

**THE BLUEGREEN  
ECOLOGICAL HABITAT**

**SOLAROOF**

**2016**

**CITYPOD**



**SolaRoof International**

**AgriPOD & CityPOD**

**GLOBAL**

**BUSINESS HUB**

**CANADA**

**PODNET**

"Introducing the CityPOD  
Concept" by Richard Nelson  
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**CityPOD Structure**  
 an OpenSource architecture for  
**EcoCities of the future, today**

The land area required for TOTAL GLOBAL ENERGY SUPPLY FOR 2030  
 (assuming 8.5 B population) is:  
 496,805 Km<sup>2</sup> or, ~ 500,000 Km<sup>2</sup> or, 500 B M<sup>2</sup>, or ~ 60 M<sup>2</sup> per capita

**SURFACE AREA REQUIRED TO POWER THE WORLD**  
 WITH ZERO CARBON EMISSIONS AND WITH SOLAR ALONE → [www.landartgenerator.org](http://www.landartgenerator.org)



Graphic source: [www.landartgenerator.org](http://www.landartgenerator.org)

The CityPOD value proposition is to provide for the universal success of all of humanity, which means that we enable a way out of unsustainable and unplanned urban sprawl and slum living by making CityPOD, as a BlueGreen ecological habitat, accessible to everyone, everywhere.

SolaRoof technology is integral to the CityPOD structure, enabling the building to capture, convert and utilize Solar Energy at the effective rate of 20% called for in the above graphic, and with extraordinary efficiency benefits that amplify the social and financial returns. Therefore, as we implement CityPOD we go forward with confidence that our CityPOD solution answers the nexus of global challenges in the overlapping domains of Food/Energy/Water while additionally (what a bonus!) providing 21st



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Century shelter and comfort for humanity with a generous provision of 60 M2 per capita of climate controlled built environment that can operate with zero carbon and zero debt.



500 Billion M2 of SolaRoof applications, provides for global energy supply, and for context, this compares to approximately 243 Billion M2 of existing urban land use in the USA. Thus the global urbanized land-use is likely to **contract and converge** on this new architectural paradigm for EcoDynamic living, which is demonstrated with the implementation of the rural AgriPOD, and urban CityPOD concepts. SolaRoof can empower the 8.5 Billion population of 2030 with OpenSource solutions providing a way for every family and community to prosper and adapt to Climate Change to the extent that entire worlds' population is responsive to begin now to transition to a 21st Century lifestyle that is BlueGreen and sustainable forever into the future.

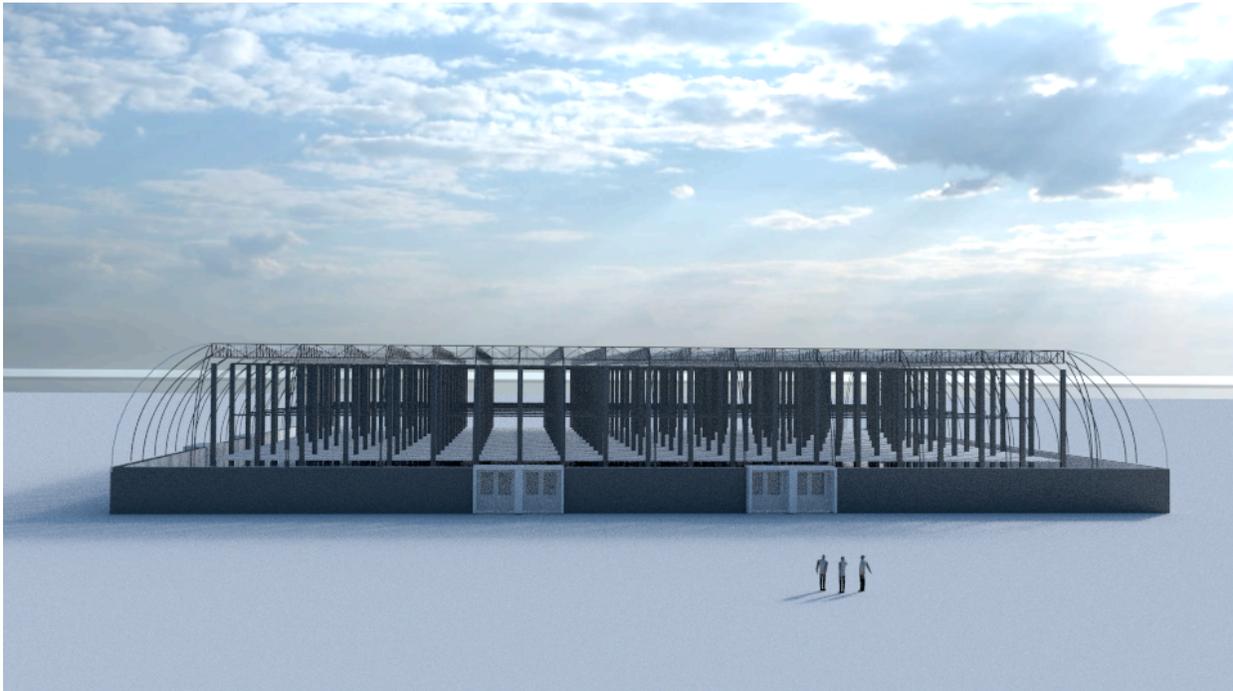
The global study of land-use for Solar Energy to provide the totality of Humanity's need for energy in 2030 (with assumed population of 8.5 B) is presented in the graphic above and this surface area is derived assuming a 20% energy conversion efficiency, which yields @200 W/M2/hr @2000 Hr/yr = 400Kw/M2/yr. The area required is therefore calculated to be 496,805 Km2 and I have rounded up the number of 500 B M2 of SolaRoof Closed Ecological Environment (CEE) construction. CityPOD can be an exemplar pattern for a vast portion of this construction that provides a complete, integrated BlueGreen package capable of delivering, in addition to clean energy, an abundance of nutritious food and a great excess of pure water. This integrated technology is called an EcoDynamic solution with the capacity to restore global ecosystems by ending millennia of deforestation and extractive agriculture practices - as



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described in my White Paper, titled "[closing the hunger gap](#)". This new urbanization pattern for abundant urban living, is now considered for adoption by a visionary Norwegian venture, [UrbanFEED](#), who are implementing a demonstration project at the Bastøy Island Prison, a facility of the Ministry of Correction Services of Norway.

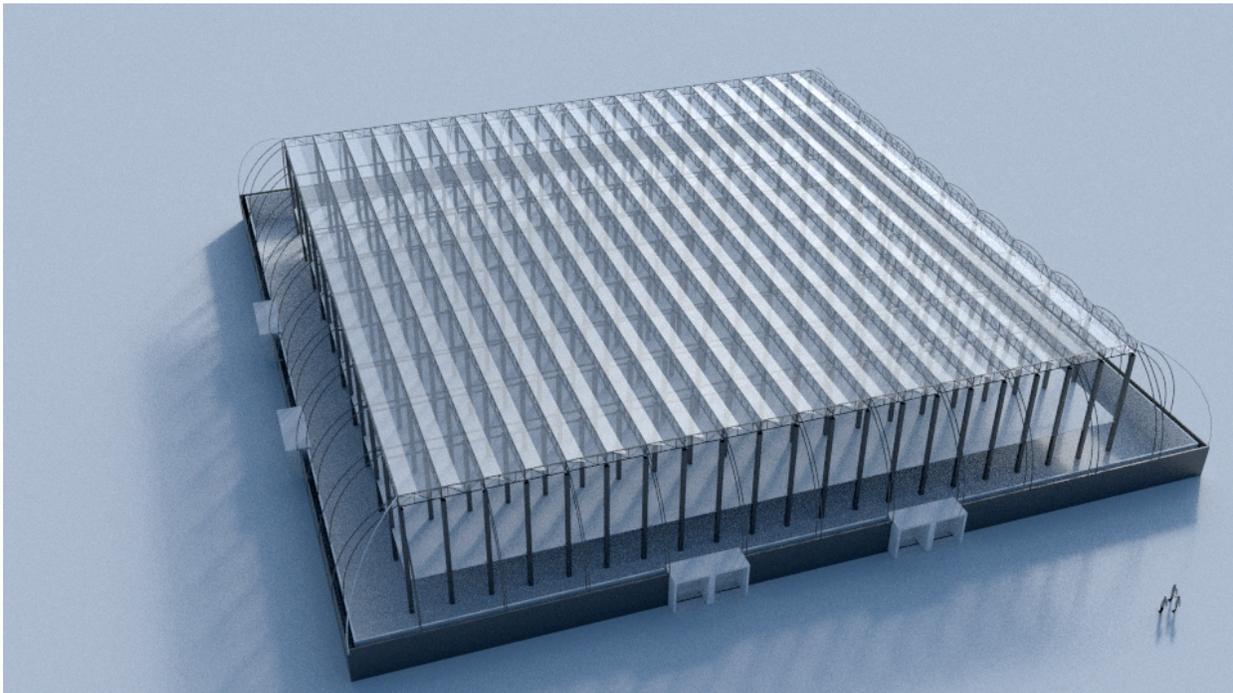
SolaRoof International, of Canada, is delivering the CityPOD platform to this receptive Public/Private Partnership to pioneer the vision to build the "EcoCities" of the future today. AgriPOD projects, now going forward, will be a testbed to investigate and demonstrate that we have a collective capacity to create the CityPOD solution. This solution will enable urbanization itself to work for the restoration of both ecosystems & human health and will prove that we have a way for billions of people to thrive while living in total harmony with Nature - this is key to surviving and shifting the world into a green growth economy in the coming decades of Climate Chaos as we make a global shift from a man-made scarcity to a world of universal prosperity.



500 Billion M2 of SolaRoof structures will generate the 200 Million Million Kw of energy consumed per year globally by 8.5 Billion people in 2030. With an allocation of 60 M2 per person, we get a clean energy supply of 24,000 kWh/yr per person, which is approximately twice the USA average annual electric power consumption per capita. Who can calculate the value to all of humanity of an investment that will supply safe, clean, zero carbon energy in abundance for all time?

With the advent of the CEE processes, enabled by SolaRoof, human life support becomes a regenerative, sun powered, photosynthesis driven energy system. The CityPOD concept adopts SolaRoof and several other key technology components to

create the ultimate intelligent, global energy grid where production and consumption is completely distributed throughout the CityPOD global footprint and is integrated with the BlueGreen technology with such efficiency that the net present value is positive within the first year from completion and, assuming a standard 3600 M2 project, then the Net Present Value of the investment, due to the value of our energy production alone, will grow at a rate of \$144,000 per year (assuming \$100,000 value per gWh of electricity). If we were to add the benefit of efficiencies with quantifiable energy savings, these could easily bring the total of energy produced plus savings realized to a value of \$216,000 per year. The global value of this clean energy supply is in the order of \$30 Trillion per year.



Total market penetration for CityPOD in the scenario above would call for early adopters to rapidly deliver on the required 500 Billion M2 of total market penetration. This global market represents sales of 139 Million of our standard 3600 M2 CityPOD. I anticipate that the built environment supply cost per project is about \$3.6 M USD, which is \$1000/ M2 or only \$60,000 per person (\$180,000 per family) at the standard occupancy of 60 M2 per person. The CityPOD “added value” proposition is that family and community space is built into the mid-level of a CityPOD and our Demonstration projects would validate that a human occupancy space can be provided between the Blue (below) and the Green (above) and allow the exploration of the integration of human habitat at the mid-level of the CityPOD in a variety of building applications.

I encourage the SolaRoof community to join me in running more numbers based on the referenced graphic of global energy production being sourced by a similar area of the CityPOD urbanization model. From the graphic it is clear that rigorous analysis will



predict that the human footprint can contract to a very light and zero-carbon urban habitat. This is important; I would say, it is critical that people understand the outcome: how little land area and impact we humans may have if we can utilize solar as our principal clean energy source. Adoption of 60 M2 CityPOD per capita, when human habitation is merged with the BlueGreen paradigm, would eliminate homelessness while providing a great over abundance of food and a huge excess of pure water.

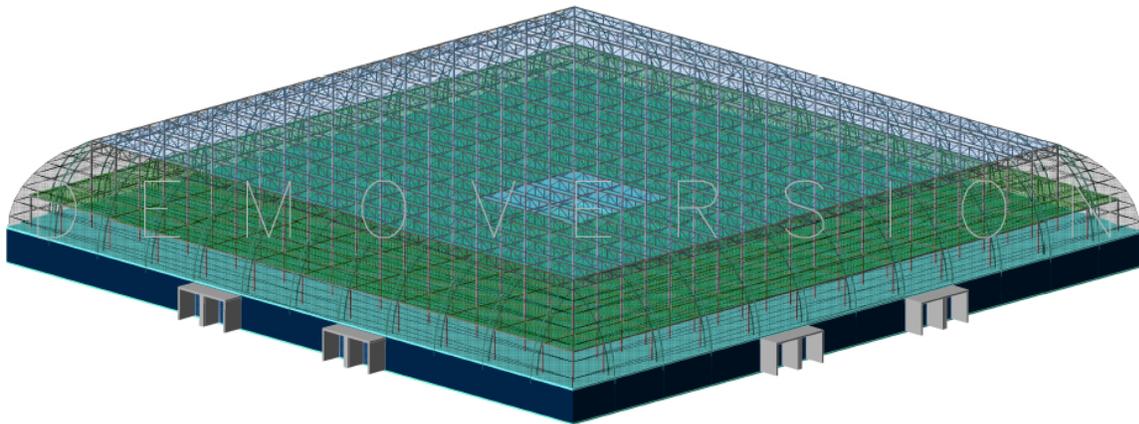
All people could inhabit a Closed Ecological Environment (CEE) and live in total comfort, safety and security with abundant space for both private residences and generous common spaces within the CityPOD environments. This is a better place to thrive and the mission is to provide “plenty4all”, with no family left behind. This new way of life, when experienced, will win over most people to a sustainable lifestyle, which is actually affordable. The wide adoption of the CityPOD platform would transform the ongoing pattern of urbanization, relieving the “population pressure” is greatly accelerating the unplanned, unsustainable growth of cities. If this growth adopts the BlueGreen paradigm, then can crisis can be averted, but if present trends continue unchanged there will be devastating collapse and a human die-off (See my White Paper “closing the hunger gap”) with cities as the epicenter of disaster.

### **Quantitative Analysis of Capital Cost and Operational Revenue**

I am quite confident about the capacity of our distributed network of qualified and professional teams in several countries to develop the exemplar projects that will redefine our concepts of urban living. SolaRoof International (Canada) has the goal to deliver multiple Demonstration projects as we co-create OpenSource solutions that are replicable, pre-engineered and prefabricated; with technology components that are well integrated and balanced within a closed ecosystem where one system feeds the other. CityPOD will build a strong Aquaculture expertise for the Blue systems that occupy the ground level of the project. Above the Blue is the Human Habitat Zone that includes testbed living, working, learning and recreational space, with one floor + loft space that is designed for range of human activities to be experienced, studied and researched for optimized comfort and productivity. Our collaborative partners in this development have a vision for family and community life that has synergy with the CityPOD environment to create with us a new lifestyle for the 21st Century. A CityPOD can provide integrated living space for 10 to 20 families who are the owner/operators (most often set up as a COOP). There is sufficient space within the human occupancy mid-level that we could experimentally integrate 20 to 40 guest suites for EcoTourism or to research other opportunities related to transitional shelter for climate/conflict refugees. The Green Zone is not lacking in available collaborators with a background with Vertical Farming and Aquaponic growing of food crops. Our cooperation with PODnet (Iceland) is a source of great diversity of growing systems and growers with good experience can be invited to participate in the CityPOD projects, as they launch. Experience with AgriPOD technology and available expertise of PODpioneers and the PODnet community is a vertical farming resource that can help pave the way for a wide adoption of the CityPOD

platform, as all these developments are empowered by the shared OpenSource knowhow, SolaRoof.

In the current global emergencies, I see great opportunity to Demonstrate how one or more of the integrated human habitat levels can be employed to replace substandard “refugee camps” and homeless/slum living that are experiencing ever more dire crisis conditions with the rapid urbanization in poor countries. I project that at maximum density, within the standard CityPOD project, each floor level can house about 80 families in transitional shelter and basic communal facilities that would transform the lives of refugees and that of families surviving in the urban slums of the cities of the developing world. I estimate that these private family quarters and social common areas may be fitted-out with an additional expenditure of \$25,000 per person and would bring the project completion cost up to about \$5 M to shelter a total of 400 or more persons, including children. The BlueGreen operations will have the capacity to supply all the food required for the complete nutritional needs of these Refugees who would thereby consume about 20% of the daily harvest of food 2000 Kg or, about 1 M Kg per year. The total value of this food harvest, at \$5/Kg would earn over \$5 M of income per annum and the sale of food alone would make the RefugePOD self-funding.



SolaRoof is a solution for food, energy and water. Water consumed by the agriculture sector, is consuming typically more than half the available fresh water and unfortunately is also polluting the remaining water resources to the degree that these become unhealthy for human consumption. Therefore there is a great water conflict between the demands for agriculture and urban populations for good, pure water. SolaRoof equips CityPOD with the capability of harvesting daily a large quantity of pure, condensate



water from the atmosphere within the Closed Ecological Environment of the CityPOD structure. This moisture, that is continuously condensed, during the daytime, is pushed into the atmosphere by the action of plant transpiration taking place, that cools the leaf canopy as it absorbs solar thermal energy. Our food, feed, fibre, and fuel growing operations consume nearly zero water, because of the regeneration of water from the air, that becomes a source of pure potable and drinking water, which substantially returns (as waste water) to the growing systems. The only true “water consumption” is due to the export of food from the operation. This amount, can in most cases, be more than compensated by the collection of rain water from the SolaRoof. Where “grey water” make-up water is available, then the Condensate Water is also exportable as drinking water and the quantity is approximately 6,500 Metric Tons per year. While producing abundant food and pure water, the ecosystem can take in brackish water and output fresh water in quantities up to perhaps 1,000 Tons per year with adjustment of the crops to those that are salt tolerant. The same result may be possible with nitrate polluted ground water that can be input and then exported as pure Condensate Water.

#### **A more detailed capital cost breakdown of the Demo Project:**

Each level of our 5-floors CityPOD has a capital budget for the structure of \$100 per floor, per M2 of footprint. Our standard 5-floor vertical configuration is: 1 sub-grade: **Blue**; 2 at ground and 1st-level: **Habitat**; 2 at roof-top: **Green**. Together with footings and flooring systems and transparent envelope, the total adds up to \$1000/M2; the envelope includes the SolaRoof technology with integrated energy and CEE control systems. I am allowing per M2 of footprint: \$1000/M2 for BlueGreen installations and systems integration with AI controls and total automation; and \$500/M2 for site development and construction. The **Total Capital Cost is \$9M** plus approximately 15% gross charges by the UrbanFeed design/build team. The RefugePOD, with provision for 400 occupants, makes a turnkey completion price of \$10M for the standard 3600 M2 CityPOD, as a bench mark Capital Cost. Note that this capital cost is roughly equal to 12 months revenue from food sales alone.

The food harvest of the standard CityPOD project is projected to yield 2000 Kg per day, comprised of variety of fruits, vegetables, leafy greens, herbs, mushrooms, tubers, nuts, seeds as well as fish, shrimp, eggs, poultry - all of which have an excellent efficiency of conversion of feed to food product. This harvest is ongoing and independent of the season or external climate. We design the growing process for continuous harvesting and planting so that the rate of production is relatively constant through the year. The annual harvest is in excess of 1M Kg (or, about 2.25 Million pounds) of fresh, nutritious, delicious food that is entirely organically grown. The base of all life is the nutrient produced by Algae, which we culture and produce in substantial quantity. The CityPOD layered, vertical growing systems have a footprint of 3600 M2, but a total vertical growing area well in excess of 10,000 M2 which sustains a continuous rate of production of 100 Kg/M2 per year, which is a conservative projection of the CityPOD food harvest when allowing for the benefit of our CO2 enriched, closed atmosphere.



Aquaculture production for a 60 M x 50 M ground floor production area is estimated at 150,000 Kg, which equals 50 Kg per M<sup>2</sup>/year. Our multiple crops (mentioned above) in Vertical Farming, with an enriched CO<sub>2</sub> atmosphere and supplemental lighting as required, can reasonably produce the million Kilograms harvest, while the upper value of possible yield is about 2M Kg/year. The Demo project is intended to confirm the validity of the projected yield that will then factor into our marketing position and Project Pricing and Terms. We also have confidence that our technology advantage over every other high tech growing venture is that we have a greater degree of utilization of CO<sub>2</sub> that is combined with a precise regulation of Relative Humidity, with the application of the low-cost, low-tech SolaRoof technology.

What is truly financially and technically advantageous is the reduction of input costs to near zero (excepting labour and management). This is due to the regenerative “Biodigester” component that operates to continuously produce BioMethane from our waste biomass. All biomass is converted to BioMethane and an effluent that is supplied as organic nutrients for growing food, feed, fibre and fuel crops. Our principal BioFuel harvest will be oil from algae that is stored for use in the Winter season of nordic locations where significant supplemental lighting is used to maintain crop yield. The mass culture of algae is a future integrated technology component that converts and stores solar energy for seasonal use or for transportation. These “bio-regenerative” energy systems result in operations that are independent of fossil energy and petrochemicals and have a zero carbon footprint and zero GHG emission.

Our operations will utilize and study the most advanced lighting systems for delivering supplemental lighting to shaded crops plus night time (24 hours) growth of leafy greens, and for winter season crop growth in the far north. The fuel used to power our winter season lighting can be supplied by intensive summertime production of oil-from-algae, which is stored for use in the dark winters. Such capabilities are so novel that we will need operational experience to determine the market potential in the far north, which is important as the Arctic region develops with the influence of Global Warming. I would like CityPOD to provide the opportunity to explore the use of advanced Plasma Lighting technology, which is just now becoming available to commercial applications.

The early stage adoption of CityPOD platform by UrbanFEED in Norway provides an important opportunity for Proof of Concept in the context of a closed community in a Nordic climate. With EcoTourism sales in the pipeline, I propose to seek \$10M in equity funding for the Canadian Demonstration Project. Within one year from completion of these pioneering projects we will have the results to attract a substantial flow of investment that would greatly accelerate rapid replication of CityPOD around the world.