

international demand. UK would become a net importer of oil and gas within the next few years and investment was required in new refining capacity for heavy-grade oils from abroad, and storage facilities/transport infrastructure for Liquefied Natural Gas (LNG). There were no fundamental materials development issues in the sector, although the development and manufacturing of special alloy pipes was cited as an area where the UK had substantial expertise.

4. John Oakey spoke about the increasing use of biomass in power generation, particularly its use in co-firing with coal. Biomass offered big returns in relation to reductions in CO₂ emissions, but there were problems with the fuel in relation to increased boiler corrosion. Many of the materials challenges were similar to those of other carbon-based fuels and were associated with providing long-term reliability of power generating plant. The convergence of biomass and waste processing technologies was also identified as providing some technical challenges, particularly in relation to gasification techniques.

5. John Kilner covered Fuel Cells. The major players in the development of the technology for automotive use were based abroad. However, the UK had a very strong research base in the broad area of ion conducting membrane technology and there was considerable potential for the export of knowledge and expertise. The key materials challenges were related to the development of durable and cheap low-temperature fuel cells, which could provide a practical and economic means of small-scale power generation.

6. It was acknowledged that there was no one at the meeting with specific expertise in solar/wind/tidal/wave technologies and that further investigation might be required on these particular areas. However, it was agreed that there were some significant materials issues in this area, including operation in harsh environments (wave & tide), reduction of radar interference (wind turbines), and energy storage.

Nuclear Energy Generation

7. Ian Cook gave an overview of the current state of play in fusion technology. A 500 MW experimental pilot plant was to be built in France and was expected to start running in ten years. A large programme of materials development and testing is required, in parallel, to support the development of commercial fusion. UK was a world leader in modelling and validation for fusion materials and the IGT could assist in highlighting the synergies between this work and that taking place in other energy sectors, notably fission.

8. George Smith gave a report on the Materials for Nuclear Energy in the 21st Century workshop, which was held on Oxford on 28 October 2005 (draft report attached). A range of issues were discussed, but, in relation to materials technology, modelling and validation was seen as a priority in the sector, both for the maintenance of existing plant and building of new installations. The loss of nuclear testing facilities was, however, seen as a threat to the UK's future capability in this field, as was the loss of knowledge and expertise as a result of large-scale retirements. It was suggested that the Materials Knowledge Transfer Network might have a role in addressing these issues.

9. Continuing the skills discussion, Richard Clegg gave a presentation showing the decline in R&D spend and academic manpower in the nuclear industry (slides attached). UK was now lagging well behind the industry leaders, Japan and USA. There was a need to bring together the various groupings within the nuclear industry and an initiative to set up a new

facility in Cumbria to act as a 'teaching hospital' for the industry would be a key driver for collaboration. The industry would also benefit from greater integration between the fusion and fission communities. It was noted that there was a substantial amount of nuclear activity in the defence sector (naval) and that this community also needed to be considered within the context of the mainstream industry. Future materials technology requirements would fall under seven broad headings: decommissioning, operation of existing plant, new build, advanced reactors, naval applications, fission/fusion interface and waste disposal.

10. There was a further discussion surrounding a potential programme for new reactors in the UK. It was felt that generating companies would probably buy new technology off the shelf as opposed to initiating a new development programme. Suppliers would respond to functional specifications, but standard designs would form the basis of their product offering. Although this would limit the opportunities for new materials development, improvement in the reliability of nuclear stations and associated generating plant would continue to be vital for the industry. Dealing effectively with the waste products would also continue to provide technological challenges.

11. It was noted that the UK supply chain and skills base had diminished considerably over the last decade and that this might cause some difficulties in relation to any new UK programme. However, it was agreed that the industry would probably respond with adequate investment in capacity and skills provided that any new programme was planned on a sound, long-term, footing.

Energy Conservation

12. Elizabeth Warham spoke about work that DEFRA was undertaking on identifying energy efficient technologies. So far 125 such technologies had been listed and DTI was looking at 23 in the context of the Technology Programme. Areas of interest to the materials community included: glazing and insulation, light emitting diodes, domestic and industrial boilers, process plant design, light weighting, decarbonisation of materials (reducing the carbon count in processing and manufacture), and waste minimisation.

Review and Key Themes

13. The Chairman concluded the meeting by summarising some of the key themes of the discussion. It was apparent that there were many common materials themes across the broad range of energy sub-sectors. Ensuring long-term reliability of generating plant, both in fossil fuel/biomass and nuclear stations, featured in a number of discussions and materials science had a key role to play in this, particularly in respect of modelling and validation. Although there did not seem to be imminent plans to initiate any large-scale publicly funded nuclear R&D programme, the nuclear industry still presented significant materials development challenges, notably in relation to the fusion programme and waste handling. The field of energy conservation was also highlighted as having significant potential for materials development. A number of issues had been raised in relation to loss of skills in the energy sectors, largely associated with a shrinking supply chain. This loss of knowledge, expertise and R&D capability across the energy industry could compromise future energy generation programmes.

Next Steps

14. It was agreed that, following further consideration of the outcomes of the meeting by the MatIGT Secretariat, a draft recommendation on materials in energy would be developed for further comment before being submitted formally to the IGT.