

Assistance to schools in war affected areas in Donetsk and Luhansk regions

Content:

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1. Introduction
 2. Activities implemented
 3. Benefits of the project
 4. Schools in need of energy efficiency assistance
 5. Experience from the pilot projects (Lessons learned)
 6. Implementation methodology
 7. Next step
- Attachment: Technical solutions developed and used in the pilot projects

1. Introduction

Since 2014 Naturvernforbundet and the Ukrainian foundation Global Synergy have assisted schools in the government-controlled areas in Donetsk and Luhansk regions of Ukraine. We have contributed with repairs of damages, development of good indoor climate for the students and improvement of energy efficiency. Insulation, installation of new doors and windows, renovation of heating and ventilation systems and up-to-date lighting system was implemented in 43 schools. In addition to this, more than one hundred schools received trainings and materials needed to start renovation and improve energy efficiency. This became possible due to financial support from Norwegian Ministry of Foreign Affairs, and by active collaboration with other donors like Save the children, NRC, Caritas and coordination of activities with UN Educational Cluster in Ukraine.



In a difficult situation with many schools and local communities affected from the war activities in the eastern Ukraine, the simple low cost energy efficiency measures that have been developed over time within the project activities of Naturvernforbundet in the EECCA-region has proved to be particularly useful in assisting the schools and local communities with fast, accessible and low cost measures to improve their situation.

The military conflict in Eastern Ukraine has directly affected lives of over 4 million people and leads to severe damages of social infrastructure. Overall, 20% of power supply infrastructure were destroyed, 35% of transport system, around 200 bridges, and over 20 000 residential houses were damaged. In Luhansk oblast alone, during the active period of conflict 112 schools, 94 health institutions and 170 water supply facilities were damaged. In Donetsk oblast, the estimated value of infrastructural damage is at least \$1.5 billion. The government has set up restoration plans, with intentions to rebuild the regions' infrastructure and restore adequate living conditions. At the same time, the government of Ukraine implements long-term programs to increase energy efficiency of buildings and reduce Ukraine's dependence of natural gas consumption. Becoming more energy efficient and bringing energy and resources consumption to European levels has been set as one of priorities of the government.

We have used our experience to assist communities along the "contact" line defined by the Minsk agreement to repair damages, and to develop good indoor climate for the students in a cost and energy efficient manner. This has a large impact on local communities and help to decrease social tensions in the settlements affected by military conflict along the contact line. The project activities help to keep the schools in operation and adapted to the specific needs of communities living along the "contact" line in Donetsk and Luhansk regions. Practical trainings for school staff, representatives of local authorities, entrepreneurs and activists from local communities were conducted in pilot regions. This made it possible for schools to take active part in implementation of low-cost measures for energy efficient renovation.

Schools and local communities still needs assistance and support. According to local authorities and school representatives, the main problem they face right now are: lack of local strategies, knowledge and experience regarding available and low cost energy measures to reduce consumption and increase efficiency and comfort, which is particularly critical in conflict region where also social infrastructure is largely damaged. The absence of clear practical examples of how to conduct necessary repair and maintenance of public buildings in and efficient and sustainable manner lead to inefficient decision making and poor project implementation where resources are available.

2. Activities implemented

So far we have implemented a wide number of activities to reach the target groups and create sustainable environment for future changes:

- A. Establishment of cooperation with local authorities and key stakeholders in the districts of Donetsk and Luhansk regions. Twelve meetings and workshops has been conducted. In addition, we have established cooperation with local NRC and NEFCO projects and with the CIMIC department in Stanytsia-Luhanska district.
- B. Evaluation and further development of different kinds of low-cost EE measures for internal insulation, roof and floors renovations, acquirement of materials and resources needed for efficient repairing damages.
- C. During the current project period, we substituted more than 1400 old type lamp bulbs with 1100 new EE luminescent luminaries. By this, we reduced the energy consumption by 50 %. With this measure, we also

improved the educational conditions for more than 1500 pupils, as the lighting level in the classrooms increased up to 500 lux on the desk, instead of 60-90 lux they have before.

- D. We have repaired, insulated, sealed and improved of 1841,1 m of windows frame, installed 26 new windows to replace windows destroyed by blasting, re-glassed 579,2 m² of windows, repaired of 725,5 m² of damaged roofs and insulated of 2510 m² of attic floor, installed 16 new doors to replace doors destroyed by blasting, we have conducted internal insulation of 541 m² of walls and 448 m² of floors.
- E. We have installed 18 infrared heating panels for emergency heating of 2 classrooms in school #4 and 32 panels for restitution of damaged heating system in 4 classrooms in school #1 of Krasnohorivka city of Donetsk region.
- F. We have ensured switching heating boiler from coal to biomass in pilot schools in Hranitne (Donetsk region) – 300 kW and Novoivanivka (Luhansk region) – 100kW, to demonstrate possibilities of substitution of fossil fuel by renewable source of energy. We expect that this leads to the substitution of more than 350 tons of coal per year.
- G. Among other main achievements is demonstration of possibilities to solve problems with ventilation in an economic and energy efficient way. Ventilation is a major problem in Ukrainian schools. It is common that the CO₂ level in classrooms is more than 2000-ppm m³, which is at least twice as much as recommended. Often this happens after old windows are substituted by new energy efficient windows, and after external insulation of schools like in school in Novoivanivka village where the level of CO₂ raised up to 5200 ppm m³ after energy efficiency measures were implemented. We have used local energy recovery systems for ventilation in individual rooms to demonstrate that even without big budgets it is possible to improve indoor microclimate and save energy.



H. We have conducted practical training for representatives of schools, local authorities and NGOs to raise awareness about low-cost effective methods for recovery of damaged school buildings, including organization and control of work. We provided all participants with training materials and kits for windows insulation and door sealing, and reimbursed transport expenses for school representatives. This training sessions reached out to 192 educational institutions from Donetsk and Luhansk regions (more the 1% of all schools in Ukraine), in addition to representatives of local authorities and local business, and project staff from partner organizations like Nordic Refugee Council, Caritas and CIMIC. Moreover, we conducted on-site trainings for staff from all pilot schools in Luhansk and Donetsk regions.

The trainings covered the following topics:

- low-cost energy efficient measures for renovation of damaged school buildings;
- recommendations on choice and control of commodities and services in school renovation;
- renovation and insulation of doors and windows;
- low-cost energy efficient renovation of lighting systems.

I. We involved other international programs like NRC, Save the Children, and NEFCO in our project activities. Save the Children International provided additional donations to the project in form of insulation and building materials, with a value of 89 000 USD. This helped us to increase the amount of beneficiary schools where we provide direct and indirect support to increase EE of school buildings and repair damages. These materials were distributed among 47 educational institutions in Luhansk and Donetsk regions, including the pilot schools and kindergartens. The project has also received substantial co-financing from local authorities (see subchapter 3).

J. We have conducted 9 practical training sessions for local building companies and artisans in Luhansk and Donetsk regions, which works as sub-contractors in the implementation of building improvements.

K. We have also promoted the SPARE educational activities in the schools involved in energy efficiency improvements.

L. All involved schools have been given practical trainings and informational support for further improvement of indoor microclimate and energy efficiency of school buildings.

Project photos and news in English: <https://www.facebook.com/GlobalSynergyFoundation?ref=hl>

3. Benefits of project

We have implemented our project activities along the contact line, where most donors have limited activities. Activities taking place is mostly limited to supplying the foods, medicines, coals and wood for the habitants or educational kits for children. Our project activities aimed at improvements in critical social infrastructure like schools and kindergartens, has helped to create a sustainable base for further development of communities. The trainings and capacity building of activists in local communities helps them to meet challenges and facilitate to develop a measure to prevent further degradation of social infrastructure and an alleviation of human suffering.

We provide consultations for school administrations to help them choose right decision. Often the first request from the schools is to change old wooden windows with new windows of metal and plastic. Repairs and sealing of wooden windows are low-cost alternatives to installation of new and expensive windows. The money saved we suggest to use for measures improving of the energy efficiency and the indoor microclimate in classrooms: Internal insulation of classrooms, lighting system renovation and/or installation of ventilation with heat recovery in the classrooms.

As a part of the project implementation we have trained local entrepreneurs, internally displaced persons or representatives of local SBOs to establish local human resources for further project development after the ending of grant support. Participants were thoroughly trained in implementation of modern, low-cost insulation techniques and reconstruction of different elements of school buildings.

As our experiences shows, local authorities are ready to co-fund the repair works using their ordinary budget, when the solutions, materials and competent artisans be available. This is what happened, for instance, when Save the Children International donated building material for school insulation and repair to our project. It enabled us – in addition to our project planned activities - to obtain co-funding from the local authorities and other donors and thus distribute to schools over 8850 m² of wool insulation, 5000 m² of insulation penobord, 3540 m² of OSB sheets, 1593 m² of Thermal Curtain Fabric, 26550 m of timber batten for framing and for wall insulation. Thus, in Dobropilia, local authorities have provided over UAH 400 000, in Sloviansk region – UAH 70 000, in Stanychno-Luhansk region – around UAH 200 000. Schools in Lyman and Myronivske have obtained co-funding from UNDP and private foundations to insulate windows with building materials which we provided to these schools. It is advisable to continue this practice. This will have a considerable influence on decision-making of local authorities and will enhance the responsibility of school management towards use of finances and planning of projects in energy efficiency.

4. Schools in need of energy efficiency assistance

In most of the schools the main part of severe damages after armed conflicts were renovated with support from the state budget. But a lot of other issues are still not resolved and local communities need assistance. It is still a big need for improvement of the conditions for the pupils as well as energy efficiency measures like insulation of doors, windows and roofs together with renovation of the lighting systems. Another important issue is switching the heating system from gas to other sources.

Experience shows that schools by themselves are not able to address these questions. They lack practical experience and trained workers. There is no tradition for monitoring and following state sanitary norms for the working conditions of students. Cold classrooms, lack of ventilation and bad light quality give a significantly negative impact of the school performances by the students. With a lack of awareness and competence in these fields, the problems are not addressed even when funding is available. Most schools are not in the position to evaluate their conditions compared to norms, and do what is necessary to get access to and use efficient technology to improve their situation.

To mitigate these barriers, we have conducted practical training sessions for representatives of schools in affected regions, which were combined with the implementation of pilot projects in selected schools. This was done after field visits in collaboration with regional and local authorities local departments of education, which have identified schools with highest needs, such as schools in Toretsk and villages around it, Troitske, Novoivanivka and Nizhne villages in Popasna districts and several schools and kindergarten in Stanicchno, Luhansk region; Krasnohorivka city and Hranitne village.

Another challenge for local communities is reduction in the budgets for renovation for schools which are not damaged. This leads to tension in the local communities. We therefore also included in our training session all schools interested and in need of simple measures to improve learning environment and energy efficiency in their buildings. To enhance the mastery of practical skills, which were presented to schools during training sessions, we provided participants with insulation material for them to independently insulate and repair their school. This has an especially strong positive effect on the consequent participation of schools in the project. The activities have encouraged parents and volunteers from local communities to participate directly in school restoration.

5. Experience from the pilot projects (Lessons learned)

Our experience and observations from use of communal and state budget funding for school renovation projects, shows that access to funding is not necessary the main barrier for improving the conditions in school buildings in war affected communities.

The most important barriers are:

- Low level of awareness in the local administrations and schools about energy efficiency, indoor climate quality and they relations;
- Lack of practice in developing and implementing of operational and maintenance plans of school buildings,
- Manipulations with Public Bidding and Contracting, lack and low quality of internal rules and norms for public procurement of efficient and safe EE equipment and solutions, habit of hiring inexperienced and untrained entrepreneurs or companies,
- Lack of practice or inability to choose adequate solutions for current needs and to control quality of work,
- Lack of internal culture and responsibility in business environment regarding the quality of work and of commodities that they supply to schools, kindergartens, and other social institutions.

It is possible to create and improve awareness and good practice in local communities and business environment to increase energy efficiency of public buildings by awareness raising and special training for key stakeholders about norms, regulations, and good practice in resilience of social infrastructure in affected by war communities along the contact line in Donetsk and Luhansk regions.



6. Implementation methodology

Three different but complementary approaches, have been used to achieve the project goals:

- Pilot demonstration projects;
- Capacity building and awareness raising of representatives of schools, local administrations and NGOs on how to implement low cost measures to improve their energy efficiency and indoor climate in

schools;

- Introduction of new technologies and training of local business, entrepreneurs and artisans to use them.

As a part of the project implementation we have trained local entrepreneurs and artisans to assist them in adaptation to the new conditions of work in the regions with affected infrastructure in new cities and introduce them to new income possibilities. To create a sustainable business environment and possibilities for schools, the trained personnel and experts have been involved in transfer of knowledges and skills to the schools and school administration.

Collaboration with regional and national authorities for dissemination of the best practice and solutions for resilience of vulnerable communities in sustainable manner. This is made by:

- join meetings and field visits,
- practical training session for key stakeholders and local decision makers,
- capacity buildings of local CBOs.

The participants showed a clear interest in demonstrated possibilities of low-cost damage restoration in schools. A part of schools that were represented during the training still were damaged from artillery shelling and fire; they remained in dire need of assistance with restoration.

During our on-site visits, to promote changes in behavior, staff, we developed a practice with joint inspections of school buildings together with school staff and representatives of local authorities.

7. Next step

Our approach has proven to be effective, and we received positive feedback from local communities and regional authorities. It is an acute need for transfers of practical knowledge and skills through capacity building and demonstrational pilot projects. We received requests from local authorities and schools from different region to make program are wider and to continue our activities. There is an acute need for practical knowledge and skills. We have seen the positive impact of our pilot projects implementation on local authorities and school management. Moreover, we can conclude that the demand for knowledge and good management practice has increased compared to previous years. To meet the needs of local communities in affected by conflict areas, we need to, in addition to school and kindergartens, include other important public buildings like health stations, libraries and public halls. The main goal for the next period: to demonstrate for local communities along the contact line and officials, possibilities to maintenance the energy related services like heating, lighting and other energy related services on appropriate level by a simple low-cost energy efficiency measures. This is critically important for the affected communities along the contact line in the situation of the limited resources and partial isolation of local communities due to special security measures in the zone of the Antiterrorist operation.

Attachment:

Technical solutions developed and used in pilot projects

- Window and door restoration

Apart from the problem related to broken glass, there is also an issue of weatherproofing and insulation of windows and doors. Most schools have wooden windows used for over 20 years. Such windows, even after re-glassing, do not provide appropriate conditions in classrooms. Many older windows allow big infiltration of cold air and become the main heat loss. This can be solved with weather-stripping of the old windows. We have strict rules for our subcontractors or local activists who helps us to renovate windows. All windows must not be permanently closed. Opening of windows is essential for good ventilation during occupied hours. Many schools have single glazed windows and we help them to install a second layer of glass to increase energy saving and comfort. Repairs and sealing are low cost alternatives to installation of new expensive PVC windows. We already have experience of working with special slot insulation strips for wood and PVC windows frames. After several expert consultations and practical experiments, we found new solutions which enable us to renovate windows in any condition using materials and tools easily accessible on the market. The solution - in addition to slot insulation, wood frame renovation, and glass replacement - includes installation of a special energy saving film. In case of cracks between a window and its frame, draught-proofing strips used for reducing heating losses and increasing comfort. The same approaches we use for old damaged doors. This method for quick windows and doors restoration allows schools to keep heat inside and increase the temperature in classrooms in a quick and cheap way. After this they can wait until local authorities get the possibility to install new windows and doors.

Installation of new windows	Alternative method for low-cost renovation of windows in any conditions
250-300 EUR per window, including installations	15-20 EUR per window
Made only by special trained personnel	Need trained personnel
Need special equipment for installation	Need simple equipment, easily available on local market
	Need PE insulation strips, special insulation films and ordinary materials for wood workshop

Operations:

- Remove old window
- Prepare place for new window
- Install window
- Weatherproof and insulate (need a kit with a special insulations strips and foams)
- Restore and paint wall around the window frame etc

Operations:

- If possible, take out windows in bad condition. Remove old paint, debris from window frame
- Renovate the window frame if necessary with wood filler
- Weatherproof the window glass with hermetic silicon and new molding fillet
- Paint the windows frame
- Weatherproof the gap in the window frame with PE strip and wood filler.
- Choose 2 ventilator windows for classroom and weatherproof it with self-adhesive strip or with slot insulation strip if possible.
- Install the renovated window back in place
- Add a special window insulating film for improvement of the weatherproofing and to increase the energy efficiency of the glass.



Light system renovation

Light is another important issue for schools. Most schools still use ordinary incandescent lamps. This results in high energy consumption, yet there is still not enough light for the students to study in proper learning conditions. Nearly 30% of schools have luminescent tubes, but equipped with old electromagnetic ballast (which is banned in the EU countries) because it generates disturbing noise and the flickering effect. Most classes are not equipped with lighting for school boards.

The traditional way for renovating lighting system is installations new luminaries in the roof from famous brands such as Philips and Osram. This is a good, but far too expensive to be realized in most schools.

Installation of state of the art luminescent lighting system for one classroom can cost from 1100 to 2000 EUR. Even if schools use local brand fixtures with electronic ballasts the cost of one classroom will not be less than 700-900 EUR per classroom with installation. Another important issue is that subcontractors often do not have experience with proper design and installation of lighting system in schools. The light condition has big impact on the work conditions in the classrooms. Students get quickly tired and lose concentration if the light is not within certain level and quality. There are clearly defined norms for light system in class rooms, but neither schools nor local companies pay attention to them. The result is To create a sustainable business environment and possibilities for schools, we have trained personnel and experts and involved them in transfer of knowledges and skills to the schools.

Traditional renovation of the lighting system	Low cost renovation of the lighting system	Low cost renovation of old luminescent luminaries
<p>Materials and installation cost are from 1100 up to 2000 EUR per classroom:</p> <ul style="list-style-type: none"> - 8-10 luminaries – 160-190 EUR for one; - 2 asymmetrical luminaries for school board: 220-250 EUR per unit; - Additional wire, switches, fix system etc: 15-20 EUR per unit; - Installation cost 10-15 EUR per fixture; 	<p>Materials and installation costs from 350 to 460 EUR per classroom:</p> <ul style="list-style-type: none"> - 8-10 economy luminaries: 18-20 EUR for one; - Quality electronic ballast: 9-10 EUR per fixture - New luminescent tubes according to standards for classrooms– 4-10 EUR per fixture - 2 locally produced asymmetrical luminaries: 20-23 EUR per unit; - Additional wire, switches, fix system etc – 6-8 EUR for each fixture ; - Installation cost 5-7 EUR per fixture; 	<p>Materials and installation costs from 160 to 220 EUR per classroom:</p> <ul style="list-style-type: none"> - Electronic ballast: 9-10 EUR per fixture - New luminescent tubes according to standards for classrooms: 4-10 EUR per fixture - 2 locally produced asymmetrical luminaries: 20-23 EUR per unit; - Additional wire, switches, fix system etc: 4-6 EUR per fixture; - Installation cost 5-7 EUR per fixture;



Classroom insulation

Internal wall insulation is the fastest and the simplest methods to ensure energy efficiency of damaged schools in affected regions. First, it can be implemented on a room-by-room basis, thus allowing more flexibility with scarce building materials and human resources in damaged regions, and minimizing the disruption of classes during the school year. Internal insulation has significant advantages in rooms for temporary use, such as schools and kindergarten, which can be heated with minimal energy consumption, thus making the building overall more sustainable and environmentally friendly. It is easier to install, compared to other types of insulation, 40-50% cheaper than external wall insulation, and will not require additional scaffolding expenses. Special attention should be paid to insulation of ceiling and floor to avoid thermal bridges. Due to their simplicity, it is possible to involve school workers and even parents to take part in internal classroom insulation process. Active involvement of parents, volunteers, and school staff, has reduced drastically the cost of insulation: by more than twice in comparison with private companies. This is a very good example of local community involvement in implementation school renovation projects.

Roof repair and attic floor insulation

Roof repairs are needed immediately in most schools situated along the “contact” line to allow facilities to get through the winter without additional damage to school envelope and capacity to provide good and safe indoor microclimate. Damaged roof is a major threat to maximum possible potential of building’s energy efficiency, as well as its longevity. Even a slight damage can have a negative effect on the performance of roofs elements, and in case of schools and kindergartens in Eastern Ukraine we are dealing with gaping holes and destruction from shelling, which if left untreated will damage the building. Leaking roofs – a risk in the beginning of autumn – is a direct threat to the roof’s structure itself, since it will further damage rafters, ceiling joists, and wall framing. Leaking will also result in damage to attic areas. Many schools don’t have attics; thus, they risk direct damage to the interior ceiling. Walls, plaster, insulation will lose their energy efficient properties and their integrity will be compromised, leading to higher energy consumption and restoration expenses. Lighting system may also be damaged, and if the electrical wiring is damaged we risk fire hazard from shorted wires.

Over 20% of heat in a building may be lost through the roof. Improving insulation levels in this area has an big impact on the classroom temperature and in the same time cost effective, especially with pitched roofs witch are presented in the most part of the schools in the target regions. Installing attic floor insulation in an un-insulated attic is likely to be the single most cost-effective way to improve the efficiency in the school building.

Attic insulation and roof restoration according to sustainability principles requires careful guidance, because inadequate roof repairs and insulation can result in further damage to the building. We demonstrated the efficiency of roof restoration in our pilot schools in Donetsk and Luhansk regions: Myronivske school of Art, Nyznjo-

Teplivska school and the Department of culture in Stanitja Lukanska where during winter due to severe damages to the Village's Concert Hall children took extra-curriculum activities. Moreover, currently we are testing different solutions to choose the best for their further promotion in schools along the contact line.

Ventilation

Ventilation is the biggest problem in the schools due to old wooden windows by air tight PVC windows and winterization and sealing old windows without proper training of school staff about necessity of permanent ventilation of classrooms. This leads to dangerous increasing of CO₂ level in school environment. Our measurements in schools shows that average level of CO₂ in classrooms is more than 2400 ppm per m³. This is twice more than recommended by hygienic standards. According to the recommendations the concentration of carbon dioxide during the period between the start and finish of teaching, the average concentration of carbon dioxide should not exceed 1500 parts per million (ppm) and the maximum concentration of carbon dioxide should not exceed 5000 ppm during the teaching day.

No schools have proper centralized ventilation systems. Schools are built without or the ventilation systems are for long out of order. Retrofitting schools with an up-to-date centralized ventilation system is extremely costly and out of question in the current situation.

To solve this issues we use two approaches:

- 1) To teach school administration how to proper use the windows ventilation of classrooms. We have developed practical guidelines for window ventilation based on size of room, windows and outside air temperature.
- 2) We are piloting installation of local energy efficient ventilation system in each classroom based locally produced ventilators with efficient heat exchangers. This gives the best results and recovery of up to 90 % of heat in the ventilation air.

Boiler & Heating system

Access to goods from outside are limited along the contact line and prices are often higher, due to scarcity and difficulties in transportation. This is affecting the supply of fuels for heating.

In Ukraine coal and natural gas is the main fuels for heating. The use of “imported” fuel is a big risk for communities along the contact line. Most parts of the gas pipelines are damaged by shelling and the local government try to switch schools to use of coal. After ATO veterans started a blockade of railways and roads in late January, to prevent transport of coal and other goods across the frontline, the supply of coal is also becoming more uncertain. The Government has announced a state of emergency for electricity supply in several provinces due to the blockade of transport of coal to the power stations. A rise in transportation costs and coal prices has forced communities to reduce the amount of coal distributed to the social institution. This hit the most vulnerable communities hardest.

Most schools in the region have old inefficient coal boilers. There are two ways to increase the efficiency of the old heating systems:

- 1) In most boiler rooms insulation of pipes is in bad condition or totally absent. Insulation of pipes and represent a quick and cost efficient solution to save the heat.
- 2) Installation of reflective sheets behind the radiators prevents the heat losses through uninsulated walls and keep the heat inside the classrooms. Experience show that this measures alone increase the temperature in the classrooms with 2-3 C. And 4-6 C if used together with insulation films for windows .

The old coal boilers are in it selves very inefficient with a typical 55-60% efficiency. Changing to a new biomass boiler do not only introduce a renewable source of energy, but also increasing the boiler efficiency up to 90 %.

Introduction of local biomass is an efficient way to support resilience of local communities in affected areas. In addition, this is an important environmental measure for reduction of emission, improved energy efficiency and finally use of biomass support development of local economy in the supply chain.

We have completed conversion of the heating system in two schools from coal to biomass. One is Hranitne (Donetsk region) with a 300 kW boiler and the other in Novoivanivka (Luhansk region) with a 100kW boiler. The selection of boilers was done after the consultation with representatives of local authorities and certified engineers. Proper training for local staff was conducted. Negotiations with local authorities to confirm that they provide a sustainable supply of biomass for pilot schools were held. Schools staff and parents were involved in preparations of boiler rooms to installations of equipment. We expect that this leads to the substitution of more than 210 tons of coals per year. In addition to this In Hranitne school we demonstrated that by simple restoration of pipeline system and regulators we can save 3,5 tons of hot water per year, which now lost during the technical maintenance of school heating system.

