



## Reduction of Greenhouse Gas Emissions in the European Union

### KEYWORDS

climate change, responsibility, informing the public

### Merica Pletkovic

CEMEX Croatia, F.Tuđmana 45, 21212 Kaštel Sućurac

**ABSTRACT** *With the aim of adapting to climate change, former Kyoto Protocol's policy put the burden of reducing greenhouse gas emissions only on industrial installations.*

*The European Union assumed a greater role in greenhouse gas emission reduction and, by Policy 20-20-20, plans to reduce the emissions in the period from 2013 to 2020 for 20% in comparison to 1990. The economic sector is faced with two choices; they can reduce the overall CO<sub>2</sub> emissions or buy the allowances for CO<sub>2</sub> emissions. The public and civil sector is expected to take responsibility in preparing and informing the public.*

*On a sample of 100 entities statistically significant difference was established between target and sector groups about the awareness and the consequences brought on by climate change as a social problem, about the responsibility of previous effects of environmental protection by local government, and the attitudes about the implementation of measures and policies. Based on the SWOT analysis, a proposal of measures was made with the aim of raising awareness and informing the public about the importance of adaptation to climate change.*

### INTRODUCTION

One of the most important segments affecting the world today is climate change and its impact on the economy and population. It has become a global problem, and governments take significant steps to solve this problem. In European Union countries, the Post Kyoto comes to effect in 2013 and brings novelties into the system of emission units' distribution to particular sectors and industries. The aim of this paper is to investigate the attitude of interested and competent public (representatives of government, economy and the civil sector) and to determine the level of awareness and readiness for change in adapting to climate change, in order to obtain answers to the research question: Who is responsible for informing and involving the public in dealing with the problem of climate change in Croatia and what actions should be taken?

### METHOD

The subject sample consisted of 100 entities in Croatia, EU, 55 of whom were male and 45 were female. Mean age of the subjects was 47.9. The respondents were divided into nine subsamples (target groups) which were qualitatively defined as:

**ORGANIZATIONS** – representatives of non-governmental environmental organizations of Split-Dalmatia County, 10 participants; **TOWNS** – representatives of local government employees from Kaštela, Solin and Split, 10 participants; **BUYERS/SUPPLIERS** – representatives of buyers and suppliers of CEMEX Croatia, 10 participants; **POLITICS/SCIENCE** – representatives of local political structures and scientists, 10 participants; **SPONSORSHIP AND DONATIONS RECIPIENTS** – representatives of beneficiaries and recipients of CEMEX sponsorships and donations, 10 participants; **KAŠTELA RESIDENTS** – representatives of neighbours of the plant "Sv. Juraj" in Kaštel Sućurac, 15 participants; **SOLIN RESIDENTS** – representatives of neighbours of the plant "Sv. Kajo" in Solin, 15 participants; **CEMEX EMPLOYEES** – representatives of Cemex employees, 10 participants; **THE COUNTY** – representatives of local government employees of Split-Dalmatia County, 10 participants.

Out of the abovementioned subsamples, three new clusters (sectors) consisting of the total of 70 participants were classified, which were qualitatively defined as:

**PUBLIC SECTOR** – 30 participants from the target groups: **TOWNS**, **POLITICS/SCIENCE** and **THE COUNTY**.

**CIVIL SECTOR** – 20 participants from the target groups: **ORGANIZATIONS** and **SPONSORSHIP AND DONATIONS RECIPIENTS**.

**ECONOMIC SECTOR** – 20 participants from the target groups: **BUYERS/SUPPLIERS** and **CEMEX EMPLOYEES**.

The variable sample is represented by a set of 3 qualitatively defined questions which were used in a problem-oriented in-depth interview.

The first variable, which was code-named *climate change\_present*, was defined based on the first question which reads:

1. By Kyoto Protocol's policy, EU decided to reduce greenhouse gas emissions. What is your attitude towards global warming and climate change as environmental problems?

The second variable, which was code-named *responsibility\_climate change*, was defined based on the second question:

2. In your opinion, who is responsible for dealing with climate change in Croatia and what actions should they take?

The third variable, which was code-named *local government\_environmental protection*, was defined based on the third question:

3. Do you think that local government takes care of the environmental protection adequately?

A problem-oriented in-depth interview and participant observation was conducted with 100 respondents divided into nine target groups and three control sector groups representing a target sample of informed public which is rich in information and, in its activity, involved in forming the attitudes of others. After being presented with the problem and the aim of the research, all participants gave willing consent for participation in the research.

Based on written transcripts, and by quantitative method of substantive theory, numerical coding of responses was per-

formed for the purposes of forming the entity matrix, defined by the overall subject sample and coded variables, for further statistical analysis. By descriptive analysis, frequency of each code-named variable applied for each question was determined, as well as their relative and cumulative values. The analysis of differences between the defined subsamples (target groups), as well as between the three classified clusters (sectors), were also conducted.

Quantification of qualitative empiric materials and transformation to the numerical form was performed for the purposes of further statistical analysis. Complete statistical analysis was performed by STATISTICA, Ver.10.00 software package. Quantitatively analyzed empiric material was further qualitatively analyzed through 4 areas of SWOT analysis.

**RESULTS AND DISCUSSION**

Quantitative analysis of the entity matrix and the first variable was based on responses obtained by qualitatively defined first interview question, which reads:

By Kyoto Protocol's policy, EU decided to reduce greenhouse gas emissions. What is your attitude towards global warming and climate change as environmental problems?

The respondents expressed their opinion about the presence or absence of climate change, and about their certainty or knowledge of the statements written.

Their responses were defined at three levels:

The first group was classified based on negative responses, the second group was defined by positive responses, and the third group of subjects was classified based on the response: I don't know, I'm not sure, I'm not familiar with the Kyoto Protocol's policy.

The results of frequencies of all entities and the first variable *climate change\_present* are shown in Table 2.

The total of 23 respondents think that the problem of global warming and climate change does not exist and that it does not represent any sort of ecological problem. Also, they do not support the Kyoto Protocol's policy and are convinced that mentioned changes are natural occurrences and phenomena due to the activity of the Sun and the Earth's orbit.

As the total number of entities was 100, the value of numerical frequency description also represents the relative value expressed in percentages or percentiles (centiles). Frequency value of 23 matches the relative percentage of 23%.

73 participants gave positive responses about the existence of climate change and global warming. They believe this is an ecological problem of great proportions and they support the Kyoto Protocol's policy.

Only 4 entities have no opinion about climate change and global warming, and they remained undefined regarding this question.

**Table 1 Relative and cumulative frequencies of the climate change\_present variable, N=100**

	Count	Cumulative - Count	Percent	Cumulative - Percent
0	23	23	23.00	23.00
1	73	96	73.00	96.00
2	4	100	4.00	100.00

LEGEND: 0 - no; 1 - yes; 2 - I don't know, I'm not sure

Tabular presentation (Table 2) of the *climate change\_present* variable and grouping variables of *target groups*, indicate that separate subsamples fully differ according to the defined responses. Namely, target groups *BUY/SUP* (buyers

and suppliers), *SPO/DON.REC* (sponsorship and donations recipients), as well as *CEM/EMP* (Cemex employees) gave a maximum number of positive responses about global warming and climate change. They all consider these to be great ecological problems and that the impact on environment is evident. They support the Kyoto Protocol and insist on taking urgent measures for greenhouse gas emissions reduction.

Participants defining the subsample *Kaštela residents, neighbours of the plant "Sv. Jure"* have the same opinion as the representatives of the target group *The County*.

Entities in target groups *Organizations, Towns and Politics and science* also, for the most part, decided on the existence of climate change and global warming.

Representatives of the subsample *Solin residents, Neighbours of the plant "Sv.Kajo"*, separated themselves considerably at this question and the variable *climate change\_present*, by thinking, in great majority, that such ecological problem does not exist, mainly attribute global warming and climate change to natural occurrences and phenomena as well as to the consequences of activity of the Sun and Earth's orbit.

Frequencies of the *climate change\_present* variable according to the grouping variable of target groups are presented in Table 2.

**Table 2 Frequencies of the climate change\_present variable according to the target group, N=100**

	ORG	TOW	BUY/SUP	POL/SCI	SPO/DON.REC	RES/KAS	RES/SOL	CEM/EMP	COU	TOTAL
0	4	3	0	3	0	1	11	0	1	23
1	6	7	10	7	10	14	0	10	9	73
2	0	0	0	0	0	0	4	0	0	4
total	10	10	10	10	10	15	15	10	10	100

LEGEND: 0 - no; 1 - yes; 2 - I don't know, I'm not sure

Quantitative analysis of frequency of the *climate change\_present* variable according to the sector group, are presented in Table 3. The *Public sector*, as a separate subsample, was defined by *target groups Towns, Politics and science* and *The County*. The *Civil sector* is represented by the respondents of *target groups Organizations and Sponsorship and donations recipients*, while the third cluster represents the *Economic sector* and includes entities of *Buyers and suppliers* and *Cemex employees*.

The overall *Economic sector* expressed the opinion about the existence of climate change and global warming, as well as the existence of a very relevant and generally important ecological problem, calling for urgent action and dealing with the source. Their share of frequency in the overall quantitative analysis in relation to the number of subjects is 29%, with the maximum number of YES responses. All 20 participants responded identically.

The majority of the *Public* and *Civil sector* also decided on the implementation of the Kyoto Protocol and the existence of a global ecological problem. The *Public sector* with the total of 43% share in this analysis, advocates the opinion of nonexistence of climate change at a level of 10%, and *civil sector* at a level of 6% out of the possible 29%.

**Table 3 Frequencies of the climate change\_present variable according to the sector group, N=70**

	public	civil	economic	total
0	7	4	0	11
1	23	16	20	59
2	0	0	0	0
total	30	20	20	70

LEGEND: 0 - no; 1 - yes; 2 - I don't know, I'm not sure

Quantitative analysis of the entity (respondent) matrix and the second variable was based on responses obtained by qualitatively defined second interview question which reads:

In your opinion, who is responsible for dealing with climate change in Croatia and what actions should they take?

Respondents gave their opinion about who is responsible for dealing with climate change, gave suggestions about what actions should be taken and what must be changed.

Their responses were defined at four levels:

The first group classifies those entities who responded that Croatian Government, Parliament, Ministry of environmental and nature protection or all national authorities and competent ministries were responsible, and their opinion was that this is a matter of their jurisdiction, their authority, and that the key role in dealing with climate change, ecological problems, as well as taking certain measures should be given to the Croatian governing bodies. Politicians are also responsible because this is not only an ecological problem, but also a political one.

The second group defined their answer as: Croatian national authorities, the Government, and competent Ministry, but also the local government, are responsible. Decentralization must be implemented; the structures of the County and city authorities must be involved in dealing with ecological problems which cannot be resolved by some Government regulations. All governing structures, from city authorities through county authorities up to state authorities, all should encourage, organize and participate in implementing measures of environmental protection.

The third group of respondents was classified according to the response: Croatian Government, the Ministry of environmental and nature protection, the Parliament, all political structures, but also County and local authorities, are responsible. The industrial and economic sector, which are greatly responsible for environmental pollution due to extensive CO<sub>2</sub> emissions, are also responsible. Decentralization must be implemented, governing structures of all levels, as well as consumers of natural and energy resources, particularly the industry and the economy, must assume responsibility, authority and activities of environmental protection.

The fourth group of respondents was classified according to the response: There is no collective responsibility, each individual is responsible. Imperatively, the jurisdiction must be "brought down" from national, county and local authorities, as well as the industrial sector, to each individual. Decentralization is the key here; each individual is equally responsible and authorized. This is both ecological and political problem; urgent action is needed in dealing with the sources of pollution and reduction of greenhouse gas emissions.

The results of frequency of both relative and cumulative values of all entities and the second variable *responsibility\_climate change* are shown in Table 4.

33% of respondents think that the responsibility and jurisdiction in dealing with climate change fall exclusively on Croatian Government and national structures, as well as the Ministry of environmental and nature protection.

32% of entities believe there is no collective responsibility, the individual is responsible, and they insist on decentralization of the overall governing structures and on participation of each individual in dealing with climate change and management of natural resources, as well as in CO<sub>2</sub> emission reduction.

The third group was divided in their opinion about whether the responsibility falls solely on national and local structures

or is it shared with governing bodies of industry and economy. 18% of respondents dismiss the responsibility of the industry, while 17% think that the industry is the primary accomplice and responsible party for the occurrence of climate change, and that their responsibility is equal.

**Table 4 Relative and cumulative frequencies of the responsibility\_climate change variable, N=100**

	Count	Cumulative - Count	Percent	Cumulative - Percent
1	33	33	33.00	33.00
2	18	51	18.00	51.00
3	17	68	17.00	68.00
4	32	100	32.00	100.00

Legend: 1 – Government; 2 – Local government; 3 – Economy; 4 – Individuals

If we analyze the respondents' attitudes according to the target groups, we can see that *Kaštela residents* hold the Croatian Government and competent ministries (9%) responsible, while representatives of *The County*, in addition to Croatian Government, Ministry of environmental and nature protection, the Parliament and all political structures, point out the responsibility of county and local authorities, as well as the industrial and economic sector, which are, for the major part, responsible for environmental pollution due to extensive CO<sub>2</sub> emissions (6%).

All representatives of the target group *Solin residents* share the opinion that there is no collective responsibility and that each individual is responsible, and that this jurisdiction is not shared only by the officials of national, county and local authorities, as well as the industrial sector, but it is a responsibility and obligation of each individual. They demand decentralization, pointing out that this is both ecological and political problem, and that urgent action is needed in dealing with pollution sources and reducing greenhouse gas emissions (15%).

The results are presented in Table 5.

**Table 5 Frequencies of the responsibility\_climate change variable according to the target group, N=100**

	ORG	TOW	BUY/SUP	POL/SCI	SPO/DON REC.	RES/KAS	RES/SOL	CEM/EMP	COU	Total
1	2	4	4	4	5	9	0	3	2	33
2	4	5	1	3	0	5	0	0	0	18
3	2	0	5	2	2	0	0	0	6	17
4	2	1	0	1	3	1	15	7	2	32
total	10	10	10	10	10	15	15	10	10	100

Legend: 1 – Government; 2 – Local government; 3 – Economy; 4 – Individuals

The results of the frequency analysis of the *responsibility\_climate change* variable according to the sector group indicate that the *Public sector* decided on responsibility and jurisdiction of Croatian Government and the competent Ministry with the overall incidence of 14%, 11% for local authorities, and 11% for industrial structures. The minority of them thinks that the climate change is caused by the actions of individuals, and their responsibility is of least importance. Relative value of this frequency is 6% of the overall incidence.

The *Civil sector* and the *Economic sector* share the opinion about who is responsible for climate change. Seven respondents, or 10%, also think that Croatian Government, national authorities, the Parliament and Ministry of environmental and nature protection are most responsible. However, 10% or 7 respondents who represented the *Economic sector* also think that the individual is the most important "link" in the chain of ecological problems which have occurred, they think decentralization is needed and there is no collective responsibility.

Total value of frequency of the *responsibility\_climate change*

variable for all three sectors was 34% for government structures. 19% point out the responsibility of local authorities, in addition to government, 24% expand these to the consumers and members of industrial and economic structures, and 23% of all entities think that all of the mentioned structures and each individual share the responsibility for the occurrence of climate change, and that decentralization must be implemented.

**Table 6 Frequencies of the responsibility\_climate change variable according to the sector group, N=70**

	public	civil	economic	total
1	10	7	7	24
2	8	4	1	13
3	8	4	5	17
4	4	5	7	16
total	30	20	20	70

Legend: 1 – Government; 2 – Local government; 3 – Economy; 4 – Individuals

Quantitative analysis of entity matrix and the third variable was based on responses obtained by qualitatively defined third interview question which reads:

Do you think that local government takes care of the environmental protection adequately?

Respondents expressed their view and opinion on whether local authorities pay enough attention to environmental protection. Their responses were defined at three levels:

The first group was classified according to the negative response, the second group defined their answer as positive, and the third group of respondents was classified according to the response: I don't know, I'm not sure, I don't have enough information.

The analysis of results of all respondents and the third variable named *local government\_environmental protection* indicates a relative value of 93% of entities who think that local authorities do not take enough care of the environment, i.e., their participation is only declarative, they are not adequately involved (very little in practice), they are not active at all, they give a lot of promises in public but they do not act, they do not put much effort except before the local elections, only ecological organizations are active, etc. Relative value of 4% refers to the respondents whose attitude is opposite and who think that local authorities take enough care within their jurisdiction, while 3 respondents answered with: I don't know, I don't have enough information.

The results of frequencies of all entities and the third variable *local government\_environmental protection* are shown in Table 7.

**Table 7 Relative and cumulative frequencies of the local government\_environmental protection variable, N=100**

	Count	Cumulative - Count	Percent	Cumulative - Percent
0	93	93	93.00	93.00
1	4	97	4.00	97.00
2	3	100	3.00	100.00

Legend: 0 - no; 1 - yes; 2 – I don't know, I'm partially informed

Tabular presentation (Table 8) of the *local government\_environmental protection* variable and the grouping variable *target group* indicates that the subsamples do not differ considerably according to the responses defined. Namely, only one respondent from the *TOW target group* and the *COU target group*, and two respondents from the *POL/SCI target group*, think that local government takes care of environmental protection adequately. At the same time, three representatives of *CEM/EMP* were not familiar with how much the local government cares about environmental protection.

**Table 8 Frequencies of the local government\_environmental protection variable according to the target group, N=100**

	ORG	TOW	BUY/SUP	POL/SCI	SPO/DON.REC	RES/KAS	RES/SOL	CEM/EMP	COU	TOTAL
0	10	9	10	8	10	15	15	7	9	93
1	0	1	0	2	0	0	0	0	1	4
2	0	0	0	0	0	0	0	3	0	3
total	10	10	10	10	10	15	15	10	10	100

Legend: 0 - no; 1 - yes; 2 – I don't know, I'm partially informed

The analysis of the third variable named *local government\_environmental protection* according to the *sector group* confirmed that only 6% of respondents from the public sector approved and supported the engagement of local government in environmental protection, while 4% of entities from the *economic sector* or three respondents out of *CEMEX EMPLOYEES* do not know to what extent the local government takes care of environmental protection.

All the aforementioned quantitative values are shown in Table 9.

**Table 9 Frequencies of the local government\_environmental protection variable according to the sector group, N=70**

	public	civil	economic	total
0	26	20	17	63
1	4	0	0	4
2	0	0	3	3
total	30	20	20	70

Legend: 0 - no; 1 - yes; 2 – I don't know, I'm partially informed

**CONCLUSION**

Representatives of the *economic, public* and *civil sector* are not adequately informed about the changes and consequences brought on by climate change. Representatives of the *public* and *civil sector* should be deeper involved in activities of raising public awareness about the importance of climate change, together with the *economic sector*, which is the only one with legal obligation regarding this issue. All three sectors, in order to achieve the necessary synergy, should work together in dealing with this problem and raising public awareness about the responsibility of all sectors and every individual. The *public sector* should strengthen its own capacities and increase the importance of environmental protection in city authorities because the *civil sector*, due to these shortfalls, assumes the role of the *public sector*, which disables or slows down the development of the *economic sector*. A process of decentralization of environmental protection, which has been initiated about ten years ago with the aim of redirecting some of the activities from the jurisdiction of the Ministry to the local authorities, has not been fully realized. Informed public must still have access to all information in the area of environmental protection, in order to remove the existing state of *fragmentism* in which each target group has a small and insufficient piece of information, on the basis of which they must form attitudes and offer solutions, while neither of the target groups have enough information to perceive the whole, which causes their solutions to deepen the problem instead of solving it.

## REFERENCE

1. Andriantiatsaholainaina L.A., Kouikoglou, V. S., & Phillis, Y. A. (2004). Evaluating in Strategies for Sustainable Development: Fuzzy Logic Reasoning and Sensitivity Analysis. *Ecol. Econ.* 48 :149–172. | 2. Brockington, D. (2003). Myths of Skeptical Environmentalism (a Discussion). *Environ. Sci. Policy.* 6: 543. | 3. Cifrić, I. (2002). Environment and sustainable development. HSD and Institute for sociological research. Faculty of philosophy. Zagreb. [In Croatian]. | 4. Clift R., Doig, A., & Finnveden, G. (2000). The Application of Life Cycle Assessment to Integrated Solid Waste Management. Part I. – Methodology. *Trans. Inst. Chem. Engn.* 78: 279. | 5. Constanza, R. (2000). Vision of Alternative (Unpredictable) Futures and Their Use in Policy Analysis. *Conservation Ecology* 4 (5): 18. | 6. CSR Europe and Prince of Wales International Business Leaders Forum (2002). It simply Works Better Report on European CSR Excellence 2002-2003. The Copenhagen Centre. | 7. Delort, R., & Walter, F. (2002). European environmental history. Ministry of environmental protection and spatial planning. Zagreb. [In Croatian]. | 8. Dewulf, J., & Langenhove, H. (2002). Assessment of the Sustainability of Technology by Means of a Thermodynamically Based Life Cycle Analysis. *Enviro. Sci. & Pollut. Res.* 9:267. | 9. Dyson, R.G. (2004). Strategic development and SWOT analysis at the University of Warwick. *European Journal of Operational Research.* 152. | 10. Halmi, A. (2005). Strategies of qualitative research in applied social sciences. Naklada Slap. Jastrebarsko. [In Croatian]. | 11. Lay, V., & Šimleša, D. (2011). National interests of development of Croatia through the prism of concept of sustainable development. Zagreb: Institute of social sciences Ivo Pilar.[In Croatian] | 12. Petz, B. (1997). Basics of statistical method for non-mathematicians. Naklada Slap. Jastrebarsko. [In Croatian]. | 13. Pravdić, V. (2003). Sustainable Development: its Meaning, Perception, and Implementation. The Case of Ecotourism in Croatia. *Društvena istraživanja.* Zagreb 12: 285. | 14. Tafra-Vlahović, M. (2011). Sustainable business. Zaprješić: VŠPU B.A.Krčelić. Zagreb. [In Croatian]. | 15. Tafra-Vlahović, M. (2011). Crisis management. Zaprješić: VŠPU B.A.Krčelić. Zagreb. [In Croatian]