RENEWABLE POWER AND HEAT FOR BAYANBULAG SCHOOL

Supporting transformational climate action under the climate responsibility approach

The project

SunOyster Systems GmbH and EasyWind GmbH will install an innovative solar co-generation system combined with a low-maintenance wind turbine to provide renewable power and heat to a school in Bayanbulag, a district (sum) of Bayankhongor Province in central Mongolia. The local service shall be organized via Motak LLC of Ulan Bator.

The innovative technology can overcome traditional barriers for renewable heating in harsh subarctic conditions

Situated between the Kanghai mountains and the central steppe region, Bayanbulag has a dry subarctic climate with mild summers and severely cold winters; temperatures are consistently below freezing level for most of the year and reach average lows of -30°C in January. Bayanbulag is the home of ~250 families. The school, with its combined boarding house, gives shelter to hundreds of children from nomadic families in addition. Access to education is generally difficult for nomadic families and would otherwise mean separation of children and their families over long distances. The school in Bayanbulag has in autumn 2020 been extended with new building parts to increase its capacity to 650 students, of which some are also hosted in the boarding house for parts of the year. The new buildings are provided by the central government, while the installation of a heating system is the responsibility of the school and the local administration.

Like most buildings and gers in the region, Bayanbulag school has up to now used coal for heat production which is currently the cheapest available energy source. If burnt in living spaces, the emitted fine dust has detrimental health effects. Given the harsh climate conditions of the region, especially in winter months, it is difficult to reliably meet the school's heating requirements with most mature renewable energy heating technologies.

The central part of this project is a new innovative solar co-generation system, called SunOyster 16 heat and pvplus (12 kWth). Its development was supported through funding from the European Union's Horizon 2020 research and innovation programme. The SunOyster's mirror concentrates solar radiation on a 4m long hybrid receiver which converts the concentrated radiation into heat of up to 170°C and electricity (solar co-generation, CPVT). Well protected within a hermetically closed glass tube, glass lenses concentrate the radiation a second time in order to reach a total concentration of 1250x. This radiation hits the III-V concentrator cells with 44% electric efficiency to generate power.

SunOyster 16 heat and pvplus system

The co-generated heat is conducted through the aluminium pipe to the heat transfer fluid (water, water with glycol or potentially thermal oil) circulating in the tube. This fluid cools the cells and transports the heat to the user or the storage. Altogether, the receiver reaches up to 30% electric efficiency and 45% thermal efficiency in relation to the direct radiation, representing one of the highest solar efficiencies worldwide.

This system is combined with a wind turbine (EasyWind 6) for additional electricity generation. The wind turbine is a small and very low maintenance model (19 meters high). It can be installed and maintained without the need for a crane. The engine can be raised and lowered manually. There is no software needed to operate the turbine according to changing wind conditions, the turbine regulates itself with mechanical components. The wind turbine is very robust and thus suitable to reliably operate under these extreme conditions. Availability of wind and sun are largely complementary over the year and day, making SunOyster and EasyWind a promising combination in Mongolia.

This combined system will produce electricity and heat to deliver approximately 18,000 kWh heat and 19,140 kWh electricity to the school each year, equivalent to approximately 85% of the school's total annual energy demand. The advanced solar co-generation system generates higher water temperatures than most existing solar thermal technologies; water is heated to around 60-70°C and can thus also supply traditional heating systems. The installation of a buffer tank for heat is included in the project design.

The project will demonstrate replicable GHG emission reductions from a hard-to-abate emissions source

The heating sector in Mongolia is an example of an emission source where new and less mature technologies must be demonstrated to improve the "accessibility" of further efforts to decarbonize the sector. Global efforts to reach net-zero and eventually negative GHG emissions in the second half of this century requires the identification of innovative solutions for hard-to-abate emission sources, where the current lack of affordable GHG emission abatement technologies casts uncertainty on climate change mitigation potentials.

The project will lead to annual emission reductions of approximately 340 tCO_2e over the first ten years of its operation, at a marginal abatement cost of around EUR 240/tCO_2e, by replacing the consumption of electricity and direct coal combustion.

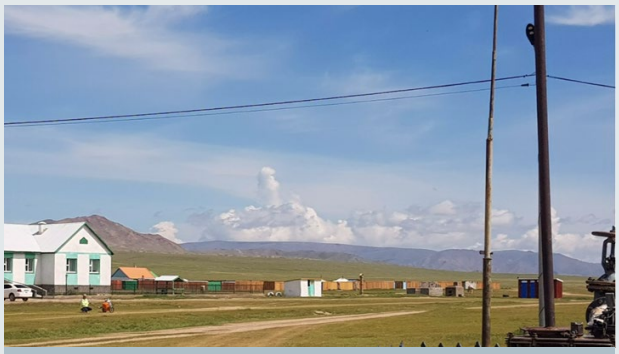
This relatively high marginal abatement cost, in combination with the higher risk level entailed by any pilot activity, represents a barrier for the exploration of this technology in the Mongolian context. The deployment of the technology in this project is an important first step to demonstrate the technology, which could hopefully be replicated at other sites in Mongolia and similar climates. The demonstrated renewable heating system may represent a solution to the heating challenge of 50 other new schools in Mongolia which are under construction, as well as other buildings in both rural and urban areas. Initial estimates indicate that the system costs could be reduced by approximately one half as the technology matures and local value chains develop.

Emission reduction outcomes will remain with Bayanbulag school and support climate change mitigation ambition raising in Mongolia

Any emission reduction impact caused by the project should be counted towards the emission inventories of Bayanbulag school and the Mongolian People's Republic. None of the project implementing partners – including NewClimate Institute, atmosfair, SunOyster, EasyWind and other contractors – will claim the emission reduction outcomes towards the neutralization of their own emissions, nor should any other potential support providers in the future. This means that no carbon credits will be generated from the project and transferred to the project implementing partners or other parties, now or in the future.

Since the accounting of any emission reduction impacts remains within Mongolia, the project – and other replicating projects that follow the same support model – could support Mongolia to raise the ambition of its climate change mitigation targets in the future.

By identifying and implementing solutions in areas that are outside of the reach of the national government, such projects unlock additional mitigation potential that can be reflected in national climate targets.



School building in Bayanbulag

The renewable heating system improves the air quality and health of children in Bayanbulag

The positive effects on air quality and health can be even more significant in urban contexts. Once the technology has proven its feasibility under Mongolian conditions, the further roll-out also in larger cities could mean a turning point for a higher number of citizens.

Local technicians will be trained to service and repair the renewable heating system

The project will be implemented alongside training exercises that seek to build up local expertise for servicing the renewable heating system, with the intention to minimize reliance on the international technology provider. SunOyster envisage the development of a local value chain resulting in significant job creation in Mongolia, should the system be replicated across more sites in Mongolia in the future.

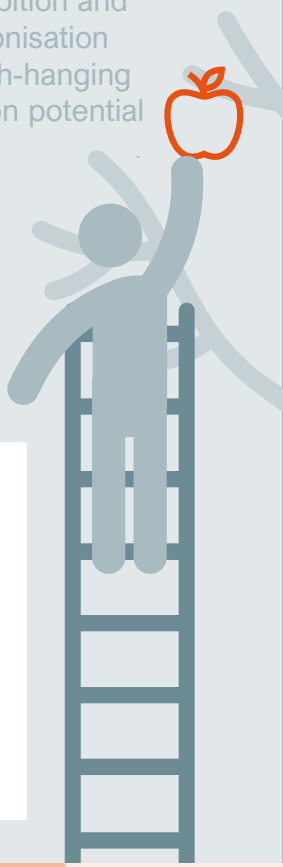
By the nature of the project being a first of its kind in Mongolia, there remains a degree of uncertainty regarding potential issues that might arise and the operational expenditures incurred to resolve them. However, it is estimated that the operational expenditures of operating the system with support from local technicians should lie well below the school's current annual costs for fuel, and the project partners commit to ensuring that this remains the case. atmosfair will manage this project throughout the project lifetime and support the school to render it successful.

The "high-hanging fruit" project could not happen without the external investment

The installation of the SunOyster system in Bayanbulag requires an upfront capital expenditure of approximately EUR 80,000, which is financed through a grant donation of EUR 67,500 from NewClimate Institute and approximately EUR 12,500 from the Cultural Association (former students of the school in Bayanbulag).

The high marginal abatement costs of the project make this clearly out of the reach of other sources of carbon finance, as well as being out of the accessible reach of the national government's own climate change mitigation action. Bayanbulag school has not identified any other investment options, and the renewable heating system would not be installed without the external investment from NewClimate Institute and atmosfair.

Supporting ambition and deep-decarbonisation through the high-hanging fruits of mitigation potential



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Questions, comments, feedback?

Please get in touch via climateresponsibility@newclimate.org

More on our climate responsibility approach at newclimate.org/climateresponsibility

This information represents NewClimate Institute's understanding of the project situation and rationale. The information has been agreed with all project partners and implementing organisations, including NewClimate Institute, atmosfair, SunOyster GmbH, EasyWind GmbH, Motak LLC, and the Cultural Association of Bayanbulag.