TASK GROUP REVIEWS

Fossil-fuelled Power Generation

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Energy Materials

Fossil Fuelled Power Generation.

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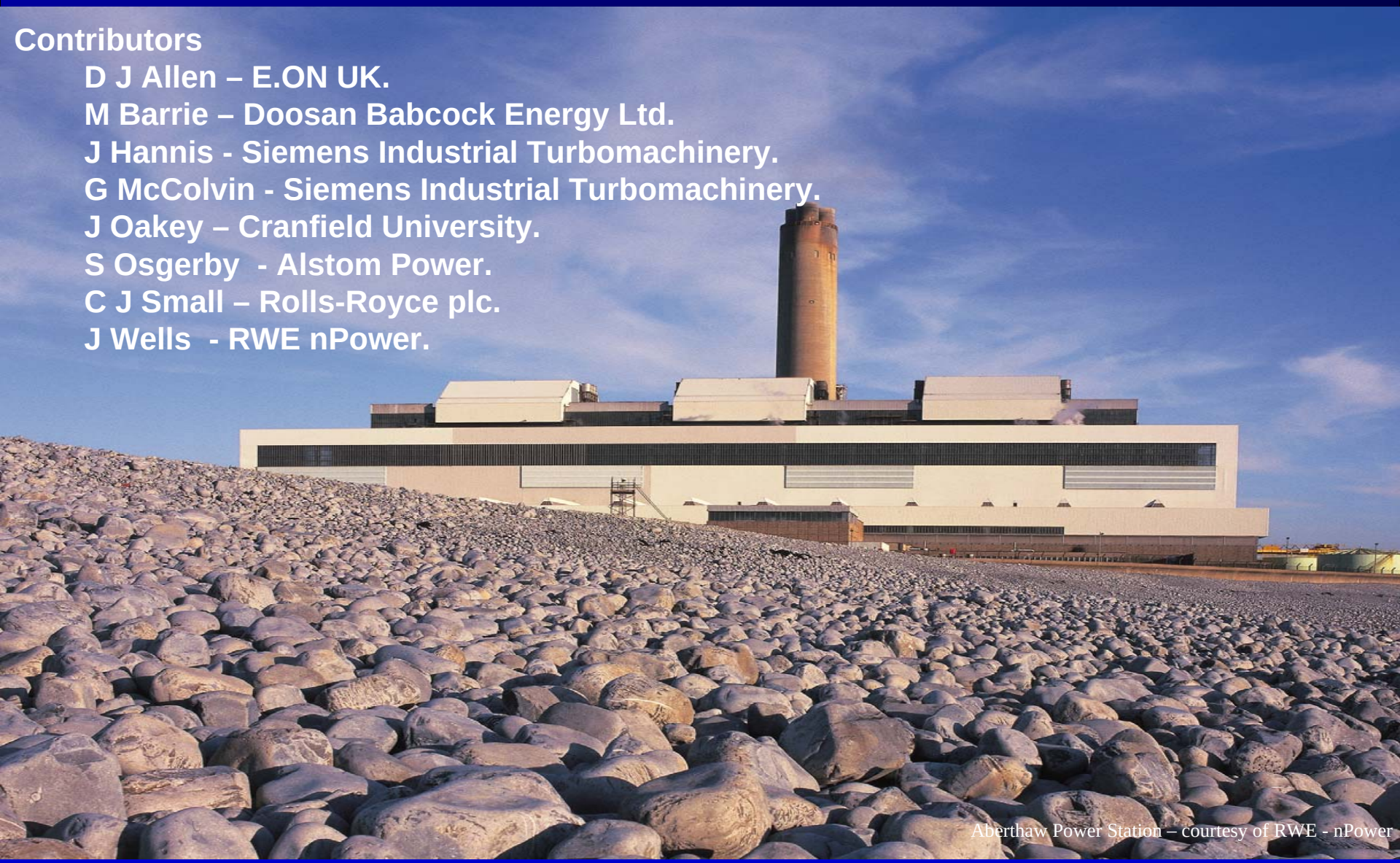


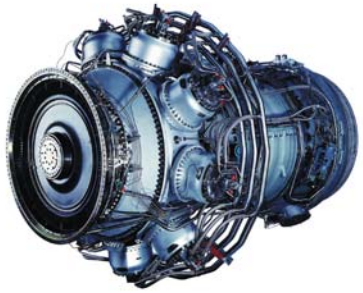
Aberthaw Power Station – courtesy of RWE - nPower

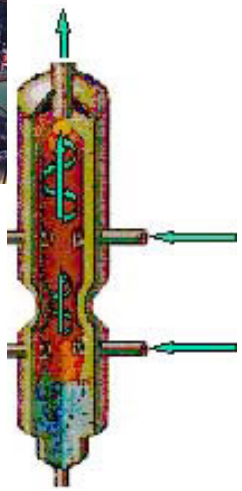
Fossil Fuelled Power Generation.

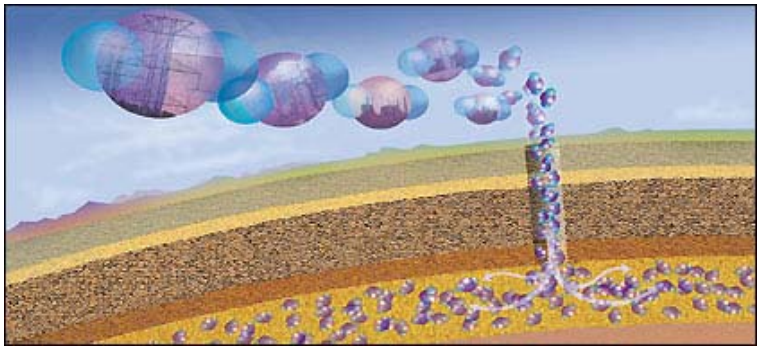
- Contents.
  - Scope.
  - Drivers.
  - Main approaches.
  - Generic technology.
  - Materials challenges 5, 10 and 20 years.
  - UK capability.

Fossil Fuelled Power Generation

- Scope.
  - Boilers.
  - Steam Turbines.
  - Gas Turbines.
  - Gasifiers.
  - CO_2 Capture.







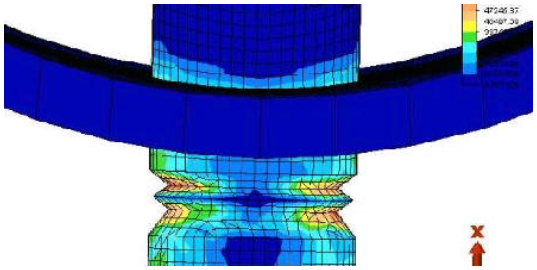
Fossil Fuelled Power Generation

- Drivers.
  - Reduction of CO_2 emissions.
  - Cost (original manufacturer, ownership/use and end of life disposal).

- Main approaches.
  - Increasing plant efficiency.
  - Co-firing with renewable fuels.
  - CO_2 sequestration.

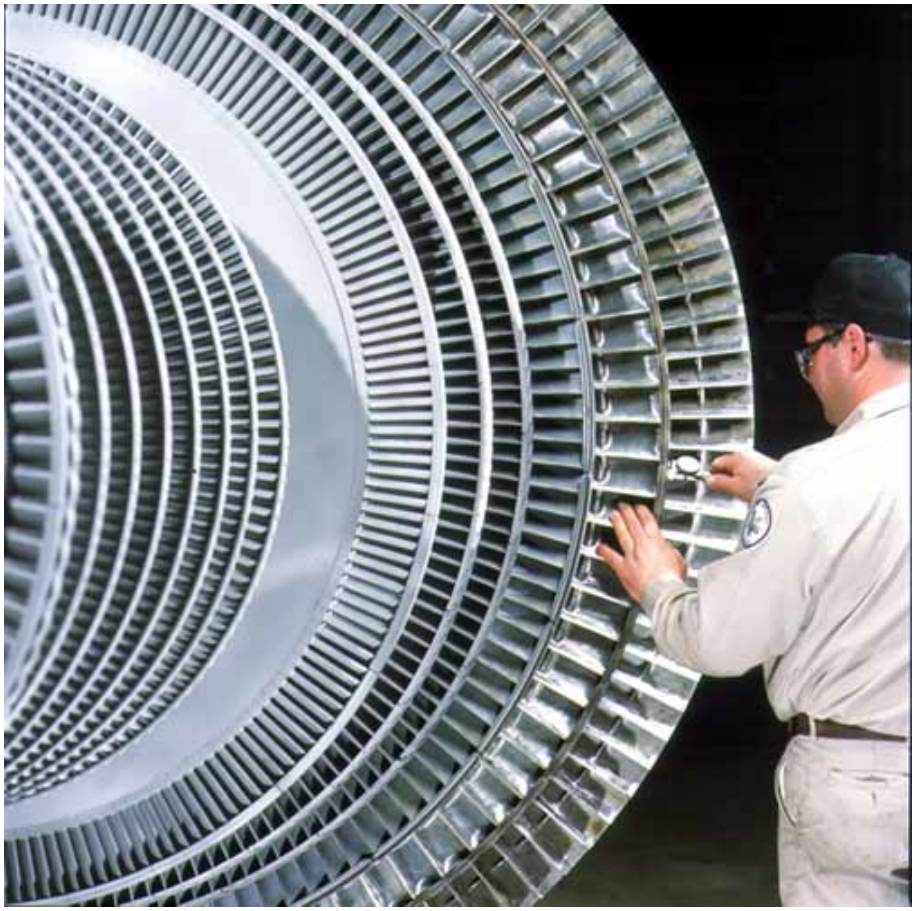
Fossil Fuelled Power Generation

- Generic technologies
  - Surface protection technologies (coatings).
  - Non-destructive evaluation (NDE).
  - Lifing.
  - Repair.
  - Joining.
  - Recycling



Fossil Fuelled Power Generation

- Key Materials Challenges – 5 Years.
  - **Production and characterisation of prototype components manufactured using identified materials and processes.**
  - **Repair and improvement solutions for existing plant and materials.**
  - **Advanced manufacturing development for existing materials and processes aimed at cost reduction, increased performance and integrity.**



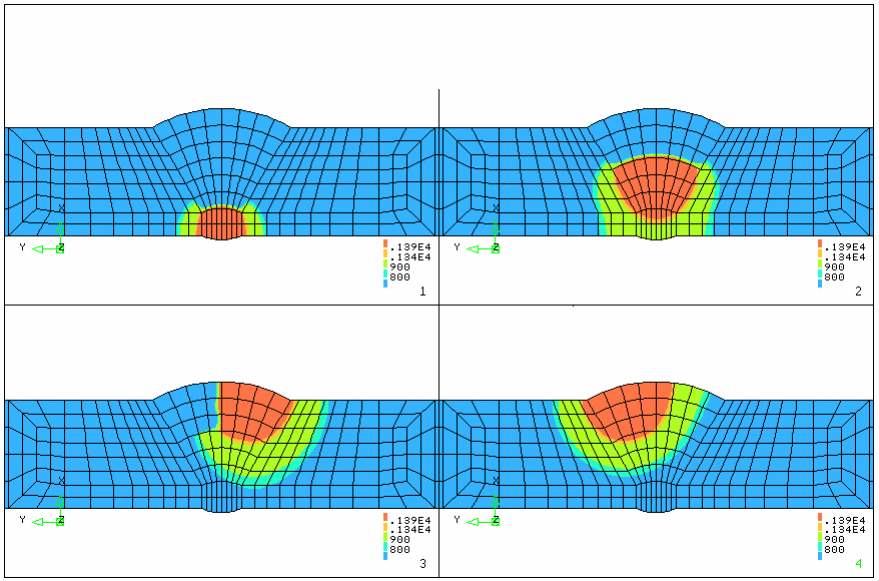
Refurbishment and Repair of a Steam Turbine – © Sulzer Metco

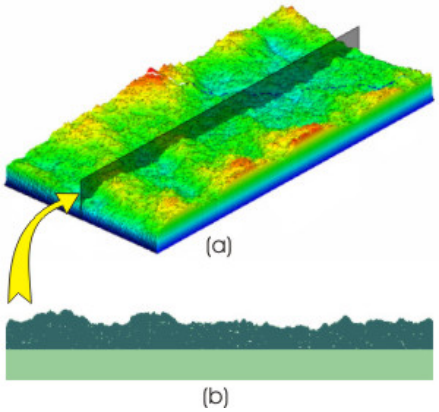
Fossil Fuelled Power Generation

- Repair and refurbishment.
  - For current materials , affordable extension of life of current plant.
  - For new materials – extended reliable operation. Designed in as part of materials development.
  - Predictable refurbishment intervals (minimum disruption).

Fossil Fuelled Power Generation

- Key Materials Challenges – 10 Years.
  - Development of new material systems (substrate and coatings) based on existing knowledge including behaviour in realistic environments.
  - Development and application of process modelling to new materials to speed up introduction and help define new system solutions.
  - Adopting a total system approach to critical part design and life prediction with multi-material components with joints and coatings.





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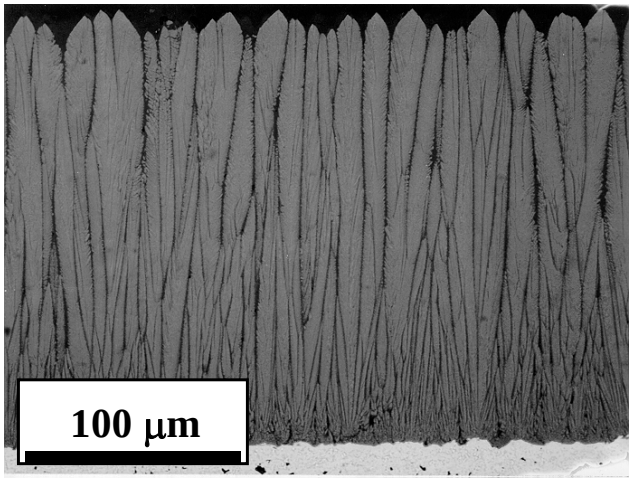
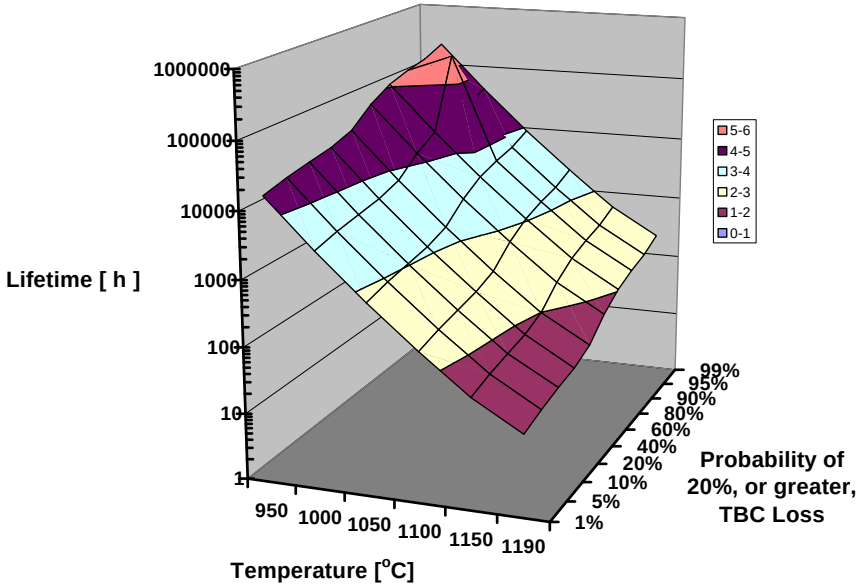
- Modelling Materials.
  - Linked (Integrated?) models
    - Material systems – substrate and coatings.
    - Process.
    - Properties.
    - Environmental effects.





Fossil Fuelled Power Generation

- Key Materials Challenges – 20 Years.
  - Development of novel material systems that will enable high overall efficiencies that will significantly reduce emissions and
  - Initial characterisation to identify most promising approaches.

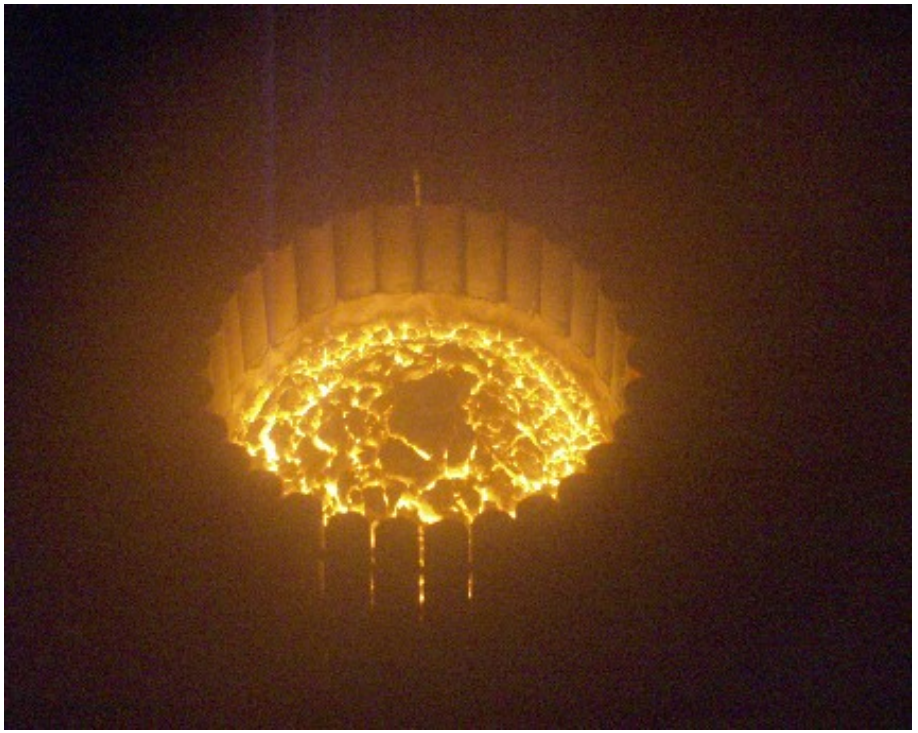
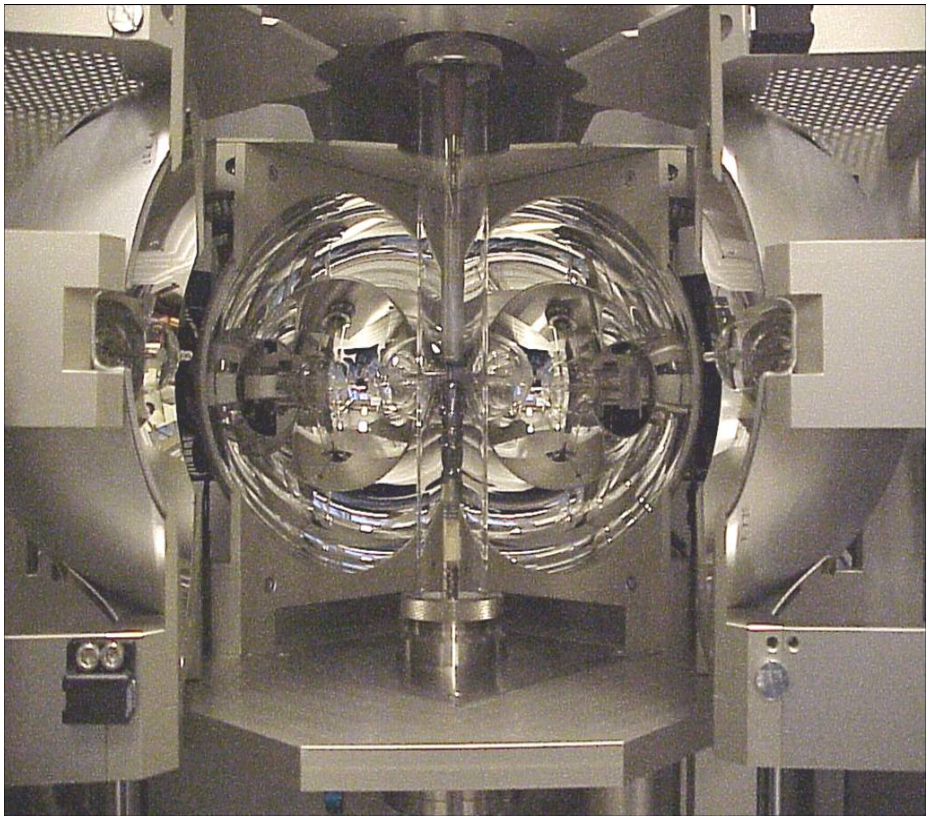


Image © Berlin TU

Fossil Fuelled Power Generation

- Novel Materials Technology.
  - Gas turbine materials targets for 2020.
    - Density <7g cm-3.
    - T capability >2100K.
    - Oxidation resistance 1450K.
    - Creep +100K over current.
    - Ductility equivalent to Ti.
    - Recyclable
  - Material ????
  - Manufacturing process??
  - Etc.



Fossil Fuelled Power Generation

- Skills and Capabilities.
  - UK based OEMs with technical capability to develop and deploy new materials.
  - End users with need to improve/repair, extend plant life and capability to develop the appropriate solutions.
  - Supply chain capability in limited areas to develop and supply new materials.
  - Strong academic groups and RTOs involved in materials design, development, NDE, repair, joining and lifing.

- UK has capability to rise to challenge.

Fossil Fuelled Power Generation

Thank you

With acknowledgement to the co-authors and all others who contributed to this report