evaluation of the Urban Energy Efficiency Programme (SEP) of the City of Vienna, as well as from the progress reports on the implementation of the Vienna Climate Protection Programme (KliP))
- Reports and studies from other relevant institutions as quoted in the text

Procurement situation in Vienna

There are three different types of paper procurement: printing paper, office paper and hygienic paper. For each of these areas there is a criteria list for different paper properties, such as fibrous raw material, dye or bleach, glue or packaging, amongst others. A sample folder for eco-friendly produced printing, office and roll paper according to EU criteria was also produced. Paper for various applications can be ordered directly on the basis of the sample folder and are also used by the City of Vienna printing office.

Office paper

The average consumption of office paper in recent years amounts to approx. 890 t per year. For total paper consumption a distinction is made between white copy paper and paper without optical brighteners/recycling paper. Fluctuations in the annual consumption data are generated by special events like elections, etc. There is no explanation for the consumption peak in the year 2007.[12]

Figure 13 shows the procurement volume between 2005 and 2012:

Both white copy paper and paper without optical brighteners meet the criteria of "ÖkoKauf Wien", which means that for instance wood for all types of paper exclusively originates from sustainable forestry certified by FSC and PEFC and that paper with optical brighteners is bleached without chlorine.

The strong demand for white copy paper can be explained by the low product price and accounts for about two thirds of the total procurement volume incl. annual fluctuation.

Hygienic paper

There are average values for annual procurement of hygienic products for the Municipal Departments and for the Vienna Hospital Association (KAV). On average 740 t of hygienic paper are procured per year.

8 cf. Austropapier (2012), annual report of the paper industry 2012, http://www.austropapier.at/fileadmin/Austropapier/Dokumente/JB_2012/-_Jahresbericht_2012__Letztversion_.pdf, as of 4 February 2014

9 cf. Austropapier (2011), Statistics. International figures 2011, http://www.austropapier.at/uploads/media/Papierindustrie_international.pdf, as of 4 February 2014

10 cf. die umweltberatung (2014), http://www.umweltberatung.at/papierverbrauch-steigt-weiter-an, as of 4 February 2014

11 cf. Grieshofer & Mader (2014), Über die Holzverfügbarkeit (Concerning wood availability), http://www.austropapier.at/fileadmin/Austropapier/Bilder/Zeitschrift/vier_13/22-24.pdf, as of 4 February 2014

12 cf. Programme Environmental Management in the Municipality of Vienna – PUMA (2013), activity report 2005-2011

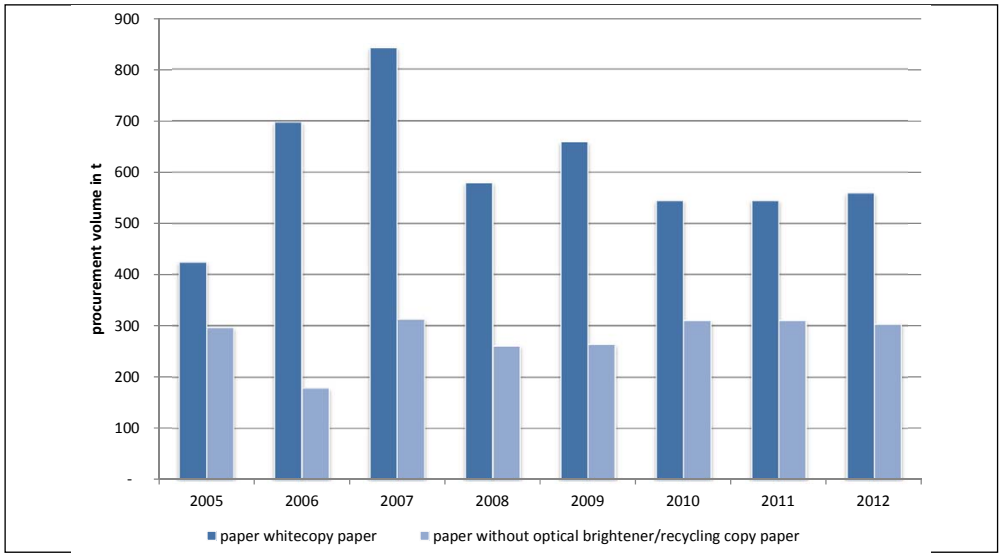


Figure 13: *purchase of office paper for the institutions of the City of Vienna, source: City of Vienna (source of data: Municipal Department MA 54)*

Office supply and office furniture

"ÖkoKauf Wien" pays attention to easy disassembly, reusability and recyclability of the procured office supply.

One objective of the criteria list for office furniture is to restrict materials to a limited number only and to ensure recyclability after use. The persons in charge at Municipal Department MA 54 ensure regular implementation of these requirements. Considering the small number of providers of eco-friendly office furniture the choice of eco-friendly and cost-effective products is limited.

Evaluation methodology / calculation base

All paper products for the City of Vienna are ordered on the basis of the sample folder for eco-friendly printing, office or roll paper or according to the criteria list of hygienic paper. The paper types in the sample folder were assessed and meet the "ÖkoKauf Wien" criteria.

The impact of the criteria lists and the sample folder is evaluated by the means of eco-balance data for recycling paper. A study carried out by the Consumer Association of Austria (VKI) provides a first estimation of damage to the environment caused by procurement of paper for the City of Vienna.13 Emission data for the procured paper types were taken from this study.

Potential savings through use of recycled paper cannot be generalised, since different paper manufacturers and production processes provide different results. Only a project-specific assessment of individual paper producers will provide detailed results. However, one aspect is certainly true, recycling paper clearly has a better eco-balance than primary fibre paper. The Forum Ecology & Paper (FÖP) provides the following balance:

Table 1: *eco-balance of recycling paper and primary fibre paper (FÖP (2012), http://www.blauer-engel.de/_downloads/publikationen/Papierbroschuere.pdf, as of 4 February 2014)*

	per kg recycling paper	per kg primary fibre paper
water	15 Liter	50 litre
energy	2 kWh	5 kWh generated in particular from 1.2 kg non-fibrous components (lignin, hemicellulose) made from 2.2 kg wood
fibre base	1.2 kg waste paper	fibres of 1 kg fibrous components (cellulose) made from 2.2 kg wood
chemical oxygen demand (COD) as measure for ecologically persistent substances	3 g	15 g

It is evident that the production of paper made of primary fibre requires a lot of water and twice as much energy as production from recycled paper.

These statistics are confirmed by the Institute for Energy and Environmental Research Heidelberg. The study compared the total sum of primary energy consumption for paper production made from wood with that for paper produced from recycled paper. Consumption for the production of primary fibres was calculated to be two and a half times higher than for recycling paper.[14]

Since CO_2 emissions are closely linked to energy consumption it is assumed that similar dimensions are true for the CO_2 balance of primary fibre and recycling paper.

[13] cf. VKI – Consumer Association of Austria (2004), Evaluierung der CO_2 Einsparung durch die Anwendung der Ausschreibungskriterien der AG03 für die umweltgerechte Beschaffung von Papier und Druckaufträgen (Evaluation of CO_2 reduction using the WG03 tender criteria for eco-friendly procurement of paper and print orders)

[14] cf. IFEU Heidelberg (2006), Ökologischer Vergleich von Büropapieren in Abhängigkeit vom Faserrohstoff (Ecological comparison of office papers depending on fibrous raw material), http://www.initiative-papier.de/docs/IFEU-Studie_Langfassung.002.pdf, as of 4 February 2014

This is also confirmed by a study on emission values by the Consumer Association of Austria (VKI). Emission values for different types of paper used by the City of Vienna are also taken from the VKI study.

The following calculation is based on the documents provided by the Municipal Department MA 54 and the evaluation study of the VKI on CO_2 reduction by means of ecological procurement.

Office paper

The procured paper types must meet the criteria of the sample folder. The assessment is done with a points-based system in the categories waste water emissions, air emissions, electric energy consumption for production and ecological forestry. The weighted sum total of points for any type of paper may not exceed one hundred and there is also a limit on specific emissions. The following figure shows the weighting of the individual emission criteria and how they are integrated into the calculation of points.

Table 2: *point-based system of sample folder for ecological printing, office and roll paper (ÖkoKauf Wien (2012), www.wien.gv.at/umweltschutz/oekokauf/pdf/papermappe.pdf, as of 18 December 2013)*

calculation				
parameter	**limit value**	**reference value**	**weighting**	**calculation of points**
CSB	≤ 37,5 kg/t	25 kg/t	10 %	$P_{CSB} = 10 \times (CSB_{Paper}/CSBD_{reference})$
AOX	≤ 0,17 kg/t	0.07 kg/t	20 %	$P_{AOX} = 20 \times (AOX_{Paper}/AOX_{reference})$
SO_2	≤ 1,35 kg/t	0.9 kg/t	10 %	$P_{S02} = 10 \times (SO2_{Paper}/S02_{reference})$
NO_x	≤ 3,45 kg/t	2.3 kg/t	10 %	$P_{NOx} = 10 \times (NO_{xPaper}/NO_{xreference})$
CO_2	≤ 1100 kg/t	733 kg/t	40 %	$P_{C02} = 40 \times (C02_{Paper}{}^{1)}/C02_{reference})$
$wood_{CERT}$	≥ 50 %	0 %	10 %	$P_{WOOD} = 10 \times (1 - \%_{WOOD}/100)$
points				$P_{TOTAL} = P_{CSB} + P_{AOX} + P_{S02} + P_{NOx} + P_{C02} + P_{HOLZ}$
assessment				
number of points				$P_{total} \leq 100$
environmental management				needs to be established

[1]) is increased with 400 g CO_2 emission per kWh electric energy

The CO_2 emissions weighting accounts for 40 percent in this calculation scheme which is the highest score. Choosing paper with a low sum total of points is very likely to have a positive effect on the emission balance. One point in the assessment equals up to 18 kg CO_2 per tonne of paper, provided the other emission parameters remain the same.

Based on the VKI study emission reference values for procured office paper were determined. The following CO_2 emission values were taken as a basis for the calculation:

- Paper not qualified for the sample folder 1,100 kg CO_2/t[15]
- White copy paper, e.g. type "Biotop 3" 690 kg CO_2/t[16]
- Paper without optical brighteners/recycled copy paper, e.g. type "Nautilus" 330 kg CO_2/t[17]

The procured paper types are compared to the maximum limit of 1,100 kg CO_2/t paper as required in the sample folder to quantify the CO_2 reduction with office paper.

Hygienic paper

Assessment of hygienic paper is based on limit values required for being awarded the Austrian Ecolabel. As with the criteria list, the basic requirement for this distinction is that for the production of the hygienic paper waste paper only is used as fibrous raw material. For CO_2 emissions the reference value is 1,000 kg/t of hygienic paper.[18] CO_2 emissions are defined on the one hand as emissions caused by combustion of fossil raw material for heat and electricity generation at the production site and, on the other hand, as emissions generated by the electricity purchased in addition.

The supplier for all procured hygienic paper is TORK, the market leader for hygienic paper with a share of 100

[15] cf. ÖkoKauf Wien (2012), http://www.wien.gv.at/umweltschutz/oekokauf/pdf/papiermappe.pdf, as of 18 December 2013

[16] cf. VKI – Consumer Association of Austria (2004), Evaluierung der CO_2 Einsparung durch die Anwendung der Ausschreibungskriterien der AG03 für die umweltgerechte Beschaffung von Papier und Druckaufträgen (Evaluation of CO_2 reduction using the WG03 tender criteria for eco-friendly procurement of paper and print orders)

[17] ibid.

[18] cf. Austrian Ecolabel (2013), guideline UZ 04. Hygienic paper made from waste paper, http://www.umweltzeichen.at/richtlinien/Uz04_R7a_Hgienepapier_2013.pdf, as of 18 December 2013

percent waste paper. The VKI study assumes an average CO_2 pollution of 420 kg/t for the production of this type of paper.[19] This value is clearly below the required maximum limit identified for the Austrian Ecolabel.

To estimate the reduction of CO_2 emissions it is assumed that the hygienic paper purchased before the introduction of the procurement criteria has an emission value of 1,000 kg/t (acc. reference value of the Austrian Ecolabel), which means a reduction of 580 kg/t of hygienic paper.

The results in detail

Office and printing paper

Based on the procurement data between 2005 and 2012 the following reductions of CO_2 emissions were calculated.

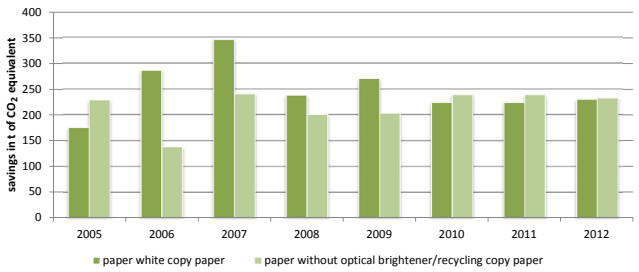


Figure 14: *reduction of CO_2 emissions based on the paper sample folder, source: author's diagram*

With office paper an average annual reduction of 460 tonnes of CO_2 emissions could be achieved through procurement according to the sample folder. In total the emissions regarding office paper were reduced by 3,700 t CO_2 in the aforementioned period.

In recent years recycling paper has had a share of about 50 percent of the CO_2 reductions because of its improved CO_2 balance compared to that of white copy paper.

Hygienic paper

Procurement of hygienic paper made from waste paper caused a reduction of 50 percent of the CO_2 emissions incurred during the production. The following figures show the reduction of CO_2 emissions for the average procurement volume per year achieved by applying the criteria list for hygienic paper.

[19] cf. VKI – Consumer Association of Austria (2004), Evaluierung der CO_2 Einsparung durch die Anwendung der Ausschreibungskriterien der AG03 für die umweltgerechte Beschaffung von Papier und Druckaufträgen (Evaluation of CO_2 reduction using the WG03 tender criteria for eco-friendly procurement of paper and print orders)

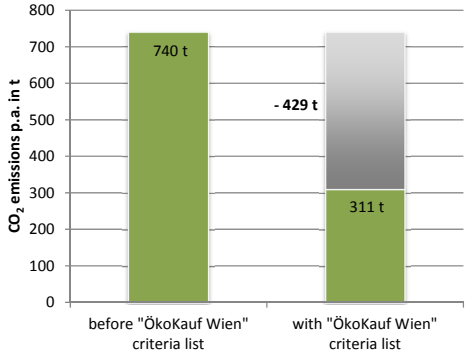


Figure 15: *reduction of CO_2 emissions achieved by applying the criteria list for hygienic paper made of waste paper, source: author's diagram*

Paper in total

In the period under review an average of 900 t CO_2 per year were saved in office and hygienic paper. In total CO_2 equivalent emissions with paper were reduced by 6.300 t CO_2 equivalent between 2005 and 2012. According to the studies above more than 50 percent of CO_2 equivalent emissions were saved on average compared to conventional primary fibre paper. Reducing the use of paper as such saved additional volumes of CO_2 equivalent emissions (see success story: double-sided printing and copying). The following figure shows the aforementioned reductions between 2005 and 2012.

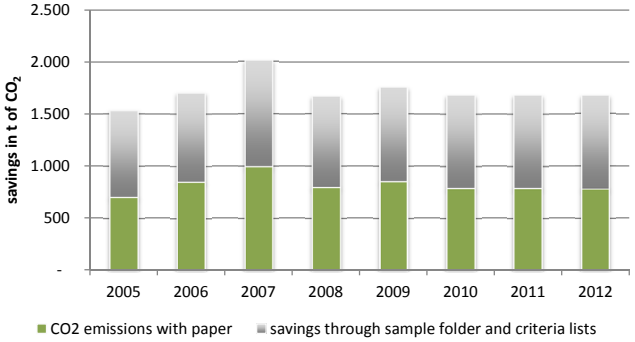


Figure 16: *total reduction of CO_2 emissions with paper, source: author's diagram*

Opting for recycling paper over primary fibre paper has an impact not only on the CO_2 balance. Recycling paper is eco-friendlier in general since the production process is less energy intensive, requiring significantly less water and producing less waste water and air pollution. Another important issue is the fact that recycling of waste paper is a worthwhile way of re-using waste paper so as to protect wood resources.

The criteria of the sample folder integrate all of these aspects in the final assessment. The impact of the sample folder and the criteria list is visible at many levels.

The sample folder where applied is listed in the imprint on printed products as "printed on eco-friendly paper from the "ÖkoKauf Wien" sample folder. This confirms, on the one hand, that the sample folder is used and ecological criteria are applied for procurement of paper and, on the other hand, it communicates the initiative "ÖkoKauf Wien" to the public as an inspiration to follow suit.

Office supply

The criteria list for office supply in general demonstrates forward-thinking procurement and resource saving use of office supplies. All materials must meet the criterion of easy disassembly so that different materials can be separated for recycling. The use of instantly refillable ballpoint pens and pens, for instance, is obligatory where shaft and cap are not made of 100 percent recycled material. As a rule this ensures long-term use of materials, a fact conducive to permanently reducing the use of supply material. No data are currently available on recycling and re-use.

Procurement volumes at the City of Vienna being sufficiently large ecological criteria for the purchase of paper also have an impact on suppliers. Suppliers delivering these paper volumes have already adjusted their range of products to the "ÖkoKauf Wien" criteria, supplying all of their customers with products of this quality.

Success story: double-sided printing and copying

Different departments of the City of Vienna place particular emphasis on reducing the use of paper. Daily consumption of paper in the office can be reduced significantly through double-sided printing and copying while simultaneously enhancing the ecological impact of procurement based on the "ÖkoKauf Wien" criteria lists and sample folder.

Paper consumption was reduced in the long term by about 30 percent through double-sided printing and copying. Current procurement numbers indicate a drop in annual consumption of approx. 300 t of office paper, which means that CO_2 emissions were reduced by yet another 160 t per year through double-sided printing and copying.

Switching to double-sided printing and copying required a change in awareness among staff. To change the behaviour of employees effectively and particularly in the long term, it is necessary for employees to be well informed and accepting of the suggested measures. To this end a comprehensive information campaign for double-sided printing (e.g. mouse pads, stickers, etc.) was initiated and posters for double-sided copying were designed and distributed.

The motto of the information campaign was: "Double-sided printing and copying saves money, folders, archive and storage space, mailing expenses and it also reduces the weight of binders. Our environment says thank you"; "I can do double-sided print outs, what about you?"

Summary of the impact analysis on activities of the Working Group Paper, Printing, Office Supply and Office Furniture

Criteria lists and available data

The sample folder for eco-friendly print, office and roll paper is used for procurement of printing and office paper. Paper types listed in the sample folder were assessed (assessment scheme see sample folder) in the categories waste-water emissions, air emissions, energy consumption for production and ecological forestry. The lower the number of points the better for the environment. Paper types with a sum total of points equal to or less than one hundred are included in the sample folder.

Data for the impact analysis on procurement of office paper were provided by Municipal Department MA 54. Annual demand is 890 t on average.

Hygienic paper for the City of Vienna must be made of recycled waste paper. The criteria list for hygienic paper made from waste paper comprises additional criteria, e.g. paper must not be bleached with chlorine or chlorine containing compounds.

Data for the impact analyses on the procurement of hygienic paper were provided by Municipal Department MA 54. 740 t of hygienic paper is required per year on average.

Assessments and impacts

Impacts of eco-friendly paper procurement are reflected in the reduction in CO_2 equivalent emissions related to procurement.

Impacts were assessed separately for office paper and for hygienic paper. A total reduction of 6,300 t CO_2 equivalent was observed in the period under review between 2005 and 2012. Double-sided printing and copying reduces emissions related to office paper by yet another 160 t CO_2 equivalent per year.

While it was not possible to quantify other parameters it can be assumed that the sustainable procurement concept based on the sample folder also brings about a reduction of energy consumption, as well as a reduction of waste water and air emissions in paper production.

3.3 Disinfection

PROGRAMME IMPACTS ON DISINFECTION – AN OVERVIEW

ECOLOGICAL IMPACTS

Reducing resources:
Efforts of WG Disinfection are focused in particular on avoiding harm to human health and waters.

Avoiding damage to the environment:
Consciously deciding for and procuring disinfectants assessed by WIDES has reduced the amount of persistent substances harmful to the environment and their emissions into sewage to almost zero.

Contributing to climate protection:
Efforts of WG Disinfection are focused in particular on avoiding harm to human health and waters.

SOCIAL IMPACTS

Improvement the working and living environment:
Reducing skin-irritating, allergenic, toxic, carcinogenic and teratogenic components improves the working conditions for employees using the disinfectants and reduces the number of sick leaves due to skin diseases, etc.

Promoting environmentally conscious behaviour – developing a demand market:
Procurement for the City of Vienna has become more sustainable due to WIDES. Major buyers, such as the Vienna Hospital Association (KAV) include environmental and employment protection criteria in their procurement procedures. The media campaign "no disinfectants in private households" ('Nein zur Desinfektion im Haushalt') launched by WG Disinfection points out that disinfection is not necessary for clean private homes, instead it could even cause disadvantages.

Strengthening initiatives for "environmentally sound procurement":
WG Disinfection does a lot of networking at the national and international level and upon invitation presents the WIDES database at international conferences and meetings.

ECONOMIC IMPACTS

Reducing costs:
Procurement of high-quality products (low-risk potential) at KAV did not incur cost increases.

Influencing the supply market:
Suppliers have reacted to the WIDES database and now go to considerable effort to adjust their product range to feature with good assessment results.

Promoting regional producers of environmentally sound products and services:
The WIDES database is a platform for smaller producers of eco-friendly disinfectants, too, giving them the opportunity to set themselves apart with their products.

Challenges and objectives for disinfectants

More than 400 tonnes of disinfectants are used in hospitals, nursing homes, schools and Kindergartens of the City of Vienna. With the rise in antibiotic resistant and dangerous germs, especially in hospitals, as well as strict health standards (e.g. regulation (EC) No. 852/2004) consumption has increased in the last 15 years.

Chemical disinfectants are indispensable for healthcare and other areas of hygienic risk, however, they are also a source of health and environmental hazards. The cytotoxic substances used may cause allergies, eczema or asthma in users. Some ingredients are suspected to be carcinogenic or teratogenic. Once these substances enter waste water treatment plants through the sewage system they can impair the cleaning performance of the sewage treatment plant. Components of low degradability are emitted into the environment, damaging living organisms in water. With no eco-labels for disinfectants available it has been very difficult in the past to choose disinfectants not harmful to the environment and human health. WG Disinfection has contributed significantly to making employment and environmental protection easier and more transparent for the procurement of disinfectants.

Base data of the impact analysis for disinfection

Regarding the procurement of disinfectants for departments of the Vienna City Administration the following basic information was analysed:

- Interview with WG02 working group leader, Marion Jaros / Vienna Ombuds Office for Environmental Protection
- Vienna Database for Disinfectants (WIDES), developed by WG02
- Reports and studies from other relevant institutions as quoted in the text

Procurement situation in Vienna

Institutions and facilities of the City of Vienna use more than 400 tonnes of disinfectants per year. Main users are hospitals, nursing homes, schools and Kindergartens. Disinfectants protect against infections and are indispensable for health protection in the above areas. A disinfectant's main property is its antimicrobial efficiency in the area of application. While the potentially negative effect on the environment and on user health has been known for some time, it was only through the Vienna Database for Disinfectants "WIDES" that it was systematically registered and made readily available for procurers and lay persons. The WIDES database is openly available at www.wides.at, with an English version at www.wides.at/en.

Evaluation methodology – an overview

The WIDES database and its impact on public relations work and awareness building was evaluated for the impact analysis. Relevant data were complemented by its website, as well as by interviews with Marion Jaros.

The impact of WG Disinfection was observed in the following areas:

- Influence on the market
- Potential for substituting disinfectants containing high danger potential
- Establishing an international platform
- Sharing costs with partner organisations
- Awareness building for dangers inherent in disinfectants and disinfecting cleaning agents in private households

The results in detail

Main results of the Working Group Disinfection are seen in the establishment and regular up-dates of the WIDES database, as well as active awareness raising and networking on the topic of disinfection.

Impact on the market

WIDES makes more transparency of disinfectants possible for the market and thus directly promotes more sustainable procurement. The City of Vienna uses disinfectants to a large extent and helps setting market trends with its procurement behaviour and thus causes changes in the supply.

The WIDES database is compulsory for procurement at the Vienna Hospital Association (KAV). Results of the WIDES database were taken into account as set out below:

KAV draws up a binding list of recommendations according to the results of the WIDES database. In addition, a team of hygiene experts compiles a performance profile for all disinfectant groups relevant for KAV. This profile contains information on the amounts required, size of packaging, range of efficacy, etc. Only one criterion relevant for labour protection has been integrated from the very beginning, i.e. "aldehyde free" for all routine applications. Based on the performance profiles a tender for pharmacies was conducted. The products offered were sorted by price and, starting with the most favourable price, were analysed according to the WIDES requirements regarding their effects on the environment and human beings. Fortunately no noteworthy conflicts between price, environment and labour protection criteria were determined. Standards of environmental and labour protection had to be lowered in the case of two surface disinfectants only, as well as with special applications requiring a very wide range of efficacy.

The list of recommendations is to be updated every other year so that any new findings from the data availa-

ble on hazards of disinfectants and interesting new product developments can integrated regularly.

Kindergartens in Vienna also procure their disinfections upon consultation with the ÖkoKauf Working Group Disinfection and according to the WIDES results.

The application of WIDES is recommended by the Austrian Action Plan for Sustainable Public Procurement and by the Austrian study group indoor air quality.[20]

WIDES has become a nationally and internationally recognised and appreciated database. It is therefore very important for producers of disinfectants to achieve good results in the assessment. Products with the worst results at the beginning of the WIDES publications have already been taken from the market.

Substitution potential

The WIDES database helps to identify risk potentials in disinfectants and to substitute them gradually.

A study assigned by „ÖkoKauf Wien" calculated the substitution potential for hospitals of the City of Vienna (consumption data of 1997), arriving at the conclusion that with a total product volume of 23.9 tonnes of surface disinfectants per year an annual substitution of 0.975 tonnes of ingredients harmful to human health and 3.871 tonnes of ingredients harmful to the environment could be achieved, provided the WIDES requirements were fulfilled.[21]

A recent calculation in early 2014 (M. Klade, 2014)[22] investigated the avoidance of hazardous substances for KAV according to its current list of recommendations for disinfectants. For this calculation the products most in use in 1997, i.e. at the beginning of "ÖkoKauf Wien", were applied to the consumption volumes indicated and replaced with the products from the current recommendation list of the Vienna Hospital Association (KAV) (see also above). The calculation has significant practical relevance since compliance with this recommendation list is compulsory except for well-founded reasons.

In this substitution calculation the products mentioned first in the recommendation list were used where possible or old products were replaced with those on the recommendation list which have the same range of efficacy.

For all applications included in the calculation, consumption of toxic, respiratory and skin sensitising chemicals, suspected carcinogenic, mutagenic and teratogenic substances and substances causing long-term harm to the environment is reduced practically to zero when complying with the recommendation list and based on state-of-the-art knowledge.

Changing to the product range indicated in the recommendation list of KAV reduced the risk of allergic contact eczema, allergic asthma, poisoning,[23] possible harm to unborn children, cancer or environmental contamination caused by this highly dangerous product group to the widest possible extent.

The high share of corrosive substances and substances damaging the eye, however, were not reduced significantly. These days corrosive properties are buffered by applying highly diluted concentrates (as low as 0.25 percent) and by more and more effective lipid-replenishing substances in skin and hand disinfectants, which in combination with current, improved skin care products reduced problems to a minimum.

Similarly, the current product range cannot do without non-persistent environmentally hazardous substances. This is also reflected by the WIDES results which do not provide better alternatives to the first ranked wiping surface disinfectant products than those chosen by KAV. However, reducing the share of persistent environmentally hazardous substances by changing to products from the KAV recommendation list is a huge ecological progress in itself. It is assumed that when using biodegradable substances the majority of the substances are degraded in Vienna's waste-water treatment plant and therefore only small amounts will enter surface water.

Overall this result is considered a big success, especially since the drop in especially hazardous substances was managed without raising costs.

[20] cf.) Positionspapier zu Schadstoffvermeidung in Saunaanlagen (Position paper on avoiding pollutants in sauna facilities), Austrian Federal Ministry of Agriculture, Forestry, Environment and Water Management

[21] cf. Klade, M. (2009), Ökologische Effekte von Produktersatz auf Basis von WIDES (Ecological Effects of Product Replacement based on WIDES)

[22] cf. Klade, M. (2014), Wirkungsanalyse der WIDES (WIDES impact analysis), Technisches Büro Klade; February 2014, not published

[23] In private households cases of disinfectant poisoning are for instance more frequent than drug poisoning. cf. http://www.pan-germany.org/download/biozide/Desinfektionsmittel_Hintergrundpapier.pdf

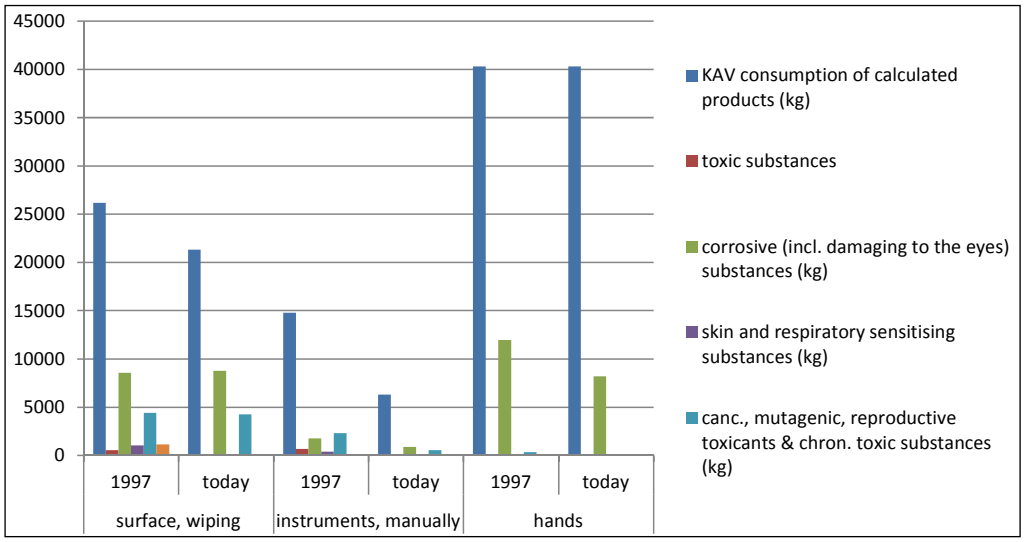


Figure 17: *substitution potential for ascertainable (application of) disinfectants from 1997 compared to products in the current recommendation list of the Vienna Hospital Association (source: Klade, 2014)*

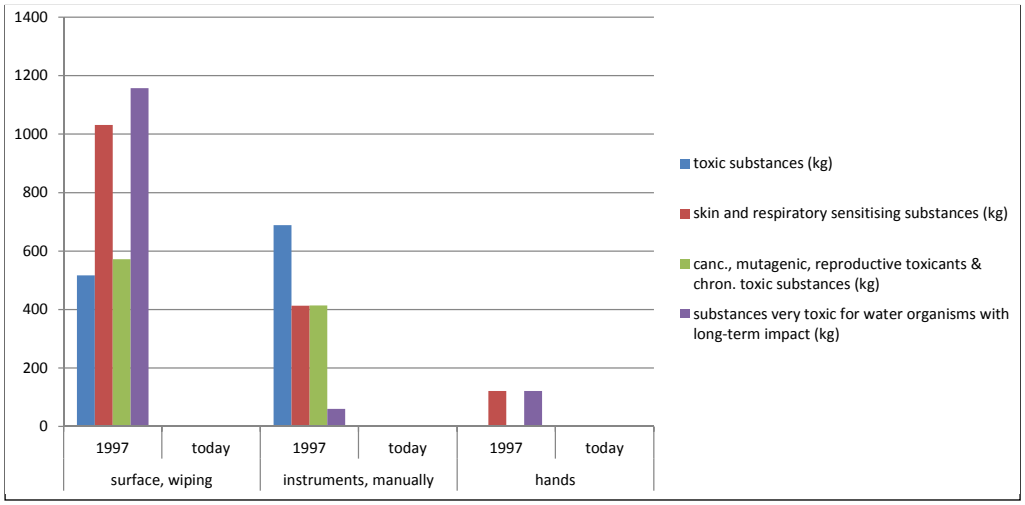


Figure 18: *substitution potential for substances with especially hazardous properties by adhering to the (obligatory) recommendation list of the Vienna Hospital Association (source: Klade, 2014)*

Not all products were included in the calculation, as some of them have been withdrawn from the market and the concentration of the different substances could not be fully researched anymore. Including them into the overall calculation would have provided even better results in the reduction of hazardous substances.

Setting up an international platform

The WIDES database has stirred a lot of interest internationally and has been presented at many conferences and meetings in Germany, Sweden, Belgium, etc. This has triggered an official partnership with Health Care Without Harm Europe, one of the organisers of these conferences, and more networking possibilities with international organisations also interested in sustainable health care.

WIDES has taken over a pioneering role internationally. There is no comparable database for disinfectants worldwide. Many training requests have been received from the US, South Africa, India, the Philippines and Mongolia. Even the WHO is interested in the WIDES database.

The database is also available in English. Although disinfectants vary internationally, the ingredients are more or less the same. Thus WIDES provides reliable results for other countries as well.

Sharing costs with partner organisations

One aim from the very beginning was to share the costs for developing the database and regular updates with other interested organisations. The following institutions supported the project financially, some of them quite substantially.

- AUVA (the Austrian Workers' Association board (annual contribution: 14,000-20,000 €)
- KAV (Vienna Hospital Association)
- BMLFUW (Austrian Federal Ministry of Agriculture, Forestry, Environment and Water Management)
- BG Bau (Central Association of the German Construction Industry)
- Health Care Without Harm Europe

No disinfectants in private households ("Nein zur Desinfektion im Haushalt")

Disinfectants as such are very important in hospitals and in healthcare. In private households, however, regular use of disinfectants and disinfecting cleaning agents has mainly negative effects, e.g. an increase in allergies, harm to the environment due to residual material entering the waters, as well as supporting the development of resistance in germs.[24]

The campaign "No disinfectants in private households" ('Nein zur Desinfektion im Haushalt') was launched to inform citizens about the issue and build awareness for the fact that hygiene at home does not require disinfectants.

The campaign, which incidentally was well received, was necessary because advertising messages are sometimes contradictory and communicate the wrong sense of cleanliness. Dozens of newspaper articles, thousands of information folders, radio infomercials on two popular state-owned radio stations (Ö1 and Ö3), as well as TV reports in the national news (ZIB 2 etc.) show that the "ÖkoKauf Wien" Working Group Disinfection is active well beyond its scope of duties.

Success story: WIDES – The Vienna Database for Disinfectants

Selecting disinfectants with a view to their safety for human health and the environment used to be difficult. There are no eco-labels for disinfectants and case-specific assessment of ingredients and their risk potential is not feasible for bigger procurement volumes.

For this reason "ÖkoKauf Wien", in cooperation with international experts, set up a database to systematically register disinfectants and their ingredients. WIDES (short for the German "**Wi**ener **Des**infektionsmitteldatenbank") now makes it possible to quickly select suitable disinfectants on the basis of their toxic effects on human health and the environment. The database has been publicly available since 2009 and has raised international interest.

The database currently comprises approx. 200 disinfectants for disinfection of surfaces, instruments, hands, skin, dishes and clothes commonly used in Viennese hospitals and whose efficacy is certified by independent hygiene societies.

WIDES users can search for individual products or retrieve a list of product assessments for individual application, using the dropdown selection field in the online template of the database.

Ingredients for all listed products are shown and gaps in information and full assessment are clearly indicated as the case may be. Assessment of the properties toxic to human health and the environment for individual products is provided on the basis of the ingredients. The products are assessed in their application areas according to the following criteria and the result is shown in a colour scale ranging from yellow to red.[25]

Table 3: *evaluated categories of efficacy in WIDES (source: Technisches Büro Dr. Manfred Klade (2013), https://www.wien.gv.at/wuawides/internet/Download/Bewertungsraster, as of 16 December 2013)*

hazards	category of impact
hazards to human health	acute toxicity (respiratory system)
	irritancy and corrosivity
	sensitisation, allergenic potencial
	carcinogenic, toxic for reproduction, teratogenic, mutagenic (CMR) and chronically toxic properties
hazards to the environment	behaviour in surface waters
	behaviour in waste water treatment plants
physical hazards	flammability

The WIDES database has become a nationally and internationally recognised database. It provides the basis for procurement for the City of Vienna and is recommended in the Austrian Action Plan for Sustainable Public Procurement.

The disinfectant producers have also adjusted to the new requirements. It has become a competitive advantage to be assessed well in the database.

The WIDES database has been translated into English and is now available worldwide. Ingredients are similar for most disinfectants, which is why the database provides reliable results internationally as well.

Conclusion: The WIDES database makes the market for disinfectants transparent.

[24] cf. ÖkoKauf Wien (2009), http://www.wien.gv.at/umweltschutz/oekokauf/pdf/desinfektion-folder.pdf, as of 17 December 2013

[25] cf. City of Vienna Database for Disinfectants (2013), https://www.wien.gv.at/wuawides/internet/Start/Overview, as of 16 December 2013

Summary of the impact analysis on activities of the Working Group Disinfection

Criteria lists and available data

The WG Disinfection led by Vienna Ombuds Office for Environmental Protection in cooperation with several organisations set up WIDES, the Vienna Database for Disinfectants. The results of the database are now included in the procurement process of the City of Vienna's institutions. The Vienna Hospital Association (KAV) compiled a recommendation list including the results of the WIDES database.

Assessments and impacts

The WIDES database significantly contributes to transparency on the disinfectant market. Its impact is reflected in rising purchases of disinfectants with low risk potential and in the influence on producers it entails. The amount of substances harmful to the environment or human health has therefore been reduced. Detailed quantification of the reduced harm to the environment and human health requires precise procurement volumes for the individual product groups.

The WIDES database is one of a kind internationally and has subsequently stirred much national and international interest. WG Disinfection has already presented the WIDES database at international conferences and meetings and also does a lot of networking.

3.4 Cleaning

PROGRAMME IMPACTS ON CLEANING - AN OVERVIEW

ECOLOGICAL IMPACTS

Reducing resources:
Efficient use and low dosage of the applied cleaning agents has reduced the procurement volume for the Vienna Hospital Association (KAV) which was taken as an example, by 37%.
This is supported by e.g. the use of microfiber cloth for virtually chemical-free cleaning.

Avoiding damage to the environment:
The criteria list of the WG Cleaning determines content limits to avoid the risk of change or damage to the balance in nature should they be released into the environment. The criteria list for microfiber cloth defines the properties of microfiber cloth to promote chemical-free cleaning. Procurement according to the criteria lists helps to minimise damage to the environment caused by cleaning agents.

Contributing to climate protection:
The results of "ÖkoKauf Wien" for procurement of cleaning agents is mainly targeted at avoiding damage to the environment and human health.

SOCIAL IMPACTS

Improving the working and living environment:
Reducing substances harmful to human health significantly contributes to improving the work conditions for employees who regularly get in contact with cleaning agents.

Promoting environmentally conscious behaviour – developing a demand market:
"die umweltberatung"'s participation in the "ÖkoRein" database helps to make the supply of cleaning agents transparent for consumers and for the industry.

Strengthening initiatives for "environmentally sound procurement":
The KAV experts are renowned for ecological procurement and are in high demand as speakers at national and international expert meetings.

ECONOMIC IMPACTS

Reducing costs:
Reducing the number of cleaning agents procured for KAV for maintenance cleaning caused a cost reduction of 113.000 € between 2009 and 2012 (compared to the tender in 2009). This is an annual reduction of 28,250 € on average.

Influencing the supply market:
Applying the criteria lists in procurement processes and increasing transparency of the cleaning agent market ("ÖkoRein" database) has contributed significantly to influencing the supply market.

Promoting regional producers of environmentally sound products and services:
Production of cleaning agents is dominated by large international enterprises. Measures taken to increase transparency of the market such as the publicly accessible database called "ÖkoRein" provide a platform for smaller producers to present their eco-friendly products.

Challenges and objectives for cleaning

Cleaning agents because of their complex composition often have properties harmful to the environment and human health. Lists of ingredients, while available, are not sufficiently assessed and provide too little transparency for the average user to make their own assessment.

Working Group Cleaning set itself the goal to reduce damage to the environment and human health caused by the use of cleaning agents. This includes protecting users regularly in contact with cleaning agents, as well as minimising the release of toxic or ecologically persistent substances into the environment, e.g. by using microfiber cloth for almost chemical-free cleaning.

To this end Working Group Cleaning issued criteria lists to provide a uniform, scientific basis for sustainable procurement of cleaning agents and microfiber cloth for the departments of the City of Vienna.

Base data of the impact analysis for cleaning

Regarding procurement of disinfectants for departments of the Vienna City Administration the following basic information was analysed:

- "ÖkoKauf Wien" criteria lists for procurement of cleaning agents and microfibre cloths
- Interview with WG10 working group leader, Herbert Nentwich / KAV
- Database provided by KAV on the tender volumes of cleaning agents for maintenance cleaning incl. cost estimate
- Reports and studies from other relevant institutions as quoted in the text

Procurement situation in Vienna

Procurement of cleaning agents for all departments of the City Administration is organised by Municipal Department MA 54 which subsequently distributes cleaning agents to the departments requesting them. Since KAV is a separate institution and has a particularly high demand for cleaning agents procurement there is regulated by its own central tender.

Procurement volumes are available for the impact analysis based on the most recent KAV tender for products of maintenance cleaning.

Compared to 2009 a significant reduction in volume was observed in the most recent tender in 2013, as the following figures show.

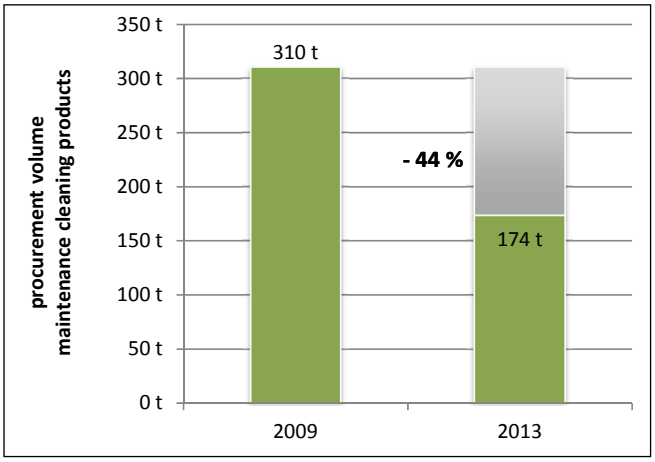


Figure 19: *procurement volumes at KAV for maintenance cleaning products, source: City of Vienna (source: provided database)*

The reduction in volume amounts to 44 percent. One reason for this is the fact that dosage has become more controllable in recent years and nowadays the same cleaning performance can be achieved with smaller doses of cleaning agent.

At the same time the share of cleaning by third parties (incl. the use of eco-friendly cleaning and microfiber products) was increased by about two thirds. Cleaning and microfiber products provided by third-party cleaning companies must meet the "ÖkoKauf Wien" criteria without exception.

Disregarding the share of third-party cleaning companies there is still a reduction of approx. 37 percent which can be traced directly back to lower dosage of the cleaning agents.

Evaluation methodology – an overview

Evaluation of the impact is based on the criteria lists of WG10 and additional information from the interview with the working group leader. The economic assessment was conducted on the basis of the procurement data and cost estimates provided.

The results in detail

The criteria list on the procurement of cleaning agents has the objective of reducing substances damaging to the environment and human health by introducing limit values. Furthermore criteria will be defined in order to guarantee the most efficient use of products. The objective of a separate criteria list for procurement and application of microfiber cloth is to promote a reduction of cleaning agents and single-use cloths, including a recommendation to collect and clean cloth for re-use.

Procurement volumes for the central tender at KAV, see above, show a clear reduction of cleaning agent volumes. An economic advantage was achieved along with a high

eco-friendly level of the procured products: in 2013 a total cost reduction of approx. 113,000 € was achieved compared to the tender in 2009, the equivalent of 37 percent.

The criteria list comprises product groups, such as detergents, cleaning and care products, floor cleaning products and defines bans and limit values for alkali, bleaching agents, builder components, organic solvents, neutral salts, acids, surfactants, fabric softeners, preservatives and additives.[26] To meet the requirements of the criteria list all products must be free of, for instance

- complexants (EDTA, NTA): capable of remobilising heavy metals from sediments
- bleaching agents on chlorine basis: can cause environmentally hazardous effects in waste water
- Formaldehyde and formaldehyde releasers: cause allergies and skin irritations

The "ÖkoKauf Wien" criteria were also included in the "ÖkoRein" database established by "die umweltberatung". The "ÖkoRein" database provides the possibility to list eco-friendly cleaning agents for use in private households and industry. The database comprises only cleaning agents classified by "die umweltberatung" as low-risk for the environment and human health. Additional information is provided if these products meet the "ÖkoKauf Wien" criteria. The database can therefore be used to find out more about the impact of the cleaning agents on the environment and human health and serves as a guide for private households when purchasing eco-friendly cleaning products.[27]

Summary of the impact analysis on activities of Working Group Cleaning

Working Group Cleaning issued two criteria lists with the objective to reduce the use of cleaning agents and to use them most efficiently, while introducing content limits for ingredients to minimise the damage to the environment and human health.

The central tender for cleaning agents at KAV shows a reduced demand for cleaning agents of about 37 percent between 2009 and 2013 due to better control of the dosage of the products. It is currently not possible to quantify the reduction of substances harmful to the environment and human health. It is generated by reduced procurement volumes and the high ecological standards required by the criteria lists. The reduction in volume resulted in a reduction of 113,000 €.

Due to the large procurement volumes at the City of Vienna and its pioneering role in the procurement of ecologically safe cleaning agents there is some potential for influencing the supply market so that products harmful to the environment and human health gradually disappear from the market. Consumers can also be influenced directly this way. It is recommended that activities and the results of Working Group Cleaning are made more public through media campaigns to subsequently influence supply and demand of cleaning agents in the long term.

[26] cf. "ÖkoKauf Wien" (2012), criteria list 10001: cleaning agents, http://www.wien.gv.at/umweltschutz/oekokauf/pdf/reinigung.pdf, as of 4 February 2014

[27] cf. die umweltberatung (2014), ÖkoRein, http://www.umweltberatung.at/oekorein-datenbank, as of 4 February 2014

3.5 Textiles

PROGRAMME IMPACTS ON TEXTILES – AN OVERVIEW

ECOLOGICAL IMPACTS

The WG Textiles focuses its work on the protection of users against chemicals in textiles and on the social aspect of textile processing. No general statement is possible as to the ecological impacts.

SOCIAL IMPACTS

Improving the working and living environment:
The reduction of chemicals in textiles (e.g. T-Shirts, workwear, bed linen, etc.) contributes to a better and healthier working and living environment. The working and living conditions of the people working for the textile industry in low-wage countries are also a very important topic.

Promoting environmentally conscious behaviour – developing a demand market:
By addressing the topic of poor working conditions in the textile industry the WG deals with a globally relevant issue in which the demand-driven market plays a big role. Sustainable change can be brought about by awareness building.

Strengthening initiatives for "environmentally sound procurement":
The WG co-operates with national and international partner institutions and certification companies on the development of socially fair and verifiable procurement criteria.

ECONOMIC IMPACTS

Influencing the supply market:
Suppliers with certified and clean supply chains are to be strengthened in the future by obligatory certifications according to OEKO-TEX® Standard 100 and by stricter socially relevant procurement criteria.

Promoting regional producers of environmentally sound products and services:
Since international major suppliers dominate the market it is hardly possible for "ÖkoKauf Wien" to take any influence. However, regional suppliers can be motivated to develop a more sensitive social awareness by disclosure of the supply chain throughout the processes of production to retail (e.g. certificates issued by independent monitoring organisations such as Fair Wear Foundation).

Challenges and objectives for textiles
The production chain for textiles is in most cases highly complex. The cultivation of cotton, fabric and cloth processing, as well as cutting and sewing activities are mostly done in different countries. The ways textiles go are longsome and no longer traceable for final consumers.

The majority of the textiles sold in Europe are made in low-wage countries. The working conditions in the textile factories are poor – and big textile producers usually remain silent about this fact. Processing and dyeing is done with environmentally unsound chemicals which are a considerable hazard to the workers' health due to lacking safety regulations and which are also present in final products.

Textiles pass through many chemical processes combined with the emission of environmentally unsound pollutants, such as formaldehyde, heavy metals, pesticides, chlorinated benzenes und phenols, phthalates, organotin compounds, dye and other chemical residues. Avoiding these substances is pre-requisite for "OEKO-TEX® Standard 100" which is also a criterion for procurement according to "ÖkoKauf Wien".

The Working Group Textiles has set its goal of sustainable textile procurement according to two aspects: avoiding substances which are hazardous to human health and compliance to fair working conditions in the countries of production.

Base data of the impact analysis for textiles

Regarding the procurement of textiles for departments of the Vienna City Administration the following basic information was analysed:

- "ÖkoKauf Wien" criteria lists for procurement of textiles
- Interview with WG20 working group leader, Herbert Nentwich / KAV
- Reports and studies from other relevant institutions as quoted in the text

Procurement situation in Vienna

Textiles range from outerwear (T-shirts, work wear) to bed linens. The procured textiles need to meet the "ÖkoKauf Wien" criteria and to have the properties required for the respective area of application.

The "ÖkoKauf Wien" criteria, including a ban on and limitations of environmentally unsound components, as well as social aspects, e.g. a ban on child labour, have been implied by the City of Vienna (MA 54, KAV) since 2009.

The City's procurement regulations have set forth many requirements to guarantee social and fair procurement. The labour and social standards of the ILO (International Labour Organisation) contain specifications such as the ban on child labour, equal pay for equal work, living wages, freedom of association, safe and healthy working conditions, etc. It has shown to be difficult overall to verify these socially relevant requirements, however, the objective of the working group is to define verifiable criteria and to demand their implementation.

Evaluation methodology – an overview

The work of the Working Group Textiles was evaluated according to the respective "ÖkoKauf Wien" criteria list. Additionally the OEKO-TEX® Standard 10028 required by this list was assessed according to its procurement regulations.

The results in detail

In the textile industry it is seldom possible to verify the ILO labour and social standards – and this is additionally hampered by complex chains of custody. Therefore the WG Textiles has set itself the goal to define in detail socially relevant requirements and especially to concentrate on verifiable criteria.

The textile industry has about 20 to 25 different labels that in part focus on different segments of textile production. The Working Group Textiles opted for the OEKO-TEX® Standard 100, since this label is verifiable and independently certified in contrast to many others.

OEKO-TEX® Standard 100 analyses products as to many components. Textiles for babies and toddlers need to comply with the requirements of product class I according to OEKO-TEX® Standard 100, textiles largely used in direct contact with the skin need to meet those of product class II.

In intensive co-operation with national and international organisations, verifiable criteria have been defined that are currently tested by "ÖkoKauf Wien" as to their feasibility in practice.

According to the draft the following criteria are to be met unconditionally:

- No child labour
- No forced labour
- No discrimination at work
- Freedom of association and the right to collective bargaining.

It is recommended to adhere to the following additional criteria: living wage, no excessive working hours, a safe and healthy working environment, legally binding work contracts.

Compliance with these criteria and possible measurements to improve the situation are to be verified by an external inspection authority and to continuously be monitored by an appropriate system. Additionally membership in the Fair Wear Foundation, or alternatively a certification of the supplier chain according to SA 8000, needs to be provided.

Summary of the impact analysis of the activities of the Working Group Textiles

The WG Textiles elaborated a criteria list which strives towards a reduction of chemical substances in textiles and fair working conditions in the procurement chain.

According to the criteria list textiles for babies and toddlers and clothes in direct contact with the skin are only procured when they have the respective certification according to OEKO-TEX® Standard 100. The criteria list already comprises socially relevant minimum requirements for the procurement of textiles. This part will be expanded in the future and will be complemented by testing and acceptance criteria. The proposal for the text is presently in revision and will be integrated into the textiles criteria list after positive appraisal.

[28] cf. OEKO-TEX®, Zurich (2009), OEKO-TEX® Standard 100, http://www.wien.gv.at/umweltschutz/oekokauf/pdf/textilien-beilage.pdf, as of 6 February 2014

3.6 Vehicle Fleet

PROGRAMME IMPACTS ON VEHICLE FLEET - AN OVERVIEW

ECOLOGICAL IMPACTS

Reducing resources:
As to HGVs, improvements due to stricter exhaust emission standards primarily have an impact on the reduced air pollutants. Significant reductions in fuel consumption had been achieved due to the introduction of measures taken to improve efficiency even before the relevant criteria lists were set up.

Avoiding damage to the environment:
The "ÖkoKauf Wien" programme facilitated significant reductions in HGV pollutant emissions by anticipating the emission classes EURO 5 EEV and EURO 6.
Reductions between 2010 and 2013: NO_x approx. 9 t, CO approx. 76 t, NMHC approx. 25 t, particulate matter 0.6 t.

Contributing to climate protection:
The reduction of fuel and consequently of CO_2 equivalent in diesel engines for HGVs was achieved with the implementation of EURO class 5 and thus largely before the relevant criteria lists came into force.
On the basis of the criteria lists reductions of the air pollutants NO_x and NMHC were scored which are a significant factor for damage to forests and which are precursor pollutants for the development of low-level ozone, i.e. harmful to the environment and human health.

SOCIAL IMPACTS

Improving the working and living environment:
Significant reduction of the hazardous substances NMHC and CO, as well as particulate matter.

Promoting environmentally conscious behaviour – developing a demand market:
Pioneering role and role model in the procurement of environmentally friendly vehicles.

Strengthening initiatives for "environmentally sound procurement":
Within the scope of the relevant departments of the City of Vienna.

ECONOMIC IMPACTS

Reducing costs:
The slightly higher consumption of diesel for HGVs as of the EURO 6 standard is compensated by the economical benefit arising from the reduction of air pollutants that are harmful to the environment and human health. Monetary assessment of the economic benefit according to EU Directive 2009/33/EG
2010-2013: approx. 113,000 € per year (price basis of 2007)

Influencing the supply market:
By pioneering role in procurement.

Promoting regional producers of environmentally sound products and services
Not feasible on the international automobile market.

Challenges and objectives regarding Vehicle Fleet
Traffic is one of the main causes of greenhouse gas emissions in Austria, ranking third behind the industry and manufacturing. In 2010 traffic caused 26.6 per cent of greenhouse gases in Austria, i.e. the highest increase with a plus of 60 per cent (equalling 8.4 million t of CO_2 equivalent) since 1990.[29]

[29] cf. Environment Agency Austria (Umweltbundesamt) (2012), Vienna Climate Protection Report (Klimaschutzbericht) 2012 (REP-0391), p. 23

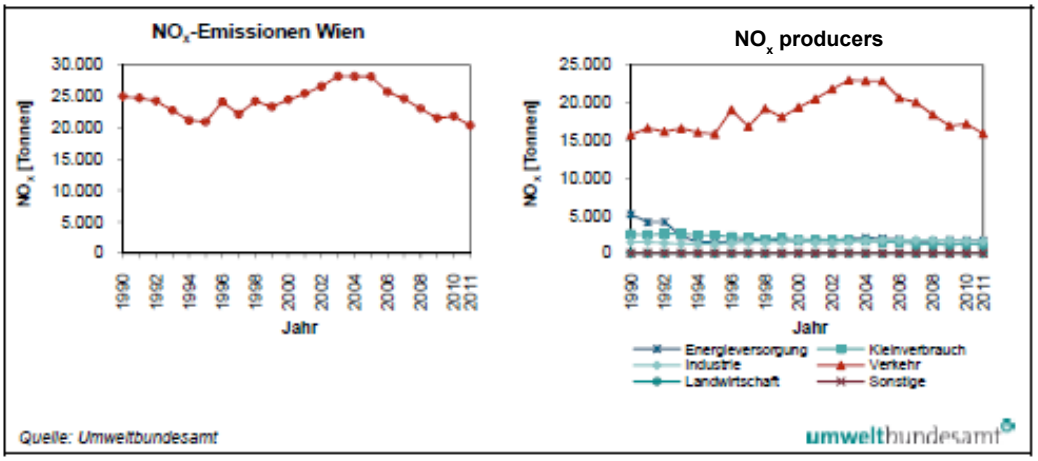


Figure 21: *NO_x emissions in Vienna in total and sectors, 1990-2011 (source: Environment Agency Austria, REP-0445, 2013)*

With its 20 per cent of the Austrian population, Vienna, the country's most populous Federal Province, held a share of total greenhouse gases of 11 per cent in 2010 (equalling 9.0 million t of CO_2 equivalent).

Traffic is one of the main causes of greenhouse gas emissions in Vienna with 37 percent, followed by energy supply (35 percent) and small-scale energy consumers (18 percent), 93 percent of the emissions are CO_2.

Between 1990 and 2011 Vienna's traffic developed a plus of 56 percent (+ 1.19 million) causing the biggest increase in emissions.

Between 2005 and 2009 emissions were reduced due to the use of bio-fuels and improved efficiency, in addition to declining fuel sales caused by the economic crisis.

The development of the years 2009 to 2011 reflects both the degree of economic recovery by increased fuel consumption in traffic, especially in freight traffic, and the cushioning effect of increasing fuel prices.[30]

Traffic also causes a sizeable share of locally impacting air pollutants and is by far the biggest polluter of NO_x emissions in Vienna with a share of 78 percent (2011) of total NO_x emissions. NO_x is a precursor pollutant for the development of low-level ozone and thus harmful to the environment and human health.[31]

Since 2004 NO_x emissions have been declining which can be attributed to the cushioning effect of the weak economic situation and primarily to technological progress in engine construction, as well as the continuous renewal of the vehicle fleet.[32]

The share of Vienna's traffic in volatile non-methane hydrocarbons lies at 11 percent of the sum total of pollutant emissions (three quarters of emissions in Vienna are caused by the production of solvents – see item 4.1, Interior Work). In the last two decades the traffic sector reduced its share by 82 percent (equalling about 9 kt), i.e. the largest reduction in emissions of NMVOCs of all sectors. This was made possible by introducing stricter exhaust emission limits and using more diesel vehicles.[33]

Furthermore traffic is the most serious emitter of particulate matter in Vienna. With a share of 44 percent of

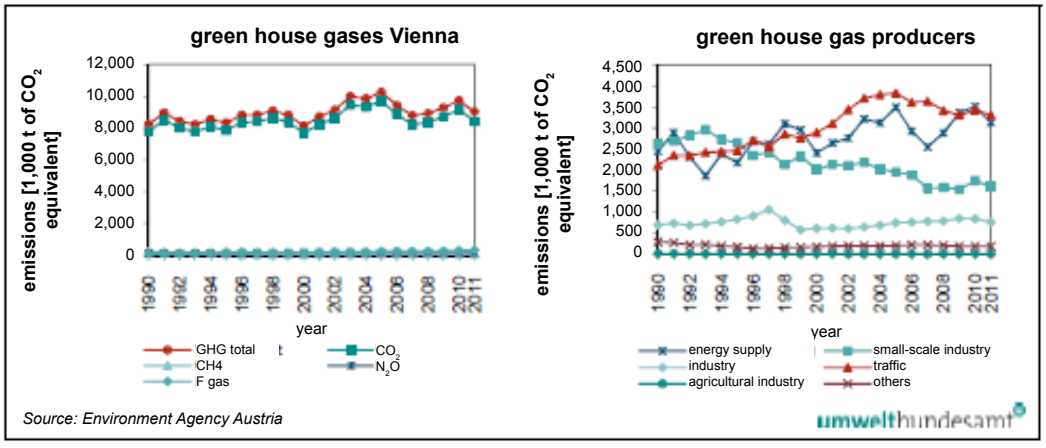


Figure 20: *greenhouse gas emissions in Vienna in total, in gases and sectors, 1990-2011 (source: Environment Agency Austria, REP-0445, 2013)*

[30] cf. Environment Agency Austria (Umweltbundesamt) (2012), Austria's Annual Air Emission Inventory (Bundesländer Luftschadstoff Inventur) 1990-2011 (REP-0445), p. 141f.

[31] cf. Environment Agency Austria (Umweltbundesamt) (2012), Austria's Annual Air Emission Inventory (Bundesländer Luftschadstoff Inventur) (REP-0440), 1990-2011 (REP-0445)

[32] cf. Environment Agency Austria (Umweltbundesamt) (2012), Austria's Annual Air Emission Inventory (Bundesländer Luftschadstoff Inventur) (REP-0445), p. 149f.

[33] ibid.

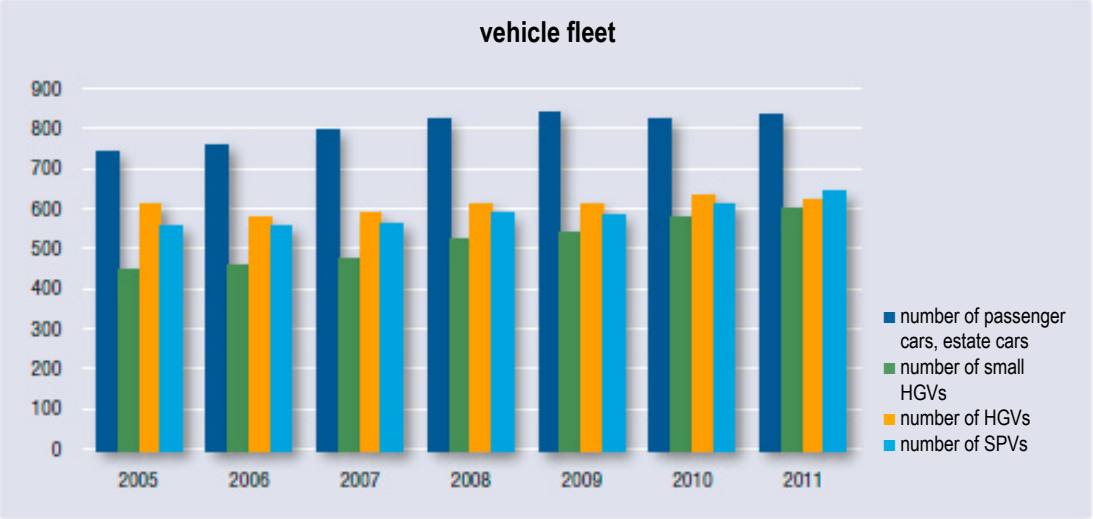


Figure 22: *number of vehicles of the Vienna City Administration (source: vehicle administration of the City of Vienna ("*Kraftfahrzeugverwaltung der Stadt Wien*") – vehicle table, from the PUMA activity report 2005-2011)*

particulate matter emissions (2011) it is ranked far ahead of the small-scale energy consumers and the industrial sector. The introduction of particle filters in recent years has helped to significantly reduce the harmful effect on the environment and human health. Particulate matter emissions in traffic were reduced between 2000 and 2011 (-36 percent PM2.5 and -22 percent PM10).[34]

The air pollutant CO is as relevant as particulate matter on account of its harmful effect on human health. CO emissions in Austria decreased by 57.6 percent to 608,800 t between 1990 and 2011. Optimised combustion and the introduction of catalysts have brought about significant emission reductions in the traffic sector.[35]

Vehicle fleet of the City of Vienna

Traffic and vehicle related environmental measures within the Vienna City Administration can be implemented with regard to the number of motorised vehicles, their fuel consumption and vehicle performance.

The overview on the number of vehicles in the Vienna City Administration shows an upward trend which can be seen practically throughout the City Administration and to the same extent. About two thirds of the whole vehicle fleet of the Vienna City Administration is made of small HGVs, HGVs and special-purpose vehicles which are operated by the City's departments in fulfilling their duties.[36]

The main fuel used is mineral diesel. Petrol and natural gas are of minor importance in the overall analysis.[37]

With regard to the regular renewal of the vehicle fleet, the procurement of vehicles with eco-friendly technology and good emission values has become relevant.

Base data of the impact analysis for the vehicle fleet

Regarding the procurement of motorised vehicles for departments of the Vienna City Administration the following basic information was analysed:

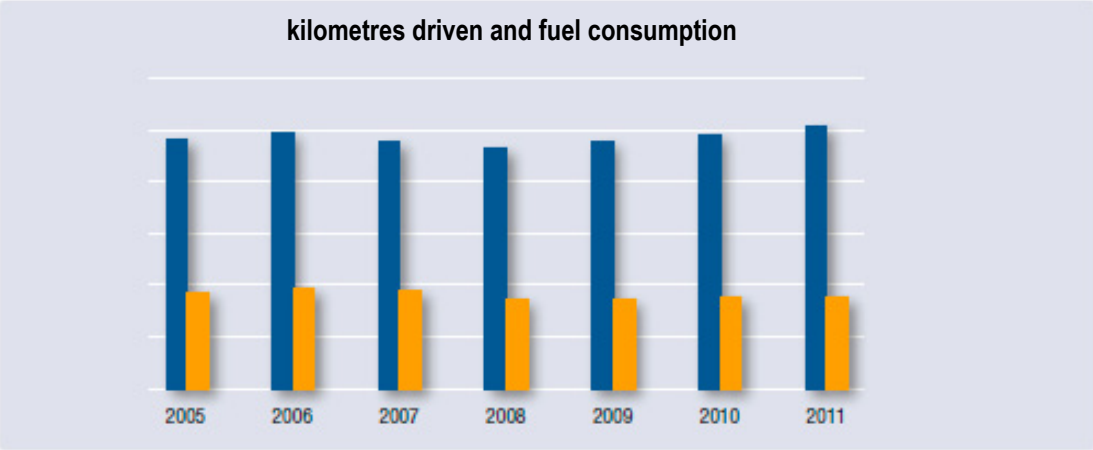


Figure 23: *mileage and fuel consumption (source: departments with vehicles, from the PUMA activity report 2005-2011)*

[34] ibid.

[35] cf. Environment Agency Austria (Umweltbundesamt), http://www.umweltbundesamt.at/umweltsituation/luft/luftschadstoffe/co/, accessed: 27 January2014

[36] cf. Environmental Management Programme in the Vienna City Administration PUMA (2011), activity report 2005-2011, p. 21

[37] cf. PUMA activity report 2005-20011, p. 21

- "ÖkoKauf Wien" criteria lists for the procurement of a vehicle fleet, as of June 2010 (small vehicles) and August 2010 (passenger cars, HGVs, tractors, municipal vehicles, construction vehicles, transportation capacity)
- Interview with WG05 working group leader, Martin Wabeck / MA 48
- Data base provided for the procurement of motorised vehicles by MA 48, 2003-2013
- Calculations provided by MA 48 on ecologically relevant reductions in a standard HGV
- Complementary information from the evaluation of the Urban Energy Efficiency Programme (SEP) of the City of Vienna, as well as from the progress reports on the implementation of the Vienna Climate Protection Programme (KliP)
- Reports and studies from other relevant institutions as quoted in the text

Procurement Situation of the City of Vienna

Out of the wide range of motorised vehicles which are procured for the Municipal Department MA 48, HGVs were investigated as an example for the impact analysis. A typical HGV (waste collection vehicle) was analysed to illustrate the impact of the application of the "ÖkoKauf Wien" criteria list.

The implementation of the exhaust emission standards (EURO classes) was taken as an indicator of eco-friendly procurement. The following diagram shows the HGV procurement by MA 48 over time.

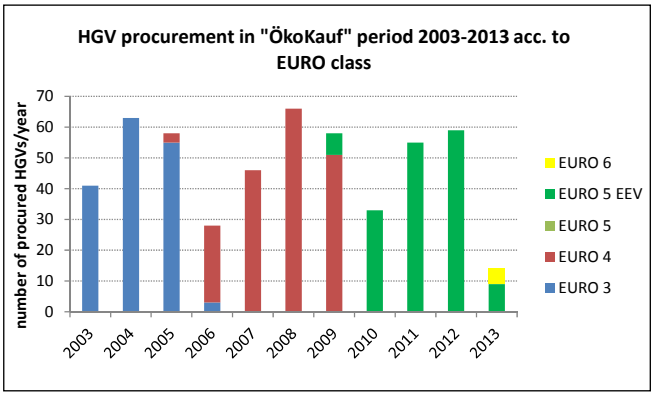


Figure 24: *HGV procurement of MA 48 between 2003 and2013, source: City of Vienna (data source: MA 48)*

By implementing the "ÖkoKauf Wien" criteria lists, approx. 170 HGVs with EURO 5 EEV and EURO 6 engines were procured by MA 48 over the past years, that is about a quarter of the total stock of HGVs of the Vienna City Administration (cf. Figure 24).

Evaluation methodology

In order to evaluate the ecological and economic impacts regarding the vehicle fleet which can directly by allocated to the "ÖkoKauf Wien" programme, the provisions of the "ÖkoKauf Wien" criteria lists were compared to the exhaust emission standards for HGVs (EURO classes) which were in force at the date the "ÖkoKauf Wien" criteria lists were introduced according to Austrian law. The following list shows the date of the national implementation of the different EURO classes compared to the introduction of the "ÖkoKauf Wien" criteria lists for passenger cars and HGVs (table on EURO standard emissions limits for HGVs, see annex item 8.5.1.3).

Table 4: *Implementation dates of the various "EURO classes"*

		EURO 3	EURO 4	EURO 5	EURO 5 EEV	EURO 6
passenger cars	Austrian law	2001	2006	2011		2015
	ÖkoKauf criteria list			08/2010		
HGVs	Austrian law	2001	2006	2009		2014
	ÖkoKauf criteria list				08/2010	2013

Comparing the "ÖkoKauf Wien" criteria lists and the emission standards for the registration of new HGVs required by law emphasises the pioneering role of the programme regarding vehicle procurement and especially concerning HGVs:

- The procurement of EURO 5 EEV HGVs was mandatory due to the "ÖkoKauf Wien" criteria of August 2010.
- Initial EURO 5 EEV HGVs were foresightedly procured in 2009, even before the respective criteria list was published.
- From 2013 onwards the "ÖkoKauf Wien" criteria provided for the procurement of EURO 6 HGVs and thus set stricter standards than required by law which stipulated that newly registered HGVs are obliged to meet the EURO 6 requirements for engines only from January 2014 (the procurement of EURO 5 EEV vehicles in the year 2013 can be explained by longer delivery times). The procurement of EURO 6 HGVs in 2013 on the basis of the "ÖkoKauf Wien" criteria was an example of forward-thinking and environmentally friendly action.

Calculation base

The following calculation was based on a typical HGV of the Vienna City Administration whose procurement is processed by MA 48:

HGV type:	**MAN TGS 26320**	
usage:	**waste collection HGV**	
kilometres driven:	[km/a]	20,000
average consumption:	[l/100km]	60

Applied to this example HGV the following maximum permissible emission limits were calculated according to the respective EURO classes:

		MA48: typical HGV (waste collection HGV) 20.000 km/year, 65 l/km				
		EURO 3	EURO 4	EURO 5	EURO 5 EEV	EURO 6
diesel consumption	[l/a]	13,963	13,963	13,000	13,000	13,138
CO_2	[kg/a]	36,723	36,723	34,190	34,190	34,552
NO_x	[kg/a]	680	680	260	238	36
PM	[kg/a]	11	11	3	1	0
CO	[kg/a]	419	209	195	15	2
HC	[kg/a]	200	140	6C	2	0

According to the table above the procurement of a EURO 5 HGV (the standard for new HGVs as required by law as of 2009) made it possible to reduce the CO_2 emissions significantly compared to the EURO 3 and EURO 4 standards. With the given example HGV fuel consumption was reduced by 963 l diesel per year, i.e. a reduction of 2.5 t CO_2 per year and vehicle. These environmental impacts were achieved during the "ÖkoKauf Wien" programme and the existence of the Working Group Vehicle Fleet. However, since there was no "ÖkoKauf Wien" criteria list at that time of changing to EURO 5, these improvements cannot directly be allocated to the effects of the programme.

The present analysis only allocates pollutant reductions to the "ÖkoKauf Wien" programme as an impact which were achieved by applying the respective higher EURO class required by the "ÖkoKauf Wien" criteria list, if respective criteria lists were applicable at the time of procurement of a new HGV. The impacts are mainly the reduction of air pollutants (NO_x, CO, NMHC, particulate matter).

The results in detail

The ambitious objectives of the "ÖkoKauf Wien" criteria regarding its pioneering role are demonstrated by the implementation of the criteria list for the procurement of HGVs from August 2010 onwards. The list required compliance with the stricter exhaust emission standards EURO 5 EEV compared to the EURO 5 standards when procuring an HGV for the City of Vienna.

Between 2010 and 2013, MA 48 procured approx. 170 EURO 5 EEV HGVs according to the "ÖkoKauf Wien" criteria list. Right after procuring EURO class 4 HGVs which were mainly bought between 2006 and 2009, MA 48 exclusively procured EURO 5 EEV HGVs from August 2010 onwards, i.e. EURO class 5 was de facto "skipped".

While the limits for CO_2 equivalent emissions largely remained unchanged over the years, the implementation of the EURO 5 EEV standards brought about significant reductions regarding air pollutants NO_x, CO, HC and particulate matter which are clearly above the legally required EURO class 5, as illustrated by the diagram.

In the years between 2010 and 2013 the overall reduction of emissions for all EURO 5 EEV and EURO 6 HGV procurements compared to the legally required exhaust emission standards amounted to the following:

savings HGV pollutant emissions through procurement of EURO 5 EEV in t, 2010-2013	
NO_x emissions:	9.1
PM emissions:	0.6
CO emissions:	76.2
HC emissions:	24.7

And finally, excerpts from price evaluations of environmental costs for road vehicles (prices as of 2007) were taken as a basis for the economic assessment of the reduction of pollutant emissions in accordance with EU Directive 2009/33/EC. The following reductions were assessed:

monetary analysis of environmental costs acc. to EU Directive 2099/33/EC			
		€/kg	AMOUNT
CO_2	€/kg	0.03	0
NO_x	e/g	0.0044	40-260
PM	e/g	0.087	47,954
CO	X	X	X
HC	€/g	0.001	24,694
estimated savings of external costs 2010-2013		TOTAL	112,908

The assessment of reduced external costs which do not yet need to be borne by the national economy when procuring an HGV – thanks to the application of the high environmental standards required by the "ÖkoKauf Wien" criteria list – serves as an example to illustrate the impacts of the programme.

Success story: alkylate petrol

The City of Vienna operates about 3,000 two-stroke petrol-driven devices (such as brush cutters, motor saws, petrol hedge trimmers and lawn mowers, etc.) which are in regular use.[38] Users are very close to the exhaust pipes and therefore intensively exposed to exhaust emissions. Due to construction the exhaust emissions of such devices are significantly higher than in vehicles with catalytic converters, thus producing a high share of unburnt fuel that is harmful to the environment and human health. The residues of commercially available fuel inhaled by the users contain different components that are harmful to the environment and human health.

For this reason the Working Group Vehicle Fleet of "ÖkoKauf Wien" developed a criteria list for the procurement of the special fuel alkylate petrol for better work hygiene and for the protection of the employees of the City of Vienna using two-stroke petrol-driven devices close to the body.

Whoever uses alkylate petrol at work realises immediately that this fuel practically burns smoke and soot-free. But there is much more to it: Alkylate petrol is largely free from substances harmful to human health, such as benzene, lead or sulphur. It is also largely free from aromatic hydrocarbons which have a high ozone formation potential. By replacing conventional fuel with alkylate petrol damage to the environment and human health can significantly be reduced.

The procurement of new devices always works best, if procurers and users join forces: for this reason "ÖkoKauf Wien" invited future users of alkylate petrol to take part in product tests and to share their experience with the working group setting up the criteria list. 129 users from different municipal departments took part in the test programme for alkylate petrol and filled in a questionnaire sharing their individual assessments regarding the usability of the product.

The tests showed that the cold start behaviour of alkylate petrol is poorer than that of conventional fuel, while re-starting the engine with petrol is better. In terms of in-service behaviour, alkylate petrol and conventional fuel were shown to be equivalent.

Significant improvement was perceived regarding smell, smoke emission and overall well-being. More than 80 percent of the respondents assessed the new petrol as a high-grade alternative to the previously used petrol, i.e. the change to alkylate petrol was conceived positively.

Conclusion: the "ÖkoKauf Wien" criteria list alkylate petrol has a major impact in small devices.

[38] cf. PUMA activity report 2005-2009, p. 21

Summary of the impact analysis of the activities of the Working Group Vehicle Fleet

Criteria lists and available data

The Working Group Vehicle Fleet (WG05) worked out criteria lists for several types of motorised vehicles and devices especially reflecting the range of activities of the Municipal Department MA 48.

The procurements are documented in detail by MA 48. The available databased on the documentations of MA 48 were well-suited for analysis.

Assessments and impacts

It was possible to show the impacts of the "ÖkoKauf Wien" programme especially for HGVs by applying the criteria lists with stricter exhaust emission standards than stipulated by Austrian law. Environment-related reductions mainly affected air pollutants such as NO_x, CO, NMHC and particulate matter. On the basis of an EU Directive a monetary assessment of the economic benefits of these reductions is feasible.

As a best-practice example the introduction of alkylate petrol for petrol-driven small devices shows the wide-ranging effects into different areas of the working group.

4 Impact analysis focusing on "eco-friendly building in Vienna"

This chapter addresses a series of challenges for eco-friendly procurement in the building industry and comprises the results of the following "ÖkoKauf Wien" working groups:

- Interior Work
- Building Construction
- Technical Services – Efficient lighting
- Technical Services – Water saving sanitary installations
- Green and Open Spaces
- Environmentally Sound Construction Site Logistics and Public Works

Due to the different phases and subtasks of public construction projects "ÖkoKauf Wien" provides criteria lists as an compulsory basis for procurement, as well as directives, guidelines and studies as references and working documents for the relevant departments of the Vienna City Administration. The following conclusions can be drawn from the impact analysis of the focus "eco-friendly building in Vienna":

- The quantitative assessment of the results of the working groups Building Construction, Interior Work and Technical Services which procure construction works and construction-related products and components on the basis of obligatory criteria lists identified comprehensive ecological, social and economic impacts.
- Regarding environmentally sound construction site logistics there is a lot of potential for the implementation of the objectives of the "ÖkoKauf Wien" programme. Amongst others, further potential could be addressed regarding the procurement of ground surfaces in open spaces and in the field of public works. At the moment the results are primarily available as recommendations and studies.
- Beside the topic of interior lighting which is already included in the "ÖkoKauf Wien" programme, additional potential is seen in a very large field which has only marginally been addressed, yet in which significant reductions of energy consumption and CO_2 emissions could be implemented: exterior lighting.

The impact analysis identified the following important impacts and potentials of the programme:

ECOLOGICAL IMPACTS:

Reducing energy and water consumption for technical services

- Reducing energy consumption with efficient interior lighting of approx. 7,200 MWh per year, this equals the annual energy consumption of approx. 2,000 private households.
- Reducing water consumption of approx. 88,000 m^3 by means of water-saving cisterns and fittings.

Avoiding pollutant emissions

- The areas of public works and interior work make an important contribution regarding the reduction of VOC emissions. In 2012 more than 4,100 kg of solvents were avoided. Between 2008 and 2012 the overall reduction of solvent emissions was approx. 40,000 kg compared to an average scenario of available products for public works and interior work. The levels of solvent emissions of the worst legally permitted construction products are more than ten times higher than the VOC emission levels of construction products meeting the "ÖkoKauf Wien" criteria. Furthermore substances in construction products which are harmful to human health and the environment (biocides, heavy metals, etc.) were repelled due to the criteria lists and the strong demands pronounced by the City of Vienna.
- There is a lot of potential in applying the findings of already existing pilot projects on environmentally sound construction site management on the basis of future "ÖkoKauf Wien" guidelines and criteria lists. Significant reductions in pollutants and noise can be achieved by minimising construction site traffic.

Contributing to climate protection

- By saving approx. 1,525 t CO_2 equivalent, environmentally friendly procurement regarding technical services and Interior Work contributes each year to achieving the climate change target of the City of Vienna. The largest share of the savings is achieved by the procurement of environmentally friendly interior lighting (approx. 1,400 t CO_2 equivalent per year). Additional savings in CO_2 equivalent can be obtained by the economical use of warm water (approx. 88 t CO_2 equivalent) and by applying environmentally sound construction products for the interior (approx. 37 t CO_2 equivalent) – data of 2012.

- On the basis of a study on the sustainability of different ground surfaces in open spaces assigned by "ÖkoKauf Wien" clear differences in the various surfaces were identified regarding energy expenditure and CO_2 equivalent. These potentials could be utilised for the procurement of the City of Vienna by working out and publishing a respective "ÖkoKauf Wien" criteria list.
- By avoiding transportation activities in construction, e.g. by applying cast-in-place concrete plants and recycling excavated gravel or by using the railway and shipping routes, additional potentials could be implemented to reduce fuel consumption and related CO_2 equivalent.

SOCIAL IMPACTS:

Improving the working/living environment through pollutant reduction and resource savings

- By reducing solvents and other emissions of hazardous substance from chemical building products the findings of the programme regarding interior work significantly contribute to a healthy and good indoor climate for building users. Furthermore it makes important contributions to the protection of employees.
- Energy and water savings help to preserve high-quality natural resources and thus the population's quality of life.
- By communicating the benefits of quality compost and by publicly promoting that it is given away free of charge, awareness is built to make use of natural fertilisers and consider their importance for soil as a resource.
- There is a lot of potential in applying the findings of already existing pilot projects on environmentally sound construction site management on the basis of future "ÖkoKauf Wien" guidelines and criteria lists. Significant reductions in noise and dust emission can be achieved by minimising construction site traffic.

Promoting environmentally conscious behaviour – developing a demand market

- A significant contribution to raising awareness in public and private builders and to support their ecological construction management has been made by developing and publishing Ö.B.U.S, a calculation tool to quickly assess the environmental impacts of procurement decisions for interior work, and by co-operating with baubook – a free of charge and publicly available database on ecologically safe chemical building products which fulfil the "ÖkoKauf Wien" criteria.
- Due to the exemplary use of energy and water by modern in-house facilities in the buildings of the City of Vienna an impact on the awareness of the employees of the City of Vienna can be expected which they disseminate in their own private living environments.
- The forward-thinking implementation of future "ÖkoKauf Wien" criteria in environmentally sound construction site logistics at distinctive construction sites and for key projects of the City of Vienna significantly raises awareness for the enormous potential of environmentally sound construction site logistics, while creating a positive environment for the publication of relevant guidelines and criteria lists by "ÖkoKauf Wien".

Strengthening of initiatives for environmentally sound procurement

- The segments public works and Interior Work of the "ÖkoKauf Wien" programme are closely linked to national and international initiatives for ecological building and and attempt to promote harmonised ecological building standards in the German-speaking region.
- The implementation of nationally and internationally recognised pilot projects of the City of Vienna in construction and building management and in environmentally sound construction management contributes significantly to the positioning of the city as a pioneer in the ecological procurement of building products and construction services.

ECONOMIC IMPACTS:

Reducing costs for technical services and the potentials in environmentally sound construction site logistics

- Together with the implementation of ecological procurement of technical services "ÖkoKauf Wien" has assisted in achieving significant cost reductions. Efficient interior lighting saves approx. 1.25 million € on average each year, the savings in water charges and costs for heating water amounted to approx. 783,000 € between 2003 and 2013.
- Already implemented projects of environmentally sound construction site management show relevant economic potentials. Efficiency measures such as avoiding transports or re-use of waste bring about relevant economic benefits. The expenses for construction site logistics and environmentally sound management have by far been compensated by cost reductions on account of an improved resource balance.

Impact on the supply market regarding building construction, interior work and technical services

- Suppliers (e.g. painters, floor layers, plumbers etc.) who are obliged to exclusively use "ÖkoKauf Wien" compliant products change their standard range of products once they experience positive outcomes. This impact

on producers and the professional user market has an effect on private and public purchasers in Vienna and even on a regionally expanded clientele of construction service suppliers.

- The impact on the supplier market is especially seen as to the procurement of construction services for building construction projects due to the application of the "ÖkoKauf Wien" criteria lists (interior work, technical services and many other criteria lists regarding building construction). The impacts of the MA 34 building construction projects are included in the assessments of Ö.B.U.S.

Promoting regional producers of environmentally sound products and services

- Based on the strong market position of Austrian and German producers of building material a regional supplier market for ecological building products has developed regardless of internationally active building material producers. Recipes are repeatedly exchanged in order to comply with "ÖkoKauf Wien" criteria.
- Regional suppliers of innovative and environmentally sound construction services use their by now more eco-friendly and "ÖkoKauf Wien" compliant services for their general business with private customers. Especially for repair work the City of Vienna puts out smaller, regional tenders, facilitating the integration of smaller and medium sized regional companies in the implementation of "ÖkoKauf Wien" criteria.

Summary of the potential for further development of the "ÖkoKauf Wien" programme for "environmentally sound building"

By way of concluding the programme has an impact on two levels of procurement (individual construction projects, complex service packages). There is potential for further programme results and impacts on both levels:

- Procurement of individual, definable building projects, e.g. interior work and technical services: within those two working groups there is always potential for expanding the criteria list depending on the development of chemical building products.
- The issue of path surfaces (Working Group Green and Open Spaces) seems to be appropriate for another criteria list.
- Additionally it is recommended to set up a criteria list for exterior lighting due to significant savings potentials.
- An assessment of the impact of the programme over a certain period of time seems to be appropriate for the aforementioned topics on the basis of procurement data and within the framework of a future monitoring process.
- Procurement of complex service packages with regard to the implementation of building projects: this is a special concern for the Working Group Building Construction with regard to the potential of environmentally sound construction site logistics. It is recommended to assess exemplary projects and to evaluate the impact potential of further implementation projects based on similar conditions in an attempt to better assess the programme impacts in these areas.

4.1 Interior Work

PROGRAMME IMPACTS ON CHEMICAL BUILDING PRODUCTS / INTERIOR WORK - AN OVERVIEW

ECOLOGICAL IMPACTS

Reducing resources:
The ecological impacts regarding interior work mainly lie in avoiding damage to the environment.

Avoiding damage to the environment:
In 2012 more than 4,100 kg of solvents were avoided.
The reduction of solvent emissions between 2008 and 2012 was about 40,000 kg in total compared to the business-as-usual scenario. The level of solvent emissions of the worst legally permitted construction products are more than ten times higher than the VOC emission levels of construction products meeting the "ÖkoKauf Wien" criteria.
Further impacts are caused by avoiding additional substances which are harmful to human health and the environment (biocides, heavy metals, etc.).

Contributing to climate protection:
Reduction of 37 t CO_2 equivalent in 2012.
Focus of the impacts: reduced emission of hazardous substances.

SOCIAL IMPACTS

Improving the working and living environment:
The reduction of solvents and other hazardous substances in chemical building products brings about a healthy and comfortable indoor climate for the users of the buildings. This is also an important contribution to the protection of employees.

Promoting environmentally conscious behaviour – developing a demand market:
Broad communication and awareness building by making information material and the calculation tool Ö.B.U.S publicly available, as well as by presenting ecologically safe chemical building products which fulfil the "ÖkoKauf Wien" criteria in co-operation with baubook.

Strengthening initiatives for "environmentally sound procurement":
The segments building construction and interior work of the "ÖkoKauf Wien" programme are closely linked to national and international initiatives for ecological building and attempt to promote harmonised ecological building standards in the German-speaking region.

ECONOMIC IMPACTS

Reducing costs:
An assessment of the reduction of costs was not possible on the basis of the provided documents. The experience of the involved departments in applying the "ÖkoKauf Wien" criteria lists indicates that environmentally sound chemical building products can be procured with no costs involved.

Influencing the supply market:
Influence on the market of producers and product distributing suppliers in the segment of interior work due to the strong position of the City of Vienna as procurer. Indirect influence on the supply market for private customers, since the same products are provided by the executing companies for various other customers.

Promoting regional producers of environmentally sound products and services:
Producers of building products produce for a regional market and regarding the adjustment of their product recipes they react relatively flexible to a change in legal conditions and the demand for environmentally sound products.

Especially for repair work the City of Vienna puts out smaller, regional tenders, facilitating the integration of smaller and medium sized regional companies in the implementation of "ÖkoKauf Wien" criteria.

Challenges and objectives for interior work

The segment interior work is characterised by a variety of chemical building products – from interior wall paints to plasters, fillers and floorings and various coating materials, etc. – which need to be assessed for an environmentally sound procurement and to be compared on the basis of several criteria.

A key ecological criterion is the use of low-emission material with a low content of solvents (VOC = volatile organic compounds).

In close co-operation with the chemical building experts of MA 34 the programme segment interior work influences all market participants involved in the provision of interior work services by its criteria lists and awareness building measures and thus contributes to a long-term change in behaviour in favour of environmentally friendly chemical building products. The target groups of these activities are primarily product processing suppliers of interior work services. However, product manufacturers are also reached to some extent who mainly produce for the regional market in regional subsidiaries, even if they are international companies, and who react to legal framework conditions and demands for environmentally friendly products by adjusting their recipes accordingly.

Beside solvents, additional ecologically relevant substances in chemical building products include biocides and heavy metals which are harmful to the environment and may bring about health problems in the building users. For the protection of the environment and human health the materials applied for interior work should be HFC-free and should not contain any organic chlorine compounds (especially no PVC). Finally the use of renewable raw materials, especially of floorings, is to be promoted because of ecological reasons.

Regarding the complexity of environmental friendliness in interior construction the Working Group Interior Work of MA 22 has been focusing on the "greening" of construction-related products for interior construction since the beginning of the implementation of the „ÖkoKauf Wien" programme and has been working closely together with the responsible department MA 34 (Building and Facility Management). With its criteria lists, specifications and single case studies, the working group covers a broad spectrum of this topic.

The large number of alternative products and the complexity of their chemical composition make it difficult for procurers to comprehensibly assess the ecological quality of the building material, to make decisions according to ecological criteria and to implement environmentally sound interior construction projects.

For this reason the "ÖkoKauf Bau Umwelt Schnellrechner" (Ö.B.U.S – ÖkoKauf quick calculator for eco-friendly building) was developed, a unique tool which supports the relevant departments of the City administration in their assessment of the ecological impacts of procurement decisions regarding interior work (also see "Success story: Ö.B.U.S" in this chapter).

For consistently implementing these criteria in the construction projects of the City of Vienna a competent department was set up within MA 34, an internal resource for chemical building management which ensures that the "ÖkoKauf Wien" criteria are included into the relevant tenders and are actually implemented after assigning the project. The products listed in the quotation of the best offer are analysed with regard to their compliance to the respective criteria lists and the use of the products are investigated on site.

The combination of binding ecological criteria and quality assurance implemented by the Chemical Building Management prior to and in the course of interior construction work ensures that the users of the buildings constructed by the City of Vienna are provided with healthy indoor space.

Success story Interior Work No. 1: "ÖkoKauf Bau Umwelt Schnellrechner" (Ö.B.U.S - ÖkoKauf quick calculator for eco-friendly building)

The basic idea of Ö.B.U.S was to develop a quick assessment tool which facilitates rapid quantitative evaluation of the ecological improvements regarding chemical building products achieved by implementing the criteria of "ÖkoKauf Wien", and to compile a comprehensive, ecologically positive balance for people involved in the project, but also for outsiders.

Parameters were chosen that can be taken directly from the billing of the individual companies involved when implementing a construction project and that are significant for the achievable ecological effect.

- Volatile organic compounds (VOC), which are often used as solvents, are hazardous for the environment and to the health of the employees and the users of the buildings.
- Hydro fluorocarbons (HFC), which are used primarily in insulating material instead of the banned CFCs, frequently show a high greenhouse gas potential. In Ö.B.U.S the CO_2 equivalents are identified as measured values.

After processing the detailed project data Ö.B.U.S assesses the identified indicators (reductions of VOC and CO_2 equivalent) as a result of a reference value of a specific product compared to the relevant average value of this product group on the market (business-as-usual scenario = BAU scenario) or compared to a worst-case scenario. The assessment is illustrated in a diagram, hence quickly and clearly documenting the impact of individual procurement decisions on the environment.

On a single project level, "ÖkoKauf Wien" provides a publicly available tool with Ö.B.U.S which serves those involved in a construction project to obtain better information and motivation and which demonstrates, by applying awareness building and communication measures, the reasonability and effectivity of environmentally friendly building regulations provided by "ÖkoKauf Wien".

Base data of the impact analysis for interior work

Regarding the procurement of building products for interior work for construction projects of the Vienna City Administration the following basic information was analysed:

- Results of the working group according to the "ÖkoKauf Wien" website, as of October 2013
- Interview and related correspondence with WG 08 working group leader, Michael Grimburg / MA 22 and with Robert Friedbacher / MA 34
- Assessments provided by Ö.B.U.S for the years 2007 to 2013
- Information provided on "baubook" and on harmonised ecological construction standards on the platform "baubook ökologisch ausschreiben" (*baubook – how to do ecological tenders*)

Procurement situation in Vienna

In general the procurement volumes and their distribution to individual product groups relevant for interior construction fluctuate depending on the implemented construction projects of the City of Vienna.

Evaluation methodology / calculation base

For the impact analysis the results of the applied "ÖkoKauf Wien" criteria regarding building construction and interior work were made available as Ö.B.U.S assessments in an aggregated form.

The results in detail

When developing version 4 of Ö.B.U.S which was published in 2012, the reference values for the Ö.B.U.S "business-as-usual scenario" were newly researched on the basis of the 2011 technical level. The market development of a decade was thus reproduced, showing some significant improvements of the range of chemical building products. For example, the new Ö.B.U.S version reflects the fact that in some important product groups the VOC share in standard products has dropped significantly.

When this report was produced, retrospective comparisons on an annual basis were not possible due to these new assessments of the ecological criteria in Ö.B.U.S. However, the following ecological impacts can be summarised for the 2008-2012 period:

Solvent emissions compared to the "business-as-usual scenario" were reduced by a total of 40,000 kg. The level of solvent emissions of the worst legally permitted construction products were even more than ten times higher than the VOC emission levels of construction products meeting the "ÖkoKauf Wien" criteria.

The market development reflected in the new version of Ö.B.U.S with a new calculation basis for the "business-as-usual scenario" can primarily be seen as a result of stricter European and national standards and as a reaction of the chemical building product industry to a changed demand. Regarding regional producers and providers of chemical building products, "ÖkoKauf Wien" contributes to this development by making the procurement criteria of the City of Vienna, one of the most impor-

tant buyers, more environmentally friendly. In total, improvements in the ecological quality of chemical building products for interior work are clearly visible.

Ö.B.U.S' worst case scenario takes the worst legally permitted products as a reference which were available at the time of assessment. Hence the Ö.B.U.S assessments illustrate the development of the market range of interior work products over many years.

The development of Ö.B.U.S made it possible that at a very early stage eco-friendly developments of chemical building products and hence the "greening" of procurement for the City of Vienna were initiated which is an important accomplishment of the "ÖkoKauf Wien" programme as a pioneer of environmentally friendly procurement of building material. At the same time further developments and updates of the tool ensure that changed market conditions are defined in a way which is comprehensible for experts and easily understandable for lay people.

A detailed comparison of the individual product groups comprised in Ö.B.U.S shows that the reduction of VOC emissions is especially significant in coatings for interior walls, floorings and concrete/stone.

The diagram shows the ecologically relevant savings achieved by environmentally sound chemical building products for interior work in 2012, calculated by Ö.B.U.S 4.0, considering all product groups included and based on the up-dated "BAU-scenario". In 2011, more than 71 percent of solvents, i.e. 4,100 kg or 37 t of CO_2 equivalent were avoided compared to the up-dated "business-as-usual" scenario.

Co-operation with baubook

Co-operation with baubook brought about an important contribution regarding the distributed results of "ÖkoKauf Wien" as to interior work and to raising more awareness in wide target groups. The web platform baubook supports the implementation of sustainable buildings. Amongst others producers and dealers can easily register and declare their own eco-products online and free of charge. baubook lists products which verifiably meet the "ÖkoKauf Wien" criteria. This information is publicly available and free of charge.

A listing as "ÖkoKauf Wien" compliable product in baubook is accepted by the City of Vienna as verification for procurement processes. This option of central verification significantly simplifies the administration of eco-friendly construction projects.

In 2011 more than 2,000 products were listed in the baubook, the platform had 6,300 registered users and every week more than 20,000 people visited the page.[39] These numbers show that baubook is highly conducive to the dissemination of the "ÖkoKauf Wien" criteria, while creating additional incentives for innovations regarding building materials.

	Comparison of solvent emissions [kg]		
Product group	**"Worst Case"**	**"Business as usual"**	**"ÖkoKauf Wien"**
concrete and stone coatings	14,973	749	463
bitumen coatings	1,529	1,189	0
wood coatings	840	366	69
interior wall paints	53,198	165	59
metal coatings (incl. flame proof and anticorrosive coating)	15,260	3,047	701
bonding and coating of floorings	10,459	197	154
Total of solvent emissions	**96,718**	**5,824**	**1,676**

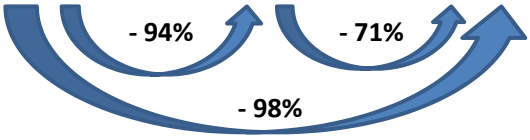


Figure 25: *solvent emissions: savings in comparison (source: Ö.B.U.S 4.0, assessment 2012)*

[39] cf. P. Bachmann, M. Lange (editor): Mit Sicherheit gesund bauen (Building Healthy), 2 edition, Wiesbaden 2012, Springer Vieweg, p. 40.

Success story interior work No. 2: harmonisation of ecological building standards

The sustainable success of the "ÖkoKauf Wien" measures in terms of building and construction is also shown in the joint activities to harmonise a common ecological building standard with the environmental association Umweltverband Vorarlberg. Important fellow campaigners include the Austrian Ecolabel, the Austrian Action Plan for Sustainable Public Procurement and the Federal Province of Lower Austria.

The results of this co-operation are communicated via baubook which helps to support the linking between stakeholders and strengthens the supply market of environmentally friendly building material. It is very likely that this harmonised building standard will be implemented on a national and international level.

The Working Group Interior Work covers a wide spectrum of the "ÖkoKauf Wien" programme and has developed from a provider of innovative support tools for environmentally friendly procurement to a co-designer of a common ecological building standard in close co-operation with national and international networks.

Summary of the impact analysis of the activities of the Working Group Interior Work

Criteria lists and available data

For the segment interior work comprehensive results are available which document the intensive work on all relevant topics of this complex subject. As mentioned above, due to the recent up-date of the Ö.B.U.S calculation base with the year 2012 only assessments on the basis of the newly researched "business-as-usual scenarios" is available.

Assessments and impacts

Due to mainly project specific procurement and fluctuating procurement volumes in the respective product groups a comparative assessment over several years in general seems to be significant only to a limited extent.

Between 2008 and 2012 the overall reduction of solvent emissions amounted to approx. 40,000 kg compared to an average "business-as-usual scenario" of available interior work products. The level of solvent emissions of the worst legally permitted construction products are even more than ten times higher than the VOC emission levels of construction products meeting the "ÖkoKauf Wien" criteria.

The criteria lists of the Working Groups Building Construction and Interior Work are applied within the range of activities of MA 34 (indicated by Ö.B.U.S) as well as in other segments of the City of Vienna that are not indicated here, e.g. Wiener Wohnen (Municipal Housing in Vienna) or KAV (Vienna Hospital Association), i.e. the absolute savings for the City of Vienna can be assumed to be much higher.

The many years of co-operation between the Ö.B.U.S affiliates and the tool itself have prepared the ground for regular internal evaluations of the ecological impacts of the programme and for feedback of the results of the WG Interior Work on important projects.

Beside such ecological consequences as reduced emissions and CO_2 equivalent savings, the segment interior work brings about long-term effects regarding the well-being and the health of building users and improvements concerning protection of employees.

The Ö.B.U.S tool and co-operation with the baubook platform are unique results of the programme and are excellent tools for illustrating and communicating the findings of the working groups. Both instruments address the target groups involved in the procurement processes of the City of Vienna and are also publicly available for institutions and individuals.

By communicating the results via these tools and due to the strong commitment of the Working Group Interior Work within national and international networks potential has been generated that exceeds the programme impacts and may help in the development of a harmonised building standard. This demonstrates the high quality and visibility of the programme regarding building construction and interior work.

It was not possible to assess the economic impacts of the programme regarding interior work on the basis of the provided documents. However, experience with "ÖkoKauf Wien" compliant procurements shows that the use of ecologically beneficial building material can be implemented with no costs involved.

Recommendations for further development of the Working Group Interior Work

- In addition to the activities which are already in the implementation process concerning the communication of the programme results it is recommended that exemplary assessments of individual interior construction projects of the City of Vienna are prepared for intensive use in the communication and awareness building measures.
- Various strategic possibilities for further development have emerged from the many years of activities and

highly substantiated findings of the Working Group Interior Work. First, activities could be extented to working out recommendations and criteria lists for additional products and possible newly developed product groups. Second, a campaign for a closer relationship with target groups which have not been reached yet within the Vienna City Administration seems reasonable. Third, a strategic workshop supported by external process moderation is recommended in order to assess the ecological potential of these options with regard to superior programme objectives and to agree on a common strategy.

4.2 Technical Services

The Working Group Technical Services led by MA 34 focuses on the complex topic of technical equipment and facility management for the buildings of the City of Vienna. About 15 percent of procurement regarding construction and building management are caused by technical services (electrical appliances, sanitation, heating) with a turnover of approx. 21 million € (2008). Important results of "ÖkoKauf Wien" are criteria lists and standardised text elements for tenders of technical service components and facilities of MA 34 and other procuring departments of the City of Vienna. The present impact analysis assessed the segments efficient lighting and water saving sanitary installations.

PROGRAMME IMPACTS ON TECHNICAL SERVICES - AN OVERVIEW

ECOLOGICAL IMPACTS

Reducing resources:
Between 2009 and 2012 approx. 7,200 MWh p.a. were saved due to efficient interior lighting which equals the annual energy consumption of about 2,000 households.
Water-saving cisterns and fittings saved about 88,000 m^3 of high-quality drinking water per year.

Additional potential in technical service systems to save water and energy (efficient heating systems, water heating systems, water-saving sanitary installations, etc.) based on the "ÖkoKauf Wien" criteria lists is currently not illustrated, yet can be indicated by an analysis of exemplary projects.

Contributing to climate protection:
The procurement of environmentally sound interior lighting contributes to achieving the climate mitigation target of the City of Vienna by reducing CO_2 equivalent by approx. 1,400 per year. There is additional potential for reductions and savings relevant to climate change in the water heating system. Water-saving taps alone saved avoided 88 t CO_2 equivalent per year. Additional potential in technical service systems to save water and energy (efficient heating systems, water heating systems, water-saving sanitary installations, etc.) based on the "ÖkoKauf Wien" criteria lists is currently not illustrated.

SOCIAL IMPACTS

Improving the working and living environment:
Saving energy and water helps preserve high-quality natural resources and thus contributes significantly to the population's quality of life.

Promoting environmentally conscious behaviour – developing a demand market:
It can be expected that the exemplary use of energy and water due to technical service systems in the buildings of the City of Vienna will build the awareness of the employees of the City of Vienna which they will spread in their private living environment.

Strengthening initiatives for "environmentally sound procurement":
The implementation of nationally and internationally recognised pilot projects by MA 34 contributes significantly to the national and international positioning of the city as a pioneer in resource efficient building technology and modern facility management in public administration.

ECONOMIC IMPACTS

Reducing costs:
Efficient interior lighting saves about 1.25 million € of energy costs each year.
The savings in water charges and costs for heating water were approx. 783,000 € between 2003 and 2013.
Additional potential for cost reductions can be indicated by analyses of single projects.

Influencing the supply market:
The market of mass products including lamps and sanitary components can only be influenced to a low degree.

Promoting regional producers of environmentally sound products and services:
Regional producers and environmentally sound products for technical services and installations can be promoted especially by the implementation of research and demonstration projects of the City of Vienna, primarily by MA 34.

4.2.1 Efficient lighting

Challenges and objectives regarding efficient lighting
The Working Group Technical Services focuses on the environmentally friendly procurement of interior lighting. The issue of exterior lighting is sometimes discussed in a joint "ÖkoKauf Wien" study group of the Municipal Departments MA 34, MA 33 and MA 39, however, it is not subject to the impact analysis.

During the implementing period of the "ÖkoKauf Wien" programme the conventional light bulb was replaced by energy-efficient lamps. Based on the respective criteria lists the Viennese City Hall was equipped with energy-efficient lamps as an early exemplary object. In an important phase of technological change this key project amongst all the official buildings was a visible contribution to awareness building and to positioning Vienna as a pioneer in energy saving. These impacts were already assessed in the internal programme evaluation of 2008.

At the same time the light bulbs of the general lighting in apartment buildings owned by the City of Vienna were gradually replaced with energy efficient lamps by the Facility Management, which is reflected in high procurement numbers (on average 112,000 energy efficient lamps per year) for the years up to 2008.

Since the energy inefficient light bulbs have meanwhile gradually been taken from the market and the first wave of replacements has already been implemented the number of new acquisitions of energy efficient lamps has decreased since 2009.

The next innovation would be the use of LEDs, however, this technology is still in a development phase. As the responsible expert department MA 34 is involved in many research projects and demonstration objects of the City of Vienna and is hence preparing the next up-coming step forward in technology for future environment-relevant procurement.

The example of energy efficient lamps clearly shows that technology scouting and a technology driven, periodic development of procurement numbers are typical characteristics of technical services.

Base data of the impact analysis for efficient lighting
Regarding the procurement of efficient lighting for the departments of the Vienna City Administration the following basic information was analysed:

- "ÖkoKauf Wien" criteria lists for procurement of energy efficient lamps, 2010
- Interview with WG06 working group leader, Michael Minarik / MA 34
- Basic data / assessments of technical services from the 2008 internal programme evaluation
- Base data / calculations provided by MA 34 for the impact analysis 2013
- Complementary information from the evaluation of the Urban Energy Efficiency Programme (SEP) of the City of Vienna, as well as from the progress reports on the implementation of the Vienna Climate Protection Programme (KliP)
- Reports and studies from other relevant institutions as quoted in the text

Procurement situation in Vienna
For the impact analysis the procurement volumes of different types of bulbs between 2009 and 2012 were available.

type of lamp		2009	2010	2011	2012
compact fluorescent light	piece/a	22,237	12,888	15,354	13,444
fluorescent tube		47,242	51,209	59,544	54,098
halogen light bulb		101 830	78,250	79,150	63,570
procurment volume		171 309	142 347	154 048	131 112

Figure 26: *procurement volumes energy efficient lamps, (data source: MA 34, MA 54, PUMA)*

For the years before the aforementioned period only summary or incomplete numbers were available which could not be included into the impact analysis (see annex item 8.5.2.1).

The decreasing procurement numbers of efficient lamps in more recent times indicate that the initial wave of replacing conventional bulbs with energy efficient lamps in the mid-2000s has long been completed.

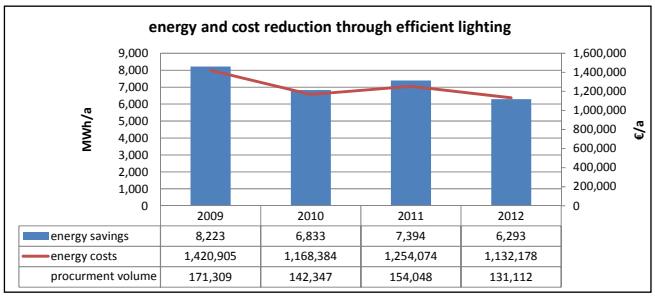
Evaluation methodology / calculation base

For the assessment of reductions in energy consumption, costs and CO_2 equivalent the calculations for the internal evaluation of the programme in 2008 were taken as a first basis, which were critically questioned and to some extent adjusted for the present impact analysis.

Adjustments were mainly made regarding the calculations of the energy costs and reductions in CO_2 equivalent based on the annually effective prices and CO_2 equivalent emission factors according to the information given by Wien Energie. The impacts of these adjustments are described in detail in the annex under item 8.5.2.1.

The results in detail

The average procurement volume of energy efficient lamps was approx. 150,000 pieces per year between 2009 and 2012, showing a rather down-ward tendency at the moment.



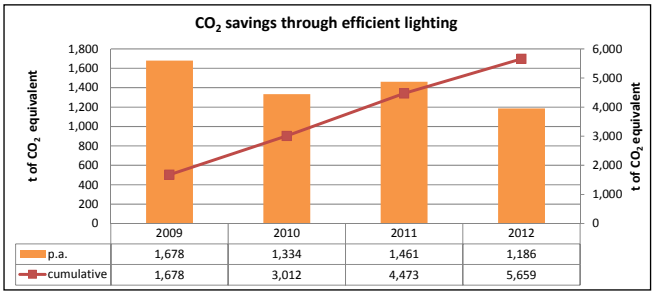
	2009	2010	2011	2012
energy savings	8,223	6,833	7,394	6,293
energy costs	1,420,905	1,168,384	1,254,074	1,132,178
procurment volume	171,309	142,347	154,048	131,112

Figure 27: *energy and cost reductions by means of energy efficient lamps, author's own calculation and diagram*

Between 2009 and 2012 more than 7,200 MWh of energy could be saved on average by procuring energy efficient lamps. This equals the energy consumption of about 2,000 households and a cost reduction of 1.25 million € per year for the City of Vienna.

The annual cost savings due to energy efficient lamps compared to electric bulbs is indicated under item 8.5.2.1 of the annex.

The following diagram shows that regarding climate protection an average of approx. 1,400 t CO_2 equivalent were avoided due to the procurement of energy efficient lamps in the period under review.



	2009	2010	2011	2012
p.a.	1,678	1,334	1,461	1,186
cumulative	1,678	3,012	4,473	5,659

Figure 28: *CO_2 equivalent reduction due to energy efficient lamps, author's own calculation and diagram*

The procurement of energy efficient lamps within the "ÖkoKauf Wien" programme is therefore a single measure of strong impact regarding climate change mitigation.

4.2.2 Water-saving sanitary installations

Challenges and objectives regarding technical services / water-saving sanitary installations

About 77 billion m^3 of water are available in Austria each year. However, about 2.5 billion m^3, i.e. approx. 3 percent of the available amount of water is used in Austria per year.

About two thirds thereof are used for business and industry and almost one third for private households. Agriculture consumes nearly 7 percent.[40]

An average of 135 litres is consumed per day and per person (without business, industry or large-scale consumers). If industry and business are included 260 litres are consumed, however, only 2 percent thereof are used for drinking. The major share of drinking water is used

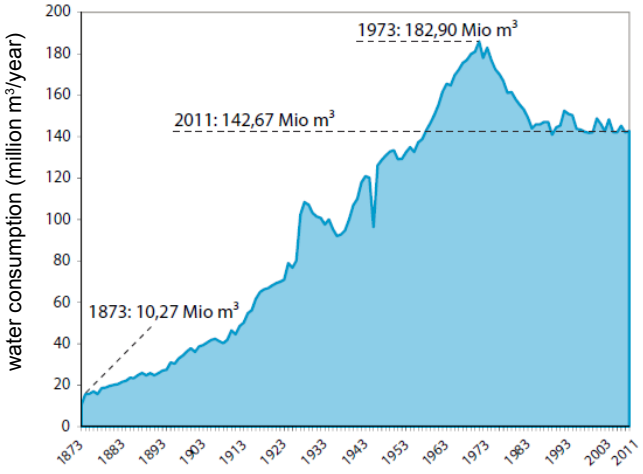


Figure 29: *water consumption Vienna (source: Wiener Wasser, 2011)*

[40] cf. Austrian Federal Ministry of Agriculture, Forestry, Environment and Water Management (2013), http://www.lebensministerium.at/wasser/nutzung-wasser/Trinkwasser.html, accessed on: 26 January 2014

for taking baths / showers / for body care, flushing toilets and washing hands.[41]

The City of Vienna is provided with plenty of high-quality drinking water by two water aquifers. Regardless of this abundance of water, economical use of the water resources and reduction of sewage pollution is a permanent challenge for the City of Vienna.

Water consumption in Vienna has been decreasing since the 1970s. The reason for this reduction is first a rehabilitation of pipes and second the use of water-saving household appliances and sanitary installations.[42]

The collection of data concerning the water consumption of objects owned by the Vienna City Administration shows some irregularities according to PUMA (Environmental Management Programme in the Vienna City Administration) which are primarily attributed to organisational changes and irregular meter readings. However, data has shown that in general the water consumption in the Vienna City Administration has decreased by 5 percent per year. Significant reasons include the use of water-saving fittings and toilet cisterns, as well as a raised awareness regarding the efficient use of water as a resource and hence water-saving behaviour.[43]

The series of "ÖkoKauf Wien" criteria lists of the Working Group Technical Services (and to some extent also of the Working Group Electrical Appliances), which compulsorily stipulate water-saving fittings of sanitary installations in the service buildings of the Vienna City Administration, have contributed significantly to this overall development in the last decade.

Base data of the impact for technical services / water-saving sanitary installations

For the impact analysis the following basic information was analysed:

- Criteria lists for different sanitary installations (esp. water-saving fittings of wash basins and shower systems, water-saving cisterns, urinals, etc.) accord. to the "ÖkoKauf Wien" website, as of October 2013
- Interview and related correspondence with WG06 working group leader WG06, Michael Minarik / MA 34
- Basic data / assessments for technical services from the 2008 internal programme evaluation
- Base data / calculations provided by MA 34 for the impact analysis 2013
- Complementary information from the evaluation of the Urban Energy Efficiency Programme (SEP) of the City of Vienna, as well as from the progress reports on the implementation of the Vienna Climate Protection Programme (KliP)
- Reports and studies from other relevant institutions as quoted in the text

Procurement situation in Vienna

The impacts of the programme due to water-saving measures regarding technical services have been assessed in agreement with the working group management on the basis of the procurement volumes for fittings and cisterns. The annual procurement in these product groups results from re-equipping of buildings of the City of Vienna and from a gradual refitting and modernisation of existing systems.

In agreement with the MA 34 working group management the following average annual procurement volumes for water-saving taps and cisterns were assumed:

water saving sanitary installations	procurement / refitting p.a. approx.
cisterns	200
water taps	600

Evaluation methodology / calculation base

In order to assess the water-saving measures calculations of the internal evaluation of the programme of 2008 were taken as a basis, which were critically questioned and to some extent adjusted for this impact analysis.
Adjustments were mainly made concerning the presumed service life of washbasins (change of calculation base!). For the new calculations the water charges (for water supply and sewage) and the energy costs effective in the respective year were taken as a basis. The new calculations of water savings are described in detail in the annex under item 8.5.2.1 .

The results in detail

Water-saving cisterns

Assuming that an average of 200 water-saving cisterns are procured per year and assuming the number of approx. 2,700 toilets (calculated already in 2008) in buildings of the City of Vienna, it can arithmetically be verified that the buildings of the City of Vienna were comprehensively equipped with water-saving cisterns from 2011 onwards.

In the following diagram, this is indicated by the consistent level of savings since 2012.

[41] cf. ÖVGW, http://www.wasserwerk.at/home/alles-ueber-wasser/verbrauch, accessed on: 26 January 2014

[42] cf. Wiener Wasser (2011), Die Wasserversorgung im Überblick 2011 (Water supply – an overview 2011)

[43] cf. PUMA (2013), activity report 2005-2009, p. 22

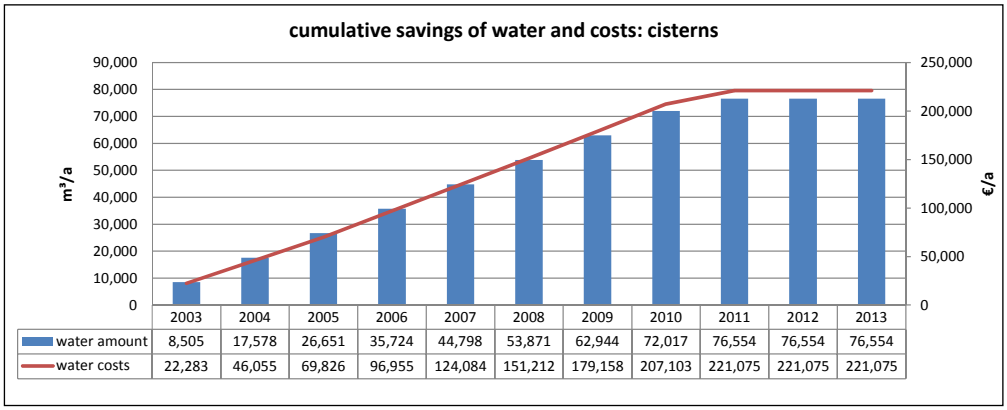


Figure 30: *savings in water consumption and water charges by water-saving cisterns between 2003 and 2013, calculation and illustration by the City of Vienna (data source MA 34)*

For the subsequent years it can be presumed that the potential of water savings in toilets will be fully exploited with 76,500 m³ less water consumption each year. This equals the annual consumption of high-quality drinking water of more than 1,500 citizens with an average water consumption of approx. 50 m³ per person per year which would have been used for toilets without any additional use.

Additionally, the City of Vienna saves resource costs of 220,000 € per year.

Water-saving fittings

The basis for the calculation of the savings of water due to water-saving fittings is an annual procurement volume of 600 aerators. Due to the changes in the calculation base (see annex item 8.5.2.1) from 2009 onwards the increase of cumulated water savings is less.

The new procurement of 600 water-saving aerators causes an annual water reduction of about 11,300 m³ and a cost reduction of about 41,000 € (cost basis 2013). (For calculations see annex item 8.5.2.1)

Regarding water-saving taps additional savings for the heating of water can be attributed to the impacts of the "ÖkoKauf Wien" programme.

The diagram shows that more than 7,000 MWh were saved in total due to a reduction of hot water at wash basins between 2003 and 2013, i.e. about 88 t CO_2 equivalent per year and a total reduction of almost one thousand tonnes of CO_2 equivalent since 2003.

The cumulated cost reduction between 2003 and 2013 of about 783,000 € is comprised of a reduction of water costs of about 470,000 € and a reduction of energy costs for the heating of hot water of about 313,000 €.

Summary of the findings regarding further development of the Working Group Technical Services

Criteria lists and available data

The criteria lists elaborated by the "ÖkoKauf Wien" programme for the procurement of technical service systems and components cover significant procurement segments of technical services and are fully included in the respective text elements of the relevant procurement processes.

The available data for the analysed procurement of efficient lighting and water-saving sanitary installations supports selective assessment (or future accompanying monitoring) to a limited extent only.

Regarding efficient lighting the impact analysis was restricted to the years 2009 to 2012 due to the limited continuity of the available procurement numbers.

Regarding sanitary installations it was not possible to obtain detailed numbers for both segments despite the

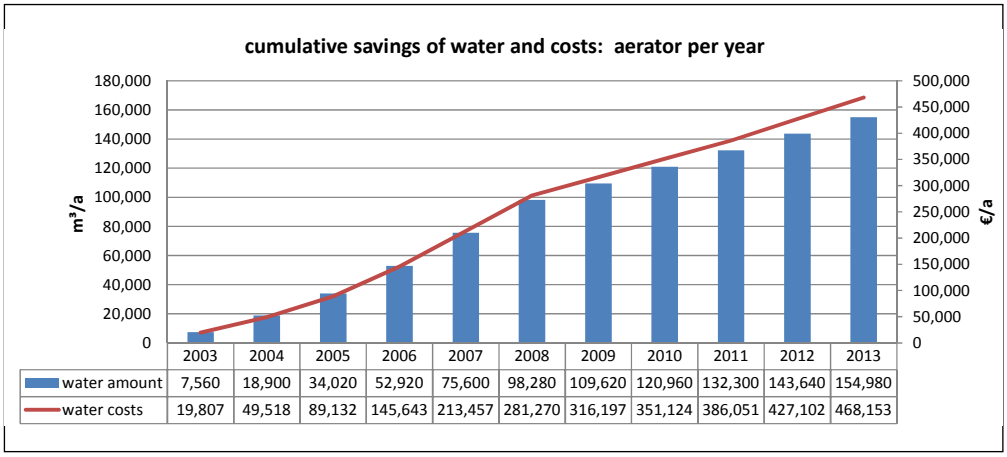
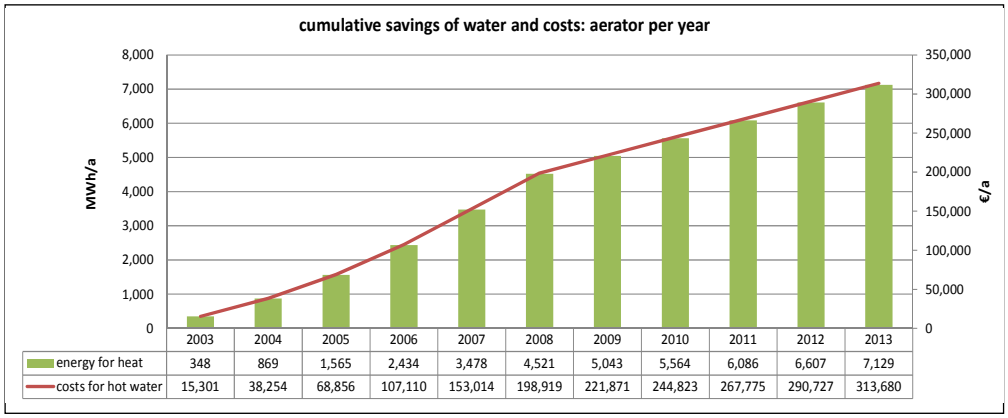


Figure 31: *reduction of water consumption and costs due to water-saving taps between 2003 and 2013, calculation and diagram by the City of Vienna (data source MA 34)*



	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013
energy for heat	348	869	1,565	2,434	3,478	4,521	5,043	5,564	6,086	6,607	7,129
costs for hot water	15,301	38,254	68,856	107,110	153,014	198,919	221,871	244,823	267,775	290,727	313,680

Figure 32: *reduction of hot water and costs for heating water due to water-saving taps between 2003 and 2013, author's own calculation and diagram (based on data provided by MA 34)*

excellent support of the working groups. The calculations were based on assumptions as in the internal evaluation of 2008.

Assessments and impacts

The analysed programme impacts show that the measures taken in the segment technical services are an important lever for the achievement of the programme targets regarding resource efficiency and climate protection. Furthermore significant cost reductions are feasible due to the implementation of the "ÖkoKauf Wien" criteria lists.

MA 34 is significantly involved in several working groups (Building Construction, Technical Services, Interior Work) of the "ÖkoKauf Wien" programme and can be seen as best practice for the implementation of the programme in the departments due to its strong commitment for environmental protection and sustainability. The "success story: MA 34" is summarised at the end of item 4.3.

4.3 Building Construction

PROGRAMME IMPACTS ON BUILDING CONSTRUCTION – AN OVERVIEW

ECOLOGICAL IMPACTS

Reducing resources:

Avoiding damage to the environment:

Contributing to climate protection:

Criteria lists of the Working Group Building Construction are summarised in Ö.B.U.S and are both described including their impacts under 4.1 Interior Work and are reported on in the chapters Interior Work and Technical Services.

SOCIAL IMPACTS

Improving the working and living environment:
The implementation of environmentally friendly construction principles contributes to the mitigation of climate change and to the development of a healthy and pleasant working and living environment in buildings. The respective guiding principles were defined within the framework of the integrated environmental management programme of MA 34.

Promoting environmentally conscious behaviour – developing a demand market:
Impacts regarding interior work and technical services were described in the respective chapters.
Similar impacts can be assumed with regard to building envelopes.

Strengthening initiatives for "environmentally sound procurement":
Within the framework of "ÖkoKauf Wien" and regarding the implementation of joint research projects together with academic institutes.

ECONOMIC IMPACTS

Reducing costs:
Due to a lack of analysable data the impacts were not defined.
In relation with the project planning of the Wien Nord hospital, however, it was shown that the application of ecological criteria to a large extent involves no additional costs if they are taken into account in due time.

Influencing the supply market:
Impacts regarding interior work and technical services were described in the respective chapters.
Regarding building envelope similar impacts can be assumed.

Promoting regional producers of environmentally sound products and services:
Impacts regarding interior work and technical services were described in the respective chapters.
Similar impacts can be assumed with regard to building envelopes.

Challenges and objectives for Building Construction
Procurement for construction services is one of the most complex segments within the area of procurement for the City of Vienna. Beside MA 34 which as head of the Working Group Building Construction has been actively contributing to the "ÖkoKauf Wien" programme, Wiener Wohnen (Municipal Housing in Vienna), KAV and many other departments with their separate construction teams are involved in these procurement processes.

MA 34 procures various construction, delivery and general services on the free market for implementing its tasks. Public procurement ranges from all trade applications of construction and sub construction work to architectural services. The environmental compatibility of the service is always considered as far as it is compatible with the subject of procurement.

- In tenders for building construction projects the findings of the Working Group Interior Work are to some extent taken into account. These are generally stipulated in the tender specifications for general and individual tenders together with the criteria lists which were worked out by the Working Group Building Construction. They are implemented by standardised items added to the tender specifications.
- Some "ÖkoKauf Wien" criteria apply to some extent to outdoor services (e.g. thermal rehabilitation, façades, windows, roofs). The working group recommends an extension of the programme findings in this field.

Base data of the impact analysis for building construction

Regarding the procurement of construction services for building construction for the departments of the Vienna City Administration the following basic information was analysed:

- Findings of the working group according to the "ÖkoKauf Wien" website, as of October
- Interview with WG07 working group leader, Peter Schmiege, MA 34
- Answers provided to the questionnaire according to the interview guide
- Additional information given by Grimburg (WG07 – Interior Work) and Friedbacher (Chemicals Management MA 34)

Procurement situation in Vienna

The number of service groups specified in the "ÖkoKauf Wien" programme for building construction was increased three-fold from 12 to 38 between 2005 and 2012.

The number of environmentally relevant tenders of MA 34 has almost doubled since 2009.

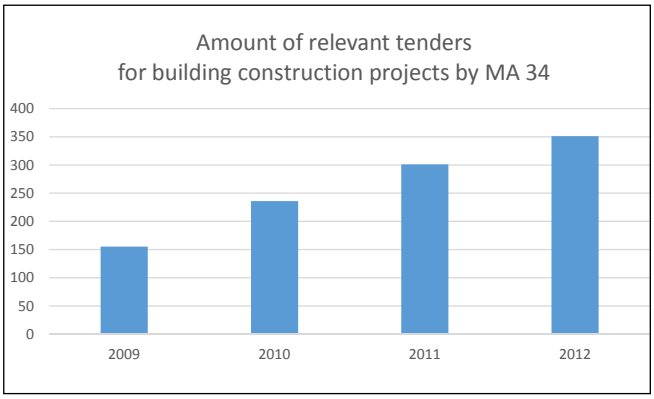


Figure 33: *environmentally relevant tenders, source: author's diagram (based on data provided by MA 34)*

Evaluation methodology / calculation base

There is no additional information on ecological impacts regarding the implemented procurement for building construction.

After initial scepticism, positive qualitative results have been reported on an operative level such as increasing acceptance by the employees of the individual departments as to the internal introduction and continuous implementation of the "ÖkoKauf Wien" criteria. The well-functioning system of criteria implementation and the strong support by "ÖkoKauf Wien" consultants for any questions constitutes an important asset.

Summary of the impact analysis of the activities of the Working Group Building Construction

Criteria lists and available data

There are comprehensive criteria lists for interior work and technical services. However, it is recommended to extend the programme findings to outdoor services (e.g. building envelopes).

At the moment it is not possible to report on any impacts of the programme due to the lack of detailed data on the implemented procurements of construction. If services were procured for interior work and technical services, they can be assessed by the existing evaluation methodology. It seems necessary that the working groups involved agree on the required exchange of data in order to avoid double compilations, etc.

Assessments and impacts

Positive impacts are only observed in the respective department as to the operative level of the introduction and continuous implementation of the "ÖkoKauf Wien" criteria lists. Therefore the example of MA 34, Working Group Building Construction, may be applied to internally push the programme and to convince other departments of the benefits of implementing the programme which possibly have not yet made any closer contacts with "ÖkoKauf Wien".

Success story: building and facility management of the City of Vienna

MA 34 is significantly involved in several working groups (Building Construction, Technical Services, Interior Work) of the "ÖkoKauf Wien" programme and can be seen as best practice for the implementation of the programme in the departments due to its strong commitment for environmental protection and sustainability.

MA 34 procures various construction, delivery and general services on the free market in order to implement its tasks, e.g. the procurement of MA 34 in 2008 with about 1,700 companies/business partners brought about a turnover of approx. 144 million €. This procurement volume makes MA 34 a strong partner for the construction and sub-construction industry.

When planning and implementing construction projects of the City of Vienna, eco-friendly building implies, amongst others, to avoid material that contains substances hazardous to the environment and human health, such as formaldehyde, PVC or halogens, to optimise future energy consumption already in the planning phase, to make use of natural light in offices, to ensure an appropriate exchange of air and to avoid excessive heat. Beside the ecological aspects, economic principles, experience with user behaviour and feasibility regarding current technical possibilities were integrated into the criteria.

As to facility management MA 34 follows a holistic approach with its integrated environmental management, making ecology and sustainability a very important topic. The issues concerned range from specifications on venue and building sites, building development and spatial arrangements to building physics, indoor climate and energy efficiency, as well as technical services (electrical installations, lighting, heating, air conditioning, ventilation, sanitary installations) and the selection of materials and instructions on continuous operations.

For MA 34, the implementation of the "ÖkoKauf Wien" criteria implies to consequently place ecological and building biological requirements on the used building materials in tenders. Texts for tenders comprising environmentally friendly requirements were defined as special provisions in contracts with MA 34 and were made available as templates of services of the tender software for the employees responsible for tenders. The texts for tenders are continuously maintained and complemented.

In research co-operations with respective university institutes and research facilities MA 34 is aiming to combine the lessons learned with external science-based findings and to implement demonstration projects by applying efficient and environmentally friendly building technologies. The continuous analysis of innovations in the field of building technology ensures the rapid adoption of sustainable technology into MA 34 projects.

MA 34 therefore is taking a big step towards health provisions for its employees and for the citizens of Vienna by managing the construction projects of the City of Vienna and as maintainer of many public buildings.

4.4 Green and Open Spaces

PROGRAMME IMPACTS ON GREEN AND OPEN SPACES – AN OVERVIEW

ECOLOGICAL IMPACTS

The impact analysis is based on the guideline for façade greening and the planning guideline on ground surfaces in open spaces.

Reducing resources:
On the basis of a study assigned by "ÖkoKauf Wien" indicators for the sustainability of path surfaces were defined bringing about significant differences in the assessment of various covering materials for different uses based on the criteria of carbon footprint and cumulative energy input.
The guideline on façade greening also refers to resource savings, however, the criteria are more complex and can hardly be defined in numbers.

Examples for concrete impacts are:
- Resource efficient use of raw materials
- Reduction of maintenance requirements by the means of appropriate systems, plants, growth support and control and especially through adequate planning
- Systems are preferably to be set up in compliance with economic and ecological requirements. Circulation systems and the use of rainwater, for instance are good water saving solutions for a façade greening.

Avoiding damage to the environment:
Chemical and biological processes are of minor importance according to the findings of the study on the sustainability of path surfaces. The guideline on façade greening explains the function of binding air pollutants in general and refers to avoiding toxic substances in façade bound greening.

Contributing to climate protection:
The achievable savings of energy input in path surfaces holds potential for greenhouse gas reductions. The guideline on façade greening contains detailed information on the significance of urban climate ("natural air conditioning"). Its function as a CO_2 sink is discussed, however, no concrete potential for a reduction of CO_2 can be empirically indicated due to the complexity and diversity of the systems.

SOCIAL IMPACTS

Improving the working and living environment:
The promotion of façade greening improves the urban microclimate and enhances the immediate living environment. Regarding path surfaces the social impact cannot be defined.

Promoting environmentally conscious behaviour – developing a demand market:
The guideline on façade greening gives detailed information on the different possibilities and benefits of façade greening. This raises interest for this topic and supports planners in their decision making process. Regarding the planning guideline on path surfaces it is not yet possible to define impacts on the demand market and on environmental behaviour.

Strengthening initiatives for "environmentally sound procurement":
not assessable at the moment.

ECONOMIC IMPACTS

Economic impacts are not assessable on the basis of the findings of the working group.

Challenges and objectives regarding green and open spaces

Planing guideline on ground surfaces in open space

Regarding paved areas in public spaces such as paths, squares or parks, the decision has to be made which material is used for which application. Besides criteria like function, design, functional properties, life cycle, reparability and costs, ecological criteria are also to be taken into account in future decision-making processes.

In this context the Working Group on Green and Open Spaces has elaborated a planning guideline for the ecological assessment of ground surfaces in public areas. A study assigned by MA 22 calculated indicators for a number of surfaces, taking into account the intensity of use, advisability, care and maintenance, durability and reusability of the applied materials in order to guarantee sustainable use for at least 30 years. Besides functional properties the following criteria are relevant for the selection of ground surfaces from an ecological perspective:

- Energy balance: cumulative energy input (CEI) and carbon footprint, depending on the type of material, application, durability and expenditure for waste management / recyclability.
- Transport: has a significant impact on the energy input and production of greenhouse gases.
- Fuel consumption: due to the strong impact of transport on the overall balance the use of HGVs with low fuel consumption and low exhaust emissions.
- Superstructure: the thickness and thus the volume of the material applied is part of the energy balance.
- Life cycle: a long life-cycle, ensured re-use or disposal can reduce the carbon footprint by (up to) 30 percent.
- The runoff coefficient of the different flooring types was considered as an additional factor.

The study compared different ground surfaces of one application category (e.g. footways, parking areas) which have a similar superstructure. The type of superstructure depends on the type and intensity of use of the different ground surfaces, i.e. only floorings of one application category can directly be compared.

Two indicators, cumulative energy input and carbon footprint, were used for the ecological assessment.

Guideline on façade greening

Since land in big cities is expensive and open space is rare, alternative types of greening are needed nowadays. The guideline on façade greening elaborated by the WG25 focuses on this topic and provides a comprehensive introduction for architects, planners, individuals, developers, public institutions and private businesses. Although façade greening is not a new phenomenon, there are comparatively few reports on lessons learned and studies on long-term impacts. In Vienna, currently only 5 percent of suitable roofs are "green".[44] There are no data on unused façade surface areas, i.e. there is a lot of potential regarding the development of these areas in Vienna.

The guideline façade greening is an important step for a development in this direction and to promote the exploitation of the existing potential.

Base data of the impact analysis for green and open spaces

Regarding the procurement of path surfaces for the City of Vienna the following basic information was analysed:

- "ÖkoKauf Wien" planning guideline according to the "ÖkoKauf Wien" website, as of October 2013
- Interview with WG25 working group leader, Jürgen Preiss, MA 22
- Study and additional documents provided for the assessment of the sustainability of path surfaces
- Guideline on façade greening (2013) provided as an additional result of the working group

Procurement situation in Vienna

The findings of the working group currently have the status of a planning guideline whose implementation is not mandatory for the departments of the City of Vienna.

The latest output of the working group is the "guideline on façade greening" which is also not compulsory, but provides a comprehensive set of arguments regarding the benefits and technical possibilities of façade greening. It will develop its impacts only in conjunction with a bigger number of implemented projects.

Evaluation methodology / calculation base

It is not possible to make any calculations regarding any implemented projects based on the provided documents. In the following the identified potentials for ecological savings regarding path surfaces identified by the working group are summarised in brief and the impact of the guideline on façade greening is analysed.

The results in detail

Path surfaces

Two indicators, cumulative energy input and carbon footprint, were used for the ecological assessment. The study assigned by MA 22 calculated these indicators for a number of surfaces taking into account the intensity of use, advisability, care and maintenance, durability and reusability of the applied materials in order to guarantee sustainable use for at least 30 years.

[44] Projekt Grünraumanalyse Wien. Dachbegrünung (2010), (Project analyses of greening space. Roof greening) http://www.wien.gv.at/umweltschutz/raum/pdf/gruenraumanalyse-dachbegruenung.pdf, as of 27 February 2014

For this purpose the ground surfaces were divided into the following application categories: footways, pavements, public open space, parking areas, pedestrian zones.

For the time after use, two scenarios were set up: either the materials will be re-used, utilised or recycled or the materials will be properly disposed.

The following diagram shows the findings of the sustainability study for a re-use scenario of the material at a different place according to the respective application categories. The values refer to an application area of 200 m².

Significant differences in the available materials of ground surfaces for all analysed application areas could be detected. The materials with the lowest CEI and lowest carbon footprint are indicated at the farthest top right in each diagram.

In a direct comparison based on the two energy indicators the ground surface F2 (lime gravel cover), G4 (natural stone paving cobblestone), G5 (concrete blocks in sand), as well as P3 (lime gravel cover), PL1 (concrete blocks unbonded roadbase) and FZ1 (natural stone panels unbonded) are the best in their application categories. All materials can be looked up in the guideline on ground surfaces in open spaces.[45]

In the following, 200 m² of the covers G2 (mastic asphalt on bitumen macadam) and G4 (natural stone paving cobblestone) are compared in order to illustrate the savings achieved by choosing ground surfaces in public open spaces according to ecological criteria.

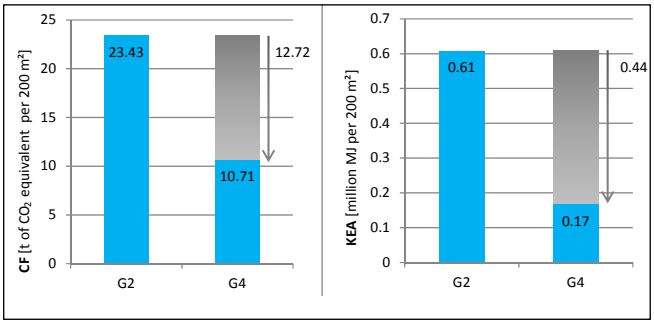


Figure 35: *comparison of two ground surfaces, source: author's diagram (based on data provided by Mayrhofer et al.)*

This example shows that the choice of material can have a significant impact on the energy balance. Asphalt, for

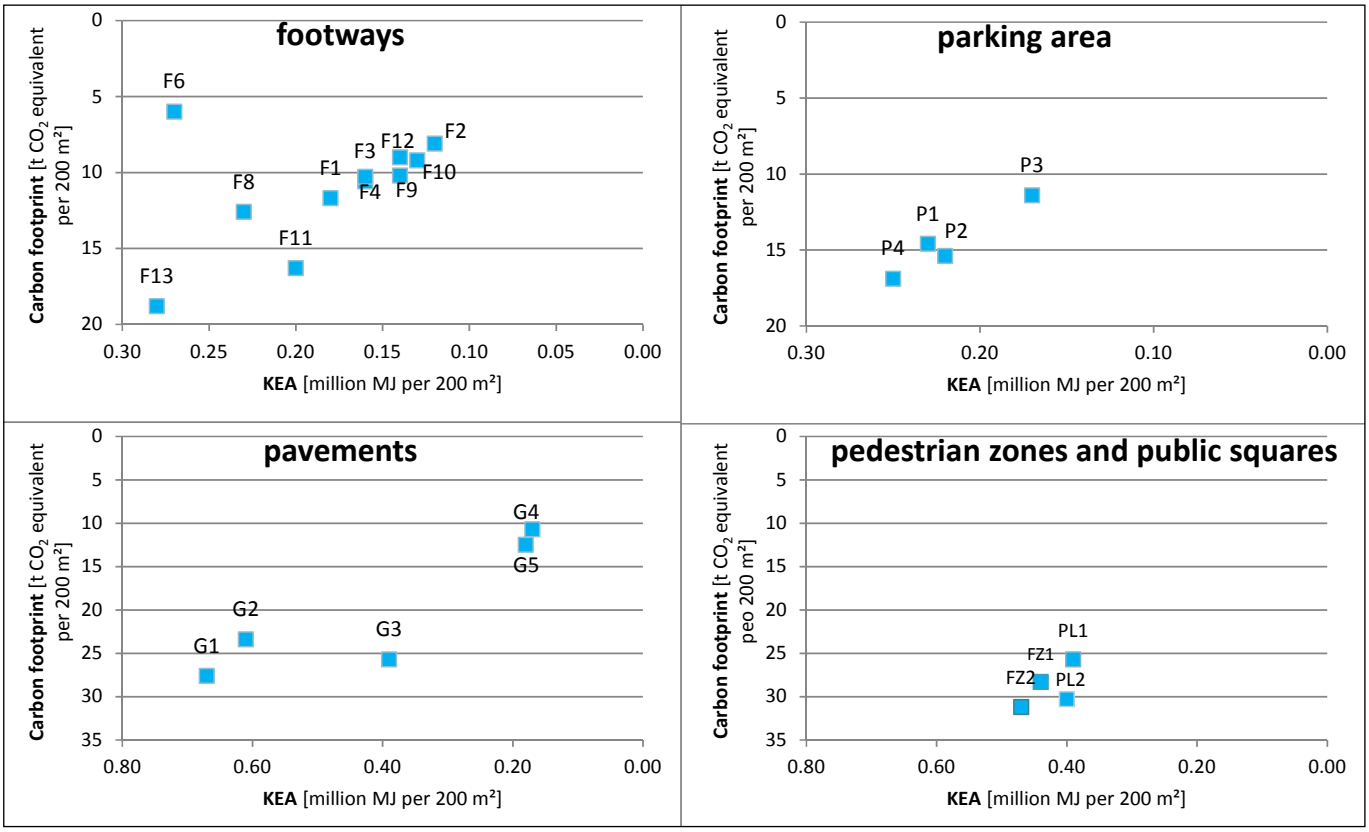


Figure 34: *sustainability of different ground surfaces according to application category, footways (F), parking areas (P), pavements (G - Gehsteig), pedestrian zones and public squares (PZ + POS – Fußgängerzonen und Plätze) source: author's diagram (based on data provided by Mayerhofer et al.)*

[45] cf. ÖkoKauf Wien (2011), http://www.wien.gv.at/umweltschutz/oekokauf/pdf/25-bodenbelaege.pdf, as of 19 December 2013

instance, needs to be heated in order to be applied, i.e. more energy is needed than with cold-applied material. Natural stones have longer life cycles than materials that wear out rather quickly, i.e. they have a lower carbon footprint and a lower CEI. Ground surface G2 thus needs to be completely renewed once every 30 years.

The indicators CEI and carbon footprint are the basis for future sustainability analyses of ground surface works by the City of Vienna, illustrating the possible savings due to a conscious choice of the ground surface.

Guideline on façade greening

The greening of urban areas has ecological and economic benefits and increases the attractiveness and quality of life of a city. Since there is a wide range of available systems for greening façades, expert knowledge is very important. The guideline provides information on which greening system is suited best for which façade and what else needs to be considered when planning and implementing a greening project.

Façade greening is not only a visual measure regarding urban design, it can fulfil a number of functions. It is a buffer zone, helps to regulate the indoor climate and thus reduces operative costs. Additionally it has a positive effect on the urban microclimate since the plants bind dust, moisture and cool the air and reduce CO_2. In short this is a possibility to make use of untapped resources.

The savings potential, such as reducing the operating costs, very much depend on the greening method and the type of building. Pilot projects such as the façade greening of the official building of Municipal Department MA 48 or of the office buildings of the 5th, 7th, 8th and 9th district showcase the impact of façade greening.

The following figure shows the heat flux through an external wall of the central office building of MA 48 with and without greening for one week in summer 2011. It is obvious that the heat transmission with greening is more balanced and fluctuations of the indoor temperature are minimised.

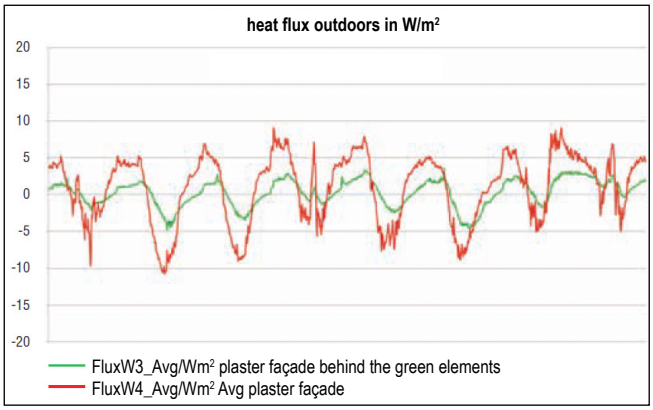


Figure 36: *heat flux through external wall of MA 48 building, 8 July-15 July 2011*
(source: "ÖkoKauf Wien", 2013, guideline on façade greening)

For the overall assessment of a greening project it needs to be considered that operating costs will also be incurred for the care of the plants. Most plants need care, water and fertiliser on a regular basis. The watering system of the green façade should be operated with rainwater in order to provide for sustainable management.

The potential of façade greening primarily lies in an increasingly "green" city, promoting the citizens' well-being. The guideline on façade greening supports and promotes this development especially.

4.5 Environmentally Sound Construction Site Logistics and Public Works

PROGRAMME IMPACTS ON GREEN AND OPEN SPACES – AN OVERVIEW

ECOLOGICAL IMPACTS

Reducing resources:
Examples have shown that sustainable construction site management can reduce the volume of the material needed, as well as fuel consumption and that a high level of waste recycling is possible.

Avoiding damage to the environment:
The various criteria lists of the Working Group Public Works are aimed at reducing CO_2 equivalent emissions, as well as avoiding waste and ensuring the right treatment of the soil by applying high-quality compost.

Contributing to climate protection:
Avoiding transports and the use of railway or ships can save fuel and reduce CO_2 equivalent emissions. At the aspern Urban Lakeside environmentally sound construction site logistics have avoided 100,000 HGV transports, 1.568 t CO_2 equivalent.
Using high-quality compost from the Lobau composting plant saves about 315 t CO_2 equivalent per year.

SOCIAL IMPACTS

Improving the working and living environment:
The targeted intelligent mass flow management at construction sites brings about a reduction of traffic, noise and dust emissions directly at the construction site, which is a big relief for neighbours and workers. Environmentally sound construction site logistics at the aspern Urban Lakeside have led to a reduction of 100,000 HGV transports, i.e. external costs of 179,000 €.

Promoting environmentally conscious behaviour – developing a demand market:
By communicating the benefits of quality compost and by publicly promoting that it is given away for free awareness is raised for applying natural fertiliser and its importance for soil as a resource.

Strengthening initiatives for "environmentally sound procurement":
The implementation of the RUMBA measurement package (guidelines on sustainable construction site management) at large construction sites of the City of Vienna (Hauptbahnhof, aspern Urban Lakeside) significantly contributes promoting environmentally friendly construction site logistics and establishing it as future standard.

ECONOMIC IMPACTS

Reducing costs:
Many efficient measures like avoiding transports or recycling of waste bring about economic benefits. Examples show how costs of construction site logistics and environmental management can be leveled out by an improved resource balance.

Influencing the supply market:
The demand for sustainable materials (e.g. stabilised filling material) and better logistics solutions could have a significant influence on the supply market due to the big procurement volume of the construction sites in Vienna. However, there is no record yet.

Promoting regional producers of environmentally sound products and services:
The shortening of transport ways and the use of locally available building material are central topics of sustainable construction site management.

Challenges and objectives regarding environmentally sound construction site logistics and public works

Both "ÖkoKauf Wien" Working Groups for Environmentally Sound Construction Site Logistics and Public Works were analysed together due to overlapping focuses. In both cases efficient the central topics are the use of resources and reduction of materials harmful to the environment at construction sites of the City of Vienna.

All over Europe environmental measures are enhanced at construction sites in congested urban areas. Since 2004 examples of environmentally friendly inner-city construction site management like the one in Berlin for the Potsdamer Platz square have been successfully facilitated and made realisable due to the RUMBA guidelines (guidelines on sustainable construction site management), an EU-LIFE research project of the City of Vienna with the participation of many important "ÖkoKauf Wien" protagonists.

The focus lies on environmental management and construction logistics. Regarding inner-city areas, there is a lot of potential for the reduction of pollutant emissions, noise and particulate matter, as well as contamination caused by construction site vehicles and traffic.

Base data

Regarding the efficient management of construction sites and sustainable procurement of building material for the construction sites of the Vienna City Administration the following basic information was analysed:

- Guideline on sustainable construction site management – RUMBA, October 2004
- "ÖkoKauf Wien" guideline on "Environmentally friendly Construction Site Management" (draft)
  Interview with working group leader, Brezansky / WUA (Vienna Ombuds Office for Environmental Protection), and Thomas Romm
- Documents provided on sustainable mass flow management, Thomas Romm
- "ÖkoKauf Wien" criteria lists and sample texts for public works (as of 3 February 2014)
- Inputs from the Working Group Public Works, espec. study by Helmut Brezinschek, as quoted
- Reports and studies from other relevant institutions as quoted in the text

Procurement situation in Vienna

At the Viennese construction sites there is still a lot of potential for reducing traffic and emissions, and the recycling of waste.[46]

- Two thirds of the tonnage of freight traffic in Vienna are building material transports.
- 99 percent of construction traffic is conducted by HGVs.
- Approx. 10 percent of NO_x and particulate matter emissions in traffic are caused by construction site traffic.
- A two-axle HGV of 18 t imposes 17,000 times more wear and tear on roads than a car, while a four-axle HGV of 36 t imposes 30,000 times more.
- The construction of one flat requires 60 HGV transports covering a total of 2,500 to 3,000 km, i.e. the HGV travels once around the globe for the construction of 15 flats.
- 13 percent of the Viennese feel disturbed by noise from construction sites.
- 75 percent of waste in Vienna is residual building waste.

Evaluation methodology – an overview

A first study on the assessment of the ecological impact of the criteria lists and sample texts of the "ÖkoKauf Wien" WG Public Works was conducted by the Austrian Institute for Healthy and Ecological Building (IBO) in 2008.[47] The following topics were regulated by criteria lists and sample texts and were analysed in the study regarding their impacts:

- Trenchless construction
- Ready-mix concrete made of sulphate slag cement
- Stabilised filling material
- Compost and compost substrates
- Prevention and recycling of waste
- Construction site transports

Results in detail

Trenchless construction

Compared to the conventional open-cut method, the trenchless construction technology shows a lot of economic benefits and helps to reduce environmentally relevant emissions. Since project-related studies are both very time-consuming and expensive, ecological parameters are rarely ever considered in the decision making process.

The Working Group on Public Works developed a planning tool to support the decision making process according to the "ÖkoKauf Wien" study "Ecological pipe-laying – study for network utility operators" (*Ökologischer Leitungsbau – Studie zur Entscheidungshilfe für Einbautenträger*) in order to facilitate such an evaluation and make it applicable to various projects. This calculation tool was developed especially for the construction of infrastructure pipes, i.e. sewage, gas, district heat and water,

[46] cf. Vienna City Administration (2004), Guideline on sustainable construction site management – RUMBA. Vienna

[47] cf. IBO (2008), Maßzahlen für den Tiefbau (Indices for public works), Vienna

enabling a comparison of environmentally relevant parameters of the open-cut and closed construction methods. The final comparison of both construction methods is based on the environmental parameters of CO_2 equivalent, NO_x and PM_{10} emissions plus environmentally relevant and economic costs.

This tool is an additional parameter in the overall assessment of the ecological impact of a construction site and contributes significantly to showing the ecological impacts of the construction of infrastructure pipes and including them in the decision making process.

Ready-mix concrete made of sulphate slag cement

The production of sulphate slag cement cement does not need any heating, which brings about an energy reduction of 80 to 90 percent in the production process and hence a reduction of primary energy. According to the study of the IBO this reduces CO_2 equivalent emissions by 70 percent compared to conventionally produced normal concrete. Furthermore it saves raw material resources like lime, clay, etc., which are the basis in the production of conventional cement.[48]

Ready-mix concrete needs to fulfil high quality requirements in order to guarantee sustainable use. Primarily it needs to be highly endurable and resistant against chemical attacks. Concrete made of sulphate slag cement fulfils these requirements and due to its surface quality it is a suitable material for the construction of sewage systems and waste water treatment plants. [49]

The sample texts provided in the criteria lists should promote the use of sulphate slag cement and the "greening" of specifications. However, this measure is only sustainable if there is a surplus of furnace slag and if the material is locally available.

If the material needs to be transported over longer distances, this will have a negative impact on the energy balance and will thus nullify the ecological benefits. The use of furnace slag is therefore not recommended as a comprehensive alternative, but needs to be decided for every individual project.

Stabilised filling material

Stabilised filling material provides a lot of technical, ecological and economic benefits regarding filling. It makes filling without settlements and low of voids possible, whereby no compilation is necessary. The benefit of stabilised filling material can be increased by using recycled construction material as aggregate.[50]

The "ÖkoKauf Wien" criteria list for stabilised filling material became an Austrian Standard rule in 2005. The Austrian Standard rule (ONR) which developed out of the "ÖkoKauf Wien" criteria list contains sample texts which can be used for tenders of filling material.

The ecological benefit of stabilised filling material depends very much on the type of construction project and its application, i.e. it is not possible to make a general statement. Since the material does not need to be compiled and the fillings can be dug up by hand the energy input for current and for future works and measures is lower than with different filling material. Furthermore locally effective emissions like particulate matter and noise can significantly be reduced. This is an important improvement regarding the protection of employees and a noticeable relief for the neighbours.

Compost and compost substrates

Compost provides plants with necessary nutrients, increases the water retention capacity of the soil and enriches soil life. High quality compost is mainly made of plant remains and fulfils additional quality criteria according to the Austrian compost ordinance (FLG. II 292/2001). The applicable criteria list provides sample texts for the procurement of quality compost and quality compost substrate.

The City of Vienna has a local source for class A+ quality compost, the Lobau composting plant. This plant is provided with approx. 150,000 t of biogenic waste and garden cuttings per year which makes for 40,000 to 50,000 t of compost. The compost made of the organic solid waste of the City of Vienna is also used in Vienna, e.g. as organic fertiliser on the Viennese farmland or as base substrate for the production of a wide variety of special soils. Furthermore the citizens of Vienna can pick up compost from the plant for free and for their own use. The produced compost is also the main ingredient of the pre-mixed, peat-free flower/potting soil "Guter Grund". The soil can be purchased in bags at all waste collection centres of MA 48. This helps to avoid long transport ways and at the same time to strengthen the awareness of the population for sustainable fertilisers.

The composting plant has two (major) benefits: on the one hand, the production of compost absorbs carbon (and thus CO_2) on a long-term basis and, on the other hand, the City of Vienna does not need to additionally purchase mineral fertiliser since it uses its own compost. These two factors contribute to absorbing and reducing climate-relevant emissions.

A study of the University of Natural Resources and Life Sciences Vienna calculated an emission balance for the Lobau composting plant including all emissions produced by the plant and by collecting / transporting the organic solid waste, as well as the positive effects like

[48] cf. IBO (2008), Maßzahlen für den Tiefbau (Indices for public works), Vienna

[49] cf. "ÖkoKauf Wien" (2008), criteria list 11.006: sample texts for ready-mix concrete made of sulphate slag cement, http://www.wien.gv.at/umweltschutz/oekokauf/pdf/zement.pdf, as of 28 January 2014

[50] cf. "ÖkoKauf Wien" (2003), criteria list 11.002: stabilised filling material, http://www.wien.gv.at/umweltschutz/oekokauf/pdf/verfuellmaterial.pdf, as of 28 January 2014

the absorption of carbon and the substitution of mineral fertiliser.

This balance shows that the composting plant saves 7 kg CO_2 equivalent per t finished compost.[51] Regarding an average compost volume of 45,000 t per year, the savings are calculated at 315 t CO_2 equivalent.

Prevention and recycling of waste

Avoiding, recycling and the appropriate treatment of waste are central topics of construction site logistics. The main focus in this respect is on avoiding waste and recycling residual building waste if possible directly on site. Both topics are addressed in the "ÖkoKauf Wien" guideline "Environmentally friendly Construction Site Management".

The ecological benefit of a comprehensive waste management plan lies in the increase of efficiency and conservation of resources. Additionally there are economic benefits through direct recycling of residual building waste and excavated material.

The deposition of residual building waste or excavated material costs 9.20 € per t according to the Law of Remediation of Contaminated Sites.[52]

Waste separation points, a recycling station and an expert on site make recycling and waste management an integral part of the construction site, which is also shown in cost reductions. According to RUMBA, an increase of the recycling quota by 20 to 40 percent can bring about a cost reduction of 30 to 40 percent.[53]

The results of an efficient waste management are illustrated by several example projects, see success story below.

Construction site transports

Traffic causes a significant part of national greenhouse gas emissions. Theoretically, without considering possible additional expenditure for loading and unloading, the shift to rail or ship provides ecological benefits. The shift from transport by HGVs to rail or ship saves CO_2, sulphur dioxide and nitric oxide emissions, amongst others.

The following table is quoted from the IBO study and illustrates the saving potentials in traffic. The Global Warming Potential (GWP), i.e. the emissions of greenhouse gases, in kg CO_2 equivalent per one thousand km serves as an index.[54]

Table 5: *potential savings of CO_2 equivalent emissions due to choice of transport means (data source IBO, 2008)*

cat	ecol. measures	GWP per tkm	diff. to HGVs per tkm
transp	transp. by train	0.032 kg CO_2-eq	-0,084 kg CO_2-eq
	transp. by ship	0.046 kg CO_2-eq	-0,070 kg CO_2-eq
	avoiding transp.	0.000 kg CO_2-eq	-0,120 kg CO_2-eq

The IBO study illustrates potential savings with the example of a ready-mix concrete plant. A major part of transport-specific emissions can be saved by using rail instead of HGVs for the required annual tonnage of 220,000 t of gravel.[55]

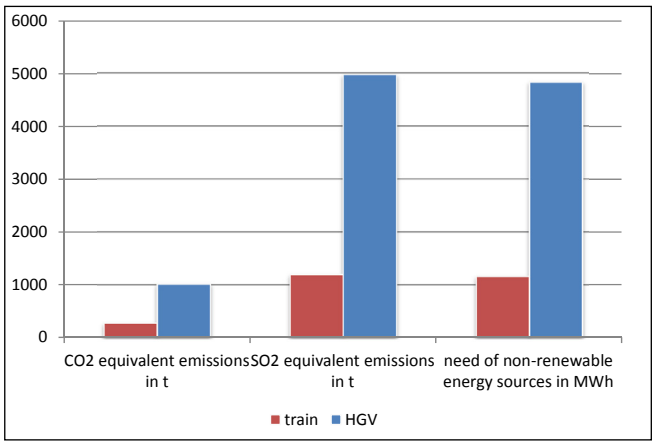


Figure 37: *savings by rail transport illustrated by the example of 220,000 t of transported gravel,*
source: author's diagram (based on data provided by IBO, 2008)

[51] cf. University of Natural Resources and Life Sciences Vienna – Institute of Waste Management (2005), Klimarelevanz der Kompostierung unter Berücksichtigung der Verfahrenstechnik und Kompostanwendung (KliKo) (Composting and its climate relevance including process technology and application), http://www.boku.ac.at/TCG/rol/KliKo_Endbericht.pdf, as of 3 March 2014

[52] cf. Law on the Remediation of Contaminated Sites – ALSAG FLG. I No. 15/2011

[53] cf. Vienna City Administration (2004), Guidelines for Sustainable Construction Site Management – RUMBA. Vienna

[54] cf. IBO (2008), Maßzahlen für den Tiefbau (Indices for public works), Vienna

[55] cf. IBO (2008), Maßzahlen für den Tiefbau (Indices for public works), Vienna

Success story: construction site logistics

Between 2005 and 2008 a pilot project for sustainable and resource efficient management was conducted for the Thürnlhof project with approx. 900 flats initiated by a developers' competition. Two thirds of kilometres driven and one third of the overall amount of transports were saved through the application of a RUMBA measurement package. At the same time the Environmental Impact Assessments for the urban development project at the new main train station Hauptbahnhof Wien and for the aspern Urban Lakeside project were conducted with explicit reference to the RUMBA guidelines regarding construction.

At the Hauptbahnhof main train station site in the Sonnwend area 1,200 flats have been built since 2010 with an overlapping construction site concept. It covers to a large extent the requirements of the "ÖkoKauf Wien" guideline on "Environmentally friendly Construction Site Management" which was developed at the same time as the construction project. An important progress has been the concept of overlapping construction sites with a mass balancing effect due to several parallel building projects on this approx. 80 hectare wide area, e.g. the traffic construction, the road construction and the 7.5 hectare large park. Approx. 150,000 m^3 of recoverable excavated material were reused at the site instead of transporting them to a landfill. At the Thürnlhof project 1 percent of the building costs were spent on construction site logistics and environmental management. However, at the Sonnwend area approximately the same amount was saved due to a better environmental balance: the mass balance of the residential building alone saved about 2,000 t CO_2 equivalent through by reducing transports.

At the moment the construction of another 1,000 flats is planned, again with the concept of overlapping construction sites and there is big potential for a project with 3,500 flats north of the park which is currently subject to a land use planning process.

The aspern Urban Lakeside project with its 240 hectares is one of the biggest urban development projects in Europe. On the former airfield a project is developed which will create work places for 20,000 people and will primarily be an attractive living area for 20,000 people. For the construction of the flats more than 1 million t of material will be extracted from the construction site. A sophisticated logistics system between the individual construction sites will make use of almost all excavation material.

The local concrete plant processes gravel from excavating the lake and the excavation pits, covering 100 percent of the concrete needed. The public works segment uses the local sand gravel from pre-excavation works for road embankments. The extraction of material also reduces the time of construction. A track leading to the new logistics centre of the construction site was laid specifically for the delivery of cement. This environmentally friendly construction site management has spared the urban area more than 100,000 heavy load HGVs during the erection of the first residential building and of a school in Aspern.

Sustainable mass flow management at aspern Urban Lakeside in numbers (m^3 loose):

100,000 m^3 of pre-excavation material is used for road embankments.

150,000 m^3 of excavation material is used for landscaping at the Nordring.

50,000 m^3 of excavation material is used as aggregate at the local concrete plant.

300,000 m^3 of lake excavation material is used as aggregate at the local concrete plant.

Sustainable mass flow management at the aspern Urban Lakeside project goes far beyond legal obligations and guidelines. It saves 100,000 HGV trips and excellently combines ecological and economical factors. The measures for public construction activities for infrastructure and for publicly funded housing are to a great extent anticipated in the "ÖkoKauf Wien" guideline.

The reduction of transport activities saves fuel, CO_2 and air pollutants. The transport distance from the aspern Urban Lakeside project to the closest building waste landfill was presumed with 14 km (outward and return).

According to the "ÖkoKauf Wien" criteria list transport activities (see item 3.6) EURO class 3 was presumed as minimum requirement for HGVs transporting construction waste. The savings of 100,000 HGV trips brought about a reduction of 560,000 l diesel presuming a specific consumption of 40 l diesel per 100 km, equalling 1.568 t CO_2 equivalent. An additional 56 t of air pollutants (NO_x, CO, HC and particulate matter) were prevented and external costs of 179,000 € were saved.

The "ÖkoKauf Wien" guideline "Environmentally friendly Construction Site Management" which is currently finalised is based on the experience of pilot projects which implemented the findings of the RUMBA research project. However, it also integrates various measures which were elaborated during the ULI (Urban Air Initiative Vienna) project of MA 22. This guideline was developed at the same time as the large urban projects of the Sonnwend area, Hauptbahnhof main train

station and aspern Urban Lakeside. The experiences and findings of these projects were hence integrated into the "ÖkoKauf Wien" guideline because of the close cooperation between external experts and employees of various departments of the Vienna City Administration who were involved in the aforementioned building projects whilst developing the "ÖkoKauf Wien" guideline. The development process of this "ÖkoKauf Wien" guideline was influenced by discussions on feasibility and practical relevance of various measures based on practical experience and best-practice examples. It is therefore to be expected that it will be widely accepted and that it will become a useful tool also for experts outside the city administration in their planning, tendering and implementing of construction projects, not at least because it is a basis for significantly minimising air pollutants, dust and noise at large construction sites and it also makes savings in resources possible bringing about higher economic efficiency and lower environmental strain.

Conclusion: environmentally friendly construction site management saves resources, reduces emissions and hence relieves the strain on the environment, neighbours and workers.

Summary of the impact analysis of the activities of the Working Group Environmentally Sound Construction Site Logistics and Public Works

The Working Group Public Works has already published several criteria lists which have been integrated into national standards. Since the implementation of the measures needs to be adjusted to the specific challenges of the respective construction site it is recommended to quantify the environmental impacts of the criteria lists based on practical implementation examples.

Regarding environmentally sound construction site logistics there is big potential for ecological savings which result in significant cost reductions. Sustainable mass flow management and environmentally sound construction site management eliminate redundancies in construction site logistics and make use of ecological and economic advantages, as shown by the aforementioned best-practice examples. However, there is a lot of potential for future implementation.

The implementation of the findings regarding environmentally sound construction site logistics of the "ÖkoKauf Wien" programme is still in the development phase. Working group representatives of "ÖkoKauf Wien" were significantly involved in the EU project RUMBA and hence have laid the foundation for further implementation of these project results within the "ÖkoKauf Wien" programme. A criteria list is currently developed, however, it has not been published yet as a compulsory procurement tool.

Several prominent large-scale projects in Vienna were and are implemented according to the future "ÖkoKauf Wien" criteria. One of the challenges is the project-specific assessment of achievable savings and environmentally friendly measures. Remarkably, even private project developers and builders are opting to adhere to the "ÖkoKauf Wien" criteria of the working group.

Therefore the analysis of several exemplary construction sites with different technical pre-requisites and dimensions is recommended in order to be able to show the complexity of direct and long-term impacts on the environment and to derive guidance for typical construction projects in the City of Vienna.

5 Impact analysis focusing on "eco-friendly living in Vienna"

This chapter comprises the following "ÖkoKauf Wien" working groups for the impact analysis:

- Food
- Events
- Prevention and Disposal
- Nanotechnologies
- PVC

The findings of this WG have a direct impact on the life and the living together of the Viennese citizens. They are divided into the procurement of organic food for the different facilities of the City of Vienna, the greening of events in Vienna, waste prevention and disposal with regards to waste management and the prevention of various substances harmful to human health and the environment.

The following conclusions can be drawn from the impact analysis of the focus "eco-friendly living in Vienna":

- The addressed topics are characterised by a high complexity and typically summarise inputs from different programme activities of the "ÖkoKauf Wien" programme (e.g. greening of events). The cooperation of the programme with other service areas of the City of Vienna or stakeholders in the city is very close and distinctive. On the one hand the "ÖkoKauf Wien" programme contributes to comprehensive strategies of the city (e.g. regarding organic food, disposal services). On the other hand results were to some extent achieved due to inquiries of procuring departments (e.g. nanotechnology, PVC) which in part can now be made available to a wide variety of target groups together with other initiatives.
- At the moment it is only possible to quantify the programme impacts regarding organic food. The procurement of organic food accounts for a big share of the overall impact on climate change mitigation due to the "ÖkoKauf Wien" programme. Another important impact in this respect is the fact that the implementation of the programme counteracts the "killer argument" that organic food is too expensive.
- The greening of events definitely has environmental impacts, even though they cannot be quantified on the basis of the provided information. An analysis of exemplary events could help to make the impacts of the programme tangible. It would also be possible to identify contributions of the programme to an ecologically worthwhile waste management in cooperation with the respective expert departments (procurers, waste managers).
- Findings on interdisciplinary topics (nanotechnology, PVC) fulfil several important functions: they help to answer inquiries of procuring departments of the Vienna City Administration and are integrated into the criteria lists of several programme working groups. Additionally these findings raise awareness, provide additional information to the citizens of Vienna and hence contribute to the focuses of related initiatives on environmental protection and consumer information. A qualitative description of the impact of these interdisciplinary topics will be most suitable in this respect.
- Since the programme services are very close to the citizens of Vienna, the pioneer work and role model status of all topics provide excellent prerequisites for this topical focus to play an important role in the awareness-building process, in the communication of the programme and hence in the public perception of "ÖkoKauf Wien".

The following important programme impacts and programme potentials were identified on the basis of the impact analysis:

ECOLOGICAL IMPACTS:

Significant contribution to climate change mitigation due to the procurement of organic food

- The procurement of food accounts for about 80 percent of the indicated annual programme impacts of "ÖkoKauf Wien" regarding climate change mitigation. Between 2008 and 2012 approx. 58,600 t of CO_2 equivalents were saved.

Complex impacts on the environment throughout the focus "eco-friendly living"

- Resource savings in different segments can be determined based on individual examples (e.g. reusable dishes at events, distances regarding the transport of waste for disposal, etc.). This, however, leads to an underestimation of the overall potential of the respective measures. A more detailed compilation of environmental impacts would be possible based on complex approaches of eco-balancing.

SOCIAL IMPACTS:

Pioneering and role model effect throughout the focus "eco-friendly living"

- Since all activities are very close to the citizens of Vienna and to a generally wide range of target groups the measures of this focus are suitable for a platform of awareness raising and communicative activities.

ECONOMIC IMPACTS:

Cost neutral procurement of organic food

- The feasibility of a largely cost neutral procurement of organic food by reducing convenience products and focusing on the purchase of regional and seasonal products mainly counteracts the "killer argument" that organic food is too expensive.

No basis for the analysis of all other topical focuses

- Due to the aforementioned complexity of the issues it was not possible to include economic impacts in the analysis of all other topical focuses.

As a conclusion it can be stated that among all analysed topics the procurement of organic food stands out by its big contribution to the ecological impacts of "ÖkoKauf Wien".

Additionally "eco-friendly living" fulfils a very important function regarding the image and overall perception of "ÖkoKauf Wien" since it has a role model status and awareness building effect due to its direct contact with the citizens of Vienna.

5.1 Food

PROGRAMME IMPACTS ON FOOD - AN OVERVIEW

ECOLOGICAL IMPACTS

Reducing resources:
The focus on the procurement of organic food is an energy saving and resource efficient alternative to conventional agriculture. Taking care of the ecosystem as the basis of life of this as well as future generations is also part of organic farming.

Avoiding damage to the environment:
Organic farming works with natural nutrient cycles and reduces the input of synthetic substances such as slowly degradable pesticides.

Contributing to climate protection:
The high share of organic food in the kitchens of the City of Vienna has already saved approx. 11,700 t of CO_2 equivalents. The savings between 2008 and 2012 amounted to approx. 58,600 t of CO_2 equivalents.

SOCIAL IMPACTS

Improving the working and living environment:
Sustainable land use by organic farming significantly contributes to a well-functioning ecosystem and ensures the availability of natural resources also for future generations.

Promoting environmentally conscious behaviour – developing a demand market:
The "natürlich gut Teller" (naturally good dish) project was well received by the public and raised awareness for and interest in sustainable food based on organic, regional and seasonal products as well as reduced meat portions. Additionally criteria lists, position papers and studies have been communicated to the public in order to promote environmentally sound decisions when buying food.

Strengthening initiatives for "environmentally sound procurement":
The criteria of the WG Food overlap with the demand of several organisations and special interest groups for a sustainable diet (keyword food safety).

ECONOMIC IMPACTS

Reducing costs:
The procurement of organic food can be achieved without a significant increase in costs for sufficiently available commodity groups.

Influencing the supply market:
The criteria elaborated by the WG Food promote "alternative" organic methods of cultivation. The "natürlich gut Teller" project included the procurement of vegetables which do not meet the aesthetic criteria of supermarket chains.

Promoting regional producers of environmentally sound products and services:
Regionalism has become increasingly important for the "ÖkoKauf Wien" objectives. Tenders on special quality criteria and the strengthening of good relations with suppliers can consolidate regional (organic) production. The cart of the KWP (Retirement Homes Fund of the City of Vienna) and of the "natürlich gut Teller" is to a large extent filled with products of regional organic farmers.

Challenges and objectives regarding food

The selection of food, how it was cultivated and procured, as well as the method of storage and packaging have a significant impact on the environment and the climate. Many studies indicate that organically produced food causes less greenhouse gases than conventionally produced food and significantly contributes to soil conservation.

Agriculture is one of the three main causes of greenhouse gas emissions worldwide, ranking third behind the energy and the transport sector. In the agricultural sector the production of artificial fertilisers and the production of meat are the main causes of emissions harmful to the environment.[56]

Every Austrian citizen's diet causes 2,600 kg of CO_2 equivalents on average per year. Increasing the share of organic food and reducing the consumption of meat products result in a significant improvement of the CO_2 balance of a meal. An additional reduction can be brought about by purchasing regional and seasonal products and avoiding convenience food.

Avoiding the application of artificial fertilisers and synthetic chemical pesticides in organic farming contributes, among other things, to a higher health-related quality of life. According to a study of the Research Institute of Organic Agriculture one third of the annual external costs can be saved through organic farming, e.g. by reducing the costs for processing drinking water, by applying fewer pesticides and fertilisers, by reducing greenhouse gases per hectare of agricultural land. The reduction of pesticides also counteracts mass bee deaths.[57]

In 1999 the Vienna Climatic Protection Programme ("KliP Wien") of the City of Vienna already defined the objective to procure at least 30 percent of the food necessary for the various facilities of the City of Vienna from organic farmers. "ÖkoKauf Wien" laid the foundation for the implementation of this objective with criteria lists and position papers and informed the public on current topics, e.g. trans fats or genetically modified organisms (GMOs). "ÖkoKauf Wien" further defined criteria for the procurement of eggs and issued position papers on the procurement of drinking water and products derived from certified and sustainable fishing.

Base data of the impact analysis for food

Regarding the procurement of food for departments of the Vienna City Administration the following basic information was analysed:

- "ÖkoKauf Wien" criteria lists and position papers for the procurement of food
- Interview with WG09 working group leader, Bernhard Kromp / MA 49 – Bio Forschung Austria
- Data base provided on the share of organic food of the meals in institutions of the City of Vienna
- Calculations provided by the internal programme evaluation in 2008
- Complementary information from the evaluation of the Urban Energy Efficiency Programme (SEP) of the City of Vienna, as well as from the progress reports on the implementation of the Vienna Climate Protection Programme (KliP)
- Reports and studies from other relevant institutions as quoted in the text

Procurement situation in Vienna

The major buyers of food in the City of Vienna are MA 10 (Children's Day Care Centres), MA 56 (schools with full-day care), the Vienna Hospital Association (KAV) and the Retirement Homes Fund of the City of Vienna (KWP). The procurement volume of these institutions is measured in required meals.

The goal is to procure at least 30 percent of the food from organic farming. This requirement was fulfilled by all institutions of the City of Vienna with one exception, the schools with full-day care. The share of organic food is significantly higher in some institutions, e.g. in the Viennese Kindergartens, where more than 50 percent of the food is of organic origin.

Between 2004 and 2012 the average share of organic food was 30 percent in the aforementioned institutions. The following figure shows the distribution and development of the share of organic food. The values were collected by the WG Food (MA 10 from 2009 onwards estimated; the data regarding the share of organic food are only available on a quantitative basis and hence are not included in Figure 38).

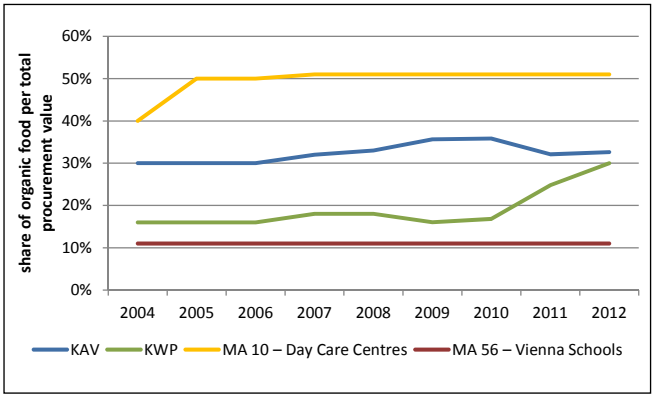


Figure 38: *share of organic food in relation to the total procurement volume, source: author's diagram*

[56] cf. FAO (2013), FAO Statistical Yearbook, http://www.fao.org//news/story/en/item/178138/icode/, as of 13 December 2013

[57] cf. FiBL – Forschungsinstitut für biologischen Landbau (Research Institute on Organic Agriculture) (2013), www.bio-austria.at/content/download/47987/342234/file/Studie_Volkswirtschaftlicher_Nutzen_Bio_4_Dez13.pdf, as of 13 December 2013

Evaluation methodology – an overview

The impact of WG Food was evaluated considering various issues.

The impact of the criteria list on the procurement of food and organic farming products was evaluated on the basis of saved CO_2 equivalent emissions. For this the calculation of the internal "ÖkoKauf Wien" evaluation of 2008 was continued. The calculation is based on procurement volumes and the number of meals needed in the kitchens of MA 10, MA 56, the Vienna Hospital Association (KAV) and the Retirement Homes Fund of the City of Vienna (KWP). The share of organic food in relation to the total procurement volume is also known or is estimated for the schools with full-day care.

Additional criteria lists and position papers of the WG Food were analysed as well and their impact on awareness building and the promotion of a sustainable diet was evaluated.

Calculation base for the assessment of greenhouse gas savings

In Austria the greenhouse gas emissions of the food sector are approx. 2,600 kg of CO_2 equivalents per capita per year.[58] Full catering for one person in the analysed institutions is hence also estimated at 2,600 kg of CO_2 equivalents per year.

The numbers of catered meals were extrapolated to full catering per day and were also taken from the internal evaluation of 2008:

KAV	22,500 units of full catering per day
KWP	11,500 units of full catering per day
MA 56 – schools	8,795 units of full catering per day
MA 10 – Kindergartens	4,544 units of full catering per day

Depending on the respective share of organic food in the institutions the number of units of organic full catering was calculated. Studies show that growing organic food saves significantly more energy and resources than conventionally produced food. As a reference value it is presumed that organic food procured for the aforementioned institutions cause 30 percent less CO_2 equivalent emissions than comparable domestic products.[59]

Average CO_2 emissions caused by organic full catering for one person are thereby reduced by 30 percent equalling 1,820 kg CO_2 equivalent per year.

The calculation of CO_2 equivalent savings is done by comparing conventional full catering to organic full catering.

The results in detail

CO_2 equivalents savings from organic food

According to the criteria list for the procurement of food from organic farming the facilities of the City of Vienna take care to use organic food. In the past years an increase in the share of organic food to 30 percent on average has been achieved without any significant increase in costs.[60]

Based on the registered shares of organic food the following savings of CO_2 equivalent emissions were calculated:

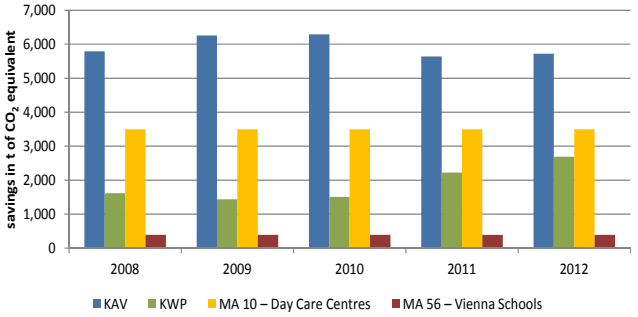


Figure 39: *CO_2 equivalent savings by means of procuring organic food, source: author's diagram*

On average more than 11,700 t of CO_2 equivalents were saved each year. Between 2008 and 2012 the overall savings amounted to approx. 58,600 t of CO_2 equivalents.

Organic farming has big advantages in many fields, e.g. no artificial fertilisers and pesticides are used which are then retrieved in soil and water and are slowly or not at all bio-degradable.

Ecological and economic drinking water supply

"ÖkoKauf Wien" takes position not only regarding food, but also regarding drinking water. The "ÖkoKauf Wien" position paper on ecological and economic drinking water supply shows on a scientific basis that the use of tap water has economic and ecological advantages compared to bottled mineral water.[61]

The quality of Viennese tap water is as good as that of bottled mineral water. However, there are big differences regarding specific energy consumption. Direct comparison shows that packaging, bottling, transporting and cooling bottled water needs much more energy than supplying tap water.

The following figure shows the costs of the most common types of drinking water supply per litre in comparison.

---

58 cf. Salmhofer, C., Strasser, A., Sopper, M. (2001), Ausgewählte ökologische Auswirkungen unseres Ernährungssystems am Beispiel Klimaschutz (Selected ecological impacts of our diet systems using the example of climate protection), http://www.umweltethik.at/download.php?id=285, as of 11 February 2014

59 cf. Bio-Forschung Austria

60 Working Group Food (2013), oral report

61 cf. ÖkoKauf Wien (2012), http://www.wien.gv.at/umweltschutz/oekokauf/pdf/trinkwasser-bereitstellung.pdf, as of 13 December 2013

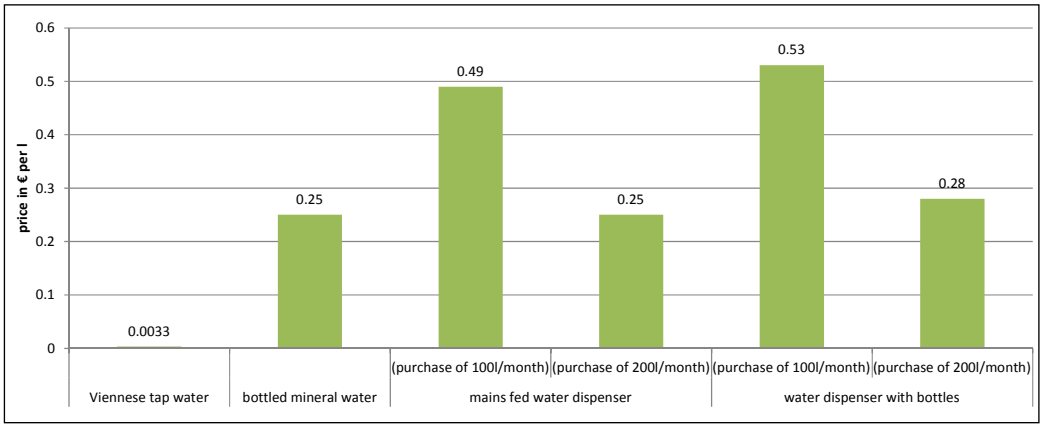


Figure 40: *specific price of water depending on the type of supply, source: City of Vienna (data source: "ÖkoKauf Wien", 2012)*

Mineral water is very often transported over long distances before it reaches the end consumer. Furthermore, single-use bottles are increasingly replacing re-usable packaging which is counterproductive regarding waste prevention.

Viennese tap water is provided to the end consumers without any packaging, HGV transport or additional cooling and ready to drink.

Public relation work and awareness building process

Regarding a healthy and well-balanced diet "ÖkoKauf Wien" is active in a complex field of ecological procurement. Based on its public relation by means of position papers, the "natürlich gut Teller" (see success story), cookbooks, etc., it has been building awareness for the environmental impacts of our daily grocery shopping behaviour.

Its position paper on the use of fish and fish products, for instance, defines sustainable fishing and hence gives clear guidance regarding what needs to be considered in the procurement of fish. The included lists make it easy for both the municipal departments and the consumer to choose between sustainable and less sustainable products and hence to make a deliberate statement. The recommendations are especially implemented to a large extent by KAV.

By acting according to the position papers, the institutions of the City of Vienna contribute a lot to public awareness building. A sustainable diet is promoted on various levels, ranging from organic fruits and vegetables in Kindergartens to canteen kitchens in the "Häuser zum Leben" homes of KWP. "ÖkoKauf Wien" actively influences the decision making process when procuring food.

Success story: "Natürlich gut Teller" in the KWP homes

"natürlich gut Teller" are meals which meet specific eco-friendly criteria. They are provided two to three times per week in several Viennese canteen kitchens, e.g. in the homes of the Retirement Homes Fund of the city of Vienna (KWP). The "natürlich gut Teller" is a practical implementation of the "ÖkoKauf Wien" criteria for the procurement of food. The meal is hence environmentally friendly, naturally healthy and produces less CO_2 equivalent.

The main criteria are that the food

- partly comes from organic farming
- is seasonally available
- preferably comes from the region
- contains only a small amount of meat and
- only sustainably caught fish.

The biggest savings in CO_2 equivalent emissions can be achieved by shifting to organic meat and reducing the meat quantity in general. Since the production of meat is very energy intensive the "natürlich gut Teller" project focuses on meals made of vegetables and with reduced meat portions.[62] The following diagram shows the possibility to save CO_2 equivalents by comparing selected "natürlich gut Teller" meals with one portion of breaded veal escalope ("Wiener Kalbsschnitzel").

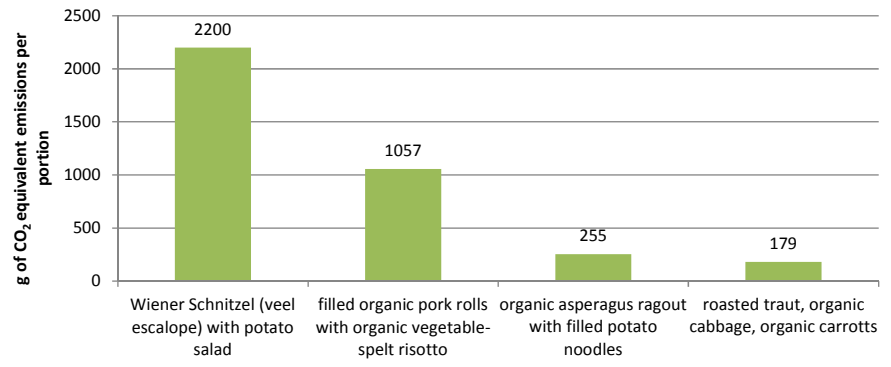


Figure 41: *CO_2 equivalent emissions of different meals (source: die umweltberatung)*

In 30 kitchens of the KWP homes the meals are currently freshly cooked which makes them especially well-suited for the "natürlich gut Teller" pilot project. The kitchens can individually order their weekly food requirements from pre-ordered goods (e.g. organic beef escalope) according to the component menu. A central "cart" has been introduced to support the implementation of the "natürlich gut Teller" project. The cart is filled with products from the region, preferably with organic food of the respective season.

The kitchens compile their own "natürlich gut Teller" meal with the products from this cart. The meal is largely made of food produced in the region. Amongst many other things, KWP buys and processes vegetables which do not meet the aesthetic criteria of the supermarket chains. The great flexibility of this cart makes it possible to centrally procure food of regional supply. At the same time it allows the kitchens to compile their own individual menus.

The seasonally changing supply holds a lot of potential for creativity and has even brought back some "forgotten" vegetables. KWP issued a cookbook with seasonal "natürlich gut Teller" recipes responding to the project's big success. The recipes also state the necessary amounts for four servings and hence can be used by other canteen kitchens or by private persons at home which makes the project's success even better known to the public.

Conclusion: the "natürlich gut Teller" meal is still very popular and shows that it is possible for canteen kitchens to cook environmentally friendly and healthy.

[62] cf. die umweltberatung (2013), http://www.umweltberatung.at/natuerlich-gut-teller, as of 13 December 2013

Summary of the impact analysis of the activities of the Working Group Food

Criteria lists and available data

With its criteria lists, the Working Group Food focuses intensively on the task to make nutrition more sustainable while taking into account environmental, health- and cost-related factors.

The working group has issued criteria lists on food from organic farming, the prevention of artificial trans fats in food, free-range fresh eggs and pasteurised eggs and the prevention of genetically modified organisms (GMO). Furthermore the working group provides arguments in its position papers for consciously procuring ecologically responsible and certified fish products and for using and drinking tap water as an eco-friendly alternative to bottled mineral water.

There are data available for the implementation of these criteria regarding organic food for the institutions of MA 10 and MA 56 as well as for the canteen kitchens of KAV and KWP. Quantifiable savings were only documented in this area.

Assessments and impacts

The average share of organic food in the aforementioned institutions amounts to 30 percent of the total procurement volume. Based on these data average savings of 11,700 t of CO_2 equivalents per year were calculated. In the years between 2008 and 2012 a total of approx. 58,600 t CO_2 equivalents were saved.

The Working Group Food also puts a lot of effort into awareness building. The aforementioned criteria lists were also made available for citizens in the form of easy-to-understand information folders.

The "natürlich gut Teller" project combines all criteria of the working group regarding environmentally friendly and healthy meals and hence raises awareness for sustainable food.

5.2 Events

PROGRAMME IMPACTS ON EVENTS - AN OVERVIEW

ECOLOGICAL IMPACTS

Reducing resources:
There are many approaches to resource saving, e.g. concerning event communication, the use of energy and water, the use of re-usable dishes or eco-friendly means of transport for the delegates and participants.

Avoiding damage to the environment:
An event is a complex compilation of various environmentally relevant aspects. However, it is possible to prevent damage to the environment through an eco-friendly organisation and implementation (e.g. prevention of waste, prevention of private transport, etc.).

Contributing to climate protection:
Returnable beakers: savings of 100 kg of CO_2 per green event (organised by ÖkoEvent) and 2 t of CO_2 in 2012 (also see success story at the end of the chapter)

SOCIAL IMPACTS

Improving the working and living environment:
The environmentally sound implementation of an event has a positive effect on the delegates and participants as well as on the neighbours of the site of the event. With respective guidance and by using the event services offered by the City of Vienna it can be organised in way that is cost-neutral for organisers, caterers, etc.

Promoting environmentally conscious behaviour – developing a demand market:
Eco-friendly events are an excellent platform for the promotion of environmentally conscious behaviour to a wide range of target groups. At the same time an increasing demand for event guidance for events of various dimensions has been registered.

Strengthening initiatives for "environmentally sound procurement":
Cooperation of several initiatives of the City of Vienna in the field of events and involvement of the Green Events Austria platform.

ECONOMIC IMPACTS

Reducing costs:
For some event segments, e.g. returnable beakers / dishes to rent, the cost savings and cost neutrality for the event organiser / caterer can be illustrated. However, exemplary assessments of typical single events are not yet available.

Influencing the supply market:
The programme can influence the supply market by listing certified suppliers (e.g. caterers, accommodation possibilities).

Promoting regional producers of environmentally sound products and services:
The cooperation of all relevant initiatives of the City of Vienna, such as dishes to rent or sustainable catering, promotes regional suppliers of corresponding services and supports the establishment of eco-friendly procurement and disposal systems.

Challenges and objectives regarding events

Due to the complex processes which need to be planned and implemented it is a special challenge to organise an event based on sustainability criteria. Eco-friendliness and sustainability need to be considered in all the organisational processes.

The organisation and implementation of an eco-friendly event is a multi-level project which involves know-how of different environmentally relevant fields. The special requirements vary depending on the type and size of an event, however they need special attention and additional planning and implementation efforts on behalf of the organisers. The requirements of an environmentally friendly event could be a considerable challenge, especially for less experienced organisers.

In 2006 an "ÖkoKauf Wien" criteria list on the greening of events implemented by the departments of the City of Vienna was issued. It comprises all procurement-relevant aspects of an ecological event management. This programme result takes into account that procurements for events have strong ecological impacts regarding energy and water consumption, as well as waste and traffic volumes and can cause emissions harmful to the environment and human health.

The implementation of the individual items of an environmentally sound event management ranging from cuisine to resource and waste management, mobility, etc. to public relations is ensured by the compulsory application of the criteria list for all events organised or commissioned by the City of Vienna and for its partners and sponsors.

The complexity of the task of organising an environmentally sound event is shown in the figure 42:

The "ÖkoKauf Wien" criteria list is implemented in close coordination with other relevant initiatives of the City of Vienna. There is a close cooperation with the event service of the City of Vienna in this respect which provides information material, check lists and contacts for the environmentally friendly organisation of events, as well as free-of-charge or funded guidance for public and private events.

Events which are especially eco-friendly regardless of size or occasion can be awarded with the "ÖkoEvent" label, the umbrella brand of the City of Vienna, and published at www.oekoevent.at, if they fulfil a given number of criteria.

The "ÖkoKauf Wien" criteria list on the greening of events is compulsory for all events in Vienna which are implemented by departments of the City of Vienna. Special attention is given to the adherence to the criteria at typical events in the Vienna City Hall and at the Wiener Rathausplatz square. "ÖkoKauf Wien" is in close contact with the responsible departments and supports them in implementing the criteria. Furthermore in the phase of introducing and implementing the criteria, information, guidance and awareness building regarding a wide range of target groups of public and private event organisers in Vienna is of utmost importance.

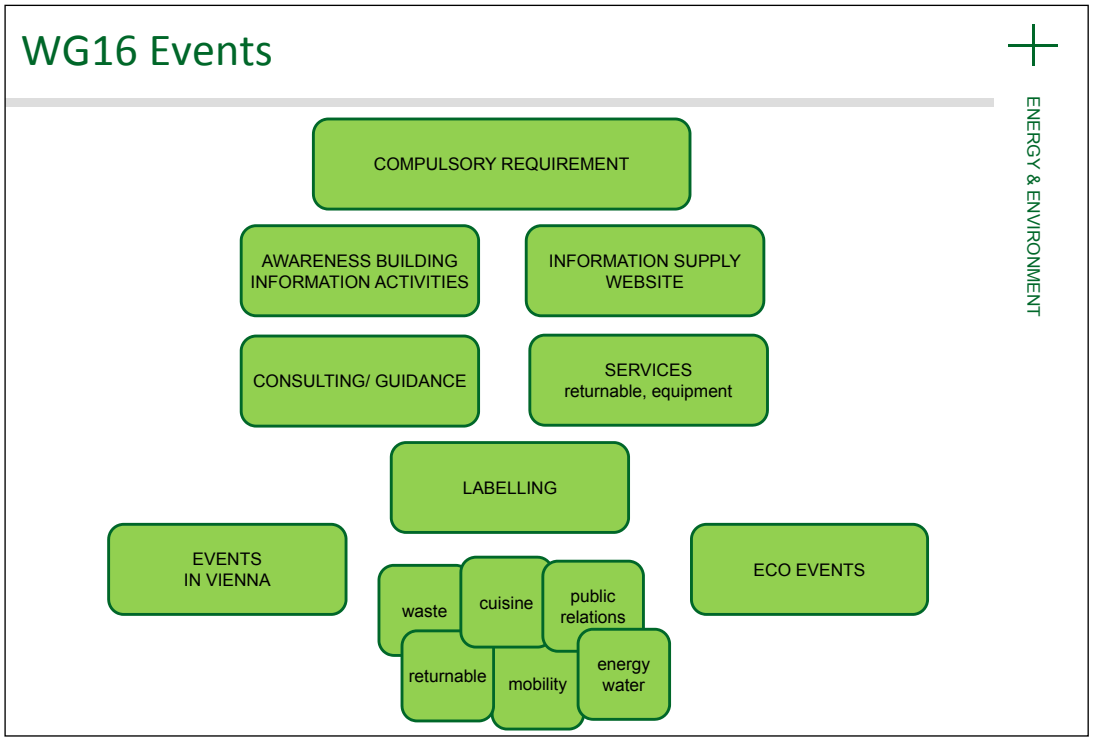


Figure 42: *aspects of greening events according to the "ÖkoKauf Wien" criteria list, source: City of Vienna*

Base data of the impact analysis for events

Regarding the greening of events the following basic information was analysed:

- Results of the working group according to the "ÖkoKauf Wien" website, as of October 2013
- Interview and related meetings with WG16 working group leader, Georg Patak, MA 22
- Information documents by "die umweltberatung" Vienna on the findings of the event service, as well as indices regarding implemented events
- Additional information of the initiatives ÖkoEvent (City of Vienna) and Green Events Austria
- Reports and studies from other relevant institutions as quoted in the text

Evaluation base

Based on the provided information it was not possible to conduct a quantitative analysis of the ecological impacts of single events implemented in compliance with the criteria.

The following assessments refer to the statistics on the use of the event service of the City of Vienna, which guides and supports organisers in applying the event criteria.

Greening of events in Vienna

According to the indices of the event service "die umweltberatung" it can be seen that there is increasing acceptance of environmentally sound events in Vienna.

The number of information inquiries at the event service of the City of Vienna is continuously increasing. Approximately every seventh inquiry leads to an in-depth on-site meeting.

The wide range of interested target groups is a sign of the role model impact of the awareness- building measures of the "ÖkoKauf Wien" programme in cooperation with the respective initiatives of the City of Vienna.

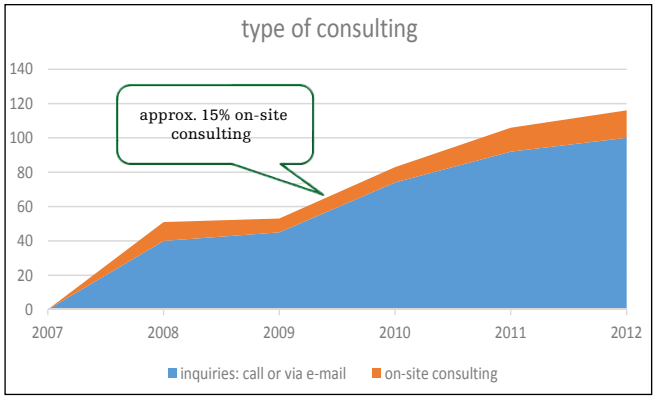


Figure 43: *guidance on greening of events, source: author's diagram (based on data provided by "die umweltberatung")*

The number of inquiries is generally increasing, but the increase in the number of private organisers asking the event service of the City of Vienna for guidance regarding the greening of their event has been especially significant in the last years. This can be interpreted as an indication that environmentally sound event management is increasingly perceived as a sign of quality, i.e. on a long-term basis important multiplying effects and continuous changes in the behaviour of the broad public can be expected.

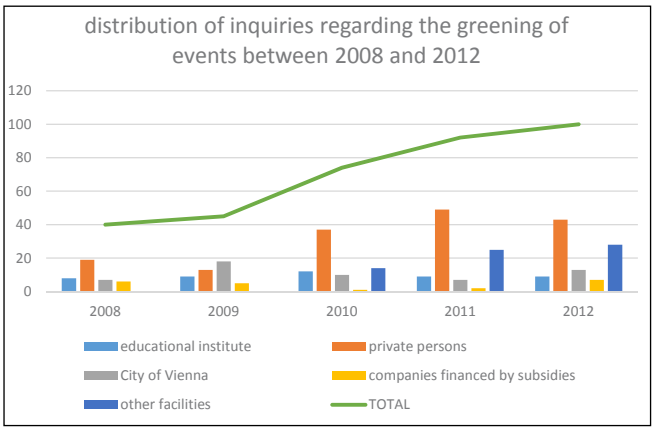


Figure 44: *consumption of guidance for greening of events, source: author's diagram (based on data provided by "die umweltberatung")*

Since autumn 2010 the "ÖkoEvent" label, which is the umbrella brand for sustainable events in cooperation with all facilities and initiatives of the City of Vienna involved - MA 22, MA 48, "ÖkoKauf Wien", "ÖkoBusinessPlan Wien", "natürlich weniger Mist" (naturally less waste) – has been awarded to and hence is promoting comprehensively ecological events.

A prominent example is the performance show of the Austrian Armed Forces which takes place each year on 26 October, Austria's main national holiday, and was awarded the "ÖkoEvent" label in 2010.

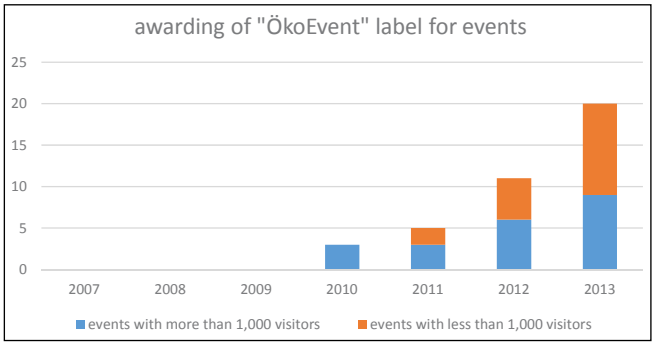


Figure 45: *awarding the "ÖkoEvent" label to eco-friendly events in Vienna, source: author's diagram (based on data provided by "die umweltberatung")*

The statistics regarding the awarding of the "ÖkoEvent" label since 2010 show that an increasing number of "smaller" events, such as school festivals with approx. 150 participants put a lot of effort into demonstrating their environmental friendliness in this respect by applying for the label. This trend can be seen as a starting point for the further development of communicative measures for different target groups, since there obviously is potential regarding events of all dimensions and for all occasions.

Success story: Vienna's returnable beaker

As early as 2008, at the European Football Championship a study on the ecological balance of disposable and returnable beaker systems was conducted which showed that returnable beakers cause significantly less environmental damage than any of the disposable scenarios analysed.[63]

Since 2005 the City of Vienna has already tested a rental system for returnable dishes at events which has proven to be very effective. The delivery, collection and cleaning of the returnable dishes is handled by a specialised service provider. This does not cause any additional expenditure compared to the use of disposable dishes and since there are no acquisition costs and no disposal costs, returnable dishes are even cheaper most of the time.

The Vienna Waste Management Act stipulates the use of returnable dish systems for large-scale events in Vienna and for events taking place on property owned by the Vienna City Administration as a compulsory requirement for the greening of events.

Since 2005 the Viennese returnable beakers have been used at more than 740 events, more than 5.5 million beakers are circulating. The returnable beakers can be used up to 150 times, are shatter-proof and can be used at any event. They can easily and conveniently be rented and given back without cleaning. A special washing system ensures that hygiene standards are met. The returnable beakers hence help to keep the event venue clean and for many event guests they serve as a souvenir and are used for many years.[64]

Large-scale events like the performance show of the Austrian Armed Forces at the Heldenplatz square and many smaller events have already made use of the benefits of the Viennese renting system for returnable beakers.

The guidance given to the organisers of events also includes providing information on additional services for an eco-friendly event such as the "Wiener Geschirr-Mobil" (mobile reusable dish service unit), environmentally sound catering services or returnable beakers.[65]

The use of returnable beakers at different types of events (sport events, festivals, etc.) combines the ecological benefit of the returnable system with practical advantages for the organiser, which also leave a strong impression on the visitors of the event and hence are an important means of awareness building and public relations.

The greenhouse gas potential for the use (production, transport, collection and disposal) of disposable beakers is 20 times higher than for returnable beakers. At an event with 1000 beakers, for example, the use of returnable beakers saves 100 kg of CO_2 equivalent[66] which in total amounted to savings of approx. 2 t of CO_2 equivalent for 20 events in 2012.

Conclusion: returnable beakers are sustainable advertising for environmentally sound events in Vienna.

[63] cf. Austrian Institute for Ecology et al. (2008), Vergleichende Ökobilanz verschiedener Bechersysteme beim Getränkeausschank an Veranstaltungen (Comparable eco-balance of different beaker systems for events)

[64] cf. http://www.wenigermist.at/der-wiener-mehrwegbecher-im-neuen-design/

[65] cf. http://www.oekoevent.at/mehrweg

[66] cf. Austrian Institute for Ecology et al. (2008) Vergleichende Ökobilanz verschiedener Bechersysteme beim Getränkeausschank an Veranstaltungen (Comparable eco-balance of different beaker systems for events)

mmary of the impact analysis of the activities of the Working Group Events

Criteria lists / available data / assessments

The "ÖkoKauf Wien" criteria list on the greening of events is an important tool to implement environmentally sound event management and is closely related to additional relevant initiatives of the City of Vienna (amongst others: "Weniger Mist"[less waste], event service, ÖkoEvent). Together they ensure that Vienna is living up to its leading role regarding the implementation of eco-friendly events and that it also makes use of the opportunity to positively influence event organisers when it comes to the greening of events.

The available statistics of the event service of the City of Vienna allow conclusions to be drawn regarding the use of the information and guidance service by organisers and event management organisations. However, based on this information it is currently not possible to quantify the ecological impacts on events in practice.

5.3 Prevention / Disposal

PROGRAMME IMPACTS ON PREVENTION / DISPOSAL - AN OVERVIEW

ECOLOGICAL AND SOCIAL IMPACTS

Vienna's municipal waste management significantly contributes to the reduction of climate-relevant emissions and provides important services for the public and for the protection of the environment.

The "ÖkoKauf Wien" guideline on waste management services ensures in this respect that the objectives of the City of Vienna regarding the prevention and disposal of waste are implemented within the scope of the Vienna City Administration (incl. Vienna Hospital Association and Wiener Wohnen [Municipal Housing in Vienna]).

Every year national and international guests and expert delegations visit the waste management plants of the City of Vienna.

Challenges and objectives regarding prevention / disposal

The City of Vienna has intentionally taken precaution in the past in order to be able to treat certain types of waste produced in Vienna (if they cannot be at all prevented) in ecologically excellent plants situated in Vienna. This strategy was already elaborated and agreed upon during Vienna's first Strategic Environmental Assessment (SEA, 2001) and was resumed in the Strategic Environmental Assessment "Vienna Waste Management Concept 2007". All waste produced in Vienna (private, industrial and waste coming from the Vienna City Administration) was included in this concept.

The City of Vienna's general goal is to set an example in ecological terms and register, collect and treat (i.e. reuse, recycle or dispose of) all waste produced in Vienna (despite all the efforts made to prevent it). The capacities needed in the waste treatment plants in order to be able to implement this goal are provided by the City of Vienna. Special focus is intentionally put on the fact that the plants fulfil the highest environmental standards. Because of ecological reasons the collection and transport distances of the waste are kept as short as possible.

Base data of the impact analysis for prevention / disposal

Regarding the prevention /disposal of waste the following basic information was analysed:

- "ÖkoKauf Wien" guideline "Waste Management Services"
- Interview with Martina Ableidinger / Petra Haller, MA 48
- Inputs provided for impact analysis
- Reports and studies from other relevant institutions as quoted in the text

Contributions of the "ÖkoKauf Wien" programme to Vienna's waste management

Approx. 1 million tonnes of municipal waste are produced on an annual basis in Vienna.[67] The "ÖkoKauf Wien" guideline ensures as a compulsory procurement basis that the objectives of the City of Vienna regarding the prevention and disposal of waste are guaranteed for the Vienna City Administration's own scope (incl. Vienna Hospital Association and Wiener Wohnen [Municipal Housing in Vienna]).

[67] cf. http://www.wien.gv.at/umwelt/ma48/entsorgung/abfallbehandlungsanlagen/index.html

As expert department, MA 48 is responsible for the proper collection, recycling and treatment of waste meeting the highest ecological requirements. This applies to waste which is generated by the services of the City of Vienna as well as by the services of third parties (by commission of the City of Vienna).
The quality of the services of MA 48 is continuously scrutinised and ensured by external certificates.

➔ **Certificates of MA 48:**

- Complaint management – ISO 10002:2004/ Cor.1:2009
- Excellent cleaning of the city – DEKRA
- Waste management company – V.EFB
- Quality management – ISO 9001:2008
- Environmental management – ISO 14001:2004 & EMAS III
- Energy management – EN ISO 50001:2011
- Occupational health and safety management – OHSAS 18001:2007
- Risk management – ONR 49001:2008
- Compost quality - Austrian compost quality label

The high quality of Vienna's waste management has been confirmed by various awards. In 2010, for example, the City of Vienna was awarded with the title "World City Closest to Sustainable Waste Management". MA 48 applied for this award on behalf of the City of Vienna.

Every year national and international guests and expert delegations visit the waste management plants of the City of Vienna. In 2012, 58 international delegations from 29 countries and 53 visitor groups from Austria participated in presentations and guided tours. A total of 1,740 experts and politicians visited MA 48.

Yet another proof that Vienna's waste management is a future-oriented system is the study on the climate effects of Vienna's waste management system (*Studie zur Klimarelevanz der kommunalen Wiener Abfallwirtschaft*).[68] As a conclusion it can be stated that the general trend to reduce greenhouse gas emissions and to increase the carbon credit of Vienna's municipal waste management continues. Vienna's municipal waste management hence significantly contributes to the reduction of climate-relevant emissions.

Success story: food waste from KAV and KWP canteens

The collection of food waste from the canteens of the Vienna Hospital Association (KAV) and the Retirement Homes Fund of the City of Vienna (KWP) is exemplary. The annual collection of up to 3,500 t and subsequent processing in Vienna's biogas plant does not cause any long-distance transports and ecologically transforms waste into district heating and electricity.

In Vienna's biogas plant 3,500 t of food waste are transformed into 350,000 m³ of bio gas.[69] This equals an annual energy amount of 2,100 MWh of district heat or 788 MWh of electrical energy. Waste is classified as a climate-neutral energy source and its energetic processing is an important part of a sustainable energy industry.

[68] cf. http://www.wien.gv.at/umweltschutz/pool/pdf/klimarelevanz-2012.pdf, accessed on: 14 February 2014

[69] cf. Fachagentur Nachwachsende Rohstoffe e.V. (Agency for Renewable Resources)(2008), Biogas. Basic data on Germany. As of January 2008, http://halfin.ch/Biogas/Dokumente/basisdaten%20biogas.pdf, as of 28 February 2014

5.4 Nanotechnology

PROGRAMME IMPACTS ON NANOTECHNOLOGIES – AN OVERVIEW

ECOLOGICAL IMPACTS

Since the field of nanotechnologies involves a wide range of products, a general statement on its ecological impact on different product groups is not possible. The WG Nanotechnology focuses on processing relevant data and making them available for all procurement areas.

SOCIAL IMPACTS

Improving the working and living environment:
Since the procurement of nanotechnologies is still in the pilot phase, it has not been possible yet to quantify any impact.

Promoting environmentally conscious behaviour – developing a demand market:
The WG Nanotechnology serves as an information point for inquiries regarding the latest nanotechnological products. Additionally, the position paper on nanotechnologies gives an overview of application areas, the respective use and risks.

Strengthening initiatives for "environmentally sound procurement":
Nanotechnology is relevant in several procurement areas. The assessment, however, needs to be done individually for each application area.

ECONOMIC IMPACTS

Reducing costs:
The application of nanotechnology can reduce costs (especially cleaning costs). The detailed potential needs to be calculated for every application area.

Influencing the supply market:
The media campaign on nanosilver has shown a direct reaction of super markets to the changed public opinion on nanosilver and antimicrobial coatings.

Promoting regional producers of environmentally sound products and services:
At the moment the WG Nanotechnology focuses on processing data and making them available. An impact on regional producers cannot yet be detected.

Challenges and objectives regarding nanotechnologies

Nanotechnologies develop very rapidly. Nanotechnology is the development and the processing of materials at nanoscale level (10^{-9} / one metre comprises one billion nanometres) in order to significantly change the properties of these materials. These "changes" can range from surface texture to melting or boiling point to colour, etc.
Since the products are relatively new on the market or are still in the development phase, no general recommendations can be given, because case-specific assessments are necessary. For this reason the Working Group Nanotechnology has developed a position paper on nanotechnologies describing the benefits and the risks of nanotechnologies as a kind of guideline for current applications.

Base data of the impact analysis for nanotechnologies

Regarding the procurement and application of products with nanotechnologies for departments of the Vienna City Administration the following basic information was analysed:

- "ÖkoKauf Wien" position paper on nanotechnological products – opportunities/risks/recommendations (as of May 2011)
- Interview with WG23 working group leader, Marion Jaros / WUA (Vienna Ombuds Office for Environmental Protection)
- Reports and studies from other relevant institutions as quoted in the text

Procurement situation in Vienna
Based on the current market situation in which many producers already advertise their products referring to the advantages of nanotechnologies and due to increasing inquiries of the procurers to "ÖkoKauf Wien" regarding new product groups employing nanotechnologies, a new working group was founded. In general the position paper addresses departments which are currently confronted with the procurement of nanotechnologies.

Evaluation methodology – an overview
The analysis is based on the position paper of the WG Nanotechnology. Information on the opportunities and risks of the new technologies were complemented by data of WUA and interviews with Marion Jaros.

The results in detail
The position paper refers to potential environmental relief but also to the risks of nanotechnologies focusing on the procurement situation of the City of Vienna.

Potential environmental relief:
Nanotechnologies can contribute to protecting the environment and mitigating climate change, e.g. through energy-saving LED light bulbs or "easy-to-clean" coatings and varnishes which help to save water and cleaning agents. Nanotechnology is also used for the development of insulating material. However, life-cycle analyses and eco-balances are not available yet, which makes it impossible to determine if the actual benefit/energy saved makes up for the (extra) production costs. The results of the position paper by "ÖkoKauf Wien" build awareness for the necessity of appropriate analyses.

Risks:
There are indications for possible risks for three groups of nanomaterials:

- **Carbon nanofibres (carbon nanotubes; CNT):** CNT are ecologically persistent and show similarities to asbestos fibres, i.e. they cause inflammation of the respiratory system and can encourage tumour growth. The focus is on employee protection.
- **Nanoparticle titanium dioxide:** ecotoxic impact on aquatic organisms. This substance is primarily used as UV filter in sunscreens. Titanium dioxide, however is also an ingredient in self-cleaning coatings for façades, glasses, roof tiles, etc. Such coatings reduce the cleaning expenditure and use of water and chemicals, however, there is a risk of input into the environment which still needs to be assessed.
- **Nanosilver and other antimicrobial coatings:** silver ions are toxic for microorganisms. This is the reason why nanosilver is used for antimicrobial coatings and is also sold for this purpose. If nanosilver gets into waste water treatment plants due to abrasion or washing out, possible negative impacts on the bacteria in the plants are to be expected. Nanosilver could also possibly damage soil microorganisms if it is applied to the fields with sewage sludge. Another point is the risk that due to wide application germs may develop resistance against silver which would render the medical application of silver ineffective.[70]

Nanosilver and antimicrobial coatings were the reason why "ÖkoKauf Wien" became active and corresponding criteria lists were complemented by a text element excluding products with antimicrobial coatings from the procurement process.

Giving an overview and building awareness:
The position paper on nanotechnologies primarily addresses the procurers of the City of Vienna, but it also provides general information for the citizens. The media campaign on nanosilver brought the current knowledge in this field to public awareness. In general the public has been sensitized according to the precautionary principle in order to make clear that nanotechnologies need case-specific assessment, even though they are trend-setting in many fields.

[70] cf. "ÖkoKauf Wien" (2011), http://www.wien.gv.at/umweltschutz/oekokauf/pdf/nanotech-position.pdf, as of 17 December 2013

Areas of impacts:
Since nanotechnologies involve a wide range of topics, a uniform definition is still being discussed internationally. At the moment there is not enough data available for a comprehensive assessment of nanotechnologies. Therefore caution has highest priority, especially regarding exposure to mobile nanoparticles. Nanoparticles show other properties than the original material which may cause new, unexpected reactions of and with the environment. Besides, no long-term studies have been conducted yet. The position paper especially refers to nanotechnologies which are related to the topics of "ÖkoKauf Wien".

The following diagram shows the procurement areas in which nanotechnologies are important at the moment and will be in the future.

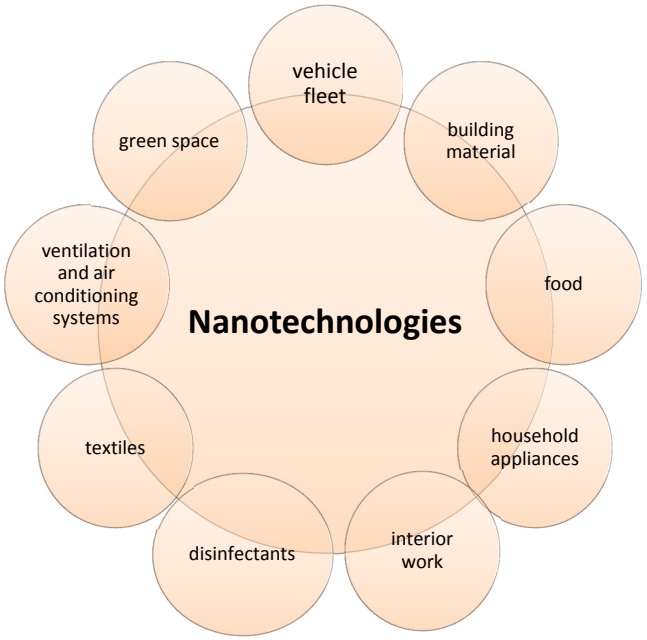


Figure 46: *procurement areas of nanotechnologies, source: City of Vienna*

Success story: media campaign nanosilver

A media campaign on nanosilver and other antimicrobial coatings used in private households informed citizens on actual and assumed benefits of nanosilver and on its disadvantages.

An important part of the information campaign was to inform citizens in which areas nanosilver is used, e.g. dishwashers, refrigerators, washing machines, computers, bed linens, sportswear, cosmetics and paints.

Another challenge was that until recently there has been no uniform labelling regulation for nanosilver coatings and hence no transparency for procurers and consumers in order to make a sound decision. According to the precautionary principle the consumers were informed during the media campaign to watch out for labels like Ag+, silver, nanosilver, microsilver, silver ions, colloidal silver, bioshield, etc.

The market has reacted to the shift of the public opinion regarding nanosilver. As an immediate impact of the media campaign it was observed that various nanosilver products have vanished from supermarket shelves.

Conclusion: the media campaign was effective, informing the public of the disadvantages of nanosilver and antimicrobial coatings.

Summary of the impact analysis of the activities of the Working Group Nanotechnologies

Criteria lists and available data
The Working Group Nanotechnology was founded because of an increasing number of inquiries to "ÖkoKauf Wien" regarding new "nano products". The position paper on nanotechnologies provides a comprehensive overview of the current application areas and the respective potentials and risks. The working group acts as a cross-product group information point for nanotechnologies in general.

Assessments and impacts
The position paper on nanotechnologies gives an overview of a rapidly developing field, states an opinion regarding specific cases and issues risk assessments. It will hence be necessary to continuously adopt the position paper on nanotechnologies.

Recommendations for the further development of the Working Group Nanotechnologies
At the moment it is not possible to allocate any quantifiable impact to the WG. It is recommended to start a pilot project with one of the "ÖkoKauf Wien" WGs concerned in order to be able to quantify the relief potential for the environment.

5.5 PVC

PROGRAMME IMPACTS ON PVC – AN OVERVIEW

ECOLOGICAL IMPACTS

Reducing resources:
There are various reasons why PVC is materially recycled only in small amounts.

Avoiding damage to the environment:
The production, disposal and sometimes even the application of PVC causes emissions of problematic substances. A reduction of PVC procurement hence relieves the environment.

Contributing to climate protection:
There is no available data regarding the emission of climate-relevant gases during the production of PVC in comparison to alternative products.

SOCIAL IMPACTS

Improving the working and living environment:
Plasticised PVC contains plasticisers which are harmful to human health, diffuse from the material and can be detected in ambient air. A reduction of PVC can thus have a positive effect on the working environment.
According to the respective criteria list it is prohibited to use PVC in childcare articles, toys which are put in the mouth and medical supplies in neonatology due to health concerns.

Promoting environmentally conscious behaviour – developing a demand market:
The prevention of PVC causes an increased use of alternative, eco-friendly materials in the respective fields of application.

Strengthening initiatives for "environmentally sound procurement":
The prevention of PVC in the City of Vienna may have a role model effect on other ecological procurement programmes.

ECONOMIC IMPACTS

A general statement on the economic impact is not possible due to the many different applications. The position paper recommends a substitution of PVC products wherever there are economically feasible alternative products available.

Base data of the impact analysis for PVC
Regarding the prevention of PVC for departments of the Vienna City Administration the following basic information was analysed:

- Several "ÖkoKauf Wien" criteria lists referring to the prevention of PVC and organic chlorine compounds
- Position paper by the steering commission of the "ÖkoKauf Wien" programme on the prevention of organic chlorine compounds, especially PVC, incl. the study "PVC 2008: Fakten, Trends, Bewertung" (*PVC 2008: facts, trends, assessments*)
- Database provided on the tender of halogen-free cables of MA 34
- Reports and studies from other relevant institutions as quoted in the text

Relevant application areas of PVC prevention

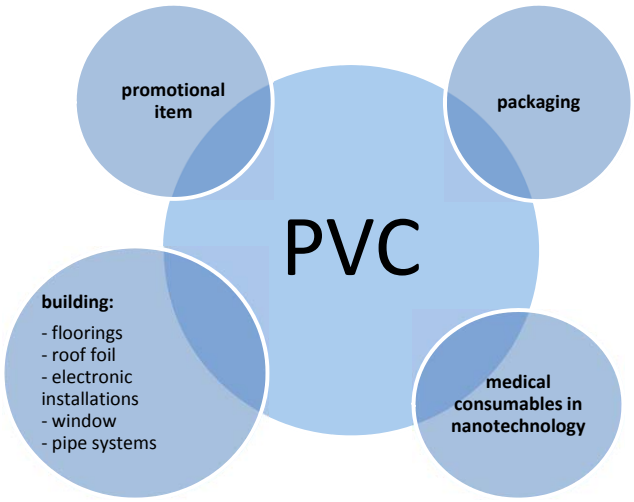


Figure 47: *impact spectrum, source: author's diagram*

Success story: halogen-free cable

The following diagram shows the procurement volume of halogen-free cables put to tender by MA 34 since 2008. It is evident that in the field of electrical installations a significant amount of PVC material could be saved and replaced by alternative products.

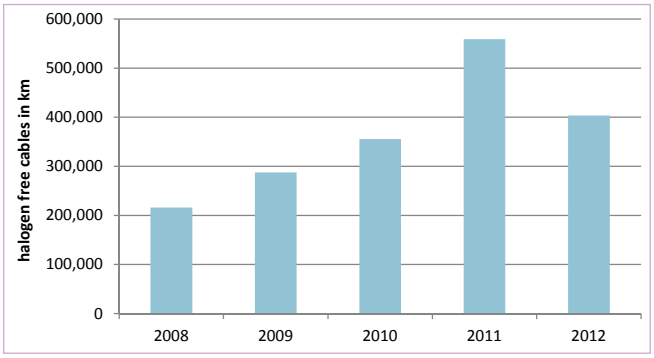


Figure 48: *procurement volume of halogen free-cables, source: author's diagram (based on data provided by MA 34)*

Summary of the impact analysis for PVC

The procurement of PVC and organic chlorine materials is a cross-product-group topic. The "ÖkoKauf Wien" position paper refers to the fact that the use of PVC is still related to risks to health and the environment.

At the moment there is no data available regarding the volume of procured alternative products in the different procurement groups.

6 Summary of findings

Based on the findings of the impact analysis this summary tries to assess the impact of each of the three defined focuses for the overall impact of the programme.

The summary clearly shows that

- all working areas of the programme significantly contribute not only to the intended ecological impact indicated by the programme name but also to the improvement of social and economic sustainability;

The differences identified can be used as starting points for the strategic enhancement of the programme activities.

- The impacts of the programme regarding ***"eco-friendly working"*** are a balanced combination of ecological, social and economic aspects. Main ecological impacts are resource efficiency and reduction of damage to the environment. With the exception of disinfectants and cleaning agents, there are few ways of influencing the market because of the mass supply markets. However, increased demand on the part of the City of Vienna can strengthen ecological supply niches.
- Important social impact potential in the summarised programme areas well beyond the programme lies in the fact that with the procurement of environmentally sound working tools employees of the Vienna City Administration typically adjust their user behaviour (from "double-sided printing" to turning off electronic devices outside office hours to training for cleaning staff and drivers). Adopting working routines for private consumer behaviour is an important contribution towards raising environmental awareness among people.
- Ecological and economic impacts of "***eco-friendly building"*** constitute a unit but also show up the limits of practical implementation of the programme criteria. Programme impacts on establishing an environmentally friendly working and living environment are limited due to the focus on building products and services.
- The interdependence of the summarised working groups is typical and it becomes evident within the programme by joint developments and applications of tools like Ö.B.U.S or concerted activities for e.g. harmonising ecological building standards. The ecological impact potentials are high because of the big volume of procurement projects on the one hand and due to the strength of the City of Vienna as buyer of building products and building services on the other. The adoption of the "ÖkoKauf Wien" compliant products into other market segments support the expansion of the market supply of environmentally friendly building products and building services.
- "***Eco-friendly living"*** programme activities are characterised by the complex impacts primarily assessed from the qualitative point of view in the impact analysis. Food is the exception, sticking out for its high impact on climate protection.
- All summarised programme areas communicated by the departments of the City of Vienna have in common that they have a direct impact on the lives of citizens. This is also reflected by the strong effect of social impacts. The working groups involved are very important for the overall programme impacts because of their visibility in the broad public and thus their influence on awareness building and communication measures. The focus also provides many opportunities for directly including and promoting small, regional providers of environmentally-friendly products.

From the point of view of the impact analysis team the wide range of the programme impacts and the interaction of the three defined focuses represent one of the "ÖkoKauf Wien" programme's major strengths.

The programme strategy shows sound basic elements for distinct development measures taking into account the peculiarities and specific contributions of the individual topics to the programme impacts.

7 List of figures and tables Figures

Figures

Tables

8 ANNEX: Methodology

8.1 Overview

As described in detail under 2.3.2 the impact analysis was conducted with the evaluation logic developed by ConPlusUltra. Figure B-2 on the following page gives an overview of the evaluation concept applied.
Programme evaluation was carried out at three different levels: the findings level, the process level and the structural level. The findings of the impact analysis reflect these levels accordingly. The range of impacts analysed was considerably wider than that of the internal evaluation in 2008, allowing for both quantitative and qualitative assessments in the three areas of sustainability (ecology, economy and society). Item 8.3. provides a detailed description of the comparison between the 2008 internal evaluation and the 2013 impact analysis.

The following figure shows the procedure applied for information aggregation and implementation for the 2013 impact analyses.

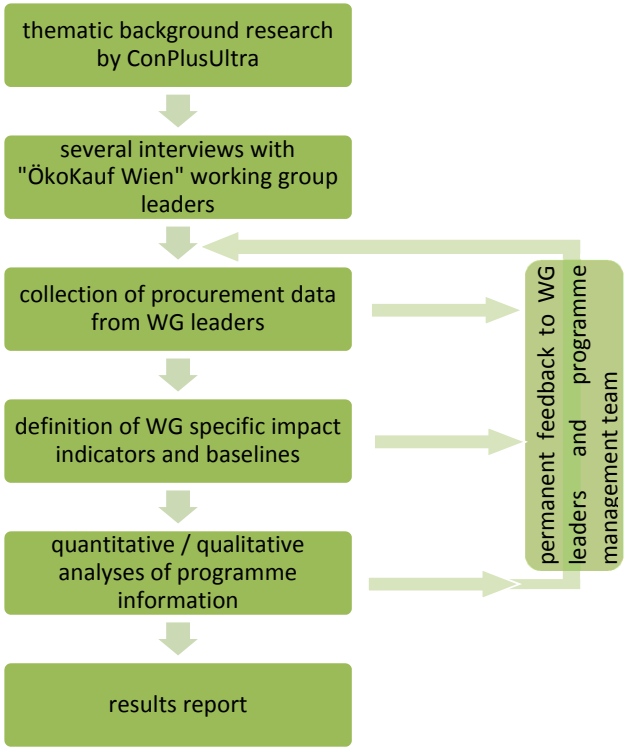


Figure B-1: *procedure of impact analysis*

Basis of assignment EVALUATION LOGIC	EVALUATION LEVELS ->	RESULT LEVEL						PROCESS LEVEL			STRUCTURAL LEVEL		
	PROGRAMME LEVELS -> "ÖkoKauf Wien"	sustainability			awareness building			programme management			basic conditions		
		ecology	economy	society	addressing target groups	intensity interaction	impact on behaviour	continuous processing	continuous monitoring	further dvlpt.	superior strategies	resources	integration
STARTING POINT	INTERNAL EVALUATION 2008	x	x		x								
implementation of IMPACT ANALYSIS 2013	METHODOLOGY	* background research regional environmental analysis * interviews WG leaders * collection of procurement data * definition of impact indicators / baselines * quantification / qualitative assessment						* background research studies / guidelines internat. * interviews with WG leaders * reflexion process impact analysis			* background research studies / guidelines internat. * interviews with WG leaders * reflexion process impact analysis		
	RESULTS	x	x	x	x	x	x	x	x	x	x	x	x
		quantitative programme impacts success stories						recommendations			recommendations		

Figure B-2: *overview of evaluation logic and impact analysis, source: author's diagram*

8.2 Interviews and data exchange

The interviews conducted with WG leaders for an overall impression of the WG activities were based on a concerted interview guide. First conclusions were then drawn regarding the focus of the WGs. WG leaders also assisted with assessing which procurement data were available and when they would be provided.

The following table lists the contact for the WGs and the dates the interviews were held.

Table B-1: *contact persons in the "ÖkoKauf Wien" working groups*

"ÖkoKauf Wien"- working group	Contact person	Contact details	Interview conducted
WG02 – Disinfection WG23 – Nanotechnology	Marion Jaros	WUA (Vienna Ombuds Office for Environmental Protection) –climate protection, assessment of impacts of chemicals on the environment and human health marion.jaros@wien.gv.at	30. Sep. 2013
WG03 – Paper, Printing and Office Supply	Irene Geiger	MA 54 irene.geiger@wien.gv.at	05. Nov. 2013
WG04 – Electrical Office Equipment, Household and Commercial Appliances	Dominik Schreiber	WUA (Vienna Ombuds Office for Environmental Protection) Programme management PUMA dominik.schreiber@wien.gv.at	30. Sep. 2013
WG05 – Vehicle Fleet	Ing. Martin Wabeck	MA 48 – Waste Management, Street Cleaning and Vehicle Management martin.wabeck@wien.gv.at	1. Oct. 2013
WG06 – Technical Services	Michael Minarik	MA 34 – Building and Facility Management, Coordination Unit for Engineering and Environment michael.minarik@wien.gv.at	30. Sep. 2013
WG07 – Building Construction	Peter Schmiege	peter.schmiege@wien.gv.at	30. Sep. 2013
Construction Chemistry	Robert Friedbacher	MA 34 – Building and Facility Management – Chemicals management robert.friedbacher@wien.gv.at	
WG08 – Interior Work	Michael Grimburg	MA 22 / "ÖkoKauf Wien" michael.grimburg@wien.gv.at	
WG09 – Food	Bernhard Kromp	Bioforschung Austria, head of institute b.kromp@bioforschung.at	1. Oct. 2013
	Georg Patak	MA 22 / "ÖkoKauf Wien" georg.patak@wien.gv.at	
WG10 – Cleaning	Herbert Nentwich	Directorate-General KAV – Environmental Protection, Waste Management herbert.nentwich@wienkav.at	30. Sep. 2013
WG20 – Textiles			
WG14 – Prevention WG21 – Disposal Services	Martina Ableidinger Petra Haller	MA 48 martina.ableidinger@wien.gv.at petra.haller@wien.gv.at	11. Nov. 2013
WG16 – Events	Georg Patak	MA 22 / "ÖkoKauf Wien" georg.patak@wien.gv.at	1. Oct. 2013
WG22 – Construction Sites Environmental Logistics	Alfred Brezansky	WUA – Deputy Director for Environmental Engineering alfred.brezansky@wien.gv.at	05.Nov. 2013
WG25 – Green and Open Spaces	Jürgen Preiss	MA 22 / "ÖkoKauf Wien"	1. Oct. 2013

8.3 Comparison with 2008 programme evaluation

The calculation methodology of the internal evaluation in 2008 was analysed and adjusted to the current state of technology. Comparing the findings from 2006 with those from 2012 revealed significant differences in the calculation methodologies as explained below. Parameters for comparison were the calculated CO_2 emissions saved by applying the "ÖkoKauf Wien" criteria.

Electrical office equipment, household and commercial appliances

The following diagram shows the savings in 2006 and 2012 achieved by applying the "ÖkoKauf Wien" criteria. Savings with office equipment and household appliances decreased significantly.

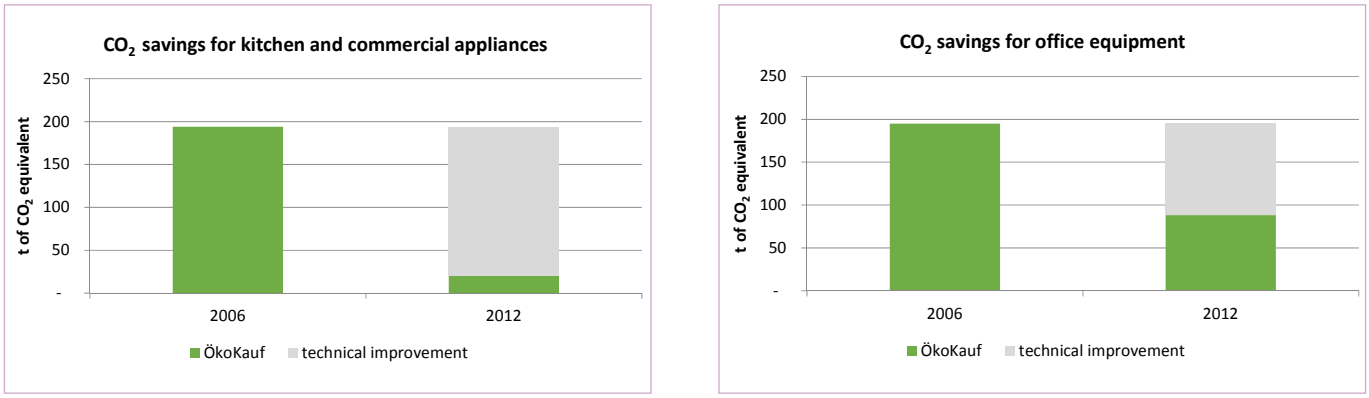


Figure B-3: *CO_2 savings with electrical office equipment and household appliances in the years 2006 and 2012*

The programme evaluation of 2008 calculated the highest CO_2 equivalent savings regarding office equipment due to the replacement of laser printers and TFT monitors by more efficient office equipment. Since this and many other potentials have already been used the annual savings are significantly lower. Based on the constant implementation of the "ÖkoKauf Wien" criteria and due to technological advances the CO_2 equivalents reduction was 55 percent less in 2012 than in 2006.

Regarding the household appliances, the highest CO_2 savings were calculated due to the replacement of 2,500 coffee machines with hot plates by machines with thermos jug. Since this and many other potentials have already been used the annual savings are significantly lower.

Printing, office and hygienic paper

The 2008 programme evaluation included printing and office paper only. The 2013 impact analysis calculated annual savings in CO_2 equivalents based on current consumption data for office and hygienic paper. Data on printing jobs were not available at the time of calculation. Savings due to a general reduction in paper consumption were also included in the calculations. The regulation on double-sided printing and copying has reduced paper consumption at the Vienna City Administration by approx. 30 percent. Related CO_2 savings were included in the calculation.

The figure B-4 shows the savings calculated for printing, office and hygienic paper in the years compared.

Efficient lighting

Calculations of savings due to efficient lighting were also adjusted to the current calculation methodology, e.g. the current values for CO_2 equivalent factors were used according to the Wien Energie electricity mix.

The savings calculated differ significantly from the findings of the 2008 programme evaluation. This is probably due to the fact that the findings of the 2008 programme evaluation are available as cumulated savings, while the 2012 findings comprise only the savings of that year.

Water saving sanitary installations

The 2008 programme evaluation assumed that water would be heated to 100°C. Seeing as temperatures like these are not necessary and are not dispensed at the washbasins more recent calculations are based on 60°C.

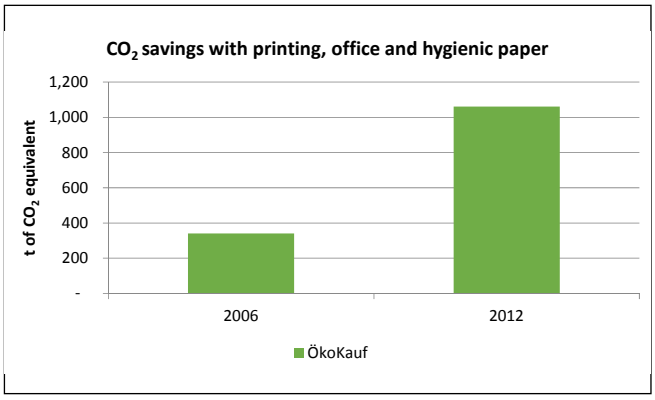


Figure B-4: *CO_2 savings with printing, office and hygienic paper in 2006 and 2012*

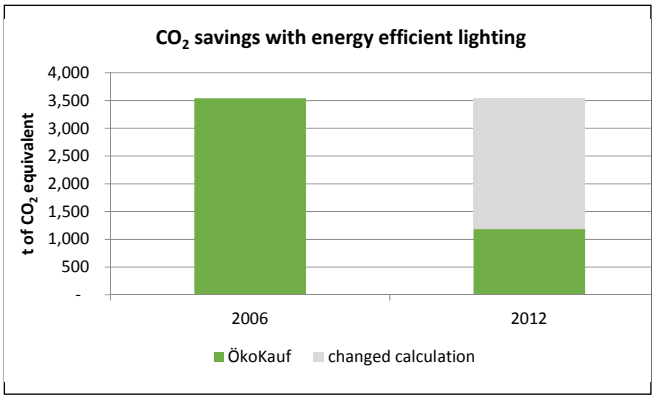


Figure B-5: *CO_2 savings with efficient lighting in 2006 and 2012*

The 2008 evaluation also assumed water abstraction of 30 minutes per washbasin and day. This assumption has since been corrected by MA 34. Presuming that it takes about 20 seconds to wash your hands, 3 times a day per employee, and there is one washbasin for every 15 employees, the water abstraction per wash basin and day is reckoned to be 15 minutes (see item 8.5.2.1).
This is why the 2013 impact analysis shows lower savings.

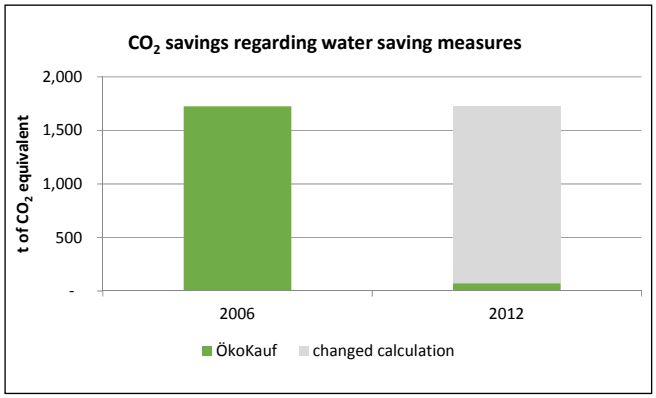


Figure B-6: *CO_2 savings with water-saving sanitary installations in 2006 and 2012*

Food

While the 2008 programme evaluation was based on the assumption that producing organic food causes 60 percent less CO_2 equivalent emissions than producing conventional food this has since been corrected to 30 percent for the 2013 impact analysis. Because of the adjustment of this base-line assumption, the CO_2 equivalent reduction accounts for 42 percent less.

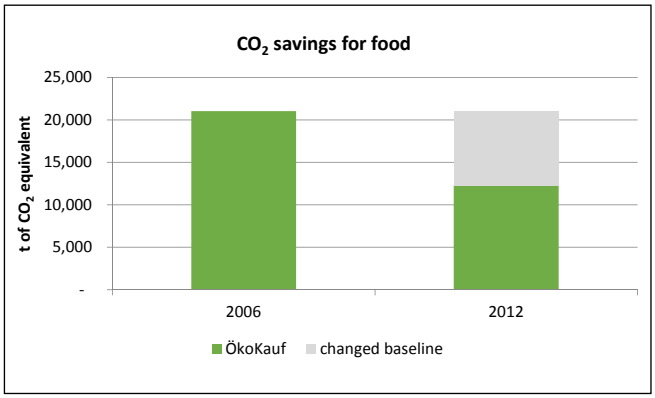


Figure B-7: *CO_2 savings with food in 2006 and 2012*

In total

The comparison shows the following: Since food has a strong impact on the overall CO_2 balance the difference caused by the new calculation methodology is significant. In some areas, e.g. electrical appliances, the potential has already been exploited and further advances are not possible with the current state of technology.

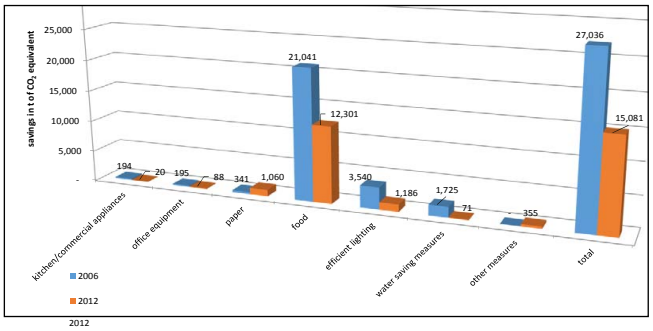


Figure B-8: *comparison of calculated CO_2 savings in 2006 and 2012*

8.4 Basic assumptions: factors

As a basis for different quantitative assessments (e.g. with electrical office equipment, household and commercial appliances, technical services) the development of various basic technical indices and price factors was researched for the period reviewed by the impact analysis. As described below these basic assumptions were compiled as a set of technical indices and price factors with a view to the framework conditions of the City of Vienna.

For all assessments it was very important to ensure maximum continuity of the applied factors and indices over the entire period reviewed by the impact analysis which also includes the period reviewed by the 2008 internal evaluation.

8.4.1 Electricity costs

All assessments are based on the electricity prices for private businesses set by Wien Energie .(fig. B-9)

In the event that electricity prices fluctuated over the course of one year, the arithmetic mean was taken as a basis for cost calculations in the impact analysis. Calculations for office equipment and household appliances used the following gross electricity prices (incl. VAT):

Table B-2: *gross electricity prices for impact analysis*

electricity costs		
2008	0.167	€/kWh
2009	0.176	€/kWh
2010	0.173	€/kWh
2011	0.171	€/kWh
2012	0.170	€/kWh

The calculation of savings with electricity costs for household appliances was conducted on the basis of the calculation methodology of the 2008 internal evaluation which uses deviating values for electricity costs.

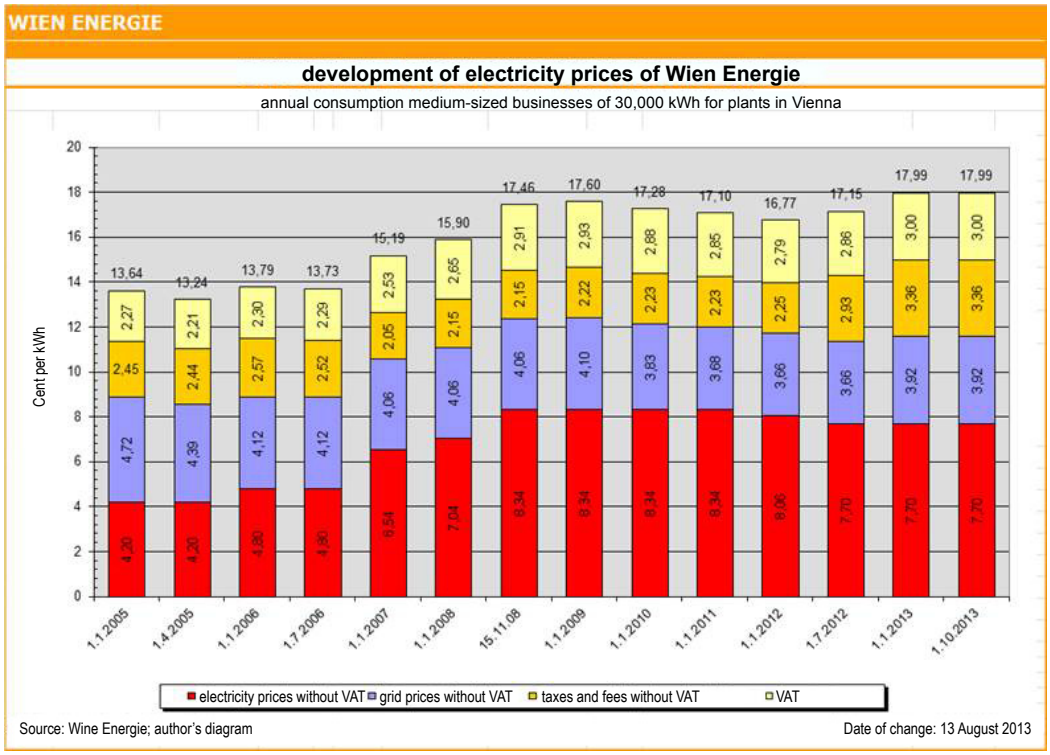


Figure B-9: *development of electricity prices for private businesses at Wien Energie between 2005 and 2013*

8.4.2 Water costs

The following table shows the cost evaluation for water consumption, including charges for water supply and water meters, as well as wastewater charges for the individual years in the period reviewed in continuation of the basic assumptions of the 2008 evaluation.

Savings with water consumption through more efficient household appliances were calculated according to the 2008 programme evaluation.

8.4.3 CO_2 equivalent factors

Regarding the relevant CO_2 equivalent factors for the years under review values for the supply mix were provided by Wien Energie.

Table B-4: *CO_2 equivalent factors of supply mix provided by Wien Energie*

Wien Energie	CO_2 emissions	
2005/2006	168.8	q/kWh
2006/2007	177.3	q/kWh
2007/2008	210.44	q/kWh
2008/2009	204.09	q/kWh
2009/2010	195.42	q/kWh
2010/2011	197.96	q/kWh
2011/2012	188.5	q/kWh

Table B-3: *development of water costs between 2003 and 2013*

		2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013
waste water charge	€/a	1.32	1.32	1.32	1.69	1.69	1.69	1.78	1.78	1.78	1.89	1.89
charge of water supply and for the meter	€/a	1.3	1.3	1.3	1.3	1.3	1.3	1.3	1.3	1.3	1.73	1.73
total costs 1m³ water	€/a	2.62	2.62	2.62	2.99	2.99	2.99	3.08	3.08	3.08	3.62	3.62

8.4.4 Time of operation

The following assumptions were taken as a basis for the time of operation of electricity consuming devices throughout:

Table B-5: *time of operation of electricity consuming devices*

working day	260	days/year
office hours	10	hrs/day

Advanced considerations on time of operation of different types of electricity and water consuming devices and the related savings potentials are discussed with the relevant assessment process.

8.5 Calculation models in detail

8.5.1 Eco-friendly working in Vienna

8.5.1.1 Electrical office equipment, household and commercial appliances (see main report chapter 3.1)

Information on procured electrical office equipment, household and commercial appliances for calculating annual savings in energy, costs and CO_2 equivalent were provided by WG04 working group leader Dominik Schreiber. The data comprise procurement volumes for municipal departments MA 14, MA 34, MA 54.

The following assumptions were derived from the 2008 internal programme evaluation and adopted for the calculations:

Table B-7: *basic data times of operation*

working days	260	days
office hours	10	h
number of washing cycles		
washing machine	3	per day
laundry dryer	4.5	per day
dish washer	2	per day
industr. dish washer	50	per day

The basic data and assumptions were used as a basis for calculating savings in energy, costs and CO_2 equivalent with electrical office equipment, household and commercial appliances per year.

Household appliances

The following scheme was applied for calculating the energy savings with household appliances, such as washing machines, laundry dryers, dish washers, etc. The calculation is based on the number of devices, days of operation and consumption according to energy efficiency classes.

Table B-6: *devices procured for the Vienna City Administration between 2011 and 2012*

	2012				2011			
	MA 14	MA34	MA 54	KAV	MA 14	MA 34	MA 54	KAV
washing machines		88	13			96	14	
laundry dryer		8	2			42	7	
household dish washers		61	15			40	25	
household refrigerating and freezing appliances		0	71			88	61	
filter coffee machines		0	31			0	8	
electric cooker		19	7			19	2	
vacuum cleaners		0	151			0	173	
TV sets		0	50			0	45	
industrial tank dishwashers		33	0			32	0	
industrial fresh water dishwashers		6	0			4	0	
video projector		0	22			0	23	
laser printers	1008				1285			
fax machines	18				517			
flat screens	6259				2390			
notebooks	997				446			
flat bed scanners	k.A.				731			
PCs	4361				3674			

Wäschetrockner

no.	operating days	energy eff. old	consumption OLD	energy eff. new	consumption NEW	diff. in consumpt.	drying cycles
pc.	days / year	class	kWh / appliance	class	kWh / appliance	kWh / appliance	no. / cycle
9	260	C	3.6	B	2.8	0.8	4.5

The calculations for refrigerating and freezing devices, as well as for electric cookers was also done based on annual consumption data.

no.	energy eff. old	consumption OLD	energy eff. new	consumption NEW	diff. in consumpt.
pc.	class	kWh / appliance	class	kWh / appliance	kWh / appliance
74	B	292	A	268	24

Office equipment

With office equipment energy savings for coffee machines, TV sets, laser printers, flat screens, notebooks, flatbed scanners, PCs and fax machines were calculated including energy savings generated by technical advances, such as power input during operation and standby mode. No technical advances were assumed for vacuum cleaners. The reduction of no-load loss (standby-mode) in electrical office equipment will be explained later.

TV sets

no.	operating days	operating hours per operating day (10 h)		standby outside office hours per day	power input W		consumption
total	days / year	in use	standby during office hours	standby outside office hours	in use	standby	kWh
	260	5	5	14	141	7	218
	260	5	5	14	125	6	192

Commercial appliances

For commercial appliances, such as tank and fresh-water dishwashers different consumption data were assumed (see figure B-10 and figure B-11) and energy and water savings were calculated.

industrial tank dish washers

no.	operating days	consumptions OLD	consumptions NEW	diff. in consumpt.	drying cycle
pc.	days / year	kWh / cycle	kWh / cycle	kWh / cycle	amount / cycle
25	260	0.27	0.24	0.04	50
		litre / cycle	litre / cycle	litre / cycle	amount / cycle
25	260	3	2.6	0.4	50

The tank dishwashers previously used at MA 34 were compared to more recent models. Energy and water consumption, as well as costs and differences (savings) were calculated. The more efficient model of the two is highlighted in yellow in the following figure.

washing cycles/day	50	
working days/year	260	
dosage detergent	3	g/l
dosage rinse aid	0.5	g/l
inlet water	7	°C

			Colged 253, Hobart Ecomax		MeikoFV 40.2, Hobart FX-70		difference	
amount of rinse water			3.0	l/basket	2.6	l/basket	0.4	l/basket
water costs	2.62	€/m³	102.2	€/a	88.6	€/a	13.6	€/a
costs for detergent	1.32		154.4	€/a	133.8	€/a	20.6	€/a
costs for rinse aid	5.64	€/kg	220.0	€/a	95.3	€/a	124.6	€/a
electricity costs	0.12	€/kWh	424.5	€/a	367.9	€/a	56.6	€/a
total costs per year			901.0	€/a	685.6	€/a	215.5	€/a
water consumption per year			39.0	m³/a	33.8	m³/a	5.2	m³/a
energy consumption per year			3537.2	kWh/a	3065.6	kWh/a	471.6	kWh/a
water consumption per day			0.15	m³/d	0.13	m³/d	0.02	m³/d
energy consumption per day			13.6	kWh/d	11.8	kWh/d	1.81	kWh/d
water consumption per day per cycle			0.003	m³/day/cycle	0.003	m³/day/cycle	0.0004	m³/day/cycle
energy consumption per day per cycle			0.27	kWh/day/cycle	0.24	kWh/day/cycle	0.04	kWh/day/cycle

Figure B-10: *comparison of "old" and "new" tank dish washers*

Subsequently two different fresh water dishwasher models currently available on the market were selected and compared with each other. Again, the model highlighted in yellow is the more efficient device.

washing cycles/day	50	
working days/year	260	
inlet water	7	°C

			ELETTROBAR dish washer River 362		KBS fresh water dish washer PR50 E		difference	
amount of rinse water		l/basket	2.4	l/basket	2.0	l/basket	0.4	l/basket
water costs	2.62	€/a	81.7	€/a	68.1	€/a	13.6	€/a
costs for detergent	1.32	€/a	123.6	€/a	103.0	€/a	20.6	€/a
costs for rinse aid	5.64	€/a	176.0	€/a	73.3	€/a	102.6	€/a
electricity costs	0.12	€/a	339.6	€/a	283.0	€/a	56.6	€/a
total costs per year		€/a	720.8	€/a	527.4	€/a	193.5	€/a
water consumption per year		m³/a	31.2	m³/a	26.0	m³/a	5.2	m³/a
energy consumption per year		kWh/a	2829.8	kWh/a	2358.1	kWh/a	471.6	kWh/a
water consumption per day		m³/d	0.12	m³/d	0.10	m³/d	0.02	m³/d
energy consumption per day		kWh/d	10.9	kWh/d	9.1	kWh/d	1.81	kWh/d
water consumption per day per cycle		m³/day/cycle	0.002	m³/day/cycle	0.002	m³/day/cycle	0.0004	m³/day/cycle
energy consumption per day per cycle		kWh/day/cycle	0.22	kWh/day/cycle	0.18	kWh/day/cycle	0.04	kWh/day/cycle

Figure B-11: *comparison of "old" and "new" fresh water dish washers*

Calculation of savings due to reduction of no-load loss

The municipal departments of the City of Vienna have many electrical devices used only a couple of hours per day which still permanently consume electricity because they are in standby mode. All office equipment at the Vienna City Administration has now been equipped with switchable power bars to minimise the no-load losses outside office hours.

Definition standby

"Standby" is defined as: An electrical appliance's operational mode where the power is on but the appliance does not need to be booted to be used. The device's electronic system requires consistent electricity supply to ensure immediate use. Since the device is not disconnected, it continues to consume low quantities of electricity. This condition is also referred to as standby or no-load loss.
The following table shows the assumptions calculations for the standby consumption of existing IT and office devices are based on. The given values are variable and depend on the individual time of use (per day).

Table B-8: *assumptions for office hours and off-time for various IT and office devices*

standby devices	office hours 10 h/day		outside office hours
	operating (h)	standby (h)	turned off (h)
coffee machine	2	8	14
TV sets	5	5	14
laser printers	1	9	14
flat screens	9	1	14
notebooks	9	1	14
scanners	1	9	14
PCs	9	1	14
fax machines	10	0	14

Energy label for TV sets

A new EU label for TV sets introduced in November 2011 effectively assists with purchasing devices. All TV sets on the market must display energy labels similar to those on household appliances. A TV set's efficiency is thus revealed at a glance. The new label takes up the concept of the classic label displayed on household devices. Currently most devices are in the A+ segment, and a few are already available in efficiency class A++.
The "ÖkoKauf Wien" criteria list for TV sets (10 May 2011) stipulates that all devices procured from 1 December 2011 onwards depending on the screen diagonal, must meet the following energy efficiency classes according to EU regulation 1062/2010:

- screen diagonal up to and including 45 inches: energy efficiency class "B"
- screen diagonal more than 45 inches: energy efficiency class "A"

A publication issued by the German Federal Environment Agency (UBA) on annual energy consumption according to efficiency classes was used as a basis for the calculated on-mode performance of TV sets. The power input in standby mode was researched on the internet.

Table B-9: *calculated and assumed power input of TV sets*

	TV sets		
year	energy efficiency class (EEC)	calculated on-mode (W)	presumed power intake standby (W)
2007	F	141	7
2008	E	125	6
2009	D	116	5
2010	C	87	4
2011	B	62	3
2012	A	50	2
2013	A	50	2

On-mode and standby mode of office equipment

Basic data for standby office equipment (2008-2013) were provided by ÖkoBeschaffungsService Vorarlberg (ÖBS) (EcoProcurementService). On-mode and standby-mode values were assumed to calculate the technical advances for 2007. In Table B-10 the current "ÖkoKauf Wien" criteria list from 2012 is highlighted in green.

It should be noted that the "ÖkoKauf Wien" criteria lists for printers and flat bed scanners (2012) allow significantly higher power input than provided for in the EU regulation (see item below). Therefore a maximum power input of 2 Watt was assumed for standby with information and status display. For notebooks and monitors no

	colour laser printers		screens 22-23"		notebooks		flat bed scanners		PCs	
year	on-mode (W)	standby (W)	on-mode (W)	standby (W)	on-mode (W)	standby (W)	on-mode (W)	standby (W)	on-mode (W)	standby (W)
2007	27.8	11.7	44	5	22	8.3	16	3.5	44	7
2008	22	8.5	40	4	20	8	15.0	3.2	40	6
2009	31	9.4	35.6	3.8	19.7	7.7	13.8	3.1	37.4	5.4
2010	34	11.0	22.5	3.8	16	7.5	12.8	2.9	31	4.9
2011	33	10.0	23.4	3.7	16.4	7.4	11.8	2.7	31	4.4
2012	7	2	17	2	15.65	2	10.9	2	24	2
2013	7	1	15	1	13.2	1	10.0	1	13.3	1

Table B-10: *power input of office equipment in on-mode and standby mode*

maximum power input values, but standby requirements only were defined. This is why the more stringent EU specifications were taken as a calculation basis for these devices.

For 2012 standby requirements for fax machines were considered according to the "ÖkoKauf Wien" criteria lists.

New EU regulation on standby mode

In an effort to limit standby losses the European Commission adopted Regulation 1275/2008 as part of the Ecodesign Directive 2009/125/EC on 17 December 2008. The regulation defines the ecodesign requirements regarding standby and off-mode electric power consumption of electrical and electronic household and office equipment in two stages.

Standby requirements

The first requirement for all regulated appliances (e.g. household and office equipment) has been in force since 6 January 2010. On 1 January 2013 maximum permissible values for new devices on the market were 50 percent less.

Table B-11: *basic data for the calculation of standby consumption*

operation mode	since 6 January 2010 max. permissible power input	since 1 January 2013 max. permissible power input
standby without information display, possibly with status display	1 Watt	0.5 Watt
standby with information and status display	2 Watt	1 Watt

Savings through standby management

Calculations of savings with turned-off devices (i.e. no energy consumption at all) compared to standby mode take into account the energy consumption for a working week and for weekends. The data stated above (Table B-11) were applied for the on-mode and standby mode (both in Watt).

The following office equipment was considered: coffee machines, TV sets, printers (colour laser) monitors 22-23", notebooks, scanners, PCs, vacuum cleaners and fax machines.

In Figure B-12 the year 2012 was chosen as a baseline for the calculation. The bar in the middle shows the technical savings (advanced technology and application of "ÖkoKauf Wien" criteria list for PCs).

Assuming that all office equipment is turned off with switchable power bars at the end of a working day and is not kept in the standby mode savings of 143 MWh were calculated for 2012. This equals a reduction of 27 tonnes of CO_2 equivalent[71] and approx. 24,000 €[72] of energy costs. These savings are shown in orange in the right bar and amount to approx. 18 percent of the energy consumption.

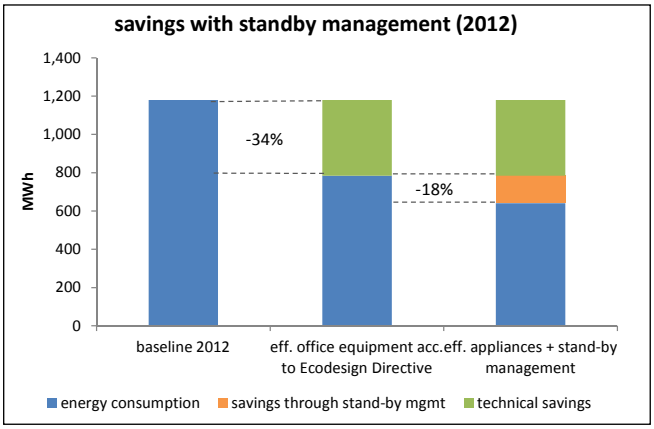


Figure B-12: *reduction of standby loss in 2012*

8.5.1.2 Printing, paper, office equipment and office furniture (see main report chap. 3.2)

Calculations of CO_2 savings for paper were split into product groups office paper and hygienic paper.

Office paper

Annual procurement at MA 54 of office paper, split into white copy paper and paper without any optical brightener/recycling paper was used as a basis for calculation. Office paper is assessed according to the sample folder for ecological printing paper, office paper and roll paper. Paper used in the offices, as well as paper used in internal and external print houses must meet the criteria in the sample folder. The sample folder states a limit of max. 1,100 kg of CO_2 emissions per tonne of paper which is the baseline for the following CO_2 calculation. Paper with higher emission values does not qualify for the sample folder and is therefore not procured.

The VKI study (Austrian Consumer Association) on the evaluation of CO_2 savings achieved with the WG03 tender criteria for environmentally sound procurement of paper and print jobs ("*Evaluierung der CO_2-Einsparung durch die Anwendung der Ausschreibungskriterien der WG03 für die umweltgerechte Beschaffung von Papier und Druckaufträgen*") was taken as a reference for the amount of CO_2 emissions caused by the paper types procured. This study analysed the CO_2 pollution of the types of paper used by the City of Vienna.

It was assumed that white "Biotop 3" copy paper and paper without optical brighteners/recycling paper corre-

[71] CO_2 emission factor for Wien Energie amounts to 0.188 kg/kWh (2012)

[72] Wien Energie electricity costs: 0.17 €/kWh (2012)

sponds to paper type "Nautilus". Additional properties of the different paper types are listed in the sample folder.

The following emission values were taken as a calculation base:

- Paper not qualified for the sample folder – baseline 1,100 kg CO_2/t[73]
- White copy paper, e.g. type "Biotop 3" 690 kg CO_2/t[74]
- Paper without optical brighteners/recycling copy paper, e.g. type "Nautilus" 330 kg CO_2/t[74]

The following table shows the volumes of paper procured and the CO_2 savings between 2005 and 2012.

	2005	2006	2007	2008	2009	2010	2011	2012	
paper white copy paper	425,932	697,625	842,775	579,850	659,143	545,731	545,731	560,366	in kg
paper without opt. brightener/recycling copy paper	296,097	179,000	312,412	260,920	263,735	310,511	310,511	302,365	in kg
	722,029	876,625	1,155,187	840,770	922,878	856,242	856,242	862,731	in kg
	2005	**2006**	**2007**	**2008**	**2009**	**2010**	**2011**	**2012**	
paper white copy paper - baseline 1.10 t CO_2/t paper	469	767	927	638	725	600	600	616	t of CO_2
paper white copy paper - sample folder 0.69 t CO_2/t paper	294	481	582	400	455	377	377	387	t of CO_2
savings	*175*	*286*	*346*	*238*	*270*	*224*	*224*	*230*	t of CO_2
RC paper - baseline 1.10 t CO_2/t paper	326	197	344	287	290	342	342	333	t of CO_2
RC paper - sample folder 0.33 t CO_2/t paper	98	59	103	86	87	102	102	100	t of CO_2
savings	*228*	*138*	*241*	*201*	*203*	*239*	*239*	*233*	t of CO_2
Total savings	*403*	*424*	*SS6*	*439*	*473*	*463*	*463*	*463*	Total: 3,713 t of CO_2

Hygienic paper

Procurement volumes for hygienic paper were measured in rolls of toilet paper and sheets of paper towels. The specific values were converted into kg for the calculation. A product research showed the following conversion factors:

- 0.1 kg per roll of toilet paper
- 0.0025 kg per sheet of paper towel

The following table shows the conversion of the procurement volumes.

	annual consumption			annual consumption	
	toilet paper	paper towels		toilet paper	paper towels
MAs	2.100.000 rolls	140.000.000 sheet	**equals**	210,000 kg	350,000 kg
KAV	1.800.000 rolls			180,000 kg	

Total: 740,000 kg

The criteria list for hygienic paper is assessed on the basis of CO_2 emissions saved. According to the criteria list hygienic paper must be made of recycled waste paper. A comparison between the hygienic paper procured and conventionally produced hygienic paper without recycled waste-paper content was used as a basis for the assessment.

The Austrian Ecolabel for hygienic paper provides a reference values of 1,000 kg CO_2 per t hygienic paper.[75] This value was taken as a baseline for the following calculation.

The study of the VKI assumes that the City of Vienna procures TORK recycling hygienic paper for its facilities, since this brand is the market leader for this segment. The CO_2 emission values for TORK were also taken from the VKI study.

[73] cf. "ÖkoKauf Wien" (2012), http://www.wien.gv.at/umweltschutz/oekokauf/pdf/papiermappe.pdf, as of 18 December 2013

[74] cf. VKI (2004), Evaluierung der CO_2-Einsparung durch die Anwendung der Ausschreibungskriterien der AG03 für die umweltgerechte Beschaffung von Papier und Druckaufträgen (Evaluation of CO_2 savings achieved with the WG03 tender criteria for environmentally sound procurement of paper and print jobs)

[75] cf. Austrian Ecolabel (2013), UZ 04 guideline. Hygienic paper made of waste-paper, http://www.umweltzeichen.at/richtlinien/Uz04_R7a_Hgienepapier_2013.pdf, as of 18 December 2013

The following emission values were used as a basis for the calculations:

- Hygienic paper, reference value – baseline 1,000 kg CO_2 equivalent /t[75]
- Recycling hygienic paper, e.g. TORK 420 kg CO_2 equivalent /t[76]

	annual consumption hygienic paper	before "ÖkoKauf Wien" criteria list	with "ÖkoKauf Wien" criteria list	reduction	
		1.00 t CO_2/t paper	0.42 t CO_2/t paper		
MAs	390 t	390	164	226	in t of CO_2 per year
KAB	350 t	350	147	203	in t of CO_2 per year
Total	740 t	740	311	429	in t of CO_2 per year

Double-sided printing and copying

Double-sided printing and copying can reduce paper consumption by up to 50 percent. The following calculation assumes that actual paper consumption can be reduced by about a third, i.e. an average of 300 t of paper were saved per year.

The following emission values of the various types of paper were used as a basis of the calculations for office paper:

- White copy paper, e.g. type "Biotop 3" 690 kg CO_2/t
- Paper without optical brightener/recycling copy paper, e.g. type "Nautilus" 330 kg CO_2/t

The following table shows the calculation of emission savings for the annual amount of saved paper.

	2005	2006	2007	2008	2009	2010	2011	2012	
reduction of paper white copy paper		141,977	232,542	280,925	193,283	219,714	181,910	181,910	186,789
reduction of recycling copy paper		98,699	59,667	104,137	86,973	87,912	103,504	103,504	100,788
Total savings paper		**240,676**	**292,208**	**385,062**	**280,257**	**307,626**	**285,414**	**285,414**	**287,577**
	2005	**2006**	**2007**	**2008**	**2009**	**2010**	**2011**	**2012**	
paper white copy paper - sample folder 0.69 t CO_2/t paper	98	160	194	133	152	126	126	129	in t of CO_2
RC paper - sample folder 0.33 t CO_2/t paper	33	20	34	29	29	34	34	33	in t of CO_2
Total savings t of CO_2	**131**	**180**	**228**	**162**	**181**	**160**	**160**	**162**	**Total: 1.363 t of CO_2**

On average double-sided printing and copying saves about 160 t CO_2 equivalent emissions per year.

8.5.1.3 Vehicle fleet

Table B-12 provides an overview of the EURO emission classes for heavy utility vehicles. Substance groups CO, HC and NO_x in g/kWh have been regulated in these emission classes since 1988. In 1992 particulates and in 2000 methane were added to these classes.

The basic data for the impact analysis were minimum specific fuel consumption and relevant air pollutant emissions of the respective EURO class. These data were compiled and prepared by MA 48, see table B-13.

The criteria list for the procurement of HGVs provides for compliance with emission standard EURO 5 EEV since 8/2010. Between 2010 and 2013 about 160 HGVs of emission class EURO 5 EEV were procured on the basis of the "ÖkoKauf Wien" criteria list compiled by MA 48. For the purposes of the impact analysis procurement of HGVs in this class was compared to the baseline scenario, i.e. procurement of HGVs in emission class EURO 4.

It was assumed that the HGVs procured have an average annual fuel consumption of 65 l/100 km and a vehicle performance of 20,000 km/year.

The limit values for CO_2 emissions have not changed since EURO 4, however, due to the implementation of emission standard EURO 5 EEV, savings with air pollutants NO_x, CO, HC and particulate matter were recorded. The monetary assessment of the reduced pollutant emissions was conducted in line with EU Directive 2009/33/EC.

[76] cf. VKI (2004), Evaluierung der CO_2-Einsparung durch die Anwendung der Ausschreibungskriterien der AG03 für die umweltgerechte Beschaffung von Papier und Druckaufträgen (Evaluation of CO_2 savings achieved with the WG03 tender criteria for environmentally sound procurement of paper and print jobs)

Table B-12: *EURO classes and their maximum emissions*

EU Directives	88/77/EEC	91/542/EEC		99/96/EC					595/2009/EC
components	Euro 0 since 1988/90 (9)	Euro I since 1992/93 (9)	Euro II since 1995/96 (9)	Euro III from 2000/01 (9)		Euro IV from 2005/06 (9)	Euro V from 2008/09 m	EEV (7)	EURO VI from 2013/01
CO	12.3	4.9	4.0	2.1	5.45	4	4	3	1.5
HC	2.6	1.23	1.1	0.66	0.78	0.55	0.55	0.4	0.13
Methane	-	-	-	-	1.6 (4)	1.1 (4)	1.1 (4)	0.66	
NO_x	15.8	9.0	7	5.0	5.0	3.5	2	2	0.4
particulate matter	-	0.4/0.68	0.15	0.1/ 0.13 (5)	0.16/0.21 (5)	0.03 (5)	0.03 (5)	0.02	0.01
particle concentration	-	-	-	-	-	-	-		-10
smoke opacity	-	-	-	0.8 m^{-1} (6)	-	0.5 m^{-1} (6)	0.5 m^{-1} (6)	0.15 m^{-1} (6)	
test procedure	13 stage procedure	13 stage procedure	ESC test and ELR test (1)	ETC test (2,3)	ETC-test (2,3)				

all values in g/kWh (unless specified differently)
(1) changed/ stricter procedure for diesel engines, also applies for Euro 4 and Euro 5
(2) additional transient test for diesel engines with exhaust aftertreatment system
(3) for gas engines only transient test
(4) only for natural gas engines
(5) only for diesel engines
(6) opacity test acc. to ESC and ELR tests
(7) espec. eco-friendly vehicles
(8) for HGV ≤ 85 kW
(9) The first date refers to vehicles with new type approval. The second date is the mandatory date for fulfilling the respective EURO standard for all new car registrations (usually one year later).
(10) Limit values will be defined in the comitology procedure until 31 December 2012.

umweltbundesamt

Table B-13: *calculation base for emissions of HGVs (source: MA 48, Austrian Federal Ministry of Agriculture, Forestry, Environment and Water Management*[77])

emission limits EURO standard for HGVs > 3.5 t		EURO 3	3->4	EURO 4	4->5	EURO 5	5-> 5EEV	EURO 5 EEV	5EEV->6	EURO 6
spec. fuel consumption	[g/kWh]	203	0%	203	-6.9%	189	0%	189	1.1%	191
CO_2 emissions:	[g/kWh]	263	0%	263	0%	263	0%	263	0%	263
NO_x emissions:	[g/kWh]	4.87	0%	4.87	-59%	2	-8%	1.834	-85%	0.2717
PM emissions:	[g/kWh]	0.08	0%	0.08	-75%	0.02	-50%	0.01	-67%	0.0033
CO emissions:	[g/kWh]	3	-50%	1.5	0%	1.5	-92%	0.117	-88%	0.0146
HC emissions:	[g/kWh]	1.43	-30%	1	-54%	0.46	-97%	0.012	-87%	0.0016

[77] CO_2 monitoring passenger cars in 2013, Austrian Federal Ministry of Agriculture, Forestry, Environment and Water Management, September 2013

8.5.2 Eco-friendly building in Vienna

8.5.2.1 Technical Services (see main report chapter 4.2)

Efficient lighting

type of lamp		2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012
compact fluorescent light	piece/a						19,434	33,291	22,237	12,888	15,354	13,444
fluorescent tube							34,389	42,508	47,242	51,209	59,544	54,098
halogen light bulb									101,830	78,250	79,150	63,570
procurment volume		112,000	112,000	112,000	112,000	112,000	69,000	75,799	171,309	142,347	154,048	131,112

Procurement volumes for the years 2002 to 2006 were researched on the basis of the prior internal evaluation in a summary form only, procurement volumes for 2007 and 2008 were incomplete, however, for the years between 2009 to 2012 it was possible to obtain precise numbers from MA 34 and MA 54 in accordance with PUMA.

Table B-13: *basic presumptions for energy savings by efficient lighting,*
(data source: http://www.monitoringstelle.at/Datenbank.472.0.html)

basic data		
average Watt - conventional light bulb	60	W
average Watt – energy-efficient lamp	12	W
difference in Watt	48	W
time of operation (assumption)	1,000	h
annual difference in consumption per lamp:	48,000	Wh
annual difference in consumption per lamp:	0.048	MWh

Assumptions for savings in energy were slightly adjusted on the basis of the method manual of the Austrian Energy Agency[78], in the chapter on energy efficient lamps in households (*Energiesparlampen bei Haushalten*). The average difference in performance were assumed with 48 W instead of the 49 W set out in the 2008 programme evaluation.

The annual up-dated Wien Energie prices were used for further adjustments with energy costs.

Finally, significant adjustments were made because of the changes with CO_2 emission factors compared to the values assumed in the 2008 evaluation which used a CO_2 factor of 0.4 kg/kWh throughout.

		2006	2007	2008	2009	2010	2011	2012
CO_2 emmision factor (acc. to Wien Energie)	kg/kWh	0.1688	0.1773	0.21044	0.20409	0.1952	0.1976	0.1885

Using the annual up-dated Wien Energie prices as a calculation basis brings about a calculative reduction of CO_2 equivalent savings by a factor 2 compared to the 2008 evaluation.

[78] Austrian Energy Agency (2013), Methoden zur richtlinienkonformen Bewertung der Zielerreichung gemäß Energieeffizienz- und Energiedienstleistungsrichtlinie 2006/32/EG (methods on assessment of the achievements of goals in line with Directive 2006/32/EC on energy end-use efficiency and energy services) , http://www.monitoringstelle.at/fileadmin/docs/de/Methodendokumente/Methodendokument_RK_AT_131015.pdf

Recalculations are shown below:

savings		2009	2010	2011	2012
consumption - conventional light bulb	kWh/a	10,278,540	8,540,820	9,242,880	7,866,720
consumption - energy efficient lamp		2,055,708	1,708,164	1,848,576	1,573,344
energy savings		8,222,832	6,832,656	7,394,304	6,293,376
energy costs	MWh/a	8,223	6,833	7,394	6,293
CO_2 emission factor	kg/kWh	0.20409	0.1952	0.1976	0.1885
CO_2 savings	t/a	1,678	1,334	1,461	1,186
electricity fee per year		0.1728	0.171	0.1696	0.1799
electricity costs - conventional light bulb	€/a	1,776,132	1,460,480	1,567,592	1,415,223
electricity costs - energy-efficient lamp		355,226	292,096	313,518	283,045
savings of electricity cots		**1,420,905**	**1,168,384**	**1,254,074**	**1,132,178**

Cost savings by changing lamps

Empirical values of the City of Vienna show that procurement costs for lamps are between 14 € and 28 € per lamp depending on the area of application. The average price for a lamp is 25 € including 20 % VAT, plus 5€ for changing the lamp. In total changing the lamp costs 30 € per piece on average. Energy-efficient lamps, on average, require replacement once every eight years, i.e. annual costs of energy-efficient lamps are 3.75 €.

conventional light bulbs	1	change per year	30	€/year
energy-efficient lamps	1	change every 8 years	3,75	€/year

Annual savings in costs with energy-efficient lamps compared to light bulbs are shown in Figure B-14. A total of approx. 34 million € are saved over the course of ten years.

As the amount of energy-efficient lamps procured has increased significantly in recent years cost savings too, have become far more pronounced since 2008.

Water-saving sanitary installations

Water-saving cisterns and toilet systems installed as part of the "ÖkoKauf Wien" programme were already reported as quantifiably impacting on water and cost savings during the 2008 internal evaluation. The then chosen calculation method for ecologically and economically relevant savings was further developed in agreement with MA34 and applied to the extrapolated procurement amounts until 2013.

The basic calculation model for water savings per toilet system was retained.

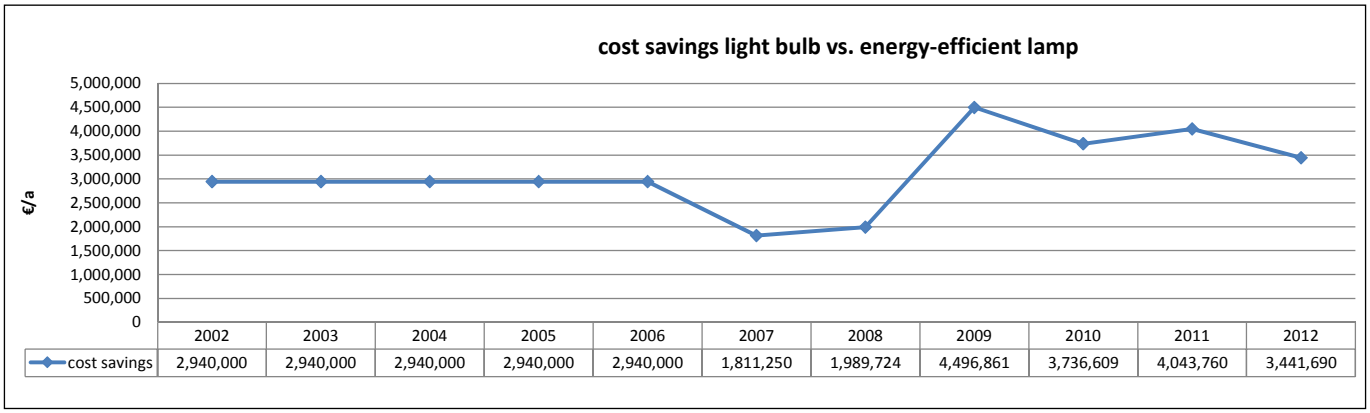


Figure B-14: *cost savings light bulb vs. energy-efficient lamp*

The following adjustments were made to the 2008 evaluation for the current impact analysis:

- The overall number of renewed toilet systems in the buildings of the City of Vienna given as a percentage for each year in 2008 was smoothed and extrapolated on the basis of an average 200 procurements of water-saving cisterns per year until 2013.
- The water charges (sum total of charges for water supply, water meter and waste water) were adjusted on the basis of relevant tariffs for the period between 2003 and 2013.

The following water and cost savings were calculated for the 2013 impact analysis:

savings		2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013
waste-water charge	€ / a	1.32	1.32	1.32	1.69	1.69	1.69	1.78	1.78	1.78	1.89	1.89
charge of water supply and for water meter	€ / a	1.30	1.30	1.30	1.30	1.30	1.30	1.30	1.30	1.30	1.73	1.73
total costs 1m3 water	€ / a	2.62	2.62	2.62	2.99	2.99	2.99	3.08	3.08	3.08	3.62	3.62
toilets	pc	2,667	2,667	2,667	2,667	2,667	2,667	2,667	2,667	2,667	2,667	2,667
share of water saving cisterns in %	%	40%	48%	56%	64%	72%	80%	88%	96%	100%	100%	100%
renewed cisterns	pc	1,067	1,280	1,494	1,707	1,920	2,134	2,347	2,560	2,667	2,667	2,667
annually renewed cisterns	pc	200	213	213	213	213	213	213	213	107	-	-
annual savings per toilet	m³/a	43	43	43	43	43	43	43	43	43	43	43
water savings	m³/a	8505	9073	9073	9073	9073	9073	9073	9073	4537	0	0
cumulative water savings	m³/a	8,505	17,578	26,651	35,724	44,798	53,871	62,944	72,017	76,554	76,554	76,554
cost savings	€/a	22,283	23,772	23,772	27,129	27,129	27,129	27,945	27,945	13,973	-	-
cumulative cost savings	€	**22,283**	**46,055**	**69,826**	**96,955**	**124,084**	**151,212**	**179,158**	**207,103**	**221,075**	**221,075**	**221,075**

Figure B-15: *water and cost savings due to water-saving cisterns*

The basic calculation process of the 2008 evaluation was retained for calculating water savings per aerator, however, in some cases the values needed to be adjusted.

tabs with water saving aerators Source: ÖkoKauf Wien assessment slides 2008
basic data

number of employees		15		
working days (acc. to MA6)	days	210		
energy expenditure for heating 1 m³ of hot water	MWh	0.046	(1)	
hot water costs	€/MWh	44		
CO_2 emission	t of CO_2 per GWh (district heat)	136.2	NEW CALCULATION	
daily water consumption tab without aerator:	in minutes	30	15	(2)
Durchfluss ohne Perlator	l / min	12	12	
Verbrauch	l / d	360	180	
daily water consumption tab with aerator:	in minutes	30	15	(2)
discharge with aerator	l / min	6	6	
consumption	l / d	180	90	
difference in consumption	l/d per aerator	180	90	
savings per year per aerator	l/d per aerator	37,800	18,900	
	m³/a per aerator	37.8	18.9	

Source: Ökokauf Evaluierung Folien 2008

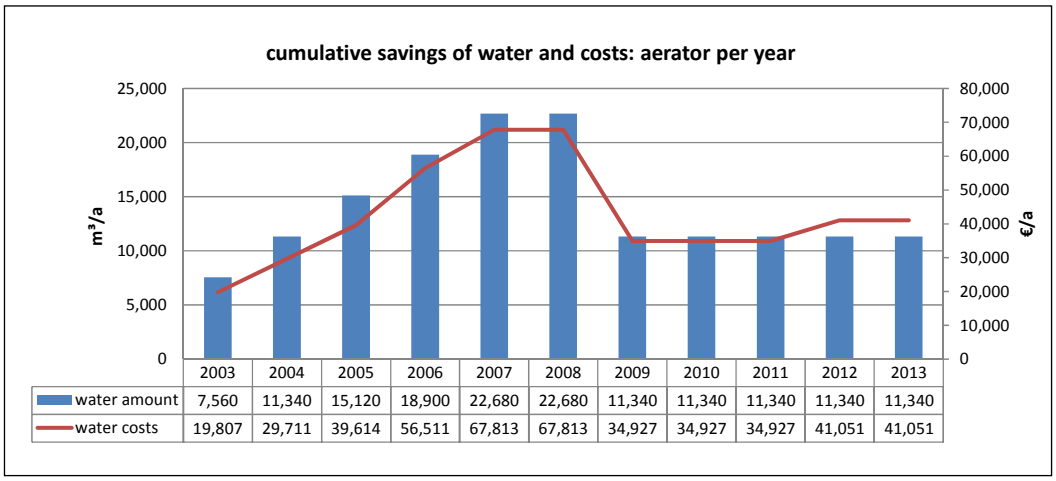
(1) During the 2008 evaluation the energy required for heating 1 m³ of water to 100°C (0.1163 MWh) was used as a basis for the calculation. This is not realistic and too high by a factor of 2.5. The new calculations are based on a temperature difference of 40°C (flow temperature 15°C, return temperature 55°C). This results in an energy input of 0.046 MWh required for heating 1 m³ of water.

(2) For the 2008 evaluation MA 34 assumed that it takes 20 seconds to wash one's hands and every employee washes their hands three times a day. One wash basin is used by 15 employees.
This amounts to: 20 x 3 x 15 = 900 sec = 15 minutes of water used per wash basin per day.
In actual fact, however, the calculations of the 2008 evaluation incorrectly used a figure of 30 minutes per day, i.e. the water consumption was overestimated by a factor of 2.

The water charges (sum total of charges for water supply, water meter and waste water) were adjusted on the basis of the relevant annual tariffs for the period between 2003 and 2013 in line with all other calculations.

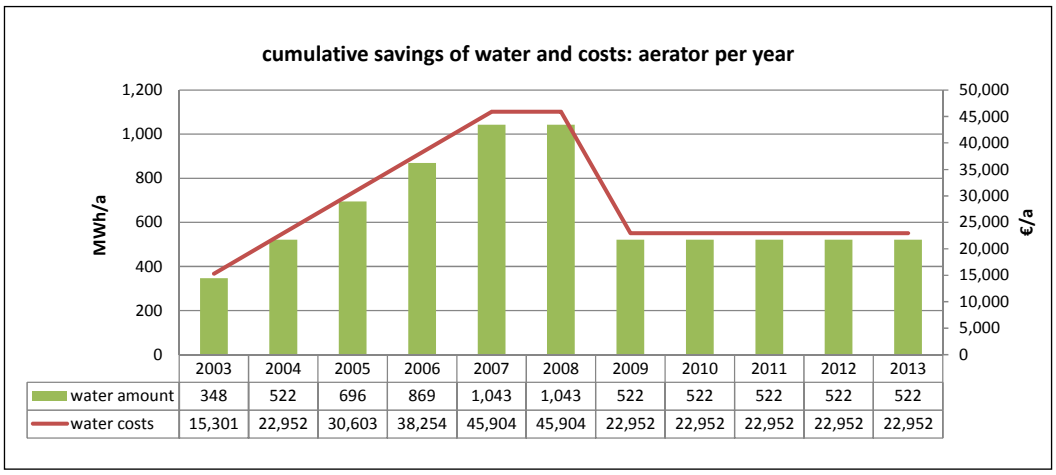
Due to the significant adjustments the new calculations were exclusively applied to the period between 2009 and 2013, since subsequent smoothing of results of the 2008 evaluation did not seem reasonable.

Hence the following development of savings in annual water, cost and CO_2 equivalent at water taps:



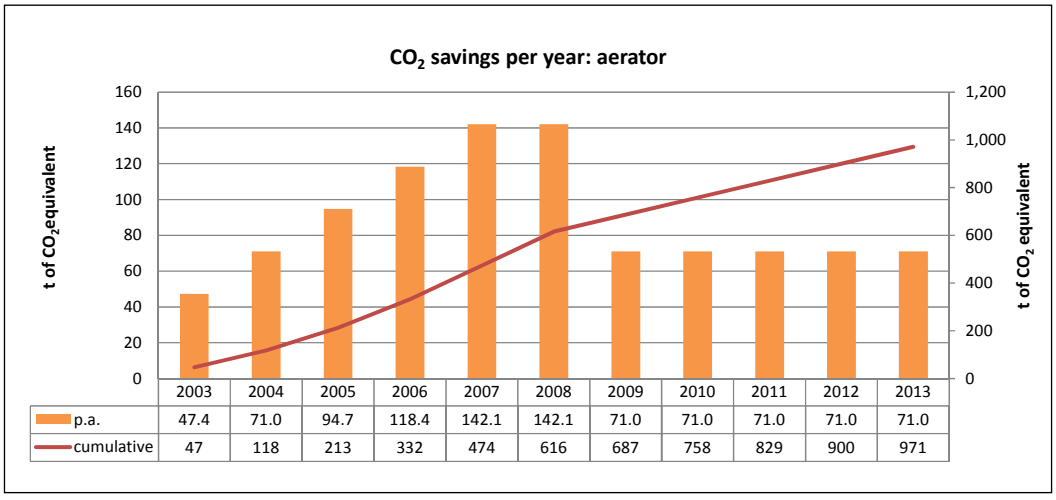
	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013
water amount	7,560	11,340	15,120	18,900	22,680	22,680	11,340	11,340	11,340	11,340	11,340
water costs	19,807	29,711	39,614	56,511	67,813	67,813	34,927	34,927	34,927	41,051	41,051

Figure B-16: *annual water and cost savings for aerators*



	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013
water amount	348	522	696	869	1,043	1,043	522	522	522	522	522
water costs	15,301	22,952	30,603	38,254	45,904	45,904	22,952	22,952	22,952	22,952	22,952

Figure B-17: *annual water and cost savings for aerators*



	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013
p.a.	47.4	71.0	94.7	118.4	142.1	142.1	71.0	71.0	71.0	71.0	71.0
cumulative	47	118	213	332	474	616	687	758	829	900	971

Figure B-18: *annual savings in CO_2 equivalent emissions for aerators*

8.5.2.2 Environmentally Sound Construction Site Logistics and Public Works (see main report chapter 4.5)

The following chapter outlines the calculation methodology applied for estimating the volume of saved CO_2 equivalents

- By cutting back on transports for the construction sites at aspern Urban Lakeside and
- By using and supplying quality compost.

Cutting back on transports at aspern Urban Lakeside project

Efficient construction site management has saved approx. 100,000 HGV trips at the construction sites of aspern Vienna Urban Lakeside. Cutting back on transport activities has many beneficial side effects, e.g. a reduction of particulate matter and noise, less HGV traffic on the roads, reduction of air pollutants, etc.

The trip from the aspern Urban Lakeside construction sites to the closest landfill (Rautenweg) was assumed as a basis. Figure B-19 shows the assumed route of approx. 7 km (i.e. 14 km both ways).

The 100,000 saved HGV trips equal 1.4 million kilometres driven.

It was also assumed that the HGVs used were older models of emission class EURO 3 with a specific fuel consumption of 40 l/100 km. Considering emission values of 2.8 kg CO_2 equivalent per litre diesel amount to savings of 204 t of CO_2 equivalents.

The following table shows the calculation bases and the calculated results.

Table B-14: *calculation of savings of CO_2 emissions by avoiding 100,000 HGV trips at aspern Urban Lakeside*

kilometres driven	1,400,000	km
average consumption EURO 3	40.0	1/100 km kg
greenhouse gas emissions per 1 l diesel	2.8	CO_2 equ

EURO 3		
diesel consumption	560,000	l/a
CO_2 emission	1.568.000	kg of CO_2
CO_2 emission	1.568	t of CO_2

For air pollutant savings see the table below.

Table B-15: *reduction of air pollutants by avoiding 100,000 HGV trips at aspern Urban Lakeside*

amount of emissions		**EURO 3**
NO_x	[kg/a]	29,292
PM	[kg/a]	481
CO	[kg/a]	18,044
HC	[kg/a]	8,601
Total	[kg/a]	56,419

Compost and Compost substrate

The Lobau composting plant was used as a local source for quality compost to assess the criteria list for quality compost. The calculation was based on a study of the University of Natural Resources and Life Sciences which also involved conducting an emission balance for the Lobau composting plant.

The plant produces between 40,000 and 50,000 tonnes of compost every year. The calculation was based on an average amount of 45,000 t.

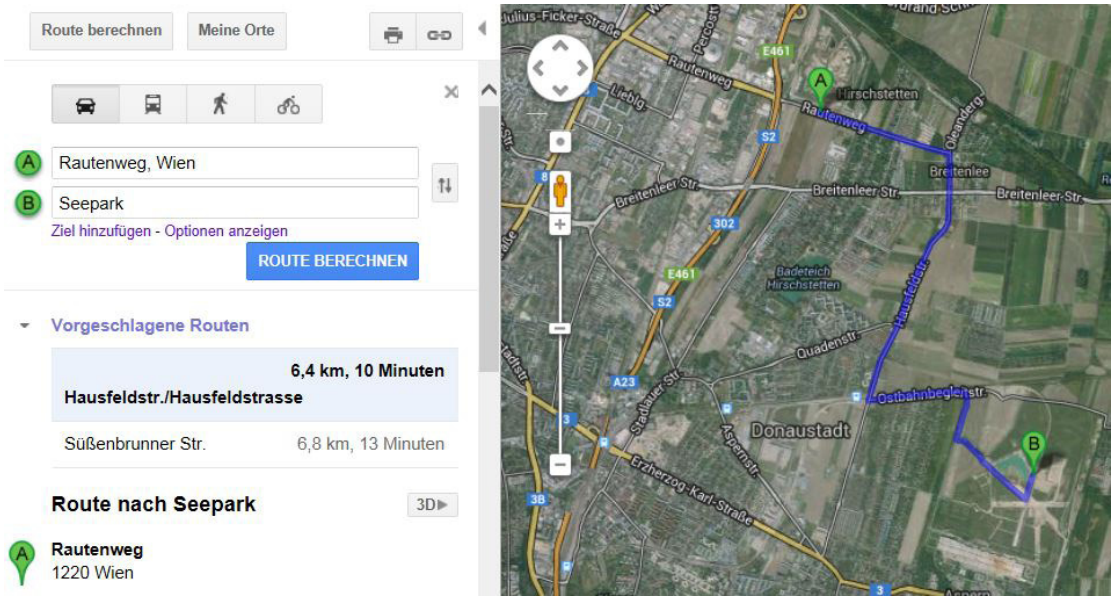


Figure B-19: *transport trip from aspern Urban Lakeside construction sites to closest landfill (Rautenweg)*

The emission balance of the plant includes all emissions produced at the plant during composting or by operating equipment, as well as emissions generated during collection and transport of organic waste. Reducing effects are included in the balance as carbon credits. A reduction of CO_2 equivalents can be achieved by bonding carbon in compost and substituting mineral fertiliser.

The following figure shows the aforementioned CO_2 balance for the Lobau composting plant:

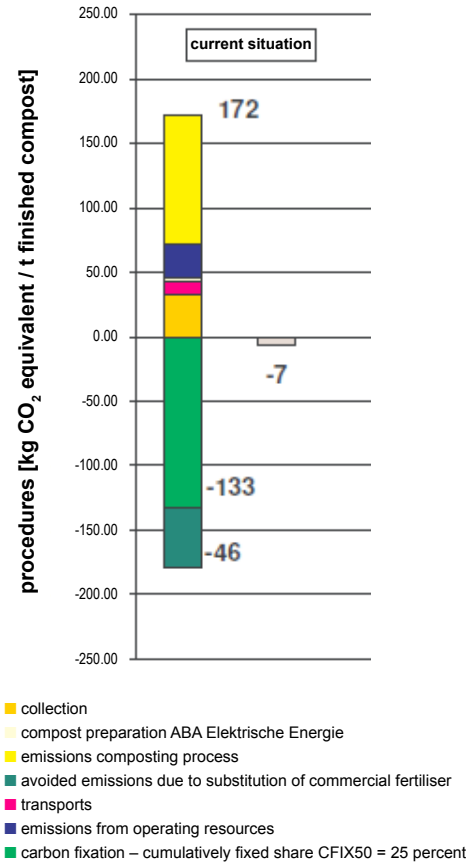


Figure B-20: *climate relevant emissions and net emissions (+) and net fixation (-) for Lobau composting plant (University of Natural Resources and Life Sciences – Institute of Waste Management (2005), http://www.boku.ac.at/TCG/rol/KliKo_Endbericht.pdf, as of 3 March 2014)*

As shown in the figure total savings in CO_2 equivalent amount to 7 kg per t of ready compost, i.e. annual savings of 315 t of CO_2 equivalents in 45,000 t of compost.

8.5.3 Eco-friendly living in Vienna

8.5.3.1 Food (see main report chapter 5.1)

The calculation of savings in CO_2 equivalent was carried out on the basis of the calculation methodology of the 2008 internal programme evaluation, with new evaluations and adjustments made on the basis of current data. This change is also reflected in the results for 2008.

For the calculation the procurement of food for the facilities of MA 10 (Children's Day Care Centres), MA 56 (Vienna Schools), KAV and the Retirement Homes Fund of the City of Vienna (KWP) was analysed.

The calculation was based on the following assumptions:

- CO_2 emissions caused by the food segment amount to about 2,600 kg of CO_2 equivalents per capita and year.[79] Full board for a person in the analysed institutions also amounts to approx. 2,600 kg of CO_2 equivalents per year.
- Production of organic food consumes less energy and fewer resources and causes up to 30 percent less CO_2 equivalent emissions. This value also includes any transport required.[80] Organic full board causes an average of 30 percent less damage to the environment and amounts to 1,820 kg of CO_2 equivalent per year.
- KAV 22,500 full boards per day
  KWP 11,500 full boards per day
  MA 56 – Vienna Schools 8,795 full boards per day
  MA 10 – Day Care Centres 4,544 full boards per day

[79] cf. Salmhofer, C., Strasser, A., Sopper, M. (2001), Ausgewählte ökologische Auswirkungen unseres Ernährungssystems am Beispiel Klimaschutz (Selected ecological impacts of our diet systems using the example of climate protection), http://www.umweltethik.at/download.php?id=285, as of 11 February 2014

[80] cf. Bio-Forschung Austria

The following table shows the calculation in detail:

Table B-16: *calculation of CO_2 savings due to procurement of organic food in selected institutions*

	full boards per day		2004	2005	2006	2007	2008	2009	2010	2011	2012
KAV	22,500	*organic share*	*30%*	*30%*	*30%*	*32%*	*33,00%*	*35,65%*	*35,83%*	*32,11%*	*32,60%*
		CO_2 savings	10,530	10,530	10,530	11,232	5,792	6,257	6,288	5,635	5,721
KWP	11,500	*organic share*	*16%*	*16%*	*16%*	*18%*	*18%*	*16,04%*	*16,80%*	*24,80%*	*30,00%*
		CO_2 savings	2,870	2,870	2,870	3,229	1,615	1,439	1,507	2,225	2,691
MA 10 Day Care Centres	8,795	*organic share*	*40%*	*50%*	*50%*	*51%*	*51%*	*51%*	*51%*	*51%*	*51%*
		CO_2 savings	5,488	6,860	6,860	6,997	3,499	3,499	3,499	3,499	3,499
MA 56 Vienna Schools	4,544	*organic share*	*11%*	*11%*	*11%*	*11%*	*11%*	*11%*	*11%*	*11%*	*11%*
		CO_2 savings	780	780	780	390	390	390	390	390	390
	total CO_2 savings		**10,668**	**21,040**	**21,040**	**22,238**	**11,295**	**11,584**	**11,684**	**11,748**	**12,301**

The calculation method was adjusted for the years since 2008. The calculation of the 2008 internal evaluation was based on 60 percent of CO_2 equivalent savings for organic food compared to conventionally produced food. Since the current calculation assumes a 30 percent reduction of emissions for organic food, the results show a significant leap although the organic food share in the meals has not been reduced.

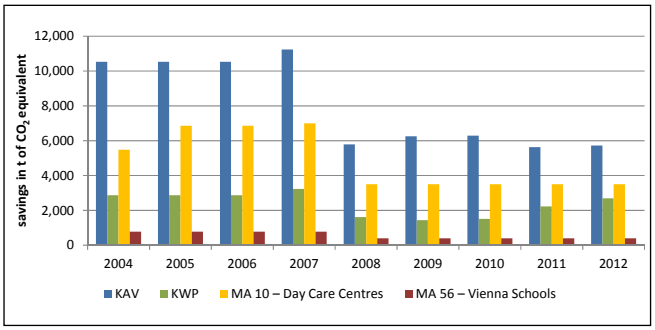


Figure B-21: *savings in CO_2 equivalent due to procurement of organic food*