論文 / 著書情報
Article / Book Information

題目(和文)	
Title(English)	Comprehensive analysis of cross-border electricity trade between Japan and South Korea ' s electric power companies
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出典(和文)	学位:博士(工学), 学位授与機関:東京工業大学, 報告番号:甲第12122号, 授与年月日:2021年9月24日, 学位の種別:課程博士, 審査員:CROSS JEFFREY SCOTT,大友 順一郎,後藤 美香,村山 武彦,時松 宏治
Citation(English)	Degree:Doctor (Engineering), Conferring organization: Tokyo Institute of Technology, Report number:甲第12122号, Conferred date:2021/9/24, Degree Type:Course doctor, Examiner:,,,,
学位種別(和文)	博士論文
Category(English)	Doctoral Thesis
種別(和文)	論文要旨
Type(English)	Summary

（博士課程）
Doctoral Program

論 文 要 旨

THESIS SUMMARY

系・コース： Department of, Graduate major in	Transdisciplinary Science and Engineering, Energy Science and Engineering 系 コース	申請学位（専攻分野）： Academic Degree Requested	博士 Doctor of (Engineering)

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要旨（和文 2000 字程度）
Thesis Summary（approx.2000 Japanese Characters ）

Title: Comprehensive analysis of cross-border electricity trade between Japan and South Korea's electric power companies

This doctoral thesis consists of five chapters and presents a comprehensive analysis of cross-border electricity trade between Japan and South Korea's electric power companies by advancing complementary and innovative quantitative and qualitative analyses.

In the introductory Chapter 1, it is observed that in many regions worldwide, international power system interconnections have been developed and cross-border electricity trade is the norm rather than the exception. In contrast, Japan and South Korea are still not interconnected with any of their neighbors. Previous works, essentially theoretical quantitative analyses based on computer simulation of countries' power systems, have demonstrated that interconnecting Japan and South Korea should be technically feasible and economically profitable. With this background it is been understood that advancing such project would make sense and should raise the interest of electric power companies (EPCOs), and particularly their transmission arms. The doctoral student identifies that this has not been the case in Japan yet, because of on the one hand energy security concerns related to possible geopolitical tensions, on the other hand the business structure of EPCOs and the fears about the impacts of international competition on their competitive generation and supply business segments. The latter being a critical research unknown. Thus, the value of this thesis lies in its creative various attempts to bring answers to the fundamental question:

What will be the impacts of interconnecting with South Korea on Japanese EPCOs' competitive business segments?

In Chapter 2, an innovative methodology based on an empirical comparison of power exchange prices is advanced to assess the potential impacts of cross-border electricity trade between west Japan and mainland South Korea on EPCOs' competitive business segments. The key findings are that: If an international electrical interconnection had existed between the two areas considered in the period 2018-2019, it would have benefited to Japanese EPCOs thanks to gains from lower

procurement costs for suppliers, overcompensating the losses of generators due to increased competition. It is also explained that despite its advantages, availability and transparency of accurate and detailed data, and its relative simplicity, this methodology proposed is confronted to one major drawback that is the impossibility to measure the impact of cross-border electricity trade on domestic prices.

In Chapter 3, a complementary theoretical quantitative analysis is led by developing a computer simulation of Japan and South Korea interconnected power systems considering three different interconnection scenarios (Chugoku, Kansai, Kyushu), and also assessing the potential impacts of cross-border electricity trade between Japan and South Korea on EPCOs' competitive business segments. This analysis, though also imperfect (sophisticated and limited by input availability), solves the main issue identified in the previous chapter. The key findings differ a little from earlier results. Indeed, though in both analyses cross-border electricity trade would benefit to Japanese EPCOs, the new analysis conducted in this chapter shows that in 2018 higher generators' sales would have overcompensated the losses of suppliers facing higher procurement costs due to increased electricity prices resulting from South Korea's net imports. Also, the Kyushu interconnection scenario is identified as the scenario delivering the most economic savings.

In Chapter 4, a qualitative analysis, complementary to the quantitative analyses of the two preceding chapters, based on a novel survey of energy experts is realized. This survey focuses on the impacts of cross-border electricity trade on power companies in the framework of a Japan – South Korea interconnection, and consisted of seven questions. Of the 30 energy experts, mainly from the Asia-Pacific region and Europe and principally representing think tank & research organizations and power companies, invited, 20 completed the survey. It is found that in the case of competitive business segments, expectations towards cross-border electricity trade are divisive with both opportunities and threats identified, and depend on national contexts. Power companies are seen as rather cautious than ambitious towards electricity trade, again depending on domestic situations. In the specific case of a Japan – South Korea electrical interconnection, participants pointed out that generators in these two countries tend to be reluctant to competition, leading to poor economic efficiency, and legitimate concerns about competition. To address this issue, participants provided multiple suggestions. In addition, even though a quasi-consensus emerged that geopolitics is the main issue that has prevented the realization of a Japan – South Korea electrical interconnection so far, some participants also stressed the importance of the stances of power companies, especially in Japan. Finally, some participants clearly indicated that the organization they represent assess the environmental impact of their international power exchange activities, some others replied negatively, and some did not provide clear answers.

Chapter 5 concludes by summarizing the above findings and opens the possibility about future research work, highlighting the relevance of updating the analyses presented in this dissertation, once Japan and South Korea will have advanced concrete plans on how they aim at reaching carbon neutrality by 2050 – as they have recently announced it.

Note : Thesis Summary should be submitted in either a copy of 2000 Japanese Characters and 300 Words (English) or 1copy of 800 Words (English).

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