

Techno-economic analysis on balance of plant (BOP) equipment due to switching fuel from natural gas to hydrogen in gas turbine power plant

フジタ, ダイド

<https://hdl.handle.net/2324/7363870>

出版情報 : Kyushu University, 2024, 博士 (工学) , 課程博士
バージョン :
権利関係 :



氏 名 : Fujita Daido

論 文 名 : Techno-economic analysis on balance of plant (BOP) equipment due to
switching fuel from natural gas to hydrogen in gas turbine power plant
(ガスタービン発電所における天然ガスから水素への燃料転換によるプラント
周辺設備の技術経済性分析)

区 分 : 甲/Kou

Category

論 文 内 容 の 要 旨

Thesis Summary

The primary aim of this thesis is to conduct a comprehensive techno-economic analysis of the balance of plant (BOP) equipment in gas turbine power plants during the transition from natural gas to hydrogen as a primary fuel. This research seeks to evaluate the technical, economic, and operational implications of this fuel switch, providing valuable insights and recommendations for industry stakeholders and policymakers.

Chapter 1 describes the background of the thesis, motivation, objectives, and the summary of the thesis structure.

Chapter 2 provides a comprehensive analysis of Japan's shift from traditional energy sources to renewable energy. This transition is driven by the need to reduce carbon emissions and increase energy security. The study highlights the challenges and opportunities associated with integrating renewable energy into Japan's electricity grid, including policy measures, technological advancements, and economic implications. The texts from Chapter 2 are copied from the published article entitled "A Study of Japan's Energy Landscape in the Transition to Renewable Electricity".

Chapter 3 investigates the effect of natural gas composition on centrifugal gas compressors used in gas turbine power plants. The texts from Chapter 3 are copied from the published article entitled "Investigating the Effect of Natural Gas Composition on Centrifugal Gas Compressors Used in Gas Turbine Power Plants".

On the other hand, Chapter 4 focuses on the technical and environmental impacts of transitioning from natural gas to hydrogen as a fuel in gas turbine power plants. This research is crucial in the context of reducing greenhouse gas emissions and exploring alternative fuels that can be seamlessly integrated into power generation infrastructure. Both studies/chapters underscore the importance of decarbonizing the energy sector. While Chapter 2 discusses the broader energy transition in Japan, Chapter 4 zooms in on a specific technological shift that can contribute to this goal. Integrating insights from both studies provides a holistic view of the energy transition landscape. Japan's shift to renewable electricity and the potential for hydrogen as an alternative fuel in gas turbines represent complementary strategies in the global effort to achieve sustainable and low-carbon energy systems. The texts from Chapter 4 are copied from the published article entitled "Techno-economic analysis on the balance of plant (BOP) equipment due to switching fuel from natural gas to hydrogen in gas turbine power plants" which is the title of this thesis.

Chapter 5 summarized a general conclusion and recommendations for future works.