

A conceptual plan of a potential New Nile Co site

To make biofuels popular in Egypt they must be regenerative not just sustainable

Solutions from the sea

Until recently Egypt has shown very little interest in biofuels. The country has traditionally had an abundance of oil and gas wells and concerns surrounding increased food prices have further constrained moves into renewable energy.

But now for the first time Egypt has become a net importer of petroleum and the country is starting to see the benefits of sustainable biofuel production.

Jatropha is becoming more popular as it can be grown on semi-arid land so poses little threat to food production. But a feedstock that poses even less competition to the food market is seawater.

New Nile Co, which is developing the world's first commercial scale seawater-based biofuels project in Egypt, will be one of the largest biofuels investments to date in the Middle East or Africa.

The company, owned by Houston-based Energy Allied International, The Seawater Foundation and Global Seawater plans to produce tens of millions of litres of biofuels from a 50,000 hectares (roughly 125,000 acres) project site.

The company is unable to disclose the location and the project capacities until selected site is secured from the Egyptian government and the feasibility studies are completed, says Tamer Nassar, regional vice president for Energy Allied International.

Once complete, construction is due to begin in early 2012 and the project should take between 24-30 months to set up.

New Nile Co will produce biofuels by applying the Integrated Seawater Agriculture System (ISAS) model that uses effluent from seawater aquaculture as a natural fertiliser to grow large plantations of the halophyte (naturally salt resistant plant) salicornia, which can yield hefty volumes of high-grade vegetable oil for use as a biofuel feedstock.

The model has already been successfully applied in Mexico and Eritrea so Nassar is confident of achieving similar results in Egypt. The biofuel produced will then be processed using Energy Allied's patented technology.

Without government mandates in place it is not yet clear how big the demand will be for the fuel. Egypt has also long subsidised petrol, so New

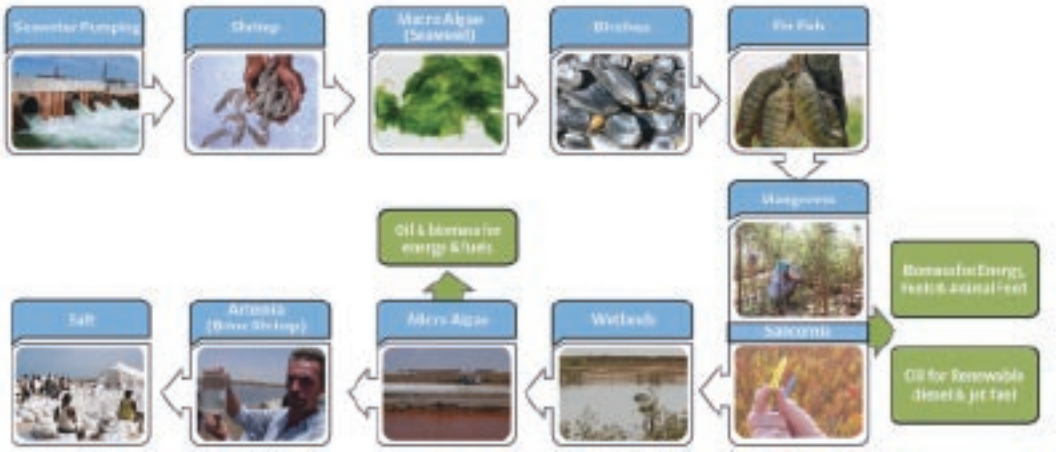
Nile Co would need the same support in order to offer the fuel to the domestic market.

Alternatively (and more likely) Egypt is well located to export to the European market, which is now subject to an ambitious Directive for the use of biofuels. New Nile Co's project developers are currently in talks with UOP Honeywell about using the feedstock salicornia oil for the production of bio jet fuel (or BioSPK) and/or biodiesel, specifically for the EU market.

But with seawater comprising 97% of the world's water resources and a solutio that produces both renewable fuel and food, even if the fuel is exported, the project should still retain a large amount of local support. ●

The process

Seawater Pumping takes the seawater from rivers and canals onto the land to greatly expand the natural ecosystem for salt tolerant plants and existing global production of food and energy products. The Seawater provides a habitat for farming **Shrimp**, the waste from which creates an ideal environment for **Macro Algae**, such as seaweed, which becomes a food source for **Bivalves** and **Fin Fish**. The salt water fertilizes salt tolerant plants such as **Mangroves** and **Salicornia**, both proven sources of Biofuels and animal fodder. This environment creates **Wetlands**, which in turn attract new wildlife to the area and support the growth of **Micro Algae**. Micro Algae removes carbon from the atmosphere and can be harvested to also produce BioFuel. **Artemia**, or brine shrimp, feed on **Micro Algae** and filter the salt water so that the **Salt** can be sold for industrial and food uses.



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Mubarak Encourages ISAS in Egypt– Al Ahram May 28, 2010

الجمعة 14 من جمادى الاخرة 1431 هـ 28 مايو 2010 السنة 134 العدد 45098

الأهرام

رئيس مجلس الادارة
د.عبد المنعم سعيد

رئيس التحرير
اسامة سرايا

تأسس ٢٧ ديسمبر ١٨٧٥ اصدر العدد الأول ٥ اغسطس ١٨٧٦ سليم و بشارة تقلا

ووجه الرئيس الي ضرورة الافادة من التكنولوجيا الحديثة في زراعة النباتات بالمياه المالحة.. للافادة من الاراضي المتاخمة للسواحل البحرية وطلب منح المواطنين تسهيلات لزراعة الاراضي الصحراوية

President Mubarak directed the Egyptian Government Ministers to apply the latest technologies in the development of agricultural projects utilizing seawater, in order to promote the constructive use of desert lands along the Red Sea Coastline.



عدد الجمعة

الرئيس يوجه بمراعاة مصالح المواطنين عند تنفيذ المشروعات

مبارك يدشن مرحلة أخرى من مشروع شبكة طرق الصعيد ـ البحر الأحمر

الرئيس يطالب بانهاء المشروعات فى مواعيدها المحددة والتخفيف عن المواطنين

From desert sands to biofuel crops

Transforming huge swathes of land from an arid desert into lush green fields might seem unethical to some, but to others it could present a 'green' economic opportunity. With food production strained across the world and biofuel demand growing, New Nile Co representative Tamer Nassar discusses the potential of a saltwater project earmarked for Egypt

As the world's population rapidly expands, stress is being placed on global food production and supplies of fresh water.

A huge saltwater project earmarked for the mouth of the region's largest river could potentially transform large swathes of desert into one of the world's largest biofuel plantations and a food production site, without placing further strain on fresh water supplies.

An Integrated Seawater Agriculture System (ISAS) project proposal, covering some 50,000 hectares, is currently being outlined, which would use seawater to irrigate arid land.

The New Nile Co project is in its planning stages and is being proposed for an area near the mouth of the Nile River, which would reshape the landscape with a mixture of mangroves, land suitable for mass cultivation, and a natural nursery for fish and shellfish.

According to Tamer Nassar, regional vice president of New Nile Co project partners Energy Allied International, seawater irrigation is at the heart of any ISAS project and consists of a process unlike traditional freshwater agriculture.

"As in so many things dealing with nature, it is an art form that requires the application of both science and practical experience — both of which exist within New Nile Co in great abundance," remarks Nassar. "This knowledge is now widely prevalent, which is precisely why seawater agriculture is not a common practice."

Nassar claims the science behind the concept of ISAS has already been proven, and has been documented through research and development, and operational experience at the Environmental Research Laboratory at the University of Arizona, and on ISAS projects in Eritrea and Mexico.

"The Eritrea project was an operational, financial and social success until it was sadly nationalised by the local government,"



The New Nile Co project will transform swathes of desert into arable land.



The Nile is the key source of water for arable land in Egypt, as well as being a key tourist draw.

remarks Nassar. "The Mexico project is still active after several decades of operation, thus proving the sustainability of an ISAS project."

Seawater comprises 97% of the world's water resources and therefore presents a solution for fuel production, food production and afforestation, which could yield substantial benefits to countries with rising populations and limited cultivatable land.

Discussions with the Egyptian government are currently underway, reveals Energy Allied International's Nassar, with a full plan set to be in place by 2011.

If all goes to plan, construction on the project will begin in 2012, with current estimates pointing to a construction phase of between 24 to 30 months.

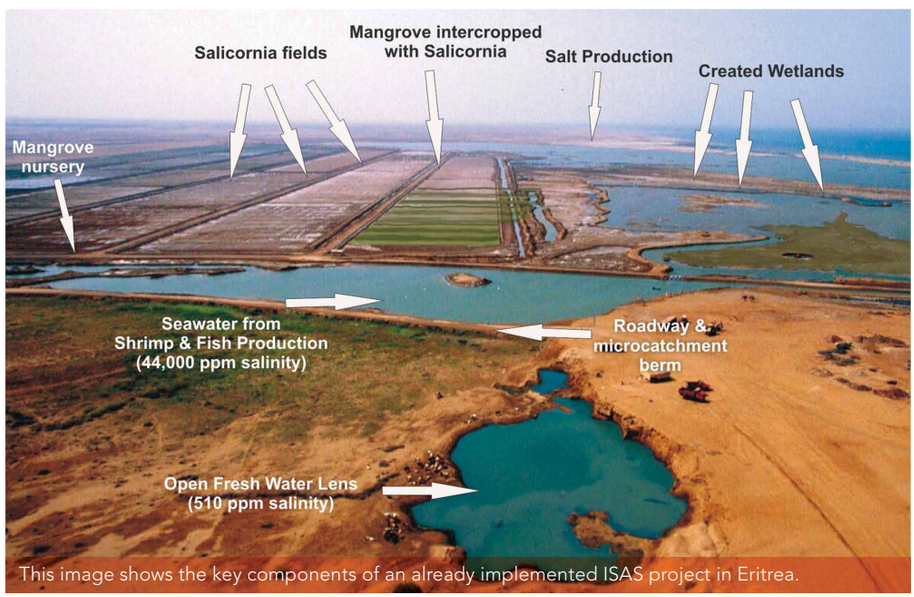
According to New Nile Co, ISAS aquaculture has a projected production ratio of 1:5 when compared with what the project team terms "general agriculture", meaning that for every hectare of aquaculture, the project will be able to irrigate five hectares of salicornia.

Nassar claims the project could produce 1.2 tons of high-grade vegetable oil from every hectare of salicornia grown, and predicts that the ISAS project on the Nile would be able to produce 650,000 tons of biofuel a year.

"This is a significant figure," remarks Nassar. "Especially when considering that this biofuel is produced from arid desert land that is otherwise entirely unproductive."

ENVIRONMENTAL BENEFITS

According to Nassar the project will be of "enormous environmental benefit".



This image shows the key components of an already implemented ISAS project in Eritrea.

"In terms of micro environmental benefits, New Nile Co will upgrade the existing ecosystem from that of being a barren, inhospitable, arid desert to one that is a green sanctuary, hospitable to humans, wildlife and plants," he notes.

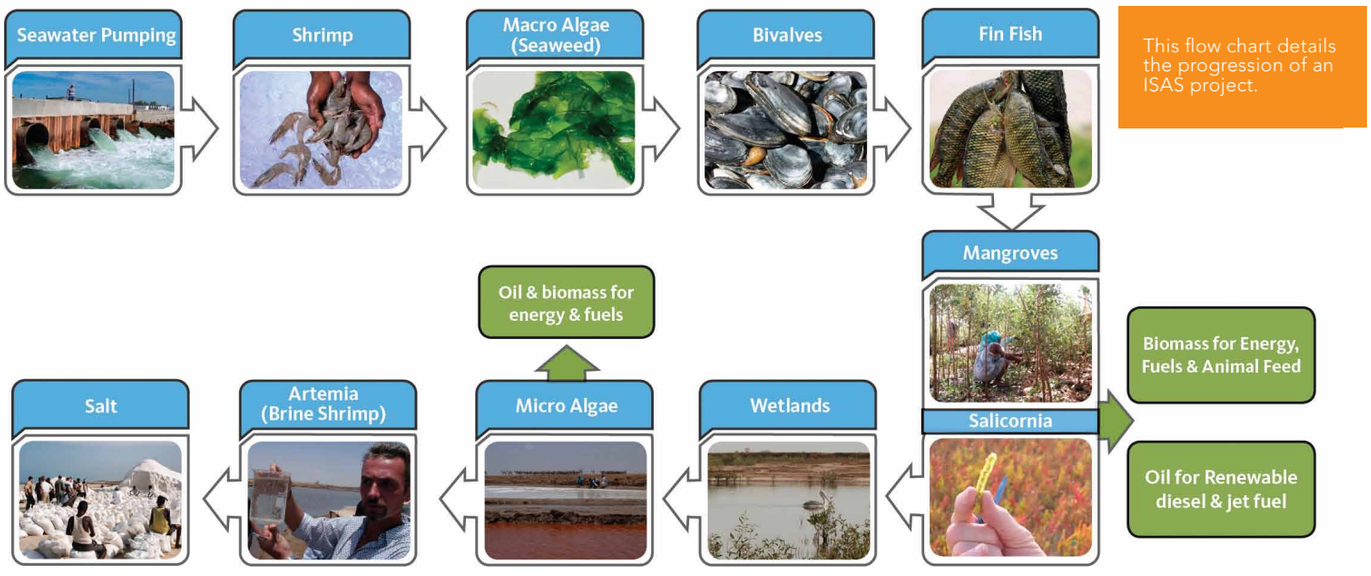
"It will enhance the soil nutrient contents of the entire project site through the practice of agriculture and aquaculture, creating an environment more suited to agricultural production, and in terms of macro environmental benefits it can offset rising sea levels by making productive use of overtly abundant untreated seawater."

Nassar argues that the project has a global role to play in cutting carbon emissions through the production of environmentally sustainable biofuels.

When quizzed on whether it is possible that transforming such a vast amount of derelict land into a new eco-system could actually end up having a negative effect on the environment, Nassar claims the project's designers are thinking ahead.

"With respect to increased carbon emissions or related activities, our in-house engineering team all been tasked with designing a project that is both environmentally responsible and sustainable," says Nassar.

"This is not an easy task," he points out. "For example, pumping seawater on to the project site in order to provide a steady flow of water to New Nile Co's seawater rivers and canals is a potentially energy-intensive exercise."



This flow chart details the progression of an ISAS project.

"We are going to great lengths to ensure that this energy can be generated in a environmentally, technically and economically sustainable manner, minimising, if not negating altogether, carbon emissions related to this aspect of the project."

Nassar claims that all environmental aspects of the project are being taken into consideration, including transportation to and from the site as it aims to operate with a carbon credit surplus.

SOCIAL PROFIT

Alongside the environmental benefits of the Nile project, New Nile Co has documented and presented its potential economic and social benefits.

An **ISAS project** is essentially an agricultural project combining untreated seawater and arid, non-agricultural grade land, which produces multiple sources of biofuels and food.
It is made up of three key components:
- Seawater: a man-made seawater river enables seawater to flow from the sea into the project area to be pumped onto the land for agricultural irrigation and other applications
- Land: large tracts of low lying uninhabited, arid desert land located inland, which will become productive through the farming of halophytes (seawater tolerant plants) and practicing aquaculture
- Labour: a sizable workforce of skilled, semi-skilled and unskilled labour is required to operate an ISAS project

"Socio-economic benefits are the primary reason why the project has received such overwhelming support from the Egyptian government at large," notes Nassar.

"With a multi-hundred million US dollar investment value, New Nile Co is presently Egypt's largest agricultural investment under development and the operation will be fully integrated, with co-located production, processing and infrastructure."

Approximately 6500 individuals will be directly employed at the 50,000ha site, says Nassar, with a further 65,000 indirect employment opportunities created through upstream and downstream services.

"New Nile Co will provide higher incomes, increase livelihood stability, reduce poverty risk, foster economic diversification, increase entrepreneurship, yield a more highly educated workforce, attract new investments and improve overall macroeconomic stability to the region where the project is to be situated," asserts Nassar.

"New Nile Co will also address critical social challenges, including urban crowding and food security, and will allow Egypt to become an exporter of solid and liquid biofuels, and seafood."

Thanks to the social and economic benefits projected by New Nile Co, it has been able to secure the support of key individuals and organisations within Egypt, despite the scale of the project.

"The Egyptian government has been wholly supportive of New Nile Co's development to date, both politically and practically," claims Nassar.

The project's leaders have been granted ministerial access and claim to have the support of key ministries within the government and local authorities.

New Nile Co has secured long-term cooperation agreements with the Agricultural Research Centre at the Egyptian Ministry of Agriculture and the Desert Development Centre at the American University in Cairo.

It is also working with the Masdar Institute of Science and Technology's Sustainable Bioenergy Research Project and has even received the support of Dr Nina Fedoroff, science and technology advisor to US Secretary of State Hillary Clinton.

REGIONAL LEGACY

The team behind the project is keen to provide a lasting legacy in the Middle East, while also addressing global environmental issues such as climate change and rising sea levels.

"There is also a great need to produce valuable products which are presently in ever-decreasing supply, such as food and biofuels, while capitalising on an abundance of otherwise unproductive natural resources such as untreated seawater and desert land," remarks Nassar.

"New Nile Co offers something for everyone, he adds, noting that the project could have a lasting educational legacy across the arid Middle East.

"Through New Nile Co's existing formal associations with the Agricultural Research Centre at the Egyptian Ministry of Agriculture and the Desert Development Centre at the American University in Cairo, we hope to be able share our knowledge and expertise with future seawater agriculturalists," he insists.

"Green, lush productive ISAS projects can eventually become a common feature of the region's otherwise generally dry and arid landscape."

Humble saltwater salad offers food and fuel alternative

Cultivation of salicornia promises food, fodder and fuel without using a single drop of fresh water.

BY CAM MCGRATH

A HARDY LITTLE PLANT THAT THRIVES in salt water promises to transform the barren coastal deserts and sun-bleached salt flats of the Middle East into green oases that feed the poor, fuel our vehicles and – quite possibly – help stave off climate change.

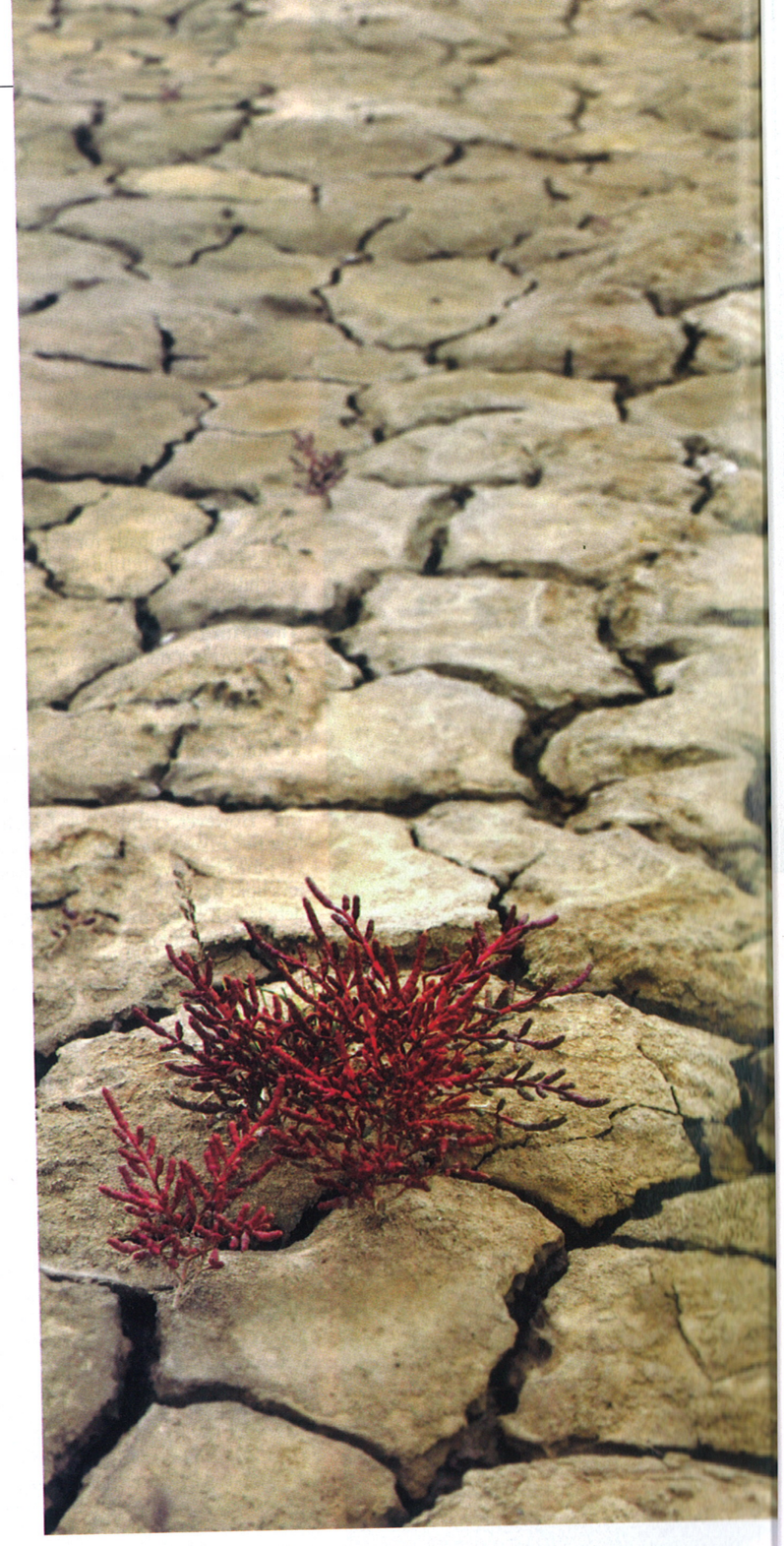
Salicornia, a salty, crunchy plant known in culinary circles as the salad herb "samphire", has traditionally been prized as an ingredient for haute cuisine. With high energy prices and concern over global warming, the halophyte (salt-tolerant plant) is now in demand for its other properties.

According to Hassan El Shaer, president of the International Society for Halophyte Utilisation (ISHU), salicornia contains more edible oil than soya beans, makes excellent animal fodder and yields a high-energy biofuel that can power jet aeroplanes. Better still – the plant can be grown without using a single drop of fresh water.

"Salicornia loves salt and can be grown intensively on saline land that would kill other plants," El Shaer explains.

University of Arizona researchers have found that salicornia seeds contain about 30% oil by weight, compared to 17-20% for soya beans, and can be processed into high-grade cooking oil or biofuel. The remaining 70% of the oil seed biomass can be used as animal feed, while the plant's stalks can be burned to produce energy or pressed into building material.

Experimental cultivation of salicornia oil seeds began in the 1970s. Rising oil prices and fuel-blending targets in industrialised nations have accelerated its development as an advanced biofuel.



Salicornia loves salt and can be grown on saline land that would kill other plants

Unlike first-generation biofuels, which are produced primarily from food crops such as corn, wheat and sugar cane, second-generation biofuels such as salicornia do not compete with valuable land and freshwater resources. By utilising unproductive desert land and untreated seawater, salicornia-based biofuel projects can scale up without causing food or water shortages.

An integrated approach

Egypt was recently selected to host the world's first commercial-scale salicornia biofuel project. In March, Houston-based energy projects developer Energy Allied International announced a memorandum of understanding with saltwater agriculture pioneers The Seawater Foundation (TSF) and Global Seawater, Inc, to establish a seawater-irrigated salicornia plantation and biofuel plant on a 50,000-hectare plot in the country. Site selection is in progress with construction expected to begin in early 2011.

Tamer Nassar, Regional Vice President of Energy Allied International, says Egypt was chosen as the location for the project because it possesses all the key ingredients: unproductive arid land, readily available seawater and cheap, skilled labour.

"This project makes sense for the country on so many levels," he says. "About 95% of Egypt is unoccupied, it has unlimited access to seawater, there's high unemployment and a third of the workforce is already in agriculture."

New Nile Co, the joint company created to manage the project, will employ an integrated seawater agriculture system (ISAS) – a model developed in Mexico and tested in Eritrea. The integrated system operates on an engineered ecosystem comprised of aquaculture ponds, salicornia fields and mangrove forests. Waste products of each process are utilised as inputs for the next in a highly efficient closed-loop production cycle with multiple coproducts.

"The primary two products from this project will be seafood and biofuels," says Nassar. "Biofuel production will go to satisfying the European automotive and civil aviation market … while seafood [raised in the aquaculture ponds] will address food security in Egypt."

The ISAS model uses nutrient-rich effluent from saltwater shrimp and fish ponds to irrigate and fertilise nearby salicornia fields, while mangroves remediate the irrigation run-off and reduce the system's carbon footprint.

"The mangroves act as a carbon sink," explains Scott Kennedy, an associate professor at the Abu Dhabi-based Masdar Institute of Science and Technology (MIST). "They store carbon dioxide from the atmosphere as they grow, which offsets the carbon generated by burning the biofuel."

Pioneering efforts at commercial salicornia cultivation in the Middle East were unsuccessful. The Arabian Saline Water Technology Company (Behar) operated a small-scale ISAS in Saudi Arabia during the 1990s that produced seafood, animal feed, edible oil and samphire (though no biofuel) for several years before shutting down due to low demand.

But times have changed, and rising energy prices and the pressing demand for advanced biofuels are playing in the Egyptian project's favour.

"We have a captive market," Nassar says assuredly. "The European Union has passed regulations that require all aircraft to use blended fuels by 2012 or be subject to penalties. And by 2020 aeroplanes won't be permitted to land at EU airports unless they're using blended fuels."

Airlines are scrambling to secure sufficient biofuel feedstock for their fleets. While fine for powering automobiles, many first-generation biofuels such as ethanol cannot handle the extreme operating conditions of high-altitude jet flights. Salicornia has shown promising results in laboratory testing, with trial flights expected to commence later this year.

Further research

Much of the research work will be carried out on the salt flats near Abu Dhabi, where MIST, Honeywell's UOP, Boeing and Etihad Airways have agreed to jointly establish a 200-hectare ISAS and research institute. The project will use UOP technology to refine salicornia oil into a high-powered jet biofuel blend for trial flights by Etihad Airways. The aim is to optimise the ISAS production cycle and biofuel blending process in order to scale up to commercial production levels within five years.

Analysts expect investments in salicornia biofuel projects to grow exponentially in the coming decade, but project developers are looking beyond the balance sheets. They see an opportunity to build a business modelled on sustainable energy production with outcomes that could benefit humanity.

Carl Hodges, TSF's chairman and the chief architect of the ISAS model, envisions "seawater-based communities" built around giant man-made channels that draw seawater inland to irrigate barren coastal deserts. The scheme – based on a prototype built in Eritrea – would create millions of hectares of seawater-irrigated farmland, providing jobs and resources for growing coastal populations.

Analysts expect investments in salicornia biofuel projects to grow exponentially

Hodges estimates that just 50 seawater channels would displace sufficient water to mitigate the impacts of the predicted rise in sea level by 2020. Meanwhile, the greening of the desert would sequester enormous quantities of carbon dioxide, the primary agent in global warming.

While governments show no sign of committing to such a massive undertaking, halophyte crops such as salicornia are driving a paradigm shift in agriculture. Rather than trying to desalinate seawater and vast tracts of unproductive desert land, researchers are developing new techniques for cultivating salt-tolerant crops and utilising their by-products.

"Think of all the coastal desert communities, especially in the Middle East, where there is no freshwater for irrigation or the soil is suffering from salinisation," says ISHU's El Shaer. "Salicornia can be irrigated with brackish water or seawater, allowing people living in these [impoverished] communities to produce food, animal feed and bio-energy."

The benefits are incalculable. Worldwide, it is estimated that 950 million hectares of land – an area the size of the United States – are afflicted with salinity, which is increasing by over 10 million hectares a year.

Experimental seawater cultivation has demonstrated its potential, but successful commercial application will require farmers to adopt sustainable practices, integrate production cycles and learn new irrigation methods.

"It's an art form that we're going to have to master over time, as we've done with conventional agriculture over the past 10,000 years," says Nassar. ■