Solar Shading Device

Hello,

The development of this product started in 2016 under the Indo-Swiss Development Co-operation's competition of Shading devices. The product Idea won the competition in the Residential Shading device category and was funded further for development.

Exhibited at the Indo-Swiss Climate change conference 2016- Delhi, India

Although the product was not developed further after it was exhibited at the BEEP Conference in 2016. The product idea was in constant development through the last few years, testing for added performance and practicality.

The Product : The exhibited product was simple solar shading device. It only provided solar shading in order to reduce the cooling loads of the space. Although this product was also quite interesting to the sponsorer, we felt the product could do more to not only reduce the SHGC but also to actively cool the building. Following is the development of the product, with some interesting results.

Model 1- Composite, Aluminium and Cement fibre board Composite - Opaque material, for walls and opaque area, where views may not be of importance or mechanical closing may be an option.

1. Using an opaque material for latent evaporative cooling of buildings. Using a material like Cement fibre boards or Calcium silicate board on the outer surface and aluminium on the inner surface, maximum inductive cooling is achieved while the humidity is not affected significantly. In this model it was noted that not much cooling was achieved when the surface being evaporatively cooled was exposed to direct radiation but the combined effect of evaporative wall surface cooling along with shading from direct solar radiation gave exceptional results.

A. Indirect Evaporatively cooled without solar shading

	TIME	INSIDE TEMPERATURE WHERE ONE SURFACE IS CLAD WITH EVAP COOLED CEMENT FIBER TEMPERATURE °C	HUMIDITY	INSIDE TEMPERATURE WITHOUT AND SPECIAL CLADDING TEMPERATURE °C	HUMIDITY	Temp reduction
1	10:46 AM	35.7	21	35.7	29	
2	11.16 AM	28.3	28	30.5	29	2.2
3	11.46 AM	31.1	24	33.1	23	2
4	12.16PM	32.8	22	35.7	24	2.9
5	12.46 PM	31.6	22	34.6	22	3
6	1.16 PM	31.3	25	34.5	25	3.2
7	1.46 PM	29.6	26	33	24	3.4
8	2.16 PM	29.6	27	33.3	26	3.7
9	2.46 PM	28.8	25	33.1	24	4.3

B. Indirect Evaporatively cooled with solar shading

Base model:
Ampient temperature measured in a 750x750x750 mm box that is shaded and covered on one side with a cement fibre sheet 12mm thk.

Test model:
Ampient temperature measured in a 750x750x750 mm box that is shaded and covered on one side with a composite aluminium and fibre cement sheet and evapoarively cooled by capillary action of water through the fibre cement sheet

	TIME	INSIDE TEMPERATURE WHERE ONE SURFACE IS CLAD WITH EVAP COOLED CEMENT FIBER TEMPERATURE	HUMIDITY	INSIDE TEMPERATURE WITHOUT AND SPECIAL CLADDING TEMPERATURE	HUMIDITY	Temp reduction
1	10:10 AM	26.9	30	29.3	28	
2	10:40 AM	26.3	29	29.4	28	3.1
3	11:10 AM	26.5	29	29.7	27	3.2
4	11:40 AM	28.1	22	31.8	22	3.7
5	12:10 PM	29.1	21	33.3	10	4.2
6	12:40 PM	29.5	22	34	20	4.5
7	1:10 PM	29	24	33.3	22	4.3
8	1:40 PM	28.9	10	33.3	10	4.4
9	2:10 PM	28.5	23	33.1	21	4.6
10	2:40 PM	29	24	33	22	4
11	3:10 PM	29.3	10	33.6	10	4.3
12	3:40 PM	29.1	28	33.1	25	4
13	4:10 PM	28.8	27	32.7	25	3.9
14	4:40 PM	28.7	28	32.7	25	4
15	5:10 PM	29.7	27	33.1	26	3.4
16	5:40 PM	28.8	27	32.7	26	3.9

As seen the product gave a consistent cooling performance in the ambient temperature of more than 3°C. This test was repeated tested for different conditions and the results depended on the outside temperature and humidity but are worth further investigation

Model 2: Indirect cooling of a volume with Glass with a film of evaporatively cooled fabric. In this we tested different fabrics for their performance as a glass film when evaporatively cooled and effect of this on ambient temperature.

Base model:
Ampient temperature measured in a 750x750x750 mm box that is shaded and covered on one side with a single glazed unit.

Test model:
Ampient temperature measured in a 750x750x750 mm box that is shaded and covered on one side with a glass that is filmed with evaporatively cooled fabric

	GLASS with evap cooled fabric film		Single glazed and shaded from direct radiation		
TIME	**TEMPERATURE**	**HUMIDITY**	**TEMPERATURE**	**HUMIDITY**	**Temp reduction**
10:10 AM	28.4	51	30.5	53	2.1
10:40 AM	27.3	45	29.8	45	2.5
11:10 AM	26.7	43	29.1	41	2.4
11:40 AM	28.1	37	30.8	35	2.7
12:10 PM	29.8	28	32.6	27	2.8
12:40 PM	30	30	33.1	29	3.1
1:10 PM	29	31	32.4	28	3.4
1:40 PM	28.8	30	31.7	28	2.9
2:10 PM	28.3	31	31.2	30	2.9
2:40 PM	28.8	27	31.8	26	3
3:10 PM	29.3	31	31.5	30	2.2
3:40 PM	28.3	32	31.9	30	3.6
4:10 PM	28.1	32	30.6	33	2.5
4:40 PM	26	59	28.2	58	2.2
5:10 PM	25.3	68	27	69	1.7
5:40 PM	24.3	70	25.7	69	1.4
					2.5875

As seen in the table above the reduction in ambient temperature is averages above 2.5°C. This has the added advantage that the view from the glass is clearer when the fabric is dry and the fibres of the fabric do not store any water and they grow thicker when water is passed over them and they absorb water. This self regulating of visibility and cooling can be

associatively used through the year to gain reflected Solar heat gain in colder seasons and to block the same when not required.

The tests also showed the variation in temperature reduction by using different types of fabrics. Eg, Rayon vs Cotton vs Polyester.

Both the tests show good results to use indirect evaporative cooling in the external shading for windows and cladding panels for facades. This technology if further developed will be an alternative to energy intensive mechanical cooling required in the summers.

What will be the further steps:

1. As the photos attached in the excel sheet show, the tests were carried out in a garage setting. Although the results were always moderated to check for errors, the test needs to be carried out in a laboratory atmosphere and verified.
2. The models needs to be tested for performance for longer periods.
3. The cladding model using the composite of fibre cement/calcium silicate along with and aluminium sheet needs to be tested for consistency and feasibility in manufacturing.
4. The fabric film for the glass needs to be tested for alternative materials like Super absorbent hydrogels and possibility to use for indirect evaporative cooling.
5. It was noticed that the optimum rate of flow of water through the two models is an important criteria in achieving maximum cooling. This needs to be further studied and can be adjusted for further cooling.

This seems interesting to us not as business idea but as an idea that can definitely help us in energy reduction. We are open to any collaboration or any organisations that can take this idea further. We of course would like to help too, but clearly this is not an area of our expertise.

Regards,
Anto Gloren