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## **Flows: People, Nature, Energy, Ideas, and Dollars...**

### **Part 1: Transportation, Energy, and Nature**

If we wish to build greener buildings and cities, we must learn to emulate natural cycles and flows. If sustainability is our goal, we must unlearn our wasteful ways. No longer can we afford to waste energy, water, or materials. Instead, we must learn to think in closed loops, where no waste is generated, and energy used is replaced in kind by energy produced.

Urban flows can take on even more complex forms than waste and energy cycles. In a city, the flow of people is crucial. People must be able to move from place to place with relative ease. This movement of people in turn facilitates the movement of ideas, communication, and commerce. There are many ways to move people, but in the last century here in the U.S., we have come to rely too much on the automobile for transportation flows. This has led to unbalance in terms of energy consumed, distances traveled, and relative freedom of movement.

How can green building address these issues? Can a green building create better transportation and energy flows, while at the same time being better integrated with nature than a conventional building? How might these improvements lead to better flows of information, ideas, commerce, and communication?

In an attempt to answer these questions, let us first examine a particular train station in Germany. A natural confluence of important urban flows occurs at a train station. People come to a station by various means, whether on foot, by bicycle, or in an automobile. Energy flows through a transit station, via the electricity needed to power the lights, heat and cool the building, or move the train. Information flows are crucial to smooth movements of passengers.

Opportunities for communication, civic enjoyment, and appreciation of nature are present at a train station as well, suggesting other flows that could be part of a harmonious mix. A recent project in the small town of Uelzen, in northern Germany, brings to light many of the opportunities to create natural flows using green building techniques at a train station.

The Uelzen station is an important historic train station, situated in a town with a surrounding population around 100,000, and representing the confluence of key north/south and east/west lines. Over time, the station had fallen into disrepair. In the late 1990's, efforts began to rebuild the station. The new structure was designed by renowned ecological artist Friedensreich Hundertwasser, who worked to integrate nature into all of his projects, often with spectacular results. The Uelzen project incorporates a host of innovative green building features.

The Uelzen station is part of a larger area under redevelopment, which includes a series of abandoned rail yards. The redeveloped land will devote a substantial area to green space, and will incorporate a number of ecological, sustainable practices. The new station building itself is a marvel of art, nature, and innovation. A vast solar array atop the flat roof of the station building covers 648 of 720 square meters of rooftop, making it one of the largest systems in northern Germany. In the first year of operation, the system generated 60,000 kWh of electricity. The performance capability of the system is 73 kWp, with a potential specific output of 820 kWh per installed kWp per year. In terms of CO<sub>2</sub>, the solar system at Uelzen offsets 45.54 tons per year. The station is able to generate more power than it uses. ([www.hundertwasserbahnhof.de](http://www.hundertwasserbahnhof.de)) Plans to expand the station's solar generation capacity are already underway. Inside the station, a digital display informs visitors of the solar panels' real-time production. Golden globes are incorporated into the architectural design to reflect sunlight in the daytime. A host of artistic and architectural features, including vibrant, colorful columns throughout, and an absence of straight lines, add visual interest to the station. Part of the interior was dedicated to providing food, as well

as meeting rooms and space for cultural events. Natural landscaping is an essential ingredient of the new station, with lush green rooftops including trees and flowers on portions of the roof not suitable for solar panels. The platform shelters also feature green roofs. Multi-modal transit was a consideration of the project, going as far as to label the new station a “Mobility Center.” Facilities were added for bicyclists, and bus-routes were adapted to better integrate with the station. There are plans to build a solar filling station, which would allow electric and hybrid-electric cars to plug in and charge using the solar panels. The project was financed through public/private partnerships. (Chales de Beaulieu) It is a beautiful building to behold, in addition to all its functional and technical innovations. The following quote from Hundertwasser describes some of the goals of the project:

“The introduction of nature into the Uelzen Train Station is important, as architecture has increasingly distanced itself from the organic patterns of nature as well as from the longings and dreams of humans. An honorable human existence is not possible without a more humanly just environment and without peace with nature...”  
(Chales de Beaulieu)



## **Part 2: Why not Here?**

The Uelzen project demonstrates that train stations offer excellent opportunities to change urban energy flows through the integration of solar technology. Stations are already designed in many cases with extensive flat roofs that could be easily retrofitted for rooftop solar panels. As public places capable of attracting large audiences, train stations represent excellent opportunities to attract publicity and provide education.

Associating clean, renewable energy with the positive environmental attributes of train travel is another benefit. Opportunities to connect with nature are also present at many stations.

One can't help wondering why projects like the Uelzen station are not happening in the U.S. Here in the Philadelphia area, for example, there are numerous train stations that could be made over in similar fashion, with tremendous benefits to communities and transit organizations such as SEPTA and AMTRAK. To examine some of the reasons why the Uelzen project was executed in Germany in 2000, while such a project has yet to occur in the U.S., the concept of flows is again critical. In this case the flows to consider are flows of information, capital, and markets. When these flows are properly coordinated, the results are innovation and progress.

Let us turn back to Germany in order to find out why such a project could take place there. Germany is home not only to the Uelzen train station, but also to many other environmentally progressive building projects. For example, there is the Bavaria Solarpark, which generates 10 MW of power from 62 acres of PV panels equipped with tracking technology to maximize the amount of solar radiation they receive. Germany is also home to the city of Freiburg, which bills itself as a "solar city." Located in the sunniest part of southern Germany, Freiburg has over 400 renewable energy projects in a city with a population of only 200,000.

There are solar panels on office buildings, a new 50 home housing development with solar rooftops, the soccer stadium has a large array of panels, and even the Ganter Brewery has a solar roof. Many homes, businesses, schools, and other buildings have been fitted with solar panels. Not only has Freiburg designed buildings using renewable and green technologies, it has attracted research, manufacturing, and installation jobs, especially for solar. (Tenz) The city uses solar panels at local schools to teach the next generation about renewable energy. City government has provided grants and tax relief to encourage the proliferation of solar. There are even solar and zero-emission hotels, which the city uses to generate solar tourism. Freiburg has demonstrated that the flow of government money, information, and incentives can lead to sustainable buildings, education, jobs, and even tourism. With this process now underway, Freiburg has a clear head start on much of the rest of the world, and has positioned itself to benefit economically as well as environmentally.

The remarkable accomplishments of Freiburg are part of a larger German system that has set similar flows in motion. What has happened in Germany that has not happened here?

For one thing, it is true that crisis often leads directly to action. In 1980, a sudden, mysterious die-off of trees in the Black Forest led to widespread environmental concern among German citizens. The Chernobyl meltdown in 1986 raised the level of concern even higher. Throughout the 1980's, Germany funded research, development, and demonstration projects for solar technologies at 18 universities, 39 firms, and 12 research institutes. Several national organizations promoting solar technologies were formed. This investment in research and development, coupled with strong public advocacy, led to the development of a wide array of viable solar technologies. In the 1990's, Germany took steps to

create the markets for the technologies it had innovated. First, the government used a cost-covering feed-in tariff that paid 90% of the domestic market price for solar panels. In 1999, Germany began the 100,000 roofs program, which used investment subsidies and low-interest loan rates to spur the installation of rooftop PV systems. The country revised its feed-in tariff rate to a 20 year fixed rate, rather than a percentage of market price. (Jacobsson) Germany has also actively promoted solar technology to the public by providing information and educational materials. For example, the country's "Solar na klar" is a federally backed program to raise awareness about solar heating and PV technologies. The program received 65,000 requests for information in 2000.

All of these measures have created the capital and information flows required to spur the growth of solar industry, including local development and production. With its solar industry in place, Germany helped create and accelerate the market for building projects that incorporated solar heat and solar generated electricity. It provided information to the public, as well as incentives, and the public responded. Local municipalities built upon the national initiatives, resulting in real world projects. Such is the flow from vision to policy to action. Without these measures, it is much less likely that a project such as the Uelzen train station would have ever been built.

In the U.S., similar programs do exist, but are not integrated into coherent national and local policies with anywhere near the same level of success and sophistication as in Germany. What we need are ambitious local and national efforts to create the flow of information and funding that will lead to innovation, research, development, demonstration, and implementation. For example, in Pennsylvania, we do have solar initiatives at the state level. But we are perhaps lacking adequate public advocacy and dissemination of information. Combined with better information flows

and strong, ambitious local efforts, we might begin to see more innovative green building projects. Maybe then our train stations could feature flowers and solar panels on their rooftops, instead of wasted space.



Photos: Uelzen train station.

Courtesy of: <http://travel.webshots.com/album/145569499CZBbde>

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