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Sustaining Human Life in 2050 Renewable Resources Communities

In 1909 Fritz Haber, a German chemist, invented a process for nitrogen fixation into ammonia. Then, Haber and his associate Carl Bosch pioneered a new commercial technology and for the production of ammonia, as a primary ingredient for plant food. This process is known as the Haber-Bosch process, which is now responsible for growing about half of the world's food. It was one of the greatest inventions of the 20th century. Without it, 30-40% of the world's population would not be alive.

Early this year, in an article published by Meister Media Worldwide 2013, Ford West President of the Fertilizer Institute said, "that there are signs, though that the day is closer than ever before, when famine could be eliminated. Untold numbers of smart people are applying themselves to developing the science of crop production all around the world. Advances in crop genetics, plant health, and production technology all contribute to the ability of modern agriculture to produce more than ever before. But, in the midst of that progress, it is still fertilizer that feeds the world. Without the fertilizer industry and the research that helps it fulfill its vital role, food and fiber production per acre could be reduced by as much as half".

The question that we need to ask ourselves today! Are we on the way to global prosperity? In our views, the world should expect gloomier days than those days preceded the time of Haber and Bosch. Unlike the earlier days of the last century, we are now witnessing serious depletion of global fossil energy reserves, while the world is facing massive increase in its population by five (5) folds between 1900 and 2050!

This article briefly reflects the understanding of MIK Technology Company of Houston Texas of the serious dilemma that we are currently experiencing. As well as this company's desire to share in finding a solution to a daunting terminal problem. This emerging Technology Company is adopting new approach in renewable technology development, taking into consideration all the means that sustain human welfare in 2050 and beyond.

Our Vision

"Sustaining Life and Advancing Human Welfare"

Our Goal

"Minimizing Entropy"

There are no other choices for mankind survival

Our Fields of Technology

*"Renewable Energy, Renewable Chemistry, Anaerobic Processes,
Emission-Free Ecology and Symbiotic Industrial Operation"*

Our Design philosophy

*"Preserving Earth Oxygen by Limiting Combustion/Oxidation Processes
and heavily relying on recycling of wastes and vent streams"*

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Today, many intellectuals contribute the demise of mankind in the next 40-50 years to population increase, energy depletion, or drowning by the rising of water level in oceans as a result of global warming.

Carbon dioxide (Figure 1) may seem the primary culprit in the serious changes in weather pattern that it will be observed in years to come. Or, would it be the primary culprit is man's greed and his miss use of what nature has offered him!

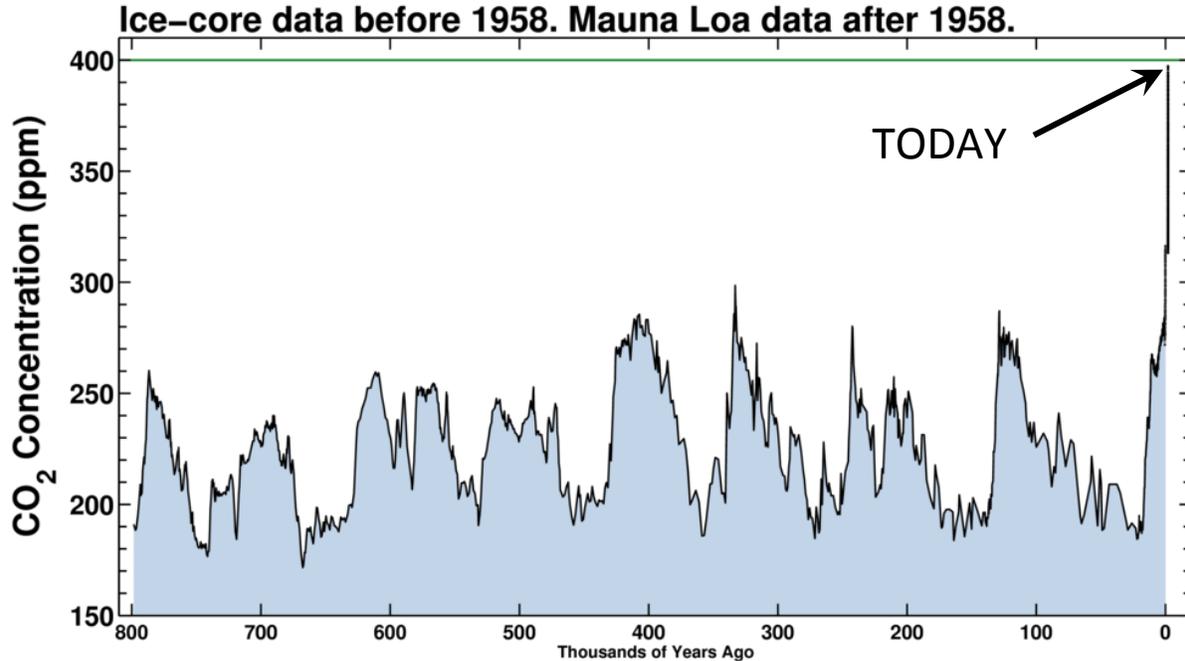


Figure 1: Carbon Dioxide conctracation changes in the last 800,000 years

Current Global Scenario

Oxygen concentration was 20.94% (209,400 PPM) and carbon dioxide was 0.036% (325 PPM) in 1970. Today, oxygen has declined by 0.0317% (66 PPM), while carbon dioxide increased by 21.5%, to 395 PPM!

Carbon dioxide emissions contribute 75% to global warming effects, while methane emitted mostly by live stock contributes about 15%. However, methane is about 25 times more powerful global warming factor than carbon dioxide.

The world's 1.5 billion cows and billions of other grazing animals emit dozens of polluting gases, including methane, at an average of 200 liters per cow-day or 7,000 Btu/cow-day. The methane production of these animals is more than 100 million tons per year (4.87 trillion cu. ft.). It is equivalent to 20% of US natural gas average production in 2013 of 24 trillion cu. ft.

In 2050, the world population (Figure 2) is expected to reach 9.6 Billion (UN February 2013 revised estimate) at an average increase of 0.77% /yr (1.05% in 2013 to 0.46% in 2050). This estimate is developed by the United Nation based on median (■) Total Fertility Rate (TFR). Increasing of population mandates increasing all life support means and 35% more cows!

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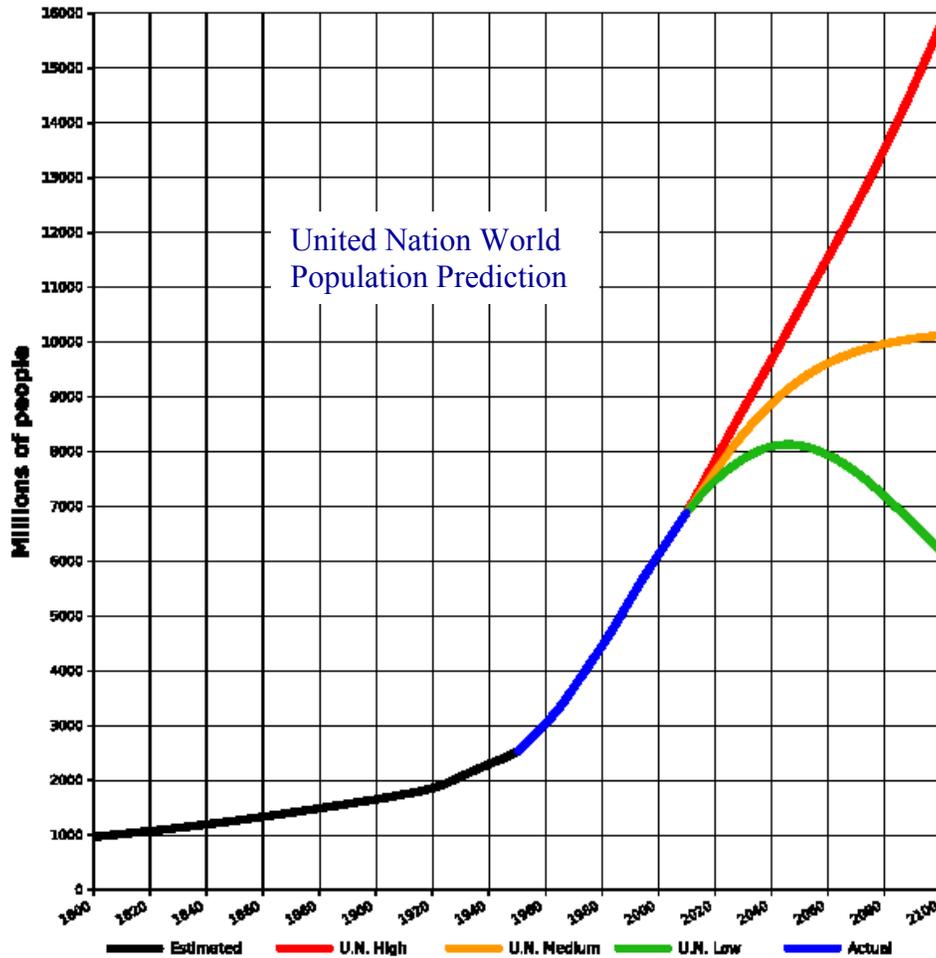


Figure 2: United Nation projected world population from 1800 to 2100

World Population and Availability of Agricultural Land

Population increase 1967-1999 = 2.51 billion, or 72% and from 1999-2010 = 0.84 billion, or 14%

Ag land increase 1967-1999 = 4,200,000 km², or 9.3% but from 1999-2010 = -700,000 km², or -1.4%

In summary, population (Figure 3) is expected to increase by 6.51 billion, or 186.5% in the period between 1967-2083. While the agricultural land (Figure 4) is projected to increase only 8.2% in the same period.

In fact, all natural habitats and wild life did not escape man's destruction. What was called one day "The Earth's Lung" the 6,500,000 sq-km Amazon Rainforest Basin (Figure 5) is being systematically destroyed by loggers and farmers! What was left is just 30% of its original size!

Here is also an astonishing observation by University of California; Berkeley early 2013, indicating that the rain falling on the Amazon Basin is shifting off land in a northerly direction! Can we imagine the changes in water and weather conditions in the Caribbean, if shifting of rain continues!

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Year	population
1000	275 million
1500	450 million
1900	1.60 billion
1950	2.55 billion
1967	3.49 billion
1990	5.27 billion
1999	6.00 billion
2000	6.10 billion
2010	6.84 billion
2025	8.00 billion
2043	9.00 billion
2083	10.00 billion
2100	16.00 billion
2100	10.00 billion
2100	6.20 billion

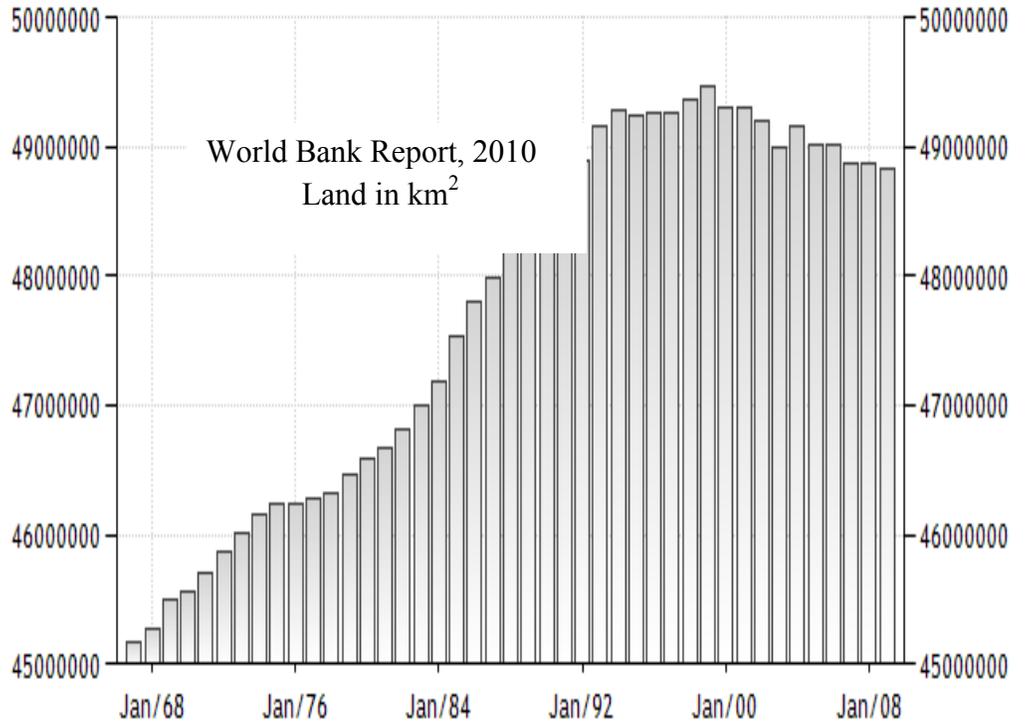


Figure 3: World Population

Figure 4: World Agricultural Land availability 1800 to 2010

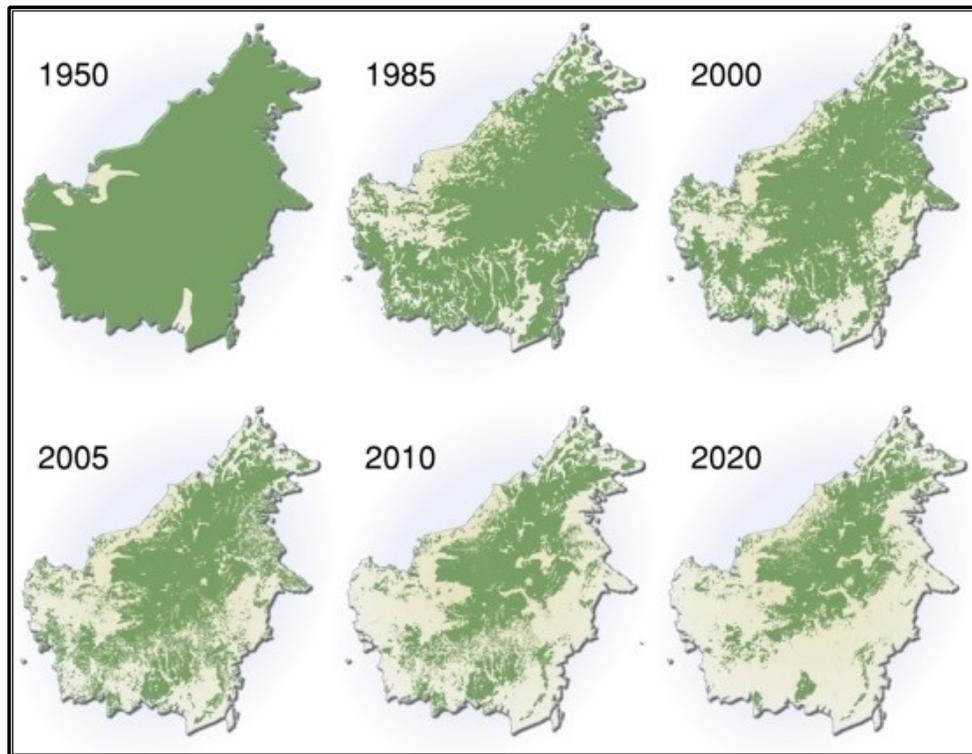


Figure 5: Amazon Rainforest Basin

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The Future of the Human Race:

Population increase, energy shortage, or the rising of water level in oceans are valid factors for the demise of human race, but we also believe that another massive catastrophic factor will lead us to this destiny. In our evaluation, the primary reason will be by **Starvation!** This is due to a simple explanation. By the mid of the current century both oil and natural gas reserves will be about to vanish from earth, except from some shale gas in China and Russia.

Natural gas is an elemental component that is indirectly contributing to the production of the basic nitrogen plant food; the fertilizers urea and ammonium nitrate. Natural gas is the only global commercial commodity that is used today to produce ammonia. If ammonia vanishes, so will urea and ammonium nitrate. As a result, it will not be possible to produce the current level of field crops to feed the projected increase in world population by mid century.

As an example, world demand in 2012 for urea was about 151 million tons and is increasing at a rate of 3.8 per year. In 2050, 623 million tonnes of urea are needed to meet current normal production of field crops that can feed 9.6 billion human beings. However, this amount of urea alone requires about 590 billion cubic meter of methane (20.836×10^{15} Btu = 525.06 million tons of equivalent oil, Mtoe). **By 2050, the required methane gas for food production will be equivalent to all natural gas that can be produced globally** (figure 6).

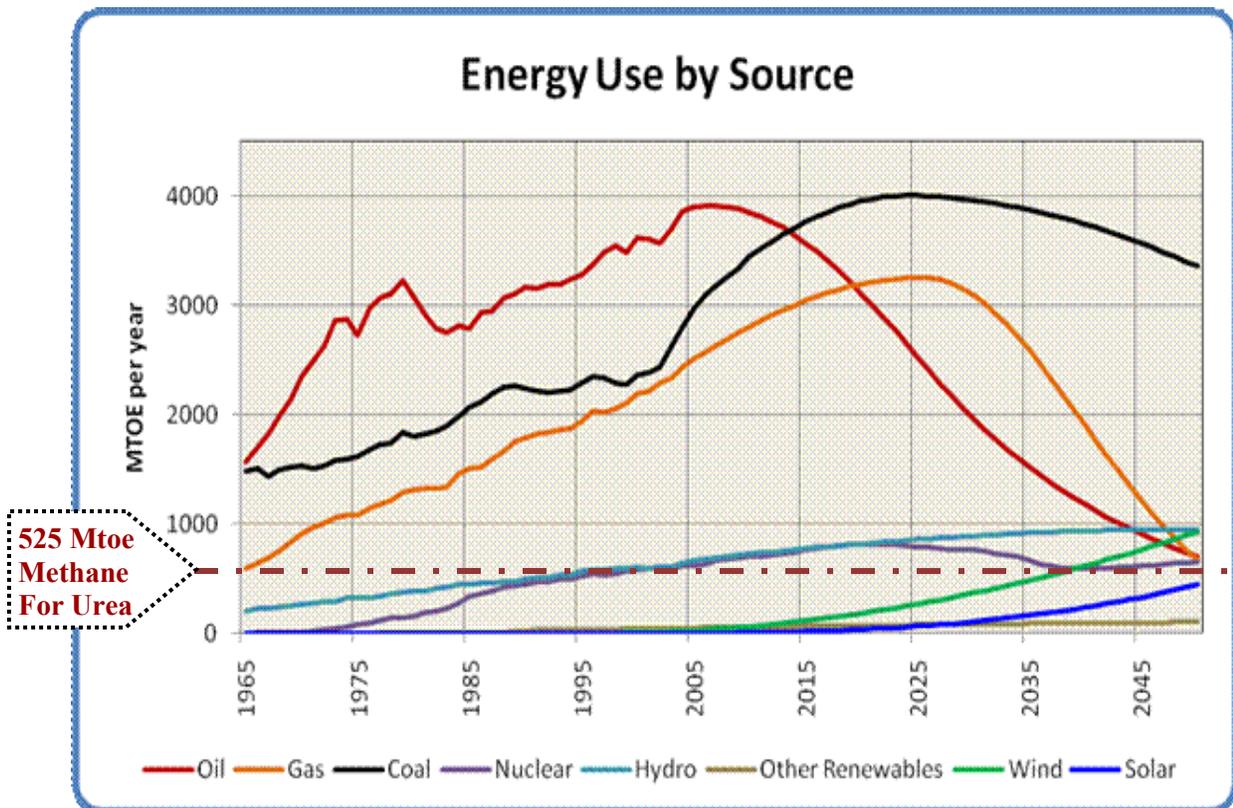


Figure 6: World Energy Depletion Model (by P. Chefurka)

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This means, if we use this global residual of natural gas for industrial and domestic applications, human race will starve to death in millions, if not in billions. On the other hand, if use global residual of natural gas to produce food, then goodbye to our modern life!!

What is our choice? How can we avoid this calamity?

Human Survival- Renewable Resources Communities

Potentially, there are two choices that come to mind:

1) Procedurally by applying very high taxation on natural gas; 100% or more, to curb gas usage, meanwhile allocating this tax revenue for developing renewable energy. This should be accomplished by fossil fuel producers and processors, as well as all industries that depend on fossil fuel products; chemical companies, transportation industries, world armies, etc., However, such attempt must be structured according to a master plan for saving humanity, administered by a responsible global authority UN, World Bank, etc. It is a fact, that most of these industries will become bankrupt, unless they diversify their business plans.

2) Massive Government financial support for educational, research and engineering organizations to develop comprehensive community life support technology, based on renewable energy and chemistry.

MIK Technology proposes a new concept for sustaining community life, which may seem utopian but is doable. We call it **Renewable Resources Community [RRC]**, which could become a model applicable worldwide. **Each RRC must be fully self-supported community**, providing all the required survival needs to its dwellers. For further illustration of this model, let us call our first RRC as **Utopian Village No. 1**. This village will be relatively small and will be designed to support the life of 2500 families of 4 members per family. This is just as an example, but the model can be expanded to support much larger number population.

In this model, the basic life support system relies on three essential factors that are common factors in agrarian communities. These are 1) Public land suitable for agricultural development, sized based on realistic estimation of 5 acres per individual for a total of 200 square kilometers, 2) Relatively long sunny days, and 3) Low salinity water supply. This relatively large area will provide the nutritional needs of the village, but as important it will provide the necessary energy that sustain the life of its settlers and potentially export some electricity to nearby communities.

The village unit operation model relies on complete recycle of all sources of food and waste.

I. Power generation: Power generation relies on four basic systems; a) anaerobic methane production plant, b) solar power generation employing solar systems for harsh environment, c) wind power generation, and d) ISO salinity power generation, if land topography allows for

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saline water accumulation in land depression of at least 1 meter deep, or in manmade ponds. ISO power generation is estimated at about 250-500 KW per square kilometer of the depression surface, based on the annual evaporation rate and the salinity of water supply. This design is relatively similar to the proposed Mauritania ISO power project, Please see published articles. If such water domains, are available, it will be operated in biodiversity mode and be used for saltwater plant farming with mangrove and salicornia (s.virginica, s. bigelovii, s.europaea for food and oil), Sea Grapes and Green Sea Feathers (Caulerpa lintillifera, Caulerpa racemosa for high nutritional value), Reindeer Lime Codium fragile for skin care, etc., but also for raising shrimp and fish in lower salinity section of the domain.

As a secondary supply of energy, all be the methane that is generated by livestock, particularly from the waste of dairy cattle that is being housed in controlled feeding barns, will be used also to compliment the energy supply of this village.

II. Fertilizer production: Plant food is the heart of any RRC project. In our renewable energy and chemistry scheme, it comprises of five integrated processes;

1. Anaerobic generation of methane from crop residues in landfill. Landfills require special design to accommodate seasonal crop production, methane gas production efficiency and better management of leachate.
2. Generation of hydrogen (H_2) by reacting methane with steam (Steam Methane Reforming Process, SMR) over a catalyst (nickel oxide) to form carbon monoxide (CO) and hydrogen (H_2). (Note: This conventional process is being in use for many years, it requires very high pressure and very high temperature (700-1,100 °C and about 100 bars). Such high operating conditions are not in line with MIK Technology philosophy of design. They violate our goal of reduction of Entropy. We are investigating other options for hydrogen generation, if successful; we may require collaboration of other research and engineering organizations.
3. Synthesizing ammonia (NH_3) by reacting hydrogen that is generated in step 2 with atmospheric nitrogen using catalytic reaction (iron catalyst promoted with K_2O , CaO and Al_2O_3). This is Haber process operating at 300–550 °C and between 150–250 bars.
4. Synthesizing urea (NH_2CONH_2) by reacting ammonia from step 3 with carbon dioxide (CO_2) in high pressure reactor.
5. Green houses and algae farms to make use of the excess of carbon dioxide that is being generated by urea synthesis to increase the productivity of these two services by 50% or more.

Ammonia is the backbone of nitrogenous fertilizers. It is the intermediate product. It requires about 80% of energy consumed for Urea production. Each ton of urea or ammonia needs about 950 cubic meter of natural gas. 250 cubic meters is required as energy for conversion and nearly 700 cubic meters for synthesizing the product.

III. Food production: All environmentally adaptable plants of dense and fast growth are preferable, since the project relies on crop residue for its main energy supply. Vegetable, flowers,

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spice plants are better produced in the controlled environment of greenhouses. This is particularly important when the atmosphere or water supply of these facilities is enriched with the recycled carbon dioxide that is being generated by the other project functions. Corn, soybean, sunflower and cotton are of good productivity field crops.

Sugarcane is one of the most efficient photo synthesizers capable of converting one percent of incident solar energy into biomass, or produce 15 kilograms of cane per square meter of warm sunny land. If this sugar is not used for food it would be used to produce ethanol to drive farm machinery! Crop rotation is standard agriculture practice to maintain land fertility, pest and pathogen control and soil structure.

IV. Recycling: Recycling is an important function in the life of this village; all human and animal organic and biological matter will be decomposed by **Wet Oxidation Process** to generate high pressure steam. Wet oxidation is assisted with air or oxygen and potentially some chemicals, acting as catalysts. The oxidation reactions occur at temperatures of 150° C to 320° C and pressures from 10 to 220 bars (150 to 3200 psig). Wet air oxidation of municipal landfill leachate, reduces COD by 78% within 15 to 20 min.

The recovered minerals depending on the type of waste, particular in the case of industrial waste, chemical waste, pharmaceutical, food industry, etc. As an example, phosphorus recovery from sewage sludge will become increasingly important within the next decades due to depletion of mineral phosphorus resources. Wet Oxidation recovered solids could be used in formulation of fertilizers and industrial chemicals.

Wet Oxidation would become also an effective process for decomposing of the decanted organic additives in natural gas hydraulic fracturing process, allowing the reuse of the treated water for further gas recovery or for other industrial applications. Wet oxidation generated steam from decomposing waste matter or organic residue can be used for warming greenhouses and occupied operation facilities, or indirectly in pasteurization of milk that is produced by raised dairy cattle.

Steam condensate from the wet oxidation process may contain dissolved carbon dioxide, which will be feed to greenhouses and algae farms to enhance their plant growth and productivity.

Production or recycling of non-degradable polymeric material (containers, toys, furniture, rugs, etc) should be avoided.

V. Community Structures: All occupied buildings; barns, houses, offices, schools, churches, warehouses, hospitals, etc., have to be designed and constructed according to high efficiency standards to minimize waste of energy and water. All facilities will be fitted with water and energy recovery equipment to provide at least 25% of their normal demand. Therefore, these structures will be provided with photovoltaic panels suitable for the weather condition in the area of interest. Each inhabited structure will be provided with basement or attached storage compartments to collect rainwater or melted snow or ice for reuse. All degradable organic waste will be transported to the village's utilities plant for wet oxidation.

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Energy and water consumption of every building or operating facility will be remotely monitored. All means of transportation in this village will be electrically powered. Most private or public commercial business that are available today will be also available in the future, but has to comply with village mandated restrictions on using energy and water.

In the first village, it will be prudent that the technical team and support functions that are involved in designing, construction and starting this unique village will have the privilege in living in this community and manage its operation and business. Their gained experience will be extremely useful in designing and constructing the next large village.

In our opinion, such village can be constructed in about seven years, if funds are available and with intense collaboration of all the required team members.

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