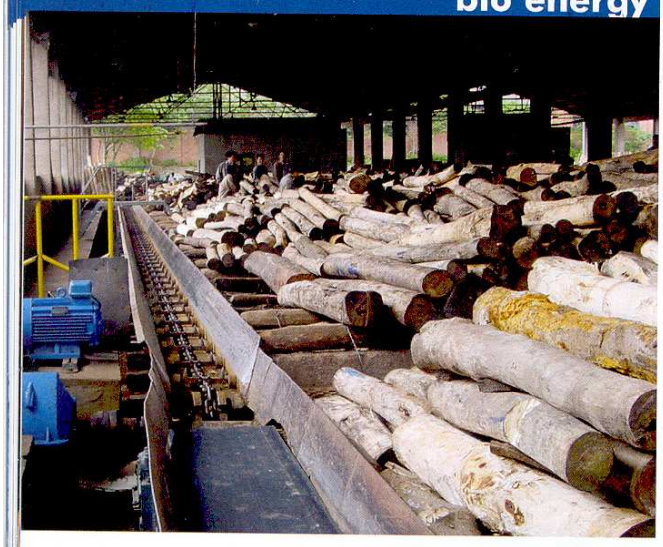

Burning ambitions

Bio energy climbs ever higher on the UK's scientific and political agenda. **Crystal Luxmore** and **Tony Bridgwater** describe the work being carried out by one of the country's biggest university research groups in the sector

Biomass can be more easily stored and transported than wind and solar power but in China the logistics of collection and transportation are challenging

Out of all the renewables, bio energy is widely held to offer the greatest potential for replacing fossil fuels, because biomass is available across the world and, unlike wind and solar power, bio energy is easily stored and transported, making it constantly available. However, bio energy development is lagging behind other renewables due to high costs, limited land availability and competition with other uses for biomass – mainly food production. While the bio energy market is growing slowly, most countries now have extensive RD&D activities in biomass and bio energy, and the UK is no exception. A look at the profile of projects at the country's biggest university research groups in bio energy shows that the RD&D necessary to secure investment in the sector is thriving and researchers are laying the foundations for a bio energy boom.

For the last 25 years, Professor Tony Bridgwater has been leading the Bio Energy Research Group (BERG) at Aston University in Birmingham. The group has been working to address challenges in the thermal conversion of biomass to produce renewable fuels, heat and power and chemicals that can fire Britain's future. Today the team of more than 20 researchers is working on a range of projects across the UK, Europe and the rest of the world that are helping to accelerate the development and implementation of bio energy.

Investigation

Although the main activity of BERG is fast pyrolysis of biomass, the team is investigating all aspects of the biomass and bio energy chain, from wood in the forest or crops in the field, to valuable and marketable end products. Fast pyrolysis is a process that involves heating biomass very quickly to a carefully controlled temperature of around 500°C and rapidly cooling the products down to produce a liquid bio-oil. Over the years the team has moved from developing the fundamental science and technology of the pyrolysis process and its products to evaluating the role of pyrolysis in a biorefinery – one of the ultimate goals for efficient conversion of biomass.

In BERG's latest project it joins a European-Chinese team to look at market opportunities for European companies to introduce co-firing of biomass in China's coal-fired power stations. The China EU Bio energy project (ChEuBio), funded by the European Commission, is a two-year initiative that will assess the commercial possibilities of co-firing biomass in China's coal fired power plants to help cut the country's dependence on fossil fuel and reduce its greenhouse gas emissions. Andrew Minchener, project co-ordinator, believes, "the potential impact of substituting coal with a CO_2-neutral fuel is large. If half of the biomass wastes currently produced in China could be used in the existing

power plants it could displace over 200million tonnes of coal."

Coal

Coal has fuelled China's emergence as an economic powerhouse and today the country is the world's largest coal producer and consumer. This reliance on coal shows no sign of stopping: installed capacity is expected to more than double to one million megawatts by 2020 from 400,000MW in 2004. Co-firing, which is not currently practiced in China, involves burning coal and biomass together – mainly straw, rice husks and wastes from crops and wood. With over 70 per cent of all energy consumed in China coming from coal, it is a promising region for European companies keen to introduce their co-firing technology to new markets. Bridgwater says, "The fast growing economy in China offers enormous possibilities for bio energy to make a major contribution to improving the global environment."

China is a complex economy with distributed farms, making the logistics of biomass collection and transportation challenging. ChEuBio will gather data on different biomass sources and availability, undertake case studies of various crops to assess possibilities for co-firing in China's coal power plants and determine the commercial potential for co-firing in China. The Bio energy Research Group will use geographic modelling to evaluate the potential of using various biomass feedstocks in different regions of China, communicate the findings to the Chinese power industry and policy makers in the country, and help European industry exploit the opportunities.

While co-firing offers an immediate means of cutting harmful emissions in China, BERG is also developing longer-term solutions that could one day see bio energy follow in oil's footsteps. BERG recently secured two new projects to work with the Energy Research Centre of the Netherlands (ECN) to develop technology for a lignocellulosic biorefinery, in which catalytic pyrolysis and processing of biomass and byproducts will play a central role. "We see fast pyrolysis as being at the heart of a biorefinery that produces transport fuels and chemicals as well as heat and power. This will help reduce fuel costs by co-producing high value chemicals and also contributes to improving economies of scale by building much bigger plants" says Bridgwater.

Co-operation

As bio energy climbs higher on the UK's scientific and political agenda, it has become imperative that universities and industry work more closely together to ensure that optimum solutions and efficient technologies are developed. BERG leads the UK's national effort to do just this. SUPERGEN Bio Energy is a national initiative supported by the UK's Engineering and Physical Sciences Research Council (EPSRC) that brings together eight academic institutions and six industrial partners to undertake joint research that spans the entire bio energy chain. SUPERGEN's continuation has recently been approved and will see the team grow to ten research groups and 12 companies and bring the total funding to £10million over eight years.

Industry also works with BERG to offer PhD projects to solve specific problems. For example BIFFA – one of the UK's six big waste companies – recently teamed up with BERG to study the potential of on-site conversion of landfill waste into energy using fast pyrolysis. The challenge is pressing given the Government's pledge to recover 67 per cent of Britain's waste by 2015. BERG is characterising different waste streams, testing them in its pyrolysis reactors and will evaluate their potential to be used on landfill sites.

On the European level, the Group is working on a variety of projects that form part of the European Commission's agenda to put Europe at the forefront of bio energy innovation. BERG leads ThermalNet – a network of experts sharing best practices in the thermal conversion of biomass – and is also a member of Bio energy NoE – a consortium of eight European bio energy institutes working to establish a virtual centre of excellence in bio energy R&D. The range of projects underway at Aston University indicates the potential of bio energy to contribute to the world's future energy mix. At the moment, bio energy is not sufficiently competitive with conventional energy sources, but as fossil fuel reserves continue to dwindle, oil prices remain high and the political commitment to bio energy grows, the RD&D activities at BERG and other UK research institutes will boost the competitiveness and quality of the bio energy available on the market, paving the way for increased usage in Britain and around the world. □

For more information please contact Prof Tony Bridgwater, a.v.bridgwater@aston.ac.uk www.aston-berg.co.uk

Biomass is available across the world, from Birmingham to Beijing