INQUIRY INTO WASTE GENERATION AND RESOURCE EFFICIENCY:

SUBMISSION ON URBAN ORGANIC WASTE MANAGEMENT:

Recycling urban organic wastes via rooftop microfarms

Submission by the Urban Agriculture Network-Western Pacific (also representing Green Roofs for Healthy Australian Cities and Aquaponics Network Australia).

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I wish to outline what is now happening in Queensland-focused research and development in harvesting urban organic wastes (especially food wastes from restaurants, cafes, food stores and food serivice facilities). It has great potential importance for more efficient waste management around Australia, and throughout the world.

This unique R&D is aimed at:

(a) Extracting plant nutrients from urban organic wastes via vermiculture, for rooftop, organic, hydroponic production of vegetables, plus growing insect pupae and worms for feeding to fish.

(c) Using the aquaponics technology meshed with (a) and (b).

(d) Developing a business model plus training and operational manuals for an urban rooftop microfarm concept that can be repeated for innovative waste management and employment in most shopping strips or shopping malls in Australia and overseas.

Major benefits to the community will be reduction of methane pollution from landfill and provision of fresh vegetables, fruits, herbs, fish and crustaceans

around or above retail food stores, restaurants, cafes and food service facilities that can use them or offer them for sale.

The project was initiated by the author in 1999, when the Federal Governemtn awarded $20,000 to the Southside Chamber of Commerce in Brisbane for a business feasibility study of an urban rooftop microfarm.

It found that an urban rooftop microfarm business which harvested the food wastes from nearby shopping strip or shopping mall restaurants, cafes, food stores and food services, could:

- Require a capital investment of around $212,000 for 600 or so square metres of rooftop organic hydroponics serviced by a basement or ground floor continuous vermiculture unit (worm farm) and intensive aquaculture unit.
- Grow enough vegetables, herbs and fish to earn sufficient revenues to provide employment to three or four people, break-even in business in about 17 months and subsequently would return on capital of around 20% a year.
- The same restaurants, cafes, food stores and food services would be the customers for fresh vegetables, herbs, fruits, fish and crustaceans grown from the food wastes (which would be sterilised before use in worm farms and insectories). .

The Southside Chamber's report have now been the trigger for a three-year research project by the Central Queensland University (CQU) with the support of the Brisbane City Council and the built environment research unit of the Queensland Department of Public Works.

The important technologies now being meshed are aquaponics, vermiculture, insect culture, water harvesting from rooftops and from air moisture, plus green roof and built-environment technologies generally,

If applied widely, the fusion of these technologies now developing could make a significant contribution to the reduction of diesel particulates in the air (from long and short haul food transport), thus consequently reducing urban problems of cancer, asthma and emphysema (particularly in the young and the elderly).

Now named the *Green Roof-Tops and Self-Sufficient Fresh Food Production* pilot project, it has great potential to provide multiple benefits for both rural and urban food production businesses.

This is because the concept being studied can be expected to find new solutions for:

1. *Reducing Australian greenhouse gas emissions:* The pilot project in urban Brisbane will make a contribution to ameliorating the likely cause of global climate change due to increasing carbon dioxide and methane emissions. This will be through both the minor photosynthesis of urban carbon dioxide on its rooftop hydroponics, and the major reduction of methane produced when food wastes are converted to nutrients for organic hydroponics instead of being buried in landfill. Methane emissions are

reported to be 21 times worse than carbon dioxide emissions in causing the so-called "greenhouse effect" that is implicated in global warming and consequent climate change. The pilot project in Brisbane should yield sound estimates of what Australia can achieve in reducing greenhouse gas emissions through local, rooftop recycling of urban food wastes into healthy fresh foods, instead of creating long-term methane emissions from landfill.

2. *Reducing Australian urban heat island effects:* The "heat island" effect of cities like Brisbane can raise air temperatures by 5 to 6 degrees Celsius as heat is reflected from buildings and pavement and reduced vegetation in urban areas also reduces the evapo-transpiration cooling effect. Rooftop greenery like that proposed for the Brisbane pilot project, can reduce significantly this heat island effect. A Ryerson University study in Canada in November 2005, showed that if only 8% of urban rooftops could be vegetated, the city temperatures in Toronto could be reduced by 0.5 to 2 degrees Celsius. Direct energy savings in Toronto's summer cooling were estimated to be C$12 million, and indirect city-wide energy savings from insulating rooftop greenery at peak load demand time was estimated to be C$80 million a year. The pilot project would aim to provide measurement of its heat island effect reduction, to demonstrate to building owners and municipal governments the other advantage of renting commercial rooftops for the growing of organic hydroponic crops..

3. *Reducing Australian transport energy costs of food:* The pilot project would be selling its fresh produce within half a kilometre of where it is grown. This means minimal transport energy costs in comparison with all other fresh food production and distribution. It has been estimated that the cost of transport of a $1 supermarket lettuce head is around 40 cents. In comparison, the cost of trollying just-picked lettuce orders from rooftop to local store or restaurant several hundred metres away is likely to be less than a tenth of the supermarket transport cost. The pilot project will produce information that will enable calculations to be made of the transport energy (and pollution and health cost) savings possible through widespread adoption of rooftop microfarming based on improved food waste management.

4. *Reducing the Australian "obesity epidemic":* Eating more fresh vegetables, fresh fruit and fresh fish in preference to manufactured foods with high fat, high starch or high sugar contents, is one of the recommendations made by nutritionists trying to combat the "obesity epidemic" that is well in evidence in Australia, especially among children. The pilot project's emphasis is on the recommended healthy fresh foods, and the facility's likely use to educate school groups about how food is grown, could become an important focus for healthy foods publicity.

5. *Reducing Australian dependence on imported wild-catch fish proteins and oils:* Because the world's rapidly-expanding aquaculture industries are causing significant increases in demand for fish meal and fish oil production from sustainable but static wild-catch and by-catch, there will be cost of production increases based on competition – especially from

China. According to FAO Fisheries Department the world's current production of aqua-feed uses around 2.1 million tonnes of fish meal and 0.7 tonnes of fish oil. Yet by 2015 the global aqua-feed industry is predicted to need around 4.6 million tonnes of fish meal and nearly 1.9 million tonnes of fish oil. If supplies of aqua-feeds do not increase from alternatives then feed supply and feed cost constraints will be placed on Australian aquaculture development. Cereal legume grains are one option. Another worth studying is worms and insects grown on urban organic wastes. The proposed pilot project in Brisbane will initiate studies of these two natural alternatives.

6. *Utilising urban organic wastes:* Every Australian currently produces more than a tonne of urban organic waste a year. At present this organic waste goes to landfill to generate methane emissions over a long period (up to 20 years). This is fine if the methane can be harvested for production of energy, but an important alternative is to recycle the nutrients in these wastes in urban areas, close to where they are generated. The pilot project in Brisbane will take in food wastes from local restaurants, cafes, supermarkets and food service operators, and convert them to organic hydroponic nutrients and fish feeds via worm farms, or fish feed via insectories. The pilot project will demonstrate how this innovative recycling can take place within half a kilometre of a commercial rooftop in a shopping strip or shopping mall.

7. *Utilising roof-water and air moisture:* It is proposed that the pilot project will be able to develop simple harvesting and storage of roof-water. It will also have solar-powered collection of water from air moisture. The pilot project co-sponsors are expected to provide help and expertise in this so that the pilot project can demonstrate both the miserly use of water by hydroponics and aquaponics, and the complete independence on municipal water supplies that can be possible. Measurements of water use as the rooftop project develops are expected to show considerable advantages of rooftop microfarming in reducing runoff of roof water at peak rainfalls.. The Ryerson University study in Toronto in 2005 estimated that 8% rooftop greening could save the city $79 million a year in reduced capital costs for stormwater management, erosion control, and reduced sewer overflows. The Brisbane pilot project will allow estimates to be made for reduced water flows from food production greenery, and the economics of capture of air moisture and evapo-transpiration losses.

8. *Creating new business opportunities in Australia based on sound principles of conservation:* The pilot project proposed in Brisbane will provide important leadership in Australian small business by developing and demonstrating sound approaches to recycling urban organic wastes into healthy fresh foods for sale close to where the wastes are generated. The project's training and operational manuals will be created in conjunction with a small business economist and accountant, so that the technical and business lessons learned can be passed on in a very usable form. They will be accessible online or via training programs on the pilot project site. A particular concept that will be studied in the pilot project is the potential linking of a ground-floor suburban restaurant with a rooftop microfarm in innovative ways. For example, ground floor fish tanks with

inspection windows can provide a fish-food theme, while light-shafts to rooftop greenery can provide restful glimpses of plants and sky. Another option is to have an open-air restaurant business actually within a working rooftop microfarm.

9. *Creating new markets for rural producers:* Because the rooftop pilot project proposed for Brisbane has limited space, it will purchase "started produce" that comes from rural producers with lower costs. For example, the aquaponics proposed would buy in semi-mature or mature fish so that there is maximised use of expensive "finishing facilities" instead of risky grow-out from fingerlings. Or, the plants to be grown would be bought from rural suppliers in advanced seedling form. Therefore, the pilot project is not expected to displace rural growers, but to expand the market opportunity for those rural growers who are attuned to the dietary changes now beginning to occur in the urban community. The appeal of the "Slow Food" and "Reduced Food Miles" movements of Europe and North America are beginning to be felt by Australians, and the pilot project and its suppliers and customers would ride in on these concepts.

10. *Creating opportunities for overseas consultancy or local techno-tourism:* It is anticipated that the pilot project will become an important source of sound information for Australian consultants in green roof technology both in local and in overseas projects. It is also anticipated that the pilot project in Brisbane will become an attraction for "techno tourists" visiting Australia to gain first hand information and training. The training aspect of the pilot project has yet to be explored, but interest exists in using the proposed facility for hands-on training of owners, managers and operatives of similar facilities.

SUMMARY:

The **Green Roof and Self-Sufficient Fresh Food Production** pilot project proposed in Brisbane is unique in its concept and its extrapolation of innovative waste management possibilities for adoption in Australia and overseas.

The project's research and demonstration linkage will show important directions for Australians to take in food production that is sustainable through recycling and through innovative design and packaging of a rooftop concept not previously tried.

However, it will also begin an important search for new feeds for Australian aquaculture that can come from improved waste management. This has implications for both the poultry and pig industries in Australia – not only in food alternatives, but also because both pig and poultry industries currently consume much of the imported fish protein and fish oil that is bound to become a much more expensive feed ingredient within five years.

Also, the green roof movement in Europe and North America has mainly focused on non-food use of rooftop spaces. ***Australia has the chance of being the world's major pioneer of rooftop greening based on food***. It is not alone in this however, because Singapore has both the motive and the opportunity to steal such

leadership from Australia. See the December guest editorial at the U.S website: ***www.greenroofs,com***

However, there is also great scope for Australian-Singapore collaboration on "food from the roof", because each country has complementary technology and people dedicated to progressive innovation in environmental matters.

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