

OPENING CONFERENCE OF THE PROJECT

“SNINA – A CITY THAT IS READY FOR CLIMATE CHANGE”

(Translation of the opening conference)

Erika Jankajová’s welcome speech:

Dear ladies and gentlemen, a warm welcome to all of you to this preliminary conference on the project “Snina - a town ready for climate change“. I am very glad that among those taking part in our conference we can welcome people, we can say, from all over Europe, as we have participants who are currently located in Salzburg, Norway, Ukraine, and we also have our university students present here. The Mayor of our town, Daniela Galandová, who follows with her welcome speech, will tell you more about this conference.

Mayor’s welcome speech

Dear ladies and gentlemen,

I would also like to take this opportunity to extend a very warm welcome to all of you being here with us today, but also to those following us online, to this preliminary conference on the project “Snina - a town ready for climate change“.

And specially, I would like to welcome:

Mr Terje Theodor Nervik, the Kingdom of Norway ambassador to Slovakia, Mr Professor Stanislav Kmet’, Rector of the Technical University of Košice, Mr Professor Mykola Vasiliovich Savytskyi, Rector of Prydniprovsk State Academy of Civil Engineering and Architecture, and Mr Professor Vladimír Benko, President of the Chamber of Civil Engineers and a representative of the Slovak Technical University of Bratislava.

I also welcome among us the representatives of our project partners, namely:

Mr Håkon Borch, Head of Urban Greening and Vegetation Economy Department of the Norwegian Institute for Bioeconomic Research, and Mr Slavomír Bakoň, parish priest of the Roman Catholic Parish of the Elevation of the Holy Cross in Snina.

I am also delighted to have Mrs Eva Rihová, a representative of the Ministry of Environment of the Slovak Republic, here with us today.

I can still remember today when more than a year ago I and my colleagues at the Municipal Office were preparing our project together. Full of fears but with a hope in our hearts we selected and completed various project activities believing that our efforts would be appreciated and that it would be our project that the Evaluation

Committee might find appealing, and that we would be successful. Well, we have succeeded!

We have succeeded indeed – within the territory of our town we have suggested 25 various investments, ranging from flood control measures, energy-friendly measures related to the modernization of public lighting, to the green and blue features not only on public buildings but in open spaces as well.

In the course of next three years, thanks to the Norwegian grants and the government budget of the Slovak Republic, we will do our best to make several localities of our town even prettier and more prosperous with the aim of building up the resistance of our town against climate change. In addition, we will contribute to saving energy, and therefore to saving operating costs of our town as well as of other organizations.

Today I am standing in front of you feeling happy that thanks to this project having been approved I can take this opportunity at this truly special occasion to tell those who are not familiar with our town a few words about it and to introduce our town to them. Snina is a beautiful town rich in history, the history of Zemplín region, a town situated nearby Ukraine and Poland, amid the beauties of nature. It is the only town in the region mentioned above that has really a great deal to offer.

What is more, our town is located at the entrance gate to Poloniny National Park, forming, together with Uzhanskyi National Park in Ukraine and Bieszczady National Park in Poland, the Transboundary Biosphere Reserve, the Eastern Carpathians.

I am sincerely glad that thanks to this project we are able to implement the activities we have suggested. I am personally especially looking forward to revitalizing the nearby historical park and to planting tree alleys, because these activities really deserve our attention.

However, there are some challenges ahead of us. Let me mention the most important one, the biotechnical revitalization of our square. Its main corridor along the bus station has some greenery that, for sure, improves the microclimate for the citizens walking across the square, as well as for the residents in the blocks of flats built around.

Then it is the area facing the Culture Centre that requires a change. It is important to approach this issue sensitively, as cultural and social events very often take place there, which must be taken into account and included in the proposal for placing green features and blue architecture features there.

It is significant that this square, which, as it is today serves its purpose really well, be preserved, but at the same time, it is important to find solutions and measures to fill in the whole space, thus mitigating the negative impacts of climate change in our town.

Which is also why the ongoing cooperation with the Slovak and Norwegian experts in the project, helping and inspiring us with their extensive knowledge, makes me very happy.

Furthermore, I wish to say how we appreciate the cooperation with the technical universities in Košice, Bratislava and Dnipro. I am very glad that they have found the agenda of our conference interesting, the conference which is being also attended by speakers, students and citizens of our beautiful town online.

Let me therefore express hope that all this cooperation and its contribution will really prove useful in the action plan of Snina being ready for climate change, as well as in other investment and non-investment measures, valuable architecture, but most of all, in the improved quality of the life of our citizens.

Because this year our town is starting to prepare a new territorial plan, I can boldly say: Today is the right time and the right place!

Dear ladies and gentlemen, let me wish you all a pleasantly spent time in a circle of true experts. We have an eventful programme ahead of us, from which each of you please take with yourself anything you need. Thank you for accepting our invitation.

Erika Jankajová

Due to the fact that the programme is supported from the Norwegian funds and that we have participants from abroad here, a brief summary of the Mayor's speech will be interpreted online by our interpreter, Mrs Eva Mihaličová.

English translation

Erika Jankajová

Thank you very much for the translation. Now I would like to ask our project partner, Mr Slavomír Bakoň, parish priest of the Roman Catholic Parish of the Elevation of the Holy Cross to say a few words to our participants. Mr Bakoň, please.

Slavomír Bakoň:

Thank you. I am happy that I have the opportunity to greet you all and, especially, partners of this project, the representatives of the Norwegian funds and the representatives of the town of Snina, as well as Mrs Mayor. I wish to say that projects like this one bring a piece of mercy to our earth on which we live and for which we are responsible, and that each of us is responsible for the piece of land on which he or she lives, the responsibility which manifest itself through our particular actions – this project being such an action. Of course, one project will not save the whole Earth, but as in a mosaic, one contribution equals one stone which this project certainly is, so I am delighted that the Parish of Holy Cross is also a partner of this project. I would like to wish you a day full of information that will enrich you, and I want this day to be spent in the spirit of, as I have already said, a piece of mercy on this Earth on which we live and for which we are responsible, also one towards

another, even with regard to whole generations to come after us, and as a believer and a priest I can say that also with respect to the Creator, this Earth, and obviously, to us all. Once more let me wish you all present here and those joining us via this online broadcast a pleasant and peaceful day. Thank you.

Erika Jankajová

Thank you very much for this speech too. Now, for a few minutes, we are going to have a technical break to get the presentation stuff for the speakers and the panel discussion following later ready. See you in 10 minutes.

Introduction of the project „Snina - town ready for climate change“

Erika Jankajová

Greetings to all dear participants back in the conference on the project “Snina - a town ready for climate change“. In my presentation I am going to tell you more about this project, the way it came to be, what activities it includes, what benefits it will bring to the citizens of our town, adding information about the grant, i.e. what amount of the grant we have achieved and what a cooperation with our partners looks like.

Let me proceed to the first slide telling you more about our town. As we also have participants from abroad here present... well, I will be speaking in Slovak, my presentation will not be interpreted, but the slides are in English, they can be followed easily, and my speech will be translated later. As for our town: the first mention about it dates back to the year of 1317 in a letter written by Charles Robert of Anjou.

Our town is at the heart of the region consisting of 33 other municipalities, being its administrative centre as the District Authority in Snina is located here. Additionally, it is situated at the borderline of two different cultures, Roman and Byzantine, which is one of the reasons why I chose to include small churches and temples we have here in my presentation to make it easier for you to understand that our people and cultures can live alongside even at such a borderline and that historically it has simply worked here and it is pleasant living together like this, so I believe that we will be an inspiration to others. As far as the specific project partners are concerned, we have two of them.

The first one is the Norwegian Institute for Bioeconomic Research participating in various projects in the field of agriculture and food safety, and their projects, let me say, are all over the world, in Asia, Africa, and Latin America. Based on this cooperation, our town, as the applicant, expects various measures to be implemented thanks to the extensive knowledge the Norwegian partners have, from which we will be happy to learn as much as possible. I can also add that it is a government institution forming a part of the Norwegian Ministry of Agriculture and

Nutrition, and that they will participate in almost all our activities, preparing together with us an action plan which, I believe, will be very well received and will be an inspiration for the surrounding regions.

The other partner of ours is the Roman Catholic Church in Snina, operating a day nursery in our town. One of the activities to be implemented within the project is thermal insulation and a green roof on this day nursery. From this cooperation with our partner we expect, above all, direct evaluation of measures that we have proposed, and if possible, transformation of our cooperation into inspiring solutions for other institutions which are not project partners, but which would wish to implement something similar in the future, so that they could gain some experience from such a cooperation, or so that they could have a kind of direct contact.

Now I will speak more about this project. Its aim is to make the town of Snina ready for climate change and, to put it simply, to improve its current condition. As far as the grant is concerned, the total amount provided to our town as the applicant (part of it goes to the partner as well) is almost 1.4 million, the total costs amounting to nearly 1 750 0000 euros, which means that our town has not only been awarded the funds, but it must contribute, I mean co-finance a part of these total eligible costs.

As the applicant, the town requested 1 130 344 euros directly from the grant and, at the same time, it will participate financially in the amount of 355 756 euros as a co-financing partner. Partner 1, this being NIBR has no co-financing within the project, nor has any finance granted, and therefore I would really like to appreciate their helpfulness and willingness to support us and help us to implement this project by joining in. And I sincerely thank you for helping us to be successful. As for Partner 2, the Roman Catholic Church of the Holy Cross in Snina, 258 856 euros will be assigned to them from the project funds, their co-financing amounting to 13 624 euros.

Maybe, if we divided this into how much money goes directly out of the grant from the citizens of Norway, and how much out of the budget of the Slovak Republic government, the two figures given below could tell us more. The contribution directly out of the Norwegian fund amounts to 1 180 820 euros, the contribution out of our government budget amounts to 208 380 euros. And then, here is the information that the citizens of our town might find interesting: this project started as early as on 27 February 2021, and changing, i.e. the reconstruction of public lighting in Jesenského Street is being carried out at the moment (internally we call it RV07), so this is what is being carried out, and at the same time, an action plan is being prepared, including this conference being a part thereof and one of the mandatory project activities.

The expected length of the project is until 26 February 2024. For this picture I chose a photograph that is a little winter-cold, telling us many things concerning climate which we will try to resolve in this project, i.e. so that in summer we have a real summer, and in winter we have a real winter, because the weather deviations in our town do not do us any good and we have had some trouble with them despite the

fact that we are situated in a beautiful countryside and we have enough greenery around us. Here, specifically, you can see such comparison, what the inside territory of the town looks like – this being a picture of the main square in Snina where we will be dealing with its revitalization, adding greenery and modern solutions, and then there is the area outside the town limits.

As for the project activities, the first mandatory activity each applicant had to schedule in their project is an action plan (its development). There is the statue in the square there and I believe that by the end of the time we have allocated for this we will also be able to wave our hands like this and say that we have made it, that we have fulfilled our duty and that this document will be of benefit as well. As far as the specific document is concerned, we really need our Norwegian partner, who has direct experience with such things and who is sure to propose solutions that has worked for them for several years, to cooperate with us in this. Subsequently, what we focus on in the project and what we actually believe will be successfully included in the action plan is the implementation of rainwater harvesting solutions in Snina and how we can contribute to the reduction, or mitigation, of the implications of climate change. We are eager to do these things actively together with our citizens, and therefore we will be making use of emotional maps, currently working on architecture studies for the section of a climate park, where the participation with our citizens is to take place – our citizens being able to choose what the park should look like. Of course, the designers who have been assigned the task must first prepare the studies, which is not an easy task for them at all, and what's more, they must be careful that their technical solutions are really an asset.

Apart from us as the applicant, both partners will be involved in this part of the project, because when it comes to our partner, the Church, but not only this partner, there are many other institutions operating in our territory, for instance forest landowners associations, then there are also other state institutions, schools owning buildings, gardens, adjacent pieces of land, so it would be really good for them to be more active and to get in touch with us, we will be contacting them too, but I would like to call on them to really get in touch with us so that the document that is to be prepared within the project could be an asset and simply so that it could be utilized by them as well and, most of all, that it could be prepared jointly with them. Let me proceed immediately to the second activity, this being the revitalization of our parks.

Not being a very big town, with the population of only around 20 thousand, we have 7 parks, and of course, I admit sincerely, we have problems with greenery in towns as well as in other localities (e.g. in intrablock areas of the housing estates), the greenery there is being reduced, having been reduced by 14 percent since 2005, i.e. from 113 ha in 2005 we currently have 84 ha of greenery there in total. The problem of our town, as with many others, is actually the insufficient care for this greenery because this causes problems: on the one hand that, when it rains heavily at one time, the mowing cannot be done at the right time, and on the other hand, it actually costs something when it does not rain for a long time because the greenery must be

irrigated using our drinking water, which is really costly. It is really not easy to approach and resolve this issue, but sometimes you need to start somewhere and we are starting right now.

Another activity within the project: out of these 7 parks, 2 will be revitalized – the Historical Park and the Park by the Home of Peaceful Old Age, and at the same time, one new park, a Climate Park will start to exist, which, let me make it easier to understand for our citizens, will be situated behind the Culture House, or where the circus used to come and stay – you will be able to see it on the Internet as soon as this information is published. As far as further green solutions are concerned, within the project, the greenery will be supplemented in two alleys where there is around 100 trees that we, together with volunteers, want to plant, this way making the citizens participate in completing the greenery of our town because that is what subsequently has a direct impact on the quality of their lives.

Again, Partner 1, i.e. the Norwegian Institute for Bioeconomic Research, will be involved in this part of the project. Now, the third activity: this concerns floods and water management in the surrounding areas to prevent what we witnessed last year from happening, having been flooded 3 times with considerable damage caused to the town's land, the land belonging to the citizens, as well as to the houses, which is then, from the viewpoint of insurance companies, not easy to resolve, so these are real challenges that need to be addressed and we must approach them so as to find preventive solutions without suffering the consequences afterwards.

Within this activity a dry polder will be installed in the part of Snina that originally was the end of the town, now an epidemic cemetery is situated there. When floods come, the citizens who live there get flooded, so it is not easy for them. The role of this dry polder is to retain water when it rains heavily. Within this activity, and already upon considering its technical designs and specifications, we also need the Norwegian partner to cooperate with us.

Another project activity within our project is nature-close solutions concerning the buildings and public spaces. Here I can say that as far as our town is concerned, there are not many parts of our town that are really full of greenery, which is what it should look like in other places too – in many parts trees are missing, the hedgerows not being in the best condition, so there is a question here for us to answer how to resolve the situation then, also from the viewpoint of where to replace the real greenery with, for instance, invasive or non-invasive types, and where to supplement it so that it could shade and cool our town. Within this activity, 4 buildings will be thermally insulated and 3 green roofs will be installed.

One of the green roofs will be for the project partner and the remaining two ones will be on nurseries the founder of which is our town. In addition, as many as ten rain gardens will be supplemented, part of them being in the intrablock areas and part of them being in the nurseries not participating in the project (of changing roofs and installing thermal insulation), so that the water pouring down from the roofs could not

run off to the sewage system and become waste. But the greatest challenge that our Mayor has already spoken about is the revitalization of our town square you can see in the photograph.

I would like to say a little more about the square because the square has already undergone reconstruction and is functioning as it should, but actually it is not possible for our town not to have a space for people to meet. Nevertheless, the square causes us trouble, because it is simply too hot, and therefore this situation must be resolved so that this could be taken into account, and I believe that along with our internal and external experts involved in the project we will succeed in resolving this within our project. Now let's move on.

Another activity is energetic efficiency and smart solutions in our town. Maybe I should elaborate a little here: well, for Snina the last year was difficult, as we all know – because of the epidemic; the number of visitors had been growing before, this being mainly because of Poloniny and Vihorlat – people wanted to spend their time in the surroundings so clean and pristine, to relax and get all those oppressive thoughts out of their minds. I, myself, like to spend my time in Poloniny, which for me is a time spent efficiently because I come home relaxed as much as possible and as we say here "I'm full of energy to work again".

The town of Snina wishes to be energetically efficient and support low-emission transport – soon it launches a bikesharing scheme with some bikesharing stations being situated at the Recreation Area Rybníky too, the remaining ones being all around the town. Out of 50 bicycles, 20 will be electrical, the other ones mechanical, which means that people can choose which type is most convenient for them. I mention this because within the project, apart from the town project which is the bikesharing, we will be adding 2 charging stations for electrobikes and one charging station for cars. This is again a challenge we are facing, being also a challenge from other points of view.

The Norwegians are one of the best at it, they are simply ahead of us, having the information we just lack, for example if a country or a town or city is to launch electrical bike or electric car service, how it should be done for people not to wait too long to charge their bikes or cars and where the charging stations are best to be situated. So, we only have one charging station in our project for now and we will be going step by step learning from the Norwegian experience, looking for the most convenient solutions.

Here I would like to underline that this is the activity to which the ongoing solution belong, being implemented at the moment, i.e. the installation of energetically advantageous elements that can save energy – the reconstruction of public lighting RV07 which includes replacing sodium lights with LED lights, and the installation of a control system thanks to which we can set the intensity of lighting, soften it, shut it off etc.

Not all the parts of lighting in Snina have already been reconstructed, so within this project we will reconstruct just this one. Partner 1 and Partner 2 are both involved in this part of the project, especially the Norwegian partner, this I have already mentioned, I mean what we expect of them, and as far as Partner 2 is concerned, I believe that the reconstructed lighting will be used by the visitors or churchgoers when parking their cars before going to mass, which, currently, I admit, is a bit of a problem here. I do believe that the people will welcome this and we will get rid of unpleasant situations when they risk getting a parking fine, because parking is not easy here. Well, another mandatory activity in this project is publicity and supporting activities, such as this conference. I chose for this demonstration this ugly photo showing floods, taken last year, because I think that the role of publicity is to provide real information and show that we propose solutions not because we want to do it for some or other reason, or because there are tenders published, but because we really need them.

For example, when we were preparing the project and considering a dry polder on Tarnovský stream, we actually had no idea that there would be a flood there, we couldn't have known it, all the more we were considering whether to install it there or not, but the situation convinced us that it was a right decision and that we just had to find a solution. So as for publicity, we will keep having this approach by, above all, publishing such content and communicating why such solutions are adopted, why such measures are chosen, not as much like pretending that something looks great.

In this project for every applicant whose grant amount exceeds 200 thousand euros there is an obligation to design their own special project website, it is not possible just to have a subpage on our town web. Furthermore, we have leaflets there through which we will present solutions to our citizens and then video recordings showing how to think smart economically and in line with nature. The final activity will be a book "Our Future" in which we want to bring inspirations to Slovakia from our Norwegian partner, offering other self-governments something to draw from so that they could implement similar projects like ours.

Now let me briefly sum up the project indicators. Well, one of the mandatory indicators was emission reduction. Our goal is 4 091 tons over five years into which the project and the sustainability of the project fall. Maybe an inspiration for others in this project is that we have chosen many green solutions where carbon sequestration - carbon reduction cannot be calculated by means of energetic audits, so with respect to the green solutions we have used the calculation specified in the project documentations. This means that you can simply reduce 20 kg of CO² per m³ with these measures. Another indicator was how much of the population, the citizens of the Slovak Republic will benefit from the project. The result is 0.7 percent, this figure was calculated including the town citizens and, of course, the visitors to the region. Subsequently, there is the action plan, as I have said before, this is a mandatory activity, and then it is the number of measures we will adopt.

After adding together all these things I have spoken about, the resulting number is 25. So, this is the end of my presentation and now I would like to ask you to give us a few minutes for a short break after which another speaker follows - Mr Professor Stanislaus Dukat. Before he starts his presentation, I will tell you something more about him. Thank you very much. See you in a few minutes.

“Principles of designing ecological buildings” - gst.Univ.Prof.Arch.Dipl.Ing. Stanislav Dukát

Stanislav Dukát

Can we hear ourselves well? Thank you.

Erika Jankajová

I would like to introduce you to our participants as a man who, to me, is one of the most inspiring people I have ever met in my life. I think it is always a good thing to give a few basic details about a person first. The fact that you have designed more than 980 constructions built to date speaks volumes about you and I'm sure this is something that only few people can boast of. Interestingly, you are involved in the field of construction, architecture, but also development, so your opinion on the designing solutions that “architecture must be, above all, of benefit to the citizens, and not only a monument to the architect”, is unique. So that's all for my short entry introducing you and now please go ahead.

Stanislav Dukát

Thank you very much and let me greet all those watching me. If I have correct information, people from the University of Bratislava have also joined us, I send greetings to my former colleagues and students, I also send my greetings to the colleagues and students at the Technical University of Košice, and of course, to my friends from Ukraine and all colleagues or interested persons who have logged on. I am really grateful that you have joined us to spend the following about 30 minutes to listen to my, so to say, issues that are on my mind from the viewpoint of architecture, urbanism and development, all this taken from the perspective of ecology, energetic efficiency and sustainability of our world for the generations to come. Green architecture, this is what they call it abroad, even if it does not fit, is actually an answer to the major problems that we, as the human race, have worldwide.

These problems are incomparably greater in urban agglomerations, so in Slovakia they can be really found in Bratislava at big crossroads, although they are not like those in Asia, China, Singapore, Sydney, but it's only a matter of time when this negative influence gradually and permanently comes and settles in your country and you will be facing a question of what to do now. The question what to do is a good

one. A greater problem is to give a good answer to this good question. Let me start, I guess for you this may not be important, I'll be brief, but it is significant to get familiar with the connections. Let's take energy consumption, the pollution related thereto, or the production of exhalates and their negative impact on all of us in the developed countries such as Austria or Switzerland, divided into thirds, one-third for industry, the second for transport, and the third for constructions, constructions of all kinds.

As far as production is concerned, there is very little I can say. As for transport, I can only say that there has been a great, great progress in the perception that transport is a serious issue. I mean, transport in general. When we talk about transport it automatically ends with electric cars. Is this debate right? Well, it is not. Why? Let me just mention one little mosaic concerning big transport tankers that today are used 100 percent worldwide.

One huge tanker produces as much CO² as 84 000 cars and this is all just statistics as there are about 45 000 tankers operating on the world seas. Students, please do some maths: 45 000 x 84 000 and you will find out that there is as many cars in the world as that. Does anybody speak about the ecologization of huge tankers, 300-meter long ships or even longer? No, nobody does. I have presented just a small mosaic, but there are more of them like this one. An average airplane, a new one, economic, so-called eco-friendly one, be it a Boeing or an Airbus, produces 380 g of CO² per 1 km, for an average car it's about 20 000 km, so this one airplane produces 380 g of CO², modern ones about 110 g - 110 g of CO².

These modern airplanes fly not 1 000 km, not million kilometres, but much more than that. However, not on such a large scale though, we must seriously discuss transport within a town and between towns which will have to go through a major ecologic wave of change. So let's get back to our topic which I was assigned to speak to you about: What, taken this pollution and negative impacts on nature, do buildings look like? Which, as I've already said, in developed countries, account for one-third, in Slovakia, if the statistics do not lie, for almost 40 percent, the figure of 38 percent was the last one I got on my desk. So not only in Slovakia, but also in Austria, something must have gone very wrong. Let's start methodically: What is the biggest mistake in the development of constructions the result of which is that they have such huge negative impacts?

The biggest mistake has occurred in two perspectives. The first one is that in Slovakia you have, from God, per square meter only from solar energy somewhere around 1200 kw per 1m²/year, on Žitný ostrov (*Rye Island*) a little bit more, which is irrelevant here. Do you know how much primary energy we need in modern constructions? 50-60. My constructions that I designed nearly 30 years ago and that have been used for 25 to 27 years, have consumption between 80-90, well, these are only gross figures, but even if a construction is badly built, it needs 100 kW per 1m², so for a year of primary energy we get 1200 kW. Is it right then to use this energy? Each of you, please, answer this question for yourselves.

The other question which I think is also very serious is the decentralized production of energy. Let's take the city of Salzburg where I live. It imports energy, some 5 200 km of gas. Please, let's not start arguing here again, it's not 5 200 but 5 080, because we have to think of the average – I don't know how much exactly it was, but it's a silly argument. Why is it silly to argue whether it is 5 200 or 4 900? Does it play any role? And then, this energy comes to Salzburg where we lose it, so we have to exert energy to get it into every house, but the best part is that the best energy having 48-percent efficiency is simply destroyed. So whether this is the right development, again, answer this question for yourselves. Why are we doing this? Why have we been doing this for years and why will we be doing this for years to come?

Well, we will, because the development goes in the wrong direction. I have been in the construction business from 1972, so from my perspective it's nearly 100 years. I compare the whole development of the society to a tanker with a weak engine. This tanker moves on its way, but if you want to do a small turn it takes years until such a change happens. And even if we stop producing CO² today, we will still have huge negative impacts existing, and even if we stop producing natural gas boilers, or whatever, still the negative impacts will be getting bigger and bigger. So again, I'm here at the question what to do, and this time it's easy to answer. Why today do we make use of solar energy, solar collectors to produce domestic hot water, which is not used that much today?

They can produce around 350-400 kWh per 1m² of a collector per year. Somewhere around 180 kWh, we're getting closer to 200, is produced by photovoltaics, we are using this energy decentrally. The decentralized use of solar energy is right. Stop for a while now, students, and think carefully if this really is right. This system of using solar energy, heat or energy...yes or no. Let's take the positive yes first: we produce it, we do not need nuclear, hydro, thermal power stations – each house is capable of producing enough energy...I have always wanted to set a good example with respect to this, but I feel that for the last 12 years it may not be true, each and every construction that I have built, and it doesn't matter what kind of construction it is, does not consume but produces energy – them being so-called energetically active houses.

My future colleagues, students, we produce solar energy and it doesn't matter whether it is thermal or photovoltaic current, but for how much. I am not speaking about CO², in recycling silicon the negative impact is lower. I am speaking about something entirely different, I mean petrification of our soil which we use and on which we put solar collectors, but this is not enough, we put them on meadows and lands of a great value, not knowing what we cause by doing this. What we cause is that the whole country – town or city is too hot, which is a major problem. A really major problem of which even politicians have already started talking. And if we connect the problem with CO², or of all CO – NO₃, all the negative impacts, and if

we add the price of energy becoming more and more expensive, what we have is a huge problem.

I mean, you, me, my children, my grandchildren, the politicians – and this problem will influence transport and production too. I have spoken about solar collectors making our countries too hot. Just imagine, there are around 550 000 citizens living in the Salzburg region, it's roughly like Bratislava. At the times of a great construction boom, around 5 years ago, around 1.2 million m² of solar collectors were installed in this region, then it dropped sharply and now we have photovoltaics on the way up. The collectors not installed on roofs produce heat, I was personally present when the measurements were being done, showing that in the centre of Salzburg in the summer we have the temperature 17.5 degrees higher than in the forest 5 km further away as the crow flies. 5 km is nothing. When you have thermal collectors to produce domestic hot water, you have collectors 130 degrees hot when you touch their little wings and lamellas. If only 100 m² of solar collectors are installed, this is not a problem, but if you install 100 000 m² of them it's bad, with millions of them installed it is very, very bad.

Do the photovoltaic collectors get too hot or not? Of course, they do, but not as much as getting close to 100 degrees of Celsius. When you touch them, you get a blister and this is the forecast with respect to today's critical questions from the viewpoint of energetical efficiency, related to making our planet too hot, this also taken locally. In addition, we create a problem for ourselves and it will rear its ugly head very soon. What are the solutions then that, for instance, I am using and that all are impossible for me to mention in this short speech? I have made an arrangement with the Rector of the Prydniprovskya Academy to make a speech on that in which I will have to delve deeper into the technical principles of designing low-energy active houses. This speech is agreed to be made in Slovak, even though as you can hear, I am not as good at it now, but it will be interpreted simultaneously into Ukrainian, so anyone interested can log on and listen to me speaking in greater depth about these technicalities.

The time I have at my disposal is, of course, not enough, but yet, let me focus on one more small detail: What are the biggest mistakes we make losing energy in a house? The first point is the whole frame of a construction, and it doesn't matter at all whether we mean a detached house or a block of flats. It must have an outer façade from all sides, a well-made one so as to avoid thermal losses as much as possible. This is what the small letter u coefficient tells us – students know this coefficient very well. For wall features it must be somewhere at the borderline of 0.1, for the roof the value is about 0.08, windows must be below 0.8, it means glass 0.5, by which we prevent, reduce energy losses in winter months, reducing the flow of extra energy into flats, houses, offices, hotel rooms etc.

As early as 5-7 years ago I saw the statistics of how much a construction consumes, so if you take 12 months, the whole year around, and you divide it into 6 winter and 6 summer months, for winter months in Austria 87 was needed and for 6 summer

months the consumption of 13 percent was needed. The interesting thing here is that by overthermalization each year this borderline moves by 0.8-0.9 percent and more and more energy in summer and less and less energy in winter is needed for heating and hot water. Dear students, please beware one thing: for the production of 1 kWh of cold you need 3 times more energy than we consume to produce 1 kWh of heat. Time's really flying, so let me pick one more feature where constructions lose most energy.

A construction loses most energy, as I have already mentioned, through the outer jacket, immediately second in order after that are so-called process losses. What am I talking about? Up on the roof we have photovoltaics which is prescribed by the Building Act and I have to install it or otherwise no building permit will be obtained, so if I fail to obtain it I won't get the final building approval, i.e. permit to use the building, which is why I have to install it there, so when I install it I have to use batteries, whether this is right or wrong I'd hate to argue here, it is simply prescribed by law. Well, this is what I did with my last construction I recently got final building approval for in Munich, Germany, Bavaria: let me just pick one small feature here, the battery. From the roof the photovoltaics pass through a voltage rectifier and a power conditioner which then pass either into the house or, if there is an extra amount of it, into the batteries, so when there is not enough of it, the batteries are used to supply the power.

As for a battery, OK let's just take a lithium-ion battery, or today a perid (?) battery, it gets hot when being charged or discharged, this getting hot is quite intensive. The temperature of a battery as a mass, according to the manufacturer, is around 37-39 degrees, right? No, it isn't right, it's right, well, for 50 percent only, maybe. Actually, the temperature of this mass is just 37 degrees, but this battery has a cooler on its back and this cooler reaches temperatures between 46-48 degrees, and in strong charging I have already measured even as much as 49 degrees. So, this is what I did for every house that should be energetically passive today, with controlled ventilation, including a recovery system. More than 80 percent of heating does not go through these peak temperatures -20 degrees or so, but when there is -3 or -5 degrees outside.

When the temperature outside is about 0 or +5 degrees, rarely at -5 degrees. What did I do? I did one thing. Let me say again, this is just one thing I'm picking here. I absorb air 40 degrees hot into the ventilation with recovery, which goes into the exchanger where outside air with the temperature of +5, +4, +3, -2 degrees comes, I heat it sufficiently enough so as to heat the construction at +-0 +-5 degrees. In fact it is 8, 10, 12 hours a day sufficiently heated construction. What do I achieve? I achieve a very simple effect. While in the normal use of technologies you need somewhere about 45 watts at these temperatures per one square meter, I only need 0.2 watts. 220 times less.

Now, students, wait a while! This means the whole chain of subsequently built constructions – which makes it easier. I have only picked one feature as there is not

enough time. And now, my time gone, let me finish my speech by saying one thing: At the end of our efforts as architects and all those involved in this field, we should do the perfect piece of work. One of the greatest geniuses of the humankind, in one of his discussions with the Pope, said: “The perfect piece of work consists of a great many little things solved perfectly. But the perfect piece of work itself is not a small thing at all.” Michelangelo Buonarroti Let me thank you all very much for your attention. It was my honour to be speaking in Slovakia and Ukraine. I send my greetings to all my colleagues and my future colleagues. And now it's back to Mrs Jankajová. Thank you very much again.

“Use rainwater from surface runoff as service water in the industrial company AUTOTEX” - Ing. Róbert Šmajda, RobSON

Erika Jankajová:

Thank you very much, Mr Professor, too. And it's goodbye to you as well. I believe that this was not our last cooperation and that we will meet again in discussing other issues. Once more, thank you and have a nice day.

And now, dear participants, let us have a short break. Our programme says it's a coffee break, but taken into account the situation here, in this hall, we cannot have a coffee here. However, all of you by your screens or on the phones, who like to have a cup of coffee, have one and we will meet again at the panel discussion at 11 o'clock. For now, have a nice day.

Dear conference participants, let me introduce to you our next speaker, designer Mr Róbert Šmajda, who is going to talk about the principles of using rainwater in an industrial building. So now, it's over to you, Mr Šmajda.

Róbert Šmajda:

Hello and thank you. First, let me say a few things about myself. My name is Róbert Šmajda and I work as a designer. My company is situated here in the town, and actually, I mostly work on town projects. Now I would like to introduce to you one project we have implemented in the town of Snina, concerning the use of rainwater. At the beginning, let's ask ourselves a question: Is it really worth using rainwater or why use it? In the past, making use of rainwater was not considered at all, as there was no reason to do so. The prices of water and sewage charges were low.

Thanks to to our geographical location and many forests we had enough drinking water. Rainwater was used mainly by gardeners who knew its beneficial effects for a long time. They would collect it in the rainy periods and use it to water their garden patches. Recently, however, water has become a strategic material on which each of us is dependent. There are more and more extremes present, the frequent climate changes cause imbalance in precipitation. There are times when it rains a lot, then

there are long periods of drought. There are more and more torrential rains, with windy and dry intervals.

This is why it is good, at the time when there is a lot of precipitation, to create a supply of rainwater, not just letting it run off. Nevertheless, all water cannot be replaced with rainwater, but for flushing toilets, watering, cleaning and washing, for example, rainwater is just the right thing. Countries known for their ecological approach came to appreciate the value of rainwater a long time ago. So, for more than a decade they have been making use of rainwater. In many countries they even provide government subsidies for the rainwater usage systems. Slowly, our country is also joining this trend and we try to make use of rainwater more and more. Briefly, these are the easiest ways to use rainwater.

Actually, in practice we see this on houses: from their roofs rainwater is led into some kind of an underground reservoir and then it is filtered, pumped back and used exactly as I have already said, either to water the garden or flush toilets or to do washing for which it is really suitable as it is soft water. Subsequently it travels to the sewage system or, which is the best, into some kind of ground infiltration. In fact, let me now present to you one real example, something we succeeded in carrying out in Snina. First, there was an idea to reconstruct a dilapidated area, converting it into a modern factory.

Apart from the technicalities, the investor was asking about the economic operation of the company to be operating there. The designers, together with the chief contractor, the company Stavex Snina, suggested utilizing rainwater as the building had a really large roof. In the town of Snina there is not a separated sewage system, which means that we do not have separate rainwater and sewage systems, which is why they decided to implement this solution. In the proposed building 200 people were considered to be employed, so quite high consumption of water was assumed.

The sanitary equipment designer suggested distributing the drinking water parallelly with the utility water used for flushing the toilets too. 4 reservoirs with a capacity of 4 x 16 m³ were used. The supply of water to the toilets and urinals was connected to a separate supply of the utility water, connected to the reservoirs for rainwater from the roof. This is what the construction in question looked like before works on it had begun. It was a dilapidated building where there used to be a distillery. The building was in a very bad condition, there were water leaks, so it really needed an overall reconstruction.

The building also required an extension to meet the investor's requirements. In fact, we looked for some space where the reservoirs could be installed, as the area was rather small. So, in the end, in the rear section of it we placed the reservoirs collecting water from the roof through sewage pipes, which through a filtration reservoir went on into all the reservoirs. It's somewhere around here. The reservoirs were interconnected through a safety outlet into the sewage or infiltration. In fact, they served two functions: as the supply of rainwater and in case of fire as fire

containers from which water could be pumped to extinguish fires. This is a picture of the roof of the construction in question. This is the whole of the area.

The roof was covered with Fatrafol foil and sloped with internal drainpipes. These are the reservoirs here. When deconstructing the area, old reservoirs for distillation were found. Therefore, we agreed to use these recycled reservoirs. This is a photo of the implementation itself, in which they were placed under the ground, covered with soil, interconnected and worked into the area. And here you can see the rainwater coming into the main sewage pipe through some filtration, and then into the reservoirs. Now, what were we considering actually? With some two hundred employees the flushing consumption amounts to some 25 litres, which means that daily this would make for about 5 000 litres. The monthly consumption of 5 000 litres 20 days a year makes some 100 000 litres per month. The yearly consumption of 100 000 litres for 12 months accounts for some 1 200 cubic meters.

Financially speaking, with the water and sewage charges being about 2 euros, it would make for some € 3 000 per year. This company has been operating for about three years now and the final sums were quite surprising. They even overcame our expectations. In the past their water and sewage charges per month were somewhere around € 600-700 per month. Having utilized the rainwater reservoirs the monthly charges dropped to some € 250-300 per month. The monthly savings amount to € 350-450, the yearly savings to 4-5 thousand euros, so the overall 5-year savings amount to 40-50 thousand euros, which, I believe, is quite interesting for such a company.

This is what the reconstructed area looks like now. Besides the financial benefit, the owners as well as the employees are happy to contribute with their little to the protection of the environment. They make use of rainwater as the utility (*service, non-drinking, domestic*) water. In the periods of torrential rains this does not present a load on the sewage system, the wastewater treatment plant or water courses. The extra water is directed to the infiltration and, of course, the economic profit of this solution is obvious. So, this is all I wanted to present to you for now.

Erika Jankajová:

Thank you very much for your interesting speech, in which we learned that even in a town which is not, as some say, at the end, but quite the contrary the opposite is true, at the beginning of Slovakia, there are projects of rainwater harvesting already implemented, projects that use the environment efficiently and do not consider water to be waste. Dear participants, let me make a short break for a few minutes now as I would like to invite experts involved in the project to continue in our panel discussion at 11 o'clock. Thanks once more.

Panel discussion: "Water management in the city" - Ing. Róbert Šmajda, Dr. Ing. Michal Gažovič, Michal Kravčík, Ing. Arch. Martin Štofira

Erika Jankajová:

Hello again to you all here at our introductory conference concerning the project Snina - a town ready for climate change. By way of introduction to our panel discussion concerning water management within the territory of our town, I would like to introduce to you our dear speakers and participants, who, at the same time, are our project experts. Let me start with Mr Michal Kravčík, who is the laureate of as they say the Nobel Prize for the environment, the first to be awarded it here in Slovakia, the Goldman Environmental Prize.

The next one after him to be awarded the prize was our Mrs President, I guess. Another person taking part in our panel discussion is Mr Róbert Šmajda, who has already spoken here as a designer and who has designed projects of rainwater harvesting in the territory of Snina for particular buildings.

Then let me introduce to you designer and architect, Mr Martin Štofira. What I can say about him is that he is a man interested in the quality of life of our citizens who is really inspiring in the matters of how the town should cooperate with the citizens.

And the last person in our panel discussion, but no less important, is Mr Michal Gažovič. He is a landscape architect and a true professional as far as the topic of rainwater harvesting is concerned, be it in towns or outside them. And now let's move to the specific issues. So, welcome again.

Thank you and greetings to the people of Snina and surrounding areas. This is my first question for you: What is it, actually, water management? Let me turn to you first, Mr Kravčík. Could you tell us something more about it? What should our citizens or people working in offices or institutions understand by that? Is it possible to manage water?

Michal Kravčík

Well, obviously it is, we have been making it quite well enough by conducting water as fast as possible away from towns, having all kinds of drainpipes, channels, gutters, the whole sewage system. And, historically, from the times of the Industrial Revolution, when some water management started to be applied for the first time, it was, basically, connected with wastewater. It was in Paris, where some 150 years ago, purely from the viewpoint of hygiene, because we all know what the situation was like before, sanitary water not being conducted away etc., from individual buildings within or beyond the imperial area, but also from other more affluent quarters of Paris. So, this was how people came to be aware of this issue. Huge areas were dug up; this has been, I mean the water flowing there, filmed too, some

people running etc., e.g. in some detective stories. And then the question arose: What to do with the rainwater?

So, let's put it there directly, which means that we made some holes in the roads. In Snina, too, we have some sewage water rings (*manholes*) for densified sewage where rainwater is collected flowing away and mixing with wastewater. In principle, I call the water a gift from God coming to us from heaven, but we still consider it waste and this is what the entire water management is based on. However, we should change it, because the phenomenon of rainwater is very interesting and I think that within the project Climate change or A town ready for climate change, this can be a great opportunity for Snina to retain such water, and my estimate is that it may be around 2 million cubic meters running off, people paying to the water management company a lot of money, two million euros, so again to retain the water in the town for it to do the thermoregulation of the land, to make our environment nicer and, at the same time, for money to remain in people's pockets so that it is not wasted uselessly. We should be saving and be good farmers in our territories from the economic viewpoint. Thank you.

Erika Jankajová

So, that's interesting. You say we should be saving, we should retain water in the town, not sending it somewhere away. My question addressed to Mr Štofira is: What is it like with the water in the town? Is it really so? And can an ordinary citizen see, or how can it be seen, that we send the water outside towns?

Martin Štofira

Of course, our citizens can see it, above all, on the features that are dependent on the water, i.e. the greenery in the town. Maybe sometimes it's not that easy to see, for example during rainy periods, or in the spring, in autumn months. And especially in the summer when there are long dry periods, the temperatures rise, then we can notice that the greenery when insufficiently watered, when there is not enough of water, it fades away, its roots dry up, the tops of the trees for example, too. Or, when heavy rains come, we cannot retain the water as it runs off into the sewage system, then there are floods, flooding the roads etc. because the capacity is not sufficient enough. All these things are not hard to be noticed by our citizens.

Erika Jankajová

Thank you. Let me ask one more question and this time I'll direct it to our designer, Mr Róbert Šmajda, because the other day as we were walking across the town thinking and talking about where to implement the project features, he gave me a really strong feeling that he really cared about the town's greenery. So, my question is: What is it really like with the greenery? What functions does the greenery have in this town?

Róbert Šmajda

Well, the greenery plays a significant role in the town because it makes every man's life here more pleasant. Everybody needs oxygen to live, so we can make some kind of comparison here: one average adult tree can produce a thousand litres of oxygen per day, which in fact is a ten people's daily consumption. So, actually, trees are very important. Another role it plays in the town is collecting dust, this is a very important function, too. In towns where cars ride, it is dusty, brine mixture is used in winter, so then again one tree can collect 25-30% of dust particles present here. Then, of course, when there is enough of greenery, various kinds of it can be present, trees, parks, bushes – so the functions really vary then, yes. In fact, another project function concerns global warming, we all feel it.

The more trees we have, the more greenery we have too, the greenery regulating the temperature too and, in fact, the humidity as well. During rains, a tree, or the greenery is a regulator, as Mr Štofira has already said, it absorbs the humidity. And then, during hot days, a tree can evaporate some 100 litres, dehumidifying the entire environment and supplying the missing moisture to the whole town in the summer. Then there are another roles or functions as well.

Trees change soil diversity for the better, some small trees dying away, it changes it all, biodiversity being very important here, and the planting of trees or greenery in general, so as to have a various scale, not just one kind or type, because they make houses for animals, from insects to birds etc. – that is really significant too. And, finally, the social significance we perceive most perhaps. When you go for a walk in the park and the park is nice, you feel good there, you go jogging, you do some sports, sit for a while there, not just sitting at some café or restaurant, it is definitely nicer to just sit on a picnic blanket somewhere in the he park, to have some barbecue ...So this is perhaps the role that people are most aware of.

Erika Jankajová:

Thank you very much. I must admit myself that for me all that is green smells really nice. I just...

Róbert Šmajda: Well, you've just said it...

Erika Jankajová: when I'm outside and can breathe the air when it is all green around, the feeling, really, is something entirely different. And maybe this is why I would like to ask you, Mr Gažovič, how we should care for the greenery, I mean the right way. Because me, as a woman, I'd just say: Well, just water it and that's it.

Michal Gažovič:

Well, the thing with greenery is just like you have said. It should be irrigated if we want it to play the role it should play and everything my colleague here mentioned a few minutes ago, I mean collecting dust particles, evaporation, cooling, yes, it should be irrigated. When I started to find out some facts about it, I came across

a fact that for two and a half centimetres of a trunk you need some 40 litres, for example for a tree, yes.

Erika Jankajová:

Yearly, or?

Michal Gažovič:

Well, it should be simulated for the particular season of the year, of course it depends on the weather. But let's take a nice picture of Snina, how much greenery there is, and when you have mentioned that when dry periods come, and we do not have enough water... I mean in planning the greenery, in caring for it, we need to take into consideration that some things seem to go against our intuition. People often feel that trees vapour back too much water, but with greenery such as lawn areas, when combined with trees, it is quite the contrary. Shadows provided by trees result in lawns requiring 50% less water, which means that some way, especially in towns, people must be thought of, too. There must be some arboristic care, so it could not present risks to anybody, and then there is the variety of types of trees – we must consider whether we need to have the trees in the soil that is under some strain somehow.

Let's say, from the past, of transport. Yes, there are some types of trees that are more tolerant to the acidity of the soil, to heavy metals, some cope better some worse. This means that this mosaic can work. And, last but not least, the care related to irrigation. Yes, many times we see the watering vehicles riding through towns, which, obviously, must be done. Of course, we can engage the architecture and the planning there. To achieve that the water does not run off into the sewage system at the specific time when there is enough of it, but, as shown in the photograph, we could direct it to that tree in the square, so the question is how we could, technically speaking, get it where we need it, not having to pay the money for watering or for the work of people doing it, people who could be doing something else instead.

Erika Jankajová:

So if I understand it well, the issue of harvesting sufficient amounts of water within the territory of our town is to supplement greenery... (Gažovič: Exactly.), to simply (Gažovič: Yes) retain and then let it vapour back and cool the environment, so let me ask our designer here, Mr Róbert Šmajda, maybe slightly ironically: Is there enough greenery in our town? What is the real situation? Your opinion...

Róbert Šmajda:

Well, I was born in Snina. Soon I will turn 50, so I know a lot about what it has looked like in Snina and what the situation is like now. And, I don't know, some older citizens might remember, I'm not sure whether it is true or not, but they say that Snina was once declared the greenest town in Slovakia. That was way back some 30 years ago, or something like that... Of course, it was the older part of Snina, there were not the

housing estates – Settlements 1 and 2 there at that time. As for the urbanism, based on it all it seems to me that in the past greater emphasis used to be put on integrating greenery in towns. To put it briefly, the intrablock areas were greener etc. And even now, as I was walking here, I noticed ... well, I live at the very end of our town, and I noticed that it was really very nice there.

For instance, let me say, this is perhaps what Erika prompted me to do, that there are very nice green hedges there, the hedges which, however, are very hard to maintain, but simply I feel there like being somewhere in France, or somewhere where it is gorgeous indeed. Obviously, taking care of it all is a tough thing to do, you need to care for, dig up old ones, plant new ones etc. But, of course, the town has been getting more and more mature and we have made some progress, although other things have started to exist here as well, like shopping centres and all that jazz.

We have built new car parks, totally forgetting about the greenery. And the square we have in our town, which is what we want to focus on too, yes. Well, this is a place, some kind of space where people meet, but more and more we all feel, year after year, that it is getting hotter and hotter, that it is hardly bearable to spend some time there. And as a point of contrast, I would choose the recreational area Rybníky, I'm sure you all know it. Sometimes there is a thermal bridge in the town, when the temperature reaches about 40 degrees.

As Mr Dukat has already said, when temperatures are measured on the surfaces, on hot surfaces, try putting the thermometer right in the sun, you will get 60 degrees on a black surface, which is something dreadful. And then you decide to go up there to Rybníky, you spend the whole day there and get back, it is some 3 km far away from the town itself, and you don't even know it's too hot, because up there it was so pleasant. So, in my opinion, we used to be a green town, now we are only partially green, well, of course, there are some drawbacks, and in short, if we want to improve the quality of living in our town, we should maybe attract more people to stay and live here. In fact, there is never enough greenery, so we have to work on this even harder.

Erika Jankajová:

Well, thank you for your opinions. I thought we might also add some professional advice. I can remember, yes speaking of Rybníky, when I was a child, when the temperature in Snina was 30 degrees outside in the summer, I just thought to myself: Well, it feels like in Bulgaria. How can it be so hot? I was trying to convince my parents that when the temperature outside was 25 degrees or above, I could go swimming at Rybníky, so in this case it was from around 1st of May, but it was hard to make them understand me, yes.

Today you have 30 degrees as early as in April. Not this year, though, but sometimes it really is so. So, very much indeed, this impact is significant. From what I have already heard, the interesting thing for me was the topic of a heat island, a thermal bridge. What is it exactly? Because I'm sure this is something that our citizens might

be interested in, I mean how it relates to the climate and the greenery. Yes, I'm turning to you Mr Kravčík, if I may, how would you explain that?

Michal Kravčík:

A heat island is, for example, like this table is round. Let's say this is the town limits. And around the limits there is the agricultural land and further away we have the forests. In the past, the territorial development was focused too much like on sectors. This is the border of the forest, this is the border of the town limits and there's where we could devastate and now we can continue in that devastation cycle. Well, and as I have already pointed out that, say, two million cubic metres of water is runs off into the sewage system in the town every year – let's realize one interesting thing then that every cubic meter of water that does not run off into the sewage system but vapours back into the atmosphere consumes 700 kWh.

This means that we can be really fast at multiplying that two million times 700 kWh is nearly four blocks of a nuclear power plant, which is how much heat is produced out of dry periods in the town, and also taking into account the omnipresent asphalt areas, we have many roofs, we have too much bitumen everywhere and black surfaces get hot too quickly, so a kind of heat island is formed.

The largest heat island in the world, as far as I know, (but this may have changed as there have been some changes) used to be in Tokyo, where in 2000 the government adopted a concept of 1 000 hectares of green roofs, based on which some amazing relaxation zones came into being on the skyscrapers up there, walking alleys etc. The bonsai gardens that basically absorb the green, I beg your pardon, the rainwater, returning it afterwards through evaporation to the atmosphere, which is what the pumping of heat is related to.

Because when you have a cubic meter of water which when changed into vapour consumes 700 kWh, this hidden energy, it is called the latent energy, latent heat, goes away with the water into the atmosphere, it's like in the car, you have a radiator there – when the cycle is closed it cools the engine, but when it gets perforated and emptied, the engine gets broken. The same applies for towns. I mean, we actually perforate the radiators, letting out all the water and then, suddenly, we are shocked that it gets too hot. And in our conditions here in Slovakia, this internal temperature, the temperature inside the town limits, in my estimate it is from 2 to 5 degrees higher than it is in the surrounding areas.

Take, for instance, Rybníky you have already mentioned. If you think of the square you've got here, I was walking across it this morning, and actually what you have there is the small bonsai trees and you have people sitting on the benches in that part when there is some shadow, yes. Which means that the tree, on the one hand, cools a little bit through evaporation, but on the other hand, that poor tree strives to survive too, it needs water, so when there is not enough of it, it roots too deep into the ground to pump some drops of water from down there and, actually, under the

surface, the roots die away and that tree is very unstable and when a whirlwind comes, it has no chance to make it and falls down.

So we do a lot of unpleasant things to ourselves alone, as if we were not aware of all those interconnections. That's why I believe this project you have started here is a great opportunity to open our eyes and present very particular examples to citizens, interested persons, I mean businessmen too, just remember the car parks and supermarkets. And what is more, when you look around standing in a car park, you see the curbs around the trees, so that the poor trees have meter by meter of space around where the rainwater can be absorbed, although there are some pipes for a water tanker to pour some water on it, which is not a bonsai solution, but a bypass solution like a man being on external ventilation in hospital. So, this is what we actually do.

We simply replace natural systems with artificial ones, and it costs money, money, money, because 2 million euros could be spent on something else instead, on the management of water, greenery for everything to be beautiful, for people to be happier, the air cleaner, the environment colder, more relaxing for all the people here.

Erika Jankajová:

I'll go right over to you, but I'd like to stop here for a while. If I understand it well, because there is not enough greenery in the centre of the town, it gets too hot, the water evaporating, a heat island starting to exist...OK, but where does the water go and fall down back again? Isn't it just some kind of current trend? And I think I should address this whole question directly to you all, concerning the harvesting of rainwater in the town, because we know how to retain it, we have the Starina dam not far away from here, and we can use the water for irrigation, let's say.

Michal Gažovič:

Well, let me add something to what has already been said and then we could go back to the current trends as you've put it. First, there are documented examples from all around the world that a heat island is really like an island. You have radiant heat that goes up into the atmosphere, and it depends on the architecture of the specific town. For example, New York behaves in a different way from Snina just because it has skyscrapers dramatically changing the flow of the wind in those upper levels, but simply, just imagine that we have radiant heat right here above this table, and now we let some humid air on it and this radiant heat prevents the humid air from reaching the town. It simply pushes it away, see? And it's all related to that current trend.

Well, actually, it's not just a trend, because as you can see, Snina lies down in the valley, though you have some hills around. This means that, naturally, if I don't let the water that should reach the territory of Snina rain down over the town, then of course, it is pushed away somewhere into the hills. Which is why it is cooler there compared with the town itself, the water condensing, as a result of which there is the risk of flash floods when the water rolls down from the hills.

The other phenomenon is that hot air can retain more humidity, which means that when the air around the town is getting hot the precipitation is be more intense compared to if the air is cooler. So I think this is not just a current trend. At present, universities, in cooperation with municipalities, focus more and more on this problem, by measuring those micrometeorologic characteristics, the flowing of the wind ... I've even got an example from Singapore, where they experiment with modelling situations, contemplating how an urban feature planned in the process of a city development will affect the phenomenon of a heat island, taking into account the following: how the people move around the city, how they mix the air ... in my opinion, this is something that can be modelled easily today. And this is why I don't think all this is just a current trend, because all around the world people try to resolve this issue.

Event the statistics say that more and more people die due to heat waves than due to floods, which means that this is presents a major issue today – that rising frequency. To put it simply, no current trend, a necessity.

Michal Kravčík:

Let me add just one thing to what Mišo (*Gažovič*) has just said. One city in America, in Latin America, in Brazil, I think it was Sao Paolo, had no precipitation for five years at all. The population there counts some 20 million. And it stopped raining there just because of the fact that the thermal air that should push away the clouds ... well, no rain at all, you know, which also results in the city not being cleaner whatsoever, there is more dust there, concentrated pollen, allergens, which, basically, the children breathe in. So this is the key issue, basically. It's not just a current trend, but an essential necessity in terms of the territorial development as such. Historically speaking, we have made a great many mistakes and we should put it all right now.

Erika Jankajová:

Thank you. From what you have just said, Mr Gažovič, the issue of the flow of the wind has resonated with me most. I remember the time when I was buying my flat...well, it was in Bratislava, the former chief architect, I guess it was him then, the chief architect of the city of Bratislava, told me: "Erika, never buy a flat situated so high up there, there are strong winds there, you know...", and I thought to myself: Well, it can't be that high up, this is Bratislava, not New York, isn't it?

The temperature there rarely rises above 25 at that time of the year, which even wasn't so at that time, so this is, in my opinion, an issue related to the urban and municipal development, which should be taken into consideration – if I understand it correctly, when high-rise buildings are built, it's better when they are as close to each other as possible, because if it isn't so, then...

Michal Gažovič:

Well, the thing is that the flow of the wind is laminar, in fact, and yes, in the upper layers it flows faster and the closer it gets near the ground the slower it flows due to

the simple reason of friction. This means that the closer to the ground it is, the more friction it has. (Jankajová:) And let's not forget about the density... (Gažovič:) The laminar flow simply does not occur over a broader space, which means that it does not flow in even layers, but starts to get mixed, creating so-called turbulent flowing, yes.

And this turbulent flowing characterizes our ground layer of the atmosphere, which means that that chief architect was right – when you are in a high-rise building, the flowing there will be much much stronger. (Jankajová:) Well, so it is really so. (Gažovič:) And then, of course, the thing I have said about Singapore. The design of a particular building can affect the flow of the wind, and subsequently all that happens in the city.

Michal Kravčík:

The laminar flow is very dangerous, it's what happened to the High Tatras in 2004, where too hot a heat island formed there inside Popradská kotlina (*Poprad Basin*) forming conditions of radiant heat and then there was the frontal system falling inside Popradská kotlina from Poland from the northwest through the crests of the Tatras, and the heat actually started to pull down air masses, which was what actually cut the trees. That was a typical example of laminar flow. And there were some guys, I didn't talk to them, but someone told me that they were in a tower somewhere up there, by coincidence they were in the bubble, and that down there it was all sheer hell, but the wind did not touch them at all even though down there it was cutting the trees.

Erika Jankajová:

So I guess it is not only Snina, but the whole of Slovakia, facing a challenge of how to cope with this issue and what solutions and measures should be adopted as quickly as possible to protect the greenery, to be a green town. I myself got dressed in green this morning, having no idea that Snina was declared the greenest town once, so I hope this is my small contribution (looking on the brighter side of it all). But let me ask you, Mr Štofira: As far as our citizens are concerned. Do you think they really perceive it all? How can all this affect the quality of their lives, because well, we can say it's good because it's green, but delving deeper into the issue, how does it all relate, say, when it gets cooler...?

Róbert Štofira:

In my opinion, this is totally undeniable. Basically, the more greenery you have, the better the quality of your life is. And, of course, if the greenery is healthy, if everything is as it should be when it comes to taking care of it, then there is the aesthetic function of it all as well. Secondly, this all has already been said today, I mean that it all has health benefits, when there is not too much dust around, too many allergens in the air. This also applies to animals, with the right greenery increased biodiversity goes hand in hand, you know.

Erika Jankajová:

Let me ask you, Mr Gažovič, what do we understand under the term biodiversity?

Michal Gažovič:

To put it simply, it is the variety of life, which means both the life of plants and animals. Just imagine having only one kind of a tree – this means not so many species being dependent on it. But imagine having more kinds of trees – this means, from the point of view of quantity and quality, more of them being present there, this forming more space for animals. Some basic cycle, say the gnat, the frog, birds...yes, these animals have somewhere to live, they can create living conditions in towns and help us to fight annoying insects, you know.

Erika Jankajová:

Yes, go ahead, please.

Michal Kravčík:

Well, Mišo says the gnat, the frog, birds and so on... It is really important (Šmajda: The fish) because, yes, the fish, of course, many people are afraid that more water in the town means more gnats, which is where it is important to realize and ask yourself a question: When we dry up the land, the species diversity is very low in fact, and what is the reproduction ability of a little bird then? Say, once per year?

But for the gnat it is 12 days, which means that when the whole land is dried up, there is not enough frogs, birds - i.e. predators for insects, then automatically, as soon as floods happen, the water pouring out, then the life simply starts to ferment, beginning with the more simple forms of life, such as the gnat, you know. This means that when the land is plundered, dried up, the land needs to have its predators, but when we leave more water in the land, in the system, let's say, whether rain gardens or something similar, then let's not say that these are the gnat hatcheries because a little bird needs 5 000 gnats per day, you know. Birds will simply find them, but they must have conditions created to do so, enough trees, roosts etc.

By coincidence, yesterday I was in Liptovská Revúca, where I met a man, I don't remember his name now, he is a doctor, works at the Academy, and he takes care of the birds in that region, well I really can't remember his name now, but I might recall it later, it's irrelevant though, yes, it is. The relevant thing is that in his opinion speaking of the land structure it is necessary to create a variety of ecosystems so that we have enough of all animals and plants, which is what will make it all more stable. Accordingly, all this process will be much slower, automatically regulated, we won't need so much chemistry, because nature will be able to take care of itself alone. And we are the creators of it, but first we plunder it, leaving it as it is, thinking that we don't have to care about it.

Take housing estates, for example, they are a typical example of how we monostructuralized our living, historically speaking. This is what we need to change,

though it's not easy, you know, you have the blocks of flats everywhere etc., but we should start discussing the internal structure, develop it, and water can only help us with that.

Róbert Šmajda:

Excuse me, I'd like to follow this, if I may.

Erika Jankajová:

Yes, just go ahead.

Róbert Šmajda:

One of my colleagues did a research in Brno concerning birds, a large number of birds. And the interesting thing was that the birds were starlings and the density of their occurrence in the city parks was much higher than anywhere not far away from the city or anywhere else, you know. When the conditions are good, as Mr Kravčík has said, when there is enough food for them, then they are there, yes. However, it's not only that there are the birds, but actually, today's agriculture is industrial – there are various crop sprayings and so on.

At present, you may have noticed, it might be that the herbs gathered in towns or cities are healthier than somewhere in agricultural soils. So, in fact, in towns or cities (Jankajová:) Because of the spraying, yes? Yes, because of the spraying, because of it all actually, in towns or cities we can create the right biodiversity, we can maintain, but even reaching a better parameter than somewhere else.

Erika Jankajová:

Well, so let me try to sum it up now. If I'm wrong, please correct me: So, when we dry up a town we do not have enough greenery there, and then a flash flood comes, simply at that moment there is enough humidity...the gnats have a fast reproduction scheme, the time, ability, so they reproduce quickly, but the birds that otherwise could and would quickly kill them will not come there, as a result of which the gnats present a risk to us all, even though we can install protection nets on our windows and so on, but... (Kravčík:)

There are more gnats reproduced than birds can eat. (Jankajová:) Yes and it means that if we install more green features, let me put it romantically, if we welcome the birds in the town, as a result they will take care of us, paying it all off in a way. Now, let me ask you about rain gardens, this forms a part of our project too. What are they, actually? They are not just parks, we won't have many birds there, will we? And my question is: When it comes to rain gardens, shouldn't we be afraid of gnats there?

Michal Kravčík:

Well, this is exactly what we have said before: that more irrigated layers of the town will support the reproduction, support the reproduction ability of birds and frogs. I remember, for example, in the bioclimatic park in Rajecká dolina (*Rajec Valley*) they

made some small lakes. Last month I went there and now they have hundred thousands of frogs, which had not been there because of a dry period. This means a food chain starts to exist there, and even, as Laco Židek told me, two years ago a pink-footed (Greenland) goose landed there.

Why did it land there? Because there is a food chain there, which means that it's quite simple and I think that ecologists and biologists should in fact be inventing schemes how to support this instead of waiting that nature itself will cope with this alone.

Michal Gažovič:

But let me add something.

Erika Jankajová:

Yes?

Michal Gažovič:

Back to the issue of rain gardens: you don't have to be afraid of rain gardens because the purpose of a rain garden is not to create a permanent water area. Its purpose is to provide a space for infiltration, which means that if I don't create a permanent water area somewhere I don't have to be afraid that I will have a large number of gnats there.

Erika Jankajová:

OK, so if I understand it correctly, we will retain water in rain gardens. This means that it won't run off quickly out of our town, it will subsequently evaporate more slowly (I mean not running off so quickly) remaining in the environment for a longer time, cooling it, and so we don't have to be afraid of gnats. Am I right?

Michal Kravčík:

One rain garden can absorb, say, it's just an estimate, 1 000 cubic meters or 100 cubic meters per year, which means that part of the water goes underground, some one-third of it. Two-thirds evaporate, this means irrigation, then you have beautiful flowers there and insects too. I remember, 15 years ago in Košice, a 3-hectare area that had been a totally plundered, dry, eroded, crusty land, was created. Now they have a hill full of vegetation there, so many flowers you can't even imagine, bees, bumblebees, butterflies and so on, even small insects. Nobody cares for it and it all grows just like that due to the fact that rainwater harvesting measures were adopted. All the rainwater remains there in those three hectares.

Erika Jankajová:

Thank you very much. Let me now finish this discussion and move on to the issue of water in Snina. Do we have enough of it here? Well, we have quite much of rain here, maybe not particularly right in the town. Last year, unfortunately, we had quite the

contrary problem. We had as many as 3 floods here. I mean, the floods affected not only our town but the surrounding villages too, which is why I think this is an issue we should discuss for a while. However, we will not be doing so until the afternoon panel discussion focused on water management outside the town limits begins. For now let me thank you again for your willingness, time and contribution and I believe that our participants will have learned a great deal by now. Thank you once more.

(Panel discussion participants:)

Thank you.

Erika Jankajová:

Thank you very much. With this I'd like to finish our morning programme and after lunch, at 1 o'clock, we will continue. Thank you very much.

"Possibilities of water retention in the forest environment" - Ing. Pavol Šutý, EKOSTAV

Erika Jankajová:

Dear gentlemen, let me welcome you back to the second part of our conference. Let's start with the presentation of Mr Šutý who will present to us the possibilities of rainwater harvesting in the forest environment. His presentation will consist of two parts. In the first part he will show you all here in the hall as well as those present online some practical solutions, and afterwards, after 15 minutes, we will go down to the ground floor of the Manor House in Snina, where outside there is a real-life demonstration of the specific solutions. For those being online with us, we will record it and publish it on the Internet, so you will all be able to see the models of how to retain water in the forest environment. Thank you and now it's over to Mr Šutý.

Pavol Šutý

Thank you, well, you must turn this on somewhere first, I guess. Good, thank you. First, let me send hearty greetings to you all. I am very happy to be here with you. I come from Kysuce, the district of Čadca. We have a three-point there, something similar to what you have here in your district, a borderline three-point, right? Yours is between Poland, Ukraine and Slovakia, ours is between Poland, Czech Republic and Moravia. (*Trouble with the microphone*) Ah, there was no green light on, well, you see, same as the crossroads. Well, Kysuce is formed by 61% of forests, my estimate is this to be some 50%. I'm going to tell you something about how a forest affects a town even though the town itself lies a little aside, or in a valley, but for sure, forests have influence on towns – here by way of comparison with Snina. This one, reportedly, is a picture from Norway.

They have a big bridge there, but I didn't find one tree there. You have a great many trees in Snina, so let me congratulate you on that. But let's move on, why I am introducing myself to you here and why I wish to tell you something here and pass on some of my experience. It's mainly because within the implementation of a programme named "Landscape Revitalization", but also before this, I worked on forest and technical improvements of landscape, but then my small company, not necessary to give its name here, did lots of such facilities and, strange as it may seem, these facilities are still working to the benefit, and I believe they will still be working for a long time to come.

However, there are some of them that were washed around by the water, maybe some of them were even washed away, so I have a great deal of experience which I would like to share with you now. Listen, you might like to watch these things later. So, now to the forest. I am a forester by profession, but for all my life I have been making constructions, interconnecting one field of work with the other. Because the constructions themselves that are specially built in the forest should be made by a person who understands forests, or has studied them. So, let's get down to the business. This is some text to go with it, you will find it on the Internet too. In English.

Before we started to work, first we did some research into what it looked like on the streams, like this stream, it's more of a "tinkler" in my opinion, a very small stream. In summer, these streams hardly flow sometimes. You, same as us, are situated in the flysch belt zone, so in summer these streams do not dry up, they just flow very faintly. Here, on the left, as you can see, it reads Na Radôstke, it's a small village not far away from Bystrická Dolina. We know that it should be 71 years old because at that time, in 1956, there was no electricity there, so they made a step like this, from where they pumped water driving some turbine, or whatever they called it, which was used to provide lighting.

The other thing you can see, on the right, can be found in Horné Kysuce. This is what Marta Sláviková told me, that it was her father who built it, it should be 50 years old. Interestingly enough, it is made of wood, but it still holds firm together. However, the work is "chaľabne" (*incompetently done; done by a dabbler*) done, as we say here, it just holds together so-so, but it does, especially on the left side, because the water washes down the wood as a result of which the wood does not decay. Do you know that Venice is built on 700-year-old wooden columns? So when it's under water it does not decay.

And now, here, these are some of the small dams that we made within the programme of landscape revitalization. This here are concrete steps. The one, on the left, is in Oščadnica, a village where I used to live for many years. In Tichá dolina. The one in the middle is interesting too because it's in the village of Stará Bystrica. It's a combined dam, stone and concrete.

It was built by the Romanians from the village of Ulič. You see, the village is in your district, right? From Ulič, Jožo Repka sent me two groups of workers. They did it,

using "wild" brickwork. It's done well, though. Somebody asked me: "How long will it last?" I think after 100 years it will still be there. So, this is in Stará Bystrica, where a member of the local government was Jano Podmanický, you might have heard this name in the Parliament too. He is a Smer party member, well, he was, no longer is. And the other day I said to him: "You know, Jano, for about 8 years there has not been a proper storm here in this little valley." And he said: "Paľko (*diminutive form of Paul-used in a friendly conversation*), I don't care, at least the people there can sleep well." So this was done in 2010.

But this is the most bottom part of the thing that is cleaned and over which there are various kinds of polders, retaining facilities, infiltration patches, which are really helpful as well. This is the village of Krivany in the east. The local mayor (*his village*) was flooded again and again and he was really scared of it. So this is what we did for him there, right on the first day, a dam like this, so that he could relax a little, and so that we could cooperate with him properly. It works as follows: the water flows through the large boulders and it also serves one more function, you see, tractors can pass there from one field to another.

Well, and this here is one of the first small dams I made. I have devoted all my life to this. When we had a day of hunters' cleaning day out I said, there was so much of it there, we call it "čečina" or "chovina" (*lots of coniferous branches piled*) and it was appalling there, so me and my friend we did something like this, it's about 3 metres high and at the top we put a stabilizing pole there. After two years it looked like this. And after 10 years there is a huge resting place for local deer where they bath in the mud. And it still works like that, there is a kind of wetland there. And these here are some special dams that we have developed as our company. And I think, they are really smart.

We even didn't know, while we were building them, how it would all turn up in the end. But it holds together very firmly, because it is as if it were reinforced. Some small wooden pieces go upstream, and the strengthening, reinforcing pieces of wood, the thicker ones, go across the stream. The one on the left is connected like that because the stream was about 20 metres wide, and we did not have wooden pieces so long as that, so we had to tie them together like that. And the guys who did it, that was a group of five bachelors, they asked me whether it was better to tie them together against the water or in the opposite direction.

But how was I supposed to know? I told them that it was good as it was. There on the right, you can see the little dam, it's really well done, my brother-in-law as the supervisor was there. He had some unemployed persons there. This must be perfectly embedded in the slope. And then there are some pieces of wood tied together again going up into the water and the water, when muddy, carries along some gravel, clogging it, but it holds together firmly as some kind of reinforcement. Simply, a dam like that will not break, or will not be carried away by water. Many times people make mistakes, and I can see the mistakes they make, but I'd hate to present them right here right now.

What is more important is the spruce, spruce forests, the wood must be peeled off so that beetles could not attack it, but also it looks nice, aesthetically speaking, and the pile of coniferous branches lying there, it serves as some kind of strainer, purifying the water from the sediments for the water to be cleaner. Now, there on the right, that dam is made of acacia. You know that acacia wood lasts for very long, for about 40-50 years, but the spruce will decay in 8 to 12 years in certain conditions. If it is flooded, it will last, in my opinion, for 20 years at least.

So, these are so-called overlaid dams, you can see the whole system upstream. There are, I think 12 or maybe more, of them there, each of them retaining some tens of cubic metres of water, but then letting the water run off. It fills in, then lets the water go out. It cannot work, a dam like this, if the water is still there. Because the purpose of rainwater harvesting would be lost then. But I should be telling you, above all, and it's something I should have started with, that such small dams are also there to control floods.

But, in my opinion, they also serve another function, they cool the forest environment because this is what this conference is about. Well, I'm a hunter. When we are looking for a deer, or some other animals, in the summer, in hot summers, we usually find it where a stream is, because it's cooler there. By the water it's cooler not only emotionally but also physically, because the water cools the surrounding area. All the water that is in a reservoir or flows in a stream, but there is one more effect existing there – the water fills in the underground, the rocks there or the sediments which contain 21 to 40% of water.

That in fact you feel when you come there that it's cooler there. The dam on the right is made of acacia, this one should last for 40 to 50 years. It's done very ugly, as you can see. And it was made again by the Romanies from Ulič. However, it's fully functional. It's situated in Hlohovec. You know what? We though hard, looking for solutions to do it right, and within budget. This dam here was built by unemployed women of Stará Bystrica. It's quite nice. What you can see there is the vegetation wood, it will sprout later, overgrow. It's hard to find it now, but each dam like this is marked with coordinates in the implementation documents, it can be found based on the coordinates, otherwise you won't find it.

A very interesting one, a kind of model dam for us too, that one on the right. I said to the foreman: "You know what? Try doing it like this." They didn't feel like digging too much, so they only dug up the embedding for those pieces of wood into the side, where I always tell them that it should be a meter and a half deep, as such the norm is. But they only did it into a half meter, covered it with soil and thought that they would get away with murder. On the next day, a sever flood came. The mayor was almost driven to tears, but interestingly, this type of dam, by mistake perhaps, remained standing on its right and left sides. So, after that, I forbade anybody to do anything else and we only went on making the overlaying dams. To date, we have made 1 900 of them.

The biggest mistake is when you embed it insufficiently and the water gradually washes it around, but I only know of very few dams that have been completely washed away by water. So the dams, not only harvesting rainwater and letting it go when there is very little of it, but also cleaning the water, and this all works. They are all made of wood, spruce wood, which is not the best solution, though. And there is another phenomenon worth mentioning: when you let the water go down like this, it goes down quickly with that rattling sound, because it takes stones with it and everything goes down into the village, where they all would start wringing their hands complaining that the forests are to be blamed for the floods because they have been cut down. But the water runs down from not only from the forest, it also runs down from the agricultural soil, as you can see, the water running from the forest, dirty and revolting, containing branches, blocking and clogging up the bridges and so on.

See, a cure for this is very easy, even primitive. What you make is a so-called "fender", a simple fender in a forest road. If deftly done, it works by fending off the part of the water which then runs into the terrain where it's absorbed or runs for a longer time. Importantly, not far away from the fender you need to make a pit for the water to be absorbed there. Well, quite primitive, isn't it? It's simple and it works, we have verified that many times. There are many "fenders" like this one, you can come and see for yourself. Lots of people have come to see the little dams. We invite people from Poland, Austria etc. You know, something as easy as that: two pieces of wood one next to another.

You see, this is how it's done, how the guys do it. You see the fender, how much water it can fend off, and down 50 metres below there is another, and another one... We have already built about one thousand of such ordinary, primitive fenders. However, we came to realize one more thing which, in my opinion, nobody has ever thought of – it's hard to believe. We don't leave spaces between the pieces of wood. We do not. You see, there are no spaces there. The pieces are placed close to each other, because that is when they hold firmly together better – when they lean against each other. There's no need to put any hooks there. Because you know what happens when the wood decays and you have the hooks there. A tractor punctures its tyre, and it's all damage done.

There are only some hooks at the beginning and at the end. And if it's done well and they are appropriately slanted, water itself cleans them because the wood is smooth and all the dirt goes over the wood, not blocking anything. And now what we have here is various kinds of small dams. I think, if my calculation is right, we have made around 31 types, not pieces, pieces we have made 5 900 of any kind. And if you want to have some water there, to have some water retained, you put some textile there. We built some posts there, so that it could still retain one-third of the water, there was a kind of pool there for frogs etc. to have somewhere to stay, the remaining water retained during the floods.

Again, it's made of the vegetation wood, the willow tree, and it works. Willow trees are for free because you won't pay anybody for the willow as wood. On the right, you

see, there is some kind of step, this one is equipped with a counter step, which is a special term used to name it. It's because over such a step the water goes and falls down, and the best way to slow down water is to let it fall back into water again. It's a very simple brake. You don't have to put stones or anything else there. These little dams, there are 36 of them in Horný Hričov. We went there not long ago, they were shooting a film there.

They came to have a look and saw one dam was not working. There was water in all of them because the mayor wanted water to be there. Then, right beside it, there is a footpath on the left, near the trees, and here a footpath again, the Romanies from Ulič did it too. That's where people can walk, they built a gazebo there and nearby they grill their sausages. Well, and where the dam failed to retain water, it simply ran off, the wood already decayed in 2008. But this wood is almost healthy, because it's under water. So I convinced them that it was ants biting through holes there and that's where the water ran off.

But it was us who made a mistake there. However, these are, say, rarities. That dam, on the left, is in Hranovnica. And in the house down below the dam, where the unplastered garage is, that's where the current mayor, Vlado Horvát, lives. He is serving his second term in office now. Again, we made it really smart. We did not go with the water deeper than 50 cm, so I guess nobody would ever drown there, because those children, this what you can see here, is a part of a Romany village, where there are those rich people and behind them there is the poor section. Well, and lots of children there. That little dam on the right, we finished it in on a Sunday, and the following Monday was the eleventh of November, wasn't it Michal? At eleven o'clock the final approval of the construction took place. So, when they were finished, it was actually the anniversary of the end of the First World War, this is what the bank manager told me on Thursday: "Paľo, but I ain't got nowhere to go for a swim here. What have you done here?"

So from Friday to Sunday we made the dam, you can see, for him, which is 30 x 18 metres or so, because he, the bank manager, "wanted to have a swim there". Well, and it's made, made of clay. And to prevent the clay from crumbling down, it's reinforced with a reinforcing agent, so that it could not be torn apart. And the edges, you can see, they are made of wood. It still holds firmly together and there is still water there. No signs of decay, because it's under water. But what is above the water there, you see, signs of decay, it needs some reconstruction, some repairs. The reservoir on the right, it's used when forest roads are being built. But this is something that drives me mad sometimes. They build a forest road, but no reservoir or a container for extinguishing fires. So then the fire engines rush up and down eight to ten kilometres to pump up water bringing it back to the forest. Bringing water into the forest where there is enough water – like carrying coals to Newcastle, right? But the reservoirs or containers, again.

They must be done smartly. It's best to do them below the springs as they do not tend to be clogged up there then. If you do them on a stream, they tend to be

clogged up by the water. So this is our experience. This is in our village where I live now, in Kysucký Lieskovec, like some things I have already shown you. This is a reservoir, because this is not in Stará Bystrica, this is below that little dam that was shown first, with that pipe I have shown you already, that can last for 100 years. And he said: "So the old women still come to the stream to wash their clothes? Palo (*another diminutive for of Paul*), please, do something for them there." So this is for washing clothes. That's why the thick board is there. The women stand there, put their clothes on the board and rinse them or whatever else they do, I'm not sure. It makes them happy. I don't know whether they're still alive, those old women there. Well, and in this village, the Mayor Jano told me he didn't mind that they had no floods there, that it didn't rain there at all. The people there could sleep well at least, knowing they could not be flooded.

And now this, at the centre, is a picture of ... this was made as a part of a fire protection road we made as a company in Kysucké Nové Mesto. This one is maybe a little too much, it's too perfect a fire protection reservoir. Seals, gaskets and what have you, but we hadn't installed little dams there before, so I made an extra one for them. It is completely clogged up now, though, because of the water coming from the forest taking with itself the topsoil layers and so on. You need a building permit for this, and I don't know what else. The building alignment for the reservoir you can see at the centre. It's 86 cubic metres. I'm not going to tell you how much it cost, just for safety's sake.

We made them a gazebo free of charge, for comparison. Everyone who goes there, I guarantee, will stop and sit in that gazebo. I do not guarantee, I see it happening every day. And suddenly I feel more calm there, the water is babbling there, and maybe one doesn't feel so hot there. And next to it, there is the forest road there, it's 5.3 kilometres long. And what you can see on the right in a forest in Makov. In Makov there are still beautiful spruce forests there. The chief of that association came up with an idea to have a fire protection reservoir built there, but he forgot to tell me everything then, so we dug up a hole for him there, it's called a "monk" and he built a gazebo on it. And do you know what the purpose of the reservoir is in the winter? Nobody would've ever thought of it. Cold water swimmers go there. First they warm themselves, or whatever they call it, and then they swim there. It's an 800-cubic-meter large reservoir. But without a building permit, without any obstructions. He just said: "It's in our forest, so it's nobody else's business." That's how cheeky he was. The reservoir works and it works well. Wait, where is this one? Ehm, 15 minutes gone?

Then give me one more minute, don't worry. Well, this one is very good, as far as rainwater harvesting is concerned, this is shortly after a storm in Hranovnica. The water runs down, gets retained, and then absorbs depending on how it's done. If you have a good excavator operator, who understands the subsoil, we can make it work that the water is retained there for a month, then gradually it is absorbed. If you dig too deep into the gravels, it will absorb in a day. If you just leave it in the clay, it will

absorb for as long as three months. This can't be precisely calculated though, but this is how we did it, and you can help it by doing some corrections if it doesn't absorb well, and the water then absorbs better. Well, I would like to finish with this. Again, a town with no trees, so let me invite you out. I will simply, well, I do not present it to you as an example of all examples, but speaking of it, rainwater harvesting in forests, so it seems, it works, indeed.

But I'm surprised that we don't have the old little dams recorded here. I took pictures of them after ten years. So let me tell you. The wood is black. Do you know why it's black? It is as if it had been impregnated, but it has just been flooded over by the water. It's enough for it to be flooded over once per month, then it, the wood, does not decay. It's almost like healthy wood. So, after ten years, if it holds firmly together as new, so then, what happens after twenty years? I think it will still hold together well. But there is one more trick. We're implementing one project to do with that in Moravia. There are different kinds of wood. Ideally, the little dams should be made of European larch, *Larix decidua*, Modřín in Czech, you know.

This is the wood that lasts twice as long as the spruce. It doesn't decay so fast. So it's all for now by way of my presentation. I really didn't want to give you a lecture, I just wanted to share my experience with you and outside I will go on showing you two models of how it could work in a forest. So, there we go and thank you for giving me this opportunity.

Erika Jankajová:

Thank you very much for the demonstration and now I would like to invite all of you present here to go and have a look outside. After that, at 1:30 p.m. we will be continuing with a presentation given by our Norwegian partner who will share his inspiring experience concerning their real-life measures related to fighting climatic change and to preparing towns and cities for its impacts. Thank you, see you all in a while. Thank you very much.

"Panel discussion: Water management in the outskirts of the city" - Ing. Róbert Šmajda, Dr. Ing. Michal Gažovič, Michal Kravčík, Ing. Arch. Martin Štofira

Erika Jankajová:

Due to technical problems related to our speaker's presentation, at the moment we will have a short break and then we will continue with a panel discussion. And as soon as we manage to deal with this technical problem successfully, we will continue with the presentation at the end. If we don't, we will arrange with the Norwegian speaker to prepare an online recording to be made available to the participants in due course. Thank you for now, go ahead and have some coffee, tea, or some refreshments. We will continue at 2 p.m. with a panel discussion.

Erika Jankajová:

Good afternoon to all of you watching us. And also to all the participant in our conference being present here at the moment. I do believe that you found the presentation given by Mr Šúty concerning practical solutions of rainwater harvesting in the forest environment inspiring.

The recording of the presentation will be going out soon, but now let me turn to our dear guests, experts involved in our project Snina - a town ready for climate change. We will continue with a panel discussion focused on the topic of rainwater harvesting or water management outside the town limits.

We talked about heat islands this morning, yes, so let me start with a specific question now which has to do with how this relates to floods, because the participants and, above all, those involved know that as far as our town and the surrounding villages are concerned, what trouble we have had with floods. So, let me ask you, Mr Gažovič, try and explain this issue to us.

Michal Gažovič:

I have already started discussing it, in the morning part, showing you the hills. So the connection is as follows: when there is, as I said, a heat island, then the territories lying lower tend to get too hot and the precipitation clouds tend to be pushed away into the hillier parts of the countryside, where it's colder of course and where the condensation occurs and rain falls down, running down with a great intensity. So the fact is that the connection there is obvious.

Not far away from here, at the river Ondavka basin we did a project, including a study conducted. We were comparing the precipitation measurement stations in Ondavská vrchovina – Vyšné Čabiny and Humenné. Well, the trends for the last 40 years really exist, telling us that the amount of precipitation is rising in the hilly parts and dropping in the lower parts. And if we add wrong management, either of the landscape or water within the landscape, then of course, it affects the floods too.

Erika Jankajová:

Thank you very much. And now, let me turn to you Mr Kravčík. As far as the torrential rains are concerned, could you tell us something more about this topic? As well as about the problems they cause?

Michal Kravčík:

I will follow where Mišo left. It's where we need to realize that there are certain physical laws that apply for the atmosphere too. And one of them is the so-called second law of thermodynamics. Yes, it sounds too abstract maybe, but in fact it can be very easily described in that that heat runs from the source, not the other way round. And when we think of a heat island and a hilly, forest environment, where it is

colder there, it means that heat from there is actually pushed into a colder environment.

Based on this, two Russian scientists described a so-called biotic pump by means of which they proved a mechanism in which natural forests create and control ocean-to-land winds, and that where there were original ecosystems the rainfall there rises, it means that where there were, actually, transformed ecosystems, it works the other way round. This means that if we put these two things together, it can also be applied similarly in a microstructure. Let's take Snina, for example, a heat island means that in the future it is possible to expect lower amounts of rainfall should we fail to do something about it, this applying, even to a greater extent, for hills. So it means that it is pushed in the so-called chimney, water vapours up into the atmosphere, the first such a dangerous phenomenon having been experienced in Slovakia 20 years ago in Jarovnice, maybe the citizens of Snina valley remember what happened there.

A flash flood caused a catastrophe during which 50 Romany children died, drowning directly on the spot there. And if we have a look at a satellite map we see an island of forest, and Jarovnice are not so far away from Prešov, but Prešov at that time had a rainfall amounting to less than 30 millimetres over the same period during which 100 millimetres of rainfall fell down. Which means that it works in microstructures too. And the solution to it all is exactly what I'm saying, but let me first finish this: well, actually, when a great deal of water falls down on the hill, it will run down resulting in a catastrophe for Snina too.

So, the citizens of Snina can resolve this problem by cooling the thermal ceiling and by reducing it, achieving a lower difference between the temperature of the urban environment and the external environment, I mean within the cadastre of the surrounding hills. And then we can expect that the clouds will be pouring down over a larger area, with no extremes, such as 100 millimetres, but say, just 80 millimetres and here maybe a little more.

The same applies when we think of the east and the Carpathians, the Eastern Slovak Lowland, we know what we have done there, I mean the drying up of the Eastern Slovak Lowland caused, in a way, a rise in the extreme vertical clouds in the hills, in the Carpathians, the subsequent torrential rains bringing forth catastrophes also for the valleys located in the Carpathians, and of course, them pouring down to the Eastern Slovak Lowland. Nevertheless, these things can be coped with, but first we must understand them and must reflect them in certain strategic decisions. In my opinion, this is a great opportunity for the town of Snina to rise to such challenges, to show us the way through particular solutions and to transform the knowledge into the everyday life.

Erika Jankajová:

Thank you very much. Let me follow the issue of the vertical cloud. This is quite interesting. It means that the cloud is, say, tall? Because from down here we see a

cloud in the sky, but we have no idea how tall it actually is, how far it reaches, and therefore how much water it contains. Is that what it means?

Michal Kravčík:

Well, it is, indeed. Like in Jarovnice, if my memory serves me well, they discussed the fact that there was a cloud 12 kilometres tall. It means that it reached (Jankajová:) Pardon? Twelve? (Kravčík:) Twelve kilometres, yes, a chimney-like cloud. When you fly on a plane you can notice things like that, when you fly over the sea, the clouds are smooth, even. But as you get closer to the continent, the clouds get more diversified. If we went even further, say around the High Tatras, and if it were cloudy at that time, it's exactly over these colder areas where large chunks of clouds would be, from which very dangerous torrential rains originate.

Erika Jankajová:

Wow, this is higher than the Himalayas, a cloud like that. (Kravčík:) Yes. (Jankajová:) Sort of, by a half, because eight plus four equals twelve, imagine that. I find this really surprising. I really didn't know that. But let me ask you a question related to this topic in a different way now, our designer Mr Šmajda: Can we, as a town, retain water, adopt any measures, if we can hardly cope with a cloud that is 12 kilometres tall? How can we prepare for this? How can we contribute to this, or should we consider it in a broader sense?

Róbert Šmajda:

Well, in fact, the previous speaker has explained that, almost completely. But, of course, the first thing we can do as a town is to remove that heat island, or to reduce the heat we radiate, and therefore the temperature difference Mr Kravčík spoke about, will be reduced, as a result of which the cloud will not be 12 kilometres tall, but only 6 kilometres tall instead.

Erika Jankajová:

I'm not sure I'm happier about that. But let's get started somewhere.

Róbert Šmajda:

Yes, sure, we all know that. All the measures must be adopted comprehensively. Not only in the town, but as Mr Kravčík has said, in the whole microregion, then maybe in a larger region, and then maybe in the whole of Slovakia and Europe. So as we know, from one side there is the Tarnovský stream flooding us, it is this side, and then there is Pichne which we have already talked about.

And it was Mr Šúty before me who talked about what we can do about it when we actually reduce the thermal bridge, although we may not prevent these various extremes from happening, so then we should adopt the rainwater harvesting measures in the forests, hills – the small dams, some fenders on the forest roads,

good forest management, the slopes that are being done right now, perpendicularly onto the slope, they will lead the water down, making it run off quickly.

Then it gets dried up quickly again and we are back in the vicious circle again and again. The same applies for the agricultural landscape. In fact, in Pichne the rainwater harvesting measures have already been taken, by installing the absorbing pits along the contour lines, the direction of ploughing being very important too here, the soil to be ploughed along the contour lines and not down the lines, to put it simply, good management of the fields. The water runs down very quickly. Furthermore, not leaving the village bare all around, but to plant some forests there by which we could reduce the inflow of the water when an extreme comes as Mr Kravčík has already pointed out. I mean, globally, for sure.

Erika Jankajová:

Would you like to add something, Mr Kravčík? Go ahead.

Michal Kravčík:

Yes, I would like to add one more thing that we all should be aware of. It's now that the period of storm clouds and storms is coming to us, the end of May, early June and so on. So it's very important that hailstorm be taken into account as well. But why does the hailstorm start to exist? And we're back at the great difference of the temperature gradient between the ground atmosphere, say, the troposphere, which is actually the space we occupy, and the upper levels of the atmosphere. This means that when the difference is bigger, here it's colder and there it's hotter, it means that it's sown for an extreme, sudden changes in the weather, to which a hailstorm is related too, as it frequently starts to exist just in such a period. And now we're again at the question why this is so? In fact, we have less water in the landscape, less water vapours back, less latent heat is produced, but more heat we all feel.

The latent heat is the heat that vapours back into the upper layers of the atmosphere and where the heat is released. But as long as we don't have water, the heat changes into the perceptible heat, the solar energy into the perceptible heat at the earth's surface which is getting too hot very quickly. This means that we need to suck the heat away into the upper layers of the atmosphere, which is like evaporated water, and it's great for this purpose. And indeed, very often the climatologists talk about so much water being evaporated and that it is oh so dangerous. Quite the contrary, this is very good because through the evaporated water we are able to suck the water from the earth's ground by which we actually reduce the difference of temperatures between the upper layers of the atmosphere and the ground layers, which, then, is the automatic prevention against hailstorms. I'm not saying that they would not start to exist at all, but we all can see the difference right now, that the hails now are almost 5 centimetres large. When I was young, even half a centimetre large hail was too much, but now we get extreme, dangerous hailstorms from above.

Erika Jankajová:

Let me ask you: Basically, we are still talking about the second law of thermodynamics in practice, that the heat goes away, the cold not coming, but the heat goes away from the hotter environment to the colder environment. So how about the speed then, correct me if I'm wrong? When there are those differences, how about the thermometers, right? First the temperature on the thermometer drops very quickly, but when I put it in a colder environment it drops more slowly. So, this is the reason, right?

Michal Kravčík:

This has to do with the sudden changes we can see, basically, in the weather becoming more and more extreme. As a result, we need to reduce the movement of the heat and of the air masses, which can be achieved by reducing the production of the perceptible heat. And heat islands, they are, in fact, the same as embers in the fire. I mean the massive heat going into the atmosphere and then there we have entire blocks of nuclear power plants producing maybe even more perceptible heat than all nuclear power plants in Europe.

Erika Jankajová:

And now, one more question for you, Mr Gažovič. I would like to ask about the global solution, as Mr Šmajda has already suggested. That we ought to start at the local level, then move on to the regional level, spreading it to the national level. What is your viewpoint, maybe you have a tip or two on how to cooperate with the citizens, as in fact we cannot be left alone in this, how to launch such a cooperation.

Michal Gažovič:

Sure. When we were implementing our project, the information programmes for risk prevention, we had a nice definition there given by the United Nations that the decade 2021 to 2030 is a decade of the renewal of ecosystems, and that it must be intensive and massive. This means that if we only stay here in Snina, we won't manage to resolve it at all, and that it must be intensive, we cannot be doing it for a century, can we? Because it must have some effect.

But in my opinion, in fact, each of the fields involved in the landscape management, be it the forestry, agriculture, water management, should, I'd hate to say return to, because very often we would not like to be returning anywhere, but I mean should embark on the good production practice. So, if the foresters have their knowledge, their know-how that there used to exist some damming of streams, some maintenance of forest roads network, then simply they must be put under pressure, in my opinion, the only way to do it is from the lowest tiers of the society. That if we know that water is rolling at us from the forest and they say that by them the forests are OK, it means that somewhere there must be a problem. Maybe it is exactly on the road network.

This morning, when I travelled to Snina, I was looking at all those villages along the way. It wasn't long ago that there must have been a heavy rain here because all the fields had eroded groves, and down at the road you had water standing still. You just can see it, it's kilometres, kilometres of the landscape looking exactly the same. And everywhere the crops are planted downhill. This means that we have no chance of resolving it otherwise than comprehensively, that simply each one of us will admit that yes, this is a problem, we perceive it and we are going to deal with it. In the forest, in the agricultural soil.

And the farmers are one of the key players when it comes to rainwater harvesting measures, because water, the most of fresh water in the world, is in the soil. Two-thirds of fresh water is in the ground. But, in fact, this is where the problem lies, that the water does not remain in that mineral water. It is not in the mineral particles, but in those organic parts, in the humus, which means that if we simply tend now to have the arable land oxidized, we don't have humus in it, although we can add some NPK fertilizers, even though the cycle is broken as a result, which means that we have large areas of soil that cannot retain water because, to put it simply, it lacks humus.

Erika Jankajová:

The same goes for the human body, right? That we have 90% too (Gažovič:) Quite so. (Jankajová:) made of water? But now, let's have a look at it from the economic point of view because these things are not always, let me say, cheap. Or, how are all these things related economically? Michal, maybe you, Mr Kravčík?

Michal Kravčík:

Well, one thing is becoming aware of this reality, and the other thing is finding solutions that could motivate people to change their modes of behaving with respect to the forest soil, agricultural land, urban land, and so on. To all their owners. And it's not easy because, in fact, it's quite naïve to think that everybody will immediately come to terms with it and start to do what you want them to. But financial instruments could be reached very quickly at a certain political level. And if I succeed in making this work, then all the people, if they want to embrace it, or if they want to have some financial benefit out of it, should implement this. Because if they fail to implement it, they won't get any financial benefit out of it. I'll tell you, for example, something to do with direct payments in agriculture.

Every farmer gets about € 248 per hectare. Out of which € 71 is for protecting the environment in favour of the climate. And let's have a look at the land areas, the same as Mišo has already pointed out, in fact this is not happening, or the method of explaining this is wrong. I mean, I don't think that the farmer is doing it the wrong way, the farmer only makes use of the existing possibility, but if the model is, say, set up in the wrong way politically, then automatically he is still ploughing down the fall lines, but if the farmer were motivated enough, like you won't get the payment unless

you do the ploughing along the contour lines, then he would be doing it this way, yes, so this is a question of a quick change from year to year in this behaviour.

And the same applies for the fields: let's take the town of Snina, if Snina adopted a generally binding regulation that each owner of a real property must retain the rainwater on his land, not telling him how to do it, just giving him some ideas letting his water remain on his piece of land, because that's for his benefit and for the benefit of the town itself. This means that relatively a great many people could be involved.

This could be done in a popular form through a competition or something, because people can come up with amazing solutions that we could never think of ourselves. I mean that this could be a kind of involvement, engaging all interested persons in the process, I call it an integrated protection of waters in the horizontal perception, because as soon as the water is in the stream or flows away after a storm, it's too late then. It's where something must be done to fill it in.

Erika Jankajová:

Maybe one more question concerning the underground waters. How about them? Because ...

Michal Kravčík:

Well, the underground waters: when the surface outflow of the rainwater, then the absorption of water into the ground is reduced, and we know that first of all, the capillary poles get saturated, it is that water bound in the soil that Mišo has already indicated (the humus) and so on. Actually, roughly speaking, one-third of it then goes into the atmosphere through the root systems, it is pumped into the atmosphere through the vegetation. And, roughly again, one-third of this water goes to supply the underground waters. So, if I seal all this, damaging it in fact, the supplies of the underground waters are automatically reduced, and I'm sure that people perceive it when, say, a small well dries up there, a stream dries up there and so on, because the supplies of the underground waters are not supplemented, and all sources, underground and in the soil, and even those in the geologic structures, originate from the rain.

Erika Jankajová:

And now, this is a question for each of you here, one after another: When speaking of rainwater harvesting outside the town limits, what are the things that in your opinion should be done first of all? Well, maybe I'll first turn to you, Mr Štofira, the designer and architect, please try to present your point of view now that we have learned many things about how to retain water inside and outside towns. But what should be done first?

Róbert Štofira:

Well, of course, all that we have said here today, but first it needs to be started on paper, preparing various projects and documents, especially while various strategic documents are being prepared, such as the territorial plans, be it the plan of agricultural forests, or land adjustments of the agricultural landscape, it is good that experts are always invited to participate in that, and above all, that they have the same ideas on their minds, the same concepts, and then it starts to have a synergic effect, as a result of which they all pursue the same goal and do not contradict each other, but follow each other. So, this is when it is at its most efficient, exactly as we have already said, so that no completely empty agricultural areas start to exist, but that we always have something to divide them with, fill them in with, so that various rainwater harvesting features could be incorporated somewhere in between. And as we have already said, as far as rainwater harvesting is concerned, I think it would be good to create some kind of a manual for the citizens, containing some adaptation measures, in order for the people to come to terms with the fact that maybe these days they alone cannot affect the forests or agricultural land on a global scale, but that they can contribute with their little on the small areas they own. So, I think a kind of manual...

Erika Jankajová:

Well, maybe not right now ... but, still, let me thank you for this entry, though I'm not sure you will be thanking me in the long run. Because you are the experts involved in our project and a manual of adaptation measures sounds like a very interesting idea. I will follow this line and ask you to prepare one, so perhaps you won't be grateful to me in the end. Thank you, really. And one more question: we are talking about getting our citizens more involved, but I found it very interesting, I mean the idea you have mentioned of the solutions being closely related, because I know that in managing something we, people, frequently meet, interact, and that people often think that only their truth is the best, even though some things can be done in more than one way, but we need to choose the right direction and follow it. If we're progressing in various directions we won't reach the synergic effect and so on. So, thank you, yours have been very valuable contributions, if I may say so. Now, back to you, Mr Šmajda, as far as you are concerned, well, yes, it's our mission to include all that in the strategic documents, it's my point, together with the experts. But, what else could be done now that we, say, have included it in the strategic document?

Róbert Šmajda:

Me, being a designer, we have removed the heat islands in the town. Very few people are aware of it, you know, the colours of various surface finishes, too, I mean of the roofs, pavements, roads, and so on, they contribute a lot to the issue of heat islands. The absorption of a black or red roof is much higher than when the roof is ... in western countries more and more white roofs are being preferred, for example on buildings, as well as white façades and so on. This, for example, makes a great

difference, I mean, how these and those surfaces absorb. For years it has been worked on how to produce white asphalt.

Because we all know that you can only do a few steps out of a green place and you're back at it again. In addition, we've just had a walk from the restaurant, where it was fine. We went around, and in short, by the road it was by 5-6 degrees hotter although we came under some trees here under the manor house. In fact, from the final point of view, as well as from the investor's point of view, everybody wants a black roof, a shiny one, because everybody likes them, but fails to realize that the whole piece of land, with an area of 6 acres, will be dried up by that as a result, and can do nothing about it. So, in my opinion, this also is an asset, taking care of these things, which very few of us are aware of, and then there are the water areas Mr Kravčík has talked about, as for me, I didn't know much about it, but the water again, the air humidity, is perhaps the best carrier of the cold, the best carrier of the heat, I'd say, because based on what I have learned so far, it can suck away the heat and as long as we can achieve this the result is dry land, so we actually have nothing. So, this is, in fact, all that cycle: when we retain water, stop overheating, then all this will be removed. And, of course, all those things, forest management and so on, they should be automatic for the people working there.

Erika Jankajová:

Let me talk about the colours for a while. I, as a woman, found it quite interesting. We are talking about the principle that as soon as photons fall down then that's why something is white because it reflects the white colour (Šmajda:) Yes, white reflects 80% of solar radiation, which means it does not overheat. From the black colour 80 will be tied in, which means that in this sunshine a white surface will have the temperature of, say, 25 degrees, a black surface that of 50. This means that you overheat much more all that...) (Jankajová:) So it reflects as white and that's why it's white. (Šmajda:) Yes, the solar reflects white, black attracts it.

Róbert Štofira:

And it's similar to what Mr Dukat talked about in his speech that solar panels or photovoltaic panels in high temperatures, that this is the problem he outlined, overheating of the air from the panels themselves. And, of course, when we have a black roof, if we had too much of that black roof, then it would radiate much more heat than if we had a grey one (Šmajda:) Yes, a grey or a silver one, you're right.

Michal Kravčík:

But, in this respect, speaking in a broader sense, this does not solve the issue of dust and dirt. It means that this could be just something of a supplement. Because, when for instance we take the asphalt you have been talking about, the question is how to solve the problem with asphalt getting too hot (Šmajda:) It should be water permeable, that would be a solution. (Kravčík:) But in places where it freezes that would be a little complicated, I guess. But the water from the roads does not have to

be directed through a sewage system down... (Šmajda:) Sure, sewage. (Kravčík:) I mean that this can be compensated. Because this gets overheated more and that overheats, say, naturally. If we get the water into this environment here, it gets cooler much more, so on average, it's actually the same as with the original landscape structure without the road.

But, to use, for example, this form, I'm not sure if any young students are listening to us, and so on. (Jankajová:) I'm sure, they are (Kravčík:) Are they, right? (Jankajová:) Yes, they are, they are logged on at the Slovak Technical Universities of Bratislava and Košice. (Kravčík:) So, for example some start-ups could start to exist, because as far as I know, my father pays every year 200 euros for the rainwater led into the sewage system, so as a student I would come and tell him: My dear father, you are not going to pay this money to the water management company, you will give me pocket money instead and I will resolve this for you. And I will get the pocket money for something realistic, not only as a social benefit, because we are used to social benefits, but as certain motivation tools, so when the neighbour looks and thinks to himself: Well, that's interesting, "My neighbour, what is it you have there?" "Well, my son have invented a kind of rain garden." And the neighbour goes like: "Well, I want it too. How much is it?" And so on. Have I made myself clear enough? Speaking of the ways how to give ... how to inspire various groups of people and get them to think about it and create a whole chain of things that can be subsequently implemented maybe not with the municipality's investments, but on their own accord – I mean, the projects that will be justified and may lead to another innovative solutions. That was just an example, you know.

Erika Jankajová:

Thank you very much. And now to finish it all, let me turn to you, Mr Gažovič. You are a man with rich experience and a man educated in the field of landscaping. I'm sure you have a lot to say here, because I know that abroad landscaping is a topic very much talked about, and maybe here in our country many of us don't even know what it actually is. And also because we have the students listening to us, and the children who want to help their parents, I mean the older ones, since child labour is forbidden, they definitely need some inspiration in that respect.

Michal Gažovič:

I think that when together with Michal we were travelling through Germany a few times in the past, the rainwater harvesting measures along the roads looked quite different than our concrete ditches. There, they have them, in fact, in towns and cities too, they always make a small area with a slight depression for the water to run away. There are lots of them at the side of the highways. (Jankajová:) I'm not quite sure we want depressing roads. (Gažovič:) Not depressing, but with a part that is lower. The road will be positive, the depression will be a deepened place. So, what I noticed was what they had there, they were made of stone, I wouldn't call them small ponds because there was no water in there.

There's water in there when there is a lot of it, and then it gradually gets back into the land. I noticed something similar when I was in Norway.

Furthermore, green roofs are very frequent there, and, of course, it works. I guess we have been talking more and more about that here too and we have also started to perceive it in an aesthetic way. And there, for example, in the Norefjel (?) area, I think the Olympic Games took place there in 1952. Simply, they had it there at the communal level given that the houses cannot have a different roof than a green one, right. It's again about the thing that if you want to build something there, you know...these are their conditions. And if you refuse to meet the conditions, just go and build your house somewhere else.

So, they must have more powerful instruments there that could also be introduced here, with respect to rain gardens, green roofs, and even rainwater harvesting measures at the side of the roads. And today, on the road between Prešov and Vranov, the road is being under construction now, I said to myself that we must have gone crazy, because it's not enough having concrete ditches, we even install concrete grass panels around them which makes the surrounding area of the road even hotter. Hence, it occurs to me that we do not have these things thought over carefully and that the designers there should do a little more of research and find out about the latest trends in the world. Well, there is much more of it that can still be done. I'm not sure I have answered your question.

Erika Jankajová:

Yes, that's quite enough, that's what I thought. Thank you all very much for your participation and your contributions, as well as for all that we will have to prepare together and put forward as a proposal, because I think that the citizens, if they understand what is necessary to be done, if they see a benefit in it and perceive what it can bring them, like rainwater harvesting in towns, at least the sewer charges, just go ahead and add something, Michal, if you like, so then it's much easier to want them to stick to the measures because they see that they are doing it for themselves.

Michal Kravčík:

I just wish to add one connection here. We have the cadastre of Snina here, and we have the landscape, fields, urban areas here and, basically, I assume that within this project the rules will be defined, exactly as Mišo has mentioned, which means that if we prepare them carefully, and if they are clear and easy to understand, and if they are logical suggestions, then automatically we will be able to implement them all in the real life. I mean, not in a violent form, in a hard way, but in a way that the people themselves will start to understand that it is necessary, efficient, and so on, because we are all dependent on water, not only your Mayor, or the Municipal Office, but all of us, completely.

Here in your town, with 20 000 people living here it means that if the community rose to the occasion, then I expect that in the course of two or three years, this town, as

my colleague here has said, would become the greenest town in Slovakia again. And another way of looking at it: this opportunity lies in not just thinking that well, this is just a town I was born in and a town in which I just want to live all my life, or that I can't be bothered because all the young people are waiting for their chance to get out of here as fast as possible anyway, but on the contrary, that this a town of a high quality, a happy and pleasant place to live in.

Erika Jankajová:

Yes, nowadays it's possible to live in one place but to work from somewhere else, for example from your garden. But now I would like to thank you all again and, at the same time, I would like to inform our dear participants that we didn't manage to solve the technical problem with the presentation of our speaker from Norway, but we'll try to arrange with him to record his presentation which we will then make available as soon as possible. I do believe this will be possible. This conference coming to its end, let me thank once again all those participating in it, whether in person or online. Once more, my special thank you goes to Mr Theodor Nervik, the Kingdom of Norway ambassador to Slovakia, Mr Professor Stanislav Kmeť, Rector of the Technical University of Košice, Mr Profesor Mykola Vasiliovich Savytskyi, Rector of Prydniprovskya State Academy of Civil Engineering and Architecture, Mr Professor Vladimír Benko, who is President of the Chamber of Civil Engineers and who represents the Slovak Technical University of Bratislava.

And also, if I may, I would like to thank you, our Mayor, who makes it possible for projects like this one to be applied for and implemented. Any my one more special thank you goes to the former Mayor of the town of Snina, Mr Štefan Miľovčík, who honoured us with his visit and who has spent the whole day here with us, and who is an inspiration for me in that that despite not being Mayor any longer now, he still makes it clear that he really cares about the town and that he is willing to cooperate with us. I think that this is a good base for extending the cooperation because on our own we won't be able to do anything, but if we are willing to cooperate and look for the points connecting us, then we can manage to do very interesting things. Once more, thank you all present here and have a nice rest of the day.