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RENEWABLE ENERGY INSTITUTE

Cost benefit analysis for Russia-Japan and Korea-Japan

March 2018

Asia Super Grid Interconnector Study Team



Asia International Grid Connection Study Group

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Chapter 1: Basic Concept of an International Power Grid

Purposes of the international power grid

Diplomatic relations concerning the international power grid

Background of recent growth of the international power grid
in Europe

Chapter 2: The Current State of the International Power Grid in Europe

History of the international power grid in Europe

Operation methods, forms of investment, and construction
planning

Benefits European countries obtain from the international
power grid

Chapter 3: The Current State and Feasibility of an International Power Grid in NEA

Power supply structures, prices, and supply-demand patterns

Examples of interconnection in Northeast Asia

International power grid concepts surrounding Japan

Chapter 4: The Feasibility of an International Power Grid in Japan and Future Issues

Japan's electricity system and international power grid

Challenges of domestic grid operation and the need for electricity system reform

Legal considerations to work on international transmission in Japan

**Asia International Grid
Connection Study Group
Interim Report**

April 2017



Russia-Japan routes:

2 GW Interconnection

Supply RES electricity from Russia to Japan. Exporting RES electricity from Japan to Russia could be considered as well, at the time of seasonal demand and time differences.

Korea –Japan routes:

2 GW Interconnection

Supply RES electricity from Mongolia, China through South Korea to Japan. Exporting RES electricity from Japan to other Asian countries could be considered as well, at the time of seasonal demand and time differences.

Cost benefit analysis: work flow



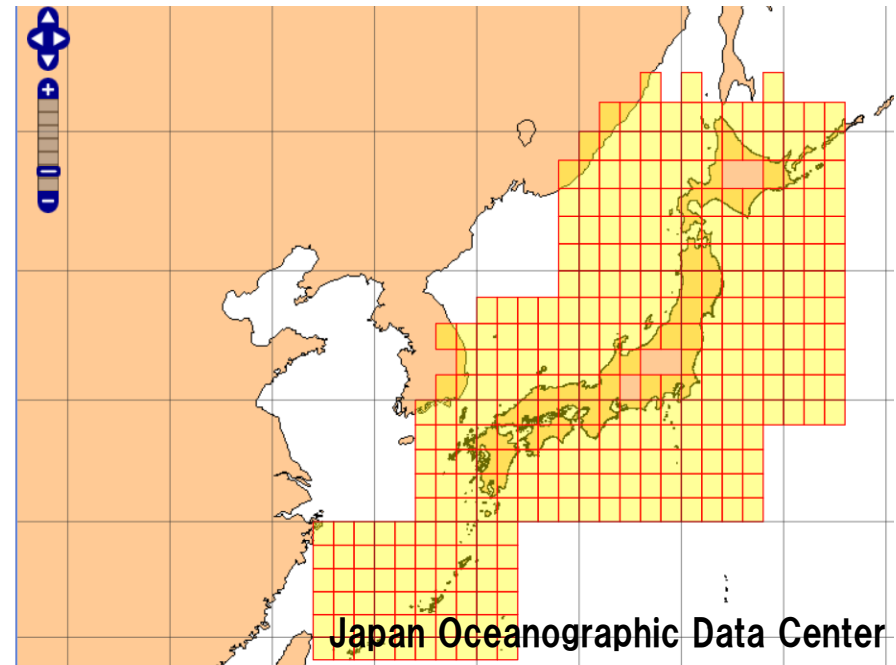
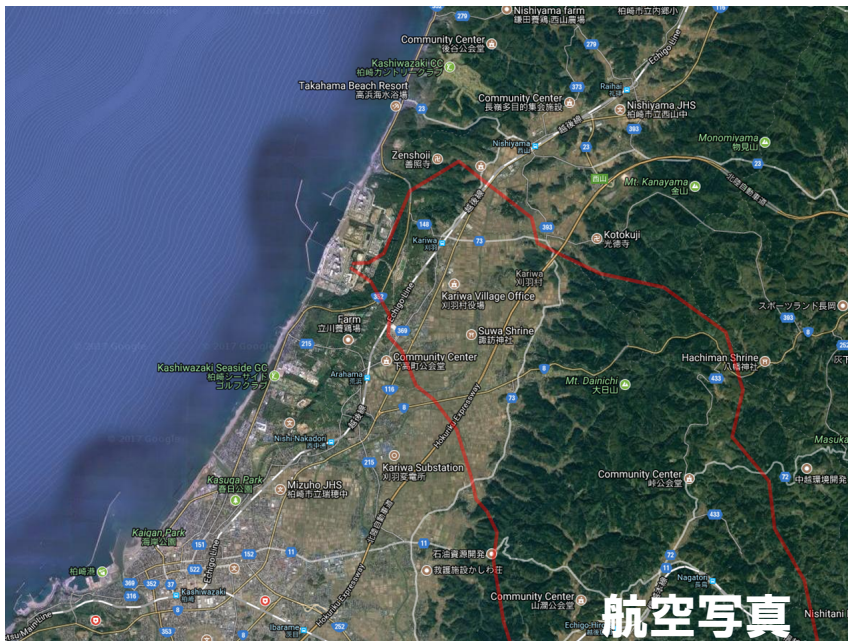
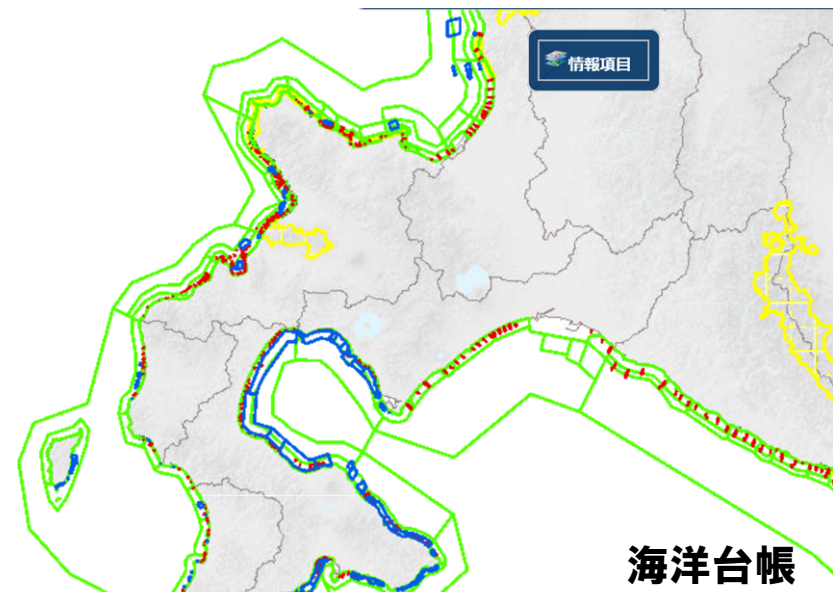
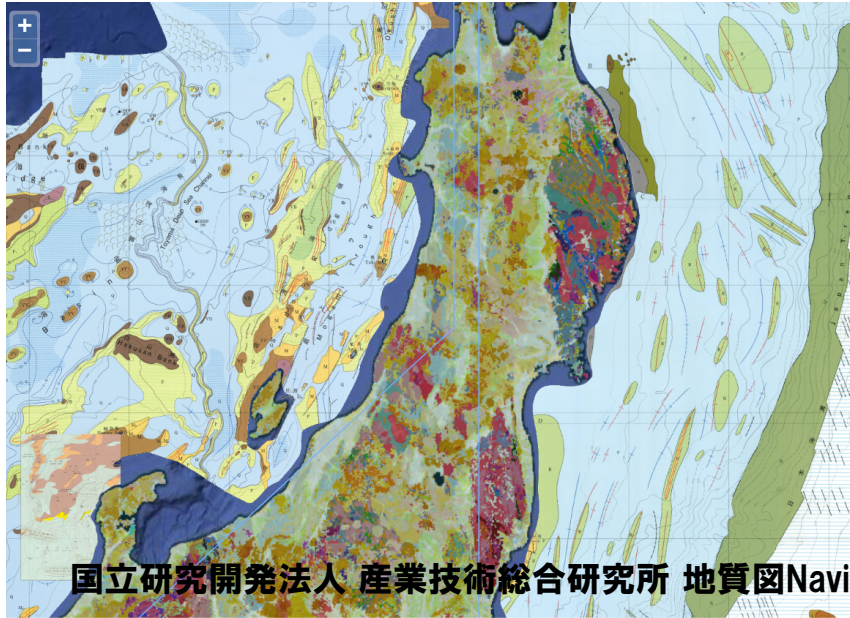
	FY2017						
	Sep	Oct	Nov	Dec	Jan	Feb	Mar
Phase 1 –Cost and Profit Evaluation							
1. Cable route design							
2. Cost estimation based on open data (European Cases)							
3. Cost factors specific for Japan.							
4. Cost Estimation							
5. Business model and business condition							
6. Estimation of expected Profit							
Phase-2 Benefit analysis							
1. Survey of existing studies							
2. Defining the focus of the study							
3. Classification and definition of Benefits							
4. Quantified evaluation							



Basic data source for desktop study to evaluate possible landing points for the interconnection, and optimize routes between landing points.

	For route design	Landing point evaluation
Fishery and protection areas	Marine Cadastre	Marine Cadastre Wind potential map (NEDO)
Geography	National Institute of Advanced Industrial Science and Technology	National Institute of Advanced Industrial Science and Technology
Depth	Japan Oceanographic Data Center 他	-
Land use	-	aerial photographs

Desktop study for route design



ex) Sub sea cable installation cost

Installation type	£ M/km
Single cable, single trench, single core	0.3
Twin cable, single trench, single core	0.5
2 single cables; 2 trenches, single core, 10M apart	<u>0.53</u>
Single cable, single trench, three core	<u>0.33</u>
2 single cables; 2 trenches, three core, 10M apart	1.1

Cable supply cost

HVDC Mass Impregnated
Cables(copperconductor)
(2000MW Pair cable)

0.649 £ M/km

National Grid “Electricity Ten Year Statement” 2015

- Reference unite cost /km

Installation 0.53+cable supply 0.649=1.179 £ M (約1.3€M=169 mln JPY)

(*rate £ =150JPY)

Average unite cost for under sea cable projects in EU (above 400km around 1 GW)

1.2m€/km (156 mln JPY)



1. Business Model Categorizing for Interconnectors
2. IRR Rough Estimation for Japan-Russia route
3. IRR Rough Estimation for Japan-Korea route
4. Regulation patterns applied to possible business models

4 types of business models are basically chosen for interconnectors by the former study.

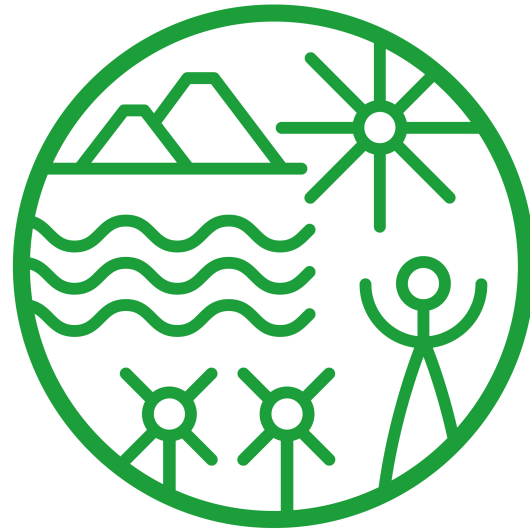
* There are several cases that two or more business models are chosen at the same time, different models are chosen for each countries even same interconnection cable, etc.

Business Model	Explanation	Examples
(1) Congestion rent model	In the power transmission line laid between market coupling, when the line is congested and market splitting is occurred, electricity in a region with a low wholesale electricity market price is supplied to a high region. Transmission and market operator can obtain the income of multiplication of price difference and transmission current.	<ul style="list-style-type: none"> • EU • PJM
(2) Transmission Rights sales model	Transmission operator obtains a price by selling the right to transmit electricity. In the case of market congestion, the power producer can exercise the right.	
(3) Regulated grid tariff model	The line is constructed by fully distributed cost method and investment recovery is carried out from all customers in the region as regulated grid tariff.	<ul style="list-style-type: none"> • Scagerrak 4 • Russia-China etc.
(4) Generators/ suppliers dedicated line model	Transmission line is laid by a specific generators or suppliers as part of a power supply project to specific customers or markets, and investment is carried out by power sale income.	<ul style="list-style-type: none"> • Russia-China • Canada-U.S. etc.



to be continued, and will be released soon.

Paradigm Shift in Energy Peace for Asia



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