

CPI Alternative Fuels Services

Introduction

Cement Performance International (**CPI**) has decided to launch a package of Alternative Fuels Services to assist its customers by providing the necessary support in the planning, design and implementation of an Alternative Fuels programme. Whilst **CPI** previously provided many of these services, this will be the first time that all of the services have been packaged together as one and presented in a logical process. This will be especially useful for first time users of Alternative Fuels, as all of the process, quality, environmental, community and legislative requirements for the successful implementation of an Alternative Fuels programme are described.

Whilst the services have been laid out in the format for a plant that is about to enter into Alternative Fuels, the services available could also be relevant to plants that have already started using Alternative Fuels. There may be requirements to start using a second or third fuel, there may be process or materials changes that require evaluation, there may even be changes in emissions from what appear to be the same process conditions – **CPI** can provide all of these services as a complete package or the client can select those that it requires for its particular circumstances.

CPI employees and associates have worked on a large number of Alternative Fuels projects and within the **CPI** network all of the necessary disciplines to ensure the successful implementation of an Alternative Fuels programme are represented. Although the implementation of an alternative fuels programme can be a daunting task, **CPI** can logically separate each requirement into a small easily-managed stage, as shown by the flow diagram at the end of this document. **CPI** has based its programme on the EU Waste Incineration Directive and will adapt this approach according to the Clients own internal resources, local conditions and legislation.

Scope of Services

As stated in the introduction, starting an Alternative Fuels programme requires careful planning not just from the technical aspects such as which fuel to use and the best injection point, but also from the perspective of the wider impact within a community and the predicted environmental impact, the

impact upon the existing process and the quality of cement that is produced, storage and dosing systems, commissioning and optimisation of the chosen Alternative Fuel. **CPI** has divided the services into Planning, Design and Implementation stages, as described below:

Planning Stage

Public Relations Planning

Whilst there are many challenges entering into an AF programme, one of the biggest that must be overcome is the reaction of the local community to changing from what might be considered as clean or traditional fuels to fuels which generally are considered as waste or are generated from waste streams. Despite the fact that many of the AFs in use are designed to a strict specification and are more strictly controlled than fuels such as coal, the perception is that they present an Environment and Health and Safety threat to the local population. For a plant using an Alternative Fuel for the first time, the success or failure of its public relations planning will have an impact for many years and will have a strong bearing on the success of subsequent AFs implementations.

CPI has resources who have been involved in AF programmes from the Operational, Technical Centre and Corporate perspectives; all of these different departments have a role in developing the public relations campaign, normally with an external consultant specializing in Public Relations. From the operational perspective the **CPI** resources can assist in understanding the local perspective, who the key stakeholders are in the community and broader legislative context, who carries influence and who needs to be targeted as part of the campaign. From the technical centre perspective, the impact of using the fuel and the predicted emissions from the implementation can be explained in simple terms. From the Corporate perspective, the wider message of the objectives and company policy on Alternative fuels can be presented.

It should be remembered that the PR process continues all the way through the trials and once the process has been started the expectation level of the community will be set; it is therefore extremely important that the message and the communication is consistent.

Fuels Supplier Selection

With significant resource and cost being committed to an Alternative Fuels project, the supplier of the fuels must be reliable, understand the process and the importance of supplying the correct quality

and quantity of fuel to the cement producer as well as demonstrating the same level of commitment to the programme as the cement producer. **CPI** can advice in the selection process of the fuels supplier, in some cases by providing a questionnaire for the fuels suppliers to identify their capability and suitability for the task. As **CPI** has knowledge of the costs involved with the preparation, treatment and supply of Alternative Fuels it can also assist in any price negotiations for the supply of the fuel.

Fuels Chemical and Physical Specification

The chemical and physical specification of the alternative fuel to be utilised is an extremely important element of any alternative fuels programme and it should be defined at the start of the process. Once the specification is agreed with the environmental authorities, it must be adhered to and therefore any specification that is formulated must be achievable and deliverable by the suppliers in the volumes required for long term (and potentially increased) usage levels. In terms of the chemistry the specification can have an impact upon the process, the environment emissions and the final product quality. The physical specification will can have an impact upon the materials handling system (and therefore the capital cost of the equipment), the injection point into the system, the burnout-time of the fuel and the stability of fuel delivery to the system (and therefore potential process instability).

With the experience within the **CPI** team any fuels specification can be evaluated and recommendations made if either chemical or physical characteristics are included which could result in difficulties during the trial and in longer term usage.

Process Impact

Following on from the specification of the fuel and the target substitution levels, it is important to identify what are the potential impacts on the process. With the inputs being known, **CPI** can predict what will happen in areas such as output, fuel consumption, required fan power, build-up in the system, by-pass requirement etc. All of this information is invaluable before the trial such that the plant is aware of what may happen and is prepared to take corrective actions to ensure that the trial does not have to stop at some stage. For example, extra teams may be planned to remove build-up in the tower or additional clinker may have to be brought in to ensure that there is sufficient stock in the case of a drop in output during the trial. In some cases the potential impact upon the process from this part of the study will be used to revise either the specification of the fuel and/or the target substitution rate.

Environmental Impact Study and Emissions Prediction (including CO₂ benchmarking and predictions pre and post fuel implementation)

As part of any Alternative Fuels programme, the cement producer will most likely be required to perform an environmental impact study and emissions prediction. The prediction of the changes in the emissions of both the major emissions species such as NO_x and SO₂ as well as the minor elements can be modeled by **CPI** as the inputs into the environmental study by a specialist company (this normal involves dispersion modeling and the impact of any changes in emissions). Furthermore **CPI**, has developed a model to identify the CO₂ emissions from the operations and also the impact upon the CO₂ emissions once an alternative fuel is being used. This is extremely important when carbon neutral fuels are being used as the element of CO₂ that is coming from the alternative fuel will have a carbon credit assigned to it.

Product Quality Impact

Equally as important as the impact on the process is the impact upon the product quality and therefore the end user of the product. Customers may well be aware of the plans to introduce alternative fuels and may seek reassurances that the cement properties that they require are not going to change.

Minor elements in the alternative fuels can have a significant impact in the properties of the cement such as colour or setting time. Therefore by reviewing the planned substitution rate and the specification **CPI** can identify any potential problems and provide solutions which will reduce or eliminate the impact upon the final product quality. For example this may be by the modification of the raw mix or the use of cement improvers at the milling stage, or by modification of the substitution rate.

Financial analysis of fuels implementation

One of the key drivers for the alternative fuels programme is the improvement in profitability for the cement plant operator. Financial analysis will be required both for the long term viability of the project and also any necessary capital investment into the project. Having completed the above analysis and quantified all of the costs and the impacts of the implementation of using alternative fuels, **CPI** can work with the cement producer to build the financial model for the trial and long term use. All costs will be taken into account, such as changes in fuel consumption, loss of output, any

new materials such as cement modifiers as well as the benefits of negative fuel costs to build an accurate model.

Fuels Quality Control Programme

In many countries the legislation is such that there is a requirement for a sample of each load of material that is used to be analysed, and in many cases samples and results stored for significant periods. **CPI** can advise on the requirements for this stage of the programme and the submissions that have to be made to the regulator, as well as the types of specific equipment that will be required for setting up the alternative fuels laboratory. **CPI** will also provide guidance on the systems that need to be put in place if a delivery of fuel is out of specification – for example isolation the fuel and burning at a lower rate such that the overall input system is limited.

Fuel related Health and Safety planning

Similar to the quality control requirements from the regulator, there will be significant implications and regulations with regard to the Health and Safety of the alternative fuels programme. Through its experience with different alternative fuels recommendations can be made in areas such as storage type and capacity, fire fighting measures, personal protective equipment, spillage procedure etc. **CPI** will ensure that the recommendations provided reach the highest standards and represent the best practice Health and Safety Standards.

Design Stage

Injection point definition and burner specification

Evidently different fuels can be injected into different areas of the process and as such for optimum burning conditions and substitution levels to be achieved it is critical to identify the best position for the fuel to be injected. Some fuels will require a residence time for the fuel to burn out fully, others will require a specific temperature to ensure complete combustion whilst others have physical characteristics that prevent them from being used in certain places in the pyroprocessing plant. Once **CPI** has the specification of the material it can identify the optimum injection point into the process, and following on from this the method of delivery. This may be via the specification of a burner pipe – either main burner or a calciner burner – or through a series of chutes and flap valves. **CPI** has

specified many burner pipes for multiple fuels using optimum flame theory and can also specify items such as blowers/fans for the system.

Storage, materials handling and dosing system definition

The storage, handling and dosing of alternative fuels is especially important for the trial. If the system is well designed then long, steady, consistent runs using the fuel will be achieved allowing a good demonstration of the effects of the fuel and data gathering. If the system is poorly designed the trial will be constantly interrupted by blockages, starts and stops of the fuel and inaccurate dosing of the material. If this is the case it is difficult to quantify the effects of the fuel and may hamper the collection of data for the environmental authorities.

Dependent upon the physical characteristics of the fuel **CPI** can specify the type of storage and transport system that will be best suited to the fuel, and a dosing system that will avoid blockages and also allow the accurate metering of the fuel into the system. Accurate dosing is important to ensure that the fuel addition rate is optimised and also so that the cement plant operator can demonstrate to the environmental authorities that the maximum addition rate has not been exceeded.

Tender documentation preparation and evaluation

Having selected the necessary equipment **CPI** will prepare the necessary tender documentation to be sent to the equipment suppliers, in conjunction with any specific requirements for the site. Once the replies have been received, **CPI** will evaluate the technical offers from the suppliers, taking into consideration the chemical and physical specification of the equipment. Critical areas such as belt size, speed and angle, transfer points, pump and blower size and weigher range and accuracy will be considered. Areas of concern will be reported to the cement producer for discussion with the equipment supplier such that a refined design can be provided. Advise on the preferred technical design and the offered price will be provided.

Trial Design and planning

The trial itself will be spread over a number of weeks and within this trial there will be both internal and external objectives. The internal objectives will include items such as demonstrating that the feeding and transport equipment works, producing steady state operating conditions at different

levels of alternative fuels, operating the Alternative Fuels laboratory etc. The external objectives will be related to demonstrating the improvement in emissions from the process with the alternative fuel, on a consistent basis, at the target level of substitution. **CPI** will also assist with identification of suitable equipment for stack gas emissions monitoring and provide advice and recommendations on calibration regime, such that the producer can demonstrate that the emissions can be measured to within the agreed accuracy and precision.

CPI with the cement producer will design the trial plan, guidelines and objectives and also ensure that all other factors and departments are well briefed and understand their role within the trial – for example for the quarry to provide consistent materials for the full length of the trial period.

Implementation Stage

Plant Commissioning and optimisation

Once all of the equipment has been installed and the trial is ready to start, **CPI** can provide resources to assist in the commissioning of the equipment, the burning of the fuel and the optimisation to the target levels. This could be in the form of a process engineer in the field or providing training to the operators before the start of the trial, to explain what the potential difference will be when using the fuel. Alternatively, it could be an expert kiln burner in the control room, assisting the plant kiln burners to adapt to the new process conditions. In many cases it is a combination of the two disciplines. As the trial develops the resource requirements will change and **CPI** can work with the cement producer to change the resources as and when required to provide round the clock support during the trial.

Preparation of the Environmental Report

At the end of the trial there is the significant task of bringing together all of the relevant data relating to the use of the fuel and the relevant emissions during the trial. This data is required for a submission to the relevant environmental body as well as being provided to the company responsible for the dispersion model of the trial. **CPI** can provide guidance and assistance in compiling the report and also analyzing technical data to provide items such as mass balances and capture efficiencies for the minor elements.

Alternative Fuels troubleshooting

Often circumstances can change on a cement plant which affect the steady state of the operation – it may be down to raw materials changes, modifications that occur during the shutdown or even external factors such as changes in the environmental legislation. In these circumstances the effects of the changes on the process or on emissions are difficult to explain but all the same need to be investigated and resolved. The issue may require on site assistance or remote analysis and support from the **CPI** offices, but as with the general **CPI** troubleshooting services the network of disciplines is available at short notice to assist.

