



TITLE:

A Framework for Assessing Energy Exporting Countries' Vulnerability and Energy Security: Current Fossil Fuel-Dependent Economy and Future Hydrogen Economy( Abstract\_要旨 )

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( 続紙 1 )

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論文題目	A Framework for Assessing Energy Exporting Countries` Vulnerability and Energy Security: Current Fossil Fuel-Dependent Economy and Future Hydrogen Economy (エネルギー輸出国の脆弱性とエネルギーセキュリティの評価フレームワーク : 現在の化石燃料依存社会と将来の水素社会の事例)		
(論文内容の要旨) This research develops and tests a framework for assessing energy exporting countries` vulnerability and energy security, with examples of current fossil fuel exports and a future hydrogen economy. The thesis is composed of five chapters. Chapter 1 introduces the background to the problem. Chapter 2 reviews existing frameworks for energy security assessment, clarifying that these are typically oriented at energy importers. It then develops a framework for assessing the economic vulnerability of energy resource exporters. This framework is applied to 5 countries. Chapter 3 focuses on exposing the blind spots in domestic energy security of major energy exporters. Using a systems approach that highlights the interlinkages between various domestic and export-oriented energy systems, a new set of indicators are developed to clarify the energy self-sufficiency of energy exporters. The analysis separates the domestic-only and export-influenced components of energy production across the main energy commodities. Chapter 4 then integrates the indicators from the previous chapters and applies the overall energy security framework to current fossil energy exports and future hydrogen energy exports. It draws on parallels from the resource curse hypothesis and the exports of aluminium to compare with electrolysis for production of hydrogen for export. Chapter 5 then presents the conclusions and potential implications. The overall conclusion is that transition to a zero-carbon energy system based on domestic renewable energy sources allows for the decoupling of energy resource exports from the domestic energy system for the benefit of domestic energy security.			

(続紙 2 )

(論文審査の結果の要旨)

The unique and novel contributions of this study include:

1. Adapting energy importer energy security conceptual frameworks and indicators to the economic vulnerability of energy exporters, other indicators derived from corporate risk assessments of energy industry participants.
2. Investigation of carbon risk for exporters, and introducing two new indicators for evaluating this risk in the context of the energy transition:
  - a. Export customer diversity risk subject to customer action on climate change
  - b. Carbon intensity of the mix of exported energy resources
3. Identifying gaps in importer-centric energy security frameworks that leave blind-spots for domestic energy security of exporters, and designing indicators for assessing these blind spots in an energy exporter's domestic energy security:
  - a. Actual primary energy self-sufficiency
  - b. Export exposure of the domestic energy system
4. Developing a conceptual framework for the domestic energy system impacts of future scenarios of large-scale green hydrogen exports, derived from critical review of frameworks used for the resource curse hypothesis; case studies of Aluminium production for export and its impacts on the domestic electricity system; and, LNG production for export and its impacts on the domestic gas and electricity systems.

This research therefore presents significant new developments that are important to the field of energy security evaluation.

よって、本論文は博士（エネルギー科学）の学位論文として価値あるものと認める。また、令和5年8月25日実施した論文内容とそれに関連した試問の結果合格と認めた。

論文内容の要旨、審査の結果の要旨及び学位論文の全文は、本学学術情報リポジトリに掲載し、公表とする。ただし、特許申請、雑誌掲載等の関係により、要旨を学位授与後即日公表することに支障がある場合は、以下に公表可能とする日付を記入すること。

要旨公開可能日：\_\_\_\_\_