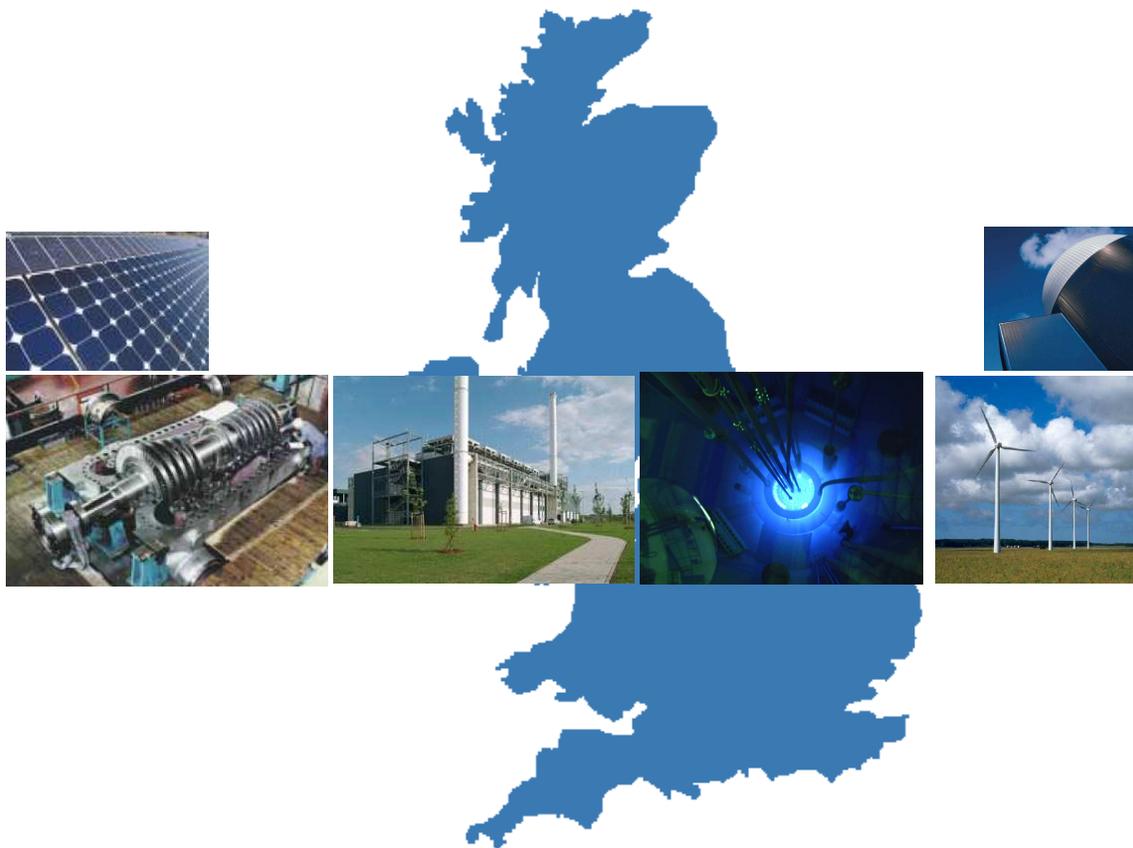




# The Mapping of Materials Supply Chains in the UK's Power Generation Sector

CONSULTATION DOCUMENT

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# EXECUTIVE SUMMARY

## Aims

The major aim of this review was to characterise the markets, strengths and opportunities of the UK's Energy Materials supply chains. Specifically, the review has focused on the application of materials in the generation of electricity by Fossil, Nuclear & Renewable fuels & technologies. Thus, for raw materials suppliers, materials fabricators/manufacturers and OEM's, through to the end users (the utilities or generators), and for each energy source supply chain(s), the major players have been identified.

An additional aim was to highlight some of the significant R&D activities related to materials in power (specifically electricity) generation in the UK. In particular, some of the key organisations and groups/individuals have been identified, as have the major, largely publicly funded, programmes.

## Approach

The review has been conducted using primary data gathering from both academic and industrial organisations within the UK and overseas, through a targeted questionnaire and through interviews with representatives from major companies, academic institutions and Research and Technology Organisations (RTOs) - listed at the end of the report. This primary data has also been supplemented with extensive secondary (public domain) data gathering.

## Summary

### ***Materials for Conventional Fossil Fuel Fired and Nuclear Power Generation***

The UK power equipment and services sector has a turnover of approximately £30 billion and provides employment for approximately 300,000 people in the UK. There are tens of thousands of companies active in this area, the largest of which are amongst the UK's leading companies. Exports of equipment have averaged approximately £1.9 billion a year in recent years, and it is estimated that the inclusion of power related services (which are broken down separately in the trade statistics) would double this figure (information taken from a Mott MacDonald Report for UK Trade & Investment, 2007).

In general, the supply chains for materials used in the manufacture of power equipment/plant for fossil-fired and nuclear power generation have been eroded over the past 10-15 years, and there are some components which UK based companies cannot now supply. For example, forgings for civil nuclear pressure vessels, steam generators and the largest steam turbine rotors. There are also supply chain issues related to nuclear grade graphite and alloys for fuel containment.

According to some estimates, since 1990, the UK has lost some 70% of the supply chain for components and plant for power generation. Reduced domestic demand has forced suppliers to seek alternative markets, and the materials supply chains for fossil-fired plant are reliant upon 'inputs' from mainland Europe, in particular, although materials are also sourced in Japan and the USA.

However, in addition to an OEM capability for large steam turbines, UK based companies also offer an extensive steam turbine service capability (repair, refurbish, upgrade, retrofit, etc.), such that of the world's four largest manufacturers of steam turbines, two maintain significant capability in the UK.

Also, there are two UK based OEMs for land based gas turbines, which together serve the full range of power output requirements for simple cycle or Combined Cycle Gas Turbine (CCGT) applications.

UK based companies maintain an extensive capability in the processing and fabrication of precision components for major fossil fuel fired plant (steam and gas turbines, pulverised fuel boilers, etc.), and could increase supply into this market, if the business conditions were favourable.

However, although a significant capability to manufacture components such as rotors, blades, discs, rings, casings, etc. for fossil-fired power generation exists, few UK based metals processors (eg, caster, forger, extruder, roller, etc.) now have the power generation sector as their major market (say 20% or more of turnover).

The gaps in the UK based materials supply chain for fossil fired power plant include limited capability in the manufacture of seamless stainless & speciality steel tube for heat exchanger applications in boilers and steam generators, and for future gasifiers and Carbon Capture and Storage (CCS) systems.

Thus, although the UK is home to a world leader in the supply of boiler plant and related equipment, much of the materials inputs (seamless tubes, pipes, etc.) are sourced from overseas.

As the strength of the supply chain has decreased, so the capacity of the industrial and academic base for research and development in materials for fossil-fired power plant has decreased accordingly. However, many R&D activities in fossil fuel fired power generation are world-class, and have an important contribution to make in the development of materials for high efficiency, low emission power plant.

In particular, the UK's world leading materials development associated with aero engines is of significant benefit to industrial gas turbine development, and it is often difficult to separate most research and development activities, both industrial and academic.

### ***Materials for Power Generation from Sustainable (Renewable) Energy Sources***

It is likely that during the introduction of sustainable energy technologies, some difficulties will be experienced in obtaining materials from domestic suppliers. In most instances, the market for renewable energy technologies is not yet mature enough to support established supply chains of any size. This may be related to uncertainties regarding the specifics of which materials are required, as much of the technology itself is developmental. Alternatively, the supply chains may be largely non-UK based, as is currently the case for wind turbine generators, for example.

In wind power, although the UK has world-class developers and consultants, there is currently very little manufacturing capacity in the UK and much of the value of wind-power projects goes abroad. . There are no established turbine manufacturers and very few UK companies export components.

However, the UK is home to both wind turbine rotor blade and tower manufacturing facilities of the world's largest wind turbine manufacturer. In addition, there are indications that with the increased commitment to wind power and with the large number of consented wind power developments, that UK based companies are positioning themselves to supply into this market, and there are certainly a considerable number of companies with the capability to do so.

For example, a UK based company is developing world-leading, direct drive turbine generator technology, and a UK based Research and Technology Organisation (RTO), with industrial partners, has developed radar absorbing materials which should see considerable global exploitation in wind turbine applications.

The UK has established itself as an early market leader in marine (tidal stream and wave) power generation with approximately half of the world's current technology developers (approximately 30) headquartered in the UK. In addition, the UK has pioneered the establishment of shared facilities for the testing of wave and tidal devices.

Currently, there are few marine energy devices / technologies which have reached full-scale testing and, of these, the front-runners currently have, and foresee, no immediate materials supply (chain) issues, as construction is largely utilising the UK's existing offshore technologies and know-how.

The UK is very active in R&D for sustainable energy, through such initiatives as SUPERGEN, the Sustainable Power Generation and Supply Programme. This programme is managed and led by the EPSRC, in partnership with other research councils (Biotechnology and Biological Sciences Research Council (BBSRC), Economic and Social Research Council (ESRC) and Natural Environment Research Council (NERC)) and the Carbon Trust. Various consortia are active in wind and marine energy, solar cell development (both conventional and non-conventional, excitonic) and fuel cells; in addition to conventional fossil-fuel fired power generation.

A further area in which the UK has both world-leading manufacturing and research capacity is in fuel cells, and the UK's materials R&D is at the forefront of fuel cell technology, and will continue to be so for the foreseeable future.

More than a hundred companies based in the UK are active in the development of fuel cell technologies, from materials R&D to fuel-cell systems integration. UK based companies in the sector are developing their supply chains as their technologies evolve and the UK is home to a world leader in catalysts and catalysed components for fuel cells.

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