How to plan your AquaPrawnics utility?

AquaPrawnics is a new clean-tech concept within industrial agriculture. AquaPrawnics enables and enforces organic agriculture. It integrates various well-known and usually independent agricultural production methods into one operation and thus achieves synergetic effects. The following production methods are integrated in the AquaPrawnics system:

1) Biochar production,
2) Production of saltwater shrimp and prawns in an indoor environment,
3) Vertical farming and the utilization of CO_2 from biochar production,
4) Production of algae for several purposes such as
   a) Food for shrimp
   b) Amendment to biochar to create organic fertilizer /soil amendment.

The different production processes enhance and support each other. If production is integrated properly, the system creates synergy effects that have a measurable positive impact on the economic outcome of the entire integrated system.

In order to achieve maximum profitability, an AquaPrawnics utility needs to be planned carefully in accordance to local conditions. The better the project is tailored to these conditions the better the financial outcome of investments.

Local fuel availability, biochar production, and sale

One of the main elements in an AquaPrawnics concept is the production of biochar through pyrolysis. Pyrolysis is the thermal decomposition of biomass at elevated temperatures (200-300 °C or 390-570 °F) in a closed environment without the use of oxygen. Pyrolysis is one of the processes involved in charring wood. Through pyrolysis, biomass is split into syngas and biochar. The syngas is used for energy production (heat & electricity) and is utilized to drive the AquaPrawnics utility. Biochar is amended with fertilizer, and is a valuable resource in organic agriculture, horticulture, and similar activities. It increases soil fertility, has the capacity to keep water in the soil, and can also create lucrative revenue streams. The tailoring of revenue streams in accordance to local demands need to be planned carefully straight from the start.

In principle, all biomass can be used as “fuel” for the pyrolysis process. Fuel can be waste wood or woody products, straw, nutshells, or even municipal organic waste like kitchen scraps. Biomass should be clean (no pesticides, chemicals, etc.), because biochar is later used for organic food production as a soil amendment. Our smallest unit for a biochar production is a process capacity of 13 tons per day. An economically viable production volume is about 40 tons of biomass per day.

In planning an AquaPrawnics-utility it should be made certain that the appropriate amount of biomass is available over the entire lifetime of the utility – at least for 15 years. By processing 40 tons of biomass per day, an annual amount of about 14,000 tons of biomass is required (350 days per year processing of 40 tons per day).

However, an annual production of 14,000 tons of biomass will generate about 3,500 to 5,500 tons of biochar per year, depending on the process temperature and on the type of biomass. Processing straw is done with a lower temperature than for example woody biomass, and biochar from straw has shown excellent effects on plant growth in scientific studies. In the beginning, fuel availability for projects and assessment of the local markets ability to absorb production should be done. Biochar can be used in an amended form for organic food production and can replace conventional fertilizers. Organic agriculture has a high demand for organic fertilizers, which is at the same time cheap and long-lasting. Compared to conventional fertilizer, amended biochar does not need to be used every year but rather every 4th or 5th year, and it does not exaggerate natural soil fertility but rather builds it up.

If local conditions do not allow such a supply of biomass and the preference is to focus in future AquaPrawnics utility rather than on, for example, indoor farming of shrimp and production of groceries only, another cheap energy source should be available. It should be known what prices will be paid for that energy in order to demonstrate economic viability of the project. It can make sense to plan such a project in proximity to a cheap energy source. As an example, a project located in an area with hot springs, or positioning close to a power plant with sufficient excess heat and cheap electricity. If the project is positioned in an area with much sun, solar can be used as an energy source.

In order to calculate a proper financial model an estimation of how much local markets are willing to pay for organic soil amendment should be made. However, it is also possible to blend the soil amendment into compost. This product can also be sold as fertilized potting soil or similar. Properly planned, fertilized potting soil can be bagged and sold in garden centers at relatively high prices.

Indoor production of saltwater shrimp or prawns

Another important element of an AquaPrawnics utility is the indoor production of shrimp or prawns. There is a minimum size for such a production of 13,000 sqft, which generates about 120,000 lbs. of shrimp annually. Scaling up production will demand a new and separate building or closed section of a building for that new production. With larger operations always keep production units separate in order to minimize contamination risks. If demand exceeding 120,000 lbs. and a higher production is eventually wanted, then a larger building should be planned for straight from the start to subsequently be put into use as demand develops. However, in such a scenario, section the building and keep each 13,000 sqft-unit in a separate part of the building. Thus, contamination risks are reduced.

Financial models for production will be needed along with an overall financial model for the entire utility. In order to make useful calculations, the local expected retail and wholesale prices for shrimp or prawns should be known. This should be planned in advance with an understanding of future markets. Will the product be sold alive or frozen? There are certain restaurants who love shellfish as fresh as possible and are willing to pay a higher price for living products. In the case of freezing, an appropriate processing and storage facility will be needed. Another option is to sell the shellfish to a processing company or arrange a cooperation with such a company. Additionally, a combination of the two could be arranged, or even selling retail in a shop connected to the production utility. In order to come up with a proper financial model, plans and local prices expected to be achieved should be established. All these estimation figures will go into the financial model of the AquaPrawnics utility.

In order to understand properly local conditions, the average local temperatures during the year should be known. This information is important due to the fact that, for example, shellfish need a consistent water temperature to grow (28 °C or 82.4 °F). The ambient temperature of the utility may have a significant influence on the energy consumption of the operation.

Indoor farming of groceries

In the same way the shrimp operation is planned, so will greenhouse operations for groceries be planned. Be aware of the prices that can be achieved locally. Especially with production in a greenhouse because products that might be in high demand at certain times of the year can be planned for. The main advantage with indoor farming is to produce independent of any local weather conditions or other local limitations and constraints. This allows for an optimal utilization of this technology. By planning in this way, estimates of average product prices throughout the year can be made thereby giving the background to prove economic viability of the project.

Since greenhouse operations can be labor intensive, labor prices should also be known. Again, this information is highly valuable to understand profitability.

Financial model and proof of economic viability

The more an AquaPrawnics system is adapted to the local conditions and the local market the better the possibility to utilize synergy effects and understand them in regard to the overall profitability of initial capital investments.

A nested financial model will be generated for each project showing separately the economic profitability of each individual line of the overall business model, a summarized breakdown, inclusive return on investment (ROI) projections, and a proforma for the first 5 years of operations. This will stand as a solid background for investment. The financial model is an excellent tool to understand the beneficial effects of the integrated concept, pursue individual optimization, and show its effects on profitability.

Renewable Energy Micro Utility (REMU)

Independent from the AquaPrawnics concept, REMU technology was developed and contracted for use in late 2014 by the Nigerian Ministry of Power to build the world´s first REMU in a remote off-grid village in central Nigeria. The built REMU system today provides solar energy to over 100 customers in the African village.

The developed system comprises of solar power generation and power storage. It includes a fully developed electricity distribution system with smart-meters connected to each user, and an underlying software to perform smart-meter management, demand side management, and transaction processing combined with a suit of other useful functions. The software developed is the brain of the utility and connected through village-wide Wi-Fi or other wireless methods. Through cellphone service, the REMU can be controlled and monitored from any point.

REMU technology can also be used in combination with an AquaPrawnics system. In that way, an AquaPrawnics utility can be positioned in a rural off-grid location. It is able to function as a power supply for an off-grid AquaPrawnics production utility as well as a housing community connected to the AquaPrawnics system.

Utility manual and education program

Since the AquaPrawnics concept is highly rooted in applied knowledge, an important part of the AquaPrawnics business model is education and proper information. Delivery of the necessary hardware for each future utility is key, as is cooperation with each team. This will be based on a long-term knowledge transfer partnership, which goes in two directions. Training of each team to understand all the implications to run a successful AquaPrawnics system will take place, and an appropriate manual which covers the various aspects of all operations in detail will be provided.

This knowledge transfer partnership is also based on the experience gained from models in local environments. To collect local data from all the AquaPrawnics production sites enables continuous improvement of the quality of all the different AquaPrawnics models. That will subsequently benefit projects.

This improvement and education process will continue as long as the AquaPrawnics utility is operational. As a part of the international AquaPrawnics network, projects will be fostered and supported in accordance to the latest knowledge and technological improvements. AquaPrawnics cooperates with various universities and all research will be available within the AquaPrawnics education network.

Time perspectives

An AquaPrawnics system needs good preparation and solid planning. The project starts officially on the day when the development contract is signed, and the initial payment has arrived.

Prior to the start-up day, there is an exploration period where the financial model for a project is generated. Based on that financial model, investment decisions are made. Roughly 6 to 12 weeks need to be accounted for the exploration period to start-up day.

After start-up, the build-up of the utility, training of staff, running of the system to full operation, and revenue generation will take about 12 to 24 months. This may depend on the location of the project and its volume.

New projects will be put into a production pipeline to be executed in the sequence of incoming purchase and development orders. Due to that fact, it might be possible that project start is postponed accordingly.

Questionnaire for planning an AquaPrawnics utility

1. Location of the AquaPrawnics utility and inclusive average temperatures.

2. What products are to be produced and which volumes are being aimed for? The given amount for one production unit is the smallest possible production volume per year. The next higher production size would be two production units.
    a) How many production units of biochar + amendments (1 production unit 1,300 tons/year)?
    b) How many production units of shrimp (1 production unit 120,000 lbs. / year)?
    c) Is a greenhouse operation for groceries planned? Aimed annual production in lbs.?
    d) Is only the produced energy for your AquaPrawnics utility needed or is there a demand for heat or electricity for other purposes. Does this exceed the amount of power needed to run the AquaPrawnics utility?

3. Feedstock for biochar production:
    a) What is the proposed feedstock being planned for processing?
    b) How many tons of that feedstock is available per year for at least the next 15 years?

4. Amended biochar:
    a) Is there a market for organic fertilizer or amended biochar in the proposed area?
    b) What will the customers/markets be?
    c) What are the prices in these markets?
    d) How far away are the local markets for amended biochar?

5. Shrimp / prawns:
    a) What are the local retail prices for saltwater shrimp / prawns?
    b) Who will be the customers? Retail customers? Wholesale customers?
    c) How much transportation from the production utility to the customers has to be accounted for?

6. Groceries:
    a) What are the local grocery prices for an average collection of groceries?

b) How much transportation from the production utility to the customers has to be accounted for?

7. Labor:
    a) What are local prices for uneducated/educated labor per hour?
    b) What are local prices for management per month?

If you are interested in further information, please take contact with us:

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