



European Technology Development Ltd.

Our Ref. 2s/ias

Dear Colleague,

ETD Review Report on ‘Damage to Power Plant due to Two Shifting and Load Following – Operational, Technical and Cost Issues’

It is our pleasure to inform you that European Technology Development have now completed an international industry sponsored project on the subject of ‘power plant two shifting and load following’. This study has resulted in a comprehensive 155 page Report on the issues involved and check lists for the plant operators. It has also resulted in producing a detailed review of the technology, cost, manpower, management and R&D issues involved and the effect of plant cycling on new materials such P91 and weld repairs etc. In fact, one of our sponsors has described it as ‘the best Report on the topic, especially from the plant operators viewpoint’. Another sponsor has described it as their ‘bible on plant cyclic operation’.

A summary of the Report and the list of Contents is shown below. The Report was initially commissioned by our sponsors worldwide, who also contributed to the study, and is now available to potential new sponsors.

The study is considered to be a very useful guide to the plant operators who are *new* to two shifting/ load following. At the same time, since the study contains useful and detailed check lists and a number of unpublished new findings - especially from more recent plant experience and R&D work, the Report will be of equal value to those operators who are *well versed* in two shifting and/ or load following.

For further information and costs involved please contact at the address below.

DAMAGE TO POWER PLANT DUE TO CYCLING

(Acronym: Two-shifting)

Final Report

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European Technology Development Ltd - UK

Final Report on a Multi-Client Sponsored Project

Damage to Power Plant Due to Cycling
(Acronym: *Two-shifting*)

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Management Overview

This report, prepared by European Technology Development Limited, evaluates the effects and implications of cyclic operation on equipment in steam based fossil fuelled power plant.

As such, one of the prime aims has been to set out the report in a form to be of direct assistance to management and senior engineering staff of individual stations, who may need guidance for more cost effective cyclic operation of their plant or when contemplating a move from base load operation to two-shifting or load cycling. Hence, although the report needs to be read in its entirety, it basically consists of a set of stand-alone sections and appendices that deal both with the technology/R&D and practical issues of plant operation. Individual chapters and appendices can therefore be conveniently consulted by the stations, if so required. These can also be used as aide-memoirs by senior plant management and engineering staff.

Because of the complex nature of various issues, and their interaction, affecting the cost of plant cycling the main text of the report has been kept brief and focuses on major issues. Many of the other issues on technical, cost, management and plant operation have been discussed in detail, together with examples where appropriate, in various appendices. The reader is, therefore, advised to make references to the appendices for in-depth understanding of some of the issues involved.

Although the emphasis in the report is on the operating problems, mechanisms of component failure, preventive maintenance and repair, and the question of costs are also addressed. One of the principal findings has been that the major cost implications of cyclic operation do not occur until some three or more years after changing from base load. After this time the cyclic effects of two-shifting will begin to cause significant damage to components.

As the report shows, repair and replacement costs of items such as superheater headers and other critical plant components can be extremely high. The medium and long term cost implications of this are not always considered. Obviously the implications of this will differ from unit to unit. For a plant that is due to go out of service, little may need to be done in terms of equipment upgrading. For other plants, which are intended to be in service for a longer period, it may be worth changing bypass systems, increasing drain lines, or adding ancillary recirculation pumps to improve operability and reduce the risk of thermal fatigue. Improved control and monitoring systems may also be an option.

However, it is clear that as a result of privatisation and ensuing competition advanced fossil fuel power plant, currently being commissioned, will need to work in a situation in which cycling of power plant is the norm. This cyclic tendency could be further exacerbated in future as a result of the increasing input of wind, solar and tidal power, all of which by their nature are extremely variable. Hence, turning to the R&D aspects of the report, there is much scope in this area, particularly where some of the new power plant materials, such as the P91 steels are concerned. Creep-fatigue, repair welding, and cyclic oxidation are pertinent issues. These are addressed in more detail in the appropriate sections and appendices.

Finally, the report shows that there is a close and complex link between the technical and cost issues. Therefore, to reduce the cost of plant cycling, while there is a need to develop sophisticated cost models a clearer understanding of technical issues needs to be advanced in parallel to produce reliable and robust cost models.