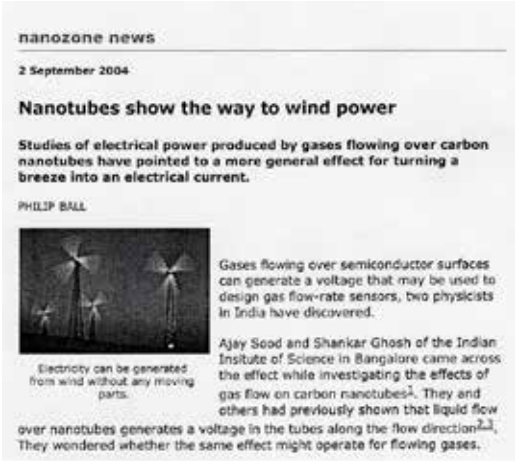
CARBON NANOTUBE SUBSTATION

Master's Studio
Rhode Island School of Design

I am particularly interested in finding new ways architecture can become a part of positive change, especially in an urban setting. The opportunity to use advancements in nanotechnology for an architectural intervention will likely prove vital to the future of the practice of pro-active architecture. For this project I chose carbon nanotubes because they have the potential to produce clean energy. This substation design is dedicated to power the local subway lines at the site, yet has the potential to power back to the existing electrical grid so that no energy production is lost.

Site :: The Prada Flagship Store
New York City, NY



nanozone news

2 September 2004

Nanotubes show the way to wind power

Studies of electrical power produced by gases flowing over carbon nanotubes have pointed to a more general effect for turning a breeze into an electrical current.

PHILIP BALL

Electricity can be generated from wind without any moving parts.

Gases flowing over semiconductor surfaces can generate a voltage that may be used to design gas flow-rate sensors, two physicists in India have discovered.

Ajay Sood and Shankar Ghosh of the Indian Institute of Science in Bangalore came across the effect while investigating the effects of gas flow on carbon nanotubes[1]. They and others had previously shown that liquid flow over nanotubes generates a voltage in the tubes along the flow direction[2,3]. They wondered whether the same effect might operate for flowing gases.

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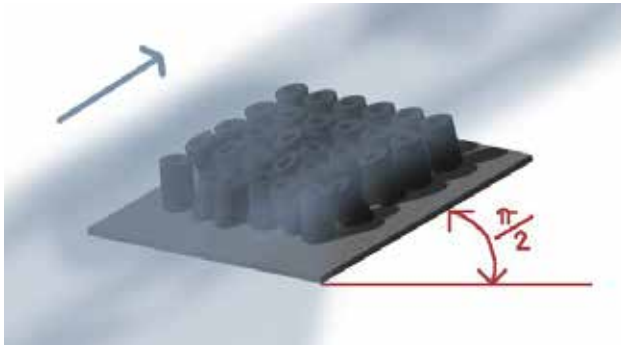
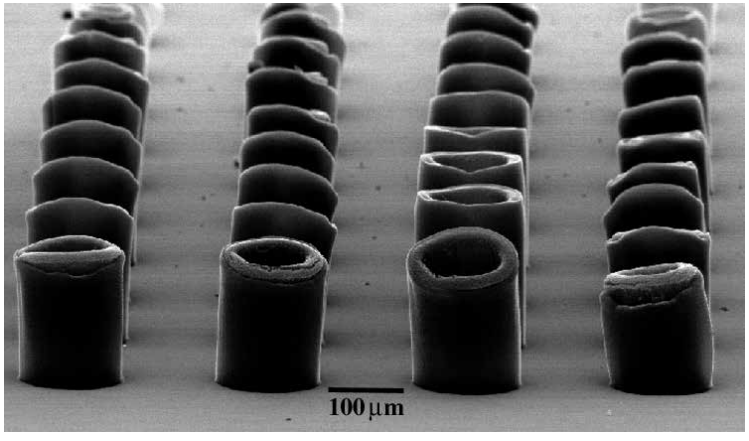
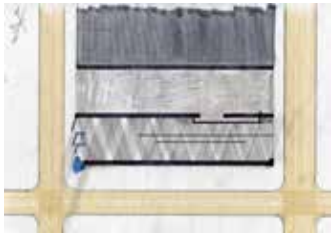
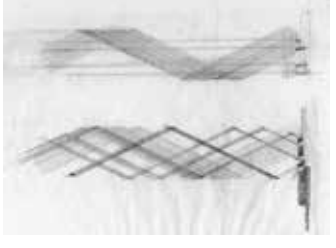
Carbon nanotubes produce electricity when a gas, wind or liquid is passed over a plate of them at an angle of pi/2. Electricity can be harnessed via anodes and cathodes connected to the plates and wired to an output power source.





Wind travels like light, that is, the angle of incidence is equal to its angle of reflection. I used these wind studies to configure wind tunnel structures enveloping the interior of the building.





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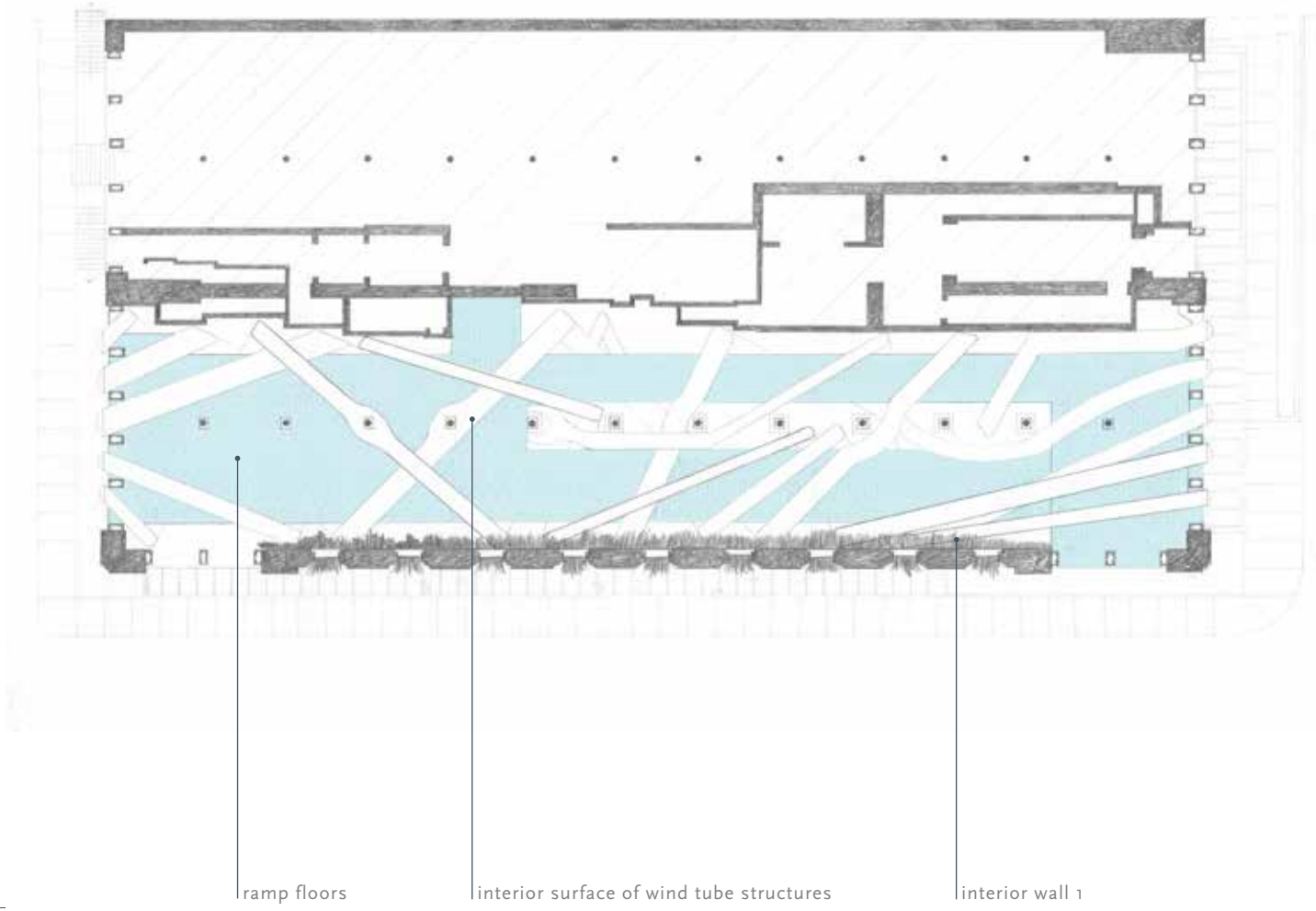
Based on my wind studies, and for maximum potential energy collection, I covered the following areas on the ground floor with carbon nanotubes.



GROUND FLOOR PLAN

not to scale

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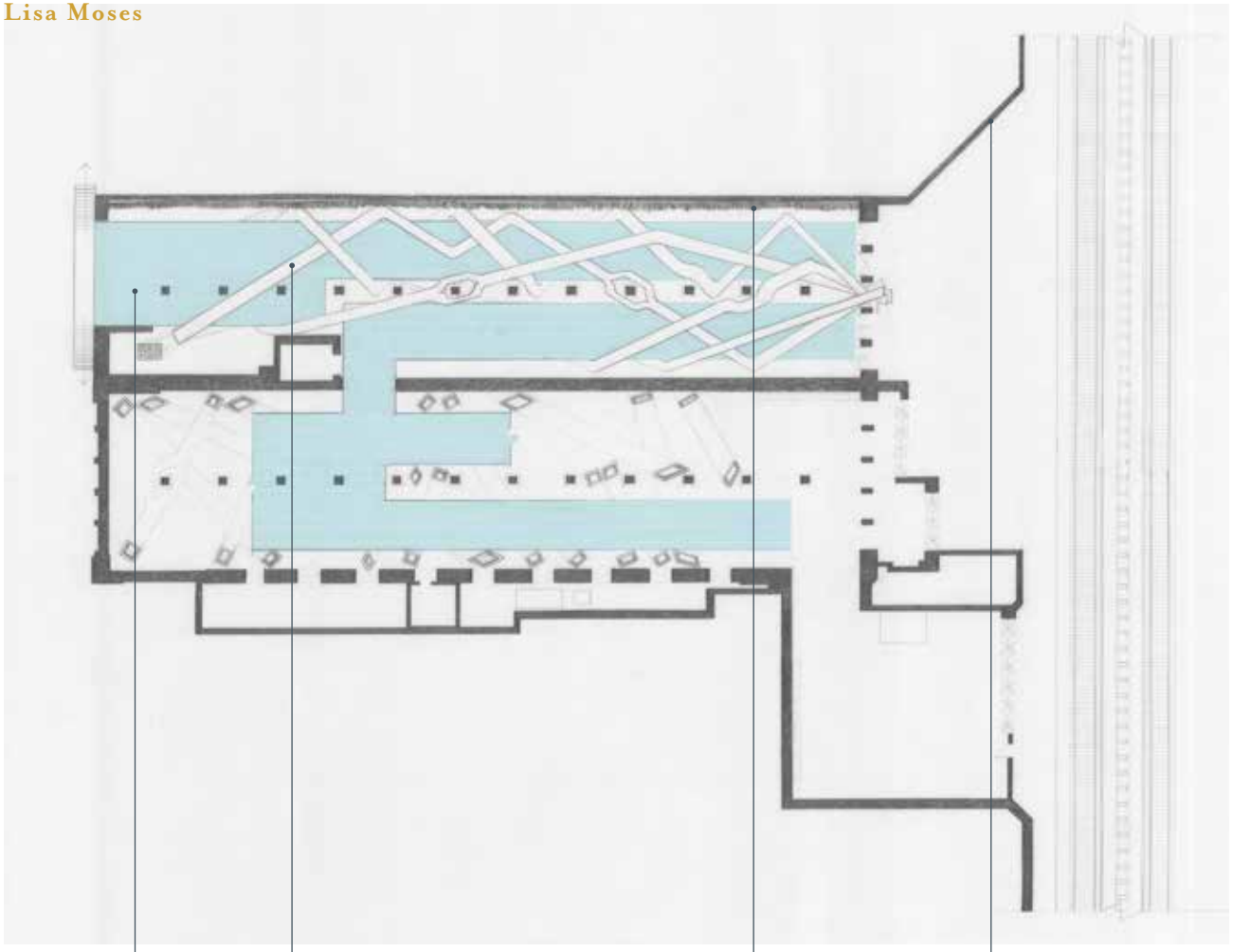
The following areas were also covered with electricity-producing, carbon nanotubes on the subway level space.



SUBWAY LEVEL PLAN

not to scale

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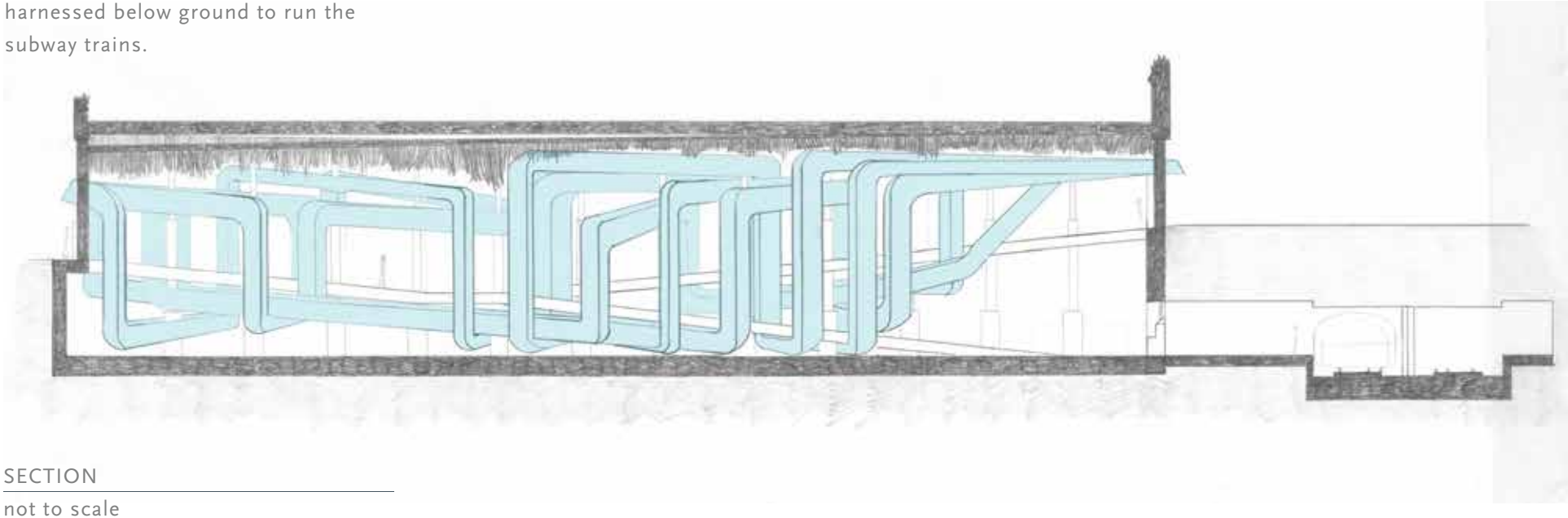
This longitudinal section shows the wind tunnel structures enveloping the entire ground and sub-level space. The open entrances on either side of the building allow for naturally occurring wind to enter into the wind structures, pass over the nanotubes and produce electricity, which is then harnessed below ground to run the subway trains.



SECTION
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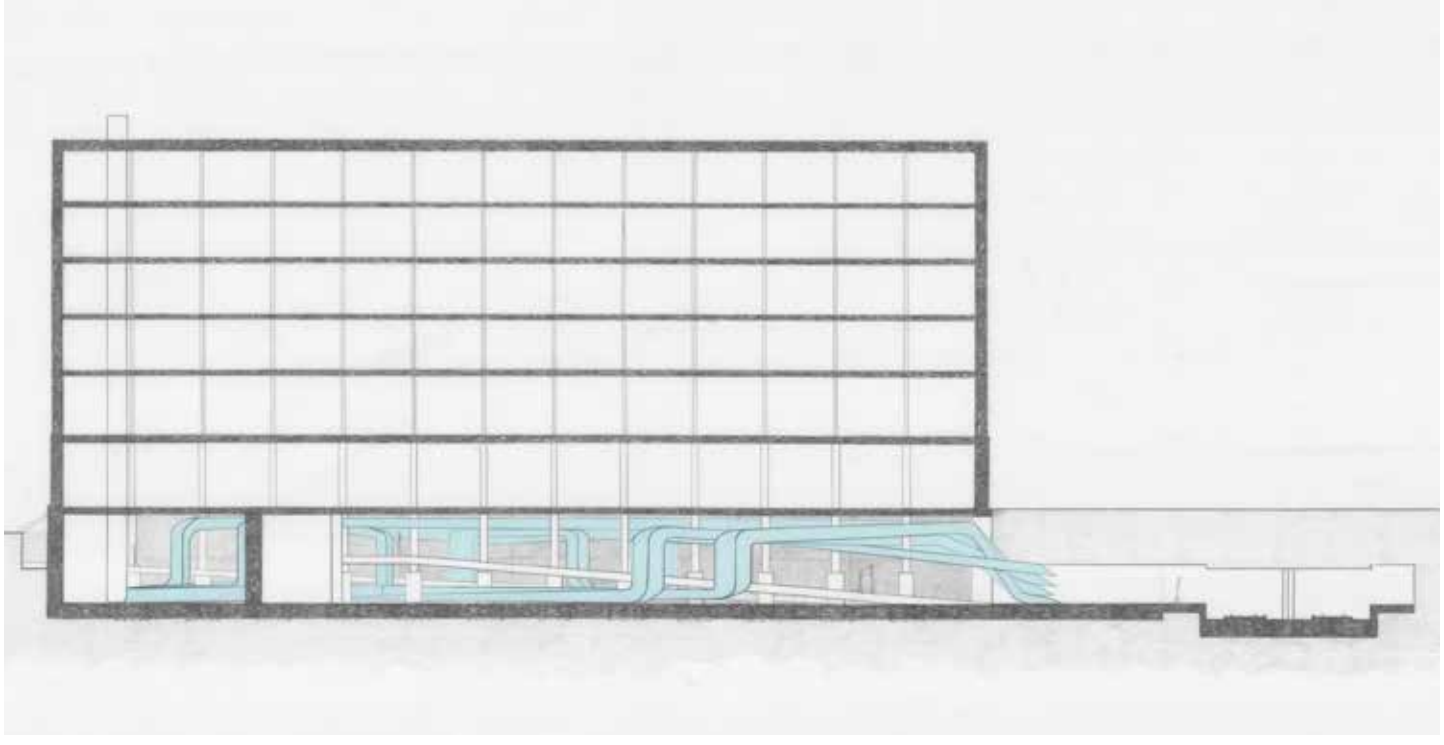
This section shows the wind tunnel structures enveloping the entire sub-level space on the exiting side of the building.

As wind is forced through the subway tunnels by the trains, it is re-routed by the architecture to enter into the wind tunnel structures and affect the carbon nanotubes, creating another source of energy. This produces an almost self-perpetual scenario as the trains power themselves.



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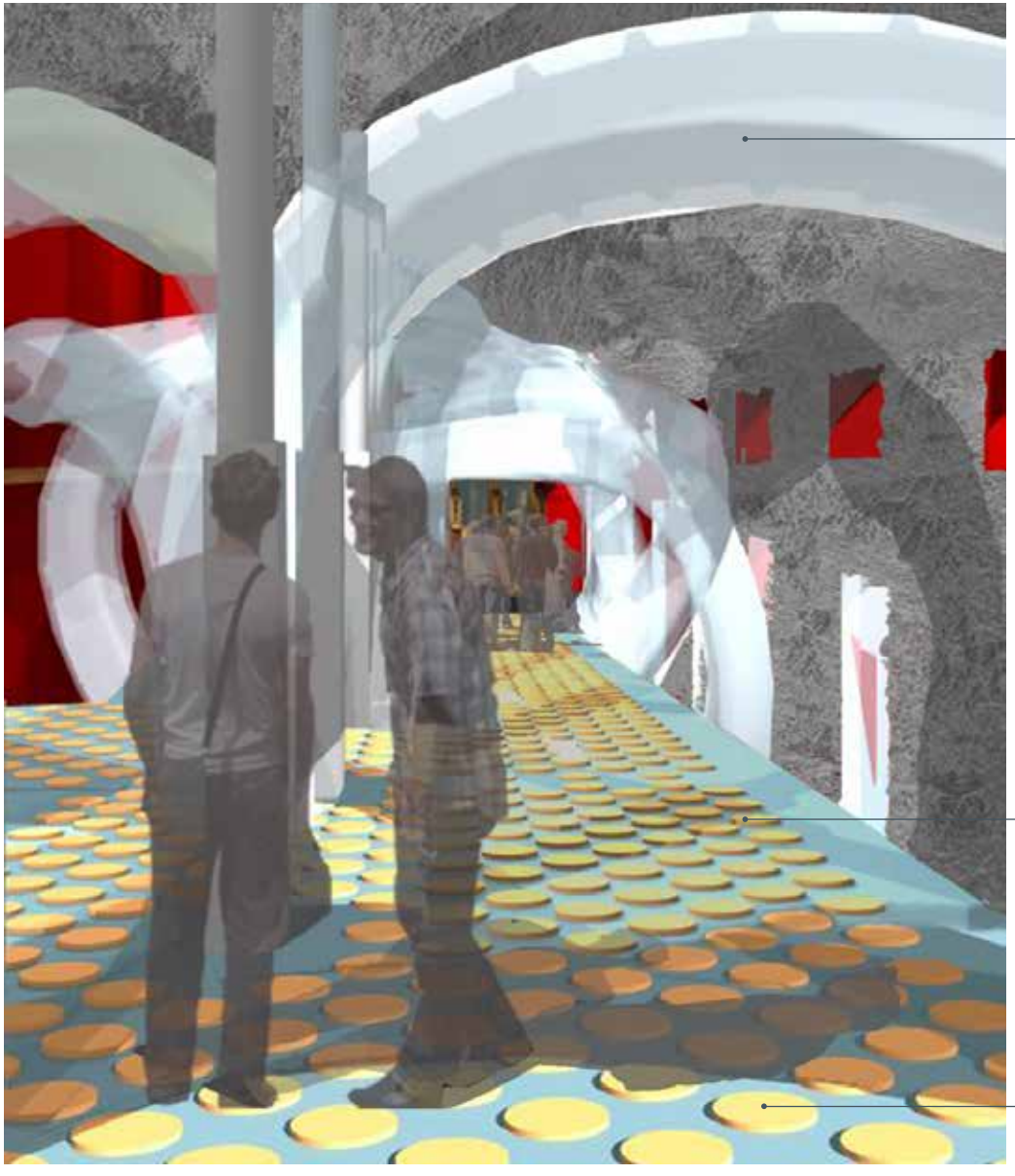
This station would produce enough energy to run the nqrw subway line, while also supplying additional energy to the city's existing electrical grid.



Air passing over carbon nanotubes lining the interior of the wind tube structures generates an electrical charge.

Pedestrian traffic forces air out of flexible tiles embedded in the ramped floors. This creates vibrations in the nanotubes, which also generates an electrical charge. The public becomes active participants in the production of energy for their transport.