

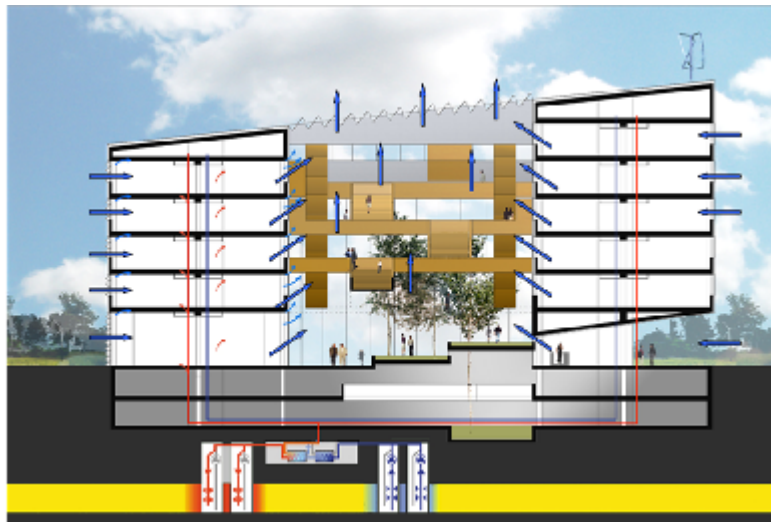


May 2008

## IPC Strategic Perspectives

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# Environmentally Sustainable Construction



TNT's new head office in Hoofddorp

**“When one tugs at a single thing in nature, he finds it attached to the rest of the world.”** *John Muir*



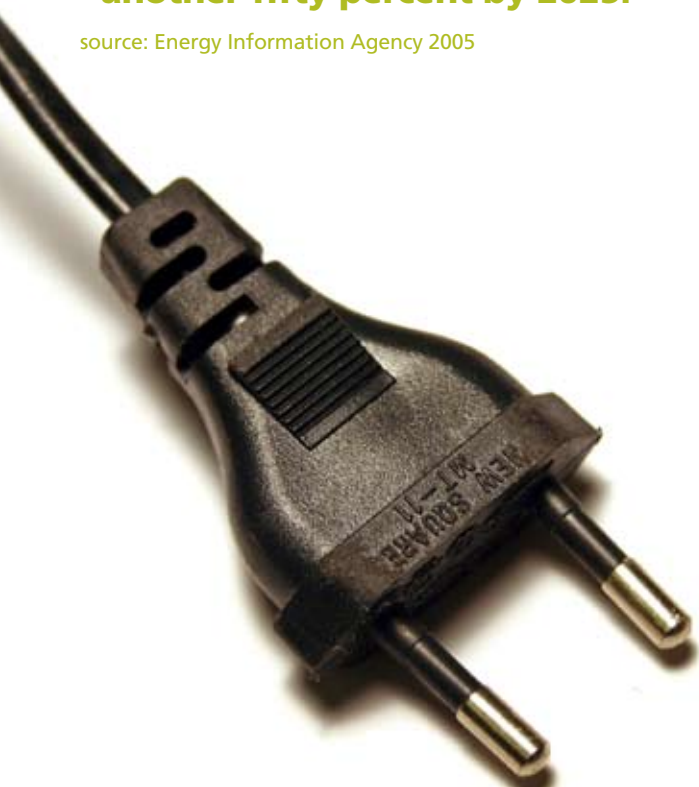
Globally, organisations have embraced the plea for environmental sustainability and have, to a wide extent, implemented strategies within their corporate culture to be more environmentally sensitive. Increasingly, annual reports of major corporations include a sustainability report or statement on the company's environmental initiatives. Many industries have implemented sustainability concepts into their manufacturing, packaging, logistics and operating processes.

A natural extension of this is the uptake of sustainable construction or green buildings.

This report gives an overview on buildings that are sensitive to the environment, consider the well being of employees, and provide economic benefits to the company. IPC will research and communicate upon sustainable technologies that reduce the industry's environmental footprint.

**“Electricity consumption in the commercial buildings sector doubled between 1980 and 2000, and current projections indicate it could increase another fifty percent by 2025.”**

source: Energy Information Agency 2005



According to the <sup>1</sup>Royal Institution of Chartered Surveyors, a UK-based organisation, construction is the world's largest and most fragmented industry and, due to the changing socio-political environment, the industry as a whole, faces a huge challenge in the pursuit of sustainability.

Further, construction <sup>2</sup>“accounts for an estimated forty percent of all resource consumption and produces about forty percent of all waste, including greenhouse gas emissions.”

In fact, recent trends indicate that the energy used in buildings will increase as many countries such as China and India are witnessing construction booms.

The environmental impact of a building - whether a private home, an industrial complex or a postal processing centre is felt throughout the building's life cycle, spanning from the planning and construction stage to the buildings use, management, maintenance, through to the dismantling or demolition of the building.

Other negative impacts on the environment include the loss of agricultural land, forests and wetlands due to urbanisation, increased mining, and pollution.

In order to mitigate these negative environmental effects, companies across many industries have turned to sustainable construction.



### Commercial Buildings

According to the <sup>3</sup>Organisation for Economic Cooperation and Development (OECD), sustainable construction is defined as “the creation and responsible management of a healthy built environment based on resource efficient and ecological principles.”

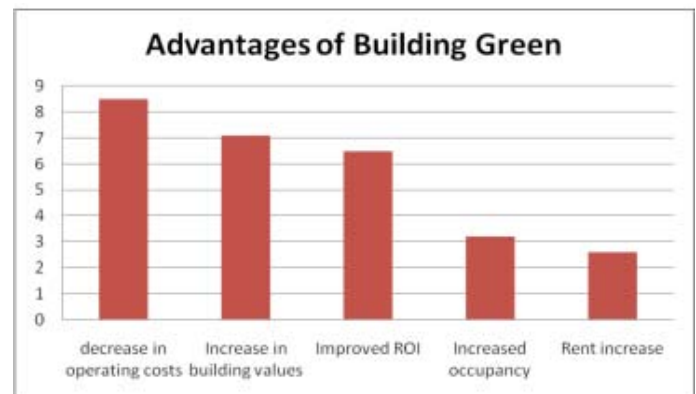
The buildings themselves, their immediate surroundings, and the broader regional and global setting are considered in sustainable construction. The concept is mainly concerned with reducing the environmental impacts of new construction.

Additionally, sustainable construction, allows for the community that the building contains, to contribute, in a positive way, to the environment by reducing the energy needs and the by-products/waste produced by the community.

Most sustainable efforts are concentrated on early design. The focus is on decisions such as selecting site and building layouts that minimize the environmental burden of buildings; creating an efficient and integrated building enclosure system; integrating the heating/air-conditioning systems and electrical systems to reduce energy use; and specifying reused, renewable or recycled materials.

The methods for construction are also significant to achieving the sustainable goals of a project. What may appear to be minor decisions, such as the selection of adhesives and sealants, may have long lasting negative effects on indoor air quality, maintainability or future adaptability of the space.

Many of the day-to-day decisions made by construction workers and supervisors are important to achieving sustainable project goals and assuring a healthy built environment.



Statistics from U.S. Green Building Council

<sup>3</sup> RICS – Construction Market Survey 2004

<sup>4</sup> RICS – The Construction Challenge: Sustainability in Developing Countries

<sup>3</sup> OECD – Environment Policy Committee June 2002

## Zero Energy Buildings

With consideration towards reducing energy consumption and waste, a realisable goal of sustainable construction is zero net energy – which is the term that applies to a building that has a net energy consumption of zero over a given period of time. In a zero energy building, the building produces as much energy as it consumes.

In order to keep this balance between production and consumption, environmentally sensitive buildings are being designed by firms such as OVG in the Netherlands.

According to <sup>4</sup>Area Development Site and Facility Planning – a trade and industry publication, sustainable or “green” construction accounts for approximately ten to fifteen percent of the overall new construction market.

Perhaps this low estimate is due to the perceived notion that green buildings are more costly to construct and maintain than standard buildings. However, research by the <sup>5</sup>U.S. Green Building Council estimates that green buildings operating costs are 8-9 percent less than the standard and have an ROI of nearly seven percent.

## Technologies in the construction industry

To date, there are numerous technologies that promote environmental sustainability within the construction industry. These technologies have evolved in accordance with consumer needs and demands.

This demand by consumers (companies and private home owners) is placed on designers to understand and integrate a wide range of increasingly complex materials, components, and systems into the building enclosure.

Due to the wide range of materials that are available for new or retrofitted buildings, this paper will only focus on a few technologies available.

## Photovoltaic Electricity

Photovoltaic (PV) windows are windows that consist of a double glazed window with semi-transparent solar cells. The window provides natural light transmission as well as electricity production.

PV windows are increasingly being used as a design feature by architects, replacing elements in a building’s envelope. Solar roof tiles or slates can replace conventional materials, flexible thin film modules can even be integrated into vaulted roofs, whilst semi-transparent modules allow for an interesting mixture of shading and daylight.

PV can also be used to supply peak power to the building on hot summer days, when air conditioning systems need most energy, thus helping to reduce the maximum electricity load.

A study conducted by Tokyo University of Agriculture and Technology showed that using the optimum PV window, electricity consumption was reduced by 55 percent compared to the single glazed window with a window wall ratio (WWR) of thirty percent and no lighting control.

## Lighting Controls

Lighting controls are used in lighting design projects to achieve a high quality energy efficient lighting system. Daylight-integrated lighting and control systems give the occupants control of the lighting, while providing appropriate lighting levels, minimizing glare, balancing surface brightness, and enhancing the surrounding architecture.

Lighting controls can help reduce energy demand by:

- Reducing the amount of power used during the peak demand period by automatically dimming lights or turning them off when they are not needed
- Reducing the number of hours per year that the lights are on
- Reducing internal heat gains by cutting down lighting use, which allows for reduced HVAC system size and a reduction in the building’s cooling needs
- Allowing occupants to use controls to lower light levels and save energy

<sup>4</sup> Area Development Online – “Got a Green Building?” January 2008

<sup>5</sup> U.S. Green Building Council – Presentation: Chicago 2007

## Green Roofing

Green roofs or eco-roofs are roofs that have partially or completely covered with vegetation and soil, or a growing medium, planted over a waterproofing membrane.

There are two types of green roofing systems:

- An intensive green roof is similar to a rooftop garden, with a variety of shrubs, plants and trees planted in several inches to several feet of soil.
- An extensive green roof includes two to eight inches (5 - 20 cm) of growth media, and is planted with sedum, grasses and other hearty, drought-resistant plants.

According to the magazine, *Environmental Design and Construction*, "Green roofs are quite common in Germany and other parts of Europe, as well as in Asia; however, few or only limited studies evaluating their benefits have been conducted."

<sup>6</sup>The green roofing trend started in Germany in the 1960s. By 2003, green roofs accounted for fourteen percent of the total roofing area in Germany.

In the U.S. state of Colorado, the city of Denver's Environmental Protection Agency (EPA) is conducting a study on the effectiveness of green roofing at their facility in Denver.

For a variety of reasons, there was some difficulty in establishing the study, other green roofs located were either not comparable or were not directly connected to the city's storm sewer system, which would make gauging rainfall retention and pollution very difficult.

## Cooling With Ice

In Europe and the United States, air-conditioning systems are responsible for between five and nine percent of a building's energy consumption. Although European countries are at the lower end of the spectrum, commercial air-conditioning use is expected to increase over the next ten years.

US-based CALMAC, a manufacturer of cooling systems, designed IceBank a thermal energy storage unit that utilizes a chiller to produce solid ice at night when the building's electricity load is minimal.

The ice is built and stored in tanks which provide cooling in order to help meet the building's air conditioning load requirement the following day, allowing chillers to be turned off.

Environmentally, thermal energy storage systems, such as IceBank, help reduce a building's carbon footprint because they take advantage of off-peak electricity. Off peak or night time electricity consumes up to thirty percent less fossil fuel per kilowatt-hour than during peak periods.

## Eco Friendly Working Environments

There are many case studies which illustrate that the environment contained within a building (the envelope) directly impacts the employees.

Companies that have created artificial or manmade ecosystems in urban environments - buildings (the envelope) and workspaces have reaped benefits such as increased productivity and reduced absenteeism, while contributing to a sustainable environment.

The concept of people interacting with a natural-like environment known as <sup>7</sup>biophilia, a hypothesis that was developed by Harvard University biologist, Dr. Edward Wilson. Biophilia is defined as "the connections that human beings subconsciously seek with the rest of life."

In his discussion of biophilia, Dr. Wilson argues that our ancestral environment consisted of three key features: savanna - which contained abundant animal and plant food, topographic relief - consisting of cliffs and vistas that gave better vantage points, finally water (lakes and rivers) - which offered fish and other aquatic life including edible vegetation thus adding to the food supply.

<sup>6</sup> Green Roof Polices: tools for encouraging sustainable design - Goya Ngan



### Case Studies

We often find these three natural elements in our homes and in particular in our work places; a concept that is not novel. This is evident when we consider the gardens of ancient Japan, Greece and Rome. People, Wilson states, gravitate statistically toward a savanna-like environment.

Yale University professor, Dr. Stephen Kellert has been leading a research effort on green buildings or "biophilic building design." Through this research, Dr. Kellert hopes to communicate how to transform business practices by integrating resource efficiencies, environmental sensitivity, and community and cultural responsiveness.

Drawing from Dr. Wilson's theory of biophilia, Dr. Kellert defines biophilic as "the inherent inclination to affiliate with nature instrumental in human health, productivity, and well-being."

Dr. Kellert argues that buildings that are designed with consideration only to the environmental impact are not truly sustainable. To be a truly sustainable, the human element - the physical and mental well-being, must also be considered.

As stated, creating manmade ecosystems is not a concept of modern times. However, it is only in recent times that we have begun to measure the outcome of creating biophilic workplace.

*The following case studies highlight some of the best practices within the postal sector. This selection is intended to provide examples and is not an exhaustive report on postal sector developments in this area.*

### France – Groupe La Poste

Groupe La Poste has made inroads into sustainable construction with several new environmentally sensitive buildings – the mail sorting centres in Montelimar and Lorraine, and the parcels hubs in Mer, Moissy-Cramayel and Clermont-Ferrand.



<sup>7</sup>Biophilia: The human bond with other species – Edward O. Wilson



The centre in Lorraine incorporates environmentally sensitive materials and equipment – a rain water recovery system, solar heating, and a passive energy well for heating and cooling the centre.

In its integration of sustainable building criteria into its new and retrofitted buildings, Groupe La Poste has the goal of reducing energy consumption, to use renewable energy, and improve working conditions – such as providing better access for those with disabilities.

The sorting centre in Montelimar integrated France's Haute Qualité Environnement (HEQ) criteria into the building's design.

The HQE Association, through its certification of buildings (new and retrofitted), seeks to promote a lifestyle that places emphasis on the comfort and health of the user, while reducing the impact that the building has on the environment.

The building project in Montelimar will develop an industry specific certification – the NF-HEQ Building Certificate for logistics buildings.

In 2006, the first sustainable construction building was built in the east of France with solar heating for water, natural air-conditioning through underground heat, windows in the roof for natural lighting and no steps in the building to reduce accidents. As a result, the absence rate in this building decreased by 25 percent.

### **New Zealand – New Zealand Post**

With its commitment to the country's people and businesses, New Zealand Post Group has a committed sustainability policy that encompasses both the environment and society.

Acting in an environmentally and economically responsible way, the company has several building projects that will help reduce its environmental footprint, while reducing the company's energy dependency at the same time.

The post's building projects consist of three environmentally sustainable mail centres in Auckland, Hamilton and Christchurch.

Prior to construction, environmental criteria was developed that helped to establish and evaluate the environmentally sustainable design initiatives of the chosen architecture firm Warren and Mahoney. New Zealand Post was keen on understanding the tangible outcome of return on investment, specifically for energy and water. The buildings incorporate timber from sustainable sources and have onsite waste management facilities that uses rain water for toilet use.

Additional design features of the mail centres include:

- Solar water heating - to provide hot water to the main toilet block
- Energy-saving appliances rated by Energy Star
- Low energy lighting systems and zone lighting that makes use of natural light
- Fast acting doors that minimise heat loss and gain within the building
- Double glazing in the Christchurch facility



In order to create a pleasant work environment in-line with biophilic theory, the design included rain gardens and swales into the landscaping, and the planting of indigenous plants. Adding to the work environment, employees were involved in the design of the new buildings which helped increase employee engagement. New Zealand Post's commitment to the environment is for the long term as it is part of the post's business strategy. The post is expecting an immediate ROI in regards to energy savings.

### Netherlands – TNT

In 2007, about seventeen percent of TNT's emissions came from the energy used in their buildings, including electricity and heating.

The post's ambition is to make its future buildings CO<sub>2</sub>-neutral or even CO<sub>2</sub>-positive (where the net CO<sub>2</sub> equivalent emissions from activities are positive). While contributing positively to its CO<sub>2</sub> footprint, the company will also offer cost savings and a better working environment for its employees.

In 2007, TNT launched its Planet Me buildings concept in the Netherlands. The concept consists of a new CO<sub>2</sub> -positive Group Head Office by 2010 and will contain a total of 70,000 square meters of CO<sub>2</sub> -neutral or -positive offices at increasingly accessible locations closer to employees' homes.

This flexible office concept will not only impact TNT's own footprint and the commuting footprint of its employees. It will also allow the post to make significant savings on office expenses. TNT is looking into the possibilities of developing CO<sub>2</sub> -neutral depots.

As of 2008, all TNT's operations in the Netherlands will be using 100 percent CO<sub>2</sub>-free electricity produced by hydropower.

### USA – United States Postal Service

In a case dating back to 1986, mail sorters at the Reno, Nevada main post office showed a higher productivity rating than all sorting centres in the western region of the United States, from Colorado to Hawaii.

Prior to 1986, the federal government selected the Reno post office to receive a renovation that would make it an energy efficient site. The building was a modern warehouse with high ceilings and due to the sorting machines, it was quite noisy.

The architecture firm hired to conduct the renovation proposed a lower ceiling making the building easier to heat and cool, and improving the acoustics.

The new ceiling would be sloped to allow for indirect lighting and the harsh down-lighting would be replaced with energy efficient lamps.

Before and after the renovation work was completed, the architect performed a test in one of the completed sections of the sorting centre where the new ceiling and lighting were installed.

Within the first twenty weeks after the change, productivity increased eight percent.

In the area where renovation work was yet to be completed, there was no change in productivity. A year after the work was finished, overall productivity increased a further six percent and stabilised.



<sup>13</sup>Quoted from Annual Report 2006

<sup>14</sup>Source: Annual Report 2006



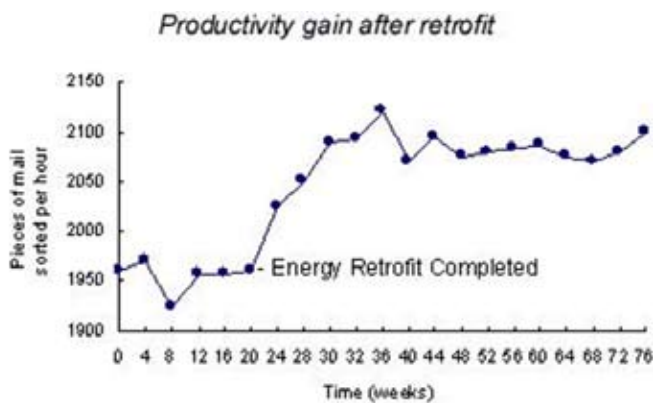
## Conclusion

Further, data revealed that sorting errors had dropped to 0.1 percent (one mistake per 1000 letters sorted).

Financially, the cost of renovation was estimated at USD 300,000. The combined energy and maintenance savings per-year were project to be USD 50,000. Surprisingly, the productivity savings per-year was worth USD 400,000 – 500,000.

The mail manager at the time Robert McLean, stated that there was no experiment designed to increase worker productivity, nor was there any unusual interaction between management and staff. McLean believes that increased productivity was irrefutably due to the changes made in the building.

The graph below shows the increased productivity of mail sorters at the Reno office. The employees are represented by trade unions, which bargain collectively and sign company collective agreements.



The world is changing and so is the postal world. We as an industry cannot ignore the technologies that other industries are adopting in order to create a more sustainable work environment, while reducing their impact on the natural environment.

Many of the technologies associated with green construction are not new. In fact, the concept of green roofing is several thousand years old; the most famous example being the Hanging Gardens of Babylon. Passive solar heating dates back to the 5th century BC. What is new and significant is the fact that these concepts are being tested and are proving to be a benefit – both financially and environmentally.

Over the next several years, we will realise the effects of designing and building sustainable work and home environments – however, these effects can only be realised through measuring outcomes and developing an industry best practice.

Sustainability, regardless of the industry, is not simply a trend. It is a way to bring our industry into the future by respecting our human and natural resources.



<sup>15</sup>Source: Annual Report 2006



## References:

**U.S. Department of Energy – Building Technologies Program**

<http://www.eere.energy.gov/buildings/deploy/index.html>

**U.S. Green Building Council**

[www.usgbc.org](http://www.usgbc.org)

**Environmental Design and Construction magazine (online)**

<http://www.edcmag.com/>

**World Business Council for Sustainable Development**

<http://www.wbcsd.org>

**The Whole Building Design Guide**

<http://www.wbdg.org/>

**United Nations Division of Economic and Social Affairs:  
Division for Sustainable Development**

<http://www.un.org/esa/sustdev/>

**Energy Information Administration**

<http://www.eia.doe.gov/>

**International Energy Agency**

<http://www.iea.org/>

**European Environment Agency**

<http://www.eea.europa.eu/>



<sup>16</sup>Source: Annual Report 2006



## ABOUT THIS PUBLICATION

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