*J. Dekker*

# ENDANGERED MAN: A VIEW OF THE CHRISTIAN SCHOLAR*

The seventies will most probably go down in history as one of the most critical periods in the history of mankind. Simultaneously with the petroleum crisis of 1973 man has become intensely conscious of his dependence on irreplaceable natural resources. It is, therefore, not to be wondered at that existentialism with its emphasis on the present and its lack of hope for the future has become so viable a world view in our time. Man, who cannot or will not perceive the hand of God within Creation, is a confused being who wants to evade the future because of the threat it poses to him. The cumulative effect of contemporary negativism expresses itself in the ever-increasing number of suicides, in spiritual impoverishment, and in moral degeneration. The scientist or scholar has contributed to the present spiritual climate by his enormous techonological advances during the past few decades. In this respect one is reminded of the catastrophes inherent in the possibility of a nuclear war. The exponential growth of the world population, and the accompanying and competing industrial automatization which ever strives to employ fewer people might eventually as in the case with the Industrial Revolution in England, lead to insoluble problems of unemployment and anarchy.

The wider public is in general quite sceptical as regards the technological achievements of the scientist because the aims of these developments do not emerge clearly enough. This happens for a variety of reasons: partly as a result of the actions of scientists themselves, or as a result of incorrect reporting in the media and also partly as a result of deliberately doom-laden prophecies. One finds a very good example of this sort of thing in a recent event in Germany. Fruitless efforts were made to erect two new

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nuclear reactors for power generation. In spite of the fact that it has been proved conclusively and scientifically that these reactors do not hold any pollution dangers for man, misinformed agitators succeeded in convincing German courts that such reactors are out. The only alternative to nuclear power for the powerful and growing German industries, dependent for 80 percent of their needs on imported crude oil, viz. additional coal fired power stations, were equally unacceptable to the pollution-conscious zealots.

From this it would appear that mankind blames science for the threat to his existence, as it is the scientist who exhausts sources of energy, pollutes the environment and causes unemployment.

Seeing that the scientist is thus made out to be the culprit, it is essential to look closely at the aims and tasks of the scientist. I would thus primarily like to focus your attention on this threat, the energy threat, which I regard as one of the most fundamental issues regarding the continued existence of man. This threat will be looked at not only in terms of its international application, but also in terms of its applicability for South Africa. In my reply to this threat I would like to focus on energy-from-coal, especially as regards our domestic situation, and I would also like to indicate the rôle assumed by the PU for CHE in this field.

**The energy threat**

The sustained growth of the world population during the past decades and the accompanying industrial growth as well as the improved standard of living have seemingly plunged the world into a dilemma as regards the proper utilization of energy.

Up to and during World War II coal was the single largest source of organic chemicals and energy. The discovery of rich deposits of natural gas and oil has, however, brought about a revolution in the field of energy provision. The ease with which oil and gas can be exploited as well as the low initial prices of these commodities seemed to relegate coal to the background completely. It is thus not to be wondered at that the petrochemical industries of the world, which had their most dynamic de-

velopmental phases during the fifties and sixties, are based, with few exceptions, on crude petroleum.

The discovery of rich uranium reserves and post-war technological breakthroughs in the field of nuclear energy has also contributed to the shrinking rôle played by coal. The rôle of hydro-power in the provision of energy is limited, while solar energy and geothermic energy might play a negligible rôle in future especially for domestic use.

The change in commercial consumption of primary sources of energy is summarized as follows by Dr A.J.A. Roux[1]):

(i) By 1900 the contribution of coal alone was 94,2 percent as compared to the 3,8 percent of oil, 1,5 percent of natural gas and the 0,5 percent of hydro-power in the provision of world energy needs.

(ii) By 1970 the contribution of coal had shrunk to 32 percent while the consumption of oil and natural gas increased dramatically to 46 percent and 20 percent respectively. The contribution of hydro-power amounted to 2 percent while nuclear power amounted to a mere 1 percent.

(iii) It can be expected that the downward trend in energy-from-coal contribution will continue for the next three decades, while oil will continue to make the most significant contribution. It is expected that natural gas will become a more significant source of energy while hydro-power will continue to play a subsidiary rôle. It is further expected that nuclear power will only become significant from 1980 onwards, and then become rapidly more important. The projected contributions from various sources are as follows for the year 2000:

Coal.....16,8 percent
Oil .....34,6percent
Natural gas .....29,0 percent
Hydro-power.....2,1 percent
Nuclear power.....17,5 percent

According to Dr Roux[1]) the problem of energy seen in the light of reserves of oil, coal, and uranium can be distinguished in three periods, viz. the short term up to 1990, the medium term up to 2010 and the long term after 2010. In the short term oil

will be the most significant supplier, although yielding gradually as a result of the use of coal and nuclear power. As far as the medium term is concerned coal and uranium will be the most important sources and as fast breeder reactors come into use fully, coal should gradually be reserved for the chemical industry. In the long term, according to Dr Roux, fast breeder reactors will be the most significant suppliers until nuclear fusion is perfected. The enormous energy potential of nuclear fusion can be seen clearly in the fact that the fusion of deuterium locked up in 30 cubic kilometres of sea-water equals the total initial energy contained in fossil fuels.

Dr W.L. Grant[2] has said that "according to the projected energy consumption by the year 2000, solid fuel reserves will only be able to supply in world energy needs for 30 to 300 years; oil only for 3 to 30 years and gas only for 1 to 13 years. Fast breeder reactors using high cost uranium (up to $220 per Kg $U_3O_8$) will supply energy for several thousands of years. By that time the heavy water fusion process will no doubt be in operation too, in which case sources of energy will not create any more problems. As far as energy problems are concerned then, it would seem that the biggest problem is to be found in the short rather than the long term".

The energy crisis which confronted the world in the first half of the seventies is definitely not unique and we should be prepared for similar situations in future. If such emergencies should be politically inspired scientists would have little cause to be conscience-stricken. If, however, a situation should be reached where, under normal conditions energy consumption exceeds supply it would be too late to shed the proverbial tear.

At an average annual increase of 5 percent in the demand for energy there will be, according to Prof. I. Fells[3], a serious shortage of oil and gas by the middle eighties while nuclear and coal power, as a result of slow developmental programmes, will fail to provide in the remaining needs. Were nuclear power alone to supply in 50 percent of the projected energy needs of the world by the year 2000, it would be necessary to start now and start operating three large nuclear power stations (1000 MW) weekly

up to the end of the century. Such a programme, of course, is totally unrealistic not only because of the enormous financial implications but also because such a programme would exhaust the total proven resources of precious uranium within a few decades. The conservation of uranium until the technology of fast breeder reactors has been perfected is of fundamental importance – and this may take three to five decades.

Planners of energy provision thus have no alternative at this stage – they have to consider coal. This concerns not only electric power, but coal, with reserves estimated at ten times as much as oil and gas, will play an increasingly important rôle in the synthesis of liquid fuels and petrochemicals.

**Energy provision in South Africa**

According to Mr J.A. Stegmann[4] the contribution of coal amounts to more than 70 percent and of imported oil to less than 25 percent of the total South African energy needs. In contrast to this the energy provision of the free world depends on coal for 20 percent while the balance (more than 70 percent) is found in oil and gas. This difference in spectrum is not a coincidence. South Africa does not possess any economically viable sources of oil or gas while easily mined coal is freely available. For this reason coal has always played an important rôle as a primary source of energy in South Africa.

According to a report by the Coal Advisory Board[5] saleable South African coal reserves amount to $16431 \times 10^6$ metric tons. Projections[6] based on the increase in tempo of consumption indicate that a maximum production of about $200 \times 10^6$ metric tons of coal will be reached by the year 2026. After that, should no alternative source of energy be utilized, production will decrease gradually because of limited reserves to 10 percent of the stated maximum production by the year 2100.

If we were to keep in mind that further escalations in oil prices are to be expected and that economically exploitable oil reserves in the Mideast will be practically exhausted in 3 to 5 decades,

policy makers on energy exploitation should keep in mind that the Koeberg power station should be regarded as the first in a series of power stations, and that we should not make too prodigal use of our "black gold". The 9 million tons of coal despatched annually at Richards Bay constitute only a fraction of our coal reserves, but should the existing contracts be renewed or enlarged after 1986 it might amount to a threat for our children in the long term.

It would be a healthy energy policy for any nation to attain the highest possible degree of independence in an economically viable fashion. This implies that the country should not be highly dependent on imported oil. No country can afford to have its petrol and diesel stocks manipulated by politically inspired freaks from outside; this is unthinkable now and in the future, for the internal combustion engine will continue to constitute the heart of the transport system for several decades to come. Sophisticated organic industries which to a large extent determine the heartbeat of a country, and without which no civilized country can remain standing should also be fed organic material, preferably of indigenous origin.

South Africa thus has no choice but to stick to coal. Coal is a complex mixture of high molecular organic compounds and is converted to required products through complicated refining processes. In this fields SASOL has done invaluable and pioneering work thanks to the vision of the post-war national government.

Basically there are several methods by which coal can be refined to gaseous, liquid and solid materials. All these processes are aimed at converting the maximum available energy in coal to the desired product, that is, to strive to achieve the highest possible thermic efficiency. At SASOL the so-called indirect refinement process is used. Coal is first gasified with the help of oxygen and water to carbon monoxide and hydrogen and these basic materials are then converted catalytically (according to the Fischer-Tropsch-method) to a wide range of organic products. Due to faith, daring and sustained and intensive research conducted continually in this field, one might safely claim that

SASOL is the world leader in the field of oil-from-coal. This skill will, especially in future, function as a valuable deterrent for international pressures on South Africa.

At SASOL II, also known as Secunda, which is expected to become operative by 1981, and of which erection costs amount to approximately R2 000 million, the same indirect method will be used. For those who might have serious concern about the rentability of the SASOL process I would like to quote the following reassuring words[4] spoken by Mr J.A. Stegmann, current managing director of SASOL: "The SASOL II project will compete with products refined from crude oil at the current OPEC price and show a profit when in full production".

There are also direct methods for the refinement of coal. One of these is the so-called hydrocracking route, through which coal or other organic black materials is converted catalytically with hydrogen under high pressure and at high temperatures (selectively) to the desired spectrum of products. This process does not yield exactly the same products as those gained in the SASOL process and should therefore be regarded as a supplementary rather than a competitive process.

The Institute for Petrochemical Research at the Potchefstroom University for Christian Higher Education aims to make a contribution to the responsible use of energy in the interests of the country at large. One of our main aims is to study the potential of the direct refinement process. The pilot plant of the Institute, which was made operative successfully in October 1977, has been designed to enable us to evaluate a wide spectrum of reaction conditions critically. Although this programme is still in its initial phase, I can report here that the pilot plant has come up to expectations and that the first results, achieved with organic black materials as feed, have given us reason for optimism. In order to give a clear idea of the activities of the Institute, it should be mentioned that there are in progress other laboratory scaled research activities aimed at relieving pressing energy problems. Some of these involve coal refinement while others involve the refining and conversion of locally available petrochemicals to more desirable products.

As far as research projects are concerned the Institute liaises closely with SASOL and the CSIR. The moral and financial support of these two institutions is vital to the functioning of the Institute.

## The reply of the Christian scientist to the energy threat

God gave man his vocation at creation: Love your neighbour as you love yourself and discover and use creation for the glory of God and in his service. The Christian-oriented scientist has to fulfil this vocation and contribute to the harmonious development of creation. He thus may not be a disruption or a threat to created reality. In practising his scientific activities, he has to be on his guard against secularization and against absolutes in any shape, such as the practice of science for the sake of science itself (scientism). He has to guard also against rationalism, i.e. presuming to be able to argue everything out perfectly rationally without the spiritual enlightenment provided by Holy Scripture.

The Christian oriented scientist would thus, as Prof. J.J. Fourie[7] has said, "unlike the unbelieving scientist, who regards his practice of science as being exclusively in the service of man, the 'Blonde beast', and in order to glorify his own wisdom and grandeur, fulfil his scientific activities while always deeply aware that through his work he is always studying the miracle of God's creation, given to man on sufferance for a time. He has a different starting point from the unbelieving man. He starts out with the firm conviction that knowledge, for the sake of knowledge, is not possible – thus he knows that the practice of science can never be free of evaluation and can thus not be neutral because all things (and by this is not meant all things *except* scientific facts) should, according to the Scriptures, emanate *from* God, *by* God and be *to* the glory of God. Under the sovereignty of Christ all this should serve to glorify God, and this includes knowledge and science. Even the science of one who has denied God but who has been included in the great encompassing mercy of God for a specific purpose is implied here. Most specifically, however, one thinks of those who have, under the protective

shield of God's mercy made a gift of their science in the service of God".

Thus the Christian oriented scientist has a vocation, in the field of energy provision, and a responsibility towards the world which he should not try to evade – even if he wanted to. He has to carry on delving deeper into the mysteries of creation and to allow the light of the Scriptures to illuminate the whole of creation and so to proclaim the glory of God. May God use this work in the service of his Kingdom.

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