

## **Blue Roof** *'An Urban outdoor shower Oasis.'*

The bath is not a private island. We are all connected in a global ecosystem where we must conserve water for the public good. The blue roof shower is an outdoor ecosystem that reclaims previously unused flat mechanical rooftop space as an urban oasis. Renewable energy sources on the roof at 330 Dundas Street West, in Toronto, transform it into an electric energy production space, where wind, rain, and sun are all fully utilized.

Use of wind: The Lakota wind turbine continues to produce energy regardless of how strong the winds are. If more energy is produced than can be used, the excess is dumped into a dynamic braking system, that prevents the blades from reaching dangerous speeds. The dynamic braking system is a resistive load that can be used to heat water, thus providing a source of hot water, which can be stored in tanks for later use.

The wind turbine is mounted on the roof, which is also fitted with solar panels. Six inches of Styrofoam insulation on the roof provide an R60 insulation rating. Furthermore the upper roof is covered with solar panels (BP Solar, 12 volt, 160 Watts each, total output power is 4,000 watts) that gather the sun's rays for energy use in the building. This energy is used, together with wind energy, to heat the shower water, as well as to run various equipment, including the shower control systems.

Rain water is collected from the flat roofs, and stored in tanks for treatment such as filtration. The treatment is powered by wind and sun.

The lower roof has a rooftop garden that is irrigated by the used shower water. If one or more people use the shower on a daily basis, there is enough used shower water to irrigate a good sized rooftop garden.

The result is a zero-runoff roof that re-uses the rainwater twice: once for showering, and then again for irrigation of the rooftop garden oasis.

Additionally, the shower base contains micro radar systems to track the body of the user, and rainwater is directed exactly at the flesh, so that none of the reclaimed rainwater is wasted.

During heavy rainfall seasons, when there is more water than what is needed for showering and irrigation, excess water is used to cool the solar panels so that they run more efficiently.

The urban oasis also retains rainwater in the rooftop garden, to help keep the building cool in warm weather. This eliminates the need for mechanical cooling (air conditioning) on the top floor. Additionally, occupants can use the shower for a quick rinse at various times of the day, to cool off in hot weather, thus reducing or eliminating the need for mechanical cooling equipment on the roof.

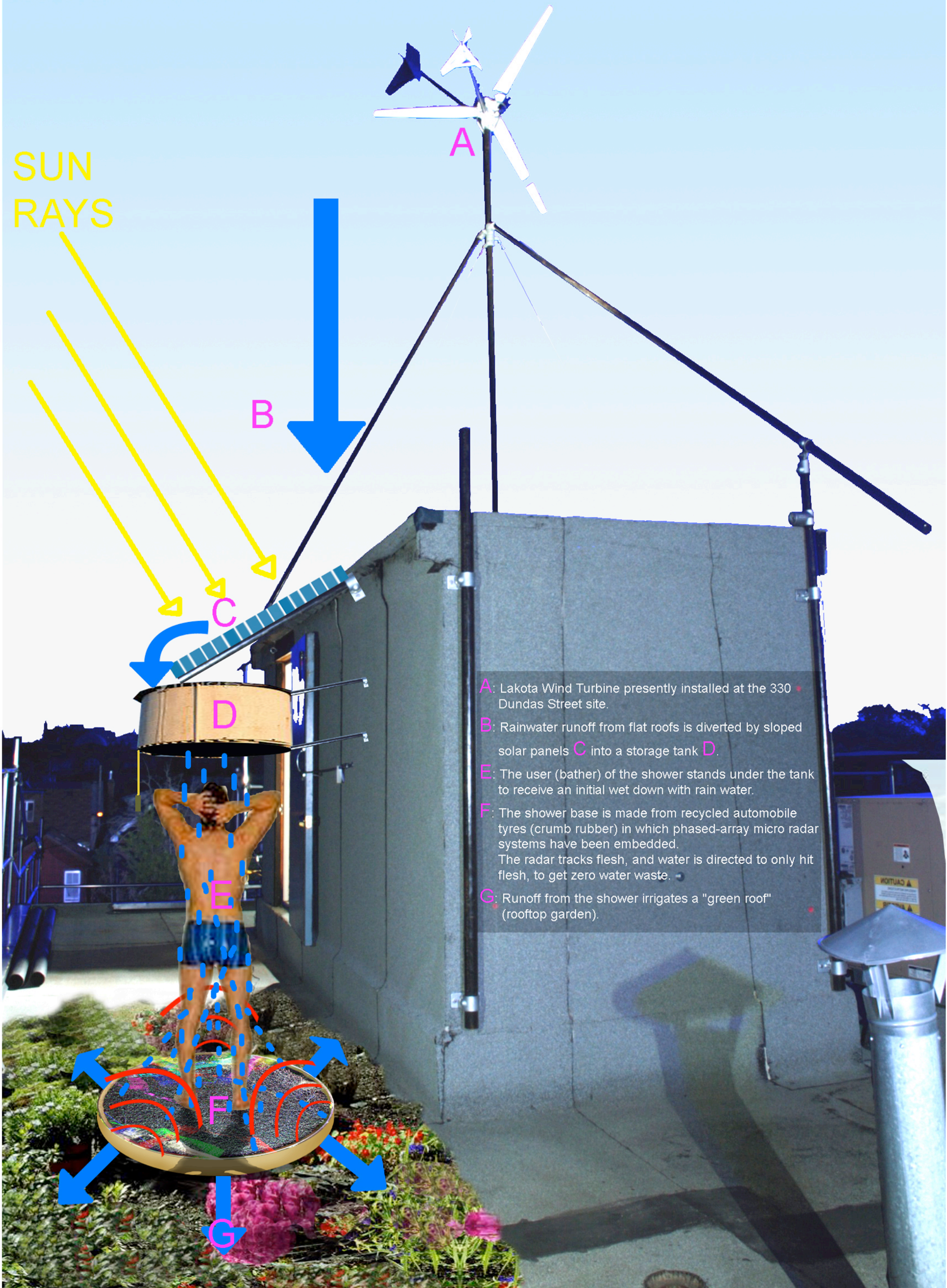
This results in a reduction or an elimination of electricity consumption, since air conditioning accounts for a major portion of electrical utilities load. Additionally, the solar panels and wind turbine collect sufficient energy to power other electrical equipment in the building, in addition to the shower. This other equipment includes rooftop lighting so that the garden oasis and outdoor shower can be enjoyed day or night.

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# Rooftop Eco-shower

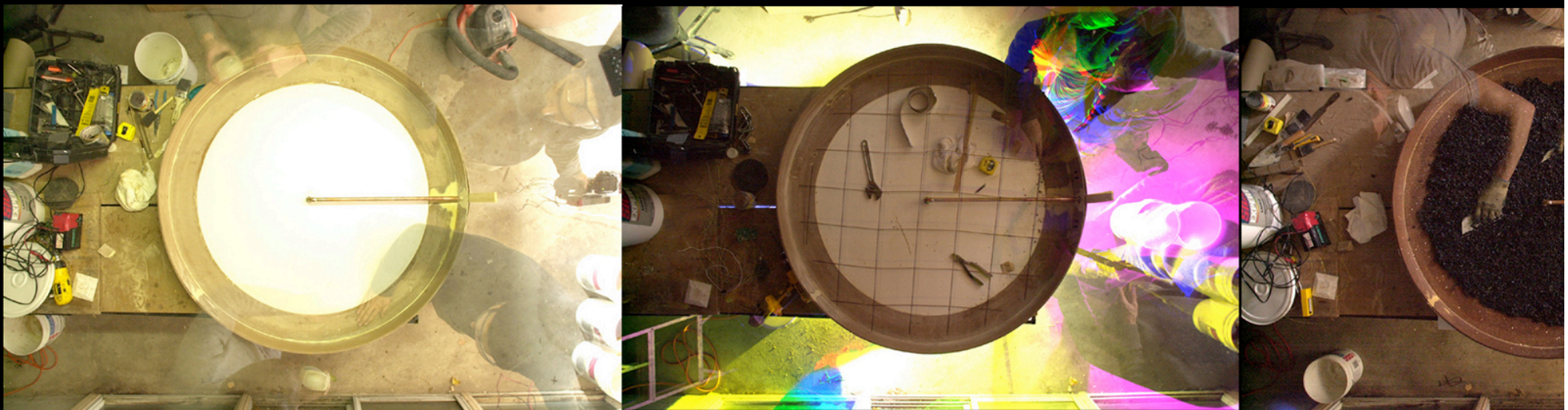
SUN RAYS



- A: Lakota Wind Turbine presently installed at the 330 Dundas Street site.
- B: Rainwater runoff from flat roofs is diverted by sloped solar panels C into a storage tank D.
- E: The user (bather) of the shower stands under the tank to receive an initial wet down with rain water.
- F: The shower base is made from recycled automobile tyres (crumb rubber) in which phased-array micro radar systems have been embedded. The radar tracks flesh, and water is directed to only hit flesh, to get zero water waste.
- G: Runoff from the shower irrigates a "green roof" (rooftop garden).



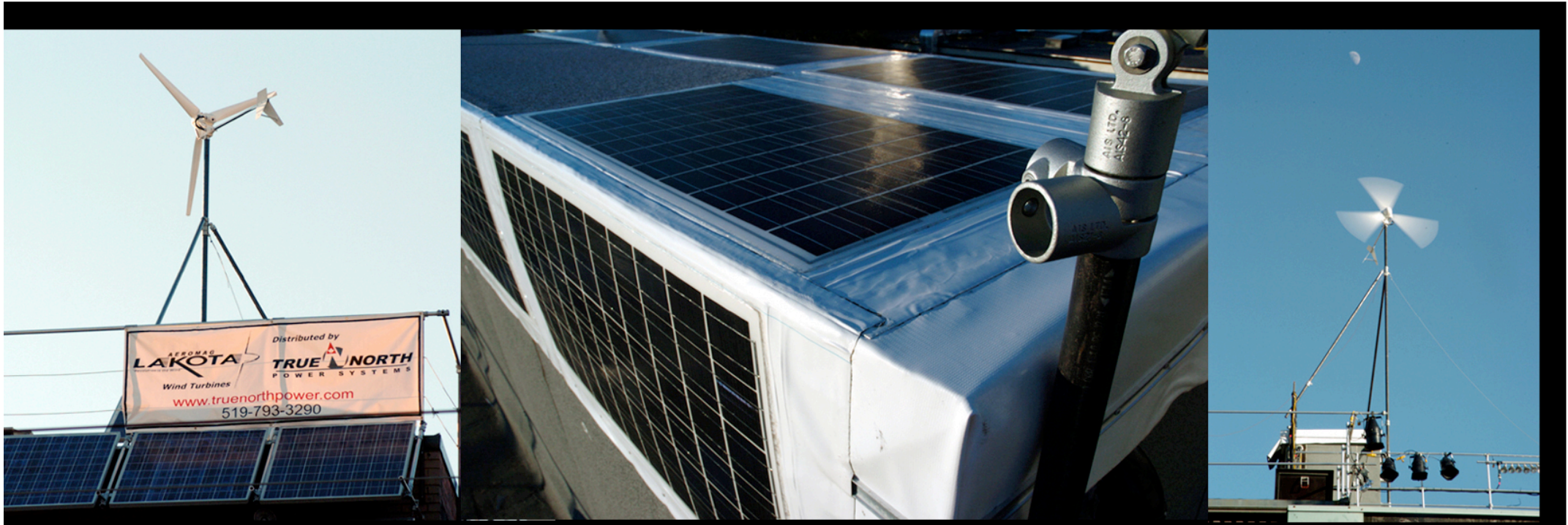
The set of pictures is of an actual "Blue Roofs" installation at 330 Dundas Street West. It features eco friendly showers to irrigate "green roofs" (rooftop gardens). Blue roofs combine solar and wind energy with water. A blue roof is an urban oasis that recontextualizes the boundary between public and private rooftop spaces, together with wind and solar energy.



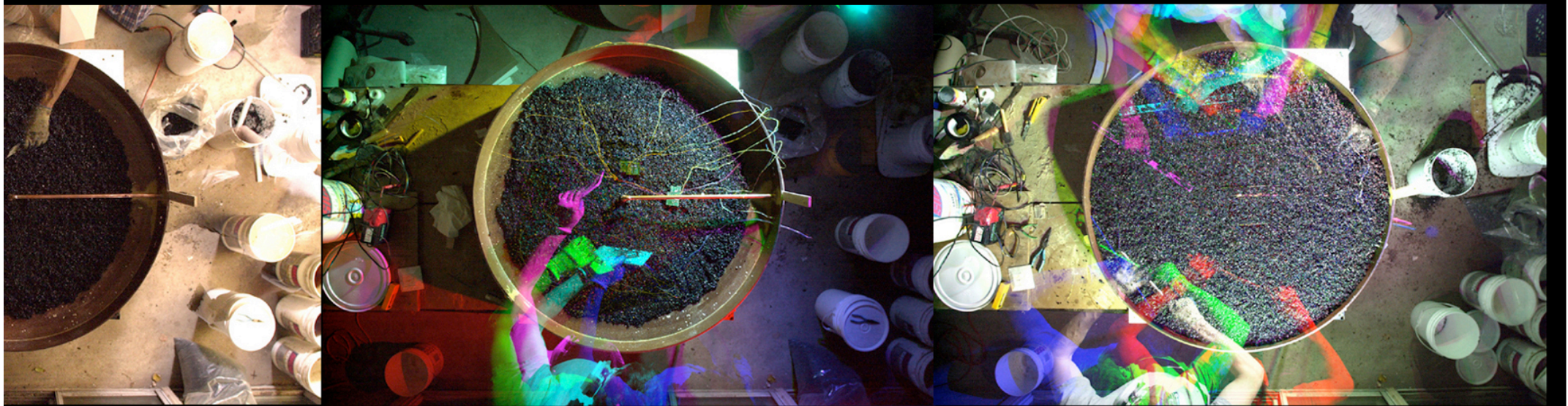
These pictures illustrate the making of the "blue roofs" outdoor shower base: Phosphoric acid is mixed with water capillaries into a crumb rubber mould. The recycled tyres used to make the electronic equipment from water. The radar array accurately tracks the three dimensional position of the bather's body. The computer control of the water distribution system, so that every drop of water lands exactly where it is needed.



These pictures illustrate a variation on the radar tracking in the shower. This shower uses computer vision (CCD sensor arrays) to track the position of up to six bathers. This design is also suitable for mass casualty decontamination, in order to process large numbers of people. The system is completely off-grid, it will continue to function even when all electricity is lost in an emergency.



at West. "Blue roofs" are ecologically conscious waterplay spaces, that use combine sustainable energy (wind, solar, etc.) with waterplay spaces. and private space. The outdoor shower finds a new context on urban flat



phased array micro miniature radar transmit and receive antennas are embedded make the shower base thus create a comfortable non-slip surfaces that protects body. Accurate 3d modeling of the bather's body position is combined with nds on flesh. This results in zero waste of the shower water.



ower, made of stainless steel is also suitable for outdoor "blue roof" applications. others at the same time, and direct water in a zero waste way. ess large numbers of people, in the event of a bioterror attack. Because the and water pressure are lost, such as might happen when utilities are shut down