REPORT
on the outcomes of workshop for experts, engineers, architects and technicians of refrigeration engineering and air- conditioning, «Assistance to the built-up environment, safe for ozone and climate»
April 8, 2015 Bishkek

I. Full name of the event
Workshop for experts, engineers, architects and refrigeration technicians «Assistance to the built-up environment, safe for ozone and climate»

II. Lead time
April 8, 2015
Number of participants: 44 persons

III. Full name of the organization
Ozone Center of Kyrgyzstan

IV. Topics (program) of the workshop

08:30 – 09:00	Registration
09:00 – 09:20	The opening of the workshop. Greeting of the participants. Goals and objectives of the meeting. **Mars Amanaliev – Head of Ozone Center of Kyrgyzstan**
09:20 – 09:35	Ensuring the construction of objects in modern engineering infrastructure of Bishkek **Nasridin Tokombaev – Chief Engineer of BishkekGlavarhitektura**
09:35 – 09:50	Problems of heating high-rise buildings in a dense housing in Bishkek **Alexander Usolcev – Engineer JSC of «Bishkekteploset»**
09:50 – 10:10	Potential of sewerage systems and water removal, Bishkek Muradin Seidaliev – Deputy chief of Bishkekgorvodokanal
10:10 – 11:00	Building High-Tech. World and Russian experience **Nikolay Shilkin - PhD in Technical Sciences, Head of Chair « Engineering equipment for buildings and structures » MARCHI**
11:00 – 11:20	**Coffee break**
11:20 – 11:40	Features of influence of climatic factors on the formation of architecture in the Bishkek city **Yuriy Smirnov - Head of Chair, professor, Doctor of Architecture, Kyrgyz-Russian Slavic University**
11:40 – 12:00	The policy issue of energy saving and increase of energy efficiency of buildings in the Republic of Uzbekistan **Kahramon Usmanov - Coordinator of the project of UNDP and GEF**
12:00 – 12:30	Increase of energy efficiency of objects of social appointment in the Republic of Uzbekistan **Kahramon Usmanov - Coordinator of the project of UNDP and GEF**
12:30 – 12:45	Discussions
12:45 – 13:00	Message on the 45th international congress of specialists for heating, ventilation and air conditionings (HVAC&R) in Serbia, on December 3-5, 2014 in Belgrade **Maken Berdybaeva - Kyrgyz-Russian Slavic University**
13:00 – 14:00	Lunch
14:00 – 14:50	Design of heat pump systems. Experience of «Insolar» **Victor Gornov – Head of JSC «INSOLAR-INVEST»**
14:50 – 15:10	The use of CO2 heat pumps in Kyrgyzstan

	Sovet Mamadaliyev – LTD «Dordoi Energy»
15:10 – 15:30	The use of heat pumps in sanatorium of «Blue Issyk Kul» **Victor Shostak – LTD «Engineering Service»**
15:30 – 15:40	The modern design and architectural elements for posting engineering communications in designing of energy-efficient objects **Yuriy Smirnov - Head of Chair, professor, Doctor of Architecture, Kyrgyz-Russian Slavic University**
15:40 – 15:40	Discussions
15:40 – 16:00	**Coffee break**
16:00 – 17:00	Group work **1 group:** Implementation of energy-efficient solutions of HRVAC in architecture and designing **2 group:** Promotion of national capacity in green buildings' designing **3 group:** The cooperation of engineers HRVAC, architects and designers
17:00 – 18:00	Adoption of recommendations. Closing of the workshop.

V. The purpose and objectives of the workshop

The purpose of the workshop is to unite the efforts of architects, designers, with builders operations in the civilian sector. Architects, designers should be aware of all current changes in the world on introduction of advanced equipment and should consider options, mechanical features of the new equipment in the process buildings designing in the field of civil engineering.

The workshop was organized under the auspices of UNEP. Specialists with a huge amount of experience in the sphere of green technologies promotion in building construction and architecture were specially invited as resource-persons. The guests of the workshop were Kahramon Usmanov - the head of the UNDP and GEF in Uzbekistan, Nikolay Shilkin, Ph.D., professor of the Moscow Architectural Institute, director of NP «ABOK», chief editor of the magazine «Energy», Moscow, Viktor Gornov - the director of the project department «Insolar – Invest», Russia, Boris S. Babakin, professor of the Moscow State University of Applied Biotechnology.

The program of the workshop provided two sessions. In the first part, a plenary session took place. The second part was dedicated to the work in groups to elaborate draft decisions and recommendations.

Ratifying the Montreal Protocol, Kyoto Protocol, Kyrgyzstan has committed to reduce the harmful effects on the ozone layer and climate change. Last year, the Prime - Minister of the Kyrgyz Republic expressed his position on sustainable development, saying that Kyrgyzstan by 2020 will reduce by 20% the emissions of greenhouse gases. An agreement on accession of Kyrgyzstan to the EAEC comes into force on May 9, 2015. This means that in the framework of the Customs Union import of equipment for ozone-depleting substances will be prohibited. Therefore, the Government takes steps of preparations for the upcoming event. In the construction sector, the biggest part of the power of any country accounts for residential (civil) building, which is about 65%. With the growing prosperity of people, usage of air conditioning systems with ozone-depleting substances grows rapidly. If 10 years ago, Kyrgyzstan imported air conditioners in amount of 2000-3000, in 2014 it will reach amount of 4000-17000. Power consumption for their operation as well as amount of ozone-depleting substances emission is growing up.

Kyrgyzstan strives to arrange and organize the work in connection with the rejection of ODS and transition to new alternative technologies. The world practice shows that new equipment with natural refrigerants such as ammonia, carbon dioxide, propane, isobutene used for the newly built facilities. This practice allows phasing out of CFCs R12, R22, R134a, R407c, R410a, R404a that are widely used in civil engineering. Consequently, the domestic architects,

designers should be aware of the changes that are taking place in the world to introduce modern equipment. They should take into account the parameters, mechanical features of the new equipment in the design of buildings of civil engineering. Therefore, the main objective of the workshop is to join forces of architects and designers with the actions of developers in the civil sector on the use of new green technologies.

The search for technology solutions in the period of the accelerated HCFC phase could become an integral part of national strategies for low-carbon growth if it is combined with energy conservation. Building energy efficiency standards, though set standards for energy efficiency and the various components, like insulation materials, HOVKV, etc., do not take into account the environmental problem such as the ozone-depleting potential and / or global warming potential refrigerant. It is necessary to develop comprehensive standards with regard to control measures for HCFCs and energy efficiency in the replacement of HCFCs, thereby minimizing the impact on the climate.

RAC «Ecoholod» - Association of Specialists in Refrigeration and Air Conditioning Kyrgyzstan fully supports the new policy of the country's leadership on sustainable development of the Kyrgyz Republic and is ready to make a professional contribution to its implementation. Particular field of its implementation is civil engineering and the introduction of new «green» technologies in the refrigeration sector to ensure food security of the country and to prevent negative consequences for the environment. The civil construction is still used inefficiently in terms of energy savings, the design of buildings and structures, building materials and construction. It is required to update energy efficiency standards (energy efficiency) and bring them in line with international standards. Housing and communal economy of the country is characterized by irrational spending of gas, water and heat. The average energy consumption per 1 m^2 of the total area per year in the Kyrgyz Republic is 450-650 kW, whereas in European countries this figure does not exceed 100-150 kW. As housing heat loss is several times higher than in other countries with the same climate, it is necessary to make structural changes in buildings, to address issues of insulation walling to reduce power consumption and heat load. For newly constructed buildings it is very urgent the development of projects using energy-saving technologies, including heat pumps and other alternative energy sources.

In 2013 the Ministry of Energy and Industry of the Kyrgyz Republic introduced the ban on the issuance of technical conditions for connection of newly constructed residential buildings in the center of Bishkek to electric heating. Accompanied with no additional thermal capacity of «Bishkekteploset», it gives the first sign of an impending energy crisis. Without large-scale reconstruction of distribution networks 10 / 0,4 kW in the capital of Kyrgyzstan, it is impossible to reach economic and social development in the future. In connection with the planned by 2015 completion of Datka-Kemin, it is necessary in parallel to find financial sources for the reconstruction of the internal distribution of power lines.

At the same time, it is necessary to proceed to a total rescheduling placement of industrial and residential facilities in the capital. It is helpful to focus on the energy efficiency of industrial processes and the reduction of energy consumption in the operation of the existing buildings and structures.

Great prospects in this transition are the design and construction of civil buildings with modern technology, heating, ventilation and air conditioning used in global urban development. Unfortunately, design and scientific - research institutions in Kyrgyzstan experienced certain difficulties in solving these problems. There is no information base, design techniques, professionals in the field of architecture, design and construction of energy efficient buildings. Nevertheless, the need to begin work in this area is obvious and dictated by the above-mentioned reasons.

In this regard, in pursuance to the Law «On energy saving» and «On the energy efficiency of buildings», urgent action is needed on the organization of a pilot design of modern types of buildings in civil engineering with application of new energy-efficient and resource-saving technologies. The presence of such pilot projects will allow the private sector to invest in

the development of the city through the construction of houses and buildings on a fully autonomous heat and water supply in the future. For example, application in civil buildings heat pumps or chillers as heating and air conditioning systems allows to reduce the total power consumption for several times (3 to 6). At the same time, the use of new types of building materials and structures, combined with modern design of residential buildings, will further reduce power consumption during operation.

Builders Association and HRVAC can raise awareness of investors, engineers HRVAC, architects and designers of self-sufficient buildings in regard of the energy saving features of heat pumps for heating and cooling buildings (reversible cycle). Engineers of HRVAC should participate in the design of self-sufficient buildings at an early design stage.

Experience achieved in the process of design and construction should be extended to the entire country and improve the efficiency of energy consumption across the country. Practice in other countries shows that with the active conduct of the state energy saving policy, the level of energy consumption of the economy can be reduced by several times (from 1.5 to 12 times). It is equivalent to the nationwide production of additional electricity at several hydroelectric power plants.

According to the draft decree of the Government of the Kyrgyz Republic on energy efficiency and energy policy planning in the Kyrgyz Republic for 2015-2017 years, ministries, administrative departments, government enterprises should provide 5% reduction in electricity consumption by implementation of energy-saving measures for departmental and subordinate objects per year.

One solution to this problem could be the design solutions of architects, engineers at the design stage of construction projects:

• Use of energy-efficient building materials, structural elements and equipment with minimal power consumption.

• Development of standards, rules and regulations, methodical literature on the design and installation of energy efficient equipment and materials in urban planning.

• Ways to obtain technical solutions for the design and construction of civil buildings in the central districts of the city.

• Formation of architecture of Bishkek in accordance with the climatic factors.

During the workshop it was scheduled to get acquainted with the developments of specialists from Russia and Uzbekistan in the field of energy efficiency and conservation:

- «Buildings of High-Tech solutions. World and Russian experience» Moscow Architectural Institute, Moscow.

- Design of heat pump systems. Experience of «Insolar». JSC «INSOLAR-INVEST», Moscow

- The policy of energy saving and energy efficiency of buildings in the Republic of Uzbekistan on the prospects for further implementation of energy efficiency solutions in the design and construction of multi-storey buildings in Uzbekistan (using Tashkent as an example) with independent heat-assistance of houses as well as with hot water and air conditioning supply.

- Experience of the UNDP-GEF project «Rise of Energy Efficiency in Public Buildings in Uzbekistan» in the field of new educational programs for schools, energy management systems in buildings, as well as the design and construction of buildings with a pilot implementation of modern energy efficiency technologies and solutions.

VI. The content of the workshop

During the workshop the following topics were discussed:

- Problems of multi-storey buildings heating in a dense development of Bishkek;
- Buildings of High-Tech solutions. World experience;
- Features of the influence of climatic factors on the architecture;
- Improving the energy efficiency of social facilities;
- The policy of energy saving and energy efficiency of buildings;
- Report of 45 international HRVAC Congress in Serbia, December 3-5 2014, Belgrade;
- Design of heat pump systems. Experience of LLC «Insolar»;
- Heat pumps on carbon dioxide;
- The use of heat pumps in the «Blue Issyk – Kul» sanatorium.

Nasridin Tokombaev – Chief Engineer of BishkekGlavarhitektura

«Ensuring the construction objects with modern engineering infrastructure of Bishkek»

According to the scheme of the general plan of the city, in 2025 the number of the city population is expected to reach 1.5 million people. This number has been reached in 2015. However, for the full and modern development of the city, it is need of a reliable, cost-effective and environmental engineering infrastructure. Therefore, we need to consider these issues at the appropriate level. Let's consider acute problems, primarily the preparation of technical specifications for engineering infrastructure projects under construction, particularly in the housing sector. Water supply of Bishkek is carried out from intake devices of Ortho-Alyshskiy groundwater deposits. The underground source has very clean water. There are such problems as outdated pipes that are needed to be replaced. These problems are solved in cooperation with the State Construction Committee.

City sewer system can be considered as a system that can be expanded. Housing estate arising around the city created problems in securing the city irrigation.

With the coming of Gazprom, it started to replace the outdated gas pipelines. It is expected that the population of the city will be provided with gas by 70-80% until 2017. It is necessary to complete construction of the gas distribution station near Malovodnoye.

District Heating. District heating covers the city on 50% and is provided by CHP №1. There is an agreement with China for its renovation. The northern and western part of the city is not covered by district heating of CHP №1. In the western part of the city, the second source of heat supply of CHP №2 which is designed for the supply of natural gas stands idle. If this heat source will start heat supply, the city district heating will get 80%. We have 60 local boiler, solid fuel, and natural gas. The issue of the transfer of that boilers to gas fuel and the running thermal power station №2 is solved.

Questions of power supply in the country are resolved positively. From the Toktogul power line, there is a construction of Datca-Kemin. But that does not mean complete supply of electricity. There are problems in getting technical conditions for connection of newly built high-rise buildings to the electricity grid. This problem will exist until high-voltage line 500 kV of «Kemin-Datca» to be completed. We are looking for alternative ways to provide power supply of the city. We need to build another 6 large substations. It is necessary to provide residential area around the city needed with electricity.

In addition, there are problems in getting technical conditions for gas supply to residential buildings with more than 9 floors. Soviet regulatory framework did not have Construction rules and regulations. This problem is not yet solved. To create a modern city, we need energy-efficient systems of air conditioning and cooling of buildings. Completion of the issue of obtaining of technical conditions for high-rise buildings up to 24 floors will create the problem of laying utility plants as Bishkek is the old town. The problem of passenger transport system relief is under solution. There are negotiations with investors for the construction of elevated rapid transit on electricity. Due to lack of finances, we can not properly solve the problems of

city infrastructure. Resolution of this issue falls behind 10-15 years. The state takes special attention to this problem but funds are not allocated at the proper level.

There is a limit on the construction of high-rise buildings (24 floors). For example, a pilot district of multistory buildings, Jal-Artis, now functions normally. The city definitely needs in these modern technologies of multistory building construction.

Question. Is it possible to get technical conditions for the construction using heat pumps? Another problem is the fall of main voltage to 160V in the winter instead of the 220V in the electrical networks in new buildings because of lack of enough capacity. This problem can be solved by the use of heat pumps which consume less electricity in 3-4 times. In addition, according to the World Bank, the service life of heating systems Bishkek has already reached 40-50 years. It is very difficult to replace the district heating system having current level of funds. What to do?

Answer. We banned use of underground sources of water for different connections. This is due to the fact the concentration of nitrates was found in the ground water before BCHK (Big Chu Channel). Drilling is also banned to prevent contamination of harmful substances into the water caused byunauthorized drilling.

There are problems in heating system as almost all the pipes are worn out. We are ready to consider and support the proposed innovations in heating systems.

Alexander Usolcev – Engineer JSC of «Bishkekteploset»
«Problems of heating of high-rise buildings in a dense housing in Bishkek»

The main problems in the city district heating system (DHS) are: lack of heat in the SCT and the actual, physical and moral deterioration of pipelines of heating networks and heating equipment at the pumping stations and individual heating units.

Bishkek thermal power station, which is located in the eastern part of the city, provides the generation of electricity and heat fulfilling all its functions of CHP on its own territory. The heat generated by CHP goes to Bishkekteploset and electricity is taken by Chui CHP. All lines operate thermal heating network. The length of city heat network is about 430 km. Partially, the heating is carried out in Bishkek departmental boiler or boilers of Bishkekteplokomunenergo.

First, we need to pay attention to major problems of the city district heating system (DHS): lack of heat in the SCT as a whole and the actual, physical and moral deterioration of pipelines of heating networks and heating equipment at the pumping stations and individual heating units.

Deficiency of heat is estimated at 250-300 Gcal / h due to the actual state of heating equipment at CHP-1 Bishkek. CHP-2 and boiler Bishkekteplokomunenergo do not work for various reasons. In 1993, CHP 2 worked only for three months and later was stopped. CHP 1 is the sole source of heat that in turn contributes to the reliability of heat supply systems. Connected load of consumers is about 1,000 Gcal / h. Maximum load during the heating period is about 60-65% of the maximum load of CHP 1. This is because during the heating period temperature of environment is not fixed. Parameters of coolant issued by CHP-1 in accordance with the actual schedule is 95, 100 ° C in the feeding and up to 70 ° C in the pipeline. Network is overloaded by low-grade heat transfer system. Pumping equipment works at its limits reaching the circulation in the system the limit values. 70% of 430 km of heating networks is out of operational term that is 25 years.

These factors significantly limit the ability of «Bishkekteploset» on extradition specifications and operation of district heating systems in the areas of operation of MCT. Among these areas are: west - the west zone of Turusbekova str., south-west - the zone of Ahunbaeva str., Sh.Rustavelli, KSTU, cinema «Manas», south - the southern districts of the city, especially 6, 11, 12 and neighborhood «Asanbai». The reason is that the above-mentioned areas are at great

distance from the CHP 1 and the fact that operation of the CHP 2 was planned. *This raises the problem of providing heat in remote areas*.

Objects of the central part of the city receive technical terms. However, *each connection in the center of the deteriorate situation in the end parts of MCT*. Taking into account that the problems with the hydraulic conditions and the actual condition of the pipes, when issuing technical conditions «Bishkekteploset» includes certain regulations to attract customers, developers in the development and renewal of existing heating networks. Budget of heating networks in the current tariff for heat is still lack. Existing tariffs are not enough for the development of heat networks. One of the decisions is the introduction of fees for connection to the heating system.

There are other problems in the issuance of technical conditions. One of them is the lack of planning documentation:

• General Plan of Bishkek for the period until 2025 was approved in 2006. It is 9 years old and needs changes and additions with the current realities to be made.

• No general scheme of heat supply of the city, including the SCT scheme

• Lack of corridors for laying engineering communications (narrow streets, red lines, private lands).

• It is necessary to provide for the general scheme of heating the question of individual heat source for new objects.

• It is necessary to build another series of pumping stations to reduce the load of the heat.

In addition to operation of thermal networks of «Bishkekteploset», Intra performs maintenance of heating and hot water, located in the general share property of owners of apartments in the buildings. In this regard, the area of our focus is the design documentation: heating networks, heating units, heating, hot water system.

Common issues in the design of heating systems are:

- Availability of energy passport of the object;

- Laying of pipelines, with the possibility of normal operation and maintenance.

- When drafting heating systems, it is necessary that part of the project is developed by the card setting of balancing valves rather than simply including them in the specification of the equipment

The issue of oversight functions when installing heating systems object:

- Supervision - in order to save funds, customers - developers finance major issues (building construction), neglecting the issues of heat supply, especially appropriate design solutions, systems of heating and hot water.

- Technical supervision - is carried out, as a rule, the customer's personnel - developers and all decisions aimed at reducing overall costs. It should be noted that virtually neglected works are performed in the heating and hot water in apartments (private property);

- State supervision – is performed by the State Inspectorate for Ecological and Technical Safety staff. According to JSC «Bishkekteploset», functions of a technical inspector of the State Inspectorate for Ecological and Technical Safety should include proper supervision of the execution of works in the entire chain of the object heating: heating networks, heat point (ITP), heating and hot water. Unfortunately, it is currently not occur.

- Technical control is provided by the staff of «Bishkekteploset». At the same time there is no regulatory procedures to implement this kind of control in the legal normative documents,

but a certificate confirming the readiness of the object to the admission of heat, for some reason, must be provided and offered by «Bishkekteploset».

Upon the completion of the project, it should be formed the actual energy performance certificate for compliance with the resulting figures, taking into account any deviations from design solutions,

All of these problems indirectly and somewhere directly affect the energy efficiency and energy efficiency of buildings, including those in the process of construction.

The issue of energy audit and energy service of buildings is a separate issue. Today it is possible to say that there is complete absence of methodological network for the evaluation and subsequent calculations on energy efficiency provided in the projects.

Nikolay Shilkin, Ph.D., professor of Moscow Architectural Institute, director of NP «ABOK», chief editor of the journal «Energy», Moscow.

«Building High-Tech. World and Russian experience»

In the high tech buildings, priority is given to improve the quality of indoor environment and environmental security to reduce power consumption. This solves the problems associated with architectural shape, size and orientation to energy consumption for heating it during the cold period, and (or) cooling in the warm period was minimal, ceteris paribus (degree of glazing, heat and sun protection, etc.). The concept of creating intelligent buildings is a set of technical solutions and organizational measures aiming to create a high-performance building management system that best meets the needs of users and building owners. Currently, the world of construction has developed different ways of increasing energy efficiency and improving the ecological condition of the buildings. A large number of buildings, neighborhoods and even architectural zones has appeared which were designed and constructed based on different concepts of energy efficient and environmentally friendly technologies.

By the definition of Professor Y. Tabunshchikov, high-tech building is a harmonized system of innovative architectural and engineering solutions aimed at ensuring a high level of internal heat, light and aesthetic comfort with the maximum use of the energy of the outer environment. Energy efficiency should be based on the comfort and quality of life of people and the outdoor climate must be treated as a friendly environment.

Implementations of the heating system based on heat pump units in Moscow that uses low-grade thermal energy of the earth, three objects, the office building of the developer, the cottage settlement and the local administration building.

Initially, based on heat pump heating system, it was developed heating of the office building of the developer located in the village of PervoMai in Moscow. Analysis and comparison of alternatives energy facility showed that the variant with heat pumps for capital expenditures, even without taking into account the cost of the gas, is economically more advantageous than a variant with a gas water heater, which was caused mainly by the high cost of connecting to the gas network. This project has been successfully implemented. Commercial operation during the four heating seasons confirmed his technical ability and economic viability of selected solutions. Successful experience in implementation of a heat pump heating system of the office building has become a prerequisite for the implementation of a large-scale project - the device of the heating system cottage settlement on the basis of heat pump systems that use low-grade thermal energy of the earth.

Engineering systems cottages

The first stage of the cottage village envisages the construction of houses for several families with a total area of 19 thousand M^2 (residential area without corridors, stairwells etc.). The gas heating needed to be provided with the general boiler room, heating networks and individual heating units or control units in each building (in different buildings different number

of sections). As a result, after the calculation of the economic feasibility of several alternatives, it was decided to use a heating system based on heat pump units. Operation of the heat pump heating system of an office building in one of the heating season with reasonably low (-35 ° C) ambient temperatures showed *that the heating system, designed on the calculated outdoor temperature -28 ° C is not always possible to maintain a comfortable temperature in the rooms - during low outdoor temperatures the room temperature drops to +14 ° C.* Inside working employees at the giving temperature did not feel very comfortable, but still the organization functioned normally. For residential premises, such decrease in temperature is totally unacceptable. The heat pump can change mode to maintain higher temperature, however, efficiency is greatly reduced. Therefore, in result of operation, it was decided to include in the scheme of heating electric water heater (electroboiler) for reheating the coolant after the heat pump system for peak loads during periods characterized by an extremely low outside temperatures. Electroboiler comes into operation on automatically. For each section of the heating of residential buildings two heat pump systems are used. It allows to get redundancy in case of a possible failure of the equipment.

The heat pump works more effectively if the temperature difference between the evaporator and condenser is smaller, i.e. the temperature of low-grade heat source and the temperature of the consumer. Thus, *the most efficiently heat pumps might be used for heating systems where the hallmark has relatively low temperature than the coolant. These requirements correspond to the heating system on the basis of floor heating panels («warm floor»).* It is known that in order to prevent diseases related to the overheating of the human legs, the maximum surface temperature of the floor in the room with a constant presence of people should not exceed +26 ° C, in areas with temporary stay of +31 ° C, in the children's playroom +22 ° C 4. On the revised objects, a low-temperature heating devices are used based on rendered monolithic screed in coils of heat-resistant pipes and cross-linked polyethylene (PEX). This solution, a combination of heat pump systems with a «warm floor» is often used in foreign construction practice.

Ground heat exchangers

According to the initial project, the devices of ground heat exchanger involved drilling wells with a depth up to 60 m. The distance between two adjacent wells of conditions to ensure the normal operation of the ground heat exchanger should be at least 5 m. If possible, it is better to increase the range. At a shorter distance, in the case of a large demand for thermal energy at the heat pump between adjacent wells may soil freezing and formation of so-called «cold lens». The best solution is usage of a single combination of heating-cooling. In this case, during winter ground is used as a source of low-grade thermal energy and thus quenched. In summer, contrary, by injecting coolant into the wells heat is removed from the premises and compactor masses around the wells at the same time is heated preparing for the next heating season. In this case, the risk of freezing of the soil mass decreases significantly.

Studies of soil temperature regime of arrays showed that in soil and climatic conditions of most of the Russian soil, the temperature of which decreases during the heating season, there is no time to restore its thermal capacity at the beginning of the next heating season. By the beginning of the next heating season temperature potential soil mass is reduced even more, but the decrease is exponential. By the fifth year of operation compactor array comes to temperature that is close to periodic. In other words, starting from the fifth year of operation, long-term consumption of thermal energy from the ground mass is accompanied by periodic changes in temperature. *Thus, the design of heat pump heating systems seems necessary to account the temperature drops soil mass caused by long-term operation of the heat system and use as design parameters of Temperature soil mass expected for the 5th year of operation.*

In combined systems used for heat and cooling, temperature control of soil mass is maintained in a natural way: in winter, when heating is required, cooling the ground mass; in summer, when refrigeration is required, there is, on the contrary, heating of the soil mass, in this case the compactor array can be seen as a kind of battery heat.

In systems with vertical ground heat exchangers in the selection of the temperature of the ground, heat exchanger around the ground is reduced. The lowering of the temperature is affected both by the design features of the heat exchanger, and its mode of operation. For example, in systems with a high quantities of withdrawn heat energy (several tens of watts per meter of length of heat exchanger) or systems with a soil heat exchanger arranged in the ground with low thermal conductivity (e.g., in dry sand or gravel, dry), the lowering temperature will be particularly noticeable and can lead to the freezing of the soil mass around ground heat exchangers.

In one of the revised objects, primarily in the office building of the developer, in addition to the heat pump heating system installations, include solar collector. The collector has been arranged in the simplest way, on the long side of the building there were Navara conventional steel water pipeline (GRP) pipes. In summer, the coolant heated in this simple collector by solar radiation heat is pumped into the ground heat exchanger, thus warming up compactor array, that is, in fact, an accumulation of low-grade heat. By the beginning of the heating season it was possible to warm up surrounding ground array to a temperature of +14 ° C which is a high enough temperature. Energy cost at the same time was minimal, only for circulating the coolant, i.e. electrical energy to drive the circulation pumps. Such solution made it is able to avoid the threat of freezing the soil mass around the heat exchanger during the heating season due to the accumulation of heat energy. According to estimates, at the beginning of the heating season, the conversion factor should be 5, and by the end, to the extent of cooling the soil mass, drop to 4. Currently, the calculated values are confirmed during the operation. The heat pump to a temperature of +54 ° C. heats the heat medium. This temperature maintained in the tank battery. Required circuit underfloor heating temperature +35 ° C is set by the mixing of coolant return. The heat pump does not work continuously, it comes into operation when the temperature of the coolant in the accumulator tank falls below a certain value. Under these conditions, the conversion factor of the heat pump is about 4.4.

Yuriy Smirnov - Head of Chair, professor, Doctor of Architecture, Kyrgyz-Russian Slavic University

«Features of influence of climatic factors on the formation of architecture in the Bishkek city»

The territory of Bishkek and its suburban areas have a high environmental stress. Physico-geographical and meteorological factors determine that here is extremely limited self-healing environment. Relatively reduced climatic comfort area is accompanied with high intensity of solar radiation. It causes a steady overheating in summer, dryness, pollution and dust levels (prevalence of weak winds at a speed of less than 2 m/s and calms 4-6 and maximum allowable concentrations of dust, especially during the summer period), as well as the relatively small number of ponds and landscaping on the outskirts of the city and in the suburbs.

Existing man-made (architectural) landscape is formed without psychology of perception and aesthetics. In particular, cluttered and chaotic built up facilities referred in the city plan downtown esplanade landscape oriented at background mountainous landscapes (which are also the main source of natural aeration of urban areas). The prevailing character of the building prevents the creation of conditions for increase of microclimatic comfort and improve the design of urban spaces. Addressing urban revitalization in the process of developing, a master plan involves consideration of interrelated factors, including: an extremely weakened wind activity associated with the formation of stagnation - inversions in the surface layer of the atmosphere

with a predominance in the annual light winds and frequent calms; different climatic parameters within the city due to the nature of the landscape, aeration conditions, temperature and humidity, soil conditions, etc.; the difference in terms of air pollution emissions by some parts of the city. It is advisable to use urban planning techniques, aeration-stimulating activity. In particular, it is recommended:

• Arrangement of so-called «wind channels» in the meridional direction which consists of a linear park of devices and low-rise «floating» construction; recommended width of such landscape-recreational entities - not less than 0.5 km, with the distance between 1.5-2 km;

• An increase in the width of the roads and streets of the meridional direction within the red lines to the maximum possible normalized values;

• Maximum disclosure of semi interiors (areas, courtyard spaces, landscaped fields, and so forth.) and gaps in the building at the west and the north-western side of the horizon with the creation of residential groups with minimal aerodynamic drag (free setting of buildings to include homes tower, «chess» placement of buildings, etc.) in relation to the mountain wind flow south and south-east.

Kakhramon Usmanov - Coordinator of the project of UNDP and GEF on energy effective buildings. A report subject «Increase of energy efficiency of objects of social appointment in Uzbekistan. Experience of the project in the field of new educational programs for HIGHER EDUCATION INSTITUTIONS, systems for energy management in buildings, and also design and construction of pilot buildings with introduction of modern energy effective decisions and technologies».

Our project is directed on 20% decrease of energy consumption and emissions of CO2 and introduction of the best practices in construction and reconstruction of social buildings. The project consists of the following components

1. Improvement of standard and legal base
2. Introduction of system of energy management
3. Education
4. Demonstration of the best practices
5. Distribution of results of the project

Within implementation of the project 10 normative legal acts covering all range of design, reconstruction and construction of all types of buildings were revised. Special manuals for better understanding were printed. The special attention was paid to training. During the project more than 1000 people in the sphere of design, reconstruction and construction were trained. The separate specialty «energy management» is entered.

Average decrease of an expense of thermal energy on 8 objects is made 54%, in a section on new construction 51%, on reconstruction 57%. Reduction of emissions of CO2 on 380 tons.

Thanks to the project, there is an increase in construction with use of energy effective technologies.

Also Usmanov K. shared experience **on a policy issue of energy saving and increase of energy efficiency of buildings in the Republic of Uzbekistan** - about results and further prospects of introduction of decisions on energy saving in the field of design and construction of multistoried buildings in Uzbekistan (on the example of Tashkent) with autonomous providing buildings with heat, hot water supply.

There was developed the state program for power effective construction according to which construction of 70 thousand rural houses until the end of 2020 is provided. Taking into account the international experience, the system of certification of energy efficiency of buildings was developed.

Experts carried out the analysis according to which, the number of power effective buildings for the period since 2015-2020 will make more than 1,5 million m^2. The general

decrease in energy consumption will make 200 thousand kWh, reduction of emissions of CO2 will make 40 thousand tons. Average annual decrease in consumption of energy will make 685 thousand kWh. and decrease in emissions of CO2 will make 538 thousand tons. There is need for production of heat-insulating materials, which has to make 230 thousand m^3.

Maken Berdybayeva made the message **on the 45th international congress of specialists for heating, ventilation and air conditionings (HVAC&R) in Serbia, on December 3-5, 2014 in Belgrade.**

Main objectives and tasks of the congress - an exchange of knowledge and their distribution, scientific activity and transfer of technologies in the field of modern heating, ventilation, air conditioning and cooling.

Subject of the congress:

- Heating and conditioning in modern construction sector
- Refrigerating systems in relation to a modern ecological situation
- New designs of refrigerating systems
- Buildings with zero consumption
- The centralized heat supply and cooling
- Buildings of the future as autonomy of energy objects
- New materials and technologies in construction sector in relation to energy needs
- Reconstruction of the existing buildings with application of energy effective technologies
- Modern architecture as necessary condition for zero energy of buildings
- Ventilation in the cities - today and tomorrow
- A power situation in the world in particular the Southeast region of Europe

Buildings in the future have to become independent producers of energy and provide healthy and comfortable stay of people inside of them. The biggest part of energy in buildings is consumed by HVAC&R systems that often work on ozone-depleting substances. There is a strategy of the EU on the future that is known as 20-20-20. It means: 20% reduction of emissions of GHG from the level of 1990, 20% decrease in consumption of energy and increase in sharing of renewable sources of power to 20%.

The particular interest created material on the subject «Buildings with Small Consumption of Energy and Low Level of Emissions» of **Professor Norbert Lechner**, the USA. According to his opinion, for the solution of issues of heating, cooling and lighting of buildings are responsible not only engineers, but also architects. He also presented three-level design of self-sufficient buildings:

At level 1 if the correct architectural concepts in relation to a form, orientation, color, placement of windows, isolation are made, than building itself is capable to provide to 60% of heating, cooling and lighting.

level 2 will save more 20% of energy due to architectural concepts, as self-heating at the expense of solar radiation, passive cooling and lighting with natural light.

level 3 consists of the mechanical and electric equipment, the building has to provide remained 20% of loading. This approach to design of buildings, in comparison with traditional, will help to save 85% of energy.

In the Kyrgyz Republic losses of primary energy on transformation of electric energy at heat and power plant makes 68%, losses at transportation of the energy carrier is 2%. Decrease in power consumptions by 2-3 times is possible to reach by introduction of combined solar and heat pump installations. The potential of solar radiation is huge in the Kyrgyz Republic.

Sunshine is 2800-3000 hours in a year, the average annual volume of solar energy is about 2500 kW • h/m^2.

The plan of reduction of consumption of the energy per m^2, which is necessary for heating in Europe.

- 2015-16 25% reduction in comparison with 2011 48 kWh/m^2
- 2017 25% reduction in comparison with 2015 36 kWh/m^2
- 2018 25% reduction in comparison with 2017 27 kWh/m^2
- 2019 25% reduction in comparison with 2018 20 kWh/m^2
- 2020 25% reduction in comparison with 2019 15 kWh/m^2

Use of thermal pumps in the Kyrgyz Republic taking into account the international experience.

Use of thermal pumps is one of the most effective, environmentally friendly remedies of heating, hot water supply and also air conditioning of buildings. Thermal pumps actually get 75% of the given-out energy from environment, using energy of the Sun, Earth and ground waters during the whole year.

Today the housing, communal services and the population of the republic consume 65% of energy resources. If in 1990 the housing, communal services and the population spent 1,939 billion kWh of energy, in 2012 this indicator is 7,34 billion kWh. These data shows relevance of energy saving technologies for heating and cooling of buildings with use of the combined solar and heat pump installations which will allow to reduce the energy consumptions on housing and communal services and the population by 2-3 times.

Area density of a stream of solar radiation in Kyrgyzstan is rather high. The average duration of sunshine makes 2800-3000 hours a year, and the average annual volume of solar energy is about 2500 kW • h/m^2. Therefore use of solar energy for preparation of hot water, heating and cooling with thermal pumps will only increase energy efficiency of these systems.

Idea of power efficiency of the combined solar and heat pump installations in comparison with traditional options of heat supply can be defined, having compared them, on extent of use of primary energy. At technical transformation of energy in traditional sources of heating there are big losses of primary energy, and there is a pollution of the atmosphere.

By means of thermal pumps, it is possible to reach more considerable efficiency of primary energy in comparison with burning coal. Losses of primary energy on transformation of electric energy at heat and power plant make 68%, losses at transportation of the energy carrier - 2%. The efficiency when transforming primary energy makes 30%.

Lack of any toxic emissions during the operation of thermal pumps, promotes saving of traditional energy resources and environment protection by reduction of emissions of CO, SO2, NOH, SO2, PbO2 which are negatively influence the climate.

Victor Gornov - director of JSC «INSOLAR-INVEST»
«Design of heat pump systems. Experience of «Insolar»».

The report contains two sections: The developed objects by «Insolar»; The Developed standard documentation.
What steps are taken in energy saving in Russia. Federal law from 23.11.2009 No. 261-F3 and in the resolution of the Government of the Russian Federation of 25.01.2011No. 18 delared requirements for decrease in energy consumption of buildings by years are established:
1 stage 2011-2015gg. decrease by 15%
2etap 2016-2020gg. decrease by 30%

3 stage by 2021 decrease by 40%.

The expense of consumption of energy in Bishkek makes 450 kW • h/m^2 a year, in Moscow 340 kW • h/m^2 a year. This number includes power consumptions on all-house energy consumption: (water supply, lighting of the all-house territory heating and ventilation) and also energy consumption of the all-house equipment. It does not include household consumption of energy in the apartment. At the moment we have a standard of 160 kW• h/m^2 a year.
Decrease in a specific energy consumption to 160 kW•h/m^2 a year - in each 10000m2 apartment house for 30 years of operation will provide energy saving in a form of 100 cars of diesel and 300 cars of coal, will reduce emissions of harmful substances by 15000 tons of CO2 that is equivalent to landing of 140 hectares forest plantations.
How the structure of energy consumption of a house looks now?
The standard of 160 kW•h/ m^2 a year is distributed as follows:
6% on all-annual electrician
23% for transmission
17% *for ventilation*
54% *for hot water supply*

Reduction of a specific energy consumption to 130 kWh/ m^2 a year:

When there is a speech about *energy saving, it is about warming of the building. The increase of heat-shielding reduces energy consumption of the building only by 12% when it is required 19%.* **There is no sense farther to warm therefore we see all reserve in the field of engineering systems: in development of hot water supply and ventilation.**

The house constructed in 2000. It is used the hybrid heat pump system using heat of soil and ventilating emissions for hot water supply is used. The system of accumulation of heat works, final warming up is carried out from the centralized heat supply. In this house the scheme where possibilities of operation of the thermal pump and a thermal network are integrated is used, on the one hand, possibilities of ventilating emissions are effectively used and the operating mode of a thermal network isn't broken. Moscow energy department strictly watches temperature of the return water and if something happens is ready to apply penalties. *The hybrid heatpumps provides energy economy on 55-60% of the replaced loading (hot water supply and/or heating).*

One more house consisting of 17 floors. In this house cold supply was provided except all the rest. About 60% of apartments are provided with cold at the expense of the thermal pump. **Rise in price of system makes 3%, thus the economy of energy is essential.**
Some technical solutions: thermal point is in underground part of the building, soil heat exchangers settled down under the building from - for the limited area.

We created the program Heat Pump complex which is carrying out modeling of the operational modes and determination of optimum parameters of their basic elements: soil heat exchangers, utilizers of heat of ventilation emissions and thermal pumps depending on climatic conditions of the area of construction. In calculations the expected behavior of soil a minimum for 5 years is considered.

The following object – production premises of JSC MOEK of the city of Zelenograd where the automated heat pump installation with use of warmth of sewer drains is established. The heat pump system warms up make-up water for gas coppers. As a source of heat sewerage drains are used. The heat exchanger the utilizer works at the crude sewage. They on a design and material of execution are simple. For example, Japanese manufactured such heat exchanger of non-ferrous metal with mechanical system of the cleaning.

For development of a subject of energy saving and achievement of final indicators, the idea of creation two-level utilization of air for houses was born. It is room system of utilization of secondary energy resources and all-house system of utilization of secondary energy resources. The all-house utilizer of heat of ventilating emissions is a part of system; thermal pump, storage container of high-potential heat, soil heat exchanger, utilizer of heat of sewage.

Our development is the auto adjustable forced-air and exhaust ventilating device with recovery of warmth of exhaust air **allows saving more than 50% of thermal energy on heating of stitched air**. It is recommended to install it in the new, reconstructed buildings and houses with the decentralized ventilation. Utilizers of heat of exhaust air. Two types of designs are developed for installation in the garret and specially taken away room and open air. Application: extraction and the subsequent useful uses of part of the thermal energy lost by the building together with system of ventilation by exhaust air.

Works on improvement of the thermal pump were carried out therefore the cascade thermal pump which allows providing heating of water to temperature of 65- 70°C was developed. It allowed installations to work without additional heaters.

Normative and technical regulation:

- SP 60. 13330.2012 Construction Norms and Regulations 41 - 01 - 2003 Heating, ventilation and conditioning.
- GOST P54865-2011 Heat Supply of Buildings. A method of calculation of power requirement and system effectiveness of heat generation with thermal pumps.
- STO NOSTROY 149 Structure of heat pump systems of heat cold supply of the building. Rules, control of performance, requirement to results of works;
- An application guide of thermal pumps with use of secondary energy resources and renewable sources of power
- The technical recommendations (staticized) the Album of standard technological circuit and technical solutions of the hybrid heat pump systems of heatcold supply (HHSHS) of multistoried residential buildings in the conditions of dense city building (TP 209-09).
- The album of standard technical solutions of thermo wells of systems of collecting low-potential heat of soil and blocks utilizers of low-potential heat of ventilation emissions for hybrid heat pump systems of heat supply of multystoried residential buildings.
- Technological schedules of design and installation of hybrid heat pump systems of heat cold supply of multystoried buildings in the conditions of dense city building.
- TU 3113-001 specifications - 26362384-09 Heat exchange soil (thermowells) Standard «Heat supply of buildings. A method of calculation of power requirement and system effectiveness of heat generation with thermal pumps». The standard defines a method of calculation of energy consumption and power efficiency of heat pump systems of heat supply. The technique is based on use of the operational parameters of the equipment specified in technical documentation, and also the characteristics of the equipment received as a result of tests by the Russian or European techniques.

Standard «Structure of heat pump systems of heat cold supply of buildings. Rules, control of performance, requirement of results of works».

The decision on a choice of this or that set of technical solutions has to be made on the basis of consideration of cost of life cycle of the building on the temporary horizon of 30 years taking into account the predicted increase of tariffs for energy resources. Thus, in economic effect (the net discounted income) of application of a package of decisions have to be considered as a consumer component (effect at residents of the house from economy of energy), and a municipal component - economy of the budgetary investments, subsidies and grants in creation

of municipal infrastructure (creation, repair and the maintenance of the generating capacities, networks, dating of tariffs).

In addition, the technique of carrying out natural heat technical tests by tool determination of power efficiency and the actual energy consumption of the residential and public buildings put into operation is developed. The technique provides carrying out natural tests at full independence of influence on energy consumption of the building of subjective factors.

Question. Where from heat pumps are used?

Local (Russia).

Question. You told, that heat pumps which are used by you, work for production of cold and heat. Whether there is need for installation of two heat pumps separately for cold and separately for heat.
Answer: by no means. The matter is that, when we work with the same soil, we download cold, but why to download it into soil if it is necessary to be used in the house. Therefore, we can supply it, even without reverse with cold of the same consumers in the house. Hot water is needed, but the cold is necessary too. It is an ideal situation for the heat pump. In such situation it works with the best efficiency.
Question. What is COP level? /
Answer: it depends on many factors. It is dependent on what kind of source we deal with and at what temperature level of heat we give to consumers. When we work with soil and transfer hot water as the final product, COP is around 3 or little bit lower.
Question. Payback period? /
Answer: we could not count the payback period, but the use of the heat pump is more profitable, than use of electric heating. But in comparison with gas, the use of heat pumps are less profitable.
Question. What refrigerant do you use in heat pumps? / **Answer:** R410a, R407c.
Question. Do you produce compressors by yourself? / **Answer:** no, compressors are made by the producers companies.
Comment. Construction of a house with use of the heat pump leads to rise of the price of square meter on $54 in comparison with traditional construction. In this regard to convince builders of Kyrgyzstan to construction with use of heat pump doesn't see difficult.
Question. How in practice in the Russian Federation there is an introduction of heat pumps, whether there is any statistics? / Answer: unfortunately there is no statistics, summary data are also absent. Process on exchange of experience isn't present.
Comment. In Kyrgyzstan the law on renewable sources of rower is adopted, in this regard use of heat pumps has a sense.

Sovet Mamadaliyev, LTD «Dordoy Energy», «The use of CO2 heat pumps in Kyrgyzstan»

Our thermal pump, in difference from foreign colleagues, uses heat of external air as it is favorable from the economic point of view. We do not have to drill wells that is expensive. Today we cooperate with Japanese producers (Sangdeng company) who work only with natural refrigerants (ammonia, carbon dioxide). The company makes compressors of two types - screw and piston. The company is on the threshold of creation of hybrid type of compressors.
Advantages of CO2 heat pump:
1. Environmental friendliness
2. Heat pumps can work at temperatures from 45 °C to – 25 °C, and some to -30 °C
3. Profitability

Our company within two years delivers heat pumps of this type, before was carried out much practical tests regarding use in the conditions of Kyrgyzstan. Electricity consumption of the heat pump made 6,5 kWh and at the exit is 26 kWh. These heat pumps were installed in the territory of sport center of "Dordoy" in Bishkek which replaced three water-heating coppers with consumption of 7 kWh. For practical tests 5 units, from which there were bought two semi-industrial and three household types. The household heat pumps intended for hot water supply consume only 1,5 kWh., the volume of a tank makes 370 liters which heat up in three hours at a temperature of external air of 7 °C, at a temperature of -15 °C, 370 liters of water heat up in 5,5 hours. In Bishkek three units are installed. The only shortcoming is location of a tank outside, near the heat pump, but modern technologies already allows installation of a tank inside for an exception of heat loss.
Question. What is pressure level? / **Answer:** the level of pressure is 15 bars.
Question. Because of location of a tank outside, do you think that there can be a freezing? **Answer:** in these installations there is an automatic system of plum and system of defrosting.
Question. What means concept the semi-industrial heat pump? /
Answer: heat pumps are subdivided on household, semi-industrial, commercial and industrial, which differ from each other in power level.
Question. Whether any collecting and the analysis of the heat pumps was carried out? / **Answer:** the main accent when using heat pumps was given to economic profitability which suits us.
Comment. This installation is the first in Kyrgyzstan which has potential for further development.

Victor Shostak - LTD «Izhinering Service», «The use of heat pumps in sanatorium of «Blue Issyk Kul»»
Some while, in sanatorium there was an electric boiler room, high-voltage electric boilers heated water at night. However the system of distribution worked not regularly. There was a continuous loss of heat. In 2013 after long discussions, we came to a conclusion to install heat pumps. Near each object of sanatorium thermal pumps were installed. There were some mistakes from which it is possible to distinguish that during distribution of heated water (50°C-60°C) there was no circulation, there was no the closed contour, it wasn't clear where water leaves. Heat pumps of sanatorium use water from the lake and external air. There is small deficiency of water in the main building of sanatorium because of problems with distribution, but this issue will be resolved soon. For a balneary, heat pumps use water from the lake.
Profitability of the heat pumps installed in sanatorium is at the worthy level, there is an economy of the electric power of about 150 thousand kWh a month.
For individuals our company is engaged in installation of the combined types. They are heat pumps and heliosystems. For the private sector the combined types are the most suitable.

Question. While using the heliosystems in summertime, the surplus of hot water is observed what do you do in such cases?
Answer: some people use a water surplus for the pools, someone simply merges, but we try to make installation so that hot water supply was closed, it allows avoiding a surplus of hot water.
Comment. Installation of heat pumps in Issyk kul area doesn't demand existence of heat exchangers, the heat exchanger is lake water, it is a priority.
Question. Where cold water leaves the tank after passing through heat pumps installed in sanatorium? **Answer:** in summer, water goes back to the tank, in winter to the sewerage.

VIII. Recommendations of workshop

Kyrgyzstan is located in a zone with sharply continental climate. The main part of its territory is located within a zone of a temperate climate, and only the southern part belongs to a subtropical zone. Location in the center of the greatest continent of Eurasia, remoteness from oceans and the seas, and also proximity of deserts - these are factors owing to which the climate can be defined as continental and droughty, and seasons sharply contrast with each other. Thanks to a considerable difference in a relief and to existence of such big lake as Issyk Kul, climate changes from continental to the sea. In a year, there are on average 247 sunny days. For winter heavy snowfalls are characteristic. The coldest month is January. The annual amount of precipitation fluctuates from 180 mm. in the east, to 1000 mm. in the southwest. Fluctuations of air temperature reach especially great values here. The arrangement of its territory in southern latitudes (370-420) makes specifics of insolation mode. For this territory the big height of the Sun is characteristic (in the summer its midday height reaches 720), the insignificant overcast, transparency of the atmosphere caused by rather small number of days with rainfall and fogs, high intensity of the reflected radiation. Besides, in Central Asia small concentration of ozone in the atmosphere leads to intensity of ultra-violet (UV) radiation is especially great.

Distribution of thermal radiation in the territory of Kyrgyzstan differs in a number of features. In winter time monthly sizes of radiation gradually decrease from the South to the north. And the average level is only not much higher, than in other regions of the CIS at the same latitudes. In summer, the maximum of total radiation is sharply expressed. Heat revenues to a horizontal surface from direct solar radiation are 2 - 3 times higher, than in regions of northern and middle latitudes of the CIS. The large number of a solar heat received in summer by Central Asia causes high temperature of air, especially in flat territories - the maximum summer temperatures almost everywhere exceed 40 °C. It should be noted that in the summer a long time daytime temperature keeps approximately at the constant level and certain regularities are inherent in its daily changes.

In winter absolute minima fluctuates ranging from -15°C to -40°C. Besides, the open arrangement of Kyrgyzstan from the North and the northwest favors to penetration on its territory in winter time of cold air masses thereof the periods of warm and dry weather alternate with the periods of a cold snap and rainfall. Therefore, in winter, within 1 – 3 days, there may come sharp change of weather, and daily fluctuations of temperature do not submit to accurate regularity.

Total illumination in the Central Asian region is very great. At the clear sky on a horizontal surface at noon illumination changes from 50 thousand luxuries (lx) in winter, to 100 thousand lx in the summer.

Especially it should be noted that across the territory of Kyrgyzstan there is a process of alignment of climate that finds reflection on climatic distribution. Types of weather define the possible modes of operation of rooms in buildings.

The main components of climate that significantly influence design of buildings are: radiation, insolation, humidity, wind mode.

In traditional understanding of optimization of thermal protection of the external protecting designs of buildings consists in determination of thickness of thermal insulation of a design (or thickness of material of the design, if it is single-layer) «on a minimum of the given expenses». The given expenses generally include two indicators: costs of production of designs and costs of their operation. This method is recognized around the world, but it contains the serious danger reflecting objective reality of the economic situation existing in the country. It is connected with

use of cost indexes of energy and materials in a method. It is not possible to forecast for the next 20 – 30 years cost indexes of energy and materials. In this regard, the most important is the solution of the *problem of heat power optimization of the protecting building designs*.

The main objective solved at design of the building – *rational use of energy resources (decrease of power expenses to economically justified minimum level) by a choice of an optimum heat-shielding of the building taking into account system effectiveness of the existing heat supply and providing the set microclimate in rooms. Thus, the building and systems of its providing are considered as a unit.*

Heat power impact of external climate of the area of construction on thermal balance of the building can be optimized at the expense of a choice in a **form of the building, an arrangement and the areas of filling of window openings, systems of a sun protection, regulation of filtrational streams, the organization of rational aeration of a choice of effective heat-insulating materials**.

Hygienic recommendations of comfortable parameters of a microclimate in the dwelling in the conditions of their convection heating in winter in various regions is provided in normative documents. The effective means capable to reduce heat receipts to rooms from solar radiation is sun protection. When the arrival of heat from solar radiation through the unprotected window opening is high, than more sun protection can improve a microclimate. So, in rooms with big areas of translucent protections at the expense of the shading devices the maximum temperature of internal air can be reduced on 5 – 6 °C.

Thus, in the conditions of dry, hot climate of Kyrgyzstan the architectural, planning and constructive measures at design of buildings directed on fight against the summer overheat caused by intensive solar radiation and high temperature of external air need to be coordinated to the requirements following from features of winter mode.

The role of the designer in creation of the demanded microclimate consists, first of all, in application of most technical and economically of the effective protecting designs of buildings in various construction climatic conditions.

The new European concept of the power effective house with the maximum norm of annual energy consumption to 50 kW • h/ is developed for possibility of decrease of energy consumption in the existing buildings the size of consumption of thermal energy in which is equal 100-120 kW • h/(m^2 • year) (m^2 • year). Implementation of the concept provides at the same time increase of comfort of conditions of accommodation and economy of energy resources.

The concept was developed on the basis of results of pilot studies of the operated buildings and methods of mathematical modeling of processes of a heat transferring with use of methods of thermography at inspection of designs. According to the developed concept, at design of the power effective building some fundamental architectural and construction principles are observed.

In terms of energy efficiency increase:

– optimization of architectural forms of the building taking into account possible impact of a wind;

– the optimum arrangement of the building concerning the sun providing possibility of the maximum use of solar radiation;

– increase in thermal resistance of the protecting building designs (external walls, coverings, overlapping of roofs) to a technically feasible maximum level;

– minimizing of quantity and the thermal conductivity which are available in a design of thermal bridges;
– ensuring necessary air density of a design of the building concerning inflow of external air;
– increase to the maximum technically feasible level of thermal resistance of the translucent protecting designs;
– *creation of system of ventilation for supply of fresh air, removal of the fulfilled air, distributions of heat in the room and the organization of regeneration of heat of ventilating air.*

The combination of the factors stated above provides *the minimum energy consumption* of the building, thus the defining factors of increase of energy efficiency of the building are the increase in thermal resistance of its constructive elements and reduction of number of thermal bridges.

Reduction of emissions in the atmosphere of CO2 is an important consequence of decrease of consumption of energy. By the given estimates, development of 150 kW • h/(m^2 • year) demands burning of 15 m3 of natural gas or 15 l of oil that leads to emission in the atmosphere to 30 kg of carbon dioxide. Thus, at such energy consumption on each square meter of the area of the building about 30 kg of carbon dioxide a year are released into the atmosphere. Ten times decrease of energy consumption of the building leads to the corresponding decrease of emissions of CO2 in the atmosphere.

In respect of comfort increase:

Increase of comfort of conditions of accommodation within the offered concept consists:
– in possibility of reduction of difference between temperature of an internal surface of the protecting designs (external walls, coverings, overlapping over undergrounds) and temperature of internal air.
– in uniform distribution of air temperature indoors, an exception of «drafts»;
– in providing optimum moisture conditions of rooms at expense of uniform *compulsory ventilation of rooms* (instead of periodic «opening closing» of window leafs, windows and doors;)
– *in ensuring oxygen balance outside and inside the building at expense of uniform compulsory ventilation of rooms;*
– *in an air conditioning possibility at its constant or periodic compulsory supply to the room.*

The building of such comfort gives great opportunities to design depending *on national traditions and a geographical site*. However, anything fundamentally that is different from usual construction is not present. From the economic point of view implementation of such project demands increase of capital expenditure **for construction by 5–8%. However, these investments pay off with the help of economy of energy and, respectively, decrease of operational expenses and providing comfortable conditions of accommodation**.

Among examples of implementation of this concept there are houses, public and production buildings. Technical solutions on buildings of the increased comfort are adapted for various climatic conditions. For example**, for tropical countries the special attention is paid to comfort during a summer season, for the cold countries – tightness, modernization of systems of heating and ventilation.** The data given above shows that the need for thermal energy in operated and buildings under construction can be considerably reduced at the expense of increase of thermal resistance of constructive elements and elimination of thermal bridges.

Only strict observance of the European standards and progressive concepts in the field of increase of energy efficiency of buildings can promote a solution of the problem of energy saving in buildings.

Technical sector

1. To address to the government with the offer to lower customs tariffs, interest rates for the credits for those who works in the field of energy saving and renewables;
2. To develop additions for heat pumps in the law on renewables;
3. To introduce the energy saving equipment at a design stage of buildings;
4. Stage-by-stage control of installation of the energy saving equipment at a construction stage;
5. To harmonize construction norms and rules of Kygzyzstan in the field of energy saving and renewables according to the best practices of foreign countries;
6. In specifications on construction of buildings to establish the minimum threshold of consumption of energy for the purpose of increase of indicators of energy saving;
7. Creation of an electronic database for collecting offers in the field of energy saving;
8. Inclusion in the program of training of HIGHER EDUCATION INSTITUTIONS of information on energy saving technologies and renewables;
9. The organization of regular workshops on training of designers and architects on new technologies in the field of the engineering equipment of buildings;
10. To address to the government with the offer of development of the program for energy saving technologies and renewables;
11. Creation of the manual for experts of RAC on energy saving technologies and renewables in city planning;

Education sector

1. Carrying out audit of the existing training programs in education regarding presence of data on energy saving technologies and renewables in city planning;
2. Introduction of practical experiment on application of energy saving technologies and renewables;
3. Attraction of the international experiment on design of energy saving engineering systems;
4. Publicizing of successful experience of application of energy saving technologies and renewables through mass media;
5. To revise the existing educational and legislative standards regarding existence of issues of energy saving not only in buildings, but also other sectors of economy. In case of lack of issues of energy saving to begin work on their revision and introduction;
6. On the basis of the revised educational standards to begin development of educational modules, programs, disciplines, specialties on all education levels (lyceums, colleges, HIGHER EDUCATION INSTITUTIONS);
7. Creation of uniform body for coordination of actions in the field of energy saving technologies and renewables.

Sector of design

1. To accelerate process of acceptance of strategy of development of construction branch for 2015-2017;

2. To consider an issue of strengthening by competent personnel the administrative board of the State Committee for Construction;
3. To consider an issue of introduction of a national component in architecture of Kyrgyzstan (national color);
4. Creation of association as «ABOK» (Russian Federation);
5. Carrying out demonstration projects in Issyk kul area on application of solar installations and heat pumps for needs of hot water supply and heating during the winter period for the purpose of decrease of electricity consumption;
6. Carrying out demonstration projects in new buildings of Bishkek on application of alternative energy sources for decrease of consumption of fossil fuel and the electric power;
7. To work out mechanisms taking into account foreign experience on introduction of energy saving technologies;
8. Creation of science and technology park on practical application of energy saving technologies and renewables;
9. Creation of the educational center for energy saving technologies and renewables.

VIII. List of participants of workshop

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7	Smirnov Yury Nikolaevich	Doc. Arch.Sci.KRSU	0312449699
8	Tagirov Yusuf Ibrahimovic	Head Architect of PI «Issyk Kul Project Kurorturizm»	0312312712
9	Murzakulov Taalay Choroyevich	«Kolizey» construction company	0312900078
Education sector			
10	Abdurasulov Ilimidin Abdurasulovich	Doc.Tech.Sci., professor, KRSU	0312479960
11	Ivanova Tatyana Nikolaevna	Senior teacher KRSU	0312479960

12	Odozov Alaybek Dzhumabekovich	Doc.Tech.Sci., professor. KSTU	0312541452
13	Abdyldabekov Kubanychbek Toktobolotovich	Can.Tech.Sci. KSUCTA	0772613944
14	Ismailova Elmira Kalykovna	Can.Tech.Sci., KRSU	0312479960
Designers			
15	Putilov Andrey Alekseevich	JSC «Kyrgyzgiprostroy»	0312311608
16	Miniakhmetova Tatyana Borisovna	JSC «Kyrgyzgiprostroy»	0312311561
17	Golovina Svetlana Konstantinovna	JSC «Kyrgyzpromproyekt»	
18	Saprykina Galina Pavlovna	JSC «Gorproyekt»	0312442372
19	Nogoyev Kubatbek Myktybekovich	«Kolizey» construction company	0771893316
20	Bekbayeva Jamilya Askarovna	LTD «Taza Aba Kurulush»	0312317879
21	Ysabekova Taalaygul Abdumutalipovna	«Bishkekglav architecture»	0772314166
Organizations			
22	Kurganov Mikhail Vladimirovich	JSC «Bishkekteploset»	0775585359
23	Seydaliyev Muradin Avasovich	«Bishkekgorvodokanal»	0312561655
24	Tokombayev Nasridin Ismailovich	«Bishkekglav architecture»	0312456809
25	Zhanykeeva Chinara of Dokturbekovna	State Committee for Construction of Kyrgyzstan	0312313129
26	Seyitkaziyev Baktiyar Toktogulovich	State Committee for Construction of Kyrgyzstan	0312313129
Suppliers of equipment, assemblers			
27	Shostak Victor Alekseevich	LTD «Engineering Service»	0701121318 0312343799
28	Myrzayev Iskender Alybekovich	LTD «Engineering Service»	0703976613
29	Mamyrgaziyev Sovet Toktonazarovich	LTD «Dordoi Energy»	0312439848 0701130101
30	Gigauri Tatyana	LTD «TISSA»	0555329994
31	Azis Isa	LTD "Kyrgyz Zher-Kubat"	0777418877
32	Moryakhin Roman Sergeyevich	LTD «TISSA»	0555704740
The state inspection for ecological and technical safety under the Government of the Kyrgyz Republic			
33	Zamira Zhalil	Leading expert	

34	Fedotova Irina Mikhaylovna	Leading expert	
35	Anarbekov Cuyongbai Tuoktuosongovich	State design institute of city planning and architecture	0312 31 31 19 0312 31 72 64
36	Morejon Lázaro	Ген. Директор LTD «Caribe South»	0555333444
37	Kabanchenko Denis Vladimirovich	LTD «TSR»	0543 91 99 31
38	Ismailov Imarali Zaynidinovich	LTD «Buudan»	0312 880 965
39	Bekbayeva Zhamilya	LTD «Buudan»	0312 880 965
40	Storozhenko Vasily Ivanovich	LTD «Promholod»	0772 552 060
41	Melyakov Ilya Nikolaevich	Center of development of renewables and energy efficiency	0555 755 306 0543 92 38 61
42	Malikov Eric Malikovich	LTD «Galanz»	0555 384 600
43	Soronbayev Salavat	KYRSEFF	0312 901217
44	Saksarov Rustam Zamirovich	LTD «Megavents»	0700 53 53 53


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Первоначальный вариант