Increase of CO$_2$ and NOx Promote CO$_2$ Assimilation, CO$_2$ Fix and Food Production

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Abstract
Since the industrial revolution, burning of fossil increased. Production of CO$_2$ and NOx increased greatly. Increased CO$_2$ and NOx promoted the CO$_2$ assimilation. Production of grain and fish increased. About 360 billion tone CO$_2$ is produced by burning of much fossil. About 14.4 billion tone NOx is produced in 2015. Most of emitted CO$_2$ is fixed by CO$_2$ assimilation. Developed country like USA, Japan, Germany, UK, France and Italy started NOx elimination and NP elimination at around 1980, 6 billion tone NOx is eliminated. NOx is main nitrogen fertilizer. NP in waste water is main nitrogen, phosphorous fertilizer. Therefore CO$_2$ assimilation, CO$_2$ fix plant growth is retarded and emitted 360 billion tone CO$_2$ is not fixed completely. Concentration of CO$_2$ increased about 2 ppm. In 2016, 142 billion tone CO$_2$ is remaining to give global warming. We must promote CO$_2$ assimilation by complete use of NOx and NP in waste water.

Fossil fuel is burning out soon. We should not spend precious fossil fuel for the elimination of NOx and NP. We must increase CO$_2$ assimilation as much as possible.

Keywords: CO$_2$, NOx, Protection of global warming, CO$_2$ assimilation, Fish production, Grain production

Introduction
The earth is warmed by the fossil fuel burning releasing CO$_2$ and heat. The plant is growing by CO$_2$ assimilation absorbing CO$_2$ producing carbohydrate and O$_2$. If we can compensate the generation of CO$_2$ and heart with the absorption of CO$_2$ and heart by CO$_2$ assimilation, global warming can be protected.

CO$_2$ react with water by CO$_2$ assimilation to produce carbohydrate and oxygen. Carbohydrate turns to cellulose, tree, plant and plankton. Tree turn to coal, plankton turn into oil in many billion years.

Our human being are using this fossil fuel and enjoying civilized life. Animal including fish can live by eating plant and plankton. Animal release CO$_2$ by respiration. Released CO$_2$ react with water to give carbohydrate. CO$_2$ is cycling in such way.

CO$_2$ assimilation is accelerated by fertilizer: nutrient nitrogen and phosphorous. Nature set up the system to change Nitrogen gas to nutrient nitrogen, nitrogen oxide by the reaction of nitrogen with oxygen. The reaction needs high temperature. High temperature is obtained by burning of something like, fossil fuel or by thunder. By burning, CO$_2$ is produced and NOx is also produced.

The ratio of CO$_2$/NOx is around 25/1. When 1 tone fossil is burned, 1x 44/14 = 3.14 tone CO$_2$ is produced. 3.14x1/25 =0.125 tone NOx is produced.

When 140 billion tone fossil is burned. And 140x 44/ 14= 440 billion tone CO$_2$ is produced. And 440x1/25= 17.6 billion tone NOx is produced. By the increase of CO$_2$ and NOx production, CO$_2$ assimilation is promoted greatly. Some developed countries are eliminating NOx. Then CO$_2$ assimilation is retarded. I wish to describe the relation of NOx elimination, global warming, CO$_2$ assimilation, production of grain, fish and showed the best method to protect global warming [1-28].

CO$_2$ Assimilation is Promoted by Increase of CO$_2$ and NOx
Since plant growth by CO$_2$ assimilation reaction. Velocity of CO$_2$ assimilation is carried out in proportion to the concentration of CO$_2$, H$_2$O, sunshine, nutrient N, nutrient P as shown by following equation

\[ v = A \left( \text{CO}_2 \right) \left( \text{H}_2\text{O} \right) \left( \text{sunshine} \right) \left( \text{N} \right) \left( \text{P} \right) \]

Since the industrial revolution, burning of fossil and production of CO$_2$ and NOx increased greatly. CO$_2$ emission, CO$_2$ fix, NOx...
emission, Grain production, GrainJa (Grain production of Japan), GrainInd (Grain production of India), Fish (Fish production of the world), FishJa (Fish production of Japan), Fish Chi (Fish production of China) Fishp (Fish price in Japan), GDPgJ (GDP growth rate in Japan) are shown in Table 1. Unit is billion tone [22-24].

Table 1

<table>
<thead>
<tr>
<th>Year</th>
<th>CO₂em Bill t</th>
<th>CO₂f Bill t</th>
<th>NOxem Bill t</th>
<th>Grain Bill t</th>
<th>Grain Ja Bill t</th>
<th>GrainInd Bill t</th>
<th>Fish Bill t</th>
<th>FishJa Bill t</th>
<th>FishChi Bill t</th>
<th>Fishp Bill t</th>
<th>GDPgJ USD/kg</th>
</tr>
</thead>
<tbody>
<tr>
<td>1900</td>
<td>20</td>
<td>20</td>
<td>0.8</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1920</td>
<td>30</td>
<td>30</td>
<td>1.2</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1940</td>
<td>50</td>
<td>50</td>
<td>2</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1960</td>
<td>100</td>
<td>50</td>
<td>4</td>
<td>0.7</td>
<td>0.35</td>
<td>0.035</td>
<td>0.015</td>
<td>0.2</td>
<td>6</td>
<td></td>
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</tr>
<tr>
<td>1970</td>
<td>150</td>
<td>150</td>
<td>6</td>
<td>11</td>
<td>0.13</td>
<td>1.0</td>
<td>0.062</td>
<td>0.02</td>
<td>0.4</td>
<td>7</td>
<td></td>
</tr>
<tr>
<td>1975</td>
<td>170</td>
<td>170</td>
<td>6.8</td>
<td>12</td>
<td>0.1</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1980</td>
<td>200</td>
<td>150</td>
<td>8</td>
<td>14</td>
<td>0.1</td>
<td>1.2</td>
<td>0.095</td>
<td>0.025</td>
<td>0.7</td>
<td>6.5</td>
<td></td>
</tr>
<tr>
<td>1985</td>
<td>210</td>
<td>140</td>
<td>8.4</td>
<td>15</td>
<td>0.095</td>
<td>1.05</td>
<td>0.12</td>
<td>0.04</td>
<td>1.5</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>1990</td>
<td>220</td>
<td>140</td>
<td>8.8</td>
<td>17</td>
<td>0.09</td>
<td>1.7</td>
<td>1.1</td>
<td>0.09</td>
<td>0.04</td>
<td>2</td>
<td></td>
</tr>
<tr>
<td>2000</td>
<td>250</td>
<td>150</td>
<td>10</td>
<td>22</td>
<td>0.085</td>
<td>2.2</td>
<td>1.4</td>
<td>0.085</td>
<td>0.16</td>
<td>3</td>
<td>1</td>
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<tr>
<td>2005</td>
<td>270</td>
<td>160</td>
<td>10.8</td>
<td>21.5</td>
<td>0.082</td>
<td>1.55</td>
<td>0.05</td>
<td>0.3</td>
<td>4</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>2010</td>
<td>300</td>
<td>170</td>
<td>12</td>
<td>23.5</td>
<td>0.08</td>
<td>2.5</td>
<td>1.65</td>
<td>0.04</td>
<td>0.5</td>
<td>5</td>
<td>1</td>
</tr>
<tr>
<td>2017</td>
<td>360</td>
<td>220</td>
<td>14.4</td>
<td>27</td>
<td>0.075</td>
<td>2.0</td>
<td>0.032</td>
<td>0.78</td>
<td>8</td>
<td>1</td>
<td></td>
</tr>
</tbody>
</table>

Weight of vegetation of world increased about 2 times since the industrial revolution, Area of tropical rain wood area increased very much since these several 10 years. Total weight of wood is said to be 800 billion tone.

Zaichun Zou reported the change of global change of leaf area from 1982-2009. Total area of increased green is 18 million km², double of USA area [28]. The effects of CO₂ and NOx on climate and plant growth are studied by many investigators [29-48].

The increase of CO₂ and NOx production increased the CO₂ assimilation. The increase of CO₂ assimilation increased the production of grain and fish. The production of grain in 1960 0.85 billion tone in 2010 2.6 billion tone 3 times.

The production of grain in India increased 5 times from 1950 to 2010. In 1950 0.5 billion tone, 1060 0.7 billion tone, 1970 1 billion tone, 1980 1.2 billion tone, 1990 1.7 billion tone, 2000 2.2 billion tone, 2010 2.5 billion tone, CO₂ emission is now 24 billion tone. NOx emission increased to 1 billion tone. The increase of NOx contributed for the production of 2.5 billion tone grain. Population of India increased 1951 3.8 billion to 2014 12.5 billion. 3.3 times. Grain production increased 5 times.


China produced 4 billion tone NOx. This NOx increased nitrogen concentration of sea. East China sea in now top fishing sea. The three big fishing sea were north Pacific ocean, north Atlantic ocean, west of south America. These sea were rich in nutrient NP caused by counter current of deep sea water NP rich deep sea with NP poor surface sea water.

When CO₂ concentration increase, yield of grain increased about 30%. The concentration of CO₂ at green house is kept at 1000-1500 ppm. Normal concentration of air is 400 ppm. Therefore the concentration at green house is 2.5-3.75 times higher than normal air CO₂. The tree at population dense big city growth much rapidly than normal district.

NOx is very effective promotor of CO₂ assimilation. Therefore the production of grain and fish increased proportionally to the increase of CO₂ and NOx. In 1900 20 billion tone CO₂ is emitted and 20 billion tone CO₂ is fixed. In 1920 30 billion tone CO₂ is emitted and 30 billion tone CO₂ is fixed. In 1940 50 billion tone CO₂ is emitted and 50 billion tone CO₂ is fixed. In 1960 100 billion tone CO₂ is emitted and 100 billion tone CO₂ is fixed. After 1980, amount of CO₂ emission and fix become different. Fix amount become smaller than emission.

In 1980 200 billion tone CO₂ is emitted and 180 billion tone CO₂ is fixed. In 1990 220 billion tone CO₂ is emitted and 140 billion tone CO₂ is fixed. In 200 250 billion tone CO₂ is emitted and 160 billion tone CO₂ is fixed. In 2010 300 billion tone CO₂ is emitted and 160 billion tone CO₂ is fixed. In 2016 360 billion tone CO₂ is emitted and 220 billion tone CO₂ is fixed. Amount of CO₂ fix is 140 billion tone less than emission. This is caused by the elimination of NOx and NP. CO₂ assimilation is retarded by NOx, NP elimination.

Most emitted CO₂ is fixed by CO₂ assimilation. CO₂ increase is calculated based by CO2 emission minus fixable CO₂. CO₂ increase of 10 countries is shown at next Table 2.

10 K tone CO₂ can be fixed at 1 km² wood and 10 k tone CO₂ is fixed at 1 km² cultivated land. Then we can calculate fixable CO₂ by area Km² multiply 10 K tone.

### Table 2

<table>
<thead>
<tr>
<th>Country</th>
<th>CO₂ cm</th>
<th>NOx</th>
<th>Area</th>
<th>Fixable CO₂</th>
<th>Fish</th>
<th>CO₂ flpa</th>
<th>CO₂ increase</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>billion t</td>
<td>bill t</td>
<td>km²</td>
<td>Kt</td>
<td>mills</td>
<td>bill t</td>
<td>bill t</td>
</tr>
<tr>
<td>World</td>
<td>360</td>
<td>14.4</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>142</td>
</tr>
<tr>
<td>China</td>
<td>106.4</td>
<td>4.25</td>
<td>1.0x 10⁷</td>
<td>1x 10⁰</td>
<td>79.38</td>
<td>19.8</td>
<td>0</td>
</tr>
<tr>
<td>USA</td>
<td>51.0</td>
<td>2</td>
<td>9.5x 10⁶</td>
<td>9.5x 10⁶</td>
<td>6.05</td>
<td>1.2</td>
<td>0</td>
</tr>
<tr>
<td>India</td>
<td>24.6</td>
<td>0.7</td>
<td>3.2x 10⁷</td>
<td>3.2x 10⁷</td>
<td>10.11</td>
<td>2.0</td>
<td>0</td>
</tr>
<tr>
<td>Russia</td>
<td>19.6</td>
<td>0.63</td>
<td>3.2x 10⁶</td>
<td>3.2x 10⁷</td>
<td>4.61</td>
<td>1.1</td>
<td>0</td>
</tr>
<tr>
<td>Japan</td>
<td>12.5</td>
<td>0.5</td>
<td>3.8x 10⁶</td>
<td>3.3 x 10⁸</td>
<td>4.6</td>
<td>0.92</td>
<td>8.7</td>
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<tr>
<td>Germany</td>
<td>7.8</td>
<td>0.31</td>
<td>3.5x 10⁶</td>
<td>3.5x 10⁸</td>
<td>0.29</td>
<td>0.58</td>
<td>4.3</td>
</tr>
<tr>
<td>Iran</td>
<td>6.3</td>
<td>0.25</td>
<td>1.6x 10⁶</td>
<td>1.6x10⁶</td>
<td>6.3</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Canada</td>
<td>5.6</td>
<td>0.22</td>
<td>1.0x 10⁶</td>
<td>1x10⁶</td>
<td>1.05</td>
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<td>0</td>
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<tr>
<td>Indonesia</td>
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<td>0.2</td>
<td>1.9x10⁶</td>
<td>1.9x10⁶</td>
<td>3.7</td>
<td>0.7</td>
<td>0</td>
</tr>
<tr>
<td>U. K</td>
<td>4.0</td>
<td>0.16</td>
<td>2.4 x 10⁶</td>
<td>2.4x10⁸</td>
<td>1.6</td>
<td>0.3</td>
<td>1.6</td>
</tr>
<tr>
<td>Turkey</td>
<td>4.0</td>
<td>0.16</td>
<td>7.8x 10⁶</td>
<td>7.8x 10⁸</td>
<td>3.2</td>
<td>0.7</td>
<td>3.2</td>
</tr>
<tr>
<td>Italy</td>
<td>3.5</td>
<td>0.14</td>
<td>2.0x 10⁶</td>
<td>3.0x 10⁸</td>
<td>0.5</td>
<td>1.0</td>
<td>0.3</td>
</tr>
<tr>
<td>France</td>
<td>3.3</td>
<td>0.13</td>
<td>6.4 x 10⁶</td>
<td>8.4x 10⁸</td>
<td>0.9</td>
<td>1.2</td>
<td>0</td>
</tr>
</tbody>
</table>

China can produce goods with cheapest price electricity (1.6-4.3 c/kWh) and China is winning priority of productive industry of the world.

Japan is emitting 12.5 billion tone CO₂, Germany 7.6 billion tone, UK 4 billion tone, Italy 3.5 billion tone. Areas of these countries are narrow. They cannot fix all CO₂ produced at his country. Green wood or cultivated land 1 Km² can fix 1000 tone CO₂. Area of Japan is 3.8x10⁶ Km². Fixable CO₂ is 3.8x10⁵ x 1000 = 3.8x10⁸ 3.8 billion tone. Japan is increasing 12.5-3.8 = 8.7 billion tone CO₂.

Germany is increasing 4.3 billion tone CO₂, UK 1.6 billion tone, Italy 0.3 billion tone. Amount of NOx produced at world 14.4 billion tone. At China 4.25 billion tone, USA 2 billion tone, India 1 billion tone, Japan 0.5 billion tone. Japan eliminating this 0.5 billion tone. Butane 0.1280 billions is used for the production of H₂ 0.0606 billion tone and Japan 0.5 billion tone. Japan eliminating this 0.5 billion tone. Butane. Three is consumption of precious fuel for the production of ammonia.

About 0.5 billion tone phosphorous and 10 billion tone nutrias nitrogen are contained in waste water. By using this phosphorous and nitrogen, 100 billion tone CO₂ can be fixed. And 37.5 billion tone plankton can be produced and fish 1.5 billion tone can be produced.

Animal eat food containing P and exclude excreta containing P. When toilet disposal and drainage are sent to excreta disposal treatment plant. P in water was made to water insoluble mass, mixed with cement and made to concrete and buried in soil. Plant cannot use P any more [1]. This process use huge electricity and consume much fossil fuel. Around 10 billion tone fossil and producing 30 billion tone CO₂. For the elimination of one phosphorous, about 25 carbon fossils are used and about 25 CO₂ is produced. One phosphorous can fix 56 CO₂ [10]. The phosphorous and nitrogen elimination process should be avoided. Excreta is best food for plant. Ocean dumping, field dumping and forest dumping of excreta are recommended to increase CO₂ assimilation.

### CO₂ Assimilation Must be Promoted by Stopping of NOx Elimination and by Stopping of Waste Water Purification [21]

In 2015 fossil 140 billion tone was burned and CO₂ 360 billion tone and NOx 14.4 billion tone are produced. If we use all NOx for the fixing of CO₂, we can fix 14.4x25x 10⁵ = 360 billion tone CO₂. But NOx is hated as pollution gas causing illness. Many governments of developed countries set up very strict law to eliminate NOx in burned gas and forced to eliminate NOx using ammonia. To eliminate NOx, huge amount of ammonia is necessary and huge amount of fossil is burned.

4NO + 4NH₃ + O₂ ————> 4 N₂ + 6 H₂O

Elimination of NOx is promoting global warming three ways. One is retardation of CO₂ fix. Two is increase of CO₂ by using much butane. Three is consumption of precious fuel for the production of ammonia.

I wish to propose plan that NOx elimination should be stopped and waste water purification should be stopped. Then CO₂ assimilation is promoted and food production increase and global warming can be stopped.
Heat Balance of Earth [24]
On earth 140 billion tone fossil fuel is burned and CO$_2$ 3.6 x $10^{10}$ t was produced. And 7.4 x $10^{13}$ kcal is produced. When we consider the heat produced by animal respiration, 7.4 x $10^{15}$ kcal x 4.6/3.6 = 9.45 x $10^{13}$ kcal are produced.

The earth is also warmed by the heat of atomic energy. Uranium produce 2 x $10^{15}$ kcal heat. Electricity generation capacity of the world is 16868 Tetra watt h. Electricity generation by atomic energy is 2086 Tetra watt h. Therefore 7.4 x $10^{15}$ x 2986/10868 = 2.02 x $10^{15}$ kcal evolved by atomic energy.

The earth is also warmed by the heat evolved by animal. Human being eat 1000 kcal food every day and release heat 1000 kcal every day. Population of the world is 76 billion. Therefore human being is releasing 1000 x 365 x 76 x 10$^8$ = 2.8 x $10^{15}$ kcal in one year. Animal other than human being, caw, bird, whales, seal are producing heat. We can estimate as same as human being 2.8 x $10^{15}$ kcal. Therefore total heat is fossil burning produce 7.4 x $10^{15}$ kcal, atomic energy produce 2.02 x $10^{15}$ kcal. Human being produce 2.8 x $10^{15}$ kcal. Other animal produce 2.8 x $10^{15}$ kcal.

Total heat produced is (7.4+2.02 + 2.8+ 2.8) x $10^{15}$ = 15.02 x $10^{15}$ kcal. We must absorb 15.02 x $10^{15}$ kcal by CO$_2$ assimilation.

CO$_2$ assimilation must be promoted by stopping of NOx elimination and by stopping waste water purification. By stopping NOx elimination. 14.4 billion tone NOx can fix 14.4 x 25 = 360 billion tone CO$_2$. Amount of N.P in drainage is around 10 billion tone. By using this 10 billion tone N.P, we can fix 10 x 25 = 250 billion tone CO$_2$. By adding 360 + 250 = 610 billion tone CO$_2$ can be fixed. And we can absorb 15 x $10^{15}$ kcal. And earth can be cooled down.

Electricity Generation by Solar System
Construction of solar mega system by the sacrifice of wood is not clever way. 1 hectar, 1000 m$^2$ wood can absorb heat 3.8 x $10^8$ kcal and can fix 13.7 tone CO$_2$. Heart absorption efficiency of solar system cell is 1/3 of green leaf of tree. Solar system cell cannot fix CO$_2$. For the preparation of solar cell material, much fossil fuel is necessary generating much amount of CO$_2$ in compared with the generation of CO$_2$ and electricity by burning of fossil fuel. Therefore construction of solar mega system by the sacrifice of wood is promoting global warming.

1000 m$^2$ cell can generate 114000 kWh and can save 7.5 t CO$_2$ and can absorb 1.3 x $10^6$ kcal for the production of 1000 m$^2$ cell 5 tone CO$_2$ is produced. Electricity generation should be done at no green land. The house located near wood, cooler is unnecessary. But the house located near solar mega system, cooler is necessary at summer.

Fossil Fuel is Burned Out Soon
Estimated amount of buried fossil;

<table>
<thead>
<tr>
<th>Fossil</th>
<th>buried amount</th>
<th>yearly use</th>
<th>year</th>
</tr>
</thead>
<tbody>
<tr>
<td>Natural gas</td>
<td>2769</td>
<td>46</td>
<td>60</td>
</tr>
<tr>
<td>Oil</td>
<td>1730</td>
<td>41</td>
<td>42</td>
</tr>
<tr>
<td>Coal</td>
<td>9090</td>
<td>75</td>
<td>121</td>
</tr>
</tbody>
</table>

When fossil is burned out, we need not worry about global warming. We must worry how can we live civilized life. How can we drive car, air plane, and agriculture machine. How can we generate electricity. How can we make plastic. We must save the consumption of fossil. We should not spend precious fossil for the elimination of NOx, NP. We must depend on wood.

Electricity Generation Should be done by Coal [18]
IPCC asking electricity generation by oil and natural gas than coal, because coal generates more CO$_2$ than oil. But I think coal is better for the generation of electricity to save the consumption of oil. Global warming is caused by the heat and not by CO$_2$ when we compare buried amount, coal (132 years) is 3 times as much as oil (42 years) and natural gas (60 years). We can manufacture many kind of chemical and plastic from oil. Oil is more convenient as transportation fuels. Therefore oil and natural gas are 3 times more precious than coal. Price of coal is 1/3 of oil. Therefor we can generate electricity by coal at low price. The price of electricity is very important for the competition of productive industry. The year of oil scare is coming in 50 years. Then we must do liquefaction of coal to get liquid fuel for transportation. In this process, about half energy of coal is lost. We can enjoy our civilized life longer by saving the consumption of oil and natural gas.

Summary
Global warming can be protected by promotion of CO$_2$ assimilation. CO$_2$ assimilation is promoted by the increase of nutrient nitrogen and phosphorous. NOx is main source of nitrogen fertilizer. P and N in waste water are main sources of phosphorous, nitrogen fertilizer. NOx produced by burning should be released as it is. NP in waste water should be released as it is. Increase of NP concentration of sea water increase the growth of plankton. Increase of plankton growth increase the fish production and protect global warming.

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