

Globsec City Challenge 2018

## **IT AND SOLAR ENERGY MEET URBAN AGRICULTURE – A HYBRID SOLAR, SERVER, URBAN FARM**

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### **Abstract**

*The rise of cloud computing and mining of cryptocurrencies such as Bitcoin creates a demand for building new server farms. These facilities produce a great amount of heat which is often just released to the environment without being used. This negative factor can be mitigated by creative planning of adjacent infrastructures, in this case greenhouses, which often need heating. The synthesis of server farms and greenhouses can be further developed by constructing greenhouses using transparent solar panels which would produce at minimum part of the electrical energy required to run the server farms. The aim of this essay is to demonstrate that the rise of these new technologies used in environmentally friendly way represented by the creation of the abovementioned multifunctional hybrid buildings can help Pijova-Rocla to mitigate problems of idle suburban industrial complexes, high unemployment and lack of meaningful opportunities for youth. If supported by government initiatives, both on local and state level, the greenhouses could serve as places where the youth and the unemployed would be offered opportunities in the form of educational activities, volunteer work, scholarships, internships and paid work with the direct contact with businesses.*

Essay Cities previously depending on their heavy industry often suffer from the pollution, disrupted land of little use and derelict industrial buildings. Part of their population faces little opportunities to find meaningful training, education and local employment. Reducing and eliminating these negative effects should be a priority of both the local and state governments. As a result of the loss of heavy industry and manufacturing places, local governments may face negative growth in the population. One of the biggest examples of these negative trends was seen in the Midwest and Great Lakes area of the United States which was formerly known as the “Manufacturing Belt” or “Steel Belt” and later gained the nickname “Rust Belt”. In the late 2000s and following years, initiatives promoting the growth of new businesses using innovative technologies were seen as a partial solution to the problem (Writer 2013). Although partially solving the problem, the jobs created tend to be in form of highly skilled labour and thanks to the increasing automation, the generation of new job positions is not comparable to the scale of manufacturing jobs of yesterday (Ford 2015).

There is a growing trend among the upper middle class, increasingly comprised of the people working in the information technology, to support local food production and community initiatives that have an additional value of environmental friendliness and sustainability. This trend gave rise to community initiatives such as community gardens, rooftop gardens in densely populated urban areas and community supported agriculture. Such initiatives have potential to create many additional jobs in places where there is a striving economy based on informational technology and R&D initiatives. The main hypothesis of this essay is that such a merger of informational technology, new breakthroughs in transparent solar panels and growing food locally through community supported agriculture will bring unexplored benefits to the challenged communities in the suburbs of the previously striving city with economy relying primarily on heavy industry. On the outskirts of

these cities are often situated distribution complexes that may be abandoned and reused. Old industrial buildings can potentially house server farms. Either the rooftops or spaces around these buildings, which often have large areas of open space around them, can be transformed into the modern combined greenhouse-solar farm using the heat server farms to grow crops throughout all the seasons of the year. Businesses running the server farms can provide their employees with opportunities to support community agriculture run by local organisations working with youth and unemployed. Solar tech companies developing the transparent solar panels would have ideal place to test their products in real life conditions of the greenhouses.

There is a real question of where to place the newly build server farms and how to use them in the most efficient manner considering that the global market experiences the rise of cloud computing and virtual cryptocurrencies. Because of this trend and the growing importance of internet in general, the last decade have seen the growth of the data centre building and the forecasted growth is still very high with predicted multi-tenant revenue growth around 13% (Bisnow 2017). Rows of servers stacked together produce a huge amount of heat that must be taken away to cool down the servers. Normally, this heat is just released to the atmosphere. But there are ways to use it more efficiently, e.g. in the form of heating for the greenhouses (Pervilä et al. 2012; Mangone 2016). This gives rise to hybrid buildings, buildings that serve more purposes than is typically seen in this kind of structures. These hybrid infrastructures have potential to provide environmental, social and economic benefits to the municipalities by effectively using energy flows and space. Compared to basic rooftop gardens or passive greenhouses, these heated greenhouses provide a better production capacity throughout the whole year with the bonus of larger selection of plants to grow.

By itself the heating provided by data centres, consuming hundreds of kilowatts of electric power, should be enough to persuade many that this joint project has its environmental benefits when the heat will be used to grow local produce. To diversify the local economy, provide more opportunities to highly skilled researchers and their academic works, the actual glass of the greenhouses could serve as a test ground for transparent solar panels. There are research groups and companies that are developing the technology (Zhao et al. 2014; Ubiquitous Energy Inc. 2018) and could perceive this as a great means to advertise themselves. The solar panels produce electricity and let the visible light be used to grow plants and the server farms produce heat to support the growth of the plants. It is a combined server, solar, plant farm situated into the urban area. The shown synergy enables creation of a very effective building complex which supports its constituent parts.

Urban farming is on the rise as the population in the cities grows and the development of suburbs takes away large areas of arable land (Opitz et al. 2016). Community gardens are one of the several types of urban farming. They are run by different means and entities, but their main characteristic is that they connect local people in a meaningful way. For the purpose of this essay the main focus will be given on the community gardens that offer the produced foods and flowers to the local markets and may be run in such a way that there are professional gardeners educating the locals on how to effectively produce food and legally sell it to the locals. This can be a project directly run by the local government or by NGO entities which could provide it as a yet another means of re-educating the unemployed and offer valuable experience to the youth.

To realise a meaningful construction of the multifunctional server farm with solar panel greenhouses serving the community by providing local food, chance of education and employment several factors are needed. Implementation of government schemes and funding to enable such long-term projects, willing local government or web of NGOs that could run the community centres around the greenhouses and willing companies from IT and transparent solar energy sector. The first essential step would be the selection of potential sites and purchase or renting of the abandoned complexes. A preference should be placed on the proximity of the socially marginalised groups, the willingness of these

communities to participate and reusability and architectural importance of the abandoned complexes. Here, local government can play a significant role by facilitating the processes that need to be undergone to use the selected sites. Then, the community gardens should be built near these abandoned complexes. During these steps, willing companies that run server farms, universities, and companies researching and selling the transparent solar panels should be approached and offered these facilities to be their demonstration sites. This is the step where the abandoned buildings like warehouses are turned into high tech IT facilities and the community gardening takes steps to increase the food and/or flower production by newly built solar panel greenhouses. The highly skilled workers within the IT and solar power companies may be offered to pre-buy the locally grown vegetables, fruits or flowers. They may have access to the garden and see how the local unemployed people gain new skills and/or actually start to work for the community garden. Building personal connections between these groups may draw the attention of wealthier members of the community to the everyday problems that some of the less fortunate members face in the Pijova-Rocla. It can also provide new inspirations on how to create better communities that are inclusive of people with different work skills and life styles. The first successful projects should be also viewed as a technical demonstration that these kinds of buildings bring synergistic effects of local food production, reduction of greenhouse emissions, preservation of historical industrial architecture and community work with job creation and education.

With the rise of global population and disappearance of the arable land, there is a demand for increasing food production by creative means. Urban agriculture may be a partial solution to this problem. Yet standing alone it might not have the impact that is needed. Thus, creating hybrid infrastructures that combine several different roles in synergic effect may be of higher relevance. The proposed hybrid server farm using the emerging technology of transparent solar panels in a greenhouse is such an example. Used correctly it could serve as a demonstration of new technological revolution and new design concepts that pave the way towards sustainable future as such concept has a potential to alleviate the problems of unemployment and youth engagement by reusing and preserving old abandoned architecture on the outskirts of Pijova-Rocla.

## Bibliography

Bisnow, 2017. Double-Digit Growth Expected In Data Center Industry. *Forbes*.

Ford, M., 2015. *The rise of the robots: Technology and the threat of mass unemployment.*, London: One World Publications.

Mangone, G., 2016. Constructing hybrid infrastructure: Exploring the potential ecological, social, and economic benefits of integrating municipal infrastructure into constructed environments. *Cities*, 55, pp.165–179.

Opitz, I. et al., 2016. Contributing to food security in urban areas: differences between urban agriculture and peri-urban agriculture in the Global North. *Agriculture and Human Values*, 33(2), pp.341–358.

Pervilä, M., Remes, L. & Kangasharju, J., 2012. Harvesting heat in an urban greenhouse. *Proceedings of the first workshop on Urban networking - UrbaNe '12*, p.7. Ubiquitous Energy Inc., 2018. Ubiquitous.energy. Available at: <http://ubiquitous.energy>.

Writer, S., 2013. Rethink the Rust Belt. *Silicon Rust Belt*. Available at: <http://siliconrustbelt.com/rethink-the-rust-belt/>.

Zhao, Y. et al., 2014. Near Infrared Harvesting Transparent Luminescent Solar Concentrators. *Advanced Optical Materials*, 2(7), pp.606–611.