

Farming in the Middle East 2050

Story by Lisa Reinisch

Concerns about the future food and water supply of Dubai – one of the world’s fastest growing cities - are mounting, forcing the government to think outside the box.

It’s an emotive issue with grave implications, not just for the UAE but for the entire Mena region. Increasingly, designers and architects are also starting to chip into the future food debate, with innovative ideas for greenhouses and urban farms in the sky.

The latest statistics paint a dire picture (see fact box): by 2050, climate change will have reduced average “calorie availability” in developing countries by seven per cent, slashed agricultural yields across the Middle East and boosted prices for staple foods such as rice, wheat and maize, according to the World Food Programme.

The UN Food and Agriculture Organisation predicts that by then, the world's population will top nine billion and, unless investment in agriculture is ramped up radically, people will be struggling to feed themselves. Should supplies run short, arid, developing countries such as those in Mena will be the first to experience food and water shortages.

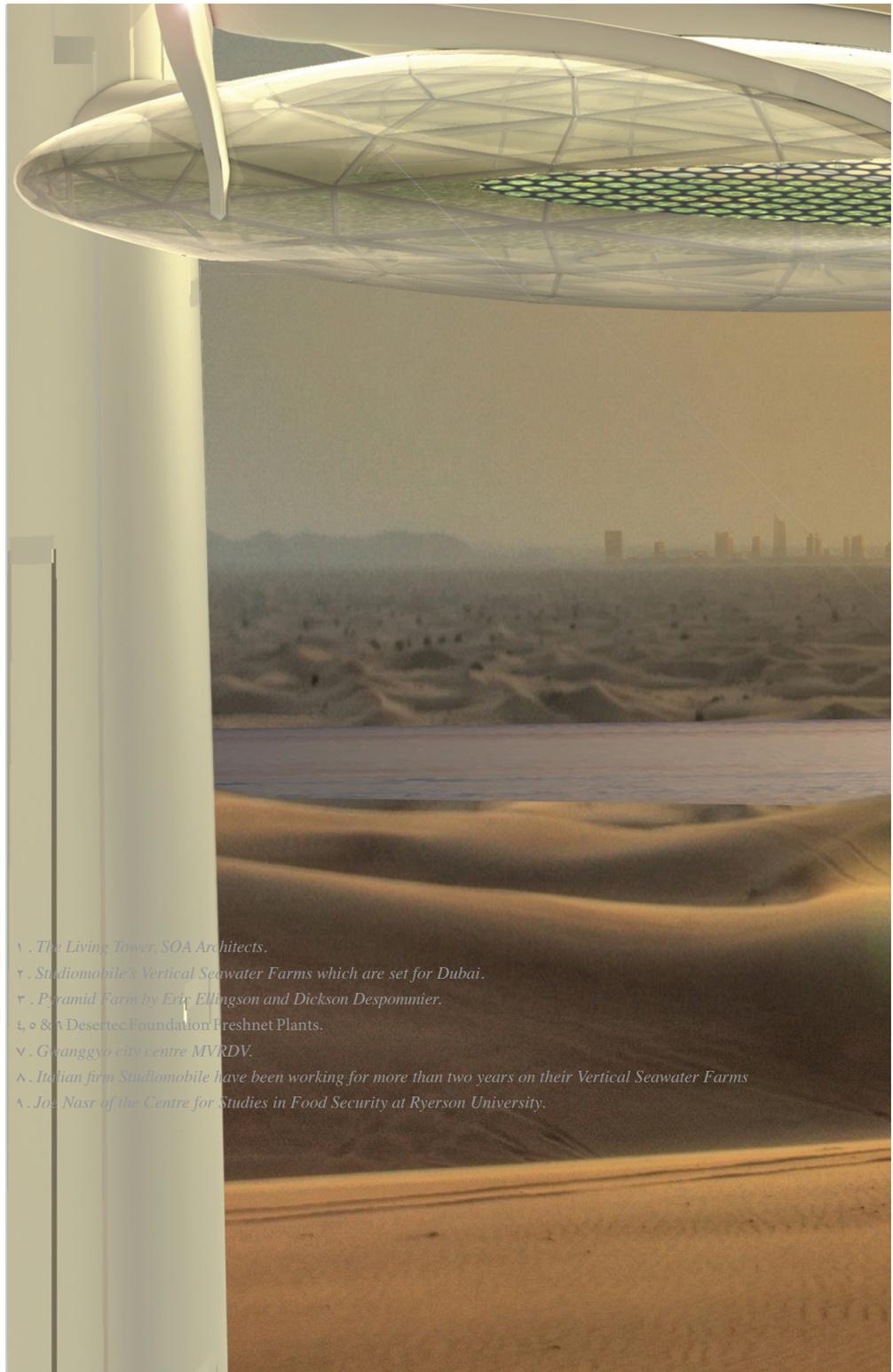
In Dubai, sustainability and development remain mutually exclusive concepts, just like in most of Mena. The city relies on imports for almost 90 per cent of its food supply and its growing population has water consumption habits that couldn't be more out of tune with the city's desert environment: at 550 litres per head, it is the highest in the world.

In this context, sustainable development is certainly more challenging than elsewhere, especially considering the mounting pressures to adapt lifestyles immediately. "It is easy for everyone to say 'You have a huge footprint' when you are sitting in a place that has more rainfall, better soil, better everything," says Gayatri Raghwa of the Environmental Agency Abu Dhabi. "The carrying capacity of this land and many countries means that you would have to go back and lead a pioneering or traditional life. The climate would dictate that."

In the UAE, a country that is both wealthy and willing, the race to develop sustainable long-term food and water supplies that don't compromise people's quality of life is well under way. This includes efforts to improve domestic production and establish crisis-proof import networks.

There is a lot of political steam behind these projects, much of which is due to the legacy of the country's founding father, the late Sheikh Zayed, who channelled substantial oil revenues into desert farming and afforestation projects. The current leadership seems willing to try anything that could help reconcile Sheikh Zayed's vision with the demands of a rapidly growing, largely immigrant population.

Interestingly, designers and architects are also starting to be get involved in food security projects, a domain normally dominated by agronomists, biologists and engineers. "It is becoming more common for designers to be asked to consider food provision in their work," says Joe Nasr of the Centre for Studies in Food Security at Ryerson University. The result: a



1. *The Living Tower, SOA Architects.*

2. *Studiomobile's Vertical Seawater Farms which are set for Dubai.*

3. *Pyramid Farm by Eric Ellingson and Dickson Despommier.*

4, 5 & 6 *Desertec Foundation Freshnet Plants.*

7. *Gwanggyo city centre MVRDV.*

8. *Italian firm Studiomobile have been working for more than two years on their Vertical Seawater Farms*

9. *Joe Nasr of the Centre for Studies in Food Security at Ryerson University.*



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range of imaginative concepts, large and small, that could help to secure the food supply of places like Dubai.

Designs like the Vertical Seawater Farm by Italian firm Mobile Studio are among the flashier recent proposals. “Vertical farming, or indoor farming, is a perfect solution for the Mena area,” says Dr Dickson Despommier, professor of environmental health science at Columbia University, who works with a number of architects on what he describes as ‘engineered design’. “You can control the temperature, you can control the humidity and you don’t need a lot of water, if you’re doing it hydroponically or aeroponically.” Considering Dubai’s acute lack of fertile soil and water reserves, vertical farming could be part of the solution to the city’s growing concerns over food and water security.

The concept has caught the imagination of a number of architects. Despommier insists that

while many vertical farm designs may seem utopian, the potential is real. “If you look around the world, at single-layer greenhouses that capture trans-evaporation and recycle their waste, this is already being done in many places. You might call it futuristic, but it’s now. All we want to do is take that concept, stack them on top of each other and move them into the cities, so that the food supply is closer to where we live. It’s a simple concept, with a very difficult solution.”

Interest in vertical farming is on the rise. Despommier has been invited to develop ideas for the carbon-free Masdar City, in Abu Dhabi and is also in talks with officials in Amman, Jordan, and Doha, Qatar, about the construction of prototypes. “If we can find enough money, in the neighbourhood of \$30 million, we could build a high-end vertical farm, which would allow agronomists, engineers, designers, micro-biologists and food-safety experts to test

everything before commercialisation.”

Vertical farming is part of a broader vision of integrating food production into the urban environment. By 2050 around 70 per cent of the world’s population is expected to live in cities – compared to 49 per cent today – meaning that the production of food within city limits may become far more widespread. Apart from large-scale production units such as vertical farms, community efforts will also play a larger role. Small-scale urban farming practices include the creation of “edible landscapes” in public parks, the reuse of organic household waste and gardening and livestock rearing on top of, around or within buildings.

“Over time, as cities continue to spread out and transform, food production will begin to interact with the urban environment,” says Nasr. “The question of good design is starting to come in, aesthetically and in terms of technology.”



Nasr has spent years working on urban farming projects in Mena and believes urban farming has special potential here, because food production at urban family homes is culturally already more established than in other parts of the world.



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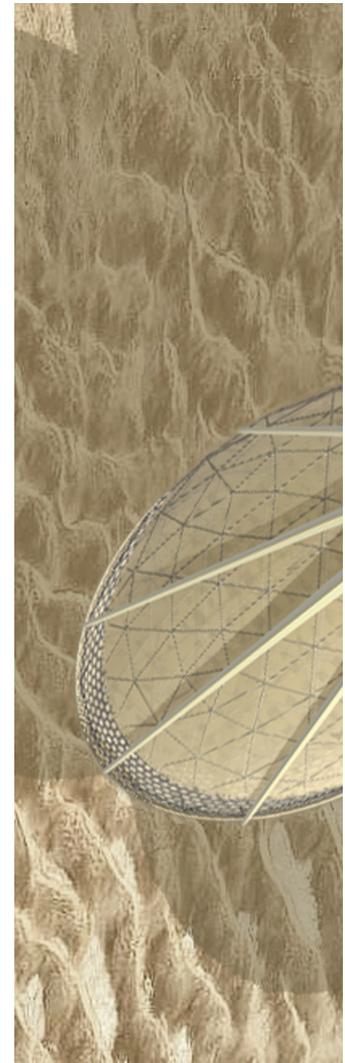
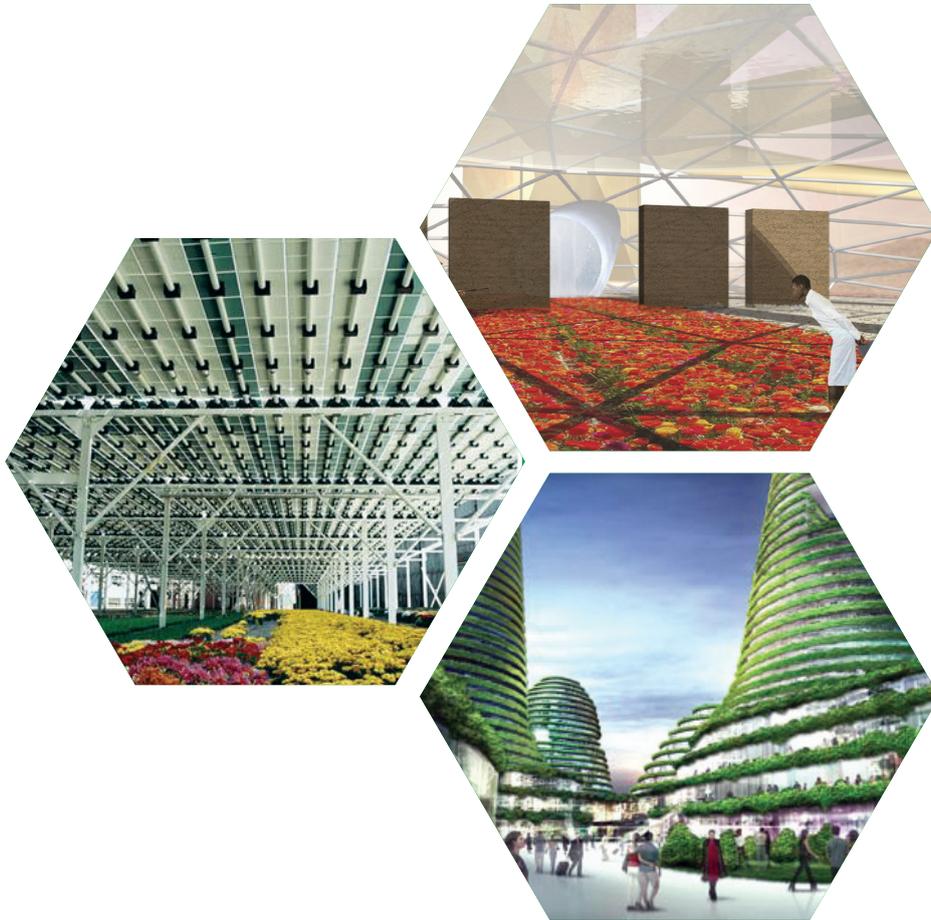
A number of small-scale urban farming projects are currently under way across the region; pilot projects in Tunis, Casablanca, Amman and San'a that involve the creation of community and roof gardens, using treated waste water for irrigation and developing urban agro-tourism.

Salwa Tohmé Tawk, of the Environmental and Sustainable Development Unit at the American University of Beirut, is currently involved in projects in Amman and San'a. She thinks that designers also have a role to play in such smaller initiatives: "In Amman we are starting to produce dried herbs and vegetables and we are working with designers on the product design. There is a lot of competition and it is important for small-scale farmers to have a nice final product with which to attract consumers," she says. By 2050, neatly packaged produce from urban farms and well-designed urban farming equipment may well occupy a sizeable portion of retail shelf-space.

But not all future food concepts revolve around cities, or, indeed, solid ground: the world's oceans are also seen as a vital source of food for future generations. Since aquaculture requires neither fresh water nor fertile soil, it is especially suitable for Mena. And considering the high carbon footprint of meat production, fish is an appealing sustainable alternative that is likely to feature more prominently in diets across the globe. But with overfishing already having pushed many species to the brink of extinction, the challenge to come up with sustainable aquaculture methods is a tough one. American company Ocean Farm Technologies has recently piloted the Aquapod (see profile), a giant floating fish farm, and is now working on a robotic, remote-controlled model.

Algae are another marine food source that could be mass-produced in a sustainable manner. Nori and Agar Agar are already staple foods in many Asian countries, but there are also less





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well-known varieties such as Spirulina - a super-nutritious food supplement. Mena's first Spirulina farm was set up in the UAE this summer and it is hoped that it will help improve the diets of people in the local area as well as in hunger-stricken parts of Africa.

The sun, the region's most abundant natural resource, could even accomplish a triple-whammy and provide sustainable energy, food and fresh water all at once. An ingenious proposal by the Desertec Foundation suggests that waste heat from Concentrating Solar Power (CSP) plants could be used to desalinate sea water at practically no extra cost and the shade created by

the reflective Fresnel panels could render even unproductive desert ground fertile. With large-scale CSP plants cropping up across the region, these useful byproducts of solar power generation could help address local food and water scarcity.

To avoid future shortages, the reuse of organic wastes - including waste water - will also play a central role in the food production of the future. The use of waste water may not be appetising, but given the right technology, it bears few risks while dramatically improving efficiency.

"It is a question of cultural practices," says Nasr. "Trash is still seen as something dirty, rather than something of a resource."



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Another concept that some may find unsavoury is the use of bioengineering to improve soil quality and crops. Land resuscitation through biotechnology was recently proposed as an especially relevant solution for Mena by Nobel laureate Dr Rajendra K. Pachauri. The chairman of the Intergovernmental Panel on Climate Change advised Gulf states to move “from oil wealth to soil wealth”.

But Dubai, and large parts of Mena in general, are unlikely to ever become independent from imports. Some experts, such as Mona Bkheet

at Sharjah University, think that the UAE’s endeavours to boost local agriculture can never be sustainable and will eventually be dropped altogether. “Farming has been developed in this region at great environmental cost and that will be in question in the future,” says Nasr.

But even though the UAE government is winding down farming subsidies and buying up large tracts of farmland abroad, investment in local food production projects - whether they are sustainable or not - is likely to continue for decades.

This is driven partly to realise the founding principles and gain the respect of the international

community, rather than profit or a realistic expectation to achieve food independence.

“I’d almost compare it to the US putting a man on the moon. It’s not going to make money,” says Razan Khalifa al Mubarak, chairwoman of the Emirates Wildlife Society-WWF. “It’s that drive, it’s that interest. Sure, it has macro-economic diversification and we can use this window of opportunity very similar to the US.”

This makes the UAE a laboratory for sustainable and agricultural design, which could eventually benefit the wider region and, indeed, the world.



Profile

The Seawater Vertical Farm uses seawater to cool and humidify greenhouses and to convert sufficient humidity back into fresh water to irrigate crops. Designed by Studiomobile, the towers would be a viable option for Dubai in its quest for sustainability.

The problem

The growth in demand for water and increasing shortages of supply are two significant problems for the 21st century. Fortunately, says architectural firm Studiomobile, the world is not short of water it is just in the wrong place. Dubai's lack of fertile soil and fresh water an ideal candidate for seawater farms.

The technology

The process would work in three phases. The first would see incoming seawater evaporated to condition the air of the tower creating a humid environment.

Secondly, the air would be pushed out of the greenhouse or pod and through another evaporator which mixes the humid air with the air from outside.

On the way up fresh water condenses around tubes of cool seawater and as drops accumulate they are collected in a tank and used to water the plants

The brief

Sustainable desalination would mean the use of portable water for food production.

The design

Giant vertical structures would be positioned close to the coast and have pod-like greenhouses that would use imported soil and seawater to grow crops.



Mena's dependence on imports will increase by almost 64 per cent over the next 20 years.

Arab countries currently import at least 50 per cent of the calories they consume and are the largest net importers of cereals in the world.

The Arab world is quickly proceeding from water stress to absolute water scarcity. There is little to no potential for sustainable increase in water use in most Arab countries.

Globally, by 2050 the number of people at risk of hunger as a result of climate change is expected to increase by 10 to 20 per cent more than would be expected without climate change.

Annual cereal production will need to rise to about three billion tonnes from 2.1 billion today and annual meat production will need to rise by over 200 million tonnes to reach 470 million tonnes.

Annual investments in agriculture in developing countries will have to increase by around 50 per cent in order to meet the planet's food demands forecast for 2050.

Sources: Improving Food Security in Arab Countries (World Bank, 2009); How to Feed the World in 2050 (Food and Agriculture Organization, 2009); Fighting Hunger, Responding to Climate Change (World Food Programme 2009).

