



# Influence of lignite composition on thermal power plant performance

## Part 1: Theoretical survey

Janez Oman<sup>a,\*</sup>, Andrej Senegačnik<sup>a</sup>, Boris Dejanovič<sup>b</sup>

<sup>a</sup>*Faculty of Mechanical Engineering, University of Ljubljana, Aškerčeva 6, 1000 Ljubljana, Slovenia*

<sup>b</sup>*Power plant Šoštanj, Lole Ribarja 18, 3325 Šoštanj, Slovenia*

Received 4 October 1999; accepted 13 April 2000

---

### Abstract

Conversion of energy with the highest possible efficiency is of primary importance in processes with high intensity of energy flows, among which the most significant are those in thermal power plants. The paper deals with the influence of coal composition on the conversions taking place in power plants. The analysis of energy conversions treats, above all, the heat loss due to the exhaust flue gas. The analyses of the power plants use of electric powers are focused on the processes of coal pulverising and exhaust flue gas cleaning. The results of the analyses are graphically presented. © 2000 Elsevier Science Ltd. All rights reserved.

*Keywords:* Coal; Lignite; Power plant; Flue gases; Energy losses

---

### 1. Introduction

The impact of coal quality on power station availability and its operating efficiency is uncontested. The changes in the composition of coal are reflected not only in changes of boiler specific consumption and in the quality of the processes of the unit, but also in the emission requirements the power plant must meet. Accordingly, while striving to produce power at the lowest cost possible, quality of the coal used becomes an important parameter. There are

---

\* Corresponding author. Tel.: +386-1-477-1306; fax: +386-1-2518-567.

*E-mail addresses:* janez.oman@fs.uni-lj.si (J. Oman), andrej.senegacnik@fs.uni-lj.si (A. Senegačnik).

different criteria for examining coal properties, in particular, power plants and also a lot of papers dealing with the effect of coal quality on power plants. The criteria for including particular properties of coal as influential factors depend in the first place on the coal rank, the composition of coal, its mechanical and physical properties and on the type of the power plant installation. Basic data for coal quality specification are heating value, ash content, moisture and sulphur. For a particular power station, the importance of individual factors varies [1]. Additional properties are volatile matter, fixed carbon, ash fusion temperatures, grindability etc. These factors influence the processes, in particular, power plants as early as the phase of coal handling and storage and, to the highest degree, in the processes of coal preparation and coal combustion in the boiler.

A comprehensive review of coal specifications, pre- and post-combustion performances, the influence of coal composition on the combustion processes and the coal related effects on overall power station performance and costs was presented in Refs. [2–4]. The effects in the boiler are immediate and indirect. Among the immediate significant effects are fouling, slagging [5,6], abrasion [7], erosion [8] and corrosion. The indirect influence is reflected not only in the amount of power consumption for coal grinding, gas cleaning processes, transportation of coal and ash etc., but also in heat losses of the boiler and in the efficiency of the unit. These effects for bituminous coals are described in Ref. [3]. There are some typical coal quality requirements for power generation based on theoretical and practical grounds. Regarding composition, lignite (according to ASTM classification) cannot be numbered among the coals that meet the expected requirements. Among the extensive literature dealing with the impact of coal properties on power plants, there are only a few publications related to the influence of lignite composition on boiler and power plant efficiency.

The subject of this contribution is divided into two parts. In Part 1, a survey of the influences on heat loss and efficiency of the boiler on the basis of the theoretical composition of coal is carried out. In Part 2, the influence of the actual coal composition on the operation parameters of the boiler and on the efficiency of the boiler and unit are presented on the basis of measurements.

## 2. Theory

### 2.1. Efficiency improvements and coal savings

Suppose that the boiler efficiency changes from  $\eta_1$  to  $\eta_2$ , but the boiler energy output remains the same,

$$\dot{Q}_{B_1} = \dot{Q}_{B_2} = \dot{m}_{F_1} \eta_1 H_i = \dot{m}_{F_2} \eta_2 H_i, \quad (1)$$

then, at equal lower heating value  $H_i$ , the mass flow of fuel should be changed from  $\dot{m}_{F_1}$  to  $\dot{m}_{F_2}$  where:

$$\dot{m}_{F_2} = \dot{m}_{F_1} + \delta \dot{m}_F. \quad (2)$$

If the fuel mass flow change is defined as  $\Delta \dot{m}_F = \delta \dot{m}_F / \dot{m}_{F_1}$  then we can write:

متن کامل مقاله

دریافت فوری ←

**ISI**Articles

مرجع مقالات تخصصی ایران

- ✓ امکان دانلود نسخه تمام متن مقالات انگلیسی
- ✓ امکان دانلود نسخه ترجمه شده مقالات
- ✓ پذیرش سفارش ترجمه تخصصی
- ✓ امکان جستجو در آرشیو جامعی از صدها موضوع و هزاران مقاله
- ✓ امکان دانلود رایگان ۲ صفحه اول هر مقاله
- ✓ امکان پرداخت اینترنتی با کلیه کارت های عضو شتاب
- ✓ دانلود فوری مقاله پس از پرداخت آنلاین
- ✓ پشتیبانی کامل خرید با بهره مندی از سیستم هوشمند رهگیری سفارشات