



TITLE: Re-Used Display Systems as Sustainable Media Facades

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ABSTRACT

In modern, high-tech society multimedia is constantly evolving to become more realistic and interactive. New display technologies are continually coming on-line making others obsolete and generating a significant amount of electronic waste (e-waste). This paper suggests an integrated approach to create Media Integrated PV guided by a vision of a future where buildings and technology are integrated to promote environmental design. This paper discusses potential applications where re-use of obsolete display systems could serve as a symbol and embodiment of sustainable futuristic façades. Such a strategy, using Media Integrated PV to renovate building exteriors, may be particularly appropriate in developing countries where disposal of local or even foreign e-waste is frequently an issue and resources for public media may be limited. Many challenges exist for this use of interactive display technology on the exterior of buildings in developing countries. We discuss Egypt as a potential case study where we propose to reuse old flat displays (laptop, flat monitors) as illuminated double-skinned façades. By integrating such a system with photovoltaic (PV) technology this strategy could present a dynamic visual representation of sustainability at a relatively low cost. The proposed Media Integrated PV technology takes the field of sustainable architecture into a new arena, one where the artist, architect and the designer work together to promote and visually communicate a more rich and sustainable world.

Keywords: *Media Integrated Photovoltaic, Sustainable technology, Media Façade, Futuristic Design, E-waste*

INTRODUCTION

We live in a digital age where media is more and more involved in our daily lives. Visual imagery is everywhere presenting individuals with continually evolving visual knowledge. In architecture such a digital influence can be seen through media mesh and illumination murals being used as building envelope materials. Using such technologies the architect can *media-ize* buildings by adding time as a 4th dimension to building elevations. Using facades as billboards creates the opportunity for buildings to host animated graphics or communicate cultural or commercial visual messages to its neighbors or community.

In developing countries access to the latest technology and interactive visual communications tends to be limited. Economics is frequently the constraint. To build such complex displays of digital systems in developing countries requires economic, cultural and societal cooperation. To promote such interaction, we propose to build illuminated murals using discarded flat screen monitors (mainly the lid of portable computer laptops) to form tiling screens fixed on metal grid and operated by photovoltaics on the exterior of buildings in Cairo, Egypt. An external grid structure will support both the flat display monitors and the solar panels to provide a strategy for self-sufficient, cost effective, dynamic, media-rich façade renovation in a city burdened with poorly maintained buildings and a desire for increased media exposure.



1 Media Façade Technology

A wide range of technologies exist which support light and movement in a media façade. Some are kinetic and others are static, in both the movement of light plays a main role in design. Examples include the use of sunlight or ambient light to create surface effects and image information (e.g.. Flare project) **Fig.1**. Or using a number of screens to serve as pixels and for larger scaled, more detail images (e.g. Blinkenlight 144 pixels (**Fig.2**), [1]. Various electric lighting sources (e.g. LED, fluorescent, and others ...) can be used to generate the light used in these media facades resulting a range of image properties and resolutions.



Fig. 1. Flare project process.



Fig. 2. Blinkenlight Building.



Fig. 3. Allianz Arena, Munich, 2005.

The most important issue in the media façade is how to integrate the display onto the building façade and into its operation. Successful media architecture emerges when all factors are well planned and incorporated into the project functionality and goal(s). Examples include Chanel Tower, Tokyo (Fig.4) and GreenPix, Zero energy Media wall, Beijing (Fig.5) [2]. Another important factor for successful integration is proper coordination between the dimensions of the media and the dimensions of the building. This may prove particularly challenging when the building exterior and second skin integrating the media are not flat (e.g. National Library Project, Belarus (Fig.6) or Allianz Arena Building, Munich (Fig.3) where the entire building serves as a single and 3-dimensional screen.



Fig. 4. Chanel Tower, Tokyo, 2004.



Fig. 5. GreenPix, Zero energy Media wall, Beijing, 2008



Fig. 6. National Library, Belarus, 2006.



2 Media Façade and Futuristic City

“Futuristic Design” strives to realign future human needs with current economic, esthetic, political, cultural values to build a better human future. Futuristic environmental design is a term that incorporates sub-disciplines into this pursuit by re-conceptualizing the basic unit of urban space with existing of high technology in order to present novel ways to design environmental applications so as to leverage the appropriate scale of these technologies for maximum benefit [3]. This is no small challenge, and we need new perspectives on cities, dreams, knowledge, creativity and motivation in order to find new ways to develop successful city management in the future. New *Media Integrated PV* displays may facilitate futuristic environmental design by providing a new arena for dialogue with leaders in cities and as a tool for strategic development and knowledge sharing, ultimately resulting in added value for people in cities, organizations or companies. [4]

Product manufacturers are continually producing new displays with updates to functionality and aesthetics. Therefore we have to research which visual systems can best serve to improve our human society and make applications that meet our needs. Aesthetic value in surroundings, good visual knowledge, effective image communication, new sustainable technologies in architecture, and modern urban landscapes are all areas of need in developing countries. These needs can be used to guide the selection of technologies to be used in the design of sustainable future cities in the third world. This paper deals with the digital architecture using *Media Integrated PV* as an effective communication tool for futuristic design.

3 Media Façade Challenges

Today, several significant obstacles impede the upgrade of existing buildings and the repair of their decaying solid exteriors. While various technologies support media facades as new digital murals, media façade materials are costly. For example, greater investment in research development and demonstration is needed to see if more advanced materials can produce more cost-effective and aesthetically acceptable insulation options. In addition to cost, challenges facing Media Integrated PV futuristic facades in developing countries include[5]:

- Maintaining thermally comfortable and productive conditions by including elements such as smart glass, window systems, shading, control systems, innovative insulation products, and new forms of construction.
- Efficiency of equipment used to convert energy (usually but not always electricity) into specific end uses (e.g. low energy refrigeration and lighting).
- Providing heat and/or electricity with lower carbon content or zero carbon compared to conventional sources (e.g. micro CHP, solar PV etc).
- Increasing the lumens per Watt from LEDs.
- Retaining the characteristics of the lamp (color, brightness etc) throughout its life.
- Evolving socio-technical systems and changing levels of interest in high-tech by society.
- Increasing energy prices and their impact on cost effectiveness. Long term projections may require high energy price assumptions.
- Increasing constraints on the amount of carbon we can emit into the atmosphere.

These points should be answered clearly in every building case study. Such a pre-design study serves as the first step in the media façade design process.

The technologies that could be used in Media Integrated PV façade systems are becoming more and more sophisticated. Screen facades technologies include Media mesh, Illumesh, and Single Dot technology [6]. Selection depends on application type, cost, area surrounded, building type, and interior or exterior design details. Using Egypt as a case study we next seek to select technologies appropriate for building illuminated



facades using these factors. Our research seeks to answer these questions by assessing economical, political, cultural, and social factors.

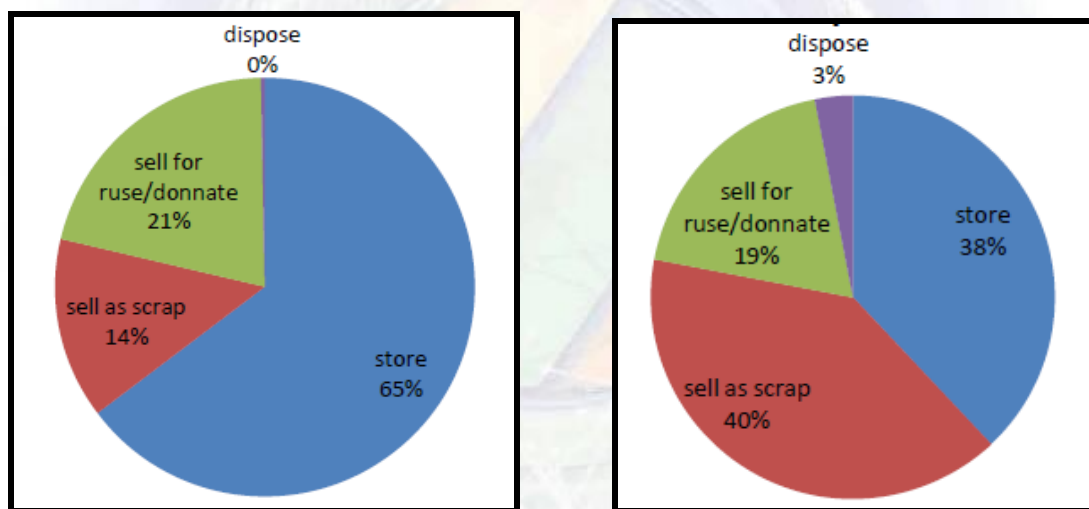
4 E-waste and Monitors re-use in Egypt

In Egypt no records regarding e-waste generation rates are available. In California, the National Safety Council estimates there are 2.9 million unused TVs and 3.2 million computer monitors stored away in closets and attics. In addition, three million tones of electronics gear is dumped into American landfills each year. This number is only going to increase in the near future since somewhere between 20 and 80 million PCs currently become obsolete every year in the US [7].

A research project and an e-waste forum initiated by Egypt cleaner production center and some regional organization CEDARE, BCRC-Egypt, in Egypt found that the import of used personal computers and monitors has increased dramatically in Egypt since 2001.[8] (Fig.7)

In Egypt, the Ministry of State for Environmental Affairs (MSEA) is coordinating with the Ministry of Communications and Information Technology (MCIT) to address the concern put forth by the Egyptian Green initiative (EGI) in an Action plan for e-waste management. A main point was the development of incentives to increase the number of e-waste disposal agencies and encourage beneficial reuse/recycling of e-waste. [8]

Increase in number pf PCs in Egypt from 1987-2008



Status waste PCs owned by individuals

Status waste PCs in institutes and companies

(Fig.7) E-waste status in Egypt [9]

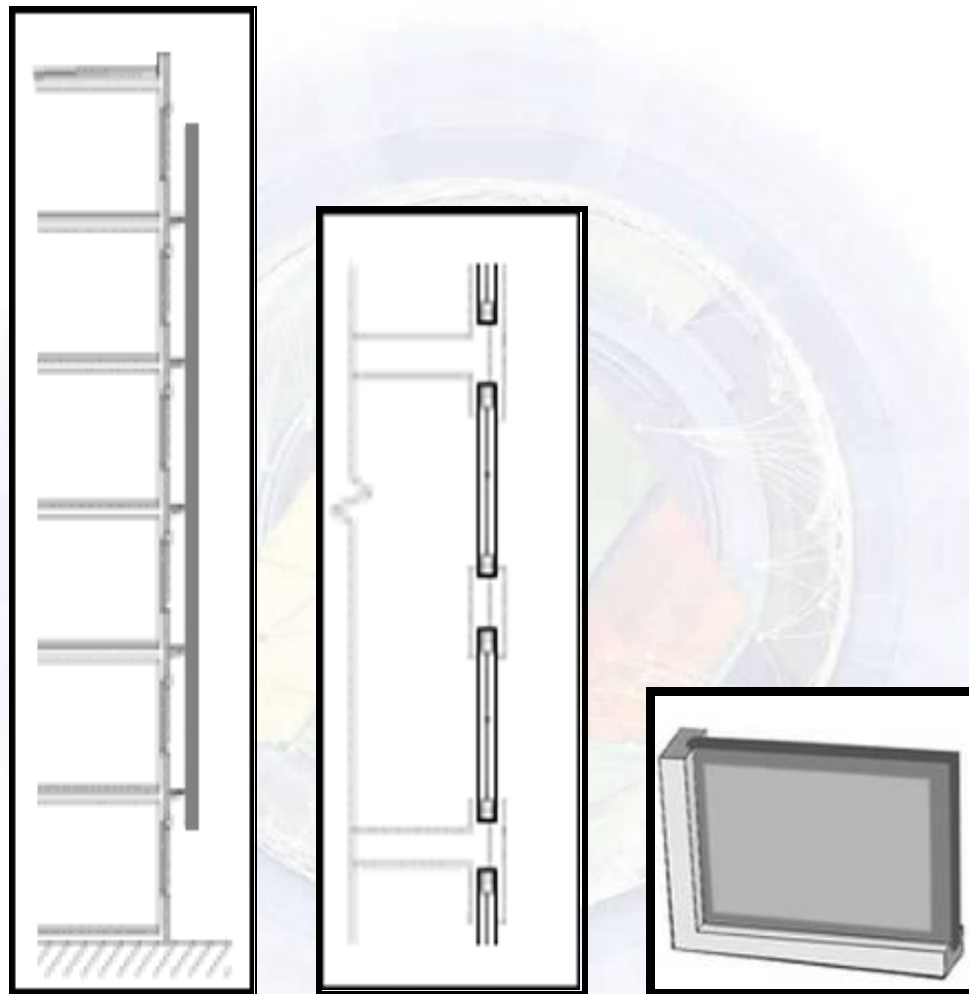
5 Media Facades in developing countries

Re-creating a building facade and mapping it using a digital mesh serves as a futuristic strategy to enhance visualization in the Egyptian urban landscape, which includes many unplanned areas seeking sustainable solutions. *Media Integrated PV* can provide a new physical presence for architecture while addressing environmental concerns.

However, since transforming buildings or walls into sensitive dynamic or static illuminated structures based on a distinct architectural form using a flexible media mesh is a new technology, it may be difficult in developing countries to find qualified staff who knows the various technologies sufficiently well to develop the systems, adapt them according to the project needs, and maintain and operate them throughout the project's lifetime.



Using portable or laptop computers reduces this challenge since the market for such computers renews every few months. As a result, a large number of unwanted used portable computers exist most of which have working screens. By re-using these LCD screens as the tiling units for a media mesh, it reduces the cost of the project while also addressing with the issue of environmental waste. Furthermore, by designing a system, which is a flexible structure, containing both used portable computer screens and PVs arranged together according to the architectural design, the system can be relatively self-sufficient and simple to operate reducing the need for technological expertise on the project. (Fig.8) Shows the conceptual layout of such a system.



(Fig.8) Flexible designed structure by using used portable compute display systems and PV panels

The grid is developed to provide optimum utilization of PVs in order to produce energy for display units. A LCD 19 inch computer monitor needs about 17-31watts, and 20 – 24 inch LCD computer monitor needs about 18-72 watts, and most laptop computers use about 15-60 watts, far less than desktops. For reference, the average plasma TV uses about 339 watts per hour, while an average LCD TV uses 211 watts per hour. [10]

PV systems convert sunlight directly into electricity. The conversion process takes place in a solar or PV cell, usually made of silicon, although new materials are being developed. PV cells connected as a group into a larger DC electrical unit called a module which can take place in the grid with the display monitors (Fig.9) . PV inverters connected to the grid create an AC output that is in phase with the grid-supplied AC. PV inverters are designed to shut down automatically upon loss of grid supply[11].



(Fig.8) Illustration example; Re-Used Display Systems as Sustainable Media Facades

Every Media façade has its own alternative design options. Depending on geographic, orientation and exposure of the design place, The media facade gets more or less usable sunshine. weather patterns vary due to topography and landscape details as well. The size of the PV panels and the type of the PV cells have to be decided according to the electric power needed by the media mesh. So collecting information and calculating them gives the start in making important design decisions to build the sustainable media façade.

Conclusion

Over the ages Architecture has served to reflect the status of society, the environment, and culture. Frequently the façade has been the place where advanced technology is displayed. We propose the integration of *Media Integrated PV* into the design of building facades as a modern day reflection of futuristic design meeting the social, environmental and cultural needs. Media systems surround us, even in developing countries. To build such a complex digital display systems in a developing country makes a strong statement about the country's economic, cultural and societal status. However, there are some challenges. The most important one is financial. Financial constraints can affect the kind and quality of imported technologies, new hardware and updated systems software. In addition, there may be only a few people qualified to work with these technologies.

The future development of building envelope systems is highly dependent on the potential users acceptance. In developing countries, they concenter high technology and internationalization in design as an effective tool to evaluate the developing process in their countries, which is very important, but it should be based on the needs and conditions of the developing country itself. The process has to make serve the characteristics of each developing country.



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