Sample Translation

Mechanical Engineering

- See below for the original Chinese manuscript.
- **A native-speaker of English who has studied engineering** proofreads the translated English.
- The quality of the translated manuscript is suitable for publication in an international journal.

Power Plant Thermal Efficiency Analysis Model

1. Foreword

Conventional thermal power plants can be classified by their thermal power circulation medium. , For example, those whose circulating fluid involves phase changes between steam and cooling water are called Rankin cycle power plants, or conventional steam cycle power plants. Those using air circulation are called Brayton cycle power plants. Most base-load power plants in Taiwan currently use steam turbines to run the Rankin cycle for continual long term operation, while the peak-load power plants use air turbines that use air as a circulating fluid to run the Brayton cycle. The latest power plants use both cycles, called combined cycle plants, which have advantages in achieving improved thermal efficiency.

One of the advantages of steam cycle thermal power plants is that there are various heat sources available for thermal power generation, such as fossil fuel, nuclear fission reaction, and solar energy. Figure 1 shows the schematic of a typical steam cycle power plant, where fuel is burnt in the boiler to heat the circulating fluid (liquid water) to generate high pressure steam to turn the turbine blades, rotate the turbine and thus drive the power generator. The electricity produced is fed into the power system via a dispatching network. A steam turbine system usually consists of a series of high, medium, and low pressure steam turbines so that the steam can be recycled and the majority of the steam energy is utilized, thereby increasing overall thermal efficiency. The low pressure steam exiting from the turbine is passing through a condenser and condensed into liquid water for recycling. The cooling water in the condenser could potentially be sourced from the sea, a river or a lake, so that the waste heat is removed using

natural water bodies. Alternatively, the condenser could be air cooled, where the waste heat is removed into ambient air, so that heat pollution is minimized. The exhaust air from the boiler, is then treated by various scrubbing operations such as SCR, ESP, FGD to remove pollutants including oxides of sulfur, oxides of nitrogen, carbon dioxide, suspension particles, etc, prior to releasing the exhaust air to the atmosphere.

发电厂能源系统热效率模型分析

1.前言

传统火力电厂可以用热功循环的种类来区分。工作流体以蒸汽和冷凝水交替变相工作的，称为郎肯(Rankin)循环电厂，俗称蒸汽循环，以单一热气体做功者称为布雷顿(Brayton)循环电厂。台湾多数的基础负荷电厂利用以蒸汽为工作流体的汽力机进行郎肯循环，在长期连续模式下操作；高峰负荷电厂则利用以热气体为工作流体的蒸汽涡轮机进行布雷顿循环，在高峰负荷时段操作。现代较新的发电厂则将上述两种循环合并运用，称为联合循环电厂，可得到较高的能源转换效率。

蒸汽循环火力发电厂的其中一个优点，是可以利用各种热源进行热功转换而发电，例如化石燃料、核分裂反应、聚焦阳光等。图 1 为典型蒸汽循环火力电厂的设施架构图，其中燃料在锅炉内燃烧，加热工作流体(液态水)后产生高压蒸汽，推动汽轮机叶片使之旋转，同时带动同轴发电机发电，电能由输电网络馈入电力系统。汽轮机一般采用高压、中压与低压三段串接式架构，将蒸汽重复应用，以提取最多的蒸汽热能来发电，增加机组的能源转换效率；低压汽轮机排出的低压蒸汽经过冷凝器凝结成液态水后，再由水泵输送到锅炉循环再利用。冷凝器的冷却水可由海水、河流或湖泊等提供，将蒸汽废热排入自然水体；冷凝器也可用冷却塔以风冷方式进行，将废热排入大气，可减少环境热污染问题。锅炉废气中大量的硫氧化物、氮氧化物、二氧化碳、悬浮微粒等对环境有害的物质，经过静电集尘与各种脱硫、脱硝设备处理后，再由烟囱排入大气中。