HKQAA
HONG KONG QUALITY ASSURANCE AGENCY
香港品質保證局

《Green Finance Implementation Guidebook – Environmental Industry》

HKQAA

Content

Chapter 1. 《Green Finance – SME Self-Assessment Guide》

A. Background

1. Definition of Green Finance

The regulatory details of green finance in Hong Kong are similar with those in the Mainland. Except for listed green bonds which are regulated by the Listing Ordinance, green loans are administered by financial institutions in accordance with the licensing ordinances and requirements of The Hong Kong Monetary Authority (HKMA). The HKMA is committed to promoting green and sustainable finance to address the risks of climate change. The HKMA considers climate change to be one of the major risks to human well-being. How the banking and financial systems operate clearly has an impact on how climate change risks are managed and mitigated.

The HKMA will promote green and sustainable banking in three phases.

- Phase I: Establish a common framework with the industry to assess the current Greenness Baseline for banks. The HKMA will also work with international organizations to provide technical support to local banks on the principles and methods of conducting "green checks";
- Phase II: Consultation with the industry and other stakeholders on the regulatory expectations or requirements for green and sustainable banking, with a view to establishing a set of specific objectives for enhancing the green and sustainable development of the banking sector in Hong Kong;
- Phase III: Once the objectives have been established, implement, review and evaluate the banks' progress in this area.

The HKMA is asking the banking industry to analyze the impact of climate change on them, implement timely countermeasures, and accelerate the development of green business. The HKMA

is actively participating in international forums to support the global development of green finance. As a member of The Network for Greening the Financial System (NGFS), the HKMA participates in the Network's working groups on how to integrate climate risk and other green and sustainability factors into regulatory frameworks and macro-monitoring.

The banking industry has responded positively to the HKMA's initiative to expand the focus of green finance from large listed enterprises to non-listed enterprises and even SMEs and will introduce policies and products to facilitate SMEs' access to loans. With the support of green finance, SMEs can develop new green businesses or improve the environmental performance of their products and business processes, which will not only increase their business volume and revenue and reduce the cost of production or service delivery, but also build a green brand and expand their customer base to companies or consumers who are concerned about environmental protection and climate change.

Hong Kong Institute for Monetary and Financial Research (HKIMR), established by the HKMA, released a report on November 24, 2020, entitled " The Green Bond Market in Hong Kong: Developing a Robust Ecosystem for Sustainable Growth ", an applied finance study. The report describes the current state of the green bond market in Hong Kong and globally and illustrates the benefits of green bonds for issuers and investors. Among the findings, existing market participants identified the strengths of the Hong Kong market as a large pool of international investors, supportive policies, the presence of many socially responsible issuers, and the implementation of transparent ESG disclosure. 71% of existing issuers surveyed and 100% of existing investors surveyed said they plan to participate in Hong Kong's green bond market in the future. SMEs can follow the trend of green finance and seize the opportunity of green capital from investors to prepare for green projects and help their business development.

China has provided a guiding and clear view on the definition of green finance, which will not only affect the orientation of green business and capital investment priorities of domestic financial institutions in Hong Kong. It can also provide a good definition of green finance. The People's Bank of China (PBOC) and the China Banking Regulatory Commission (CBRC) jointly promulgated the "Opinions on the Implementation of Environmental Protection Policies and Regulations to Prevent Credit Risks", which stipulates that environmental protection departments, PBOC, CBRC and financial institutions at all levels should put the State Council's implementation

of the decision and environmental protection policies and regulations on their important agenda. Strengthen the cooperation and linkage between environmental protection and financial supervision departments, promote credit security by strengthening environmental supervision, support environmental protection with strict credit management, strengthen economic restraint and supervision of enterprises' environmental violations, raise the awareness of environmental rule of law in the whole society, promote the completion of energy conservation and emission reduction targets, and strive to build a resource-saving and environment-friendly society. It also stressed the need to strictly monitor the environment and credit management of new projects in accordance with the requirements of environmental laws and regulations. In addition, the environmental protection departments at all levels strictly approve the environmental impact assessment of construction projects and strengthen the management of environmental protection facilities in construction projects. "Environmental Protection Law," Article 41 came into force on 1 January 2015 to supplement the construction of pollution prevention facilities, should be designed, constructed and put into operation at the same time as the main project. Pollution prevention facilities shall comply with the requirements of the approved environmental impact assessment file, shall not be dismantled or idle. The concept of "Three simultaneities" in other green projects also has good reference value.

The above regulations bring out the basic definition of green finance.

1. The enterprises financed must comply with applicable national and local environmental protection laws and regulations to avoid credit risks arising from environmental protection violations;

2. The funds should be used to support environmental protection industries and projects, and should bring benefits to the environment; and

3. To conduct environmental impact assessment and implement "Three Simultaneities" management.

The Hong Kong Quality Assurance Agency (HKQAA), with the support of the Hong Kong Government, launched Hong Kong's self-developed "Green Finance Certification Scheme" in 2018, which includes a definition of green finance and green projects. SMEs can use the

information and documents mentioned above to prepare green projects to meet the requirements of financial institutions.

2. Green Standards

With regard to the second definition of green credit, the guiding catalog of green industries listed in the circular issued by the PRC National Development and Reform Commission, the People's Bank of China, the Ministry of Industry and Information Technology and other departments on February 14, 2019 - "Circular on the Issuance of the Guidance Catalogue of Green Industries (2019 Edition)" (發改環資 (2019) No. 293) provides a suitable reference for the industries in which green finance is to be used.

As for assessing whether the use of loans by enterprises supports environmental protection projects, industries and projects that support environmental protection are generally referred to as eligible green projects in the capital market. The International Capital Market Association's Green Bond Principles (GBP) and the Loan Market Association's Green Loan Principles (GLP) provide the same indicative categories of eligible green projects. Compared to the existing national entities and international principles, the main difference between the People's Bank of China's Bulletin [2015] No. 39 Annex "Green Bond Support Project Catalogue" issued in 2015 and the GBP/GLP is the clean use of coal.

B. Evaluation Process

1. Purpose of Self-Assessment

Green Finance Self-Assessment is an assessment exercise conducted by enterprises or their delegates in accordance with these guidelines and using the tools provided by the Green Finance Knowledge Sharing Online Platform.

The purpose of the self-assessment is to help SMEs understand whether they can finance their businesses through green finance, so that they can continue to grow their businesses while making some contribution to the environment and climate change. It involves three levels, including the readiness of the company's policies and capabilities, the rationale for supporting green projects, and the risk management of implementing the projects. Each dimension has different assessment focus and assessment items as follows.

Layer	Evaluation Highlights
• Readiness of the company's policies and capabilities	• Company Sustainable Development Strategy • Sustainable Development Foundation Culture • Promoting Sustainable Development Results
• Rationale for the Green Project	• Use of Funds Raised • Estimated Environmental Benefits
• Execute project risk management	• Environmental Compliance • Ability to complete green projects

2. Preparation for Self-Assessment

Before conducting the self-assessment, SMEs need to clearly identify the environmental laws and regulations that apply to their business and ensure that they are in compliance with the relevant requirements. In addition, collect (1) the technical specifications and indicators of the green project for which green funding is desired and (2) the practical experience of previous projects that are the same as or similar to the green project.

3. Login to the Green Financial Knowledge Sharing Online Platform (www.greenfinance.hk)

4. Activate the Green Finance Self-Assessment Tool

a) Corporate sustainability strategy, including

- The linkage between the company's development and the solution of today's important environmental issues; and
- The company's written commitment and plan for sustainable development.

b) A culture of sustainability fundamentals, including

- Internal communication of the importance of environmental protection to the business; and
- The level of employee recognition of and participation in corporate sustainability.

c) Past achievements in promoting environmental protection, including

- Results of environmental benefits achieved (e.g., carbon footprint, water footprint, energy consumption, pollutant emissions, waste/waste reduction, etc.); and
- Measurement of environmental benefits achieved.

d) Use of proceeds, including

- Green project attributes; and
- Dedicated funds.

e) The environmental benefits expected to be generated upon completion of the project, including

- Environmental benefit key performance indicators (KPIs); and
- Measurement of the environmental benefits to be generated.

f) Environmental compliance, including

- Compliance management; and
- Compliance performance

g) Ability to complete green projects, including

- Project experience;
- Personnel capacity and skills; and
- Environmental impact assessment

Chapter 2. 《Green Project Selection and Evaluation and Green Technology Details》

A. Environmental Challenges Facing

According to the Organization for Economic Cooperation and Development (OECD), "the environmental industry comprises activities that produce goods and services to measure, prevent, limit and minimize or correct environmental damage to water, air and soil, as well as problems related to waste, noise and ecosystems". The industry is involved in waste management, air pollution, water and waste, and environmental services and equipment, and the structure of the industry is growing and changing rapidly.

The environmental industry today has different challenges every day, and the main issues identified are the following:

1. Pollution Problem

SMEs have limited R&D resources for technology application and innovation. For example, the operation of some environmental industries requires technological upgrading to cope with the ever-increasing amount of waste. Whether it is R&D or general operation, environmental industries also produce unnecessary pollution or waste, and it is not possible to recover 100% of what is collected and achieve zero carbon emissions, for example, when machines or open fires are involved, emissions cannot be avoided. This article will discuss carbon capture technology as a green project with immediate effect and easier to implement.

2. Local Market Size

The local market demand for environmental products and services is relatively low, and customers have limited motivation to spend money, so the market for environmental products has not been fully developed. The main reason for the slow development is the lack of resources for

environmental market development, coupled with the fact that some customers may not have sufficient environmental awareness, which requires more time and education and publicity to reach international standards.[1]

3. Business Value

Whenever there is a trade-off between green branding and price/functional performance, the market mostly treats green brands negatively. Because the commercial value of green brands is not high, and their establishment and promotion requires a lot of capital, the development of functional direction often has the chance to reduce their greenness significantly, and if not for laws and regulations or government funding support, companies have to withstand certain capital requirements to insist on green.

4. Climate or Location Effects

Some environmental industries are subject to adverse weather conditions, such as aquaponics farming systems, which are easily affected and damaged by temperature differences and typhoons. The following section will explore the investment in a new green technology that combines solar energy and aquaponics in one container for vertical farming, removing most of the unstable influences.

5. Lack of Common Indicators

Although environmental regulations are one of the key drivers of market demand, when regulations are inadequate, uncertain or inconsistent, they can also create barriers to development. Therefore, some certification systems have been introduced in the hope that green improvements can be quantified, and that the industry can have the same guideline, for example following the requirement as per BEAM Plus.

[1] https://www.smefund.tid.gov.hk/english/sdf/deliverables/report_brand_development_environmental_ind_eng.pdf (viewed Oct 2021)

B. Green Project Selection and Evaluation

Choosing carbon capture or investing in solar-powered aquaponics container farms as a green project has its own merits. The following is a more in-depth analysis of various aspects as a guide for selecting or evaluating green projects.

1. Legislation

The Air Pollution Control Ordinance and its subsidiary regulations regulate various sources of air pollution, including power plants, industrial and commercial processes, construction works, open burning, asbestos-containing materials, petrol filling stations, dry cleaning machines, etc. Hong Kong's existing six objectives of nitrogen dioxide (1 hour and 1 year), sulfur dioxide (10 minutes), carbon monoxide (1 hour and 8 hours) and lead have been set at the most stringent level of the WHO "Guidelines" final objectives. The general environmental industry does not need to worry about exceeding the legal targets through the effective use of carbon capture if industrial processes are involved.

On the other hand, solar-powered aquaponics container farms are basically free from many legal and regulatory difficulties, of course if you sell food fish and crops, you will need to apply for a food manufacturing license and be subject to quality control for food manufacturing.

2. Technology

The most effective way to collect carbon dioxide is to collect it directly from point sources

of pollution, and the most effective way is to operate in the environmental industry's manufacturing area, which involve technologies such as solid state adsorption or chemical absorption, both of which are relatively popular methods on the market.

As for the solar energy aquaponics technology, in fact, this technology has been developed for a long time, now only need to consider solar panels to provide electricity for the container, in order to have the most appropriate environmental protection to the growth of plants and animals.

3. Investment Return

Collecting carbon dioxide can avoid fines or prosecution for exceeding emission limits. In addition, besides pouring carbon dioxide into the deep underground, another way to use carbon dioxide is to convert it into other forms into a reusable resource. For example, plants are planted in greenhouses and supplied with carbon dioxide at higher concentrations than the atmosphere, and the captured carbon dioxide is consumed while promoting plant growth as an agricultural product.

The solar aquaponics technology saves electricity consumption, which means more profit for the products (fish and crops), the installation of containers saves a lot of space, and the rent is the most common item considered by investors, and the investment threshold will be relatively lower.

4. Environmental and Social Impact

Global warming has become a major challenge for mankind in the 21st century, and among the various greenhouse gases emitted, carbon dioxide accounts for about 26% of the total greenhouse gases, making it the main greenhouse gas, and its capture is a direct help to the earth and neighboring communities.

The solar aquaponics technology saves electricity supply from coal, and at the same time, the system is self-sufficient to achieve sustainable development.

There are additional basic factors to consider when choosing a green project:

1. Size of the green project department: The number of members or staff determines the size of the green project that can be planned and affects the operability of the project when it is running.

2. Green competitiveness of suppliers: For example, suppliers can improve the quality of supply chain management, increase corporate social responsibility in the supply chain, upgrade the environmental management system of the supply chain, etc.

C. Green Technology Details – Carbon Capture

1. Market Situation

After the industrial revolution, large amounts of carbon dioxide began to appear everywhere, causing the greenhouse effect and aggravating the global warming problem. Therefore, in order to reduce CO2 emissions, countries not only actively develop renewable energy, but also start to develop Carbon Capture, Utilization and Storage (CCUS) technology. Carbon Capture, Utilization and Storage (CCUS) is a technology that separates and collects carbon dioxide emissions from large power plants, steel plants, chemical plants, etc. and can be reused (direct use: oil and gas production, high concentration of carbon dioxide bio-culture, pressurized into fire extinguishers, dry ice, etc.; indirect use: converted into chemical raw materials such as methanol and methane) or stored in geological structures to avoid emissions into the atmosphere.[2]

2. Scientific Background

VPSA (Vacuum Pressure Swing Adsorption) is a process that uses inlet pressure, product discharge, decompression, and low pressure cleaning to separate carbon dioxide from the flue gas by program control, similar to how activated carbon removes odors from the environment. A set of software that can automatically control all the equipment, once the capture program is written, the computer can operate all the control elements by itself and adjust the program to the state we set.

Another category is CABS (Chemical Absorption), which usually uses an alkaline absorbent solution to absorb carbon dioxide at a lower temperature. Therefore, in the "absorption tower", a lower temperature is desired. When the saturated absorbing liquid reaches the "gas lift tower", it will heat the absorbing liquid to make the solubility of the gas decrease, and the carbon dioxide will be removed from the absorbing liquid to gaseous carbon dioxide, so that the carbon dioxide can be captured.[3]

Because the absorber is acidophilic, substances such as sulfur oxides, nitrogen oxides, hydrogen chloride, and hydrogen fluoride are removed by pretreatment or reaction with the

[2] https://greennet.taipower.com.tw/Page_CCUS/0 (viewed October 2021)

[3] https://greennet.taipower.com.tw/Page_CCUS/12 (viewed October 2021)

absorber, thus reducing the emission of acidic substances and achieving an estimated removal rate of over 90%. Because carbon capture technology can reduce PM emissions, trace heavy metal emissions in the flue gas are also reduced.

3. Advantages

Stable and mature technology, coupled with its excellent environmental protection immediate effect, its capture of carbon dioxide is also easy to show the data, the International Energy Agency (IEA) in 2013 CCS technology blueprint report pointed out that in order to achieve global greenhouse gas emissions in 2050 to half of the 2009 target, CCS technology will contribute to the reduction effect of 14%.

4. Cost Requirement

For example, the clean energy company Carbon Engineering has been able to remove a metric ton of carbon dioxide emissions very cheaply for about $100 through this technology. The most important thing is that only water and some energy are needed, and this is a major case of green chemistry. Even its competitors only need to use about $600, which is a reasonable investment budget.[4]

[4] https://www.circuplus.org/2019/04/09/20190409/ (viewed October 2021)

D. Green Technology Details – Aquaponic Solar Container Farming

1. Market Situation (Existing Technologies and Pain Points)

Geographically, Hong Kong consists largely of steep hillside. Agricultural activities are mainly conducted in the New Territories and urban fringes. As of March 2018, only 7.1 square kilometers were actively farmed, engaging 4,300 farmers, an equivalent to 0.1% of the city's total work force. In recent years, there has been a protracted shrink in local production of vegetable and the annual local production of vegetables has dropped by 66.6% between 2000 and 2016, i.e. from 42,500 tonnes to 14,200 tonnes, which accounts for about 1.7% of vegetables consumption in Hong Kong.[5] Declination in local agricultural activities implies that much of the agricultural land has been abandoned due to the low productivity of conventional farming which requires large area of open land and active application of nutrients. Extreme climate such as drought, floods and typhoons, has also reached far impacts on agricultural production, resulting low fertility soil and limited irrigation water.

Apart from the farmland abandonment problem, agricultural land in Hong Kong was massively converted to container yards and open storage[1] as the container yards and open storage uses could pay higher rent than agricultural use, resulting in general degradation of rural environment, causing nuisance to the local communities and creating problems such as flooding, environmental pollution, traffic congestion and safety hazards to properties and life.

In view of the urban growth, the demand for more land to grow food and changes of public aspirations for food safety is increasing. Aquaponic freight is a new generation of food production system in a controlled environment which can increase food production, improve quality of agricultural products, and increase fish stock without over harvesting of marine food source. Microbial organisms in the system decompose fish waste to provide nutrients for vegetables which in turn filter water source for fish.[6] No pesticide and contamination would be involved. conventional aquaculture, toxicity from fish accumulates in the effluents. Aquaponic combines biofiltration and hydroponics which eliminates the expense and space of a separate biofilter for aquaculture but provides nutrients for agricultural products. Water circulation of the system for recycling of water and waste management is driven by electric water pumps and air pumps. Conventional sources for electricity generation involve burning of fossil fuel which produce toxic air pollutants and greenhouses gases which accelerate global warming. Solar photovoltaic panels, one of the cleanest methods for electricity production, is a good replacement

[5] https://www.legco.gov.hk/research-publications/english/1819issh25-agriculture-sector-in-hong-kong-20190430-e.pdf (viewed on September **2021**)

[6] Food and Agriculture Organization of the United Nations, http://www.fao.org/3/a-i4021e.pdf (viewed on September **2021**)

for the current energy sources. However, the main drawbacks of solar photovoltaic are high initial cost, sunlight dependent, and limited application of direct current (DC) produced.[7]

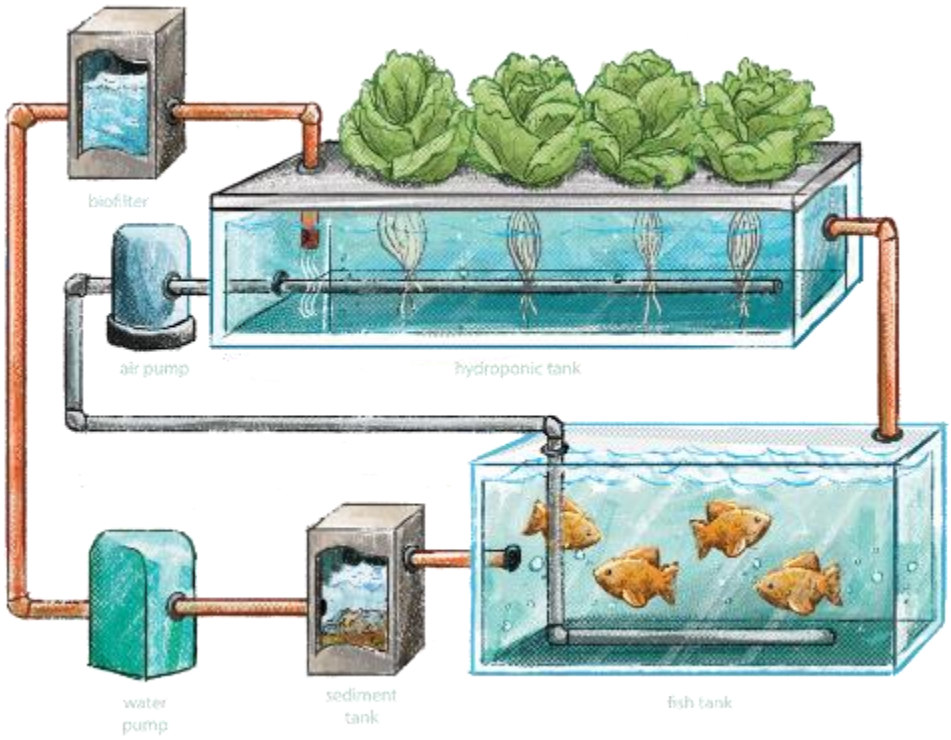


***Figure 1**: Graphic illustration of Aquaponic System*

2. Scientific Background

Freight aquaponics refers to the use of 40-foot shipping containers, normally in service carrying goods around the world. Shipping containers are being refurbished into self-contained vertical farms, complete with LED lights, fish culture tanks, filtration tanks, clarifier tanks, drip-irrigation systems and vertically stacked shelves for starting and growing a variety of plants. The self-contained units have computer-controlled growth management system that allow users to monitor all systems remotely from a smart phone or computers. **Figure 2** shows the exterior view of Freight Farm shipping container.

[7] Guangul, F.M.; Chala, G.T. Conference on big data and smart city, **2019**, ieeexplore.ieee.org

***Figure 2**: Exterior view of Freight Farm shipping container vertical farm*

Water flows by gravity through the filtration tanks on through the vertically stacked shelves and back towards the fish tanks where the water is then pumped back up to the fish tanks, usually via electrical pump. Air blower provides air and thus oxygen to both fishes and plants. Fishes excrete ammonia rich wastes directly into the water of the aquaculture tanks. As the water is being pumped into the hydroponic beds, the dissolved waste nutrients are converted by living bacteria into organic fertilizers needed for plant growth. In return, the plant roots filters and clean the water for fish utilization as it is recycled back into the aquaculture tanks. To guarantee growth and survival of living organisms in an aquaponics greenhouse system, water quality parameters on the recirculating aquaponics system such as water temperature, pH, dissolve oxygen (DO), electrical conductivity (EC), total dissolve solids (TDS), total suspended solids (TSS), salinity, nitrate (NO_3), ammonia (NH_3) levels, as well as the greenhouse environmental parameters such as air temperature, relative humidity (%RH), carbon dioxide (CO_2) and lighting, must be monitored in real-time and automatically controlled. With this process, aquaponics greenhouse allows plants and fish to exist together in a synergetic and controlled ecology that promotes sustainability in agriculture and fishery. **Figure 3** shows the closed loop nature of an aquaponics system.

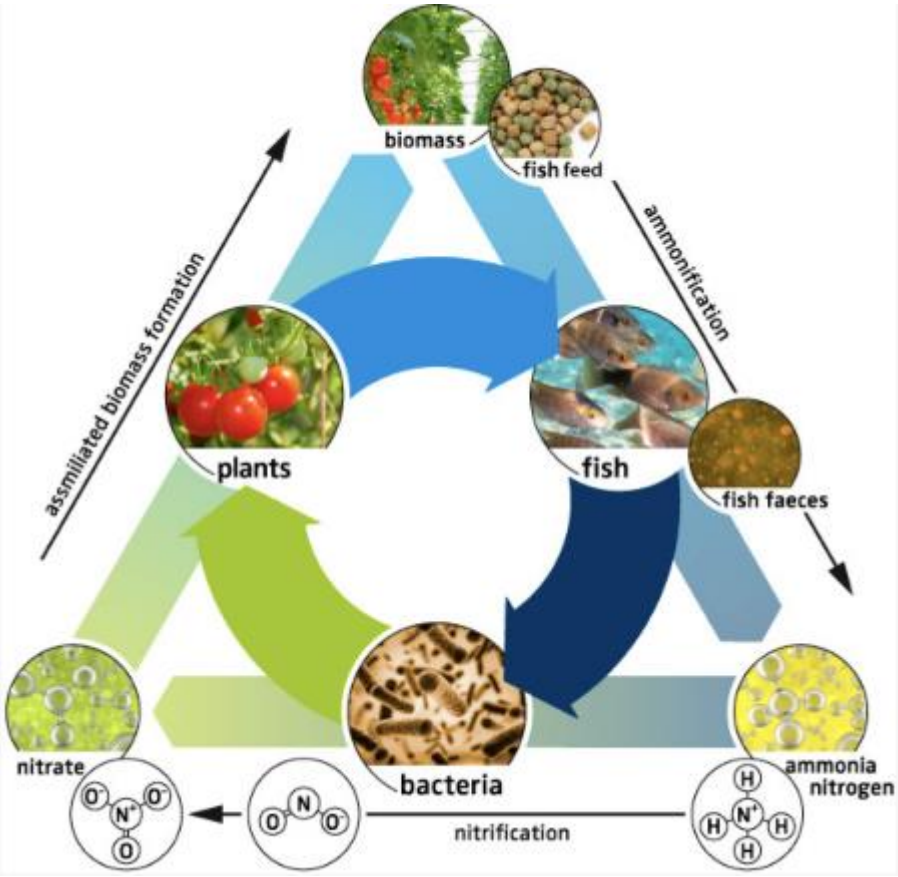


***Figure 3**: Closed loop nature of an aquaponic system*

3. Benefits

Major advantages of Freight Aquaponic Farming are that the farming, fishery, marketing and consumption can be carried out predominant locally. This not only revives the use of abandoned farmlands but also becomes less reliant on imports. The aquaponic freight system can be relocated wherever is most convenient, reducing supply chain length and thus food loss during transportation. Other obvious advantages are the reduced land and chemicals usage, and weather dependence. The amount of water required is also over 90% less than that of conventional agriculture.

Freight Aquaponic Farming promotes employment opportunities, especially for low-income workers. Moreover, studies have reported that other benefits associated with aquaponic farming activities can increase fruit and vegetable consumption, exercise, social wellbeing, and sense of community coherence.[8] Vertical Farming inside the containers represents a trend to move away from conventional farming which is less profitable but more resource intensive and have a larger carbon footprint.[9] It also can be able to grow a variety of products at any given time

[8] Mansfield, B.; Mendes, W. *International Planning Studies*, **2013**, *18*, 37

[9] Yuttitham, M. *Environment and Natural Resources Journal*, **2019**, *17*, 78

throughout the year and produce far greater quantities of food per square meter than traditional forms of farming.[10] Furthermore, more vegetables can be produced and consumed locally.[11] Short food supply chains enable the provision of high-quality niche products which can be sold at premium prices.

The rise of Freight Aquaponic Farming technologies has been instrumental in improving food security for urban dwellers without the use of hazardous chemicals such as insecticides and pesticides. All vegetables and edible flowers are simply grown vertically indoor with seeds and water, without using soil and fertilizers such as ammonium nitrate which is supplied by the dissolved fish waste. The aquaponic farming can optimize water delivery to plants at different stages of growth by drip irrigation which continuously reuse water and average just 5 gallons of water a day for up to 4,000 plants. For a 40-foot shipping container (about 320 sq. ft.), it can produce 4,000 plants each month by staggered growth approach. Plants are grown inside a fully controlled indoor environment at different stages with sufficient time between seeding and harvesting. Unlike the sun, the light intensity of Light emitting diodes (LED) in indoor farming doesn't change which give plants the same consistent and directional light. The LEDs can also be customized to emit only red and blue light since plants only have receptors for red and blue light, accelerating the photosynthesis of plants and thus increase the productivity.

4. Conditions for Application & Limitations

The major challenges of Freight Aquaponic Farming are the capital investment and operating expenses. It also requires skilled management and various sensors Internet of Things (IoT) system based aquaponic monitoring. To recover the high capital cost and operating expenses of aquaponic systems and earn a profit, both the fish rearing and the hydroponic vegetable components must be operated continuously near maximum production capacity.

Since plants are grown inside the container, there is a strong need for artificial lighting for photosynthesis which implies high electricity cost. Another challenge closely related to lighting is the level of heat by-product that is produced. This could be particular concern in summer when it may require additional air conditioning. The need to create a humid environment that maximizes plant growth incurs additional costs for the operators.

[10] Kalantari, F.; Tahir, O.M.; Joni, R.A.; Fatemi, E. *Journal of Landscape Ecology*, **2018**, *11*, 35

[11] Van der Schans, J.W.; Wiskerke, J.S.C. Sustainable food planning: evolving theory In A. Viljoen and J. S.C Wiskerke **2012** (Eds).

and practice. Wageningen Academic Publishers pp. 245

5. Show case(s)

Assuming there are 4 containers for Solar Aquaponic solution, with solar PV system installed on metal roof of containers. Investors are engaged for the investment on the solar PV system and the four aquaponics containers. The income from the FiT scheme income is shared between the investor and the landlord of the agriculture land.

a) Solar PV System

Under the Standard Testing condition (STC),[12] the peak solar power generated by the PV system on the metal roof of the 4 containers shall be not less than the peak power output, i.e. around 10.8kWh.

The detailed PV system layout drawings for the buildings and the estimated amount of electricity that can be generated, as well as the projected annual tariff revenues, are set out below. A total solar system capacity of 10.8 kW can be installed on the rooftop, generating an estimated 10,800 kWh of electricity in the first year. The rooftop will have a FiT of HK$5 per kWh. The electricity revenue generated by the solar system of 10.8 kW would amount to an estimated HK$54,000 in the first year.

Estimated Solar PV system Profit and Cashflow

Year	Estimated Electricity Generation in kw	Estimated Project Income in HK$
1	10,800.00	54,000.00
2	10,764.36	53,821.80
3	10,728.84	53,644.19
4	10,693.43	53,467.16
5	10,658.14	53,290.72
6	10,622.97	53,114.86
7	10,587.92	52,939.58
8	10,552.98	52,764.88
9	10,518.15	52,590.76
10	10,483.44	52,417.21
11	10,448.85	52,244.23
12	10,414.37	52,071.83
12 Years	127,273.44	636,367.22

b) Freight Aquaponic Vertical Farming

The price and the plant lifecycle of lettuce are about the average between Veggies and edible flowers among all the plan species the company planted, which will be used here in the scenario below:

[12] It is the testing and conditions to measure PV cells or modules nominal output power. All necessary solar arrays combiners, racks, controllers, inverters, circuit breakers, fuses, connectors, power cables, and conduits and associated accessories to facilitate the PV system are installed in switch rooms

- Veggies: Lettuce

Capacity of each Container: 4000 crops
Lettuce harvest cycle: 22 days
Number of heads of lettuce per month: 1.36
Wholesale price per head of lettuce: $6 per head
Sales generated per month per container: $32,727 per month
Monthly operation cost per container: $12,285
Net profit per month per container: $20,442

- Edible Flower

Capacity of each Container: 2000 crops
Flowers harvest cycle:7 days
Number of flowers per month: 40,000
Wholesale price per piece of flower: $1 per piece
Sales generated per month per container: $40,000
Monthly operation cost per container: $7,000
Net profit per month per container: $33,000

Assuming the price and the life cycle are all average between the plant species, the average monthly income for the 4 containers is about $106,000.

12 Years' Sales generated by Freight Aquaponic Vertical Farming ($106,000 x 12 months x 12 years)	HKD$15,264,000

c) Project Investment

Items	**Solar System**	**Freight Aquaponic**	**Total**
Solar System	300,000		300,000
Aquaponic Equipment		1,828,000	1,828,000
Aquaponics Containers		690,300	690,300
Total			2,818,300

d) Investment Payback Period in 3 Years

Year	**Estimated Solar PV Income**	**Aquaponic**	**Yearly Income**	**Breakeven Calculation**

1	54,000	1,272,000	1,326,000	1,326,000
2	53,821	1,272,000	1,325,821	2,651,821
3	53,644	1,272,000	1,325,644	3,977,465
4	53467	1,272,000	1,325,467	5,302,932
5	53290	1,272,000	1,325,290	6,628,222

Chapter 3. 《Building a Green Finance Framework & Green Technology Application Notes》

A. Background

The International Capital Markets Association (ICMA) published its first Green Bond Principles in 2014, which included the overall environmental, social and governance framework of green bond issuers as one of the issues that investors in green bonds may consider. In June 2018, the Green Bond Framework appeared in the External Review section of the Green Bond Principles, recommending an external review to confirm that an issuer's green bond framework is consistent with the four core components of the Principles. The Green Bond Framework was further identified as a key recommendation to improve transparency by recommending that issuers summarize relevant information in the context of their overall sustainability strategy and the four core components of the Principles. Overall, there are five key recommendations for an issuer's green finance framework, namely, company profile, use of proceeds, process for evaluating and selecting projects, management of proceeds and reporting.

B. Details of the Green Financial Framework

1. Company Profile

In order to introduce a company to investors or those who may be interested in its green projects, it is important to remove the concerns of stakeholders about "greenwashing". According to Investopedia, a U.S. website, greenwashing is defined as "the process of conveying a false impression or providing misleading information about how a company's products are more environmentally friendly. Greenwashing is a claim that lacks evidence to deceive consumers into believing that a company's products are environmentally friendly. Green financing can be a marketing tool to build a company's green image, but it is critical to ensure that a strong link is established and maintained between green finance initiatives and the company's overall sustainability strategy. It may seem difficult to establish such a strategy and require professional

advice, but it can be put into simple terms. This linkage can directly and easily describe how sustainability is one of the key success factors in achieving a company's long-term business success.

The ability to generate business ideas, control operating costs and build reputation are key elements of the small and medium-sized enterprise (SME) survival toolkit, and it should not be difficult to find good reasons to associate green projects with them. Environmental Industry SMEs can look to industry pioneers such as Everbright Environment to develop their sustainable development strategies.

「As of 30 June 2021, environmental energy had invested in 217 projects, commanding a total investment of approximately RMB86.792 billion, and undertook 1 O&M project. These projects are designed to have an annual household waste processing capacity of 49,019,500 tonnes, which is expected to generate annual on-grid electricity of 16,482,010,800 kWh, an annual food and kitchen waste processing capacity of 2,131,600 tonnes, an annual sludge treatment capacity of 321,200 tonnes, and an annual medical waste processing capacity of 10,950 tonnes. Everbright Environment is the first organisation to create and develop an environmental protection industrial park model. As of the end of 2017, Everbright Environment opened 12 parks with Chinese characteristics in Suzhou, Changzhou, Suqian, Zhenjiang New Area, Yixing, Lianyungang Xuyu New Area, Nanjing, Xinyi of Jiangsu Province, Weifang of Shandong Province, Ganzhou of Jiangxi Province, Lankao County and Ruzhou of Henan Province. In line with its philosophy of "Integrated Planning, Logical Arrangements, Better Land Utilization and Centralized Handling", and following its principles of "Implementing Projects with One Success Followed by Another", the company has made full use of local resources within the parks and shared infrastructure in order to recycle solid waste and increase the levels of energy conservation and effectively reduce emissions. The ultimate goal is to achieve nil discharge, and establish the parks as modern environmental protection industrial parks, as well as turn them into bases for promoting industrial tourism and environmental protection education.」

Reference：

https://www.cebenvironment.com/en/business/energy_protection.php

「It is the policy of Dunwell to achieve and maintain a high standard of environmental care in conducting its business as an environmental and industrial company. Dunwell's approach to environmental management seeks to continuously improve its performance by keeping abreast of emerging environmental technology, changing customer needs and community expectations. Specifically, it is Dunwell's policy to: comply with or exceed all applicable laws, regulations and standards; and minimize any adverse environmental impact resulting from its operations, products or services; ensure that its employees, contractors and suppliers of goods and services are fully informed of this policy and are aware of their environmental responsibilities in conducting business with Dunwell; continue providing personnel training to enhance employees' awareness of environmental protection; adopt 14000 Environmental Management Systems to identify, control and monitor environmental impact arising from its operations; conduct continuous research and establish or support programs to conserve and recover resources, minimize waste generation, use recycled products and improve processes; help educate local industrialists and the public at large their environmental responsibilities, and the proper means to dispose of wastes, to recycle and reuse precious resources.」

Reference：
https://www.dunwellgroup.com/AboutDunwell/EvnironmentalPolicy.html

「Originated in 1980, Baguio Green Group (stock code: 1397.HK) is committed to creating and maintaining a "Clean & Green" environment for society. Over the years, Baguio has developed into a group of well-established and socially responsible companies providing integrated environmental services, ranging from Professional Cleaning, Recycling, Waste Management and Collection, Horticulture and Landscaping, and Integrated Pest Management to the HKSAR Government, public utilities, and private corporations. As a socially responsible company, we adhere to the principles of sustainable development and environmental protection in our business operation to build a more "green", healthier and better environment. With the notion of customers first and striving for excellence, our professional team is dedicated to meeting the needs of different customers while continuously enhances our service performance to go above and beyond customer and social expectations, and thus gaining trust from our customers.」

Reference：
http://www.baguio.com.hk/en-US/about-us/introduction

2. Use of Proceeds

In order to implement the sustainability strategy described in the previous section, it is necessary to describe the types of eligible green projects that the Company wishes to qualify for the use of the funds raised. The list of eligible green project categories is a core part of the first core component of the Green Bond Principle (GBP) and the Green Loan Principle (GLP). Eligible green projects should have clear environmental benefits that are evaluated by the company and, where feasible, quantified, measured and reported.

Typical examples of the types of eligible green projects related to the logistics sector as listed in GBP and GLP.

- Renewable energy (including production, transmission, appliances and products).
- Energy efficiency (e.g. new and renovated buildings, energy storage, district heating, smart grids, appliances and products).
- Pollution Prevention (including air emission reduction, greenhouse gas control, soil remediation, waste prevention, waste reduction, waste recycling, and energy/emission efficiency waste).
- Clean transportation (e.g., electric, hybrid, public, rail, non-motorized, intermodal, clean energy vehicle infrastructure, and hazardous emissions reduction).
- Green buildings that meet regionally, nationally or internationally recognized environmental performance standards or certifications.

The description of restrictions on the use of proceeds is also expected to be stated in the Green Finance Framework. Typical restrictions are that the funds raised may not be placed on the IFC's published exclusion list.

(Reference：https://www.ifc.org/wps/wcm/connect/ topics_ext_content /ifc_external_corporate_site/ sustainability-at-ifc/company-resources/ifcexclusionlist)

3. Process for Project Evaluation and Selection

After identifying the types of eligible green projects, the next step is to evaluate potential green projects against a set of selection criteria that will help the company apply the funds raised to the projects desired by the company and the investors/lenders. The purpose of this section of the Green Finance Framework is to provide investors/lenders with detailed information on the environmental sustainability objectives of eligible green projects, the process of evaluating and selecting potential green projects, and the process of identifying and managing the social and environmental risks expected to be associated with the evaluated green projects. Typical details on related topics can be found in the following table：

Topic	Typical Content	Remark
Responsibility	The evaluation of the technical and quality characteristics of the project can be provided by the supplier or contractor, and the SME operator can make the final approval.	Cross-functional groups (if applicable) are desirable, but not required.
Environmental efficiency KPIs（KPI）	Typical KPIs include annual electricity generation (kWh per year), annual electricity savings (kWh per year), reduction in air emissions (mg/kg km), fuel savings (liters per km), and green certification.	There is expected to be a clear link between the environmental benefits of qualifying green projects and the company's overall sustainability goals. Where possible, KPIs can be translated into an annual reduction in greenhouse gas emissions.

Environmental Risk	Conduct environmental impact assessments in accordance with applicable regulatory requirements or internal methodological requirements to identify and mitigate significant risks related to environmental aspects (pollution of air, soil and water, solid waste, noise and depletion of natural resources).	Significant risk may mean that the risk will lead to legal violations and objections in the public domain.
Social Risk	Conduct environmental impact assessments in accordance with applicable regulatory requirements or internal methodological requirements to identify and mitigate significant risks related to the welfare and well-being of the community (population displacement, unemployment, and occupational health and safety issues).	Significant risk may mean that the risk will lead to legal violations and objections in the public domain.
Investment Return	Where applicable, the project savings over time can be estimated and used to calculate the return on investment.	In addition to saving money, environmental benefits are also a key factor in determining returns.
Process	The self-assessment mechanism and selection criteria described in Chapter 1 can be used.	Selection rules may define a minimum self-assessment score for eligible green projects and/or all eligible projects are prioritized for selection based on the self-assessment score until funds are used.

4. Management of Proceeds

In order to allay investor/lender concerns about the actual use of the proceeds, particularly the placement of proceeds in non-qualified green projects that could affect the Company's ability to complete qualified green projects, it is necessary to explain how the utilization of the proceeds will be controlled and tracked. Temporary use of uncommitted proceeds is permitted, but the proceeds can be withdrawn if necessary, to ensure that progress on eligible green projects is not compromised. The types of investments that should be made available in the green finance framework for temporary use of proceeds.

5. Reporting

Regular updates on the use of funds raised are expected to be the minimum requirement, with typical reporting intervals being once a year. In addition to the return on investment, environmental benefits are the most expected return on green finance projects. The GBP and GLP describe the value of transparency in communicating the expected impacts of the project. For investors/lenders to understand the progress of eligible green projects and the achievement of Key Performance Indicators (KPIs), the description of project monitoring in the Green Finance Framework will provide more confidence to investors/lenders. Further guidance on project management and project monitoring is provided in the next chapter.

As carbon neutrality is at the top of the investor/lender agenda, the ability to report on the project's impact in terms of carbon emissions is another feature that may be welcomed by investors/lenders. Translating KPI results into carbon reductions is one thing, another challenge is to measure these results without spending too much resources and effort on data measurement, collection and calculation. Therefore, it is recommended that smart metering and automated systems be used to report impacts and carbon emissions, and that these costs can be included in the funding of eligible green projects.

C. Green Technology Application Notes

1. Solar Aquaponic System – Main Application

Solar Aquaponics refers to a renewable energy and food production system that couples Photovoltaics and aquaculture with hydroponics whereby the renewable energy supply electricity to the electrical facilities. The system composes of 3 elements:

a. Freight Aquaponic Vertical Farming
b. Solar PV System
c. Distribution

a) Freight Aquaponic Vertical Farming

It is a bio-integrated food production system, where water from the fish tanks pass through filters and grow beds and back to the fish tanks. Filters remove the solid waste and the filters and the surfaces of the system itself act as a means for bacteria to convert dissolved wastes into beneficial nutrients. Nitrifying bacteria convert ammonia from fish wastewater, first to nitrite which is toxic to fish and plants and then to nitrate, which is easily and readily acceptable by plans and not as toxic to fish at appropriate levels.

b) Solar PV Renewable Energy System Selling Feed-in-Tariff Scheme

The Feed-in Tariff (FiT) Scheme is an important new initiative to promote the development of renewable energy under the current Scheme of Control Agreements (SCAs), which were signed between the Government and the respective two power companies in April 2017. Under the scheme, people who install solar photovoltaic (PV) or wind systems at their premises can sell the renewable energy they generate to the power companies at a rate as high as about five times more than the normal electricity tariff rate.

- HKD 5- | >10kW
- HKD 4- | 10kW to 200kW
- HKD 3- | 200kW to 1000kW

Solar PV system shall be provided to generate the electricity for the On-grid system. The system shall consist of solar panels, array combiner boxes, solar DC-AC conversion systems (PV grid interactive inverter), and other associated components.

c) *Freight Aquaponic Farming Distribution*

Freight aquaponics simply refers to an aquaponics system that goes upwards. This can increase the amount of growing space you have without the need for more floor space.

According to the data analysis, aquaponic solution can ultimate efficiency:

- Space Efficiency: ñ 7.5x
- Grow Speed: ñ 2x
- Grow Cycle: ñ 2x – 3x

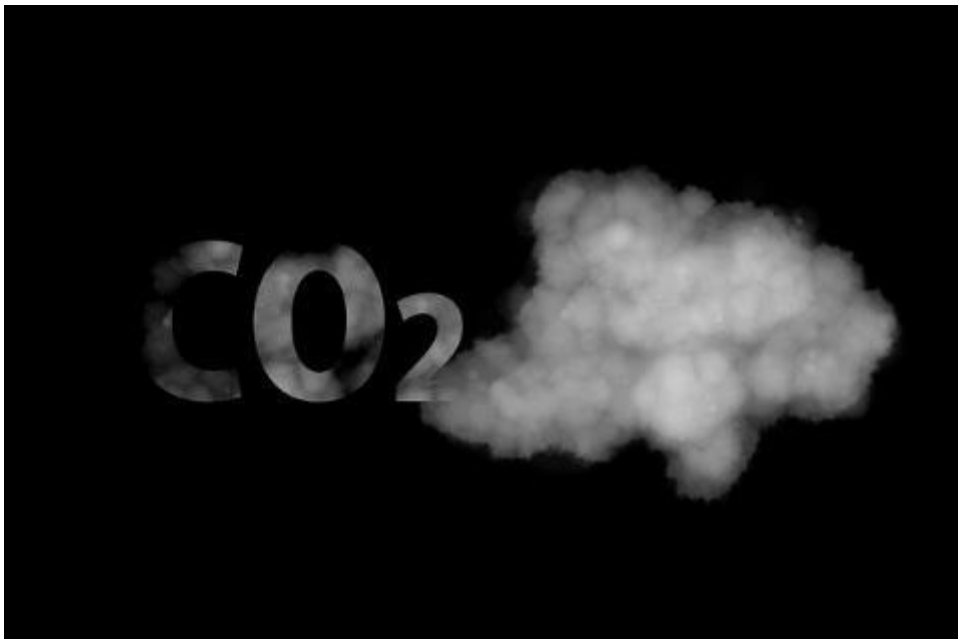
ñ 30x more efficient than outdoor farming

2. Carbon Capture – Main Application

Carbon capture currently has an installed capacity of about 40 million tons/year worldwide. This must increase more than 100-fold by 2050 to achieve net zero emissions and meet the Paris Agreement targets. Countries are investing more in CCUS projects, and in 2019, for the first time, CCUS technology will be on the agenda of the Group of Twenty (G20) Energy and Environment Ministerial Meeting. Since this year, more than 30 new CCUS facilities have been announced worldwide, and governments and industry have committed more than $4.5 billion in funding to CCUS projects in 2020.

Large point sources of CO2 include large fossil fuel or bioenergy facilities, major CO2-emitting industries, natural gas production, synthetic fuel plants, and fossil fuel-based hydrogen plants. The deployment of technology is mostly focused on places that "emit a lot of CO2," i.e., thermal power plants, or environmental industry plants, and major corporations are beginning to invest in environmental improvements. On February 8, Tesla founder Elon Musk announced a US$100 million (NT$2.8 billion) prize to be awarded to the person or group that develops the best

"carbon capture technology" within four years to encourage people to find a way to effectively capture carbon dioxide in the atmosphere.[13]

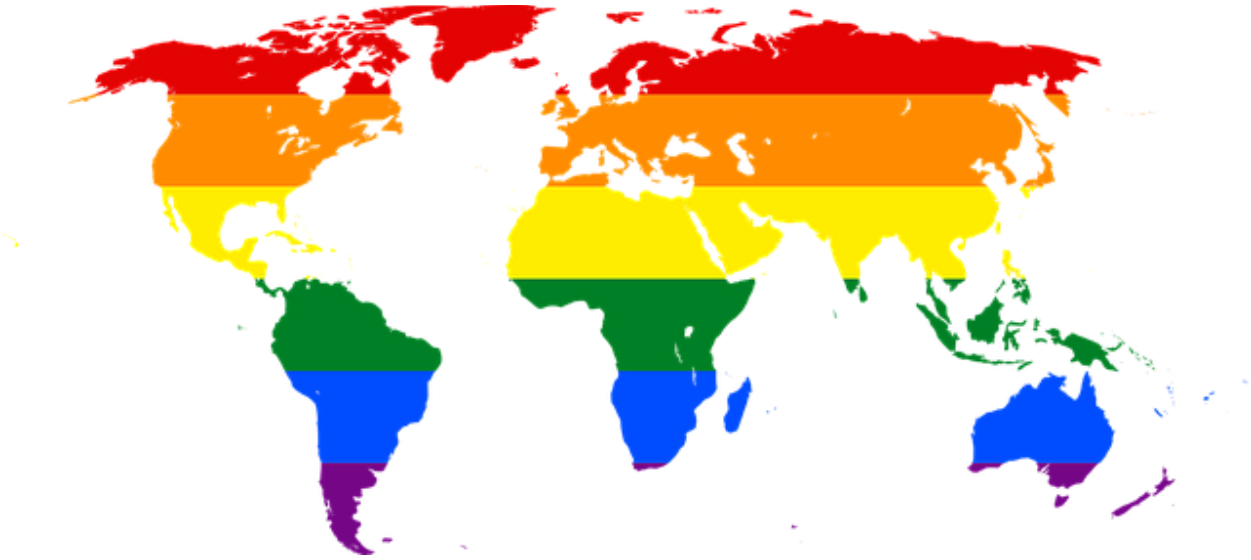


[13] https://pansci.asia/archives/315781 (viewed October 2021)

Chapter 4. 《Green Project and Fundraising Management & Green Technology Operation and Maintenance》

A. Background

Green projects have the same characteristics and risks as other types of real-life projects, and every green project should be managed properly to ensure that it produces the desired results. In 2020, the International Organization for Standardization (ISO) published the international standard ISO 21502 to provide guidance on project management. Project management is described in the standard as "the coordinated activities that guide and control the achievement of consistent objectives" and further elaborates that "project management is necessary for the execution of a given project through a series of processes and methods that include systematic design and practice". The key themes to be discussed in this chapter will be the agreed objectives and the systems to achieve them.



B. Green Project Management and Fundraising Management

1. Key Performance Indicator (KPI)

First, project objectives and KPIs should be defined. In the direct capital market, investors/lenders place great importance on KPIs linked to environmental benefits, and expected returns are as important as repayment. When defining KPIs for eligible green projects, it is important to understand the company's overall sustainability objectives and the concept of environmental benefits. ICMA, the International Capital Markets Association, published a "Handbook - Harmonized Framework for Impact Reporting" in June 2021 for setting metrics for eligible green projects (reference): https://www.icmagroup.org/assets/documents/Sustainable-finance/2021-updates/Handbook-Harmonised-Framework-for-Impact-Reporting-June-2021-100621.pdf The Handbook can provide SMEs with useful guidelines and examples to determine the appropriate KPIs for their projects. In addition, it is important to map the results of eligible green projects in relation to the UN-advocated Sustainable Development Goals (SDGs) (ref:

https://sdgs.un.org/goals) to showcase projects that ICMA has published the "Green, Social and Sustainable Development" bond: High Level Mapping of SDGs June 2020, where SMEs can find useful tips for mapping their eligible green projects to SDGs. Typical examples are：

Qualified Green Projects	KPI	SDG
Carbon Capture	1) Annual carbon captured (tonnes) 2) Annual greenhouse gas emission reduction (tonnes of CO2)	SDG7 Affordable Clean Energy
Aquaponic Solar Farming System on Container	1) Annual saved energy consumption (GJ) 2) Annual greenhouse gas emission reduction (tonnes of CO2)	SDG7 Affordable Clean Energy

2. Evaluation and Selection of Green Technologies

Since eligible green projects involve green technology, SME staff who understand the technical details need to know information about the compliance, feasibility, benefits, reliability, timing and lifecycle, and operational requirements of the equipment involved in each project. The information is then evaluated by the SME owners and their staff responsible for finance, operations, and sales and marketing.

It is critical for SMEs to identify operational risks and determine whether they can be managed to a reasonable level in terms of legal and financial liabilities. SMEs need to be prepared to meet the challenges of investors/lenders regarding the reasons for choosing green technology. SMEs need to be aware of the possible options in the market and justify their decision that "business as usual" or compliance with legal and regulatory compliance may not be welcome.

3. Project Planning and Monitoring

To demonstrate an SME's ability to execute green projects, a well-thought-out project plan is required. Given the small size of eligible green projects for SMEs, a simple project plan with a list of tasks and control points, assignment of responsibilities and timeline is sufficient.

Project Name:	Aquaponic Solar Farming on Container			
Project Reference Number:	GF_2021_AF			
Project Members:	Peter, Paul, Mary			
Jobs	Output	Responsible person	Start Date	Completion Date
Project Launch	Project plans, specifications, project monitoring report forms	Paul	2021.6.1	2021.6.7
Procurement of equipment and construction services	Quotations	Mary	2021.6.9	2021.7.14
Quotation evaluation (Control Point 1)	Equipment and Contractor Services	Peter, Paul, Mary	2021.8.1	2021.8.5
Project kick-off meeting with suppliers and contractors (Control Point 2)	Method statements and drawings, equipment lists, test plans and test acceptance criteria for functional testing, operation and reliability	Peter, Paul, Mary	2021.8.21	2021.8.23
Equipment Testing (Milestone 1)	Equipment Test Results	Peter, Paul, Mary	2021.10.15	2021.1.5
Installation Engineering	Installed solar panel, controlled system.	Vendors and Contractors	2021.10.22	2022.1.30
Complete installation test (Milestone 2)	Installation test results	Paul	2021.11.15	2022.2.10

Equipment testing and installation supervision	Notes for reporting at project supervision meetings	Paul	2021.10.15	2022.2.10
Quarterly project monitoring meetings (Control Point 3)	Follow-up and improvement measures	Peter, Paul, Mary	2021.9.1	2022.2.15

An effective project monitoring mechanism will further gain investor/lender confidence and should ensure that the project is on the right track and that project tasks and milestones are completed as planned. If delays or quality issues arise, immediate remedial action will be required.

The following table provides details of a typical project monitoring report：

Project Monitoring Report			
Project Name:	Aquaponic Solar Farming on Container	Project Reference Number:	GF_2021_AF
Responsible Person:	Paul	Commencement Date:	2021.6.1
Monitoring Distance:	Every two months	Project Completion Period:	2022.2.15

Monitoring Schedule	Executive	Satisfactory progress?	Output Satisfaction?	Questions, corrective measures and follow-up of results
2021.8.1				
2021.10.5				
2021.12.3				
2022.1.3				

4. Fund Raising Management

Typical management is to keep the proceeds in a dedicated account and record all incoming and outgoing transactions in a register of proceeds. This requires a staff responsible for compilation and verification. An example of a book of proceeds is as follows：

Fund Raising Capital Register			
Green Finance Reference：	GF_2021		
Amount of registered capital raised：	HK$10 million		
Qualified Green Projects 1：	Aquaponic Solar Farming on Container	Project Reference：	GF_2021_AF
Qualified Green Projects 2：	Carbon Capture	Project Reference：	GF_2021_CC

Date	In、Out	Marker Reference	Trading Instructions	Amount
July 2, 2021	In	GF_2021_1	First drawdown of funds raised	3,000,000
July 2, 2021	Out	GF_2021_3	Fixed Deposit	1,000,000
July 5, 2021	Out	GF_2021_AF_1	Aquaponic Solar Farming System Purchase and Set Up	500,000
July 10, 2021	Out	GF_2021_CC_1	Carbon Capture Equipment Purchase	100,000

Producers: Mary

Verifiers: Paul

C. Green Technology Operation and Maintenance Manuals

The use of green technology is bound to have a series of operational needs and occasional damage situations, so it is necessary to develop a program or code of practice, including the response to unexpected events, the following will provide a detailed example of aquaponics, as a reference for the operation and maintenance manual.

The three main operational elements in an aquaponics system are

- Nitrification system (nitrogen cycle)
- Planting bed type
- Water circulation system [14]

The main types of planting beds are Media Filled Beds， Deep Water Culture (DWC) and Nutrient Film Technique (NFT).

The medium filled bed is clean, light, high permeability, reusable, can keep earthworms, easy to plant and harvest, can plant woody species, porous with nitrifying bacteria, dry and not easy to have worms; deep water culture (DEC) type planting fast, fast harvest, convenient to expand the planting area, large root system, fast absorption, but the water should keep big belly fish or Gai Pan fish (eating mosquito larvae), nutrient film technique (NFT) type water must first clear bottom sedimentation and filtration, easy to have problems in high temperature environment. However, solar panels can improve the problem of temperature instability by changing the power supply inside the room to keep the temperature at the best position.

14 http://web.asvs.tn.edu.tw/userfiles/%E6%95%99%E5%8B%99%E8%99%95/%E5%84%AA%E8%B3%AA%E7%B2%BE%E9%80%B2/%E9%AD%9A%E8%8F%9C%E5%85%B1%E7%94%9F%E7%B0%A1%E4%BB%8B.pdf (viewed October 2021)

The following are the important points to note in the maintenance operation:

- Fish Feeding

Today's professional fish feeds provide exact amounts of protein, carbohydrates, fats, vitamins, amino acids and minerals. In a hobby or ornamental system, feeding your fish only once a day is sufficient. If food production is your goal, you will want to maximize your efforts and feeding frequency. Most commercial growers will feed three times a day. Hand feeding gives you the opportunity to observe the fish and their feeding habits. You can also use a timed mechanical feeder or use an on-demand feeder so that the fish can eat when they are hungry.

- Plant seeding, rotation and harvesting

When planting fast maturing leafy crops, such as lettuce and herbs, you should plant often so you can ensure a consistent harvest. For leafy crops, when you harvest, you sow and transplant the same number of plants as you harvested.

Many long-lived crops of indeterminate varieties, such as tomatoes and melons, take months to produce.

- Observation and Monitoring

Every day you should visually inspect the fish and the system. Make sure the water is flowing properly, the aeration system is working, and the drains are clear of debris. Observe that the fish are eating vigorously and swimming properly. Observe for problems such as fungus, split ends, torn fins or discoloration, and check the water temperature and pH. Observe plants for harmful bugs and insects. Remove any dead plant material.

- Water Quality Testing

Anyone serious about aquaponics should invest in a water quality testing kit that will allow you to measure and track pH, ammonia, nitrite, nitrate, dissolved oxygen, alkalinity and water hardness. Most of the kits sold are easy to use and are based on the color change of the sample being tested. Meters for measuring dissolved oxygen, temperature and other factors are also available.[15]

[15] https://aquaponics.com/aquaponics-day-to-day-operation/ (viewed October 2021)