

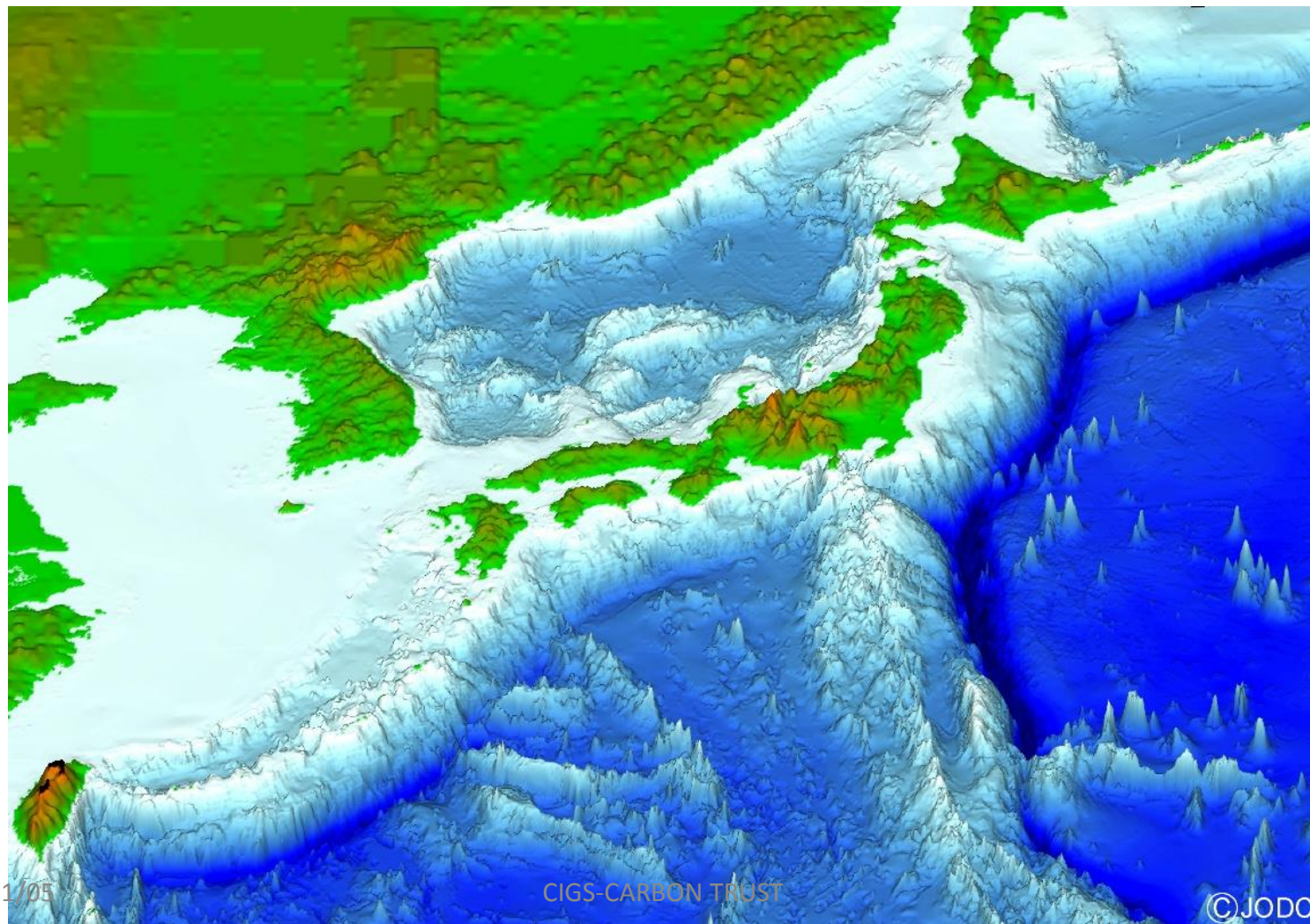
# キヤノングローバル戦略研究所(CIGS) 海洋立国シンポジウム

International Symposium on Maritime country based on Ocean industries

#6 Marine renewable energy : lesson learned from UK Carbon Trust

CIGS 湯原 哲夫TETSUO YUHARA

Research Director, the Canon Institute for Global Studies



# キヤノングローバル戦略研究所 海洋立国シンポジウム

International Symposium on Maritime country based on Ocean industries

①海洋産業の創出と振興Promotion of Ocean Industries

②排他的経済水域における海洋開発と利用の促進  
Developments of resources and energy in EEZ

③国際競争力と国際協力:Keynote Lecturers from oversea  
海外からの招待講演者

# 1 22th September 2010

**Mr. Johan Alstad**, Deputy Director-General, The Norwegian Ministry of Oil and Petroleum

"Resource management and nation building"

# 2 18<sup>th</sup> November 2011

**Prof. James Kraska**, International Law, U.S. Naval War College, US  
“Over Resources in the Sea: Friction, Security, and the Role of Japan in Asia”

# 4 26th December 2013

**Dr. Jonathan Lowe**, Exploration Manager, Nautilus Minerals Inc  
“Status and outlook on Development of Submarine hydrothermal polymetallic ore in PNG”

# 5 14<sup>th</sup> December 2014

**Mr. Neil Gordon**(Subsea UK) & **Scot Wilson**(Scottish Development International)

” Subsea technology Scotland and proposal on colaboration with Japan”

# 講演目次 Agenda

## Policy on ocean industries

1. 海洋国家のビジョン/海洋基本法 Japan's vision and ocean policy, Basic Act on Ocean Policy
2. 海洋産業の位置づけと海洋産業創出のプロセス fundamentals for new industry development
3. 海洋産業の振興と創出に関する施策について Promotion and in latest basic planning on ocean policy, and proposals by the board of advicers
4. 海洋産業創出のプロセス  
Promotion of ocean industries for developing marine resources
5. 石油・天然ガス・鉱物資源開発における海洋プラントとサブシー技術  
Subsea engineering in production of oil, gas and minerals in seabed
6. エネルギー基本計画における再生可能エネルギーの導入目標

# 海洋基本法の理念と施策

「海洋基本法」2007.7.21

Basic Act on Ocean Policy and its vision (Act No. 33 of April 27, 2007)

## 目的 Article 1 (Purpose)

海洋の平和的・積極的な開発・利用と 環境保全の調和をはかる  
新たな海洋立国を実現する。

*“it is important to realize a new oceanic State in harmonization of the peaceful and positive development and use of the oceans with the conservation of the marine environment, under the international cooperation, ...”*

## 基本理念 Basic Principles

### ① 海洋の開発と利用は我が国 経済社会の存立基盤

*“development and use of the oceans are the basis of existence for the economy and society of our State,”*

海洋環境が良好に保たれることは人類の存続基盤

*“securing the marine biological diversity and conserving other better marine environment are the basis of the existence of mankind”*

開発・利用と環境保全の調和をはかる海洋立国の実現

*“positive development and use of the oceans with the conservation of the marine environment”*

### ② 海洋の安全確保は重要、取り組みを積極的に推進

*“securing the safety and security on the oceans is important for our State surrounded by the oceans”*

### ③ 海洋の開発・利用・環境保全のため、科学的知見が重要、充実を図る。

*“scientific knowledge of the oceans is indispensable for the proper development and use of the oceans and conservation of the marine environment”*

### ④ 海洋産業は経済社会の発展基盤、国民生活の安定性向上の基盤、健全な発展を図る

*“Ocean Industries” are the basis for the sound development of the economy and society of our State and of stabilization and improvement of the lives of the citizenry, their sound development shall be promoted.*

### ⑤ 海洋の開発、利用、保全を総合的かつ一体的に行う

*“the matters with regard to ocean resources, marine environment, maritime traffic and the safety and security of the oceans interrelate closely with each other, and such matters shall be examined as a whole.*

### ⑥ 海洋に関する施策の推進は国際的協調の下に行う

*“promotion of measures with regard to the oceans shall be executed under the international partnership,”*

# 海洋基本法「海洋基本計画における海洋産業への基本的施策」

Basic Measures on Ocean Development and related industries

## 第24条:海洋産業の振興及び国際競争力の強化

- 国は、海洋産業の振興及びその国際競争力の強化を図るため、海洋産業に関し、**先端的な研究開発の推進、技術の高度化、人材の育成及び確保、競争条件の整備等による経営基盤の強化及び新たな事業の開拓その他の必要な措置を講ずるものとする。**
- Article 24 (Promotion of Ocean Industries and Strengthening the International Competitiveness)  
The State, in order to promote the Ocean Industries and to strengthen the international competitiveness, shall take necessary measures with regard to the Ocean Industries, to promote the cutting-edge research and development, to upgrade the level of technology, to nurture and secure the human resources and to reinforce the management basis with the improvement of competitive conditions and others as well as to exploit new businesses and to execute others.

# 海洋産業の振興と創出について2008年～

## *New Ocean Industry Development*

1. 海洋基本法(2007)と 海洋基本計画(第一期:2008~2012, 第二期 2013~2017) (海洋産業立国がその中核的課題) Basic Act on Ocean Policy and Basic Plan on Ocean Policy( First 2008-2012 Period, Second 2013-2017 period): Ocean industry development as a core element
2. 旧海洋基本計画の評価(海洋産業振興が不十分、政策目標一基盤構築一事業化プロジェクト一国際競争力強化) Assessment of the 1<sup>st</sup> Basic Plan was: measures to promote ocean industry development were inefficiently implemented. Fundamentals for industry development are 1) Policy making and legal base , 2)Technological base,3) Industrial development and institutions, 4) Competition and cooperation
3. 参与会議再編とPT(プロジェクトチーム)による戦略的な企画立案機能 Reorganizing the government's Advisory Board on ocean policy . Forming Project Teams(PT) to make strategic planning for each prioritized issue.
4. 新しい海洋基本計画とその骨子(海洋産業創出と包括的法整備) The 2<sup>nd</sup> Basic Plan on Ocean Policy and its essence: new ocean industry development and need for comprehensive ocean policy
5. 海洋産業の振興と創出(海洋石油天然ガス市場、海洋再生可能エネルギー発電事業化、海底鉱物資源開発) New ocean industry development: offshore oil & gas , marine renewables, seabed mineral resources
6. 今後の展開について(産官の連携強化と国際競争力強化) Future development: strengthening public-government cooperation and improving international competitiveness
7. 世界の動向、特に中国・韓国の動き(国家をあげた取り組み、サブシー分野を制するものが世界の海洋資源開発市場を制する) Global trend, especially China and Korea making serious national effort to promote the industry. He gets a double victory in offshore resource development , who conquers subsea.



# 海洋基本計画(2013.4.27): 総論 海洋立国日本の目指すべき姿

## *Basic Act on Ocean Policy: Japan's Vision*

### ①国際協調と国際社会への貢献

*International cooperation and contribution to international Community*

• アジア太平洋を始めとする諸国との国際的な連携を強化。*The government should strengthen international ties at various levels with Asia-Pacific and other countries that are related to our country via the sea.*

• 法の支配に基づく国際海洋秩序の確立を主導し、世界の発展・平和に貢献。

*Japan should substantially contribute to global development and world peace by taking leading role within the international society to share the principles that we should aim to establish such order of the sea.*

### ②海洋の開発・利用による富と繁栄

*Wealth and prosperity through ocean development and utilization of the sea*

• 海洋資源等、海洋の持つ潜在力を最大限に引き

出し、富と繁栄をもたらす。

*The government should aim to elicit the potential of the sea to the maximum extent in order to bring wealth and prosperity to our country.*

### ③「海に守られた国」から「海を守る国」へ

*From a country protected by the sea to a country that protects the sea*

• 津波等の災害に備えるとともに、安定的な交通ルートを確保。

*Prepare natural disasters (tsunami) and secure stable sea lanes*

• 海洋をグローバルコモンズ(国際公共財)として保ち続けるよう積極的に努める。

*The government should defend our territorial seas and the Exclusive Economic Zone (EEZ) and other maritime zones and positively work to maintain the ocean as part of the global commons for which rule of law persists.*

### ④未踏のフロンティアへの挑戦

*Venturing into the unexplored frontier*

• 海洋の未知なる領域の研究の推進による人類の知的資産の創造への貢献。

• 海洋環境・気候変動等の全地球的課題の解決に取り組む。

*By maximizing use of Japan's science and technologies, the government should implement research, etc. on unknown domains of the sea, including the deep seabed, to contribute to creation of intellectual assets of humankind and endeavor to resolve global issues such as changes in the ocean environment and climate change. Through these efforts, the government should aim to lead and contribute to the world with ocean policy.*

# 海洋基本計画2013.4: 海洋産業の振興・創出への目標と課題

## *Goals and Issues for New Ocean Industry Development*

### 1. 国際的な資源開発プロジェクトへの参入を実現する

*Enable Japanese companies to enter into global resources development projects/markets*

・大水深下での石油・天然ガス等の開発プロジェクト等について、国際競争力を有する海洋資源開発関連産業の戦略的な育成 *Strategic fosterage of internationally competitive offshore development related industries for oil & gas development in ultra-deep waters*

### 2. 世界に先駆けて海底鉱物資源開発を産業化する。

*Enable Japan to be a pioneer in seabed mineral resources development*

・官民連携した探査事業の展開により資源ポテンシャルの明確化

*Clearly identify Japan's resource potential under private-public exploration initiative*

・実海域での海洋産出試験等への官民連携の強化

*Strengthen private-public initiatives for offshore methane hydrate production tests*

・深海底探査・生産技術等の開発と成果の産業へ展開

*Transfer deep sea exploration/production technologies to public sectors to further lead to creating new business*

### 3. 世界最大級の規模の洋上浮体風力発電を実現

*Realize construction of the world's largest floating offshore wind power plant*

### 4. 海洋情報関連産業の創出、海洋調査産業の振興、海洋バイオマス資源産業化推進

*Creating marine information business, promoting marine-survey business, promoting marine biomass becoming business*

### 5. 海洋人材の育成 *Capacity development for ocean industry*

産業技術の開発、基礎研究と教育を一体化した国際的に通用する人材の育成計画

*Combing development of industrial technology and basic research to produce internationally viable human capital*



# 海洋新産業創出のプロセスとその内容、事例

## Fundamentals for new ocean industry development

ステップ Steps	内容 Needed Actions	最近の事例 Recent Examples
<b>1. 政策</b> Policy making and legal base	<b>政策目標と法整備(海域利用、環境規制)</b> Policy vision, legal base, legal development(marine use, environmental regulations)	
<b>2. 基盤</b> Technological base	①公的研究機関におけるR&D R&D by Public Research Institutes ②実証設備の建設、民間の利用促進 Build facilities for demonstration projects, promote public-private use ③インフラ整備 Develop needed infrastructure	<b>海洋産業に関わる事例</b> Examples related ocean industries <ul style="list-style-type: none"> <li>• ノルウェーの北海域の石油・天然ガス産業／8年                              Norway: North Sea Oil &amp; Gas/8years</li> <li>• イギリスの海洋エネルギー産業/8年(進行中)                              England: Maine renewables(8years, ongoing)</li> </ul>
<b>3. 新産業創出</b> (市場、起業、産業技術) Industrial development and institutions	①事業者の創出 Create business operators (sellers) ・複数のベンチャーの競争 Competition among multiple venture companies ・公的資金による長期的融資 Long-term state direct investment ②産業技術・製造技術の構築 Establish industrial/manufacturing technology (manufactures) 試作、実海域における実証試験をへて商業化を図る Commercialize after prototypes and offshore demonstration test ③市場の形成 や全量買取り制度 Create markets and FIT (Buyers) ◎ 官民事業化プロジェクト→商業化プロジェクトへ Shift from private-public project to commercial projects	<ul style="list-style-type: none"> <li>• デンマーク 洋上風力発電事業                              Denmark: Offshore wind energy</li> <li>• ブラジル: 深海底石油ガス田開発                              Brazil: deep sea oil&amp; gas</li> <li>• 韓国の海洋エネルギー事業                              Korea: marine energy</li> <li>• 米国・カナダの海洋エネルギー事業                              US, Canada: marine energy</li> <li>• インドの大規模海洋エネルギー利用計画                              India: large-scale marine energy use plan</li> </ul>
<b>4産業競争力</b> Competition and cooperation	①輸出産業として国際競争力(システム—標準—認証、輸出促進支援) International competitiveness as export industry (system-standards, certification, export promotion support) ②途上国でプロジェクト創出(国際連携) Create projects in developing nations (international cooperation)	

# 2000年～2010年 海洋再生可能エネルギー実用化へ向けた 各国の政策、基盤、技術力の比較

Assessment : Marine Renewable Industry Development

項目 Item	具体的施策 Measures	欧州 EU	米国 US	中国 CHINA	韓国 KOREA	日本 JAPAN
政策 Policy	誘導する政策 買取制度、税制支援、政策目標、規制緩和 Policy Inducement; FIT, tax support, policy objective, relaxation of regulations	◎	◎	○	◎	X
基盤 Technological base	公的基盤整備 系統接続、実証設備、投融資制度、シーグラント制度 Developing Infrastructure: grid connection, demonstration facilities, governmental investment & loan program, Sea Grant	◎	○	△	○	△
事業化 Industry development	技術開発(テクノロジー)と実証(エンジニアリング) 自国の大規模実用PJ Technology Development & Engineering Large-Scale operational test	◎	◎	△	○	△
競争力 Competition	途上国の公的プロジェクトに、開発商用機の大量輸出(製造は現地) Mass Export to developing countries' government programs	◎	○	X	△	○
	総合評価 RANKING	◎	◎	○	○	△

1990年代のトップランナー日本は2000年前後からの世界の動き(政策、買い取り制度、公的開発基盤の整備、ベンチャーへの公的資金支援)に取り残され、今や周回遅れで、世界の海洋エネルギー利用・開発のプレーヤーとしてすら認められていない(欧米の後追いな  
2からも、韓国、中国、インドの積極的推進にも比較できない程の遅れが報告されている。OECD-IEA 海洋エネルギー部)  
Japan is like the Hare as in *The Hare and the Tortoise*.

# 海洋産業振興・創出のために強化すべき施策に関する意見書

8 proposed measures to promote ocean industry development submitted from the advisory board to the Director-General of the Headquarters for Ocean Policy (Prime Minister S. ABE) 2014.4

総合海洋政策本部 参与会議意見書2014年4月

## ① 海洋石油・天然ガス開発のための の探査活動

EXPLORATION ACTIVITIES FOR  
OFFSHORE OIL & GAS

## ② 海洋掘削事業の国際競争力強化

ENHANCING INTERNATIONAL  
COMPETITIVENESS OF DRILLING  
BUSINESS

## ③ 海洋プラント産業の基盤技術の強化

ENHANCING TECHNOLOGY BASE FOR  
OFFSHORE PLANT INDUSTRY

## ④ メタンハイドレート開発における民間企業の参画促進

PROMOTE PRIVATE-PUBLIC  
COOPERATION IN METHANE HYDRATE  
DEVELOPMENT

## ⑤ 熱水鉱床等の開発における資源 探査と生産システム開発の民間 企業の活用

Promote private-sector involvement in  
seabed mineral resources exploration  
and production system development

## ⑥ 海洋再生可能エネルギー開発産 業の構築と持続的エネルギー供給

Marine Renewable energy

## ⑦ 海事・エンジニアリング・資源開 発などの総合産業の構築

Maritime Industries Entering to Oil &  
Gas business

## ⑧ 人材の育成⇒海洋技術者1万人 計画

Capacity Development for Offshore  
Development

## World market of ocean industries on oil,gas,mineral and energy resources

(unit:Billion US dollars)

□	□	2010年	2020年	2030年	source
海洋石油／天然ガス 海洋プラント（生産/積出） FPSO &Subsea production system	洋上 Platform	37.2	74.9	105.6	Douglas Westwood (2010)など
	海底 Subsea	45.0	116.5	189.8	
	海中 URF など	63.0	136.3	208.5	
	合計 total	145.2	320.0	500.0	
海洋再生可能エネルギー Marine renewable energy	主に洋上風力 （国内規模）	12.0*	29.1	93.0	Roland Berger (2012), IEA ETP 2012, PT 会 議資料など
	Offshore wind firm &others	— *2013年	(4.1)	(11.2)	
メタンハイドレート Methane hydrate		—	2023～		4.1 兆m <sup>3</sup> 回収想定 120 兆円相当(JAPIC)
海底熱水鉱床 Submarine hydrothermal polymetallic ore		—	2028～		資源量 1.7 億ト 80 兆円相当(JAPIC)

[1] Offshore Wind Market and Economic Analysis, Navigant Consulting, Inc. (2013)

[http://www1.eere.energy.gov/wind/pdfs/offshore\\_wind\\_market\\_and\\_economic\\_analysis.pdf](http://www1.eere.energy.gov/wind/pdfs/offshore_wind_market_and_economic_analysis.pdf)

[2] PT 会議資料「洋上風力発電の産業化に関する検討状況」

[3] Roland Berger, OFFSHORE WIND TOWARD 2020 (2013)

[http://www.rolandberger.com/media/pdf/Roland\\_Berger\\_Offshore\\_Wind\\_Study\\_20130506.pdf](http://www.rolandberger.com/media/pdf/Roland_Berger_Offshore_Wind_Study_20130506.pdf)

[4] IEA Wind energy roadmap targets (from IEA ETP BLUE MAP 2008)

[http://www.iea.org/publications/freepublications/publication/Wind\\_Roadmap\\_targets\\_viewing.pdf](http://www.iea.org/publications/freepublications/publication/Wind_Roadmap_targets_viewing.pdf)

# COP21への日本の約束草案= 2030年エネルギー需給見通し Japan's Intended Nationally Determined Contribution (INDC) July 2015.

## 1. GHG emissions reductions

### (1) Energy-Originated CO<sub>2</sub>

Approximately 90% of GHG emissions in Japan is covered by energy-originated CO<sub>2</sub>. Emissions of energy-originated CO<sub>2</sub> will be reduced by 25.0% compared to FY 2013 level (24.0% reduction compared to FY 2005 level) (approximately 927 million t-CO<sub>2</sub>). The estimated emissions in FY 2030 in each sector are shown in Table 1.

Table 1 Estimated emissions of energy-originated CO<sub>2</sub> in each sector

	Estimated emissions of each sector in FY 2030	FY 2013 (FY 2005)
Energy originated CO <sub>2</sub>	927	1,235 (1,219)
Industry	401	429 (457)
Commercial and other	168	279 (239)
Residential	122	201 (180)
Transport	163	225 (240)
Energy conversion	73	101 (104)

## 2. Energy mix used for the bottom-up calculation of the emission reduction target

	FY 2030
● Final energy consumption	326 M kl
(Energy efficiency measures)	50 M kl

● Total power generation	approx. 1065 billion kWh
Renewables	approx. 22-24%
Nuclear power	approx. 22-20%
Coal	approx. 26%
LNG	approx. 27%
Oil	approx. 3%
(within renewables)	
Solar	approx. 7.0%
Wind power	approx. 1.7%
Geothermal	approx. 1.0-1.1%
Hydro power	approx. 8.8-9.2%
Biomass	approx. 3.7-4.6%

# CIGS :Energy Mixes of Japan in 2030 and 2050 UNDER Z650Gt SCENARIO(<2°C) (Total Primary Energy)

MTOE	Coal	Oil	Gas	RE	Nuclear	Total	Eff.	CO <sub>2</sub> (Gt) Reduction
<b>2010</b>	120	210	96	26	60	512	33%	1.2
	83%			5%	12%			
<b>2030</b>	96	134	92	47	60	429	40%	0.95 -21%
	75%			11%	14%			
<b>2050</b>	66	57	84	62	60	329	47%	0.59 -51%
	63%			19%	18%			



# CIGS : Energy Mixes of Japan in 2030 and 2050 UNDER Z650Gt SCENARIO(<math><2^{\circ}\text{C}</math>) (Power Generation)

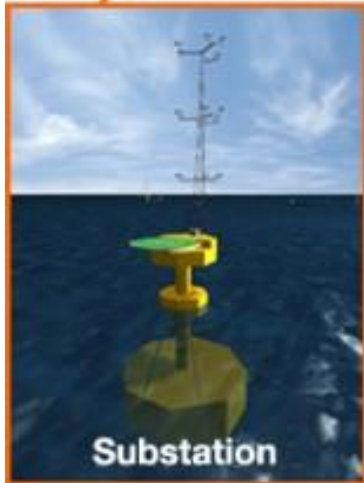
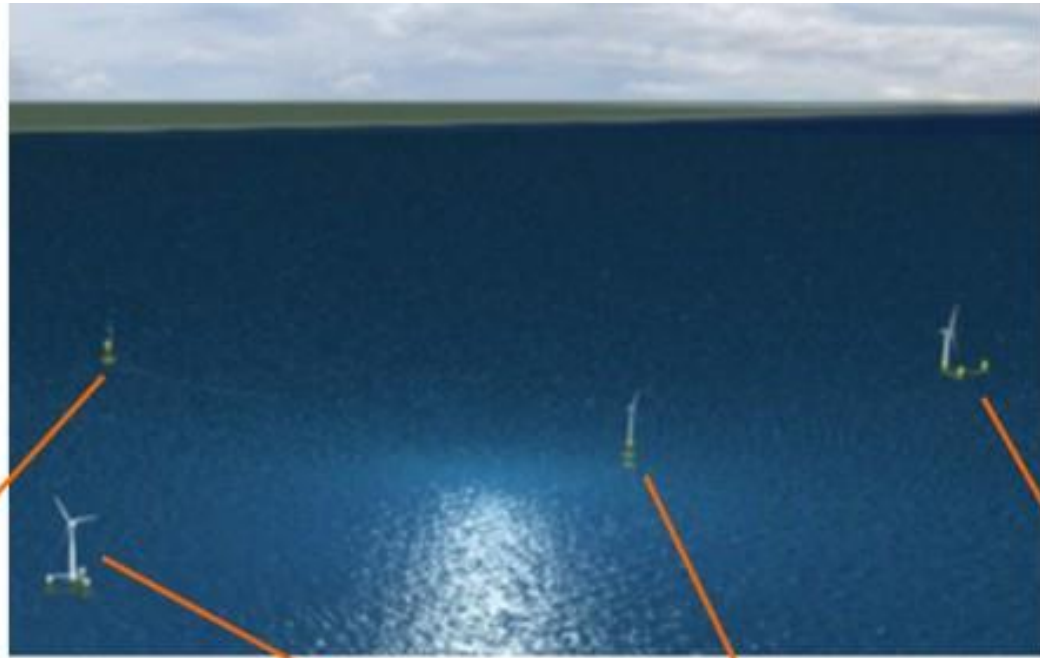
	Total (TWh)	Fossil Fuel			Nuclear	Renewable Energy					
		Coal	Oil	Gas		Hydro	Solar	Wind	Ocean	Geothermal	Biomass
2010	1006	252	75	295	292	86	11				
		62%			29%	9%					
2030	1000	235		325	240	91	29	33	15	10	22
		56%			24%	20%					
2050	1000	170		290	240	91	60	60	24	20	45
		46%			24%	30%					

Floating offshore wind farms in  
Japan, Europe and Hawaii  
2015.11

# Japan Builds World's Largest Floating Wind Turbine off Fukushima

by Arata Yamamoto Aug 3 2015, 5:26 am ET

<http://www.nbcnews.com/news/world/>



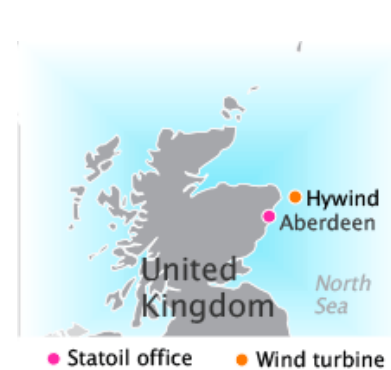
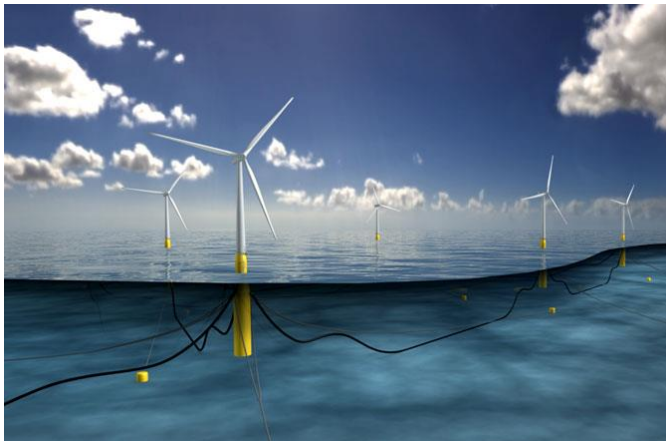
# Statoil to invest \$236 million in floating wind farm off Scotland

## By Reuters | 3 Nov, 2015,

- OSLO: Statoil will invest **about 2 billion Norwegian crowns (\$236 million)** in building a floating wind farm off the Scottish coast, in what the Norwegian oil and gas group said would be the first of its kind in the world.
- The company, which has run a single floating offshore turbine for several years in Norway, is planning to build a pilot project consisting of **five floating turbines, each with 6 megawatt capacity**, off the coast near Aberdeen in an area where the water depth is up to 120 metres.

## The World's Largest Floating Wind Farm Is Coming to Scotland Wednesday November 4, 2015

Norway had the first one. Then Portugal got one. And Japan, too. Now, the latest nation to get its own offshore, floating wind farm – a technology considered a critical advancement in eco-friendly energy production – will be Scotland. And the Scots are doing it big.



# France Ready to Issue Floating Wind Call for Tenders

July.2015

French wind industry group (FEE) announced Tuesday that the country will launch a call for tenders for floating wind power projects this month. FEE believes up to **three** projects ranging **from 15 to 60 MW** with a total capacity of up to **120MW** will participate, writes Reuters. The group could not specify the level of feed-in tariff subsidies the government would offer, however, FEE president Frederic Lanoë said it would logically be more than **200 €/MW** for fixed-foundation offshore wind farms.

Also, the project will receive **150 million euro investment subsidy**.

With a goal of **6 GW of offshore wind power by 2020**, and only 3 GW awarded, France is developing its offshore wind energy slower than its European neighbors such **as Germany, which aims to set up 15 GW by 2030** or **Britain and its goal of 40 GW by this time**, according to FEE.

The prospect of the **3rd call for tenders** for offshore wind is going in the right direction, but the industry lacks clarity for the coming years.

*"We must quickly conclude the selection of areas in autumn in order to be able to launch the third tender,"* FEE said, adding that it proposes to set a **target of 15 GW of offshore wind power** and **6 GW of floating wind built by 2030**. As for **onshore wind**, the industry's objective is **40 GW by 2030**.

*Offshore WIND Staff; Image: DCNS*



# JAPAN has a plenty of resources under sea-bed in EEZ/ Methanhydrate & rare earth and rare metals Security vs Ocean industry



## 日本は「海洋資源大国」である

安倍晋三 vs. 湯原哲夫  
元内閣総理大臣 東京大学大学院特任教授

### SHINZO ABE VS TETSUO YUHARA