

2 Bosch Automotive Systems Corp. Japan

1. Corporate profile

Bosch, the global company that started in Germany, came to Japan in 1911. Since that time Bosch has made its contribution to the development of Japanese industry by gradually expanding its diverse range of business activities including automotive technology, industrial technology, consumer goods and building technology.

Especially, Bosch Automotive Systems has supplied high-quality products and services in automotive technology. We have almost 7,800 employees and total sales in 2003 was 334,710 million yen.

2. Environmental activities

In line with the Mid-term Environmental Action Plan designed in 2001, we carry out a range of environmental activities. The manufacturing sectors are pursuing the achievement of zero emissions landfilled waste and the reduction of CO₂. The company also strives to reduce emissions of xylene and other substances covered by the Pollutant Release and Transfer Register (PRTR) and to develop innovative treatment for chips, waste water, and machining oil.

3. Objectives

We find the choice of evaluation indices very important, when examining efficacy and adequacy of environmental activities. We conducted an eco-balance analysis by means of an environmental integrated index or JEPIX, and evaluated our environmental impacts as a total. This indicates a new dimension to an evaluation of environmental impacts. We will go on to examine utility and practicability of JEPIX when evaluating and guiding future environmental activities.

4. Scope

This analysis targets a site-core-balance as a boundary (impacts of fuel consumption in factories + impacts through energy production + impacts of waste treatment). The area is surrounded by a black border in Figure 2.1.

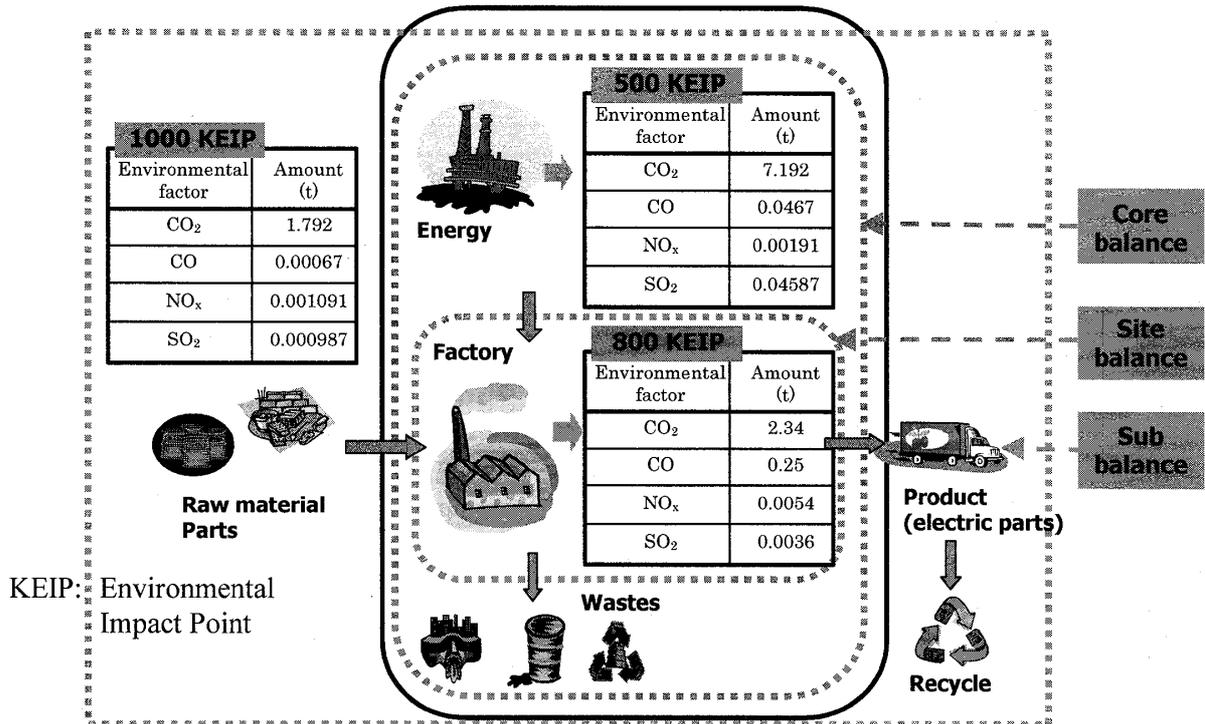


Figure 2.1: Scope of analysis

5. Condition

The whole company is the target of this analysis. The conditions (the analysis model of Regis and input inventory data) are shown in the following figures.

▼ Analysis model of Regis

We have built a model targeting the whole company (seven main factories).

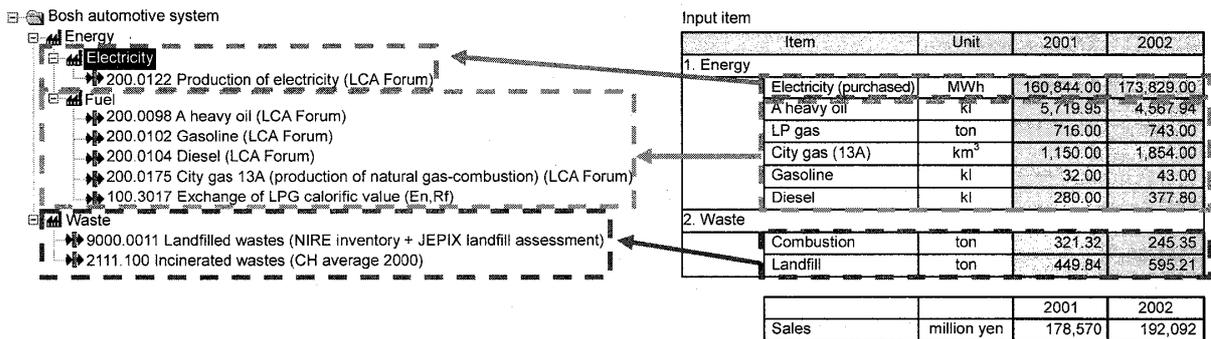


Figure 2.2: Analysis model of Regis

▼ Input inventory data

The priority of data is 1) data of the Japan LCA forum, 2) NIRE database, and 3) data (originally collected for European companies) available in Regis. See Figure 2.3 concerning each inventory data base.

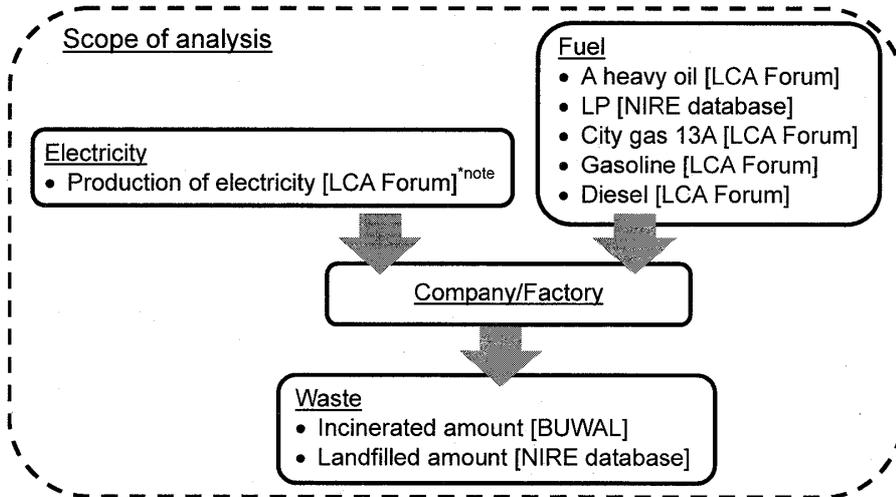


Figure 2.3: List of input inventory database

6. Results

▼ Environmental category balance

We have referred to the environmental category balance of the year 2002 so as to get a grasp of balances in each category of environmental impacts. It was found out that impacts of global warming and energy consumption comprise the largest share of 92.4%. About 60% of its breakdown is CO₂ as a source of electricity. The emission of dinitrogen oxide and nitrous oxide results mainly from electricity production. Realizing this leads to a conclusion that impacts of electricity (about 70%) are not to overlook.

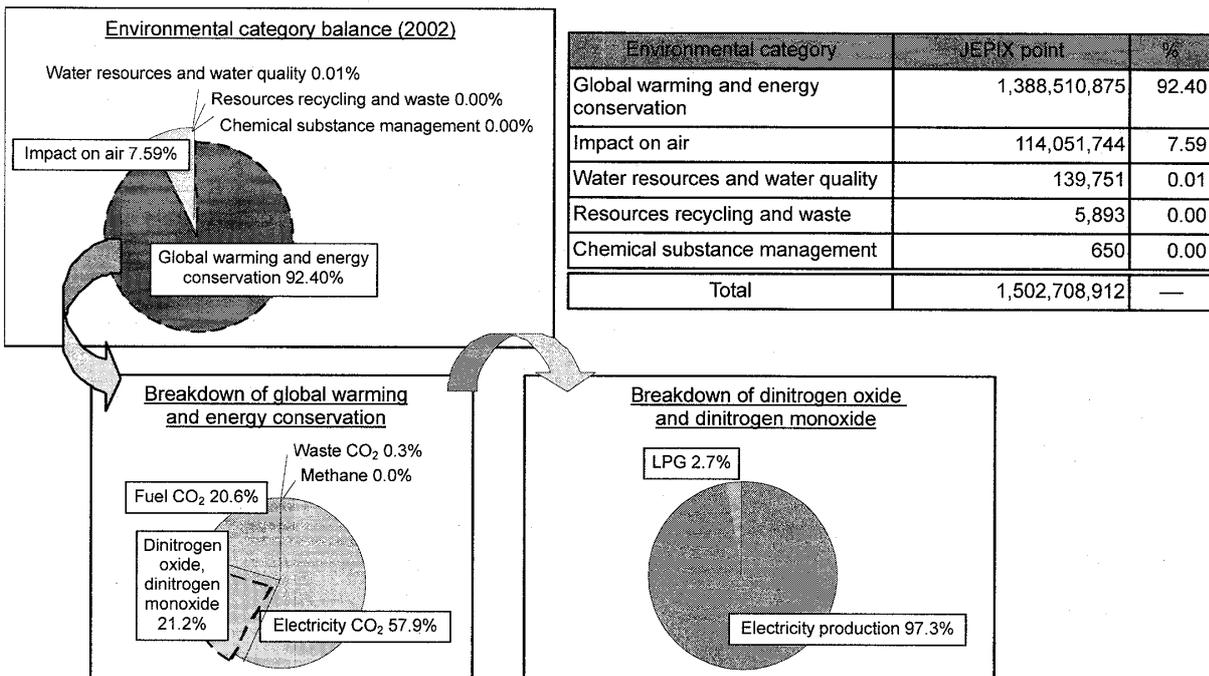


Figure 2.4: Comparison of environmental category

We went on to conduct an analysis which breaks environmental impacts down based on their own measurement points (Figure 2.5). It is clear to be seen that impacts of electricity production are the largest. Our company only buys electricity from an electric power company. Substituted by this electricity in order to emphasize environmental impacts borne at our own sites, the impacts of grade A crude oil cover almost the half, manifesting the largest share, followed by wastes-related impacts of more than 30 %.

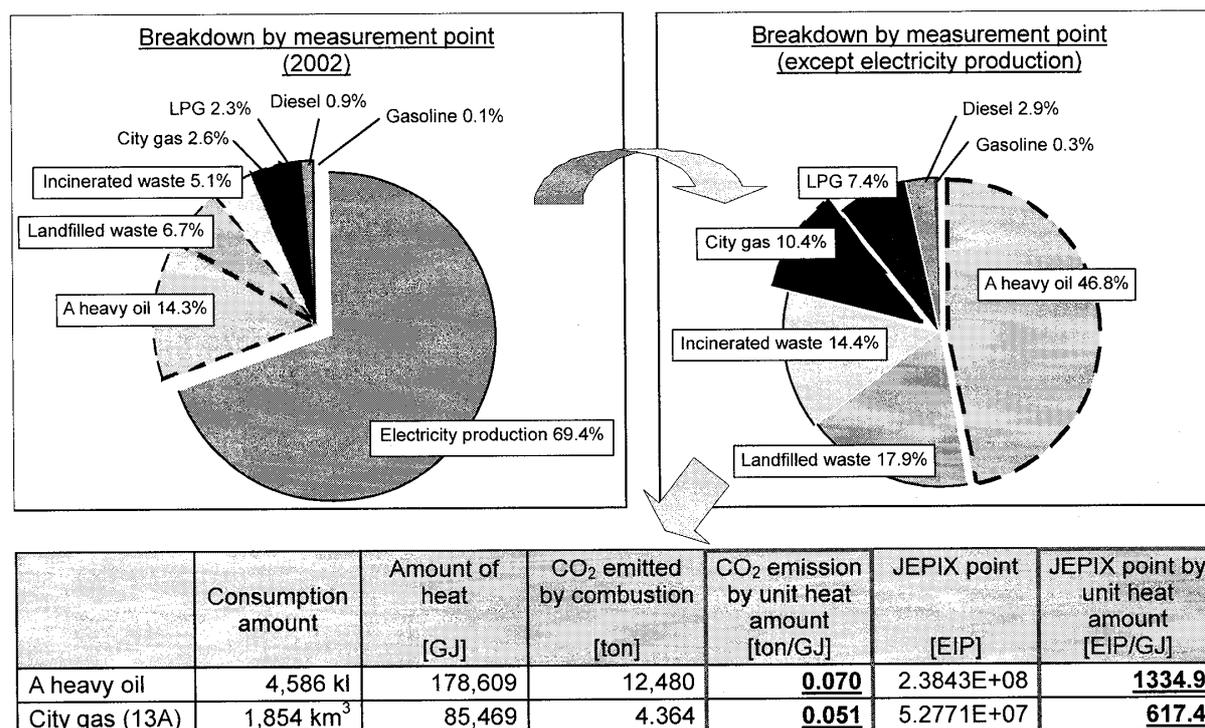


Figure 2.5: Comparison by measurement point

As far as grade A crude oil and city gas are concerned (see Figure 2.5), city gas has been considered so far as less harmful, because less CO₂ will be emitted through combustion (city gas is less harmful than grade A crude oil by about 30% based on its heat quantity). However, the evaluation based on JEPIX presents that city gas is far less harmful than grade A crude oil by about 46%. Impacts of other emission to the air than CO₂ as well as impacts through energy production presumably give rise to the difference between 30% and 46% (Details must be examined).

▼ Summary of results

The following two points are proved by the analysis of JEPIX.

1. Impacts to global warming are the largest of all environmental impacts caused by our company (Even when categories of chemical substances will be added later, there won't be expectedly any big change in evaluation results).
2. Environmental impacts decreased through the replacement of grade A crude oil with city gas will be expected to become even less when the target of an evaluation covers other

aspects than CO₂ emission.

7. Effectiveness of evaluation

▼ Effectiveness of evaluation based on JEPIX (Regis) and questions

Efficacy:

- Quantitative evaluation of environmental risks
- Evaluation of a wide range of environmental aspects is especially beneficial.

Questions and challenges:

- Use of IPCC data concerning the target flow of CO₂ (reason for a disproportionate emphasis on CO₂)
 - It would be appropriate to standardize values compatible to those regulated in the society.
- How should validity of results be evaluated?
 - It is necessary to examine inventory data.

The results of this analysis express only the importance of policies to combat global warming.

- There exists a gap in our actual problem recognition.
- ※ The followings are main efforts to improve environmental performances and regulations including self-regulations. Prioritization of efforts or approaches to improve environmental performance, based on the evaluation of the analysis, lays too much emphasis on energy saving and concludes mistakenly that other efforts are rather trivial.

◆ Energy saving

- Reduction of CO₂ emission:

Target: reduction of 1% till 2005, and reduction of 7% till 2010 when compared to the year 1990

Regulation: voluntary action plan on the environment

- Reduction of specific energy consumption:

Target: reduction of 1% when compared to the previous year

Regulation: Energy Saving Law

◆ Effort to reduce wastes

- Reduction of total wastes:

Target: Reduction of 68% till 2010 when compared to the year 1992

- Reduction of landfill wastes:

Target: keep the amount less than 1% of the total amount of wastes

Regulation: voluntary Action Plan on the environment

◆ Reduction and abolishment of hazardous chemical substances

- Substances in the process flow

Target: reduction of hazardous substances such as toluene, xylene, chlorine etc.

Regulation: Occupational Safety and Health, PRTR Law

- Substances included in products

Target: exclusion of lead, mercury, cadmium and hexavalent chromium in products

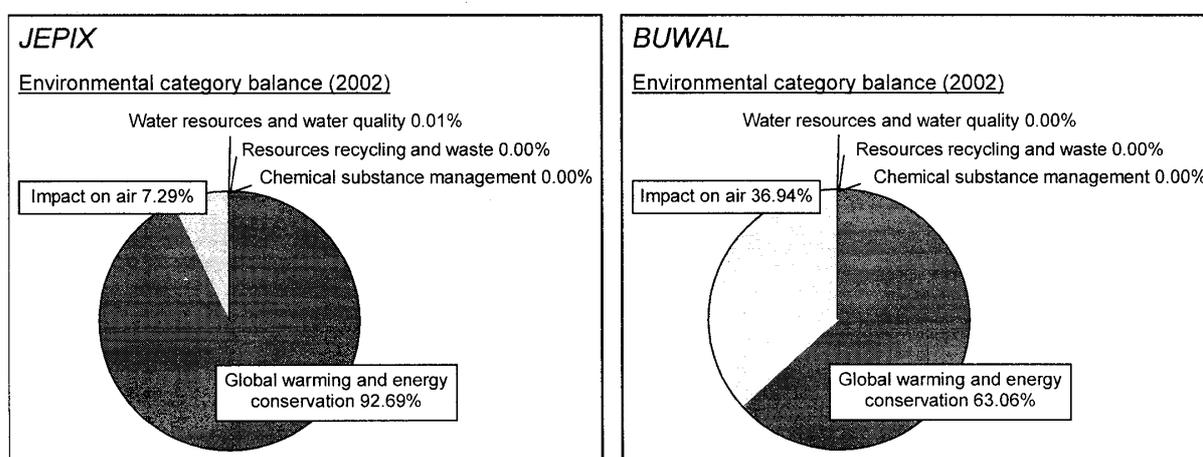
Regulation: EU/ELV Regulation, Self-regulation value set by each customer

▼ Comparison of evaluations between JEPIX and BUWAL

We compared JEPIX and BUWAL regarding results and the classification of points as to each substance based on CO₂.

A key difference lies in that the evaluation based on JEPIX has a much bigger share of “impacts of global warming and energy saving” in the environmental category balance than the evaluation based on BUWAL. Another difference is given by the fact that the evaluation based on BUWAL has a much bigger share of “impacts to the air” than the evaluation based on JEPIX. In order to find out causes, weighting factors of each substance should be taken into consideration.

One cause is a difference in weighting factors of SO_x. In Japan, the actual flow of SO_x lies near the target flow, so that its weighting factor turns out to be a small value. The impacts to the air are therefore kept small. Another difference is a large weight of substances used for the chemical substance management. These differences cause a gap between targets and actual values between Japan and Germany.



Comparison of weighted substance point of both indexes based on CO₂

Environmental category	Material [kg]	In case CO ₂ = 1.0		Ratio (BUWAL/JEPIX)	Remarks
		JEPIX	BUWAL		
Impact on air	NO _x	52.7	335.0	6.353	Goal accomplished in Japan
	SO _x	8.1	265.0	32.615	
Water resources and water quality	BOD	13.2	295.0	22.343	
	COD	255.6	295.0	1.154	
Chemical substance management	Benzene	38,290.2	160.0	0.004	
Global warming and energy conservation	CO ₂	1.0	1.0	1.000	
	N ₂ O	310.1	310.0	1.000	
	Methane	21.0	21.0	0.999	

Figure 2.6: Comparison between JEPIX and BUWAL

▼ Recognition of the evaluation based on BUWAL at the German headquarters

The headquarters in Germany use the factors of BUWAL and the following summarizes their recognition of the evaluation.

Evaluation values of BUWAL are specific to one site and are not aimed for a comparison company-wide or among sites. The evaluation applying BUWAL, as index based on basic

units, follows a trend. Efficiency-index would be therefore meaningful by dividing values by value-added production and production volume.

The evaluation of environmental performance activities depends on indices. BUWAL helps present the top management a summary of environmental performance activities of the company.

The efficacy of the evaluation applying BUWAL varies depending on contents. It would be meaningful to include categories of environmental impacts.

9. Summary

Positioning of the JEPIX evaluation

We firstly thought of the usage of JEPIX as a tool to set priorities of environmental activities. However it was found out to be difficult, for JEPIX is biased by CO₂. Still, JEPIX can be meaningfully applied to summarize environmental activities and evaluate EIP as well as the trend of eco-efficiency. JEPIX will enjoy a higher need and importance in the future.

Future consideration

Ensuring adequacy of the evaluation (examination of inventory data)

- Is it possible to review the bias of CO₂?
- Addition of input data categories

The participation in this benchmarking project has enriched our knowledge of JEPIX (BUWAL) and has clarified issues to apply this method. It was a meaningful participation in this sense. It will set us off to tackle with the clarified issues and to put JEPIX as an environmental management index into better use in the company. We will publish results in our environmental report on this occasion.

Last but not least, we appreciate the guidance of Prof. Miyazaki at International Christian University, and the help of Mr. Goto, Ms. Nagayama and Ms. Mizutani at Yamatake Co.