

OR 21/2009

Solar Energy Campaign

2008 Norwegian student-based web
campaign

Scott Randall



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Solvang School in Gran

Preface

Student research campaigns (*forskningskampanjer*) have been an annual event in connection to Research Days (*Forskningsdagene*) since 2003 in Norway. The campaigns invite students from all over the country to participate in a common scientific research event, always connected to a special environmentally related theme – for example *Air Quality in the Classroom* (2003), *Pollution along Roads* (2004), *Bacteria in Drinking Water* (2005), *The Rain Check* (2006), *CO₂ on the Way to School* (2007).

The year 2008, as with previous years, was overshadowed by the topic of climate change, and the specific role of humans. The research campaign theme for 2008 fits well into this focus: the potential benefits of solar energy as an alternative energy source. The campaign also was aligned with the Research Days theme of alternative energy sources and technologies. The campaign included the hands-on activity of assembling a solar panel and taking measurements with the device to determine efficiency, as well as a questionnaire to record the results and ask deeper questions regarding alternative energy and climate change.

We would like to sincerely thank all of the schools which participated, both the teachers as driving forces, and the students as cooperative participants. We are certain that the results of the campaign will be of interest to educators and researchers alike. We also thank the Norwegian Research Council (*Forskningsrådet*) for the financial support to create the campaign, as well as the Norwegian Centre for Science Education at the University of Oslo (*Naturfagsenteret*), and the Centre of Schools' Science Education at the University of Bergen (*Skolelaboratoriet i realfag*) for organizing and designing the campaign. Thanks also to Enova SF and to User-driven Research based Innovation (Brukerstyrt innovasjonsarena - BIA) which generously provided many participating schools with free solar cell packs to complete the campaign.

NOTE: This report is also available in Norwegian: *Solenergi: Elevbasert forskningskampanje som del av Forskningsdagene 2008* (Randall, NILU OR 24/2009).

Forskningsdagene



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1 Introduction

The 2008 Norwegian School Research Campaign “Solar Energy” was carried out in cooperation between the Norwegian Research Council’s Research Days (*Forskningsdagene*), the Centre of Schools’ Science Education at the University of Bergen (*Skolelaboratoriet*), the Norwegian Centre for Science Education (*Naturfagsenteret*) and the Norwegian Institute for Air Research (*NILU*). The Centre of Schools’ Science Education handled the most important task of designing and managing the campaign site at miljolare.no which guided the whole campaign.

The Research Days theme for 2008 was “New Energy Sources – Environmental Energy”. The 2008 Research Campaign aligned with this theme through producing an activity based on examining solar energy through a practical exercise which could be performed by students and teachers throughout the Norwegian school system during the end of September. The campaign was geared to draw attention towards solar energy as a viable alternative energy source during a period of climate change due to the reliance on traditional polluting energy sources such as fossil fuels.

Participants (teachers and students) were guided towards increasing their knowledge of solar energy through taking real measurements and calculating its efficiency for potential use on school buildings. Once the activity was completed, participants reflected over the value of alternative energy and human's role in promoting solutions to combat energy and environmental problems – this was all recorded through an online questionnaire. As with previous campaigns, this campaign was entirely facilitated by the miljolare.no website for obtaining guidance and entering the collected data and answering the questionnaire, as well as later data analysis.

The goals for the campaign as it was designed are as follows:

- Present the functionality of solar energy and its efficiency factors
- Understand how solar energy technologies can be implemented
- Understand the quantity of traditional energy which can be replaced with solar power at one's school
- Develop an understanding of alternative energy sources and their implementation in Norway
- Reflect upon changes which can be made to better our living environment and reduce climate change.

A secondary goal of the campaign was to provide the various educational and environmental researches new information regarding Norwegian students' behaviour and knowledge related to alternative energy and climate change.

The results gained from data analysis of the campaign show that many schools were able to gain maximum efficient solar power from the devices they constructed, which gave them a solid understanding of solar power technology. Analysis of the campaign questionnaire in regards to the activity shows that students believe that solar energy should be better utilized as an energy source in Norway, and that students believe most in research and technological solutions to our energy and environmental problems.

2 Methods

The campaign supplied a guidance webpage which included a description of the goals, equipment needed, registration instructions, cooperative partners for the campaign, background information, data entry sheet, discussion/reflection questions, and most importantly, the complete instructions to complete the solar cell set-up and corresponding data collection.

The campaign activity involved four primary elements:

1. The schools registered on the miljolare.no website, and collected the equipment and constructed the solar panel system (including the multimeter), see pictures below (Figure 1 and 2).

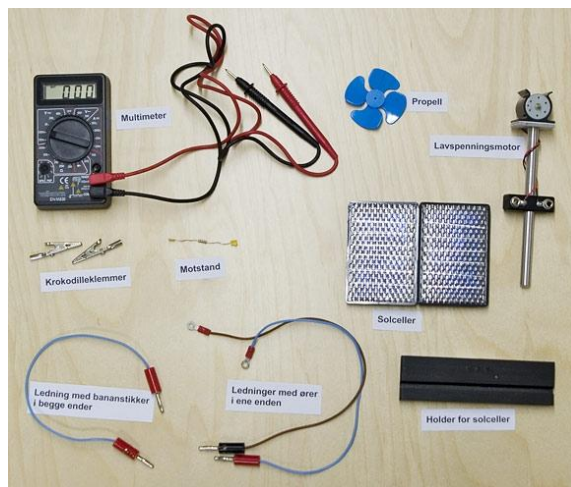


Figure 1: Solar Panel equipment.

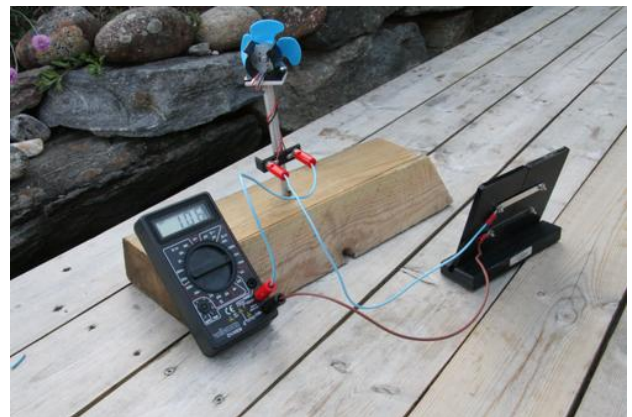


Figure 2: Assembled system.

2. The students collected solar energy output measurements (mV and mA) on the school grounds while noting the date/time and sun conditions during each data point. The area of the solar cell was measured in comparison to the area of the roof of the school, and the schools energy consumption was also noted if available (a separate miljolare.no exercise was available to calculate a schools energy budget). All of this information was then entered under their registered class on miljolare.no, see data form below (Table 1).

Table 1: Campaign Data Entry Form.

Date	
Length of the solar panel (cm)	
Width of the solar panel (cm)	

Measurement #	Time	Sun Condition (0-4)	Voltage measured in millivolt (mV)	Current measured in milliampere (mA)

Southern roof area of the school building (m ²)	
Schools energy use (kWh per week)	

- The students then answered a questionnaire on miljolare.no in relation to renewable energy use in Norway, and where they think the motivators for change are within Norwegian society.
- The students then made recommendations on at the end of the questionnaire to discuss what actions could be done in their own community to encourage renewable energy.

The complete methods for participation were outlined in the following webpage at miljolare.no (in Norwegian):

<http://www.miljolare.no/aktiviteter/by/ressurs/br34/?vis=veiledning>

All data entered in each of the above steps was associated with each student's particular school, and individual class, where the questionnaire data was on the individual student basis. A copy of the complete web-based form used for the above steps of the campaign can also be found in Appendix A.

2.1 Participants

118 different schools participated in the campaign, all from varying regions of Norway, with a relatively equal distribution by population which means more participants in the southern regions (see Figure 3, and Table 2 below). 329 students participated, with class levels ranging from 3rd to 12th grade (ages 8 to 19 years old), a full list of all participating schools can be found in Appendix B.

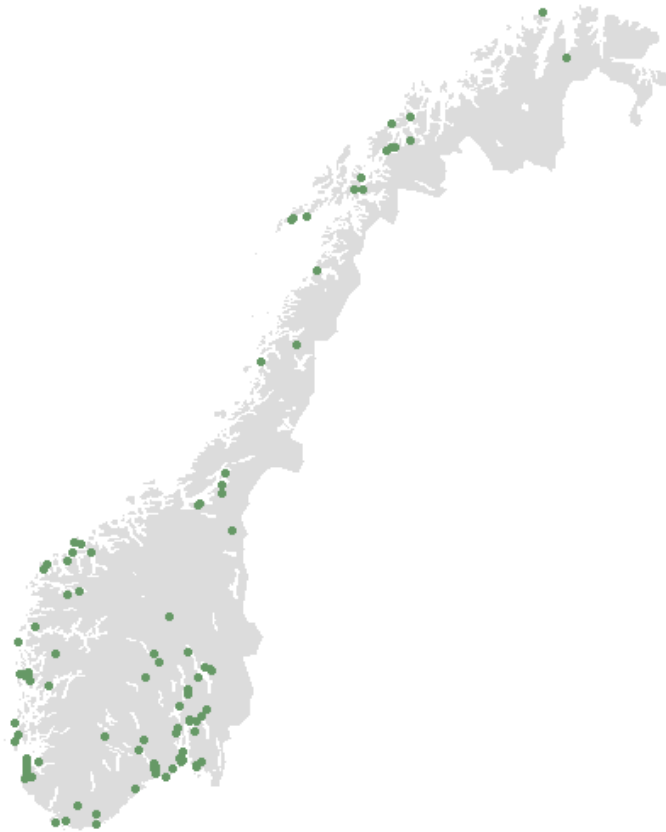


Figure 3: Map of participating schools.

Table 2: Number of participating schools and measurements taken by region.

Municipality	# Schools	# Measurements
<u>Akershus</u>	6	60
<u>Aust-Agder</u>	2	20
<u>Buskerud</u>	4	26
<u>Finnmark</u>	2	8
<u>Hedmark</u>	4	26
<u>Hordaland</u>	11	92
<u>Møre og Romsdal</u>	6	37
<u>Nord-Trøndelag</u>	3	15
<u>Nordland</u>	8	51
<u>Oppland</u>	8	69
<u>Oslo</u>	3	9
<u>Rogaland</u>	13	84
<u>Sogn og Fjordane</u>	5	20
<u>Sør-Trøndelag</u>	5	25
<u>Telemark</u>	11	128
<u>Troms</u>	11	76
<u>Vest-Agder</u>	5	30
<u>Vestfold</u>	7	66
<u>Østfold</u>	4	48

3 Results

Results from the campaign are broken down into the three activities and associated information collected from the students: measurement data, questionnaire results, and recommendations. All tables and figures are taken directly from the miljolare.no 2008 campaign results pages.

3.1 Measurement Results

Out of the 118 participating schools, 875 total measurements were taken. The average output for all of the measurements was **4.70 W/m²** (see Table 3), where 68% of all measurements were 5 W/m² or less (see Table 4). A list of the average output results for each school can be found in Appendix B.

Figure 4: Average output for each municipality.

Municipality	# Schools	# Measurements	W/m ² (avg.)	W/m ² (max)
Akershus	6	60	8	232.39
Aust-Agder	2	20	15	70.21
Buskerud	4	26	5	10.78
Finnmark	2	8	7	9.76
Hedmark	4	26	3	14.54
Hordaland	11	92	2	14.42
Møre og Romsdal	6	37	3	33.69
Nord-Trøndelag	3	15	2	10.54
Nordland	8	51	2	8.64
Oppland	8	69	4	18.34
Oslo	3	9	6	11.91
Rogaland	13	84	4	15.32
Sogn og Fjordane	5	20	2	10.68
Sør-Trøndelag	5	25	3	11.13
Telemark	11	128	5	122.67
Troms	11	76	2	18.03
Vest-Agder	5	30	7	13.56
Vestfold	7	66	6	16.62
Østfold	4	48	4	15.26

Table 3: Distribution of output based on number of measurements.

0-5 W/m ²	68.0% (605)
5-10 W/m ²	17.4% (155)
10-15 W/m ²	11.5% (102)
15-20 W/m ²	2.0% (18)
20-25 W/m ²	0.1% (1)
> 25 W/m ²	1.0% (9)

Note: any measurements greater than 15-20 W/m² are most likely outliers or measurement mistakes.

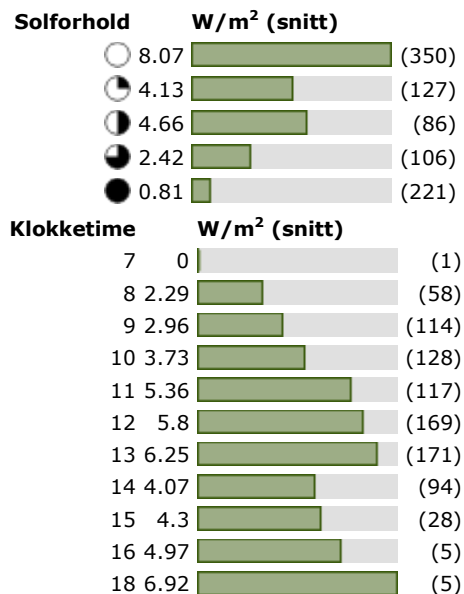
This data shows that the southern municipalities obtained a slightly greater output than the northern municipalities, for example Vestfold (southern Norway) had an average output of 6 W/m², while Troms (northern Norway) had an average output of 2 W/m². This holds true to the fact that the angle of the sun is greater in the

southern regions as compared to the northern regions at any given point, thus leading to the greater efficiency of solar panels at lower latitudes, with optimal year-round efficiency being at the equator.

At the equator, at noon, on a clear day, the maximum solar flux reaching the earth is about 1000 W/m^2 , and most solar cells are about 10% efficient, giving a maximum output in the most optimal regions of the earth at 100 W/m^2 . But at more northern latitudes like Norway, one could expect an average solar flux of approximately 100 W/m^2 , which would generate about 10 W/m^2 output. Since the collected results from the school were an average output of 4.70 W/m^2 , there are a number of reasons that the maximum efficiency was not generated, these include:

- Measurements were taken in the fall season where the sun is lower in the horizon.
- More than 50% of the measurements were taken in partly cloudy to full cloudy conditions (see Table 5 below), showing that an increase in the cloud cover greatly decreased the output.
- More than 50% of the measurements were taken outside of the optimal noon period of optimal solar conditions (see Table 5 below), showing that the maximum output results were recorded between 11:00-13:00.
- The solar panels used are not commercial quality, which may have a lower efficiency rating than the anticipated 10% of the received solar flux.

Table 4: Sun conditions and time of day during measurements.



Isolating the results taken just during the optimal 11:00-13:00 time period, and those results taken only under the brightest sun conditions, the average output is actually over 10 W/m^2 , showing that the students could obtain excellent efficiency results under the most optimal conditions necessary.

Based on the measured results, each school could calculate the percent of their total energy use which could be obtained by having solar panels on the roof. The average energy use per school is 13433 kWh , with an average roof area of 1209 m^2 ,

roof area output of 5682.3W, and an estimated average use¹ of 224kW, which gives an average solar cell potential energy percentage of **2.5%**. Some schools measured up to 5-6% efficiency, which is certainly realistic based on the conditions; a few schools measured 15-30% efficiency, and these must be considered as mistakes due to large underestimates of their school's energy use.

Below are several selected school results showing the percentage of the schools total energy that they could approximately generate if the school's roof was covered with solar panels. This is calculated by dividing the roof area output by the estimated average energy use. Examples below were selected for schools which collected more than 10 measurements and supplied their schools energy use value.

Brunla school (Larvik, Vestfold) (Southern Norway)

Average output	6.99 W/m ²
Highest output	14.77 W/m ²
Roof area	4520 M ²
Roof area potential output	31617 W
Schools energy use	31068 kWh/week
Schools estimated energy use	518 kW
Solar energy percent of energy use	<u>6.11 %</u>

Skien high school (Skien, Telemark) (Southern Norway)

Average output	2.61 W/m ²
Highest output	5.67 W/m ²
Roof area	2761 m ²
Roof area potential output	7210 W
Schools energy use	12436 kWh/week
Schools estimated energy use	207 kW
Solar energy percent of energy use	<u>3.48 %</u>

Vartdal school (Ørsta, Møre og Romsdal) (Central Norway)

Average output	9.68 W/m ²
Highest output	33.69 W/m ²
Roof area	341 m ²
Roof area potential output	3301 W
Schools energy use	6134 kWh/week
Schools estimated energy use	102 kW
Solar energy percent of energy use	<u>3.23 %</u>

Odda school (Lom, Oppland) (Central Norway)

Average output	5.92 W/m ²
Highest output	15.64 W/m ²
Roof area	280 m ²
Roof area potential output	1658 W
Schools energy use	1710 kWh/week
Schools estimated energy use	29 kW
Solar energy percent of energy use	<u>5.82 %</u>

¹ The "Schools estimated average use" is calculated using information from the annual "Strømsparegrisen" project run by Trondheim Kommune, which began in 2003.

Skjervøy school (Skjervøy, Troms) (Northern Norway)

Average output	7.26 W/m ²
Highest output	12.87 W/m ²
Roof area	243 m ²
Roof area potential output	1765 W
Schools energy use	7240 kWh/week
Schools estimated energy use	121 kW
Solar energy percent of energy use	1.46 %

These results show that solar energy could be a valuable alternative energy source for schools in southern Norway (and possibly central Norway), depending on the accuracy of these measurements, and the cost-benefits.

3.2 Questionnaire Results

329 students from 26 different schools completed the questionnaire based upon the campaign exercise. This is a school response rate of 22%, which is lower compared to previous campaign questionnaires, although responses were received from a large amount of students (329), thus making the questionnaire results significant, and valuable for analysis.

The questionnaire comprised of 13 questions, where the first part surveyed the student's opinion on the efficiency of solar energy in Norway, and the second part focused on where the students felt that solutions could be found in Norwegian society. Each question and corresponding results are presented below, with analysis of the student's responses.

Solar energy is cheaper than other energy sources

Completely agree		40% (134)
Somewhat agree		41% (137)
Don't know		9% (30)
Somewhat disagree		6% (20)
Completely disagree		5% (17)

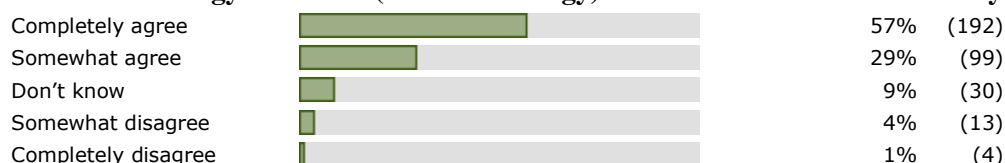
Students overwhelmingly agree that solar energy is a cost efficient energy source. While it is true that solar energy is “free”, most are unaware of the extensive costs of the solar panels, converters, and wiring necessary to turn the solar energy into usable energy for domestic sources. Initially, solar panels are more expensive than conventional energy sources, but over time (approximately 10 years) solar panels can become more cost efficient than conventional sources. This fact is changing though as solar panels themselves are becoming more efficient and cheaper, thus potentially decreasing the 10 year approximate threshold named above.

Increased renewable energy use will reduce pollution

Completely agree		65% (220)
Somewhat agree		18% (61)
Don't know		12% (40)
Somewhat disagree		3% (11)
Completely disagree		2% (6)

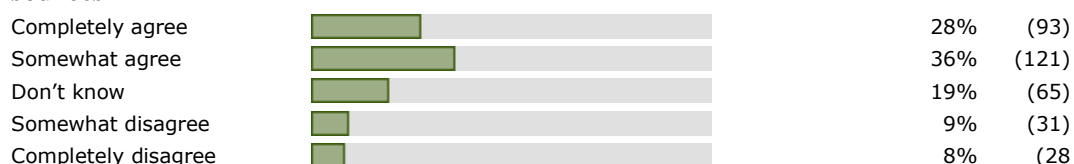
83% of students understand that renewable energy will reduce pollution, where it is alarming that 17% of students are not aware of this fact. Although 17% is a small minority of the students, this shows that the campaign exercise was not totally effective at educating all of the students of all of the benefits of renewable energy.

Renewable energy resources (like solar energy) should be used more in Norway



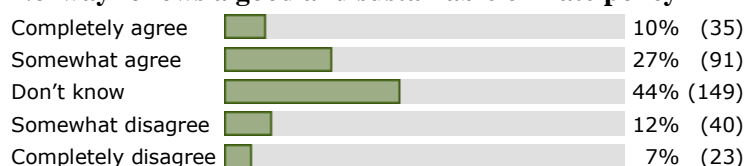
85% of the students believe that renewable energy resources should be used more in Norway, while most of the other students do not know, and only 5% disagree. These results show that the students are convinced by the benefits of renewable energy, and are comfortable with its use locally.

I will encourage my school to install solar panels and use other renewable energy sources



It is interesting that while 85% of students understand that renewable energy reduces pollution, and in turn believe that renewable energy should be used more in Norway – only 64% of students will actively encourage using renewable energy in their school. So 20% of students understand the importance of renewable energy, but will not act upon this understanding. Nonetheless, it is encouraging that a majority of students will act upon their understanding to try and employ renewable energy sources in their school.

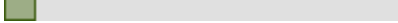
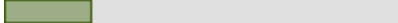
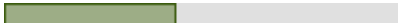

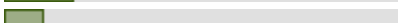
Norway follows a good and sustainable climate policy



Most students do not know if Norway follows a sustainable climate policy, which lends to belief that many were confused by the question, or do not follow national policy issues. But, of the students that answered the question, 37% believed that Norway follows a good policy, while 19% believe Norway does not. These results are interesting when comparing the same question asked in the previous year campaign (2007 campaign “CO₂ on the way to school”), where 30% believed that Norway follows a good policy, while 28% believe Norway did not (see question below). This shows that a significantly greater number of students believe that Norway is following a more sustainable climate policy, while this is

only two years of trend data, it will be beneficial to ask this question in future campaigns as well to see if the results follow this trend.

2007 Campaign results for the same question

Norway follows a good and sustainable climate policy		
Completely agree		8% (182)
Somewhat agree		22% (511)
Don't know		43% (997)
Somewhat disagree		18% (407)
Completely disagree		10% (225)

The remaining questions (compiled below) focused on where the students see solutions to our energy and environmental problems. The questions attempted to cover all aspects of where solutions can be found, ranging from technical/scientific solutions to social/political solutions. These results can be particularly interesting to see where students hold their faith in the broad spectrum of potential solution sources, as well as the areas that the students see as possible ineffective motivators for environmental change.


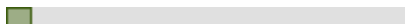
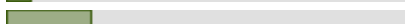
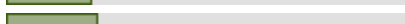

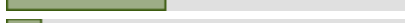
Norway should make laws that make it easier to initiate solar energy

Not important		2% (8)
Somewhat important		19% (63)
Important		31% (105)
Very important		23% (79)
Completely necessary		18% (61)
Don't know		7% (22)





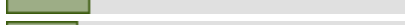
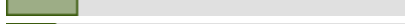
Each individual should be better at being environmentally conscious, even though this could potentially be more expensive in the short-term

Not important		1% (5)
Somewhat important		17% (56)
Important		22% (74)
Very important		30% (102)
Completely necessary		22% (74)
Don't know		8% (27)

We must perform more research to develop the technology behind renewable resources such as it becomes cheaper and more effective.

Not important		1% (3)
Somewhat important		6% (21)
Important		21% (72)
Very important		23% (77)
Completely necessary		40% (135)
Don't know		9% (30)

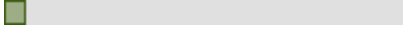
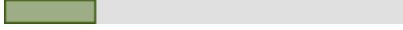
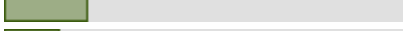
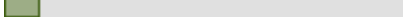
We must have better financial support schemes to increase use of renewable energy sources

Not important		4% (15)
Somewhat important		17% (59)
Important		27% (92)
Very important		21% (71)
Completely necessary		18% (60)
Don't know		12% (41)

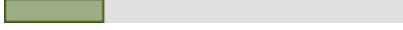
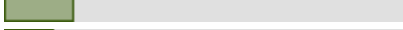
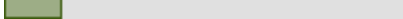
We must change our social norms, values, and lifestyles

Not important		12%	(41)
Somewhat important		25%	(85)
Important		26%	(89)
Very important		14%	(49)
Completely necessary		9%	(32)
Don't know		12%	(42)


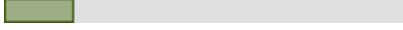
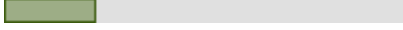
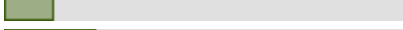
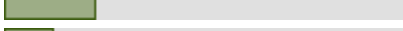
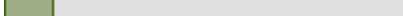
We must be better at informing each other about the problems with use of fossil fuel energy sources

Not important		5%	(18)
Somewhat important		23%	(77)
Important		29%	(97)
Very important		21%	(71)
Completely necessary		14%	(46)
Don't know		9%	(29)

The topic of sustainable use of energy sources should be better implemented in the educational system

Not important		6%	(21)
Somewhat important		25%	(84)
Important		25%	(84)
Very important		17%	(59)
Completely necessary		12%	(41)
Don't know		14%	(49)

We should receive higher incomes such that we can afford to chose environmental friendly solutions which may not be the cheapest alternative

Not important		12%	(42)
Somewhat important		17%	(58)
Important		23%	(78)
Very important		12%	(42)
Completely necessary		23%	(77)
Don't know		12%	(41)

Most students believe that research into better technologies is by far the most promising solution to our energy and environmental issues. This solution is followed by an increased environmental consciousness, financial support incentives, and political regulations. The students' responses follow the mainstream view that technology, economics, and politics should determine our reactions to energy and environmental issues. Although, the importance of an increased environmental awareness is an interesting result, which shows that the students may believe that the solutions may be extended beyond just the conventional mainstream responses.

The more untraditional social solutions are less popular responses with the students, where there is less motivation to changing one's own lifestyle/values, or seeing the value in educational solutions to our environmental problems. These latter issues can potentially give a better result than the more traditional solutions, but they take more time to implement, and it may be difficult for the students to

see this value based on this fact. Nonetheless, very few of the students believed that any of these potential solutions were simply “not important”, showing the openness to all types of potential avenues to solve our energy and environmental issues.

The miljolare.no site also allows for interesting data comparison and analysis between and within the results. For example, one can break down some of the questionnaire results further to see the differences between girl and boy responses, as well as differences in regional responses. The gender differences are minimal (except for that boys hold more weight in the research solution to environmental problems than girls), but some of the regional differences are interesting, where the importance of renewable energy can be seen as much greater in some areas of the country than others.

3.3 Student Recommendation Results

In the “recommendations” section of the questionnaire, students were asked what they could do in their community to reduce energy consumption. There were a total of 206 recommendations received from 145 students from 18 different schools, equalling a 15.3% school response rate to this section. See Appendix C for the total list of recommendations received (in Norwegian).

The results from the students' recommendations show that a majority of students believe that the most important aspects to reduce energy consumption are basic domestic actions such as turning off lights and other electronic components when not in use, and reducing the use of some domestic items such as heating and water. But there were also other interesting suggestions, which are listed in order of popularity among the received responses:

1. Energy sources. Recommended the use of renewable energy sources such as solar energy, and some also recommended wind energy, and tidal energy as well.
2. Heating. Recommended alternative heating sources such as efficient heat pumps, central heating plants, or even individual wood stoves.
3. Transportation. Recommended biking, walking, and collective transportation over single passenger car use.
4. Consumerism. Recommended buying local products and producing less waste by recycling and buying used items.
5. Consciousness. Recommended simply being more environmentally conscious, and learning from others.
6. Construction. Recommended better insulation of new and existing buildings.
7. Habits. Many of the recommendations indicated a change of habits, most particularly that individuals should watch less TV.

Interestingly, the general consensus of the recommendations contradicts the general consensus of the questionnaire results. Where the questionnaire results point that technological research, economic incentives, and political regulations are the most important solutions, very few or none of these aspects are mentioned in the student recommendations. The student recommendations are mainly focused upon lifestyle/infrastructure changes and the importance of access to

information. These aspects were rated as the least important within the survey. This total contradiction of the questionnaire and recommendations results can be attributed to the following two points:

- When answering the questionnaire, the students selected answers which were mainstream, and seemed to be “the right answers”, possibly subconsciously treating the questionnaire as a school exam. But, the open-ended recommendations section led to the belief that there was no real “right answer”, leaving the students capable of submitting more true feelings and beliefs.
- The most likely explanation for this situation is that the questionnaire was referring to the national issues, while the recommendations specifically referred to local conditions. The students may be more willing to take a different approach in own community (lifestyle changes, etc.), than they would think is necessary at the national level (research, economics, and politics).

One item that did not contradict between the questionnaire and recommendations section was the importance of “environmental consciousness” – this point scored high in both sections. Again, possibly reiterating that students believe there is more to environmental change than simply changes to the system, that each individual themselves must also deeply believe in change enough to change their thinking patterns regarding their relationship to the environment and energy issues.

Some more outstanding and unique responses from the students were also discovered, these include:

A student from Porsgrunn high school recommends: *”We must get information about what can be done and which resources are most efficient to invest in. It is also important to get enough knowledge about what’s happening and exactly how one can better the situation by doing small things that lead to a habit.”*²

A student from Skien high school recommends: *”Think more about what we are using to get electricity and to use energy.”*³

Another student from Skien high school is thinking of future energy sources when he/she recommends *”We should rely on fusion and fission energy. At Ulefoss we have Thorium why not depend a little more on that? Then we can secure our energy future. Solar panels are risky because the benefits are little. Fusion is best, a clean and secure future and enough energy for electricity and warmth!”*⁴

² ”Vi må få informasjon om hva som kan gjøres og hvilke ressurser som lønner seg å investere i. Også viktig å få nok kunnskap om det som skjer og hvordan akkurat du kan hjelpe til å forbedre situasjonen ved å gjøre små ting som kan hjelpe til en vane.”

³ ”Tenke mer på hva vi tar i bruk for å få strøm og bruke energi.”

⁴ ”Vi må satse på fusjon og fisjon energi. På Ulefoss har vi Thorium, hvorfor ikke satse litt mer på dette? Da kan vi få en sikker energi framtiden. Solceller er for risikabelt pga. utbyttet er lite. Fusjon er best, en rein og sikker framtid og nok energi i form av strøm og varme!”

4 Discussion and Conclusion

The primary goal of the 2008 Research Campaign was to introduce Norwegian students to renewable energy sources, where solar energy was used as a hands-on interactive example. Although 99% of Norway's power comes from the clean renewable energy source of hydroelectric power, there are some negative impacts to local waterways and ecosystems from this energy source. This source is also susceptible to meteorological conditions, and climate change effects as well. It is therefore that students must be aware of other renewable energy resources that can be efficiently utilized in Norway.

The campaign produced interesting results which supports that the campaign goals were achieved. The results show that the participating students were able to produce efficient solar power that could be used at their school, and the students provided valuable reflections and recommendations based on the exercise. A summary of the main results are as follows:

- Students generated an average output of 4.7 W/m² with their test solar panels, and under perfect solar and time of day conditions, the students could obtain over 10 W/m² output, which is towards the maximum probable amount expected in Norway during the Fall season using the equipment supplied.
- Solar energy (with similar solar panels mounted just on the school roof) could generate an average of 2.5% of the schools total energy use, where it is certainly possible that schools in southern Norway which reduce their energy use and install commercial grade solar panels could potentially obtain 5-10% of their total energy budget from solar energy.
- Solar energy as an alternative energy source is more successful in southern Norway due to the increased average solar flux, and in the northern regions it could be viable during the summer months, but a large part of this period is when the students are on summer break, and the school has little or no energy demand.
- A majority of students believe that solar energy is a cost effective and clean energy source that should be used more in Norway. But interestingly 20% of the students that believe in this statement will not personally act upon this understanding by encouraging renewable energy use in their school
- A greater number of students believe that Norway is following a good climate policy, in comparison to last year's campaign. This could be an interesting trend which lends support to asking this question again in future campaigns.
- Students believe that technological research is the most promising solution for our energy and environmental problems, followed by economic and political solutions.
- The student recommendations target typical domestic energy use issues such as turning off lights, etc., with exceptional recommendations also within the sectors/areas of energy, heating, transportation, consumerism, consciousness, construction, and habits.
- The questionnaire results and recommendations contradict each other based on where the students see the most important solutions. This may

be due to the fact that students are willing to take different approaches at the local level in comparison to the national level.

The 2008 campaign can be seen as a successful effort for raising student's consciousness of renewable energy, which was a unique project to encourage student's own reflections upon sources of environmental solutions, and what can be done in their community. Future research campaigns should build upon the knowledge gained from this campaign, and widen the opportunities for deeper environmental education and research where necessary.

It is recommended that results from the campaign, and further data analysis be published in an appropriate professional journal and presented to the public. For further information, results, and analysis regarding the campaign, visit the following campaign websites (in Norwegian):

<http://www.miljolare.no/kampanjer/forskningsskampanjen//>

<http://www.miljolare.no/data/ut/by/ressurs/br34/>



Sandvollan skole in Inderøy

Appendix A
Student Data Form and Questionnaire

Data Form and Questionnaire

This form can be taken and used while you are working on the activity. When you are ready to record the information in the database, go to miljolare.no ([Registrer data](#))

Part 1 of this form is answered for each class. There is room for more than one measurement.

Part 2 is handed out and answered individually for each student.

PART 1

Date	
Length of the solar panel (cm)	
Width of the solar panel (cm)	

Measurement #	Time	Sun Condition (0-4)	Voltage measured in millivolt (mV)	Current measured in milliampere (mA)

Southern roof area of the school building (m²)	
Schools energy use (kWh per week)	

PART 2

A. Indicate your agreement with the following statements

Solar energy is cheaper than other energy sources.	Completely agree	Somewhat agree	Don't know	Somewhat disagree	Completely disagree
Increased renewable energy use will reduce pollution.	Completely agree	Somewhat agree	Don't know	Somewhat disagree	Completely disagree
Renewable energy resources (like solar energy) should be used more in Norway	Completely agree	Somewhat agree	Don't know	Somewhat disagree	Completely disagree
I will encourage my school to install solar panels and use other renewable energy sources	Completely agree	Somewhat agree	Don't know	Somewhat disagree	Completely disagree
Norway follows a good and sustainable climate policy	Completely agree	Somewhat agree	Don't know	Somewhat disagree	Completely disagree

B. Vårt nåværende energiforbruksmønster fører til en del miljøproblemer. Hvor viktige er de følgende virkemidlene når det gjelder å få gjort noe med disse problemene? (1 = ikke viktig, 5 = helt nødvendig, hvis du ikke har noen mening om dette svarer du "Vet ikke")

Norway should make laws that make it easier to initiate solar energy	1	2	3	4	5	Don't Know
Each individual should be better at being environmentally conscious, even though this could potentially be more expensive in the short-term	1	2	3	4	5	Don't Know
We must perform more research to develop the technology behind renewable resources such as it becomes cheaper and more effective.	1	2	3	4	5	Don't Know
We must have better financial support schemes to increase use of renewable energy sources	1	2	3	4	5	Don't Know
We must change our social norms, values, and lifestyles	1	2	3	4	5	Don't Know
We must be better at informing each other about the problems with use of fossil fuel energy sources	1	2	3	4	5	Don't Know
The topic of sustainable use of energy sources should be better implemented in the educational system	1	2	3	4	5	Don't Know
We should receive higher incomes such that we can afford to chose environmental friendly solutions which may not be the cheapest alternative	1	2	3	4	5	Don't Know

C. What can you do to reduce energy use in your community?

Appendix B

**Overview of Participating Schools and Data
Collected**

School	Municipality	Number of Measurements	Output (avg.) (W/m ²)	Output (max) (W/m ²)	Roof area (m ²)	Schools energy use (kWh)	Number of Questionnaires
<u>Kvamsøy skole</u>	Sande (Møre og Romsdal)	5	0.55	1.94	60		
<u>Jessheim videregående skole</u>	Ullensaker (Akershus)	7	38.11	232.39	2040	62949	4
<u>Heddal ungdomsskole</u>	Notodden (Telemark)	2	7.85	8.91	200	4000	
<u>Breidablikk skole</u>	Stange (Hedmark)	12	3.25	5.42	500	6560	
<u>Vestly skule</u>	Time (Rogaland)	3	5.68	6.49	120	7896	
<u>Knappskoq skule</u>	Fjell (Hordaland)	37	1.45	7.94	1640		
<u>Jareteigen Montessoriskole</u>	Tønsberg (Vestfold)	12	0.0012	0.0033	168	700	1
<u>Korgen sentralskole</u>	Hemnes (Nordland)	4	3.84	6.87	1809		13
<u>Sandvolla skole</u>	Inderøy (Nord-Trøndelag)	6	4.57	10.54	470	3764	
<u>Hamnvåg Montessoriskole</u>	Balsfjord (Troms)	4	2.47	4.66	345	580	4
<u>Brensholmen skole</u>	Tromsø (Troms)	4	2.69	6.79	2000	15000	2
<u>Odda Skule</u>	Lom (Oppland)	22	5.92	15.64	280	1710	
<u>Mindland Skole</u>	Alstahaug (Nordland)	3	2.52	4.71			3
<u>Sjøholt skule</u>	Ørskog (Møre og Romsdal)	4	1.71	2.02	2300	5194	
<u>Eksingedalen skule</u>	Vaksdal (Hordaland)	15	1.88	6.86	180	4064	
<u>Vartdal skule</u>	Ørsta (Møre og Romsdal)	9	9.68	33.69	341	6134	
<u>Brunla ungdomsskole</u>	Larvik (Vestfold)	10	6.99	14.77	4520	31068	
<u>Storevarden skole</u>	Sola (Rogaland)	7	5.79	11.33	950	58	
<u>Solvang skole i Gran</u>	Gran (Oppland)	15	7.15	18.34	598	9379	14
<u>Stonglandet skole</u>	Tranøy (Troms)	10	0.83	6.88	205	14813	
<u>Jørpeland ungdomsskole</u>	Strand (Rogaland)	4	2.97	3.67	3700	15000	
<u>Samkom skole</u>	Vennesla (Vest-Agder)	10	7.64	13.56	712	45000	
<u>Sund skole</u>	Karmøy (Rogaland)	1	0.0097	0.0097			
<u>Skarsvåg Skole</u>	Nordkapp (Finnmark)	5	5.65	6.73	846	2352	
<u>Trosvik skole</u>	Fredrikstad (Østfold)	14	1.42	3.41	2000	6100	
<u>Rugtvedt skole i Bamble</u>	Bamble (Telemark)	2	7.7E-7	1.5E-6	400		
<u>Frede Thorsheim</u>	Fjell (Hordaland)	4	8.32	14.42		700	
<u>Byremo barneskole</u>	Audnedal (Vest-Agder)	3	6.48	10.14	200	3500	
<u>Vestlofoten videregående skole avd. Gravdal</u>	Vestvågøy (Nordland)	1	1.07	1.07	2100	22500	

<u>Kongsvik Skole</u>	Tjeldsund (Nordland)	12	0.8	5.4			
<u>Fielltun skole</u>	Strand (Rogaland)	15	8.56	15.32	2323	5300	
<u>Svinndal skole</u>	Våler (Østfold)	11	9.3E-5	0.00097	590	8396	
<u>Tasta skole</u>	Stavanger (Rogaland)	5	3.35	10.55	1000	17000	
<u>Bø skule</u>	Drangedal (Telemark)	3	0.19	0.57	90		
<u>Ballstad skole</u>	Vestvågøy (Nordland)	3	2.97	6.58	650	16895	20
<u>Bodin videregående skole</u>	Bodø (Nordland)	2	3.44	6.86			
<u>Vevelstadåsen skole</u>	Ski (Akershus)	10	8.57	13.86	2100	3550	
<u>Skjelnan Skole</u>	Tromsø (Troms)	5	0.017	0.031	300	11600	
<u>Molvær skule</u>	Sula (Møre og Romsdal)	9	1.51	3.92	760		
<u>Solås skole</u>	Gjesdal (Rogaland)	6	2.62	3.08	1852	6000	
<u>Presterød ungdomsskole</u>	Tønsberg (Vestfold)	2	9.81	16.62	462	23598	44
<u>Farsund barne- og ungdomsskole</u>	Farsund (Vest-Agder)	8	9.17	13.36		32701	
<u>Roligheden skole</u>	Arendal (Aust-Agder)	6	8.49	17.45	1021	23	7
<u>Lovisenberg Skole</u>	Hamar (Hedmark)	4	0.96	2.49	280		
<u>Høyenhall Skole</u>	Oslo (Oslo)	2	3.13	3.18	5000	15000	
<u>Reipå Skole</u>	Meløy (Nordland)	10	0.015	0.072			
<u>Soma skole</u>	Sandnes (Rogaland)	7	1.34	2.25	245	100	
<u>Innvik skule</u>	Stryn (Sogn og Fjordane)	5	0.29	0.32	180		
<u>International School Telemark</u>	Porsgrunn (Telemark)	22	6.56	122.67	350		10
<u>St. Olav videregående skole</u>	Stavanger (Rogaland)	1	0.4	0.4	400	24000	22
<u>Nabbetorp Skole</u>	Fredrikstad (Østfold)	15	8.89	15.26	884	17236	
<u>Sanne Skole</u>	Gran (Oppland)	1	0.46	0.46	265	5150	12
<u>Kalvatræet skole</u>	Bergen (Hordaland)	15	0.13	0.46	192	4181	
<u>Lutvann skole</u>	Oslo (Oslo)	4	11.6	11.91	1270	11401	
<u>Borge skole</u>	Porsgrunn (Telemark)	14	8.34	11.85	1500		
<u>Skjervøy skole i Skjervøy</u>	Skjervøy (Troms)	7	7.26	12.87	243	7240	
<u>Byrknes skule</u>	Gulen (Sogn og Fjordane)	1	9.36	9.36			
<u>Kunes skole</u>	Lebesby (Finnmark)	3	9.66	9.76	148	990	
<u>Krohnengen Skole</u>	Bergen (Hordaland)	4	0.02	0.05	30		1
<u>Barhaug Skule</u>	Nord-Fron (Oppland)	5	0.45	0.7	200		
<u>Finnfjordbotn videregående skole</u>	Lenvik (Troms)	13	1.51	4.6	550		4
<u>Sandane skule</u>	Gloppen (Sogn og	4	2.91	10.68	735	2238	1

	Fjordane)							
<u>Espevær skule</u>	Bømlo (Hordaland)	1	0.85	0.85				3
<u>Eiksmarka skole</u>	Bærum (Akershus)	18	0.85	1.51	7547	69830		
<u>Hyllestad skule</u>	Hyllestad (Sogn og Fjordane)	5	1.96	2.42	340			
<u>Finnsnes ungdomsskole</u>	Lenvik (Troms)	14	0.29	0.74	4204			
<u>Sandesundsveien skole</u>	Sarpsborg (Østfold)	8	7.61	9.14				
<u>Lepsøy skule</u>	Haram (Møre og Romsdal)	3	3.42	9.08	338	1800		10
<u>Stadlandet skule</u>	Selje (Sogn og Fjordane)	5	2.97	4.97	380	4400		
<u>Vikstranda skole</u>	Tranøy (Troms)	10	0.2	0.37	262	10532		7
<u>Prestrud Skole</u>	Hamar (Hedmark)	5	0.42	1.12	832	40000		38
<u>Henningsvær skole</u>	Vågan (Nordland)	16	4.82	8.64	180			
<u>Steindal skole</u>	Trondheim (Sør-Trøndelag)	1	2.59	2.59	10085			
<u>Vestsiden skole</u>	Porsgrunn (Telemark)	22	2.55	6.38	432	18000		
<u>Sentrum skole</u>	Horten (Vestfold)	5	5.08	9.21	594			
<u>Åsenhagen skole</u>	Skedsmo (Akershus)	19	4.03	16.51	561			
<u>Tydal barne- og ungdomsskole</u>	Tydal (Sør-Trøndelag)	6	5.81	7.73	832	4500		15
<u>Strandebarm skule</u>	Kvam (Hordaland)	4	0.17	0.56				
<u>Brandengen skole</u>	Drammen (Buskerud)	1	2.7	2.7	80			
<u>Hønefoss videregående skole</u>	Ringerike (Buskerud)	9	6.24	10.78	1900	35500		
<u>Vingrom skole</u>	Lillehammer (Oppland)	5	7.76	10.66	2000	16000		13
<u>Dalgård skole - Trondheim kommune</u>	Trondheim (Sør-Trøndelag)	9	0.41	1.77	519	15800		
<u>Kragerø videregående skole</u>	Kragerø (Telemark)	4	15.34	17.48	90	16539		
<u>Skien videregående skole</u>	Skien (Telemark)	33	2.61	5.67	2761	12429		25
<u>Kjøkkelvik skole</u>	Bergen (Hordaland)	2	5.36	5.82	4500	23703		
<u>Mosterøy skole</u>	Rennesøy (Rogaland)	4	3.12	6.03	1600			
<u>Tangen videregående skole</u>	Kristiansand (Vest-Agder)	2	0.023	0.04	344			
<u>Bø skule</u>	Bø (Telemark)	17	8.25	29.93	4053	11487		
<u>Reinli skule</u>	Sør-Aurdal (Oppland)	10	1.48	2.25	245	2800		
<u>Valdres videregående skule</u>	Nord-Aurdal (Oppland)	5	2.49	7.79	2500	24000		
<u>Porsgrunn videregående skole</u>	Porsgrunn (Telemark)	4	14.7	18.05	2368	6211		28
<u>Markabygda Montessoriskole</u>	Levanger (Nord-	4	0.17	0.27	164			

	Trøndelag)						
<u>Hjellestad skole</u>	Bergen (Hordaland)	5	5.02	11.41	800	5445	
<u>Mokollen skole, Adventskirkens grunnskole i Sandefjord</u>	Sandefjord (Vestfold)	28	8.03	12.63	370		17
<u>Askøy videregående skole</u>	Askøy (Hordaland)	4	9.09	10.05	1500	6880	
<u>Rustad skole</u>	Ås (Akershus)	4	10.62	12.98	758		
<u>Vilberg Skole</u>	Østre Toten (Oppland)	6	3.09	6.92			
<u>Stangeland skole</u>	Sandnes (Rogaland)	6	0.014	0.064			20
<u>Ulsmåg skole</u>	Bergen (Hordaland)	1	7.74	7.74			
<u>Nes Barneskole</u>	Nes (Buskerud)	10	6.79	10.19	324	10360	
<u>Jærtun Lutherske Friskule</u>	Time (Rogaland)	5	4.81	9.87	936	2429	
<u>Skånland videregående skole</u>	Skånland (Troms)	4	13.91	18.03	200		
<u>Tranby Skole</u>	Lier (Buskerud)	6	1.47	4.15			
<u>Os skole</u>	Os (Hedmark)	5	9.18	14.54	500	13120	
<u>Kvaløysletta ungdomsskole</u>	Tromsø (Troms)	1	0.049	0.049			
<u>Ringve videregående skole</u>	Trondheim (Sør-Trøndelag)	6	6.36	11.13	400	46000	
<u>Brattvåg barneskule</u>	Haram (Møre og Romsdal)	7	3.06	8.17	473	6008	
<u>Åmot skule</u>	Vinje (Telemark)	5	3.16	3.79	1470	6000	
<u>Sønedeled skole</u>	Risør (Aust-Agder)	14	19.05	70.21	255	1177	
<u>Nordby ungdomsskole</u>	Ullensaker (Akershus)	2	0.09	0.18	367	7543	
<u>Lilleaker skole</u>	Oslo (Oslo)	3	3.05	3.2			
<u>Skeisvang videregående skole</u>	Haugesund (Rogaland)	20	3.93	6.47	965	15525	
<u>Krokemoa skole</u>	Sandefjord (Vestfold)	3	9.85	11.54	3476		
<u>Neset ungdomsskole</u>	Levanger (Nord-Trøndelag)	5	2.62	9.14	774		
<u>Medkila Skole</u>	Harstad (Troms)	4	0.94	1.65	580		
<u>Å ungdomsskole</u>	Lyngdal (Vest-Agder)	7	7.49	12.34	400		
<u>Ringshaug skole</u>	Tønsberg (Vestfold)	6	7.77	13.93	300	16250	
<u>Å Skole</u>	Meldal (Sør-Trøndelag)	3	2.78	2.83	108	4382	

Appendix C
Student Recommendations (in Norwegian)

School Name	School Type	Student ID	Municipality Name	Recommendation
Espevær skule	Grunnskole	752606	Hordaland	Slå av lyset når du ikkje er i rommet. Sjå mindre på TV.
Espevær skule	Grunnskole	752607	Hordaland	Skru av lysa på rom du ikkje er i. Fyra meir med olje og ved. Kjøpa varmepumpe
Espevær skule	Grunnskole	752608	Hordaland	Skru av lyset på rommet når du ikkje er i det
Finnfjordbotn vidaregåande skole	Videregående skole	751251	Troms	Mye er allerede gjort. Fjernvarme fra forbrenningsanlegget er installert på skolen. Kanskje utskifting av lyspærer til sparepærer. Eller bruk av vindenergi. I tillegg går det an å isolere bygninger bedre slik at mindre energi brukes til oppvarming.
Finnfjordbotn vidaregåande skole	Videregående skole	751254	Troms	Reduce use of electricity. 1. sykle til skolen eller benytte seg av bussen 2. bruke sparepærer 3. isolere bygningen
Finnfjordbotn vidaregåande skole	Videregående skole	751256	Troms	4. fyre med ved
Finnfjordbotn vidaregåande skole Hamnvåg Montessoriskole	Videregående skole Barneskole	751257 752300	Troms Troms	Isolere bygninger, installere varmepumper og sparepærer, sykle eller gå til skole, fritidsaktiviteter, venner og familie, evt. benytte seg av kollektivtransport, installere moderne vedovner, stille spørsmål til etablerte holdninger. vi kan spare strøm.
Hamnvåg Montessoriskole Hamnvåg Montessoriskole	Barneskole Barneskole	752303 752306	Troms Troms	man kan bruke solseller, vindmøller og vannmøller til og få strøm, d kalles fornybar energi vi kan spare strøm!
Hamnvåg Montessoriskole	Barneskole	752309	Troms	vi kan sortere søppel og ikke brenne plast eller søppel.
International School Telemark	Grunnskole	750588	Telemark	slå av lys, varme.
International School Telemark	Grunnskole	750590	Telemark	Resirkulere, Få seg "Nei takk til reklame" klistremerker, slutte å bruke fyringsolje, parafin og andre fossile brennstoffer, bruke mere fornybare energiresurser.
International School Telemark	Grunnskole	750591	Telemark	Resirkulere, Få seg "Nei takk til reklame" klistremerker, slutte å bruke fyringsolje, parafin og andre fossile brennstoffer, bruke mere fornybare energiresurser.
International School Telemark	Grunnskole	750596	Telemark	slå av lysene når vi går å leger oss vi kan begynne å produsere mere elektriske biler. og vi kan lage en stor solpanel på bilen for att den får strømm. jeg synes at vi må sykle til plasser som er nære oss. vi må utvikle teknologien i sykler for di forandrer aldri vi må lage sykler som er lettere å sykle på. det burde være lettere å få tak i solpanneler.
International School Telemark	Grunnskole	750597	Telemark	jeg synes at bussene må slutte å kjøre hver kvarter. di burde kjøre hvert halv time det slutter producsjonen på "Co2"
International School Telemark	Grunnskole	750599	Telemark	Vi kan begynne a bruke mer sol eller vannenergi med solcellepanel
Korgen sentralskole	Grunnskole	750730	Nordland	Jeg syns vi skal få flere vannkraft stasjoner.
Korgen sentralskole	Grunnskole	750737	Nordland	solseller
Korgen sentralskole	Grunnskole	750738	Nordland	veit ikke ?
Korgen sentralskole	Grunnskole	750742	Nordland	Vet ikke?
Korgen sentralskole	Grunnskole	750744	Nordland	Begynne og bruke mindre strøm ?
Korgen sentralskole	Grunnskole	750746	Nordland	

Korgen sentralskole	Grunnskole	750807	Nordland	ta og bruke solceller
Korgen sentralskole	Grunnskole	750828	Nordland	hakke peiling Ha mindre lys på. kjøre mindre bil, å sykkle og gå mer. dusje isteden får å bade. sortere søple rett. se minder på TV. ikke kjøre bil når man skal på besøk. slå av nesten all lysa når du skal ut.
Korgen sentralskole	Grunnskole	750860	Nordland	bruke spare lys.
Krohnengen Skole	Grunnskole	751136	Hordaland	Kan sku av lysene når de ikke trengs
Lepsøy skule	Grunnskole	752351	Møre og Romsdal	vi kann skru av masse lys og ikkje bruke så mykkkje data og TV
Lepsøy skule	Grunnskole	752352	Møre og Romsdal	Vi kan bruke solcellepanel å bølgekraft
Lepsøy skule	Grunnskole	752353	Møre og Romsdal	Sykkle mer og mindre kjøring av biler.
Lepsøy skule	Grunnskole	752355	Møre og Romsdal	Vi kan bruke solcellepanel å bølgekraft
Lepsøy skule	Grunnskole	752357	Møre og Romsdal	Vi kan bruke solcellepanel
Lepsøy skule	Grunnskole	752358	Møre og Romsdal	passer på at vi slår ta lyse etter oss
Lepsøy skule	Grunnskole	752359	Møre og Romsdal	Vi kan bruke solcellepanel,lese om det litt meir om det og feks finne opp noko kansje Vere meir ute, en inne å sjå på TV.
Lepsøy skule	Grunnskole	752360	Møre og Romsdal	hugse å skru av datamaskiner og lys etter bruk. Gå å sykle meir en å køyre.
Lepsøy skule	Grunnskole	752367	Møre og Romsdal	bruke mindre tid på tv ,sykle meir
Mindland Skole	Grunnskole	754770	Nordland	Bli flinkere til å slå av TV og PC når vi er ferdig.
Mindland Skole	Grunnskole	754771	Nordland	Slå av ting når vi har brukt dem.
Mokollen skole, Adventkirkens grunnskole i Sandefjord	Grunnskole	752154	Vestfold	Alt som sto på de siste oppgavene
Mokollen skole, Adventkirkens grunnskole i Sandefjord	Grunnskole	752155	Vestfold	Sykle og gå mere Sykle til skolen
Mokollen skole, Adventkirkens grunnskole i Sandefjord	Grunnskole	752156	Vestfold	Gjøre mer for hånd
Porsgrunn videregående skole	Videregående skole	752545	Telemark	Lage mer hybrid-bilder, stoppe unødvendig forurensing, som fks. man trenger ikke kjøre over alt, man kan gå/sykle.
Porsgrunn videregående skole	Videregående skole	752546	Telemark	Være mer bevisste. alle må ta buss.
Porsgrunn videregående skole	Videregående skole	752548	Telemark	sykle mer, jogge mer, gå mer...
Porsgrunn videregående skole	Videregående skole	752549	Telemark	ALLE! må ta buss. Da mener jeg ALLE! Ikke noe biler, bare busser og sykler. Bruke beina mer. Spare strøm. Bare ha te-lys i heimen. Ikke ha på noen lys eller ovner.
Porsgrunn videregående skole	Videregående skole	752551	Telemark	Alle kan ta felles transportmiddel (som buss) .. Sykle til kompis i steden for å kjøre bil/moped etc ..
Porsgrunn videregående skole	Videregående skole	752552	Telemark	Passe på å slå av lyset når vi går ut av et rom. Slå av pc'en, tv'en og annet elektronisk utstyr, når det ikke er i bruk.

Porsgrunn videregående skole	Videregående skole	752553	Telemark	Vi kan påvirke skolen til å bruke andre energi kilder. Enkelte små ting som å lufttørke håret, slå av rettetang osv..
Porsgrunn videregående skole	Videregående skole	752554	Telemark	Vi må få informasjon om hva som kan gjøres og hvilke ressurser som lønner seg å investere i. Også viktig å få nok kunnskap om det som skjer og hvordan akkurat du kan hjelpe til å forbedre situasjonen ved å gjøre små ting som kan hjelpe til en vane.
Porsgrunn videregående skole	Videregående skole	752555	Telemark	slå av lyset når du ikke bruker det.
Porsgrunn videregående skole	Videregående skole	752557	Telemark	slå av lyset etter deg.
Porsgrunn videregående skole	Videregående skole	752558	Telemark	oppfordre folk til å ta mer kollektive løsninger som buss og tog. sette ned prisen på dette, få flere avganger og flere holdeplasser, slik at alle kommer til en plass i nærheten av skole, jobb, sentrum o.l.
Porsgrunn videregående skole	Videregående skole	752559	Telemark	Gå isteden for of kjøre!
Porsgrunn videregående skole	Videregående skole	752560	Telemark	slå av lys når du ikke bruker det.
Porsgrunn videregående skole	Videregående skole	752561	Telemark	Sykle i steden for å ta bilen. Investere i en miljøvennlig bil. Reise mindre med fly. Bruke kollektiv transport. Ikke sende matvarer til utlandet for foredling men gjøre det i Norge.
Porsgrunn videregående skole	Videregående skole	752565	Telemark	bruke kollektiv transport. ikke ha på mer strøm enn nødvendig. resirkulasjon.
Porsgrunn videregående skole	Videregående skole	752566	Telemark	Spille WOW, kjøre mindre moped
Porsgrunn videregående skole	Videregående skole	752568	Telemark	skru av lyset når man forlater et rom. Ikke ha på unødvendig mye varme. Ta bussen til skolen, istede for å få foreldre til å kjøre. (evt. gå/sykle)
Porsgrunn videregående skole	Videregående skole	752569	Telemark	Ikke ha på unødvendig mye varme inne i huset (ha på ovner og sånt når du ikke absolutt trenger).Når man går ut av et rom, burde man skru av lyset. Folk burde også ta buss hvis det er alt for langt å gå, isteden for bil.
Porsgrunn videregående skole	Videregående skole	752570	Telemark	Skr av lysene når man forlater et for. Ikke ha på unødvendige mye varme eller skru av pc når man ikke bruker den. bruke mer buss, sykkel, tog eller trikk(viss mulighetene er der) til jobb, skole eller andre ting på fritiden.
Porsgrunn videregående skole	Videregående skole	752571	Telemark	Kollektiv transport Resirkulasjon
Porsgrunn videregående skole	Videregående skole	752572	Telemark	er ikke helt sikker
Porsgrunn videregående skole	Videregående skole	752573	Telemark	Slå av lyset etter seg etter man har vært inne i et rom i huset. skaffe seg varmepumpe, slå av varmekabler osv når det ikke er kaldt.
Porsgrunn videregående skole	Videregående skole	752575	Telemark	Demonstrasjoner og opprør
Porsgrunn videregående skole	Videregående skole	752577	Telemark	Bruke mer kollektiv transport og gåsykle mer når vi skal noe sted. Kjøre mindre bil. Kjøre
Prestrud Skole	Grunnskole	748884	Hedmark	mindre fly. Heller gå eller sykkle. Det er bedre og kjøre buss og tog, for da er det plass til fler i en bil, istedet for og kjøre mange biler. Og tog forurenser ikke for det går på elektrisitet. Ikke kaste søppel i naturen men i sllle søppeldunker.
Prestrud Skole	Grunnskole	748899	Hedmark	Vi kan få

				<p>slocellepaneler på taket som ligger i sør for skolen. Det er dyrt og kjøpe det, men det er dyrere og ha vanlig energi. Vanlig strøm er mye dyrere og da kan vi ha nok penger til å dra på skoleturer med klassa. F.eks. til budor for og gå eller stå på ski/snowboard :D</p> <p>vi kan sette opp sol</p>
Prestrud Skole	Grunnskole	748900	Hedmark	<p>celle paneler over hele sør siden av skolen! (: selv om det koster mye penger men til slutt vil skolen spare på det. For vanlig strøm koster mer penger. Og da kan vi dra på skole turer hvis vi setter opp sol celle panel på hele sør siden og vi kan kan sette opp flere sol celle paneler på skolen</p> <p>Vikan ha solselle panel</p>
Prestrud Skole	Grunnskole	748946	Hedmark	<p>på taket, og bruke det til lys.Og vi kan ha sonne greier som fanger opp regn vann og renser det godt, så vi kan ha det i vannkrana på skolen. Det burde bli dyrere strøm regninger og myyye billigere solcelle panel så har det på taket så det blir lys på den måten. Mye billigere.</p>
Roligheden skole	Grunnskole	751259	Aust-Agder	Bruke mindre co2!:)Vi må også prøve å ta mere buss og sykkel.
Roligheden skole	Grunnskole	751263	Aust-Agder	elbiler, solcellepanel for lys i klasserommet :)
Roligheden skole	Grunnskole	751264	Aust-Agder	ikke spille så mye eller se på TV
Roligheden skole	Grunnskole	751389	Aust-Agder	vi kan bare skøre mindre biler og heller buss!!
Roligheden skole	Grunnskole	751398	Aust-Agder	vi kan bare sykle og gå får da bruker vi mindre co2
				ikke bruke mye strøm, mye vannenergi.
				Vi må slutte og kjøpe så mye og i steden får å bruke pengene dine på nyttige ting.
Roligheden skole	Grunnskole	751518	Aust-Agder	Og når vi vil kjøpe ting hele tiden så er det folk såm bare kaster søppel rundt om kring.
Roligheden skole	Grunnskole	751522	Aust-Agder	bruke spare dusj og sparepære.sykle eller gå til skolen.brake solsellepanel.
				Køyre mindre.
Sandane skule	Barneskole	752574	Sogn og Fjordane	Mindre luksus - senke temperatur, kortare feriereiser, mindre unødig belysning.
Skien videregående skole	Videregående skole	752320	Telemark	Bruke sola som energikilde og bli flinkere til å spare strøm
Skien videregående skole	Videregående skole	752322	Telemark	Vi kan få oss solcellepanel på hytta og kanskje i hjemmet. Tenke mer på hva vi tar i bruk for å få strøm og bruke energi.
Skien videregående skole	Videregående skole	752323	Telemark	Forbud mot elektriske tannbørster
Skien videregående skole	Videregående skole	752324	Telemark	Ta buss istedenfor at hver enkel kjører sin egen bil.
Skien videregående skole	Videregående skole	752325	Telemark	Vi bør pusse opp store bygninger, f.eks. skolen slik at de holder bedre på varmen/ temperaturen. Vi bør også ha solcellepanel som hoved-energikilde.
Skien videregående skole	Videregående skole	752326	Telemark	Slå av lyset når vi går ut av et rom.
Skien videregående skole	Videregående skole	752328	Telemark	skru av varmen om sommeren. Ha mulighet til å åpne vinduene mer enn en liten glippe øverst.
Skien videregående skole	Videregående skole	752329	Telemark	Vi kan skru av varmen om sommeren, huske å slå av lysene i rommene vi ikke er i og ikke sløse med energien.

Skien videregående skole	Videregående skole	752331	Telemark	Vi må satse på fusjon og fisjon energi. På ulefoss har vi Thorium, hvorfor ikke satse litt mer på dette? Da kan vi få en sikker energi framtiden. Solceller er for risikabelt pga. utbyttet er lite. Fusjon er best, en rein og sikker framtid og nok energi i form av strøm og varme!
Skien videregående skole	Videregående skole	752332	Telemark	bruk sykkel, ikke bil, forbedre togene og tognettverket slik at folk benytter tog istedet for buss, bruke mindre strøm i husholdning og arbeid.
Skien videregående skole	Videregående skole	752730	Telemark	Slå av elektriske aparater o.l. når de ikke er i bruk eller jeg ikke er i rommet over lengre tid. Slå av kjøretøy på tomgang, gå oftere, bruke (DET DÅRLIGE!) kollektiv trafikktilbudet mer.
Skien videregående skole	Videregående skole	752732	Telemark	Jeg bor på gård så det er litt vanskelig å kutte ned på mye av energiforbruket. Men selvfølgelig, kan bli flinkere til å spare på energi ved å skru av lys og andre ting som bruker energi
Skien videregående skole	Videregående skole	752750	Telemark	Kjøpe bruktklær, kildesortere, kjøpe lokalt dyrket mat, redusere opplag av papir, instalere tidsbrytere på ovner og lys. Bruke sparepærer i flere offentlige bygg, støtte opp kollektivtraffiken, bevist gjøre våre medborgere.
Skien videregående skole	Videregående skole	752757	Telemark	Bruke flere sparepærer og slå av lyset når du ikke er i rommet.
Skien videregående skole	Videregående skole	752759	Telemark	Ta mer buss, sortere søppel, ikke ta imot poser i butikker, ikke kjøpe flaskevann, kjøpe ting med mindre emballasje, unngå å kjøre i rush
Skien videregående skole	Videregående skole	753753	Telemark	kollektiv trafikk, kjøre med naboer eller ta beina. sparedusj, felles måltider, kildesortering, sparepærer, varmepumpe, slå av elektriske apparater hvis de ikke er i bruk. store flatskjermer tar mer energi enn de gamle, og derfor lønner det seg å se på mørke filmerr enn de lyse.
Skien videregående skole	Videregående skole	753847	Telemark	Bruke sparepærer, fyre med ved/pelets isteden for strøm, Skru av lys i rom en ikke er, la bilen stå, prøve å sykkle og gå mer
Skien videregående skole	Videregående skole	753927	Telemark	Jeg kan bli mer miljøbevisst!! Snakke sammen - forsøke
Solvang skole i Gran	Barneskole	749371	Oppland	å påvirke hverandre til å endre holdninger. Skape trender som er positive for miljøet. Informasjonskampanjer må settes igang - det er mulig - tenk på røykestoppkampanjen - mange har sluttet å røyke. Det må gå an å påvirke til å ta bedre vare på klima vårt !
Solvang skole i Gran	Barneskole	751228	Oppland	bruke handlenett og ikke poser, sykle til treninger eller forskjellige fritidsaktiviteter. Slå av lys i rom, når du ikke er der
Solvang skole i Gran	Barneskole	751229	Oppland	Vi kan sykle og gå til jobb, skole og fritidsaktiviteter. Bruke handlenett, slå av lys i rom du ikke er i ,
Solvang skole i Gran	Barneskole	751237	Oppland	vi må kjøpe litt mindre.
Solvang skole i Gran	Barneskole	751238	Oppland	Bruke handlenett og ikke plastposer. og tenke litt mer over hva vi kjøper. kjøre mindre bil. GÅ! bruke fornybare ressurser.
Solvang skole i Gran	Barneskole	751242	Oppland	Prøve å gå så mye som mulig, og ikke kjøpe det jeg ikke trenger.
Solvang skole i Gran	Barneskole	751243	Oppland	Sette på solcellepanel på taket på skolen ;-)
Solvang skole i Gran	Barneskole	751244	Oppland	vi kan kjøre mindre gå mer til skolen og alt det der
Solvang skole i Gran	Barneskole	751245	Oppland	Må kjøpe mindre plast og sånn, ting vi ikke bruker.. Gå eller sykle til skolen og til jobben. Gi bort f.eks klær til andre som har bruk for det, og ikke bare kaste det..

Solvang skole i Gran	Barneskole	751246	Oppland	Gå/sykle til jobben eller skolen. Ikke bruke plastikkposer. Bruke heller en pose flere ganger.
Solvang skole i Gran	Barneskole	751249	Oppland	slukke slysen når man går ut av et rom. bruke solcelle energi. sortere søppel så vi kan resirkulere søppelet
Solvang skole i Gran	Barneskole	751250	Oppland	gå til skolen mere.. kjøre sammen. få andre til å kjøre mindre bil. Se mindre på tv Skru av lys
Stangeland skole	Barneskole	754869	Rogaland	Bruke klær i to dager slik at vi ikke trenger å bruke vaskemaskinen så ofte. Sykle istede for å kjøre
Stangeland skole	Barneskole	754870	Rogaland	Ikke la bilen stå på tomgang selv om det er kaldt. Skru av lys Dusje mindre Bruke mer klær
Stangeland skole	Barneskole	754871	Rogaland	Sykle til jobben Spille fotball i hagen. Sykle
Stangeland skole	Barneskole	754872	Rogaland	Jogge Skru av lys når vi går ut rom Dusje mindre Skru tven helt av.
Stangeland skole	Barneskole	754873	Rogaland	Gå turer istedet for å se tv Ikke bruke mye lys Bruke mindre pc
Stangeland skole	Barneskole	754874	Rogaland	Sykle mer Gå dit man skal
Stangeland skole	Barneskole	754875	Rogaland	Huske å slukke lys etter man har vært på et rom.
Stangeland skole	Barneskole	754876	Rogaland	Vi kan begynne å ta av lyset. Vi må bruke mindre tid i dusjen. Vi må begynne å sykle. Se mindre på tv. Kjøpte mindre klær.
Stangeland skole	Barneskole	754877	Rogaland	Skru av lys når vi går. Kjøre mindre. Dusje med mindre vann. Se mindre på tv. Spille mindre data.
Stangeland skole	Barneskole	754878	Rogaland	Sykle i stedet for å kjøre. Dusje litt mindre. Slukke lys
Stangeland skole	Barneskole	754880	Rogaland	Skru av tv, data og lys. Kjøre. Sykle Ikke dusje så mye Ta av lyset
Stangeland skole	Barneskole	754881	Rogaland	Ikke se så mye på tv.
Stangeland skole	Barneskole	754884	Rogaland	Ikke se så mye på tv. Ha det kaldere i rommene. Ikke ha på lys. Heller bruke lommelykt. Sykle i stedet for å bli kjørt.
Stangeland skole	Barneskole	754886	Rogaland	Slå av elektriske ting.
Stangeland skole	Barneskole	754889	Rogaland	Skru av alle elektroniske artikler.
Stangeland skole	Barneskole	754890	Rogaland	Ikke se så mye på tv. Skru av lys i tomme rom. Dusje mindre enn 2 min. Skru av lyset når jeg går ut av rommet
Stangeland skole	Barneskole	754891	Rogaland	Se mindre tv
Stangeland skole	Barneskole	754892	Rogaland	Bade mindre
Stangeland skole	Barneskole	754893	Rogaland	Slå av lys og sykle mer.
Stangeland skole	Barneskole	754894	Rogaland	Mindre vaskemaskin, tv og lys.
Vikstranda skole	Grunnskole	752578	Troms	Vi kan bruke noe av den vann og vind energien vi har her i Vangsvik til noe fornuftig. Vangsvik er et ganske så passende sted for å produsere vannkraft, pga. at terrenget her er gaske bratt + at vi har en god del med vann tilgjengelig.

Vikstranda skole	Grunnskole	752579	Troms	Vi kan gjennvinne varmen vi bruker til å varme opp husene med. Vi bør i tillegg bruke mer vedfyring for de som har muligheten for det.
Vikstranda skole	Grunnskole	752580	Troms	tenke på hva vi gjør og om det er nødvendig og bruke så mye strøm.
Vikstranda skole	Grunnskole	752581	Troms	Solcellepanel , slukke lysene når vi ikke er i rommet, slå av datamaskinene , ta ut laddere som ikke er i bruk , pante flasker, sortere søppel ; D vi kan få penger til og kjøpe vindmøller eller solcelle panel.
Vikstranda skole	Grunnskole	752582	Troms	ka få alle til og huske og slå av alle lys og TVen og data og spillemaskiner får det kan ta en god del strøm go ta ut ledninger med krokodille klemme på.
Vikstranda skole	Grunnskole	752583	Troms	Vi kan bruke noe av den vann og vind energien vi har til noe effektivt.
Vikstranda skole	Grunnskole	752584	Troms	ikkje brende så mye ved ,og ikke kje så mye bil heller ta buss mere.
Vingrom skole	Barneskole	754483	Oppland	bruke ting såm lager ny energi!
Vingrom skole	Barneskole	754484	Oppland	VET IKKE
Vingrom skole	Barneskole	754485	Oppland	begynne og sykle eller gå.
Vingrom skole	Barneskole	754486	Oppland	Begynne å gå eller å sykle
Vingrom skole	Barneskole	754486	Oppland	kjøre mindre bil,buss. Reise kollektivt. (buss, drosje.) Kjøre mindre.
Vingrom skole	Barneskole	754488	Oppland	...
Vingrom skole	Barneskole	754489	Oppland	VET IKKE kjøre mindre bil. kjøre buss isteden for bil.
Vingrom skole	Barneskole	754491	Oppland	bølge kraft. kjøre mindre bil. kjøre buss istedenfor buss.
Vingrom skole	Barneskole	754492	Oppland	bølge kraft.
Vingrom skole	Barneskole	754493	Oppland	Vi kan slutte og kjøre så masse bil og annet kjøretøy. Vi kan heller sykle eller gå. Det er noe vi kan gjøre for å redusere energiforbruket i mitt nærmiljø. Kjøre mindre bil Mere buss!!!!!! Bølgekraft
Vingrom skole	Barneskole	754494	Oppland	Solsellepanel
Vingrom skole	Barneskole	754495	Oppland	Vi kan slutte og kjøre så masse bil og annet kjøretøy. Vi kan heller sykle eller gå. Det er noe vi kan gjøre for å redusere energiforbruket i mitt nærmiljø.

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