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# CO<sub>2</sub>nnect

## CO<sub>2</sub> on the Way to School: Campaign Data Analysis

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*"in the forest of valu lui traian" by SCOALA NR.1 VALU LUI TRAIAN (Romania)*





## Executive Summary

CO<sub>2</sub> and its relation to anthropogenic emissions has been a top issue in researching and providing solutions to the current global climate change problem. The CO<sub>2</sub>nnect project tackled this issue by crafting a campaign for schools to determine their CO<sub>2</sub> emissions generated during their daily travels to school. The campaign was based on ESD-ICT premises, with an excellent campaign webpage for registration, data entry, data analysis, and questionnaires. The CO<sub>2</sub>nnect campaign is also primarily influenced and based on the 2007 Norwegian campaign which contained similar goals and methods. The main goal of the CO<sub>2</sub>nnect campaign was to engage a large number of schools to understand more about the field of climate and transport.

Overall participation in the campaign was excellent (over 30000 participants, from 44 countries), which gives strong power for analysis and comparison of the data. A compilation of the main CO<sub>2</sub> results for all students on their daily commute to school is as follows:

Summary of results	All schools
Emission intensity (g/km)	80.4
No of reporters (students and teachers)	31808
Mean school way distance (km)	5.3
CO <sub>2</sub> emitted for pooled reported distances (kg)	13513.7
CO <sub>2</sub> per reporter per school year (190 days, kg)	161

The campaign data was analyzed by focusing on the CO<sub>2</sub> emission intensities, the transportation mode results, and the questionnaire results. Comparisons were also made to the Norwegian 2007/2008 campaigns, as well as cross-analysis of CO<sub>2</sub> data and questionnaire data was performed.

Specific recommendations are given for the future which focuses on further dissemination of campaign results and usefulness of the campaign model, as well as possibly repeating the campaign in the near future.

Thanks to the Norwegian Directorate for Education and Training for funding this report and ensuring that the project and its results are analyzed for the best possible dissemination of the campaign outcomes. CO<sub>2</sub>nnect is developed by the partners in the project SUPPORT- Partnership and Participation for a Sustainable Tomorrow, financed 2007–2010 by the EU Comenius Lifelong Learning Programme. The project is supported by 45 partner and member organizations, see Appendix A.

**Support**



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NILU OR 47/2010

## List of Tables

Table 1: Distribution of transportation modes (2007 Norwegian Campaign).....	8
Table 2: Transportation distances and related CO <sub>2</sub> values (2007 Norwegian Campaign) .....	8
Table 3: Results per region (2007 Norwegian Campaign) .....	9
Table 4: CO <sub>2</sub> results summary (2007 Norwegian Campaign) .....	9
Table 5: Student recommendations summary (2007 Norwegian Campaign) .....	10
Table 6: Questionnaire results summary (2007 Norwegian Campaign) .....	11
Table 7: Campaign participation listed by different sortings – A) Alphabetically, B) By number of Schools, and C) By number of Classes. ....	14
Table 8: Overall CO <sub>2</sub> results for CO <sub>2</sub> nnect campaign .....	16
Table 9: CO <sub>2</sub> emissions results per participant country .....	17
Table 10: CO <sub>2</sub> summary results displayed for students and school staff .....	18
Table 11: Transportation mode results for all participants.....	18
Table 12: Transportation mode results for Germany, U.K., and Malaysia .....	19
Table 13: Transportation modes and total distances and CO <sub>2</sub> results .....	20
Table 14: CO <sub>2</sub> nnect Questionnaire results for all participants (Part I) .....	21
Table 15: CO <sub>2</sub> nnect Questionnaire results for all participants (Part II) .....	22
Table 16: Cross-analysis of Questionnaire Part I results and CO <sub>2</sub> results .....	23
Table 17: Cross-analysis of Questionnaire Part II results and CO <sub>2</sub> results .....	24
Table 18: Comparison of 2007 Norwegian campaign results to CO <sub>2</sub> nnect campaign Norwegian results.....	24
Table 19: Comparison of Ranking of Importance of Issues between the 2008 Norwegian Campaign and the CO <sub>2</sub> nnect Campaign .....	25

## List of Figures

Figure 1: Map of the Participating 636 Schools .....	15
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## Contents

<b>Executive Summary .....</b>	<b>1</b>
<b>List of Tables .....</b>	<b>2</b>
<b>List of Figures .....</b>	<b>2</b>
<b>1 Introduction .....</b>	<b>5</b>
1.1 Learning Outcomes .....	5
1.2 Goals/Objectives .....	6
1.3 Background – 2007 Norwegian Campaign Results .....	7
<b>2 Methods.....</b>	<b>12</b>
<b>3 Results.....</b>	<b>14</b>
3.1 Participants.....	14
3.2 CO <sub>2</sub> Emissions .....	15
3.3 Transport Modes and CO <sub>2</sub> emissions .....	18
3.4 Questionnaire.....	20
3.5 Cross-analysis .....	22
3.6 Comparison to 2007 and 2008 Norwegian campaigns .....	24
<b>4 Project Reports, Awards, and Ideas .....</b>	<b>26</b>
4.1 Participant Project Reports .....	26
4.2 Project Report Awards .....	26
4.3 Participant Climate Ideas .....	27
<b>5 Discussion and Conclusion .....</b>	<b>30</b>
<b>6 Recommendations.....</b>	<b>32</b>
<b>7 Bibliography .....</b>	<b>33</b>
<b>Appendix A Campaign Data Sheet.....</b>	<b>35</b>
<b>Appendix B Emissions Calculations .....</b>	<b>39</b>
<b>Appendix C Partner and Member Organizations .....</b>	<b>45</b>



# CO<sub>2</sub>nnect

## CO<sub>2</sub> on the Way to School: Campaign Data Analysis

### 1 Introduction

As CO<sub>2</sub> emissions are being recognized as the pivotal contributor to global climate change, it is becoming important for students to learn about how these emissions are generated and solutions for emissions reduction in which students can relate to. The adaptive learning concept of Education for Sustainable Development (ESD) is an appropriate model to follow when developing tools to educate students in this issue. In addition, using Information and Communication Technologies (ICT) within the ESD platform yields a powerful learning tool that students can feel comfortable utilizing.

An ESD campaign with an ICT web-based platform was developed to increase awareness and understanding of the issue, and to affect attitudes and values towards the issue, at the global scale. To meet this goal the specific campaign exercise was developed in which student's measure their own individual CO<sub>2</sub> contribution during their daily travel to school, where the methods of this calculation were kept simple for greatest possible inclusion of students. The campaign (methods and platform) was inspired through a similar campaign performed in Norway in 2007 (Hansen & Randall, 2008).

The immense participation recorded by the campaign (over 30,000 participants) gives solid results for analysis for the entire campaign, as well as some analysis between and within certain countries. This analysis will be performed for the CO<sub>2</sub> emissions data, as well as for the related questionnaire. In addition, participants submitted reports based on a reflection of the campaign experience, and also uploaded "climate ideas" regarding how their local community can improve transport related CO<sub>2</sub> emissions; both of these activities are presented in this report.

Data from the campaign will be presented, compared, and summarized; results from the 2007 and 2008 Norwegian campaign will also be presented and compared as well. The campaign data analysis will be discussed in relation to the importance and impact of the results, and recommendations for the future will be given based on this concluding discussion.

#### 1.1 Learning Outcomes

The campaign was developed according to specific learning outcomes associated with the principles of ESD. ESD attempts to improve and develop understanding, skills/abilities, awareness, and attitudes/values – and these outcomes were incorporated into the campaign through the theme of sustainability, climate change, and mobility. The specific learning outcomes are shown below, with

additional background information available on the campaign website at: [http://www.co2nnect.org/help\\_sheets/?op\\_id=598&opt\\_id=98](http://www.co2nnect.org/help_sheets/?op_id=598&opt_id=98).

#### **SPECIFIC LEARNING OUTCOMES FOR THE CAMPAIGN:**

##### **Understanding** of the interconnected mobility- and climate change issue

- *Climate change, its causes and consequences.*
- *Greenhouse-gas emissions from transport and mobility.*
- *The interlinking of social, environmental, cultural and economic aspects of the local transport system.*
- *How individual choices and participation can contribute to creating a more sustainable development.*

##### **Skills and abilities**

- *Actively participate in local democratic processes.*
- *Interact with local decision-makers.*
- *Collaborate with researchers and generate reliable information.*
- *Create innovative proposals and suggest alternatives for a more sustainable society.*
- *Use ICT and the internet interactively for partnership and data analysis.*
- *Act and think autonomously.*

##### **Awareness**

- *Sensitivity to and awareness of the effect of transport on climate change and the sustainability issues raised by climate change.*
- *Awareness that each person has a role in climate change, including CO<sub>2</sub> emissions from transport.*

##### **Attitudes and values**

- *Develop concern about the climate change issue, its causes and impacts.*
- *Develop motivation to participate in decision-making for a more sustainable society.*
- *Realize that they have opportunities to help create a more sustainable society, both as individuals and through common actions.*

Source: Campaign website ([http://www.co2nnect.org/?op\\_id=595&opt\\_id=100](http://www.co2nnect.org/?op_id=595&opt_id=100))

## **1.2 Goals/Objectives**

The purpose of the campaign is to improve the understanding and practice of ESD in the context of a topic of global interest. The campaign meets this greater purpose through providing a web-based activity in which students from any nation can participate and engage with other students, researchers, and policy-maker within the topic of CO<sub>2</sub> emissions.

#### **SPECIFIC OBJECTIVES FOR THE CAMPAIGN:**

- *Engage a large number of schools, pupils, parents and communities to work with sustainable development in the field of climate and transport.*
- *Increase pupils' competencies in ways described in the learning goals.*
- *Increase schools' competency to deliver high quality ESD.*
- *Provide ICT based tools including guidelines, links, a CO<sub>2</sub> transport emissions calculator and opportunities for partnership.*
- *Generate information useful to research and management about transport- and climate issues (including an international database on CO<sub>2</sub> emissions from school transport).*
- *Generate innovative ideas for sustainable transport.*

Source: Campaign website ([http://www.co2nnect.org/?op\\_id=601&opt\\_id=100](http://www.co2nnect.org/?op_id=601&opt_id=100))

### 1.3 Background – 2007 Norwegian Campaign Results

The CO<sub>2</sub>nnect campaign was based upon the 2007 Norwegian Research Campaign “CO<sub>2</sub> on the way to School”. This campaign ran Fall of 2007 in Norway, and was carried out in cooperation between the Norwegian Directorate for Education and Training (*Utdanningsdirektoratet*), Science Days (*Forskningsdagene*), the School Laboratory at the University of Bergen (*Skolelaboratoriet*), and the Norwegian Institute for Air Research (*NILU*). The campaign is a part of annual environmental research campaigns which have occurred every autumn in Norway since 2003. The data analysis from the 2007 campaign presented below is compiled from the report “CO<sub>2</sub> on the way to school: English summary of final report assessing the 2007 Norwegian student-based web campaign” (Hansen & Randall, 2008).

The goals for the 2007 campaign were as follows:

- Become aware that emissions of the climate gas CO<sub>2</sub> leads to climate changes.
- Teach how one can measure CO<sub>2</sub> and calculate emissions rates.
- Gain insight into how CO<sub>2</sub> emissions can be reduced.
- Become known with local authorities and which climate initiatives the municipalities have set as priorities.
- Gain insight into the democratic process by recommending solutions within one’s municipality to reduce emissions of climate gasses.
- Develop and understanding of the connections between human activities, climate change, and sustainable development.

The 2007 campaign activity involved three primary elements:

1. Through web-based tools, the students **measured** the length of one’s own school route, and then through the miljolare.no webpage each student calculated the CO<sub>2</sub> emissions based upon the transportation method used.
2. The students answered a **web questionnaire** on miljolare.no in relation to their reflection concerning school route safety, climate consciousness, and assessment of Norwegian climate policy.
3. The students then made **recommendations** on miljolare.no for climate policy solutions for their own community, and what an individual can also do on their own.

The results from the 2007 campaign recorded that 2575 students from 86 different schools participated in the activity, all from varying regions of Norway. The data results show that more than 42% of the participating students walk to school, while 26% bike to school (see Table 1) indicating that more than 2/3 of the students do not emit CO<sub>2</sub> on their way to school. In addition, approximately 30% use public transportation, especially the bus, while the portion of CO<sub>2</sub> intensive modes such as taxis and cars made up approximately 15%.

Table 1: Distribution of transportation modes (2007 Norwegian Campaign)

Transportation means	%	#
By foot	42.2%	(1003)
Bicycle	26.3%	(624)
Moped	0.8%	(18)
Motorcycle/snow scooter	0.2%	(5)
Personal car	12.3%	(292)
Taxi	2.2%	(53)
Bus	27.9%	(662)
Diesel train	0.1%	(3)
Car ferry	0.1%	(3)
Local commuter boat	0.1%	(2)
Electric car	0.2%	(4)
Electric train	2.4%	(57)
Other	0.8%	(19)

Source: Miljolare.no, from (Hansen & Randall, 2008)

Busses made up more than 50% (365 kg) of the overall emitted CO<sub>2</sub>, but taxi's and boats are the most CO<sub>2</sub> intense transportation modes with rates of .21-.53 kg CO<sub>2</sub> per person kilometer (see Table 2).

Table 2: Transportation distances and related CO<sub>2</sub> values (2007 Norwegian Campaign)

Transportation Means	Length (km)	CO <sub>2</sub> (kg)	Calculation (kg/pkm)*
By foot	1058.7	0	0
Bicycle	1031.9	0	0
Moped	38.5	2.3	.06
Motorcycle/snow scooter	9	0.9	.10
Personal car	1184.9	130.3	.11
Taxi	406.5	85.4	.21
Bus	6082	364.9	.06
Diesel train	58.4	4.1	.07
Car ferry	11.2	1.3	.12
Local commuter boat	5.9	3.1	.53
Electric car	25.5	0.1	.0004
Electric train	750.3	1.8	.002
Other	28.1	0	0
<b>Total</b>	<b>10690.8</b>	<b>594.2</b>	

Source: Miljolare.no, from (Hansen & Randall, 2008)

The student CO<sub>2</sub> emission intensities ranged from 80 g/km in Finnmark to 30g/km in Hordaland, while the average CO<sub>2</sub> emission per student per year on their way to school is approximately 95kg (see Table 3), a value that is less than 1% of the yearly emission rate per inhabitant in Norway.

Table 3: Results per region (2007 Norwegian Campaign)

Region	# of Schools	# of Students	School route avg. length (km)	CO <sub>2</sub> kg/year/student	CO <sub>2</sub> g/km
Finnmark	4	61	4.4	134.4	<b>80</b>
Møre og Romsdal	3	55	4.6	135.4	<b>77</b>
Troms	7	131	10.3	282.3	<b>72</b>
Sør-Trøndelag	4	92	2.9	79.5	<b>72</b>
Hedmark	6	196	4.4	114.3	<b>68</b>
Sogn og Fjordane	4	92	7.4	184.6	<b>66</b>
Nordland	5	103	4.3	101.1	<b>63</b>
Telemark	5	148	7.3	166	<b>60</b>
Nord-Trøndelag	2	42	7	151	<b>57</b>
Vest-Agder	2	63	5.3	115	<b>57</b>
Østfold	1	24	0.9	18.5	<b>55</b>
Buskerud	4	225	3.3	67.8	<b>55</b>
Aust-Agder	3	86	4.1	82	<b>53</b>
Oppland	6	140	2.9	52.7	<b>47</b>
Oslo	6	302	6.2	93.9	<b>40</b>
Akershus	9	177	2.1	31.8	<b>40</b>
Vestfold	3	93	3.4	51.5	<b>39</b>
Rogaland	3	45	1.8	25.1	<b>36</b>
Hordaland	9	300	2.3	26.3	<b>30</b>

Avg = 95

Source: miljolare.no, from (Hansen & Randall, 2008)

The 2007 campaign CO<sub>2</sub> results are summarized in Table 4.

Table 4: CO<sub>2</sub> results summary (2007 Norwegian Campaign)

Summary of results	All schools
Average Emission intensity (g/km) <sup>1</sup>	56
# of reporters (students and teachers)	2575
Mean school way distance (km)	4.5
Total CO <sub>2</sub> emitted for all pooled reported distances (kg)	594.2
Average CO <sub>2</sub> per reporter per school year (190 days, kg)	95

The campaign also gave students the opportunity to suggest recommendations for ways to reduce CO<sub>2</sub> emissions in their community. These recommendations were categorized and tallied (see Table 5), showing that most students recommended that students and adults should try and bike and walk more, with less reliance on personal transport.

<sup>1</sup> Calculated with the following formula:  $95000\text{g}/190/4.5/2 = 56 \text{ CO}_2\text{g}/\text{km}$ .

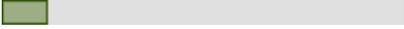
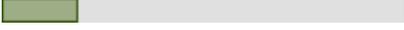
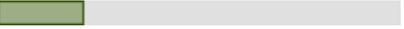
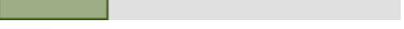
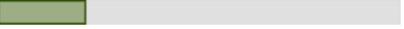
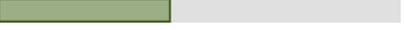
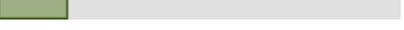
*Table 5: Student recommendations summary (2007 Norwegian Campaign)*

<b>Student recommendations (compiled into the following categories)</b>	<b>Number of occurrences</b>
Bike more (students, workers)	563
Walk more (students, workers)	559
Use more bus, train, trolley	383
Buy/use more environmental friendly cars (especially electric cars)	373
Drive cars less	327
Better public transportation (new routes, more stops, more departures)	234
Cheaper or free public transportation (especially bus)	221
More/better bike paths and walkways	154
Collective driving (to work, training, school)	119
Less trash, better sorting and recycling	75
More environmentally friendly public transportation (electric and natural-gas driven buses)	73
Raised gas prices	64
Save electricity (especially shower less, and turn off lights)	63
Use environmentally friendly fuels (especially biodiesel)	45

*Source: Hansen & Randall, 2008*

The students also completed a questionnaire based on the campaign to gauge how the students related to issues effecting CO<sub>2</sub> emissions (see Table 6). The results from these questions show that a majority of students think their school route is safe, but a surprising amount (59%) do not realize the pollution potential of automobiles, and many students (43%) are unaware of Norway's climate policy.

Table 6: Questionnaire results summary (2007 Norwegian Campaign)

<b>My school route is safe</b>		
Completely agree		33% (759)
Somewhat agree		26% (598)
Don't know		11% (258)
Somewhat disagree		19% (439)
Completely disagree		12% (276)
<b>I seldom think that car emissions can pollute the environment</b>		
Completely agree		21% (495)
Somewhat agree		38% (878)
Somewhat disagree		28% (640)
Completely disagree		13% (312)
<b>Norway follows a good and sustainable climate policy</b>		
Completely agree		8% (182)
Somewhat agree		22% (511)
Don't know		43% (997)
Somewhat disagree		18% (407)
Completely disagree		10% (225)

Source: Miljolare.no, from (Hansen & Randall, 2008)

Conclusions from the 2007 campaign can be summarized as the following:

- A majority of the students can be labeled as “environmentally friendly” concerning their carbon footprint of their transport to and from school - because they walk, bike, or take public transportation – so the CO<sub>2</sub> emissions in this regard produces less than 1% of the average CO<sub>2</sub> emission per inhabitant in Norway.
- However, a large majority of students do not understand, or periodically relate to the fact that vehicle emissions pollute the environment. So, the students on average have a small CO<sub>2</sub> footprint during their travels to school, but they do not regularly think of the fact whether they are polluting the environment or not.
- Almost one half of the students don't understand Norwegian national climate policy, which should be taken as a sign for future teaching plans in the classroom.
- Based on the students own personal recommendations, they are generally open for suitable changes to reduce emissions, and they expect the same conditions to apply to adults.
- The recommendations also show that students are well informed on possible (conventional) climate solutions, and many wish to be active on this front. This demonstrates a large potential in the student population which could be mobilized and utilized for future climate policy initiatives.

## 2 Methods

The methods for the CO<sub>2</sub>nnect campaign participation were based upon the 2007 Norwegian Campaign, and were specifically designed to be simple and straightforward in order to encourage the greatest amount of involvement from all age classes. The campaign was also open to all schools throughout the world (the campaign website was available in 18 different languages), for students and teachers to participate. The campaign composed of the following main parts:

1. Registration of user and school information
2. Enter transportation information and answer questionnaire
3. Analyze individual/school results and compare to other's
4. Additional activities (working with local authorities, uploading climate ideas, projects, pictures, etc.).

### 10 Specific steps for carrying out the campaign:

1. *Plan and prepare for the campaign (teachers, preferably together with pupils). Get familiar with the website, approach and activities. Make a school/class plan for your work with the campaign (see also [Help sheets](#) for hints about methods). Find local partners or school partners and plan how you will cooperate.*
2. *[Sign up](#) to participate.*
3. *Introduce topics of climate change, CO<sub>2</sub>, and school transport.*
4. *Collect data on distance to school and means of transportation and enter it into the international database.*
5. *Complete a short online questionnaire on climate- and transport issues.*
6. *Analyse and discuss your [results](#); compare your CO<sub>2</sub> emissions from transport with that of other schools and countries (see also suggested [Questions for discussion](#)).*
7. *We encourage you to work closely with local authorities, parents, businesses, organisations or other stakeholders during the project. You could present and discuss your findings. Then explore together how the local transportation systems could be made more sustainable. What policies or programmes does your school or community already have for transport and climate gas emissions?*
8. *Develop ideas for reducing climate emissions from transport. Upload your climate idea and photos from your work.*
9. *Submit your project work to an international school competition (optional).*
10. *Evaluate the campaign and become a SUPPORT school (teachers, optional).*

Source: Campaign website (<http://co2nnect.org/what/>)

A copy of the data sheet used to record results can be seen in Appendix A. It was suggested that one can estimate the distance to school with the following tools:

- Internet tools, such as [Google Maps](#)
- Trace the school way on a paper map and scale it appropriately
- A car or bike odometer, or pedometer
- A GPS system

It should be noted that the school way distance was recorded for one direction for the nearest kilometer used for the appropriate transportation mode. If more than one mode of transportation was used, the participant listed the number of

kilometers for each transport category used. For the precise calculation of emissions for each transportation category, see Appendix B. Help sheets for the campaign were available on the campaign website at: [http://www.co2nnect.org/help\\_sheets/](http://www.co2nnect.org/help_sheets/). The campaign also stressed development of the school, and how the campaign could be incorporated into the school learning curriculum, where information on this was available on the campaign website at: [http://co2nnect.org/help\\_sheets/?op\\_id=597&opt\\_id=98](http://co2nnect.org/help_sheets/?op_id=597&opt_id=98). Links to others valuable information sources were available on the campaign website at: <http://www.co2nnect.org/links/>. The campaign website also contained a valuable glossary of terms which is available at: [http://co2nnect.org/help\\_sheets/?op\\_id=639&opt\\_id=98](http://co2nnect.org/help_sheets/?op_id=639&opt_id=98).

### 3 Results

Results for the CO<sub>2</sub>nect campaign will be presented in the following sub-sections: participation, overall CO<sub>2</sub> emissions, CO<sub>2</sub> by transport mode, questionnaire, cross-analysis of CO<sub>2</sub> data and questionnaire, and comparison to the 2007/2008 Norwegian campaign. The dataset used for this results analysis is from the time period February 15, 2009 to May 15, 2010. Note that the project is continually open for registration and participation, so the results are continually changing as well. Also note that all of the graphs and figures presented in Sections 3.1-3.4 were generated directly from the campaign website and its sub-pages.

#### 3.1 Participants

636 schools with 2252 classes from 44 different countries registered data for the project during the stated period, see Table 7 for the full list of registrants, which shows how Malaysia and Romania alone made up for almost 50% of the total number of schools and classes which registered for the campaign, followed by Jordan, Greece and Finland. 31808 individuals from 401 schools from 30 different countries actually participated in the campaign.

Table 7: Campaign participation listed by different sortings – A) Alphabetically, B) By number of Schools, and C) By number of Classes.

A) Participation listed Alphabetically			B) Participation listed by # Schools			C) Participation listed by # Classes		
Country	# Schools	# Classes	Country	# Schools	# Classes	Country	# Schools	# Classes
Australia	1	2	Malaysia	158	472	Romania	114	536
Austria	7	18	Romania	114	536	Malaysia	158	472
Bahrain	2	5	Jordan	67	219	Jordan	67	219
Belgium	9	24	Greece	46	120	Finland	36	170
Bulgaria	2	2	Finland	36	170	Greece	46	120
Cyprus	4	8	Denmark	28	77	Germany	17	102
Denmark	28	77	Norway	25	45	Hungary	12	96
Estonia	5	16	Italy	19	45	Denmark	28	77
Finland	36	170	UK	18	61	UK	18	61
France	5	10	Germany	17	102	Spain	9	60
Germany	17	102	Hungary	12	96	Italy	19	45
Greece	46	120	Spain	9	60	Norway	25	45
Hungary	12	96	Belgium	9	24	Turkey	4	26
India	1	7	Slovenia	7	19	Belgium	9	24
Iraq	1	3	Austria	7	18	Slovenia	7	19
Ireland	2	10	Korea	5	15	Austria	7	18
Italy	19	45	Estonia	5	16	Estonia	5	16
Jordan	67	219	France	5	10	Korea	5	15
Korea	5	15	Russia	5	11	Russia	5	11
Malaysia	158	472	Cyprus	4	8	France	5	10
Moldova	1	1	Sweden	4	7	Thailand	2	10
Nepal	3	3	Turkey	4	26	Ireland	2	10
Netherlands	3	8	Nepal	3	3	Netherlands	3	8
Nigeria	1	1	Netherlands	3	8	Zambia	1	8
Norway	25	45	Thailand	2	10	Cyprus	4	8
Pakistan	1	6	Bulgaria	2	2	Sweden	4	7

Poland	1	4	Portugal	2	5	India	1	7
Portugal	2	5	Bahrain	2	5	Slovakia	2	7
Romania	114	536	Slovakia	2	7	Pakistan	1	6
Russia	5	11	Ireland	2	10	Portugal	2	5
Saudi	1	5	Ukraine	1	1	Bahrain	2	5
Slovakia	2	7	Uganda	1	3	Saudi	1	5
Slovenia	7	19	Nigeria	1	1	Poland	1	4
Spain	9	60	UAE	1	1	Nepal	3	3
Sweden	4	7	Zambia	1	8	Iraq	1	3
Switzerland	1	1	Moldova	1	1	Uganda	1	3
Taiwan	1	2	Pakistan	1	6	Taiwan	1	2
Thailand	2	10	Taiwan	1	2	Bulgaria	2	2
Turkey	4	26	India	1	7	Australia	1	2
Uganda	1	3	Iraq	1	3	UAE	1	1
Ukraine	1	1	Poland	1	4	Switzerland	1	1
UAE	1	1	Saudi	1	5	Ukraine	1	1
UK	18	61	Switzerland	1	1	Moldova	1	1
Zambia	1	8	Australia	1	2	Nigeria	1	1

A map of the participating schools can be seen in Figure 1.



Figure 1: Map of the Participating 636 Schools

### 3.2 CO<sub>2</sub> Emissions

A summary of the overall CO<sub>2</sub> results can be seen in Table 8. The emission intensity for all participants is 80.4 g/km, where this value is dependent upon the school way distance and mode of transportation. The total CO<sub>2</sub> emitted during all 31808 participants travel to school (one-way) is 13513.7 kg (2.4 kg/participant average), where each participant averages 161 kg of CO<sub>2</sub> per year during their travels to school. To put these numbers into perspective, a one-way flight from London to Kuala Lumpur averages about 1231 kg of CO<sub>2</sub> per passenger (source:

chooseclimate.org), where 10 passengers on one of these flights would almost equal all of the 31808 campaign participants CO<sub>2</sub> emitted during their one-way trip to school. It should also be noted that humans naturally respire approximately 1kg of CO<sub>2</sub> per day (depending on one's activity level)<sup>2</sup>.

*Table 8: Overall CO<sub>2</sub> results for CO<sub>2</sub>nnect campaign*

Summary of results	All schools
Emission intensity (g/km)	80.4
No of reporters (students and teachers)	31808
Mean school way distance (km)	5.3
CO <sub>2</sub> emitted for pooled reported distances (kg)	13513.7
CO <sub>2</sub> per reporter per school year (190 days, kg)	161

CO<sub>2</sub> emissions varied greatly between participant countries, where countries such as the UK, Bahrain, Spain, and Malaysia reported high CO<sub>2</sub> emission intensities over 100g/km; while countries such as Belgium, Finland, Romania, and Norway reported lower CO<sub>2</sub> emission intensities which were under 70 g/km (see Table 9). It is also interesting to note that while some countries had high emission intensities, that their overall CO<sub>2</sub> kg/year/reporter was low due to the shorter average school-way distances for these countries. An example of this is the U.K. results which show a high emission intensity of 112 g/km CO<sub>2</sub> and low yearly rate of 112 kg/year/reporter, in comparison to Germany results which show a low 75 g/km CO<sub>2</sub> intensity and a higher yearly rate of 304 kg/year/reporter – this difference can be due to that the average mean school distance for the U.K. results is 2.6 km, while for the German results it is 10.6 km, and that the U.K. results show a heavier reliance on more CO<sub>2</sub> intense transport in comparison to German results (see next section)<sup>3</sup>.

<sup>2</sup> Human respiration values were not taken into consideration when calculating CO<sub>2</sub> emissions for the campaign.

<sup>3</sup> Note with this comparison that U.K. participation was only 5 schools, which is most likely not representative for the whole country.

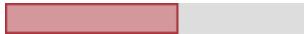
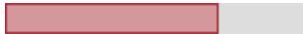
Table 9: CO<sub>2</sub> emissions results per participant country<sup>4</sup>

<u>Country</u>	<u>No. of schools</u>	<u>No. of reporters</u>	<u>School-way distance km (mean)</u>	<u>CO<sub>2</sub> (kg)</u>	<u>CO<sub>2</sub> kg/year/reporter</u>	<u>CO<sub>2</sub> g/km</u>	
<a href="#">Bulgaria</a>	1	21	5.3	13.9	250.6	<b>124</b>	
<a href="#">United Kingdom</a>	5	508	2.6	149.8	112	<b>112</b>	
<a href="#">Bahrain</a>	2	136	7.5	105	293.4	<b>103</b>	
<a href="#">Spain</a>	6	690	2.5	174.9	96.3	<b>102</b>	
<a href="#">Malaysia</a>	138	13619	4.4	5658.6	157.9	<b>94</b>	
<a href="#">Greece</a>	12	486	5.5	245.5	192	<b>93</b>	
<a href="#">Italy</a>	8	203	6.6	115.7	216.6	<b>86</b>	
<a href="#">Jordan</a>	51	2588	5.6	1236.4	181.5	<b>86</b>	
<a href="#">Slovenia</a>	3	209	2.5	44.4	80.8	<b>86</b>	
<a href="#">Estonia</a>	2	64	6.9	35.6	211.5	<b>80</b>	
<a href="#">Austria</a>	3	102	19.7	155	577.4	<b>77</b>	
<a href="#">Thailand</a>	2	177	12.1	162.8	349.6	<b>76</b>	
<a href="#">Korea (Republic of)</a>	3	110	5.6	46.5	160.5	<b>76</b>	
<a href="#">Germany</a>	12	1376	10.6	1100.6	304	<b>75</b>	
<a href="#">India</a>	1	193	8.3	116.1	228.6	<b>73</b>	
<a href="#">Denmark</a>	9	179	8.9	114.5	243	<b>72</b>	
<a href="#">Portugal</a>	1	16	6	6.8	161.7	<b>71</b>	
<a href="#">Norway</a>	17	452	5.1	160.5	135	<b>69</b>	
<a href="#">Hungary</a>	8	1570	5.8	610.1	147.7	<b>67</b>	
<a href="#">Romania</a>	77	7110	5.5	2581.5	138	<b>66</b>	
<a href="#">Turkey</a>	2	42	12.8	35.1	318	<b>66</b>	
<a href="#">Slovakia</a>	1	29	3.2	6	78.9	<b>65</b>	
<a href="#">Finland</a>	25	1763	5.3	593.4	127.9	<b>64</b>	
<a href="#">Sweden</a>	2	15	10.3	9.4	237.2	<b>61</b>	
<a href="#">Belgium</a>	4	98	6.3	32.4	125.4	<b>52</b>	
<a href="#">Cyprus</a>	1	13	0.8	0.5	15.8	<b>52</b>	
<a href="#">Poland</a>	1	22	1.1	0.8	14.1	<b>34</b>	
<a href="#">Netherlands</a>	2	17	3.9	1.9	42.6	<b>29</b>	
<a href="#">Russia</a>	1	1	0.1	0	0	<b>0</b>	
<a href="#">Iraq</a>	1	1	1	0	0	<b>0</b>	

The campaign participants were not only students – schools staff members participated as well. CO<sub>2</sub> results can be compared for these two groups (see Table 10), where school staff actually made up 4% of the total participants. School staff for the entire campaign (all countries) are emitting more than twice as much CO<sub>2</sub> per year in comparison to students, and have a higher CO<sub>2</sub> emission intensity – this result is most likely due to that staff are living farther from the school premises, and are more heavily reliant upon personal transport options.

<sup>4</sup> Countries which had less than 25 reporters, or only 1 school should be treated with caution as representing the whole country as this holds very low statistical power. Countries which fall into this category were not removed from the dataset, but were also not used in comparisons either.

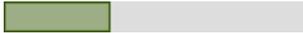
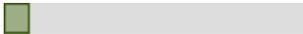
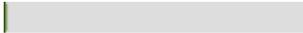
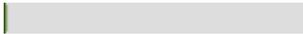
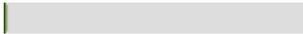
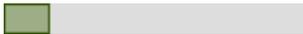
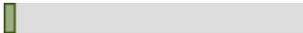
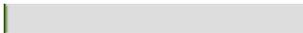
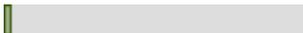
Table 10: CO<sub>2</sub> summary results displayed for students and school staff

		CO <sub>2</sub> -emission intensity	g/km	CO <sub>2</sub> per reporter (190 days, kg)	kg
Pupils	(30683)		79		154
School staff	(1125)		105		368

### 3.3 Transport Modes and CO<sub>2</sub> emissions

In order to calculate the CO<sub>2</sub> emissions for each participant, the participants needed to record the length of their travel to school, and the transportation method(s) used. Table 11 displays the 22 transportation methods recorded during the campaign, and the percent frequency of each mode (participants could choose more than one mode). 45% of participants use transportation modes which do not emit CO<sub>2</sub> (walking, biking, etc.), where 30% use mass transportation modes (busses, trains, etc.), and 36% use personal transportation modes (cars, motorcycles, etc.)<sup>5</sup>.

Table 11: Transportation mode results for all participants

Transport mode		
foot		35.4% (11262)
bicycle		9.2% (2918)
by animal transport		0.1% (39)
rickshaw/trishaw		0.1% (17)
moped		0.7% (220)
motorcycle		8.6% (2723)
auto rickshaw		0.2% (52)
snowmobile		0.0% (12)
car electric		0.1% (34)
car small		7.4% (2358)
car medium		14.9% (4727)
car large		3.4% (1078)
car hybrid		0.2% (55)
taxi		1.4% (460)
bus		22.6% (7193)
minibus		3.5% (1125)
diesel train		0.4% (136)
electric train		0.9% (297)
subway/metro		0.4% (137)
electric tram/trolley bus		2.1% (660)
ferry		0.1% (18)
express boat		0.0% (13)
other mode(s) (please specify)		1.1% (359)

<sup>5</sup> These values are greater than 100% due to the fact that some participants use more than one mode of transport during their daily travel to school.

As mentioned in the previous section, these modes vary widely between countries, where a good example can be seen between the results for UK, Germany, and Malaysia (Table 12). This comparison shows that the German results have a high reliance upon busses, and the U.K. participants rely heavily on car transport, where Malaysian participants use a lot of motorcycle transport.<sup>6</sup> These results are most likely due to cultural differences, as well as differences in city planning and school system planning.

*Table 12: Transportation mode results for Germany, U.K., and Malaysia*

Trans. mode	Germany	UK	Malaysia
foot	15%	25%	10%
bicycle	5%	1%	5%
by animal transport	0%	0%	0%
rickshaw/trishaw	0%	0%	0%
moped	1%	0%	0%
motorcycle	0%	0%	15%
auto rickshaw	0%	0%	0%
snowmobile	0%	0%	0%
car electric	0%	0%	0%
car small	5%	5%	5%
car medium	5%	25%	15%
car large	2%	10%	2%
car hybrid	0%	0%	0%
taxi	0%	0%	0%
bus	25%	2%	10%
minibus	0%	0%	2%
diesel train	1%	0%	0%
electric train	2%	0%	0%
subway/metro	1%	0%	0%
electric tram/trolley bus	3%	0%	0%
ferry	0%	0%	0%
express boat	0%	0%	0%
other mode(s) (please specify)	0%	0%	2%

For each transportation mode, CO<sub>2</sub> totals were calculated for all participants (Table 13). Each of the transportation modes has different emission factors/multipliers which were used during the CO<sub>2</sub> calculation (see Appendix B). These results show that busses contribute the greatest total CO<sub>2</sub> at nearly

<sup>6</sup> Note again that the U.K. results were only for 5 schools, which may not be representative for the whole country.

4000kg for all participants (one-way to school), and make up the greatest distance at more than 57000km. But if you look at medium sized cars, this contribution is also almost 4000kg, but the distance is approximately 29000km – nearly half the bus distance. This result is due to the fact that the bus emission factor is exactly half that of medium-sized cars.

*Table 13: Transportation modes and total distances and CO<sub>2</sub> results*

Modes of transport	Distance (km)	CO <sub>2</sub> (kg)
foot	15638.3	0
bicycle	6729.2	0
by animal transport	184.1	0
rickshaw/trishaw	113.2	0
moped	1135.4	82.9
motorcycle	11204.4	1053.2
auto rickshaw	223.7	13.7
snowmobile	88.6	8.3
car electric	274.3	11.8
car small	14089.4	1549.8
car medium	28458.8	3785
car large	6711.2	1228.1
car hybrid	419.8	35.3
taxi	3576.3	608
bus	57012.5	3933.9
minibus	8081.8	444.5
diesel train	2507.6	150.5
electric train	5251.2	341.3
subway/metro	1150.4	74.8
electric tram/trolley bus	3127.4	131.4
ferry	131.7	15.1
express boat	87	46.1
other mode(s) (please specify)	1988.5	0
<b>Total</b>	<b>168185</b>	<b>13513</b>

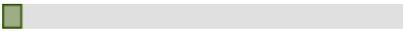
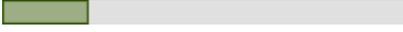
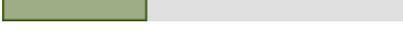
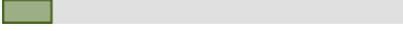
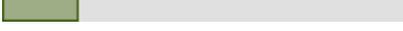
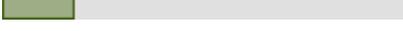
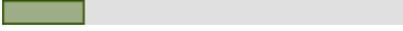
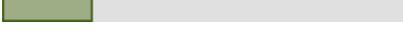
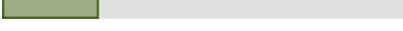
Through understanding the different emission factors which are assigned to each transportation mode, and identifying each country's differing transportation mode preferences, one can begin to understand how the CO<sub>2</sub> intensity and total CO<sub>2</sub> emissions values are assigned for each country, and how these calculations can greatly vary from one location to the next.

### 3.4 Questionnaire

The first part of the questionnaire presented four questions regarding campaign outcomes, in which participants would rank their agreement or disagreement with the statements (Table 14). All four of the statements were fairly equally agreed upon, showing that the participants are generally concerned with the greater campaign issue, feel they have transportation choices, feel safe on their

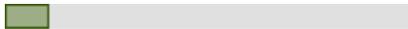
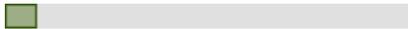
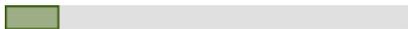
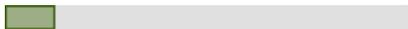
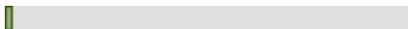
way to school, and believe that their school can do more to offer “climate-friendly” transport.

*Table 14: CO<sub>2</sub>nnect Questionnaire results for all participants (Part I)*

<b>I am concerned about how transport contributes to climate change.</b>			
1 (strongly disagree)		5%	(1583)
2		6%	(2068)
3		21%	(6757)
4		25%	(8097)
5 (strongly agree)		36%	(11399)
N/A		6%	(1993)
<b>I have a choice about how I travel to school.</b>			
1 (strongly disagree)		13%	(4106)
2		12%	(3921)
3		19%	(6088)
4		18%	(5764)
5 (strongly agree)		33%	(10400)
N/A		5%	(1618)
<b>My school and local administration should do more to provide me with a more climate-friendly way to get to school.</b>			
1 (strongly disagree)		9%	(2941)
2		9%	(2906)
3		20%	(6497)
4		20%	(6248)
5 (strongly agree)		32%	(10278)
N/A		9%	(3027)
<b>I feel safe on the way to school.</b>			
1 (strongly disagree)		8%	(2571)
2		10%	(3251)
3		22%	(7137)
4		24%	(7638)
5 (strongly agree)		31%	(9882)
N/A		4%	(1418)

The second part of the questionnaire challenged the participants to think where they believe solutions to CO<sub>2</sub> emission problems should come from (Table 15), each participant chose three topics from the available list. Results from this questionnaire are not dramatic, but it is interesting that the topics of “democratic processes”, “public awareness”, “economic regulations”, “local community structure”, and “living conditions” received very little consideration as valuable solutions, while “research”, “technology”, and “transportation plans/habits” were popular choices on average for all participants.

Table 15: CO<sub>2</sub>nnect Questionnaire results for all participants (Part II)

What kinds of changes are needed to reduce CO <sub>2</sub> emission from transport?		
Laws and regulations		7% (75)
National transportation plans		10% (110)
Education		8% (81)
Transport habits		11% (116)
Transportation of goods		8% (90)
Engagement by groups in society		8% (82)
Democratic processes		2% (18)
Information/public awareness		4% (43)
Economic support/regulations		3% (37)
Transport technology		13% (142)
Research		12% (131)
Local community structure		3% (35)
People`s priorities		9% (100)
Living conditions/income		2% (20)

### 3.5 Cross-analysis

Cross-analysis has been performed between the questionnaire results and the CO<sub>2</sub>/transport related results for the entire campaign. This analysis of the questions from Campaign Questionnaire Part I can be seen in Table 16. Some changes can be inferred from this analysis, especially with the first question relating to “participants concerns about transport and climate change”, where the mean school way distance *slightly* decreased as concern for this issue increased, as well as that males and females differed greatly for strongly agreeing with this statement – where the sexes evenly “strongly disagreed”, but almost 20% more females “strongly agreed” than males. The second question regarding that “schools should be more active in providing climate friendly ways to school” did not produce any obvious changes with cross-analysis. The third question relating to “having travel choices to school” showed a *slight* change in that as participant results moved from disagreeing to agreeing with this statement, their mean distance to school decreased; the same change occurred with the annual CO<sub>2</sub>/reporter results for this statement, in that these values reduced as participants agreement increased with the statement. The last question relating to “feeling safe on the way to school” showed a *general* change in that as participant results moved from disagreeing to agreeing with this statement, their mean distance to school also decreased.

Table 16: Cross-analysis of Questionnaire Part I results and CO<sub>2</sub> results

<b>1. I am concerned about how transport contributes to climate change.</b>							
	%	#	CO2 intensity	Mean distance km	kg CO2/reporter/year	Male	Female
1 (strongly disagree)	5 %	1583	79,0	5,6	167,0	49 %	51 %
2	6 %	2068	80,7	5,5	170,0	49 %	51 %
3	21 %	6757	81,3	5,5	169,0	47 %	53 %
4	25 %	8097	81,6	5,4	168,0	42 %	58 %
5 (strongly agree)	36 %	11399	79,2	5,1	155,0	41 %	59 %
N/A	6 %	1993	78,8	4,6	137,0	45 %	55 %
<b>2. My school should do more to provide me with a more climate-friendly way to get to school.</b>							
	%	#	CO2 intensity	Mean distance km	kg CO2/reporter/year	Male	Female
1 (strongly disagree)	9 %	2941	77,2	4,9	144,0	50 %	50 %
2	9 %	2906	81,1	5,9	182,0	43 %	57 %
3	20 %	6497	81,8	6,0	185,0	43 %	57 %
4	20 %	6248	81,8	5,3	166,0	43 %	57 %
5 (strongly agree)	32 %	10278	79,7	4,9	148,0	43 %	57 %
N/A	9 %	3027	77,6	4,8	141,0	47 %	53 %
<b>3. I have a choice about how I travel to school.</b>							
	%	#	CO2 intensity	Mean distance km	kg CO2/reporter/year	Male	Female
1 (strongly disagree)	13 %	4106	81,4	6,6	204,0	44 %	56 %
2	12 %	3921	84,1	6,3	202,0	40 %	60 %
3	19 %	6088	85,3	5,5	180,0	42 %	58 %
4	18 %	5764	81,3	5,1	157,0	46 %	54 %
5 (strongly agree)	33 %	10400	73,8	4,5	127,0	45 %	55 %
N/A	5 %	1618	78,9	4,1	124,0	47 %	53 %
<b>4. I feel safe on the way to school.</b>							
	%	#	CO2 intensity	Mean distance km	kg CO2/reporter/year	Male	Female
1 (strongly disagree)	8 %	2571	75,7	6,1	174,0	44 %	56 %
2	10 %	3251	82,3	5,5	172,0	38 %	62 %
3	22 %	7137	82,8	5,6	178,0	39 %	61 %
4	24 %	7638	77,8	5,3	157,0	43 %	57 %
5 (strongly agree)	31 %	9882	82,0	4,9	151,0	48 %	52 %
N/A	4 %	1418	74,7	4,3	123,0	51 %	49 %

The cross-analysis of questionnaire Part II results can be seen in Table 17. It is difficult to find many general change with this analysis; however some interesting points should be noted. More male's that average chose the topic of "research", and more females than average chose the topic of "information/public awareness". It should also be mentioned that participants which chose the topic of "education" had the lowest CO<sub>2</sub> emissions per year, and those that chose "local community structure" had the highest CO<sub>2</sub> emissions per year.

Table 17: Cross-analysis of Questionnaire Part II results and CO<sub>2</sub> results

What kinds of changes are needed to reduce CO <sub>2</sub> emission from transport?							
	%	#	CO <sub>2</sub> intensity	Mean distance km	kg CO <sub>2</sub> /reporter/year	Male	Female
Laws and regulations	10 %	8420	80.8	5.4	165.0	41 %	59 %
National transportation plans	11 %	9450	78.9	5.1	154.0	43 %	57 %
Education	12 %	10455	79.6	4.8	146.0	43 %	57 %
Transport habits	11 %	9580	76.4	5.3	154.0	43 %	57 %
Transportation of goods	5 %	4419	83.0	5.4	170.0	45 %	55 %
Engagement by groups in society	3 %	2551	79.1	5.9	176.0	42 %	58 %
Democratic processes	3 %	2390	83.3	5.7	179.0	46 %	54 %
Information/public awareness	6 %	5411	86.3	5.0	163.0	38 %	62 %
Economic support/regulations	5 %	4514	79.5	5.5	165.0	42 %	58 %
Transport technology	12 %	10530	79.7	5.3	162.0	46 %	54 %
Research	6 %	5086	79.6	5.7	172.0	51 %	49 %
Local community structure	3 %	2640	86.3	5.9	195.0	43 %	57 %
People's priorities	5 %	4453	79.8	5.6	169.0	39 %	61 %
Living conditions/income	5 %	4344	81.1	5.6	173.0	39 %	61 %
		AVG:	80.3	5.3	161.0	44 %	56 %

### 3.6 Comparison to 2007 and 2008 Norwegian campaigns

Different results are recorded for Norway in the CO<sub>2</sub>nnect campaign in comparison to the 2007 Norwegian CO<sub>2</sub> campaign, see Table 18. The most notable difference is the higher emission intensity and CO<sub>2</sub> per reporter for Norway in the recent CO<sub>2</sub>nnect campaign in comparison to the 2007 campaign. This comparison is difficult because there is a much smaller sample size (participants and schools) in the CO<sub>2</sub>nnect campaign for Norway, in which there is also a poor geographical distribution (participation was limited to almost entirely in Southern Norway), and the fact that different schools are being compared here as well.

Table 18: Comparison of 2007 Norwegian campaign results to CO<sub>2</sub>nnect campaign Norwegian results.

	2007	CO <sub>2</sub> nnect	Difference
Distance	4.5	5.1	(+.6) 12% increase
CO <sub>2</sub> emission intensity (g/km)	56	69	(+13) 19% increase
Participants	2575	452	(-2123)
Schools	86	25	(-61)
CO <sub>2</sub> per reporter per school year (190 days, kg)	95	135	(+40) 30% increase

The 2008 Norwegian campaign (Randall, 2009) based on a solar energy exercise contained a questionnaire similar to the CO<sub>2</sub>nnect campaign. This questionnaire asked *where importance lies in making environmental change*, where the CO<sub>2</sub>nnect questionnaire asked *what kinds of changes are needed to reduce CO<sub>2</sub> emissions from transport*. While these two campaigns were topically and geographically different, it is interesting to compare where students generally place their faith in how to better our climate and the environment (Table 19).

Table 19: Comparison of Ranking of Importance of Issues between the 2008 Norwegian Campaign and the CO<sub>2</sub>nnect Campaign<sup>7</sup>

Issue	Ranking	
	2008	CO <sub>2</sub> nnect
Transport technology	1	1
Research	1	2
Transport habits	-	3
National transportation plans	-	4
People`s priorities	2	5
Education	6	6
Transportation of goods	-	7
Engagement by groups in society	-	8
Laws and regulations	3	9
Information/public awareness	5	10
Local community structure	-	11
Economic support/regulations	4	12
Democratic processes	-	13
Living conditions/income	7	14

(-)*question not asked*

Comparing these similar questions from the two different campaigns shows that students put research and technology as a primary solution for environmental problems, and place economic incentives and societal change issues as lower priorities. One difference between the campaigns is that the CO<sub>2</sub>nnect campaign participants placed the topic of “education” as a much higher issue of importance than the 2007 Norwegian campaign.

<sup>7</sup> This table compiled from information in Table 15, and from Part 2(B) of the questionnaire in the 2008 campaign.

## 4 Project Reports, Awards, and Ideas

### 4.1 Participant Project Reports

Schools which participated in the campaign were encouraged to create a school project relating to the campaign outcomes, but within this framework the topics for the projects were very open. Guidance was given on the campaign website describing how to design and implement a campaign project: [http://co2nnect.org/help\\_sheets/?op\\_id=594&opt\\_id=98](http://co2nnect.org/help_sheets/?op_id=594&opt_id=98). This guidance centered on defining the project, considering potential cooperative partners, designing a project plan, implementing the project, writing the project report, and presenting the project to interested parties.

The deadline to submit project reports was mid-October 2009, and by that time 40 had schools submitted reports (from 11 different countries).

### 4.2 Project Report Awards

Awards were given by a selected jury<sup>8</sup> for the most outstanding reports in the following categories: Upper Secondary Schools, Primary and Lower Secondary Schools, and the “highly commendable”.

#### Project award evaluation criteria:

1. *The school or class has participated fully in CO2nnect activities (registered data in the database, submitted a climate idea and filled out the survey questionnaire).*
2. *The school or class has carried out a successful local project on climate emissions and transport in collaboration with local actors with a high degree of pupil initiative and activity.*
3. *The project demonstrates a high degree of pupil innovation to develop ideas or actions for sustainable transport and reduced climate emissions.*
4. *The project demonstrates a high degree of reflection by pupils about what they learned by doing the project.*

Source: [http://co2nnect.org/?op\\_id=705&opt\\_id=100](http://co2nnect.org/?op_id=705&opt_id=100)

#### **Awards for Primary and lower secondary schools:**

*1st prize: Pärnu-Jaagupi Gümnaasium in Pärnu County, Estonia*

*2nd prize: Colegiul National de Arte Constanta – Regina Maria, Constanta, Romania*

#### **Awards for Upper secondary schools:**

*1st prize: Lykeio Agiou Ioanni, Lemesos, Cyprus*

<sup>8</sup> The jury consisted of: Reiner Mathar – Ministry of Education in Hessen, Germany; James Hindson – Field Studies Council, UK; Gaute Grønstøl – University of Bergen, Centre of Schools' Science Education, Norway; Astrid Sandås– Norwegian Directorate for Education and Training, Norway; Åsa Renman – SUPPORT secretariat at University of Life Sciences, Norway.

*Joint 2nd prize: Sekolah Menengah Kebangsaan Serdang, Kedah Darulaman, Malaysia – and - Sekolah Menengah Kebangsaan Perempuan St. George, Penang, Malaysia*

**Highly commended projects awards:**

*Ady Endre Elmeletei Liceum, Bucharest, Romania*

*Základná škola, Dr. Janského č.2, Ziar nad Hronom, Slovakia*

*Sekolah Menengah Kebangsaan Bukit Jambul, Gelugor, Malaysia*

### 4.3 Participant Climate Ideas

Learning outcomes of ESD includes the overall improvement in the understanding of the given issue, and attitudes towards the issue as well. Building upon this direction, the campaign encouraged individual students to suggest short ideas on how climate issues should be addressed and resolved (mostly in their local community). 266 climate ideas from 19 different countries were uploaded and posted to the campaign website. Many of the interesting ideas focused on the expected topics such as:

- Ways to encourage walking/bicycling and public transportation.
- Ways to discourage the strong reliance upon cars and single occupancy.
- Utilizing innovative technologies for lower emissions.
- Planting trees for the uptake of CO<sub>2</sub>.

But, there were also many unique ideas which focused on education and societal change, suggesting that the ESD outcomes may have had large effects upon their knowledge and thinking regarding the issue. A selection of these more unique ideas are presented below, where the full list of the climate ideas can be found on the campaign website at:

[http://www.co2nnect.org/results/?vis=climate\\_ideas](http://www.co2nnect.org/results/?vis=climate_ideas)

#### **Eco-attitude**

01.10.2009 (COLEGIUL TEHNIC "IULIU MANIU", Romania)

*The education is the main way to struggle against the pollution of the environment; a well-informed person about the negative consequences of some human activities can have generating pollution, upon our common planet and finally upon those who live it, can't remain indifferent and they will do something to control and decrease these activities.*

#### **Mentality change**

30.09.2009 (János Zsigmond Unitárius Kollégium, Romania)

*We think that the most important is to change peoples mentality. They have to start to care for our climate, our nature. First of all, the use of cars should be less and not only because they produce CO2 but because is healthier to walk or to ride a bike on short distances. We think that travelling with train is less harmful as well. It would be a great idea if lots of people could join and have manifestations to show those who don't care that there are people out there how are interested in mantaining our helth and natures integrity. People should be more attentive to each other.*

**Be part of the nature**

23.08.2009 (National Highschool of Arts, Romania)

*Children need to know the beauty of the NATURE. So they will understand why we must protect it! We should organize more trips with our teachers and parents. We should use "our foot" for it!*

**Our part for the lowering CO2**

01.06.2009 (OŠ bratov Letonja, Šmartno ob Paki, Slovenia)

*We are students, who decided to take part in this project with our mentor Boštjan Ketiš, because we are interested in ecology and we care what kind of air we breathe. We wanted to find out how we could reduce CO2 emissions. We were working on this project after our regular lessons. Firstly we were talking about this subject and we were exchanging opinions as well. Finally we wrote them down and we sent them to our teacher. Socialising is very important for every relationship. We have found out that this is of great importance if we consider air, too. Why would we miss the chance to cycle to school with our friends on a beautiful sunny day? We benefit a lot with it. We keep our bodies fit, we amuse ourselves, we improve our relationship. However, the most important is that we take care of nature and we control the CO2 emissions. However, sometimes school might be too far away from our home, or we cannot cycle to school because of the bad weather. This doesn't mean that our parents should take us to school one by one. There is enough space in the car for more than just two people. We should call our friends from the same neighbourhood and we should go to school together in one car. We haven't forgotten about the school buses either. Those should be larger and more spacious, thus only one ride would be enough in order to get our students to school and also this would help reducing CO2 emissions. Since we have come to those conclusions, we wanted to present them to other students too, thus we did posters which present how to take care of the air. We have also recorded a film in which we have shown that our air is very important and how to minimize its pollution.*

**let them know how**

27.05.2009 (SMK TENGKU MENTERI, Malaysia)

*My school is located at the rural area. Most of the villagers or the local people not really understand about CO2 emission and how they can reduce the emission. From my classroom discussion we agree that we have to let them know the situation and then we can work together on how to reduce the CO2 emission. Our first step is to conduct a campaign on giving information to the public.*

**Required education for adults!**

01.05.2009 (National Highschool of Arts, Romania)

*Adults need required education to understand current environmental problems. Many fail to realize the current problems because they are very busy at work. They do not give importance to nature as they seem to be eternal and do not believe that one day everything is possible to disappear because of excessive pollution. Adults do not walk because they are allways in a big hurry. Their indifference and haste will destroy our world.*

**Ecology classes**

14.04.2009 (National Highschool of Arts, Romania)

*Our class would like to have more hours of ecology. At these classes should be invited our parents too because they stay too much in their cars! We want to walk but they have bad habits!*

**Together**

06.04.2009 (National Highschool of Arts, Romania)

*Of course the nations make the changes, but everything starts from the base: from us like person. There are various problems and various way to solve them: the important thing is to create a simple unity for helping people to understand what's happening on Earth! Informations*

*should be like food ! Informations are crucial for us as society . Informations are our power as human being . Climat change problems will be solve only by the force of people , together!*

### **Buy Less Stuff**

05.04.2009 (SMK (Perempuan) St. George, Malaysia)

*When we make an object, we use energy to collect the materials, manufacture and transport them. This creates co2. Buy less stuff and try to buy things that will last.*

### **Climate is in our hands**

26.03.2009 (Scoală cu clasele I-VIII Nr.1 Dej, Romania)

*We are all responsible for the climate changes that take place all over the world. We have all brought our contribution to the changes in nature nowadays. Each action that we take has its own results upon the environment, and, unfortunately, not all the actions taken are in the benefit of the environment. We believe that change starts with us. We are little, but we are decided to bring our contribution to help the environment. If we, as children, start protecting the nature, we will have the chance to live in a clean environment as grown ups. What is our climate idea? Children from all over the world, start using bikes to go to school, instead of going by bus. Or, why not, walk to school, if there isn't a long distance to your school. Not only that you protect the environment, but you also keep yourself healthy. Be healthy and keep the environment healthy too!*

## 5 Discussion and Conclusion

The campaign results show that overall, 45% of participants use transportation modes which do not emit CO<sub>2</sub> (walking, biking, etc.), where 30% use mass transportation modes (busses, trains, etc.), and 36% use personal transportation modes (cars, motorcycles, etc.)<sup>9</sup>. The fact that almost half of all participants do not emit CO<sub>2</sub> on their way to school is a good sign, showing that most participants have the necessary available transportation options to get to school without harming the climate – and it is excellent that a majority of students are actually utilizing these “climate friendly” options.

The total CO<sub>2</sub> emitted during all 31808 participants travel to school (one-way) is 13513.7 kg (2.4 kg/participant average), where each participant averages 161 kg of CO<sub>2</sub> per year during their travels to school. The values are relatively small when seen in perspective with how much CO<sub>2</sub> is emitted from single air travel journey's, or from industrial plants, etc. – so while students are doing a great job in minimizing their personal CO<sub>2</sub> emissions on the way to school, they must also be aware that other facets of society are contributing far greater amounts.

Modes of transportation to school greatly differ between countries, and this can be due to many regional factors including weather, cultural preferences, policy/planning, funding, and education. These factors affect the available transportation modes, which in turns affects the country-wide CO<sub>2</sub> emission rates. So it is possible that in many cases students have the desire to utilize low emission transportation modes, but the regional factors make this reality difficult – but not impossible!

An example of regional differences can be seen between the U.K. and Germany results. Where U.K. participants reported a high emission intensity of 112 g/km CO<sub>2</sub> and low yearly rate of 112 kg/year/reporter, in comparison to Germany participants with a low 75 g/km CO<sub>2</sub> and higher yearly rate of 304 kg/year/reporter – this difference can be due to that the average mean school distance for the U.K. participants is 2.6 km, while for German participants it is 10.6 km, and that U.K. participants are reliant on more CO<sub>2</sub> intense transport in comparison to German participants. So the U.K. participants have more local schools which are close to students homes, but the students on average are taking more CO<sub>2</sub> intense transportation modes to travel these short distances, while German schools must be more regionalized with farther distances to travel, but students are taking less CO<sub>2</sub> intense transportation modes. This example shows how school planning and transport options come back to effect CO<sub>2</sub> levels in different ways.

The questionnaire was successful in identifying that a majority of participants feel safe on their way to school, feel they have adequate transportation choices, and have a genuine concern for how transport impact the climate – on the same

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<sup>9</sup> These values are greater than 100% due to the fact that some participants use more than one mode of transport during their daily travel to school.

hand most also agree that their schools should do more to provide “climate-friendly” transportation options to school. It is also interesting that students put the topics of research and technology as primary solutions to address climate/transport problems, and place economic incentives and societal change issues as lower priorities. But this result somewhat contradicts the “climate ideas” proposed by the participants, because very few of these proposed ideas mentioned research/technology, where mostly addressed behavioral and societal-based changes to address climate problems. This contradiction could be a factor of that when students are given the options for correct solutions, they will pick the mainstream answers (similar to picking the correct answers to a quiz), but when the question is left open ended, they tend to be more creative through finding more personal actions that they themselves can contribute to.

Cross-analysis of the questionnaire and CO<sub>2</sub> results showed some changes, however they were mostly weak. The surprising results which came from this analysis was actually some of the differences observed between genders, for example that females show a much higher concern for how traffic impacts climate change than males, and females see information and public awareness as much more important solutions compared to males who rely on research.

It was difficult to compare the 2007 Norwegian CO<sub>2</sub> results to the current campaign, but the 2008 Norwegian campaign questionnaire showed that the 2008 campaign participants had similar ideas to the CO<sub>2</sub>nnect campaign participants regarding the importance of where solutions can be found to environmental problems. The one exception here is the importance of “education”, and this could be due to the fact that CO<sub>2</sub>nnect was based on ESD principles and stressed the value of education as a motivating tool – which could be the reason why participants ranked this topic higher than the 2007 campaign participants.

The CO<sub>2</sub>nnect campaign can certainly be considered a great success. There was excellent participation at all levels, which in part can be due to the wonderful campaign website/tool and effective campaign organization. It is amazing that the most of the results section of this report was generated directly from the campaign website, where no additional tools or raw data-sets were needed to complete most of the analysis. All of the participants should be commended for their contribution to the campaign, and extra recognition should be given to those schools which utilized the campaign to additional lengths such as writing reports, organizing community events and campaigns, and bringing issues up with local administrators and policy-makers. Based on this success, recommendations for the future are presented in the following section.

## 6 Recommendations

Due to the success of the campaign, the following recommendations are presented to consider for future planning:

- Ensure distribution of this report (or condensed versions, forthcoming) to campaign participants.
- Bring the campaign and its results to a larger audience through international teacher training workshops.
- Repeat the campaign in the near future with the same participants to begin to notice any trends in behavioral change.
- Perform a simple follow-up web survey for the participants to determine any potential effects from campaign participation on their behavior.
- Use the success of the campaign model on different environmental and social issues.
- Publish the campaign results/methods in an international journal (focusing on ESD or similar).

## 7 Bibliography

Hansen, G., & Randall, S. (2008). *CO<sub>2</sub> on the way to school. English summary of final report assessing the 2007 Norwegian student-based web campaign.* Kjeller: NILU (OR 71/2008).

Randall, S. (2009). Solar Energy Campaign: 2008 Norwegian student-based web campaign. Kjeller: NILU (OR 21/2009).



**Appendix A**  
**Campaign Data Sheet**



Name:			
Birth year:			
Tick a category:	Male:	<input type="checkbox"/>	Female:
Tick a category:	Pupil:	<input type="checkbox"/>	School staff:

Which mode(s) of transport did you use to get to school?	Distance to school in km
foot	
bicycle	
by animal transport	
rickshaw/trishaw	
moped	
motorcycle	
auto rickshaw	
snowmobile	
car electric	
car small	
car medium	
car large	
car hybrid	
taxi	
bus	
minibus	
diesel train	
electric train	
subway/metro	
electric tram/trolley bus	
ferry	
express boat	
other mode(s) (please specify)	

## Questionnaire

### Part 1

Please indicate how much you agree or disagree with these statements. 1 = strongly disagree, 5 = strongly agree (N/A = not applicable or no opinion).

I am concerned about how transport contributes to climate change.	1	2	3	4	5	N/A
I have a choice about how I travel to school.	1	2	3	4	5	N/A
My school and local administration should do more to provide me with a more climate-friendly way to get to school.	1	2	3	4	5	N/A
I feel safe on the way to school.	1	2	3	4	5	N/A

### Part 2 (optional)

What kinds of changes are needed to reduce CO<sub>2</sub> emission from transport? Select the three areas from the list below where you feel that improvements are needed most. Select the three areas from the list below where you feel that improvements are needed most.

National transportation plans	
Education	
Transport habits	
Transportation of goods	
Democratic processes	
Economic support/regulations	
Transport technology	
Research	
Local community structure	
Living conditions/income	
People`s priorities	
Information/public awareness	
Engagement by groups in society	
Laws and regulations	

## **Appendix B**

### **Emissions Calculations**



Source: Campaign website

([http://www.co2nnect.org/help\\_sheets/?op\\_id=602&opt\\_id=98](http://www.co2nnect.org/help_sheets/?op_id=602&opt_id=98))

The CO<sub>2</sub>nnect CO<sub>2</sub> calculator works by multiplying the distance travelled to school by a "multiplier". The multiplier defines the amount of CO<sub>2</sub> emitted per passenger and per kilometer for a given mode of transport.

Each mode of transport (walking, bicycling, car, train, etc.) will have a different multiplier. The multipliers have been pre-programmed into the CO<sub>2</sub>nnect calculator and the calculations are done automatically for you.

Note that the CO<sub>2</sub>nnect multipliers:

- include CO<sub>2</sub> only. Some other calculators include other "greenhouse gasses" as well, expressed as "CO<sub>2</sub> equivalents"
- include only the CO<sub>2</sub> generated by the actual travel to and from school. Some calculators include CO<sub>2</sub> produced indirectly, for example during the manufacturing or disposal of a car.

Here is a list of the CO<sub>2</sub> multipliers we have selected to use in CO<sub>2</sub>nnect  
Figures denote kg CO<sub>2</sub> per km per passenger:

- foot: 0
- bicycle: 0
- by animal transport : 0
- rickshaw/trishaw: 0
- moped: 0.073
- motorcycle: 0.094
- auto rickshaw: 0.061
- snowmobile: 0.094
- car electric: 0.043
- car small: 0.11
- car medium: 0.133
- car large: 0.183
- car hybrid: 0.084
- taxi: 0.17
- bus: 0.069
- mini bus: 0.055
- diesel train: 0.06
- electric train: 0.065
- underground/metro: 0.065
- electric tram/trolley bus: 0.042
- ferry: 0.115
- express boat: 0.53

We have tried to include the most common modes of transport to school across the globe - but we have probably missed some!

Most of the multipliers we use in CO<sub>2</sub>nnect have been taken from the UK Department of Environment (Defra). The source is "[2008 Guidelines to Defra's GHG Conversion Factors: Methodology Paper for Transport Emission Factors.](#)"

Where this document does not give data on a mode of transport, we have used other sources. CO<sub>2</sub>nnect has consulted with experts on carbon calculators while selecting the multipliers. They have confirmed that the multipliers are reliable enough for our purposes.

How accurate are the multipliers and the CO<sub>2</sub>nnect results? The multipliers in CO<sub>2</sub>nnect come from very reliable sources, they are based on 2008 data and have been confirmed by carbon calculator experts. We are confident that the results will be accurate enough for the educational purposes of CO<sub>2</sub>nnect.

However, there are several sources of error that could make the results inaccurate. It would be interesting to discuss this in your class.

For example, the amount of CO<sub>2</sub> emitted by a car using petrol will depend on many things:

- engine size and car weight (bigger engines and cars emit more CO<sub>2</sub>)
- the kind of fuel used and the fuel efficiency
- age of the car (a older car will emit more CO<sub>2</sub> than a new one of the same size)
- number of passengers (more passengers means lower emissions per person)
- car maintenance (especially the engine, and tire pressure and condition)
- how the car is driven (speed, idling, starting and stopping, acceleration, braking).

The same would be true for other methods of motorized transport.

The multipliers assume a certain average number of passengers in each mode of transport. This is called the "average passenger load.". This could be quite different than the actual passenger load in your situation. For example, if you ride a big bus that is almost empty, or extremely full, the multipliers might not be very accurate for your trip to school.

You might also ask whether the multipliers would vary from country to country. The answer is yes! One reason is that electricity is produced very in different ways. The main source of the electricity in a country (hydropower, coal, nuclear,

other) would certainly make a big difference in the amount of CO<sub>2</sub> emitted from trains, trams or other transportation running on electricity!

Countries all have their own economies, transport systems and pollution laws, which could also have an effect on passenger loads and carbon emissions – even for the same mode of transport. This would be a relevant topic to discuss this when you compare results from several countries. Unfortunately, reliable multipliers are not yet available for all countries that are calculated the same way.

Theoretically it would be possible to make a calculator that would take all of these things into account. However, today we don't have all the data needed to find such detailed and accurate multipliers. A calculator like that would be very complicated and it would take a lot of work for pupils to collect the data. We chose to make the CO<sub>2</sub>nnect calculator relatively simple so that pupils could spend more time learning about their local transport systems and working with others to find sustainable solutions.

There are a few other sources of inaccuracy to be aware of as well. Pupils will be measuring and entering the distance to school and the mode of transport. There will always be some error in these measurements depending on the method used, and the distances are rounded up or down to the nearest kilometer. Some mistakes might also be made when calculating distance or entering the data.

The information on number and proportion of people using the various modes of transport should be quite accurate. There are no multipliers, so errors would only occur while deciding on the mode of transport and registering the data.

Considering all of these possible sources of error, we are still confident that the results of CO<sub>2</sub>nnect will be accurate enough for you to use your school results to discuss CO<sub>2</sub> emissions and work to reduce emissions in your school and local community. They will also be accurate enough for you to compare your school with others in your country and in other countries.



## **Appendix C**

### **Partner and Member Organizations**



Organization	Country
Australian Association for Environmental Education (AAEE)	Australia
Austrian Federal Ministry for Education, the Arts and Culture	Austria
Austrian Institute of Ecology	Austria
FORUM of Environmental Education	Austria
Kirchliche Pädagogische Hochschule	Austria
VZW In-service training of the Catholic Education (Secretariat of the Flemish Catholic Education)	Belgium
Roskilde Technical College, Department of Animal, plants and horticulture	Denmark
University of Copenhagen, Faculty of Life Sciences	Denmark
Ökokratt	Estonia
Finnish National Board of Education	Finland
Helmholtz Centre for Environmental Research	Germany
InWEnt - Internationale Weiterbildung und Entwicklung gGmbH	Germany
State Authority of Teacher Education	Germany
National and Kapodistrian University of Athens	Greece
Education and Teacher Training Agency	Hungary
Hungarian Institute for Educational Research and Development	Hungary
Hungarian Society for Environmental Education	Hungary
Institute of Ecology and Botany of the Hungarian Academy of Sciences (IEB-HAS)	Hungary
University of Rome, The Educational Research Institute	Italy
Cheongju National University of Education	Korea (Republic of)
Ministry of Environment, Division of Environmental Education and Civil Relationships	Korea (Republic of)
Ministry of Education and Science of Republic, FYROM	Macedonia
University Sains Malaysia, Basic Educational Research Unit, School of Educational Studies	Malaysia
Codename Future	Netherlands
Lillehammer University College, Dept. of Social Science	Norway
Norwegian Institute for Air Research (NILU)	Norway
Oslo University College, Technology, Design and Environment	Norway
Oslo University, Norwegian Centre for Science Education	Norway
The Norwegian Directorate for Education and Training	Norway
The Norwegian University of Life Sciences	Norway
Centre of Schools' Science Education, University of Bergen	Norway
Healthy Environment Regional Organisation (HERO)	Romania
Licee Pedagogique Mihai Eminescu	Romania
The Educational Research Institute of Slovenia	Slovenia
The Slovenian National Education Institute	Slovenia
Autonomous University of Barcelona	Spain
Balearic Islands University	Spain
KanEnergi Sweden AB	Sweden
Keep Sweden Tidy Foundation	Sweden
Centre for Climate and Safety, University of Karlstad	Sweden
Stiftung Umweltbildung Schweiz	Switzerland
Field Studies council, FSCEE	UK
MF Associates	UK
Nottingham Trent University	UK
University of Gloucestershire, International Research Institute in Sustainability (IRIS)	UK
University of Wales Bangor, School of Education	UK





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