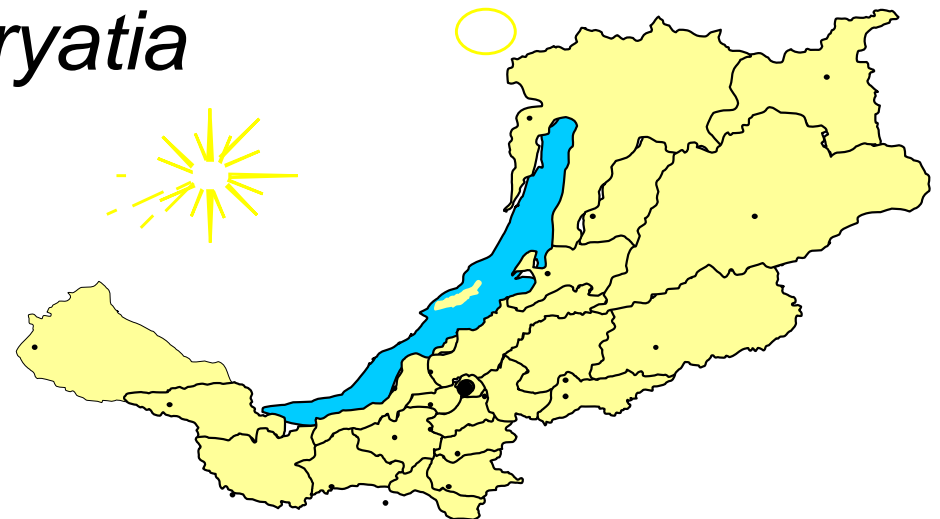


# Energy-efficient clean technologies with independent life - support systems

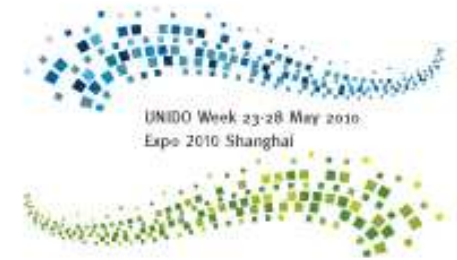
*Buryat State Academy of Agriculture (BGSHA),  
Center for Solar Energy (CSE).*

*Taysaeva Valentina, Prof.*

*Russia - Buryatia*



# Company Profile



During work In Republic Buryatia since 2000 under V.T. Taysaeva management large fundamental and applied researches on renewable energy (RE), most significant of them for the first time are executed: about the technical and economic report on energy maintenance the Baikal region on base RE, about the Scientific basis of creation the energy savings solar systems the heat supply apartment houses in conditions of Siberia.

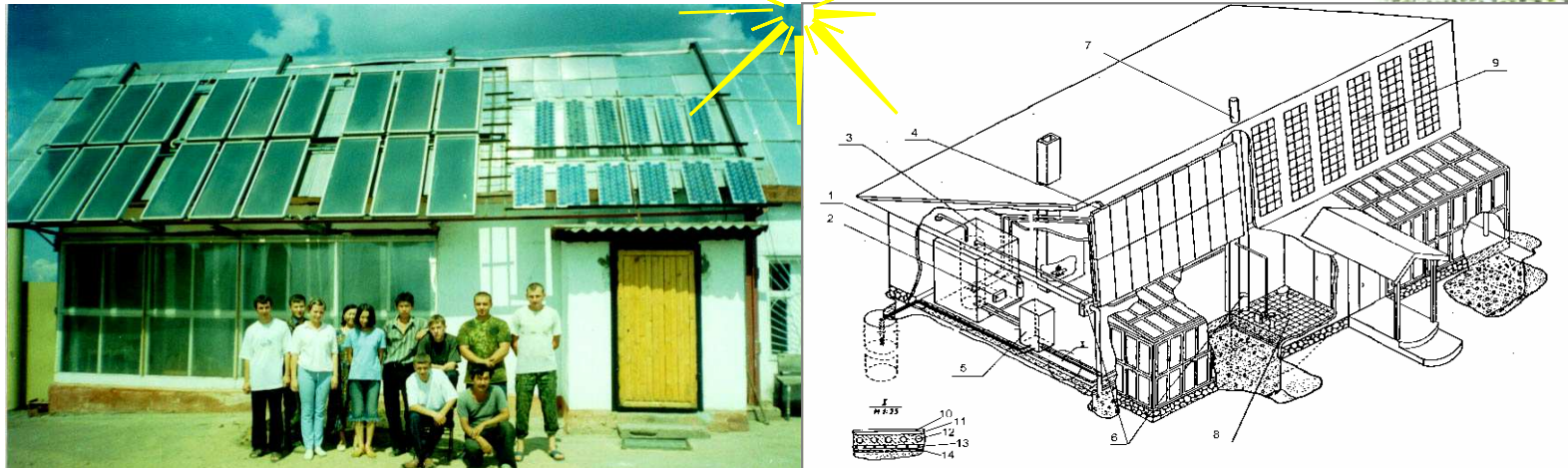
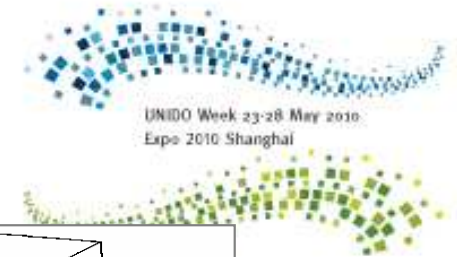
The institute develops the program about Development of renewable energy Buryatia for 2001-2005 in the federal target program about Fuel and energy where 15 projects from FEASIBILITY REPORTS are submitted.

The center actively participates not only in implementing federal, republican but also international projects like European TACIS project "Developing Energy Efficiency in Buryatia"; UNESCO funded project - «Feasibility study of creating mobile power station using RE for the biosphere reserves". At present the project "RUSTREC" contract has been signed with the EU 6th framework program.

## Proejct: Energy-efficient clean technologies with independent life-support systems

- Stock "Solar Energy Institute" has carried out researches aimed at designing energy-effective and ecologically clean house with heating obtained from solar collectors and electro-duplicated boiler, substantiating heating engineering parameters of the system, carrying out practicable experiment and elaborating recommendations for such houses applying ( Fig.1).
- The center for solar energy has developed projects to be introduced, among them ecological farm using renewable energy; solar greenhouse; hybrid farm-greenhouse for individual households, thermal accumulators with zeolite, solar collectors with heat transfer medium "water-air" (Fig.1-5).

# I. The First experimental house in Baikalsk region (of Ulan-Ude, 2000 - 2005)



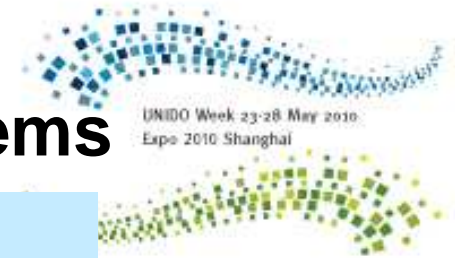
**Fig. 1 Scheme of dwelling house autonomous engineering systems**

1 - electroboiler; 2 - board of management; 3 - tank - accumulator; 4 - solar collectors;  
5 - thermal pump; 6 - fans; 7 - ventilating pipe.; 8 - biotoilet; 9 - solar batteries; 10 - ceramic plates; 11 - concrete; 12 - metal - plastic of a pipe; 13 - grid; 14 - reflecting warmly a film

## Technical and economic indicators

- **Active system of solar heating on the basis of solar collectors (SC) with the heat-carrier water replaces with the heating period to 20 % of thermal loading of an apartment house in the conditions of of Ulan-Ude, and SC with the heat-carrier water-air of a design of the Center of solar power - to 34 %.**
- **The passive solar system (PSS) in the form of a greenhouse provided in addition to 20 % of economy of thermal energy (for the heating period it is necessary in the conditions of of Ulan-Ude of annual solar radiation of 72 %, in southern areas RB - to 90 %);**

# Ecohouse with independent life-support systems



**Fig. 2 Ecohouse**

◆ **details of construction:** (metal-framed with various kinds of wall filling: straw blocks, geocar, lightweight concrete). Walls (0,77 m thick) have resistance to a heat transfer  $4.8 \text{ m}^2\text{°C/Wt}$ . The total area of the house is 146 m<sup>2</sup>.

◆ **engineering systems:**

- canalization- with flush cleaning system (“Matryoshka”) and portable toilet cubicles without flush- cleaning system, with system of clearing of kitchen drains («Stok-1»);
- heat supply - use of solar collectors with the water-air heat-carrier, the thermal pump with systems of accumulation of thermal energy as well as of fireplace thermal energy (developed by Azhichakov);
- ventilation - mechanical through a glass heat exchanger - lantern in a loft;
- electrosupply - gas generator (on natural gas and biogas); combined with solar photomodules and wind power generator. The replacement rate of organic fuel by active and passive solar systems will be 66%.

# Energy efficient solar Greenhouse

In October 2005 Taysaeva V.T. won the Global contest hold by the Department of Industry UNIDO with her project “Energy Efficient Solar Greenhouse” and was awarded by the Department of Industry UNIDO the prestigious prize BlueSky and was delivered a certificate for this development ( Shenzhen)

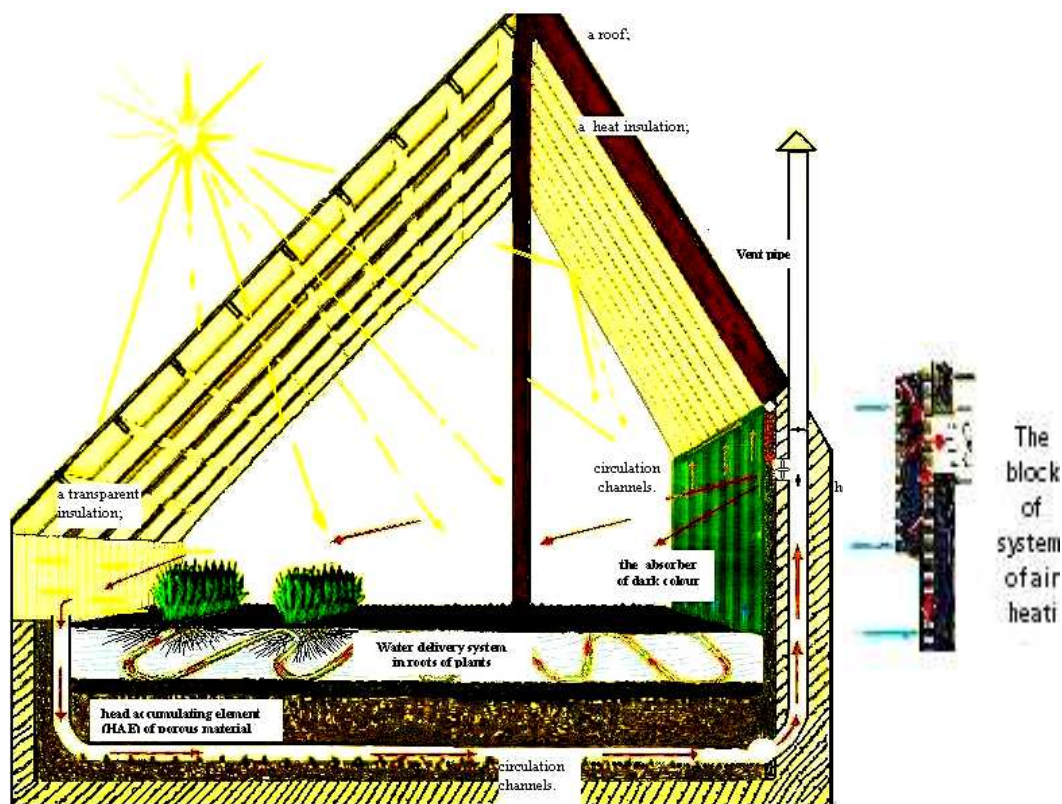
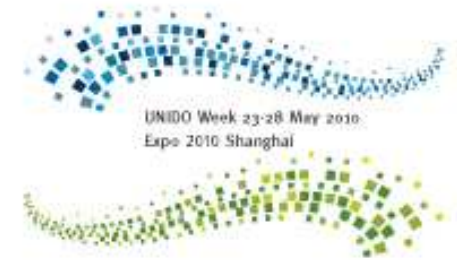


Fig. 3 The system of warm air heating the of Energy efficient solar Greenhouse

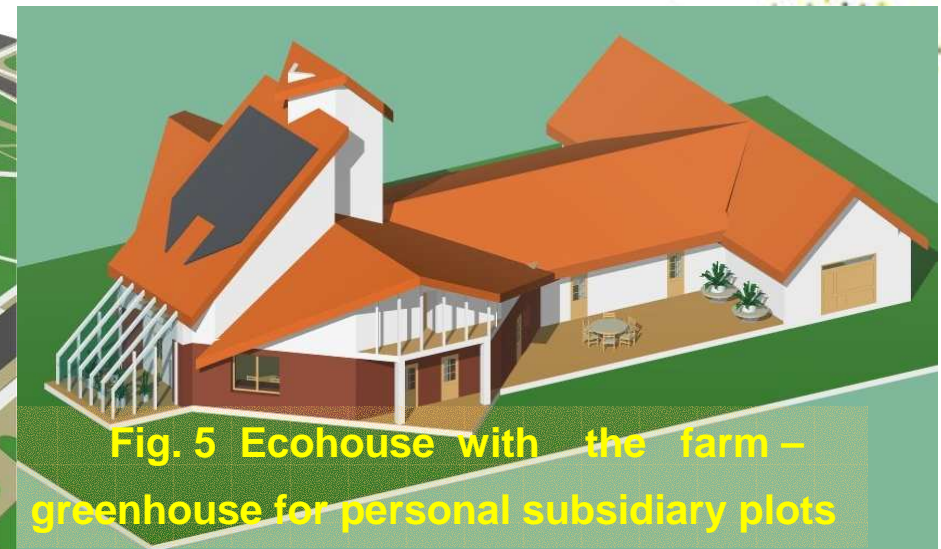


# The Elaboration of Energy efficient solar Greenhouse

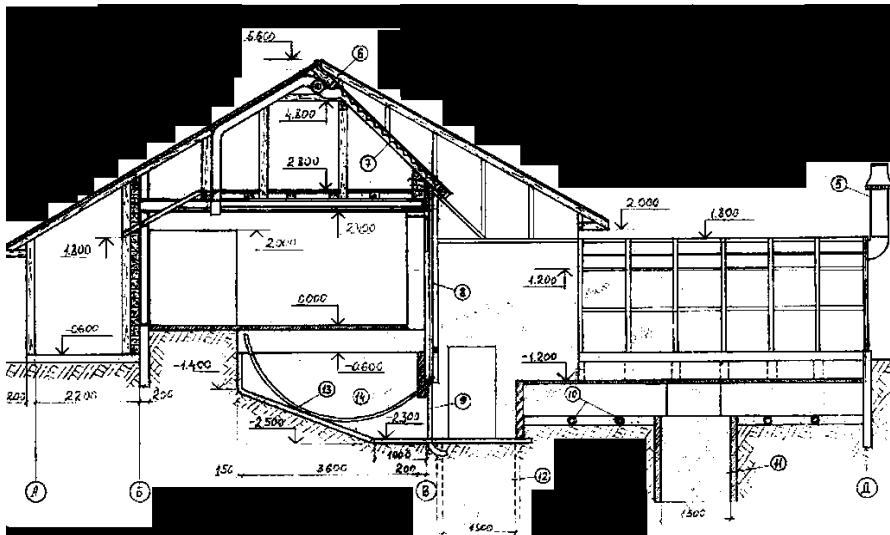


- Heat supply (heating and hot water supply) is provided with: hybrid solar system (HSS) on the base of solar collectors (SC) water-air, passive solar system (PSS) combined with the northern wall and filled in with head accumulating element (HAE) of porous material.
- Combination of fencing construction (floor, walls, ceiling) with heat accumulators will save up to 40 % of construction materials;
- The use of HSS and PSS without accumulating may provide up to 60% of heat amount (39737 kWh). Seasonal accumulation of excess heat (45785,3 kWh) directly in fencing increases the contribution of the passive system by 20%.
- The annual economic effect will be 2700 RUR. per 1 m<sup>2</sup> of protected soil at the price for heat in the districts of the Republic of Buryatia ranging from 1000 to 3000 RUR/Gcal and 1000-1512 RUR/m<sup>2</sup> with the electrical heating at the price 0,07\$/ kWh.
- Recoupment period - 4-5 years.
- The solar green house technology project resulted in the design of energyefficient hybrid options of a residential building with pot culture house, a greenhouse.

# Rural ecovillage



**Fig. 5 Ecohouse with the farm – greenhouse for personal subsidiary plots**

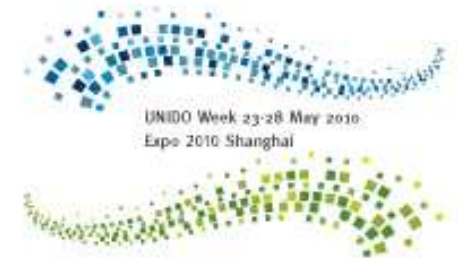


**Fig 4 The farm – greenhouse for personal subsidiary plots**

The results of development of the technologies of independent life-support systems applied agricultural buildings – farms and personal subsidiary plots (Fig 6, 7) in Baikal region, have shown their high energy efficiency because of:

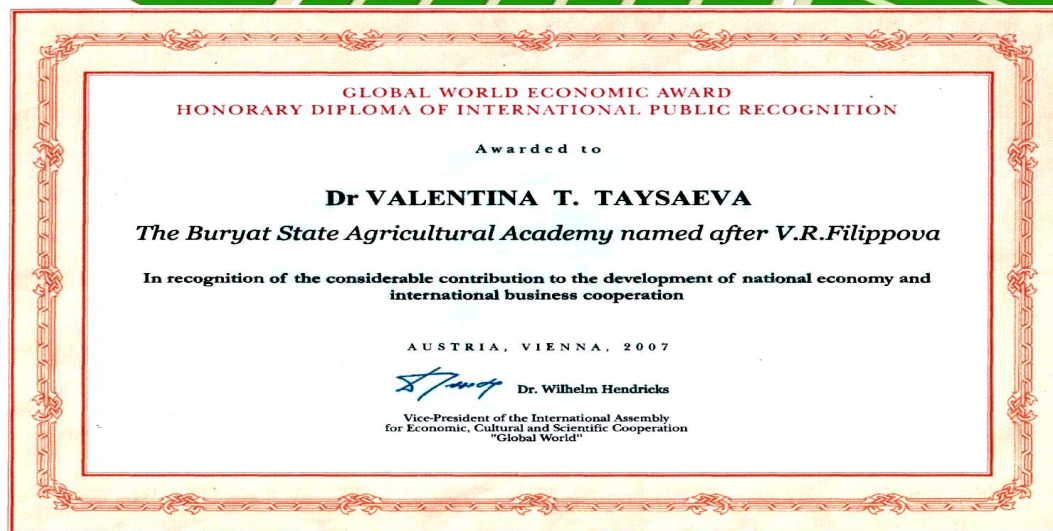
- combination of a farm (51,7 m<sup>2</sup>) and a greenhouse (64 m<sup>2</sup>) to reduce heat loss;
- heating – air on the basis of solar collectors and a mechanical ventilation through recuperator – a three-layer glass heat exchanger;
- additional bioheating of the floor with a compost store which allows to raise a temperature of protected ground up to 50 °C.

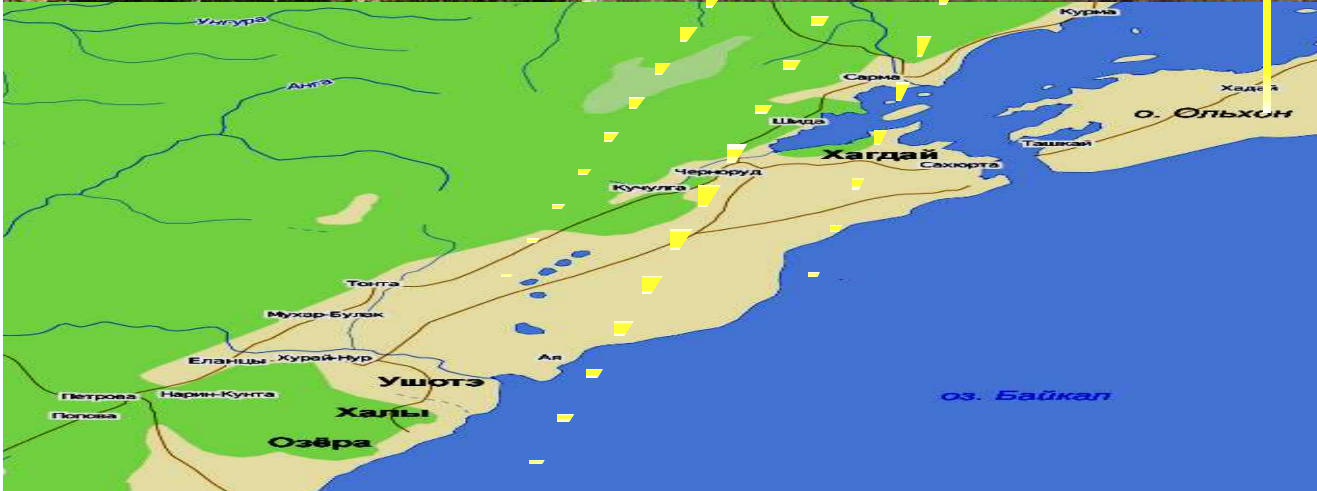
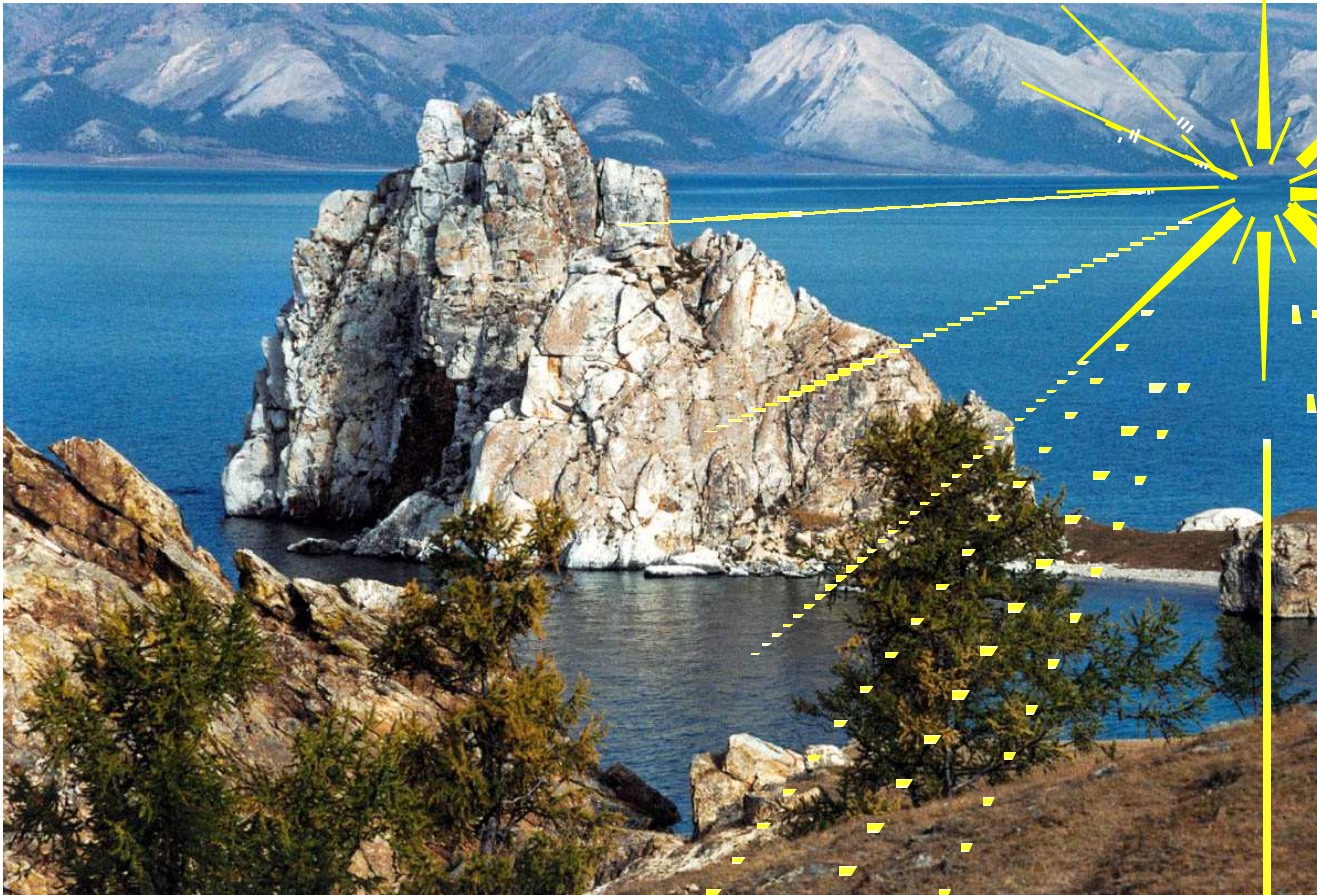
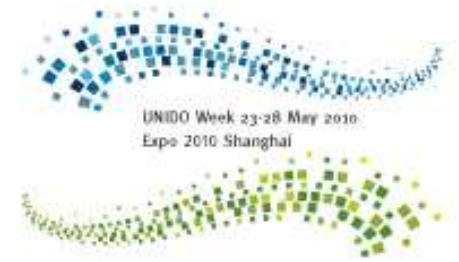
# Construction of ecological houses



In general the solar collectors, heat accumulators to be produced in the region will facilitate construction of ecological houses, farms, helio greenhouses, vegetable store-houses, villages, cultural and social facilities with autonomous heat supply.

The given project is awarded in Europe: In 2007 Taysaeva V.T. was given GLOBAL WORLD ECONOMIC AWARD diploma for the project “ Technical and economic explanation of the efficiency of building ecological farms on the base of solar energy in the Baikal Region” ( Vienna, Austria),“Honourable Scientist of Europe” title, Leibniz Medal ( Hannover, Germany(2008)) and The Europe Order Of Honour (2009) for her developments in the field of renewable energy





Authors of the project:

**Valentina Taysaeva**

**Leonid Masaev**

*solar\_en@mail.ru*

*solar\_en@bgsha.ru*

**Vladimir Malych**

*Malych58@mail.ru*

**Jirij Azhichakov**

*e-mail:*

*Azhichakov@yandex.ru*

**Thanks for attention!  
We invite to cooperation  
in Baikalsk region!**