



Figure 2 Variation with impact parameter of (a) the angular distribution (inset: position of maximum) and (b) the energy spectrum of the reaction products.

1. Studies of nearly central collisions of neon with uranium at Darmstadt by Stock gave a broad distribution peaked around 90° for the low-energy particles, and this becomes narrower and shifts to forward angles with increasing kinetic energy, in qualitative agreement with the hydrodynamical calculations.

These calculations show that many of the features of energetic collisions between nuclei can be understood using classical hydrodynamical concepts. Such collisions subject nuclear matter to very high pressures, and thus provide a way of testing the nuclear equation of state that is employed in the calculations. An additional possibility is the discovery of abnormal super-dense states of matter from irregularities in the excitation function of the Mach shock-wave angle and in other measurable quantities like the pion production rate and the nuclear temperature. □

Bio-Energy '80*

from D. O. Hall

WHEN over 1800 people and large official delegations from Brazil, China, France, Sweden and the US get together for discussions and to display equipment for biomass-for-energy systems then something serious must be happening in the field — such a meeting was inconceivable even two years ago. That something, of course, is the belated realization that the world's oil production has already peaked (not for technical reasons) and that future oil price increases

will be maintained above the inflation rate. In addition it is recognized that biomass already supplies about 15% of the world's energy but because this use occurs mainly in the rural areas of the developing world it has not been given due attention. Even in the developed world the US currently derives 2% and Sweden 10% of its energy from biomass.

The Bio-Energy Council of Washington, D.C. — a foundation and subscription funded organization — has only been established for some three years and has already made a significant impact in the biomass-for-energy field. Their main aim is to serve as an international information centre and to this end they have already published the third edition of the *Bioenergy Directory 1980* — it contains over 650 one-page summaries of bio-energy activities in 34 countries and also abstracts 250 additional reports from the 1979 Directory.

The Congress was so large that only a partial view can be given. The 'hottest' topic was undoubtedly the alcohol programmes of Brazil and the US. Brazil leads the world as it started its programme in 1975 and now spends about \$700m a year. About 4 billion litres of ethanol will be produced in 1980 and about 10 billion litres in 1985. The alcohol is blended to 20% in petrol but a quarter of a million cars will be produced this year alone to run on 100% alcohol. The Government is controlling the rate of use of alcohol to try to prevent shortages or surpluses.

The main source of alcohol is sugar cane but cassava, sweet sorghum and babussu palm are being rapidly developed as crops with wider land potential and less stringent agronomic requirements. Brazilian companies can now sell turn-key plants to the rest of the world. A Brazilian speaker made it clear that the decision to implement the programme was a political one and that economic and technical factors played secondary roles. The discussion of energy ratios was, according to him, totally irrelevant. Energy independence and foreign currency savings were the key factors. This point was well taken by the US Congressmen from the Iowa cornbelt who is one of those pushing the US gasohol programme in Washington. The Americans blend alcohol to 10% in gasoline and it is now being sold in thousands of stations in the US. It has received tax credits from Federal and State governments and is very popular with the public who perceive it as one way of 'helping America'. Current biological alcohol production in the US is about 80m gallons per year; it is hoped to expand this to 500m gallons per year within 2 or 3 years by massive federal aid — about \$1 billion per year for up to 10 years.

D.O. Hall is a Professor of Biology of King's College, London and past-chairman of the UK Section of the International Solar Energy Society.

Surplus corn is the primary source of feedstock now, but other grains, sweet sorghum, sugarbeet, sugar cane and other crops are being examined. Small-scale ethanol producing facilities on farms are being rapidly implemented and encouraged. Local self-sufficiency is the prime aim. Surplus sugar production from sugarbeet in Europe and from sugar cane in tropical countries was also widely discussed as a potential source of alcohol.

Direct combustion of wood, residues from agriculture and forestry, and wastes from cities and industry is already commercially viable in many parts of the States — especially in the north east where energy costs are high and organic matter is abundant. This use of biomass and the construction of biogas generators seemed the next most popular topics of discussion. The Chinese delegation described how they have constructed 7 million biogas digestors over the past few years and are currently building them at the rate of 1 million a year. Attention is also being given to the production of methanol from woody material — especially since such technology is compatible with coal-based systems. This was certainly stressed by the Europeans and Canadians — and would find echoes in Australia and Brazil.

There seems little doubt that biomass-for-energy systems are here to stay and their implementation must certainly be encouraged. Like any energy systems there are disadvantages in using biomass, e.g. land use competition, requirements for fertilizer and water, soil erosion problems, uncertain costs at this early stage, lack of infrastructure, and so on. The one most controversial topic right now is that of food versus fuel — should we divert plant material to fuel and away from its use as a food, or is there a rational way of providing both, e.g. by feeding corn to make ethanol and use the stillage as cattle feed. These discussions will inevitably intensify. In developing countries decisions on reforestation and rehabilitation of semi-arid regions must be made quickly if energy (mostly in the form of woodfuel and residues) is to be available on a continuous basis.

To those of us who have been advocating careful, continued and increasing use of biomass as a source of fuel this Congress and Exhibition was a dream come true. Even two or three years ago such an event may have been fortunate to attract a few hundred dedicated persons. Now the field is recognized to be of worldwide importance and will probably continue to be so as long as the 'energy problem' continues. This is likely to be for at least the next 15 to 20 years as the world pays the price of decisions made in the 1950s and 1960s which locked us in to an oil economy. The decision cannot be reversed quickly and we are belatedly realizing this fact. Biomass will be only one component in a future energy mix but it can provide liquid, gaseous or solid fuels as required. □

*Bio-Energy '80 World Congress and Exposition held in Atlanta, Georgia, April 21-24, 1980. Address of Bio-Energy Council, 1625 Eye St., N.W., Washington, D.C. 20006.