

## The Present Situation

On a global scale, energy is being produced and utilized in a manner that is not sustainable. Relying on **coal, oil, and natural gas** as energy sources promotes two major problems:

- The supply of fossil fuels is finite. Energy sources, having required approximately a million years for their formation, are being depleted in just one year. At this rate, the supply of fossil fuels will run out in only a few generations.
- The carbon bound over an enormous length of time in these fossil fuels is being released into the atmosphere as CO<sub>2</sub> in an extremely short period of time. This inequality is a major factor in climate change.

As the temperature on the earth's surface has risen 0.6 - 0.8° C in the last 100 years, it's high time for a reassessment. The impact of such a temperature change has already manifested itself in the increase of storms, floods and other climate-related catastrophes. A further temperature increase of about 2 – 6° C is expected within this century. Shifting climate zones and the shortage of fossil fuels will create a serious ecological crisis which, in turn, may lead to dramatic social and political conflicts worldwide. This agitated situation will definitely stimulate more warfare.

Only a few generations can rely on **nuclear power**. Uranium resources are limited and their usage as an energy supplier abounds in potential complications. Instead of solving problems, the creation of radioactive waste and the added risk of potential nuclear accidents lead to even more problems.

Lowering general energy consumption levels and increasing the efficiency of energy utilization are effective actions in dealing with the problem, but they cannot solve it. Renewable energy resources, such as solar energy, however, are valuable alternatives in the search for energy supplies. The amount of solar energy radiated onto the continental surface is roughly equivalent to 3000 times the total primary consumption level of energy at present. Annual biomass production (which is generated by solar energy and photosynthesis) is sufficient to cover the world energy demand 5 – 6 times over. Thus, the sheer immensity of its supply is a strong argument for the central role solar energy should play in this discussion.

The so-called energy problem is, to a large extent, a man-made one and has emerged as a nasty by-product of badly directed socio-economic development.

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Interdisciplinary Centre for Sustainable Development  
at the University of Göttingen



# The Bioenergy Village

## Self-sufficient Heating and Electricity Supply Using Biomass

## Conditions and Consequences for the Agriculture, Ecology and Quality of Life in Rural Areas

## Project Philosophy and Objectives

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## The Predominant Idea

The central idea of this project is a complete change of energy sources – away from conventional sources to the renewable and CO<sub>2</sub> neutral biomass, for an entire village. One such community is the bioenergy village in Juehnde, located in the southern part of Lower Saxony, Germany. It is the first of its kind. The know-how attained there is to be transferred to other suited villages in Germany and worldwide.



In comparison to the direct utilization of solar energy and wind power, biomass possesses some distinct advantages. The energy in biomass is “stored solar energy”, which means it

is readily available and retainable. Thus, it can be released in direct correlation with the demand for energy. Even during peak hours, biomass is a stable energy supplier.

The energy production process: Under anaerobic conditions, micro-organisms engage in enzymatic digestion to create biogas. Biogas is obtained during the fermentation process of liquid manure and plant silage in an anaerobic digestion plant. The combustion of biogas in a combined heat and power generator (CHP) then generates enough electricity for the entire village.

Burning biogas also generates heat as a by-product. This heat is mainly used to heat homes and other living space, replacing the conventional fossil fuels, oil and natural gas. A smaller



portion of the generated heat is required to fuel the digestion process described above.

The amount of heat generated cannot cover the high demand during winter months in Germany. During this period, an additional heating plant fuelled with wood chips is required. Rarely, on extremely cold days, peak demand necessitates a further boiler fuelled by oil or biodegradable diesel.

The heat generated is transported as hot water via an underground pipeline into the houses. Connected to the circuit of each individual house, the water is fed directly into the heating system. Additionally a heat exchanger transfers the energy to the hot



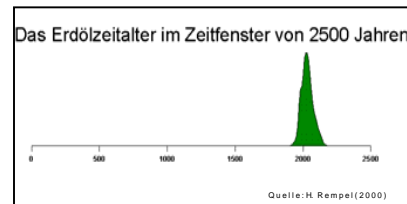
water system.

Generally speaking, the more houses connected, the more efficient the process and the higher the benefits for the individual. Motivating more people to disconnect themselves from conventional suppliers relying on fossil fuels and join this environmentally-friendly system is a central objective and a big challenge in this project.

## Main Objectives

### Protection of Climate and Remaining Resources

Conversion to renewable energy sources will help save the dwindling, precious fossil fuel resources. At the same time, CO<sub>2</sub> emissions are avoided, reducing the greenhouse effect on our planet.



### Soil and Water Protection

The soil and water contamination with nitrates and biocides could be reduced considerably through the adherence to environmentally-friendly concepts for the cultivation of bioenergy crops (maize, triticale, sunflowers).

### Plant Diversity

A wide diversity of plants, even weeds, can be tolerated as all types of plants can be utilized in the fermentation process to biogas.

### Regional Business Cycle and Economic Effects

A new market for farmers focusing on biomass as a renewable energy source is generated in addition to the traditional demand for crops. Selling plants and wood as energy crops can generate a new income base for local farmers and lead to higher employment levels in this

sector. Promoting the production of bioenergy locally is an effective instrument in strengthening economic growth in rural areas. Economic prosperity can thus be secured in the long-term. Also, the general effect on a country's balance of trade is positive as payments for oil and natural gas imports are reduced.

### Participation

Encouraging community members to participate in the decision-making process and motivating them to help solve local problems will promote collective opinion-building. All inhabitants will have the opportunity to exert influence and thus optimize the implementation of the project objectives.



### Decentralization of Energy Supply

The energy plants will be operated by local companies. Their decisions will be more compatible with local needs; and a local competence can be established.

### Quality of Life

The need for communal decision-making and problem-solving in the process of reorientation and conversion to renewable energy sources will generate a new sense of life within the community. The community culture and the individual sense of well-being will be augmented. That is, quality of life can increase notably and consistently.

## Role of the Project Team - Outlook

The project group of the University of Goettingen was the initiator of the model “Bioenergy Village”. It played a major role in defining the concept and implementing the conversion to renewable energy sources. By accompanying the process in Juehnde, continuously assessing the progress, and working to achieve project goals like motivating active participation of community members, the team helps to optimize the various steps taken. Based on its experience in Juehnde, the team can support and accelerate efforts for the utilization of more environmentally-friendly energy sources in other locations.