**RENEWABLE ENERGIES**

There is a major article on the web site of the German Insurance Association under this title.

Please refer to www.gdv.de and enter under "Suche" at the top of the web site the title of the publication "Erneuerbare Energien"

Parts of the article are copied below in English for your assistance.

**Abstract:**

Renewable energy (such as hydroelectric, wind and solar power) may be a way to prevent imminent climatic catastrophe, one that could save shrinking reserves of conventional primary energy sources.

Steps have already been taken to push for renewable energy sources. The Kyoto Protocol for example stipulates the following goals:

- The European Community is to cut greenhouse gas emissions by 8 % by 2012 over 1990 levels.
- Germany is to reduce greenhouse gases by as much as 21 %.
- The Commission has called for a reduction in $CO_2$ by 20% to 40% world-wide and by as much as 70 % by 2020 as a long-term goal.

Meeting these targets will be a challenge, as individual renewable energy sources vary in importance and level of development from one country to the next. In addition to geographic factors, political decision-making processes and political instruments play an important role in renewable energy development.

The need to replace power plants at the end of their life cycle provides a good opportunity to introduce new alternative technologies as a way to lower emissions and use resources more efficiently. (European power plants with capacities around 400 000 Megawatts will have to be replaced between 2010 and 2020.) The German government has determined that renewable energy sources in Germany must account for 12.5 % of overall power consumption by the year 2010 and as much as 50 % by 2050.

This essay provides a brief overview of renewable energy sources and discusses hydroelectric power, wind and solar energy, biomass and biogas plants as well as fuel cells, hydrogen power and geothermal energy. It compares their potential and shows how they measure up against conventional power technologies.

The last chapter of the essay provides facts and figures about special technologies such as solar chimney systems, tidal energy and wave power.

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**Biogas**

The conversion of biogas to electricity and heat offers the potential to greatly reduce the volume of carbon oxide gas.

Because the method has not be standardised, insurance companies face claims arising from poor engineering, poor design, poor workmanship and improper use.

This article explains the components of a modern biogas plant, starting with the mixing pit and hygienization unit, which are regulated under German food hygiene laws.
Chapter 9 describes the various fermenter types.

A wide range of biomass types can be converted into biogas.

The biomass is highly sensitive to loading errors. Three months can pass between the beginning of fermentation and full biogas production. The process can be very easily interrupted if the biomass mixture is changed too rapidly. If the gas production comes to a standstill, the entire fermenter mixture is ruined and must be removed.

The core of all biogas plants is the control unit. Serious claims very often arise through the lack of proper control units/systems. The best way to operate a biogas plant is through the use of computerised control equipment, which is particularly true in the case of gas analysis which must be carried out/controlled correctly. Gas analysers require high-quality and careful maintenance. Farmers are particularly subject to financial loss due to improper control.

Gas purification is another very important function. Contamination through water vapor, dust, sulphur and other substances must be minimised to avoid rapid destruction of motors and consequently the exhaust systems. This is why five different types of desulphurization are used. Following purification, biogas is used mainly in co-generation power plants.

Dual fuel motors are a special case, for they are not designed specifically for dual fuels. No manufacturers in Germany or Austria produce motors designed for dual fuels, which explains the lack of warrantees. Instead, workshops convert standard engines to dual fuel types. Due to their higher combustion temperatures, we have seen a great many claims filed after just a few hours of operation.

If the gas contains excessively high amounts/levels of sulphur, highly corrosive sulphite may be produced after combustion, again resulting in lubrication oil acidification and consequently high abrasion of the copper components. Regular oil analyses and a proper desulphurization process are essential for motors in biogas plants.

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**Fuel cells and hydrogen technology**

A fuel cell is an energy converter in which hydrogen reacts with a catalyst and is then converted to electricity, water and sometimes heat. Six different systems are under development.

Although fuel cells have a wide rage of potential applications, they are currently used mainly in the manufacture of automobiles and buses.

In addition to small models with capacities between 1 and 500 watts for portable personal computers and mobile telephones, fuel cells are developed for co-generation plants in the 200 to 300 kW capacity range for supplying district heating networks, hotels and hospitals as well as private households, where a range of 1 to 5 kW can be provided.

With the exception of the Alkaline Fuel Cell (AFC), all types are expensive and have limited life cycles, problems that have yet to be overcome.

Portable installations will begin series-production in 2004, with mass-market introduction of the fuel cell car expected to follow in 2010.

Until then, however, extensive research and development is required before fuel cells can become the norm. They are likely to take a significant share of the market by 2020.

Hydrogen seems to be the ideal fuel for fuel cells.

Because hydrogen production must be environmentally safe before it can gain general acceptance, research and development efforts focus on several different production methods.

Due to the fact that certain fuel cell types are sensitive to contamination, hydrogen must be "clean". This article describes different fuel purification methods.

Also under development are new fuel storage methods, which are needed to solve the problem of stationary and portable storage installations as well come up with effective ways to store liquid and gaseous hydrogen.

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**Geothermal Energy**

## 1.0 History of geothermal energy

Geothermal energy was first used to generate electricity in Italy in 1904 and 1905. The first power station (250 kW capacity) was built in Larderello in 1913.

## 2.0 Introduction

Beyond its benefits as a renewable energy source, geothermal energy has some special advantages.
It is independent of the weather, day or night and meets the requirements at hand. Geothermal energy is a base-load energy source.

Geothermal installations with capacities exceeding 8,000 MW were installed world-wide in early 2002.

## 3.0 Applications

A distinction is made between hydrothermal utilization and the production of electricity.

**Systems suitable for hydrothermal utilization in buildings and for heating water**
- Hydrothermal systems with a low temperature level
- Near-surface geothermal systems

**Systems suitable for hydrothermal utilization and the production of electricity**
- High-temperature hydrothermal systems (hot water from deep strata and steam)
- Hot dry rock (HDR) technology

3.1 Hydrothermal utilization

Geothermal utilization generally involves transporting hot water from deep strata to the earth's surface by drilling (feed drilling). After heat is removed in a second drilling phase (injection drilling), it is returned to the stratum (duplicate principle). The heat is then removed from the hot water by a heat exchanger and passed on to consumers through secondary circulation.

3.2 Near-surface geothermal systems

In contrast to the utilization of warm or hot water from the deep substratum, heat from the flat stratum is normally utilized through heat pumps. The latter use a wide range of heat sources and techniques in extracting energy from the substratum. The main ones include:

- Heat pumps for ground water
- Geothermal collectors
- Geothermal probes
- Earth-contact parts of concrete / energy stakes

3.3 Hot dry rock (HDR) technology

In HDR technology, two deep bores are drilled and the intermediate rock is fractured, joining the ends of the bores to form a water circuit. Water is pumped through one bore all the way to the end of the other bore. Along the way, it extracts sufficient heat from the hot rock and exits the second bore in the form of hot water. Conventional steam-generating plants provide heat through steam, using a heat pump.

## 3.4 Geothermal power plants

A number of different methods and engineering processes are used to turn geothermal heat to electricity, all of them using a turbine. A working fluid expands in the turbine and powers the generator.

The fluid is used directly by the plant at a temperature of 150° C.

Binary plants use a reservoir temperature up to 80°C. Higher temperatures are possible and vastly improve efficiency. A suitable choice of working material optimizes the temperature level.

## 4.0 Geothermal Drilling

Geothermal drilling is divided into three methods: percussive, rotary and percussive-rotary drilling. Other methods are being researched, but are not yet available commercially.

## 5.0 The Renewable Energy Law - EEG

This law deals with the purchase and compensation of electricity produced exclusively from water power, wind power, solar energy, geothermal energy, landfill gas, digester gas and gas from firedamp or biomass covered by the law or produced in the German economic zone**.**

## 6.0 Summary

The technical feasibility of geothermal projects is demonstrated in many places of the world. In Germany, development is at a very different stage: Geothermal heating centers have been operated successfully for the last few years, while the geothermal power plants are still in their infancy. This technology has to be developed further in order to make them usable on demand.

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**Renewable energy -**
**Implications for the field of engineering business interruption insurance**

As a rule, projects in the field of renewable energy have to be secured (requirement by lenders). Engineering business interruption insurance covers any economic loss due to material damage during the construction, installation and operation phases. Economic loss mainly results from renewable energy subsidies, a dominant role being played by the Renewable Energy Law, which fixes prices for feeds depending on the form of renewable energy.

On the basis of the growth rates currently forecast, and if the current subsidies are maintained (especially under the Renewable Energy Law), potential premium income in engineering business interruption insurance is estimated at approximately € 25.0 million annually in 2010, corresponding to approximately 40 percent of the overall premium income in engineering business interruption insurance in Germany in 2002 (according to GDV statistics).

The subsidies have given rise to a multitude of engineering firms, companies and operators who work with renewable energy installations. Many fields of renewable energy are at the cutting edge of technology, and the people involved often do not pay sufficient attention to quality. Many operators of renewable energy installation have little or no experience in operating these installations. Slow reaction times and lack of training in handling crises increase economic loss. Renewable energy technology has earned a bad reputation as a result of the tendency to optimize installations commercially but not according to engineering aspects.

Because there is still a serious lack of long-term experience with most forms of renewable energy (except for hydroelectric power and, to a certain extent, wind energy), the technical risk has to be analyzed carefully. Indeed, experienced engineers who can not only assess technical and commercial risk, but also examine and analyze know-how in the field, are especially important in the area of engineering business interruption insurance.

This brings both opportunities and risks to the field of engineering business interruption insurance, the former applying to existing potential and the latter to technology. In the long run, profitable business will be limited to those insurers who can master the technical risk and make a solid economic assessment. Suitable instruments (e.g. detailed loss statistics/information exchanges) will be important in obtaining a clear view of the current market situation and to respond quickly to changes.

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## Summary of solar installations

This section discusses the history and operation of solar installations as well as development programs and claims experience in this field.

In 1889 the French researcher Bacaquerel discovered a way to convert light directly into electricity. Early silicon solar cells were produced in the United States in 1954 and subsequently refined with the launch of the space program. Solar installations began to attract attention only during the first oil crisis.

The basic element of a photo-voltaic installation (PV installation) is the solar cell: a thin wafer that consists mainly of silicon. Incident light causes positive and negative carriers to be released on the silicon wafer, establishing the conditions for electric current to flow.

There are two types of PV installations: autonomous isolated systems and grid-connected installations. Isolated systems are not connected to a public utility grid and therefore are economical for use in remote off-grid areas.

Grid-connected PV installations are used when the installation can be connected to the public power grid. The electricity generated is fed into the network and the price charged for it is fixed by the Electricity Feed Law.

Heliothermal installations differ from PV installations in that they do not generate electricity, but transform solar radiation into heat. The installation heats water through solar radiation, using a collector that may be mounted on the roof. This water is used primarily as process and heating water for single-family homes and apartment complexes.

The technology of heliothermal power plants is, for the most part, quite advanced. Sunlight is concentrated onto a collector by means of tracking mirrors. The liquid in the collector is heated to 800° C. Electricity is generated using a downstream turbine.

The Renewable Energy Law in connection with the 100,000 Roofs Solar Program lays the foundation for economic operation of PV installations. Sustained growth in the sector will require ongoing state support, especially when oil, gas and coal are reasonably priced. In 2001, 20,000 applications for PV installations were approved and more than 100,000 thermal solar installations constructed. Solar electricity's share of the total electricity consumption in Germany is expected to rise from 0.02 percent at present to 1 per cent by 2010.

The PV and thermal solar installations currently available on the market are technologically advanced and reliable. When maintained and inspected on a regular basis, the risk of internal operating damage to the installations remains low. Experience has shown that natural events such as storm, lightning, snow and frost as well as wanton destruction by vandalism do pose a risk.

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**Wind Energy / abstract**

After being re-invented in the early seventies, wind energy has become an important part of the energy market in the USA and Europe.
Today, wind energy has more than 25,000 MW of installed capacity worldwide. In Germany, the number of wind turbines is about to reach 15,000 or more, with an installed capacity far exceeding 10,000 MW. Medium-term estimates show installation figures of over 50,000 MW worldwide within the next 5 years.

The following article provides an overview of wind energy trends in Germany over the last three decades.
It explains the construction of various wind turbine types and then goes on to describe the construction elements of modern wind turbines as a way to illustrate state-of-the-art wind technology.

A large part of the article focuses on the very important question of safety and liability in operating modern wind turbines. Standard safety devices like lightning protection, brake systems, fire protection devices, and condition monitoring systems are explained.

Furthermore, a broad overview of the status of development of modern wind turbines for both onshore and offshore applications is shown.

A separate section explains the technique of modern offshore wind turbines and discusses the potential of offshore wind energy.

Finally, a detailed risk assessment of both onshore and offshore wind energy turbines is given, including an estimated loss potential.