



EXPO 2012
Yeosu Korea-OECD
International
Symposium

The Future of the Ocean Economy

A Green Growth Perspective

9-10 July 2012

Conference Hall, International Pavilion Block C at Yeosu Expo

Program

Day 1

Opening Ceremony

Global Ocean Leaders Forum: *The Global Ocean Economy and Green Growth*

Day 2

Regular Sessions: *The Future of Established and Emerging Marine Sectors
and Their Contribution to Green Growth: Policy and Business*

Special Session: *Humanitarian Shipping and Logistics: Strategies and Operations*

www.yes2012.org / 2012oecd@naver.com / T. +82 61 665 0709

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I. Overview of EXPO 2012 Yeosu Korea

1. Theme

“The Living Ocean and Coast”: Diversity of Resources and Sustainable Activities

2. Background of theme

The Expo theme will help shed light on humankind’s knowledge and advancements of technology concerning the ocean and coast, and identify ways to resolve challenges facing the ocean.

3. Vision

- (1) A vision for restoring life to the sea and coast
- (2) A vision for green growth
- (3) A vision for cooperation

4. Goal

- (1) People, oceans and coasts in harmony
- (2) Unforgettable experience
- (3) A taste of the future
- (4) International cooperation

5. Strategy

- (1) Green exposition
- (2) Ubiquitous exposition
- (3) Design exposition
- (4) Cultural exposition

II. EXPO 2012 Yeosu Korea-OECD International Symposium

1. Objectives

- (1) To intensify and develop core agendas of EXPO 2012 Yeosu Korea
- (2) To seek measures of securing exhibition contents along with theme development
- (3) To promote the EXPO 2012 Yeosu Korea by holding symposiums

2. Plans

- (1) Title: The Future of the Ocean Economy: A Green Growth Perspective
- (2) Date: July 9-10, 2012
- (3) Venue: Conference Hall, Yeosu EXPO Site
- (4) Hosted by: The Organizing Committee for EXPO 2012 Yeosu Korea, Bureau International des Expositions (BIE), The Organisation for Economic Co-operation and Development (OECD)
- (5) Organized by: Korea Maritime Institute (KMI)
- (6) Sponsored by: Ministry of Land, Transport & Maritime Affairs of the Republic of Korea (MLTM), Ministry of Food, Agriculture, Forestry & Fisheries of the Republic of Korea (MIFAFF), Jeollanam-do Government, Yeosu si Government
- (7) Schedule
 - Day 1 (July 9): opening ceremony, keynote speech, global ocean leaders forum, gala dinner
 - Day 2 (July 10): regular sessions 1&2, special sessions 1&2, luncheon, dinner

(8) Participants

- Major participants: Chairman of EXPO 2012, Deputy Secretary General of OECD, Chairman of Presidential Committee on Green Growth of the Republic of Korea, President of KMI, Minister of Ministry of Land, Transportation and Marine Affairs of the Republic of Korea,
- Expected participants: 500 persons from industries, organization, universities, institutes, and the public

(9) Programs

- Day 1 (July 9)

Time		Program	
Opening Ceremony			
14:30-15:00	30'	Registration	
15:00~15:30	30'	Opening event	Opening speech - Dong-Suk Kang (Chairman, EXPO 2012)
			Welcome speech 1 - Yves Leterme (Deputy Secretary General of OECD)
			Welcome speech 2 - Hak-So Kim (President, KMI)
			Congratulatory speech - Sung-Ho Joo (Vice Minister, MLTM, Republic of Korea)
15:30~15:40	10'	Group photo	
Keynote speech & Global ocean leaders forum			
15:40~16:40	60'	Keynote speech - The global ocean economy and green growth: Soogil Young (Chairman, Presidential Committee on Green Growth, Republic of Korea) - OECD’s contribution to the green growth: Yves Leterme (DSG of OECD, Former Prime Minister, Belgium)	
16:40~16:55	15'	Coffee break	
16:55~17:45	50'	Global ocean leaders forum - Subject: The Future of the Ocean Economy and Green Growth - Chair: TBA - Discussants: Young Min Kim (CEO, Hanjin Shipping), U Nyan Htun Aung (Minister of Transport, Union of Myanmar), Han-il Park (President, Korea Maritime University), John Huckerby (Chairman, The Ocean Energy Systems Implementing Agreement (OES-IA))	
18:00-20:00	120'	Gala Dinner	

- Day 2 (Regular session 1, July 10)

Time		Program
10:30~11:00	30'	Keynote speech - The future of the ocean economy <i>Barrie Stevens</i> (Head, International Futures Programme, OECD)
Part 1. The future of established marine sectors and their contribution to green growth: Policy and Business		
11:00~11:20	20'	The 1 st topic: The future of shipping industries/companies and green growth - Thomas Lindy Sorensen (President, Maersk Korea Limited)
11:20~11:40	20'	The 2 nd topic: The future of global port industries and green growth - Choon-Sun Kim (CEO, Incheon Port Authority, Republic of Korea)
11:40~12:00	20'	The 3 rd topic: The future of fisheries and aquaculture industries: A Green Growth perspective - Carl-Christian Schmidt (Head of Fisheries Policies Division, OECD)
12:00~12:20	20'	The 4 th topic: The future of coastal tourism focused on cruise industries - Richard Jones (CEO, Seadream Yacht Club in Asia)
12:20~14:00	100'	Lunch

- Day 2 (Regular session 2, July 10)

Part 2. The future of emerging marine economy and its contribution to green growth: Policy and Business		
14:20~14:40	20'	The 1 st topic: The future of new marine eco-biotechnological industries - James Crawford Philp (Policy Analyst, OECD)
14:40~15:00	20'	The 2 nd topic: The future of offshore plant industries with new eco-technologies - Ahmad Fadzil B Mohamad Hani (Deputy Vice Chancellor, University Technology PETRONAS, Malaysia)
15:00~15:20	20'	The 3 rd topic: Global marine energy industries and green growth - John Huckerby (Chairman, OES-IA)
15:20~15:40	20'	The 4 th topic: The future of marine mineral resources - Hasjim Djalal (Senior Adviser to the Minister and Member of the Indonesian Department of Marine Affairs and Fisheries)
15:40~16:00	20'	Coffee break
Part 3. Round Table: Policy Issues for the Future		
16:00~17:00	60'	- Chair: Joon-Soo Jon (Prof. Sogang University, Korea) - Discussants: Carl-Christian Schmidt, Barrie Stevens, John Huckerby, James Crawford Philp, Thomas Lindy Sorensen, Ahmad Fadzil B Mohd Hani, Hasjim Djalal, Richard Jones, Keyyong Hong (Director, Korea Ocean Research & Development Institute), Sang-Hoon Yeum (Secretary General, Korea Cruise Industry Forum)
Part 4. Announcement and press interview		
17:00~17:10	10'	Distribution of the results from the symposium
17:10~17:20	10'	Announcement of the results - Presentation of the results from the symposium by OECD
17:20~17:40	20'	Press interview

- 개막행사 (7/9, 제1일)

시간		프로그램	
		개막 행사	
14:30~15:00	30'	등록 및 자료집 배포, 네트워킹 시간	
15:00~15:30	30'	개회식	개회사 : 강동석(2012여수세계박람회 조직위원회 위원장)
			환영사 : Yves Leterme((前)벨기에 총리, (現)OECD 사무차장)
			환영사 : 김학소(한국해양수산개발원 원장)
			축사 1 : 주성호(국토해양부 제2차관)
15:30~15:40	10'	VIP 기념사진 촬영	
15:40~16:40	60'	기조연설 : 글로벌 미래 해양 경제와 녹색성장 - 양수길 (대통령직속 녹색성장위원회 위원장) “글로벌 녹색성장과 해양” - Yves Leterme ((前)벨기에 총리, (現)OECD 사무차장) “글로벌 해양경제의 미래”	
16:40~16:55	15'	휴식	
16:55~17:45	50'	글로벌 오션 리더스 포럼 - 좌장: 백진현(국제해양헌법재판소 재판관) - 토론자 :김영민(한진해운 사장), Charlie Than(미얀마 해양대학교총장), 박한일(한국 해양대학교 총장), John Huckerby (국제에너지기구 해양에너지부 의장)	
17:45~18:10	25'	만찬장소로 이동	
18:10~20:00	110'	식전 행사(기념 공연) 및 공식 만찬	

- 정규 프로그램(7/10, 제2일)

10:30~11:30	30'	기조연설 : 해양경제의 미래 - 발표자 : Barrie Stevens (OECD 국제미래프로그램 국장)
제1세션		전통 해양경제의 미래와 녹색성장
11:00~11:20	20'	제1주제 발표 : 해운 산업 및 해운회사의 미래와 녹색성장 - 발표자 : Thomas Lindy Sorensen(머스크 코리아 사장)
11:20~11:40	20'	제2주제 발표 : 글로벌 항만운영회사의 미래와 녹색성장 - 발표자 : 김춘선(인천항만공사(IPA) 사장)
11:40~12:00	20'	제3주제 발표 : 수산 및 양식 산업의 미래와 녹색성장 - 발표자 : Carl-Christian Schdmit (OECD 수산국장)
12:00~12:20	20'	제4주제 발표 : 크루즈 산업의 미래와 녹색성장 -발표자:Richard Jones(Seadream Yacht Club, 아시아 담당 CEO)
12:20~14:00	100'	점심 및 휴식
제2세션		신흥 해양경제의 미래와 녹색성장
14:00~14:20	20'	제1주제 발표 : 해양 바이오 산업의 미래와 녹색성장 - 발표자 : James Crawford Philp(OECD 정책자문관)
14:20~14:40	20'	제2주제 발표 : 해양 플랜트 산업의 미래와 녹색성장 - 발표자 : Ahmad Fadzil B Mohamad Hani (말레이시아 페트로나스 대학 부총장)
14:40~15:00	20'	제3주제 발표 : 글로벌 해양에너지 개발과 녹색성장 - 발표자 : John Huckerby (국제에너지기구 해양에너지부 의장)
15:00~15:20	20'	제4주제 발표 : 미래 해양 광물자원 개발과 녹색성장 - 발표자 : Dr.Hasjim DJALAL (인도네시아 해양수산부 장관 고위자문역, 전 인도네시아 대사)
15:20~15:40	20'	휴식
제3세션		라운드 테이블

15:40~16:40	60'	- 좌장 : 전준수 (서강대학교 교수) - 토론자: 발표자 및 초청 토론자(Carl-Christian Schmidt, Barrie Stevens, John Huckerby, Ahmad Fadzil B Mohamad Hani, Richard Jones, Thomas Lindy Sorensen, , Hasjim Djalal) 및 국내 초청토론자 : 홍기용(KORDI 본부장), 염상훈(한국크루즈산업포럼 사무총장)
16:40~17:00	20'	휴식
제4세션		기자 회견
17:00~17:30	30'	- 국제심포지엄 주요결과 발표(OECD 측 대표) - 기자 인터뷰

개회사

바쁜 일정과 무더위에도 불구하고 오늘 “2012여수세계박람회-OECD 국제심포지엄”에 참석하신 내외 귀빈여러분, 관계자 여러분께 깊은 감사의 말씀을 드립니다.

특히 심포지엄 준비를 위해 수고해 주신 예브 레테르메 OECD 사무차장님, 김학소 KMI 원장님, 바쁜 국정 일정에도 귀한 시간을 내주신 양수길 녹색성장위원회 위원장님, 권도엽 국토해양부장관님, 정우택 국회의원님께 큰 감사를 드립니다.

더불어 본 심포지엄의 핵심이라고 할 수 있는 ‘글로벌 오션 리더스 포럼’에 참석해 주신 니안 톤 아웅 미얀마 교통부장관님, 존 허커비 국제에너지기구 의장님, 박한일 해양대학교 총장님, 김영민 한진해운 사장님께도 깊은 감사의 말씀을 드립니다.

지난 5월12일 기념비적인 해양엑스포, 2012여수세계박람회가 시작된 지 두 달 가까이 지나 어느덧 종반을 향해 달려가고 있습니다. 그간 사회 각계의 헌신적인 노력에 힘입어 여수세계박람회가 성공적인 마무리를 위하여 순조롭게 진행되고 있습니다.

조직위원회는 세계 최초의 해양박람회인 여수세계박람회의 의의와 노력을 학

문적으로 집대성하기 위해 OECD와 공동으로 “해양경제의 미래”라는 주제로 오늘
심포지엄을 준비하였습니다.

여수세계박람회는 해양을 기반으로 하는 지속가능한 경제체제인 블루이코노미
를 새로운 경제발전의 패러다임으로 제시하고 있습니다. 이번 심포지엄을 통해
많은 분들이 해양을 통한 인류공영과 미래발전을 몸소 체험하는 계기가 되기를 바
라며 여수세계박람회의 테마인 ‘살아있는 바다 숨 쉬는 연안’의 구체적 실천방
안을 제시할 수 있는 소통의 장이 되길 기대합니다.

마지막으로 이 자리를 함께 해주신 모든 분들의 뜨거운 열정과 혼을 담아 여
수세계박람회가 성공적으로 마무리 될 수 있도록 혼신의 노력을 다할 것을 약
속드립니다.

바쁘신 일정에도 불구하고 오늘 이 자리를 빛내주신 모든 참석자, 관계자 분들께
다시 한 번 심심한 감사를 드리며, 여러분 모두의 안녕과 행복을 기원하며 개
회사를 갈음하고자 합니다.

감사합니다.

2012년 7월 9일

2012여수세계박람회 조직위원회 위원장

강 동 석

Opening Speech

Ladies and Gentlemen!

My name is Kang Dong-seok, Chairman of the Organizing Committee of Expo 2012 Yeosu Korea

We would like to extend our heartfelt thanks to distinguished guests, presenters from home and abroad, panel members, and related officials for taking time out of their busy schedules to participate in the International Symposium of Expo 2012 Yeosu Korea in this extremely hot weather.

Almost two months have already passed since Expo 2012 Yeosu Korea, the monumental maritime expo, was launched on May 12, 2012. The event is getting into the final stage. Thanks to strenuous endeavors by people from all walks of life in our society, the expo has been successfully launched and implemented.

The organizing committee prepared today's symposium under the theme, 'the Future of Maritime Economy,' together with the OECD, in order to reorganize the significance and performance of the world's first maritime expo academically.

Expo 2012 Yeosu Korea presents as a new paradigm for economic development, the Blue Economy, a sustainable economic system based on the ocean. We hope that this symposium can serve as an opportunity for many experts and participants to experience future development and the co-prosperity of humanity. We also expect this event to act as a communication channel where the specific action plans for 'Living Ocean and Breathing Coast, the theme of the expo, can be provided.

Last but not least, based on the enthusiasm and spirit of all the participants, we will take all-out efforts to successfully complete the expo. We wish all of you to go back with the full knowledge of the ocean, through today's international symposium.

Once again we would like to express our sincerest gratitude to all of you here for taking time out of your busy schedules to take part in this event. We wish you and your families the blessings of love, health, and happiness.

Thank you very much.

July 9, 2012

Kang Dong-suk

Chairman of the Organizing Committee of Expo 2012YeosuKorea

환영사

여러분, 안녕하십니까?

한국해양수산개발원 원장 김학소입니다.

우선 이 자리를 빌어 성공적인 여수세계박람회 개최를 위해 물심양면으로 애쓰고 계시는 여수세계박람회 조직위원회 강동석 위원장님과 이번 행사를 공동으로 주최해주신 예브 레테르메 OECD 사무차장님께 심심한 감사의 말씀을 드립니다.

아울러 바쁜 일정에도 불구하고 기조연설을 위해 귀한 시간 내주신 양수길 녹색성장위원회 위원장님, 정우택 국회의원님, 글로벌 오션리더스 포럼을 위해 멀리 미얀마에서 참석해주신 우니안툰아웅 교통부장관님, 그리고 박한일 해양대학교 총장님, 김영민 한진해운 사장님께 진심으로 감사의 말씀 전합니다.

그리고 이 자리에 참석해 주신 내외 귀빈여러분, 발표자 및 토론자 여러분들께도 깊은 감사의 말씀 드립니다.

존경하는 내외 귀빈여러분!

여러분도 잘 아시다시피, 2012여수엑스포의 주제는 ‘살아있는 바다, 숨쉬는 연안’입니다. 이번 여수엑스포는 바다와 연안의 생명력으로 인류의 미래를 풍요롭게 하는 유토피아적 미래상을 제시하고 있습니다.

기후변화로 야기되고 있는 연안침식, 산호초 소실, 해양생물종의 감소 등 전 지구적 해양문제를 해결하고 해양을 통해 전 인류의 먹거리를 확보할 수 있는 ‘블루이코노미’ 실현 방안을 구현하고 있습니다.

이번 국제심포지엄은 이러한 블루이코노미 실현을 목표로 해양을 통한 녹색성장의 새로운 패러다임을 제시하고자 합니다. 최근 해양경제의 근간인 세계 해양산업 규모는 2020년까지 약 14조 달러에 이를 것으로 전망되고 있습니다. 이는 2011년 세계 GDP 총액인 64조 달러 기준으로 22퍼센트에 해당하는 높은 수치입니다. 이러한 성장은 개발 중심적 사고에서 벗어나 환경과 경제의 상생을 통한 새로운 패러다임의 제시를 통해서 가능합니다.

이를 위해 국내외 석학들을 모시고 해운, 항만, 수산, 크루즈 등 전통적인 해양경제와 해양바이오, 해양플랜트, 해양에너지, 심해저광물개발 등 신흥 해양경제의 조화로운 발전을 통해 인류의 삶을 풍요롭게 할 지속가능한 성장모델을 제시하고자 합니다.

존경하는 내외 귀빈여러분!

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2012년 7월 9일

한국해양수산개발원 원장 김 학 소

The Global Ocean Economy and Green Growth

글로벌 해양 경제와 녹색 성장



Soogil, Young

**Chairman, Presidential Committee on Green Growth,
Republic of Korea**

(양수길 대통령 직속 녹색성장위원회 위원장)

A senior Korean economist, Dr. Soogil Young has been serving as Chairman of the Presidential Committee on Green Growth which he co-chairs with the Prime Minister since July 2010. He is also the founding Chairman of the Green Investment Korea Forum (GIK). Dr. Young worked at four major governmental think tank on economic policies during 1978~1998, including at the Korea Development Institute (KDI) as a senior fellow, and at the Korea Transport Institute (KOTI) and the Korea Institute for International Economic Policy (KIEP) as President at each. During 1998~2000, he served as Korea's Ambassador to the OECD, concurrently serving as Chairman of the Advisory Council on the Development Centre. After working at Kim & Chang, Korea's law firm, as a senior advisor for three years subsequently, Dr. Young worked at the National Strategy Institute (NSI), an independent think tank on economic reforms, as President till April 2011. Since the early 1980s, he served on numerous governmental advisory committees, including on four Presidential commissions/committees. In 1994, he was awarded the National Decoration of *Tongbaik* Order for having coordinated the covert operation to prepare the *Presidential Emergency Decree for Real-Name Financial Transactions*, an epochal financial reform introduced in August 1993. During 2006~2009, he served as Chairman of the Korea National Committee on Pacific Economic Cooperation (KOPEC). He has written extensively on Korea's development and international challenges. Dr. Young graduated from Seoul National University in Korea with a B.Sc. in chemical engineering and the Johns Hopkins University in the U.S. with a Ph.D. in economics.

OECD's Contribution to the Green Growth

글로벌 해양경제의 미래



Yves Leterme

DSG of OECD

Former Prime Minister, Belgium

(OECD 사무차장, 전 벨기에 총리)

Yves Leterme was appointed Deputy Secretary-General of the OECD on 8 December 2011. He is in charge of Social Affairs, Education, Governance and Entrepreneurship.

Before joining the OECD, Yves Leterme held a variety of political posts in Belgium at all levels and in all areas of government. After starting his career as an alderman in his home town of Ypres, he became a Deputy in the Chamber of Representatives, Group Chairman, National Secretary and Chairman of the CD&V party, Minister-President of the Flemish Government, Federal Senator, Deputy Prime Minister, Minister of the Budget and Mobility, Minister of Foreign Affairs and Prime Minister. Yves Leterme is currently Minister of State and a municipal councillor in Ypres.

At a professional level, Yves Leterme has worked, *inter alia*, as a deputy auditor at the Belgian Court of Audit and an administrator at the European Parliament.

Yves Leterme, who was born on 6 October 1960, has a degree in Law and Political Science from the University of Ghent..

Keynote Speech

OECD's Contribution to Green Growth and its Importance for the Ocean Economy"

Ladies and Gentlemen,

I am very pleased to be here with you at the Yeosu EXPO 2012. It is an honour and a privilege to be giving this keynote speech today, and to share with you some insights into the OECD's work on Green Growth, both in general and in relation to this international symposium's overarching theme on the Ocean Economy.

The last four decades have witnessed extraordinary developments on our planet

World population has grown by over 3 billion people, and the world economy has tripled in size. The economic and social gains have been tremendous, but they have been unevenly distributed, and they have come at considerable cost to the environment. Looking ahead, the challenge will be to provide for a further 2 billion people by 2050 and improve the living standards for all. But the economic expansion required to do that job could well grind to a halt if we do not succeed in protecting the environment and its natural resources. If we fail, we will have destroyed or permanently damaged the water and mineral resources, ecosystem diversity and other natural foundations on which our well-being relies. Green growth offers a genuine alternative to this prospect.

Green growth is not a replacement for sustainable development

The OECD sees green growth as a practical and flexible approach for accelerating progress in the economic and environmental pillars of sustainable development, while taking full account of the social consequences of greening the growth dynamic of economies. The focus of green growth strategies is ensuring that human, natural and physical capital can deliver its full

economic potential on a sustainable basis. That potential includes the provision of critical life support services – clean air and water, and a resilient biodiversity needed to support food production and human health.

Green growth opens the door to new sources of growth that contribute to economic, environmental and social well-being. It can achieve this through various channels, for example:

- It can enhance productivity through the creation of incentives for greater efficiency in the use of natural resources, reducing waste and energy consumption, and unlocking opportunities for innovation and value creation.
- It can boost investor confidence through greater predictability in how governments deal with major environmental issues.
- It can open up new markets by stimulating demand for green goods, services and technologies.
- And it can reduce the risk of negative shocks to growth due to resource bottlenecks and the impacts of environmental damage.

OECD contributes to progress in green growth in a number of ways

An important first step is identifying the scale and nature of the problem and its likely consequences. The **OECD Environmental Outlook to 2050** looks four decades ahead to ascertain what demographic and economic trends might mean for the environment if humanity does not manage natural assets with more care. It then examines how specific policy actions can help shift these projections to a more sustainable course. Can the planet's resource base support ever-increasing demands for energy, food, water and other natural resources?

Or will the growth process ultimately prove counterproductive? How can we balance the environmental, economic and social objectives and secure the life support systems on which all human development depends? These are some of the guiding questions for developing the requisite policy frameworks.

At the level of concrete policy implementation, the OECD has been contributing by identifying successful green growth strategies and their essential ingredients. These include for example:

- Valuing natural assets and ecosystem services, properly pricing natural resources, and applying economic instruments to biodiversity and other ecosystems.
- **Developing indicators and measurement tools based on internationally comparable data**, which help monitor progress towards green growth. We have recently launched an **online database containing selected indicators** designed to support policy making and inform the public at large. It monitors the environmental and resource productivity of the economy; the natural asset base; the environmental dimension of the quality of life; and economic opportunities and policy responses.
- Making pollution more costly by putting a price on pollution through carbon taxes or emissions trading schemes.
- **Reforming environmentally harmful subsidies.** In 2010 governments and taxpayers spent around **half a trillion US dollars** supporting the production and consumption of fossil fuels. To assist governments' understanding of the nature and scale of their support of fossil fuels, **the OECD has compiled, for the first time ever, an inventory of over 250 measures that support fossil fuel production or use in 24 industrialised countries**, which together account for 95% of the OECD's total primary energy supply.

- Improving skills development and labour market policies. The OECD has demonstrated that a well-designed emissions trading system could generate **net gains in total employment**, and could prove a powerful weapon for developing countries in their fight against underemployment.
- Conducting green growth sectoral studies. The key message from OECD sector-specific work to date is that, over the longer term, greening these sectors can reinforce environmental sustainability, economic growth and social well-being. Indeed, green growth is essential to meet the energy, food, water and sanitation requirements for future generations.

There is no “one-size-fits-all” prescription for implementing green growth.

Greening the growth path of an economy depends on policy and institutional settings, level of development, resource endowments and particular environmental pressure points. Advanced, emerging and developing countries will face different challenges and opportunities. For this reason, the OECD is supporting countries by helping them tailor their green growth policies to match their individual circumstances. Building on the general framework developed in the Green Growth Strategy, the OECD is mainstreaming green growth in its national and multilateral surveillance exercises to provide policy advice that is targeted to the needs of individual countries. These include the **Economic Surveys, Environmental Performance Reviews, Innovation Reviews, and Investment Policy Reviews**.

But how does green growth apply to the ocean, the over-arching theme of this international symposium?

Over the last few years, the concept of green growth has begun to make important inroads

into areas of the OECD's work that have strong links to the use of, and the well-being of, the ocean and its coasts. Fisheries and aquaculture policies have come in for close examination from a green growth perspective. The work calls for a comprehensive assessment that recognises the interplay between the economics of fishing activity, the biological state of the stocks, management and governance. Efforts to 'green' tourism, not least coastal and cruise tourism, have rapidly moved up the OECD tourism agenda. Greater interest has been shown in the shipbuilding community in greener shipbuilding methods, and in-depth exploration of the environmental stresses and strains on ports has been undertaken by the OECD recently. And in the science field, OECD activity around maritime biotechnology has intensified as its potential contribution to health, nutrition, energy and environmental remediation takes on ever clearer contours.

The ocean is the last, largely unexplored frontier of human activity.

Covering 71 per cent of the globe, the ocean constitutes a huge potential resource. At the same time, it plays a key role in providing a range of essential environmental services. The many activities taking place in the ocean and along its coasts include oil and gas exploration, tourism, fisheries and aquaculture, defence and shipping, to name just a few. Importantly, the ocean also provides central eco-system services in particular with regards to climate change.

However, despite its vital importance to the life function of the planet, the ocean is an often disregarded and undervalued part of our natural resource systems. The ocean, and in particular the near-shore areas and the coasts, are heavily over-used and user conflicts are increasingly part of the landscape that policy makers are faced with and need to address.

Many ocean activities take place in a vacuum. There is a failure to recognise the urgent need for a comprehensive and holistic approach to addressing the competing demands on our natural resource base and on the limited ocean and coastal space available. Indeed, ocean governance is often spread across many agencies, and little effort has been made at the

national and international level to ensure a coherent approach. What is more, we know very little about the economic value of ocean activities, making it all the more difficult to attract the public attention it deserves.

New and shared management paradigms need to be developed by governments, the research community, the business community and civil society on a number of frontiers, if the right balance is to be struck in favour of a more sustainable use of ocean resources. The green growth agenda offers some useful insights into what is needed to address the potential over-use of ocean resources.

2012 is a key year marking the Rio+20 process from which a renewed commitment to sustainable development, including for the oceans, is high on the international policy agenda. Rio+20 places increased emphasis on green growth and in this regard the valuation of ocean activities is a key undertaking.

EXPO 2012 Yeosu is the first World EXPO focusing on the oceans and coasts

The choice of theme - “The Living Ocean and Coast” - is by no means a co-incidence. It provides a welcome opportunity to enhance the ocean’s agenda by advancing our understanding of its role in sustaining the welfare of humankind and the well-being of the very planet we live on. Without a course correction, we endanger our ocean’s valuable resources and we imperil our own common future. Addressing the challenges and opportunities of oceans and coasts is therefore a highly relevant and timely endeavour.

The ocean offers tremendous economic potential. The very significant increase in the world’s population over the coming decades means many more mouths to feed, many more jobs to be created, and many more livelihoods to be assured. Meeting that global challenge is unthinkable without the ocean and the many diverse resources it has to offer. But optimum utilization of this potential will require greater scientific, technical and political co-operation.

The lack of economic data and research in many ocean-related sectors and regions is one of the major obstacles to realising in full the promise of the ocean economy. In particular, we face an uphill task in raising the interest of policymakers in an ocean agenda if we make no effort to gain a better grasp of the economic benefits and costs of ocean-based activities. What is more, we will also require approaches that treat the ocean, ocean resources and ocean users in a more comprehensive, integrated manner.

By choosing the theme “The Future of The Ocean Economy” for the KMI-EXPO-OECD symposium, the discussions will contribute to several objectives:

1. Better define the ocean economy and quantify its potential;
2. Better understand the policy issues associated with ocean/coastal activities, their linkages, synergies and conflicts, both from today’s perspective but also from tomorrow’s;
3. Bring data, information and expertise together to map out the economic value of the ocean¹, the range of activities that takes place there, and how these are likely to evolve in the coming years;
4. Identify major governance issues including how institutional structures and resources can cope with managing the ocean space and its resources. This also includes the legal and regulatory framework around the ocean and the institutional and operational structure. As some ocean issues are local or national, others are international in nature, even for coastal and near-shore activities (e.g. with regards to pollution) a discussion on the different platforms on which ocean issues can be dealt with, and how, seems therefore to be in order.

¹ In this context the ocean is understood to encompass coastal and near -shore activities with

5. Identify a policy framework that can bring together a more holistic policy perspective to the management of the oceans, their uses and resources, and thus contribute to the Green Growth agenda.

Subsequent to this international symposium, the OECD will be building on the event's findings and carrying its work forward in the various specialised departments of the Organisation. As part of the follow-up, the OECD will step up its work on the future of the ocean economy with a special multisectoral project on the subject. We look forward to collaborating on the project with Expo 2012, KMI and other important public and private stakeholders. In so doing, we can work to ensure that the important messages from this symposium and the Expo 2012 live on, and that they can be strengthened and sharpened, to the benefit of the ocean and that of future generations.

Thank you.

Global Ocean Leaders Forum

The Future of the Ocean Economy and Green Growth

해양경제의 미래와 녹색 성장



Jin-Hyun, Paik

**Judge of the International Tribunal for the Law
of the Sea in Hamburg, Germany**

Dean of GSIS, SNU

(백진현 국제해양법재판소 재판관)

Jin-Hyun Paik is Judge of the International Tribunal for the Law of the Sea in Hamburg, Germany. He is also Dean of the Graduate School of International Studies (GSIS), Seoul National University (SNU), Korea. He has specialized in international law and organization, law of the sea, and international security and conflict management. Educated at Seoul National University (LL.B.), Columbia Law School(LL.M.), and Cambridge University (Ph.D.), he was doctoral fellow at the Hague Academy of International Law, Netherlands; visiting fellow at the Rand Corporation, Santa Monica and Hoover Institution, Stanford; and visiting professor at Johns Hopkins University's School of Advanced International Studies(SAIS). He has been a member of Korean delegations to various diplomatic conferences including the UN General Assembly, UN conferences on the law of the sea, and UN peacekeeping committees. He also has been a member of advisory committees to various government organizations of Korea including Presidential Office, Ministry of Foreign Affairs and Trade, and the National Security Council. He is currently President of a few academic associations in Korea including the Korean Academic Council on the UN System (KACUNS) and the Sea Lanes of Communication (SLOC) Study Group Korea. He is also President of the HaeSung Institute for Ethics in International Affairs, a non-profit, private foundation dealing with the role of ethics and norms in international relation. He has edited eight books and written over 100 articles on his field of interests both in English and Korean.

Global Ocean Leaders Forum

Young Min (YM) Kim

President & CEO/Hanjin Shipping Co., Ltd.

(김영민 한진해운 사장)



YM has been serving as President & CEO of Hanjin Shipping in Korea since January 2009 after spending 4 and half years as a COO of the company. Prior to January 2004 when he joined Hanjin's head office in Seoul as COO, YM served as a CEO for Hanjin's US port operating joint venture company, TTI for 2 and a half years since September 2001. During this time he managed 3 west coast marine terminals in Long Beach, Oakland and Seattle. Prior to joining Hanjin Shipping and TTI in September 2001, YM had spent 20 years with Citibank, now known as Citigroup, in various international posting and responsibilities thereby acquiring extensive cross cultural management experience. His last stint at Citi was Managing Director in charge of international corporate banking relationship out of its New York head quarter. He had also worked outside of the U.S. in a number of the world's finance and business capitals including Seoul, Hong Kong, and Bangkok. YM's first job out of college in 1977 was an export sales rep at Daewoo Corp.

He is a graduate of Yonsei University in Korea and earned MBA degree from Northeastern University in Boston in 1981. Born and raised in Korea with US citizenship, he is married with 2 children and had lived outside of Korea for 17 years. YM currently is on Hanjin's board and also a board member of World Shipping Council (WSC) and a Vice Chair of Korea Ship-owners Association. He served as the Chairman of the Transpacific Stabilization Agreement (TSA) since January 2010 until June 2011, where he made efforts to stabilize the trade and to maintain dialogue with key shipper organizations and government officials.

◎ **Date of Birth:** March 11th, 1955

◎ **Place of Birth:** Seoul, Korea

◎ **Career History**

Present: CEO, Hanjin Shipping, Korea

2004 ~ 2008: COO, Hanjin Shipping, Korea

2001 ~ 2003: CEO, TTI (Total Terminal Incorporation), U.S.A.

1981 ~ 2001: Citibank (Korea, Hong Kong, Thailand, and U.S.A.)

1977 ~ 1978: Daewoo Corporation

◎ **Educational Background**

1981: Northeastern University, MBA, U.S.A. /1977: Yonsei University, Bachelor in Economics, Korea

Global Ocean Leaders Forum



Han Il, Park

President, Korea Maritime University

(박한일 한국 해양대학교 총장)

DATE OF BIRTH : July 11th, 1957

E-Mail : hipark@hhu.ac.kr

PRESENT POSITION President of Korea Maritime University

EDUCATION

- ◇ Mar.1977 - Feb.1981 B.Sc in Dept. of Marine Engineering, Korea Maritime University
- ◇ Mar.1984 - Aug.1988 M.Sc in Dept. of Oceanography
Seoul National University
- ◇ Oct.1988 - Oct.1992 Ph.D in Dept. of Naval Architecture & Ocean Engineering
University College London, University of London, England

CAREER

- ◇ Oct.1991 - Aug.1992 Research Fellow, University College London
- ◇ Sep.2000 - Sep.2001 Visiting Professor, RIAM, Kyushu University, Japan
- ◇ Mar.2001 - Feb.2002 Director, Research Institute of Marine Science and Technology,
Korea Maritime University
- ◇ Mar.2005 - Feb.2007 Dean, College of Ocean Science and Technology
Korea Maritime University
- ◇ Apr.2009 - Mar.2012 Sea-sky Schloar, Dalian University of Technology, China
- ◇ **Mar.2012 - Present President of Korea Maritime University**

KEY ACTIVITIES OUTSIDE SCHOOL

- ◇ Technical Program Committee Member, ISOPE(2001~)
- ◇ Evaluation Committee Member, National Science and Technology Council under the Office of President,
Korea(2008~2011)
- ◇ Evaluation Committee Member, Korea Research Council for Public Science and Technology, Minister
of Marine Affair and Fisheries, Korea(2002-2005)
- ◇ Advisory Committee Member for Harbor Construction, Minister of Marine Affair and Fisheries,
Korea(2005~2010)
- ◇ President, Korean Society of Ocean Engineers(2010~2011)

The Future of the Ocean Economy

해양경제의 미래



BARRIE STEVENS,

Head, International Futures Programme, OECD

(OECD 국제미래프로그램 국장)

Barrie Stevens is Head of the International Futures Programme (IFP) at the Organisation for Economic Co-operation and Development (OECD). The IFP is the Organisation's foresight group. He holds a PhD in economics and social policy from Hamburg University, Germany, following studies in business and languages in Manchester, UK. Previous professional experience includes university teaching (economics, social policy), project management in market research (industrial and consumer research) and consultancy.

He joined the OECD in 1982 and worked on a variety of socio-economic issues, including structural adjustment, trade protection and education and training. He has been involved in foresight since the creation in 1990 of the OECD International Futures Programme. The Programme, which is concerned with the identification and evaluation of newly emerging economic and social issues, aims to promote strategic thinking, test new ideas, and stimulate dialogue between government, business and research on long-term issues.

He is author or co-author of some 40 books and articles on themes ranging from societal change, globalisation and new technologies, to trade, health, energy and transport. Recent studies he has led include "Infrastructure to 2030" (OECD 2007), and "The Future of International Migration to OECD Countries" (OECD, 2009). He is currently leading the preparatory work for a project on "The Future of the Ocean Economy".

Paris, May 2012 , Barrie.stevens@oecd.org

Abstract

The Future of the Ocean Economy

-A Green Growth Perspective -

Barrie Stevens, Head, OECD International Futures Programme, OECD, Paris, France²

The world's oceans have come under increasing pressure in recent decades, with population growth, climate change and economic growth all playing their part. But what will the next few decades bring?

Since the turn of the century there has been a growing trend of migration towards coastal areas. Today, some 44 % of the world's population (more people than inhabited the entire globe in 1950) currently live within 150 kilometers of the coast. Overall, average population density in coastal zones is three times higher than the world average, and in recent decades the overall growth of coastal populations has outstripped that of inland populations. The world's population is expected to increase from 6.5 billion in 2005 to over 8 billion in 2030, and more than 9 billion by 2050, suggesting that pressures on coastal regions will continue and may even intensify. So too will the strains on world fish stocks and other ocean resources, as the world struggles to feed an extra 2 billion people.

On the climate front, without new policy action a world economy four times its present size is projected to use about 80% more energy in 2050. Moreover, the energy mix at the global level would not be significantly different from that today, with the share of fossil energy remaining at around 85% and renewables (including biofuels) providing around 10%. At current rates the atmospheric concentration of GHGs could reach almost 685 parts per million (ppm) by 2050. As a consequence, the global average temperature increase is projected to be substantially higher at the end of the century than the internationally agreed goal of 2° C above pre-industrial levels. A temperature increase of more than 2° C would *inter alia* alter precipitation patterns, drive sea-level rise and lead to further losses in biodiversity, not least in marine environments. Significant changes in levels of ocean acidity are also expected.

Despite the poor economic performance of recent years, marked by high levels of unemployment and large fiscal imbalances, a long-term view of economic development indicates a doubling of world GDP by 2030 and a three-to-fourfold increase by 2050. What is striking however is that, over time, the rate of growth of the world economy is set to slow. The OECD's baseline long-term economic scenario points to a fall in potential real GDP growth of the world economy from around 3 ½ % over 2012-2017 to around 2 ½ % for the period 2031-2050. While OECD growth would be modest (mainly to ageing populations) but relatively stable, that of non-OECD regions is projected to slip from

² Opinions expressed are those of the author and do not necessarily represent those of the OECD or its member countries.

almost 7% in 2012-2017 to 3% over 2031-2050, driven primarily by demographic effects and technology catch-up.

To tackle the multiple challenges outlined above, the world clearly will need economic growth and development, but of a kind that ensures that natural assets continue to provide the resources and environmental services on which our well-being relies – i.e. green growth. The search is therefore on for new sources of growth, and it is for this reason, among others, that the ocean has come into sharp focus as a critical resource for the future.

The established maritime industries such as shipping, fisheries, coastal and cruise tourism are undergoing significant change. Expanding trade has brought a massive increase in maritime traffic and, despite the current economic situation, container traffic looks set to grow very fast over the long-term, most likely tripling by 2030. Wild fish stocks are being heavily over-used - around a third of global fish stocks are overexploited, depleted or recovering from depletion, and half are considered fully exploited. In tourism, ageing populations, rising incomes and relatively low transport costs will make coastal and ocean locations will become ever more attractive. And climate change will continue to affect oceans through shifts in temperature, changes in acidity, rising sea levels and the freeing up of new trade routes.

Yet, looking to the future and the prospect of 9 billion people inhabiting the planet by mid-century, the oceans will clearly need to play an increasingly important role in supporting economic growth and social development around the world. For that to happen, the traditional maritime industries will need to operate in much more sustainable ways.

At the same time, other less traditional maritime sectors offer huge opportunities for addressing many of the big economic, social and environmental challenges facing humanity in the next decades. These “emerging ocean industries” include *inter alia* renewable energy generation in the form of tidal, wave and offshore wind-generated energy, bio-prospecting and marine biotechnology, technology-intensive aquaculture, sea-bed mining for minerals, as well ocean security, i.e. industries developing and applying a range of science and technology innovations to make the oceans cleaner and safer and protect the richness of their resources. Many of these activities are still in their infancy or at least a long way from maturity. To bring them on-stream on a scale that would allow them to contribute in a meaningful way to global prosperity, human development, natural resource management, and green growth, they will require considerable R&D effort, investment, and coherent policy support, not least in ocean and coastal management.



BETTER POLICIES FOR BETTER LIVES

THE FUTURE OF THE OCEAN ECONOMY



Barrie Stevens
OECD International Futures Programme

Yeosu, July 2012

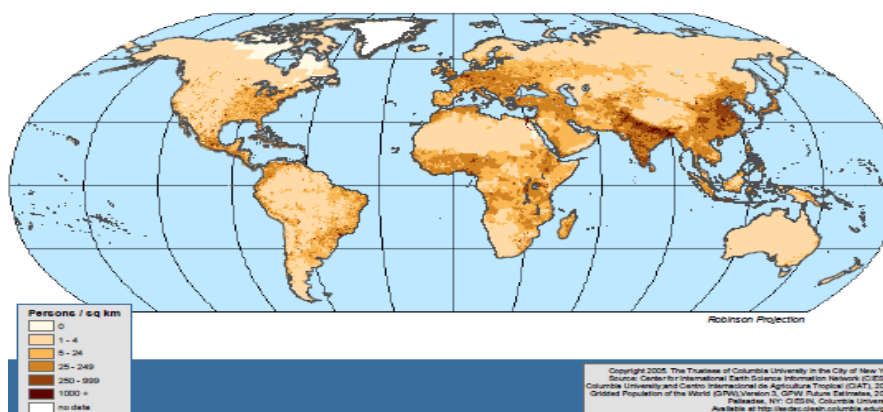
GLOBAL CHALLENGES SHAPING THE FUTURE OF THE OCEAN ECONOMY



OECD International Futures Programme

2

Global population density has increased, especially in proximity of the coast



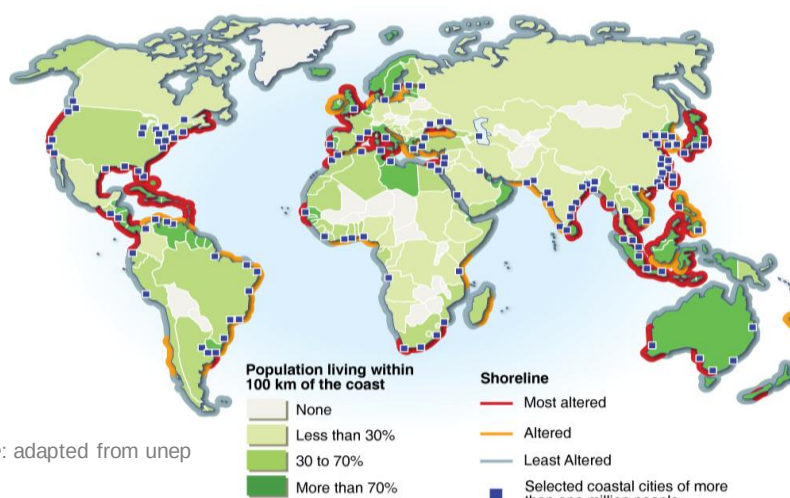
Average population density in coastal zones is three times higher than the world average, and in recent decades the overall growth of coastal populations has outstripped that of inland populations. Today, about one in every three people on the planet lives within 100 kilometers of the sea.



OECD International Futures Programme

3

Coastal Population and Shoreline Degradation



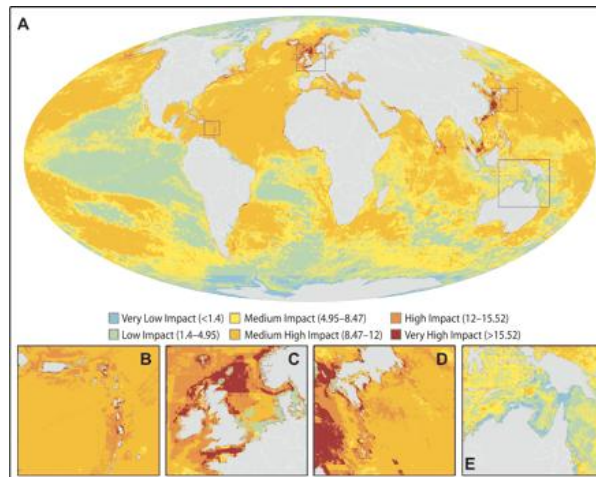
Source: adapted from unep



OECD International Futures Programme

4

Global Map of Human Impact on Marine Ecosystems

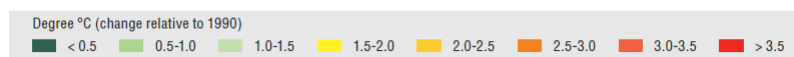


Source: nceas

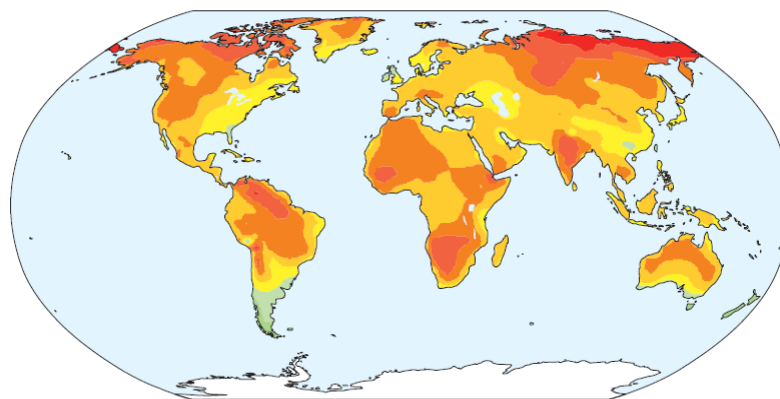
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5

Change in annual temperature: Baseline 1990-2050



Panel A. 2050 Baseline

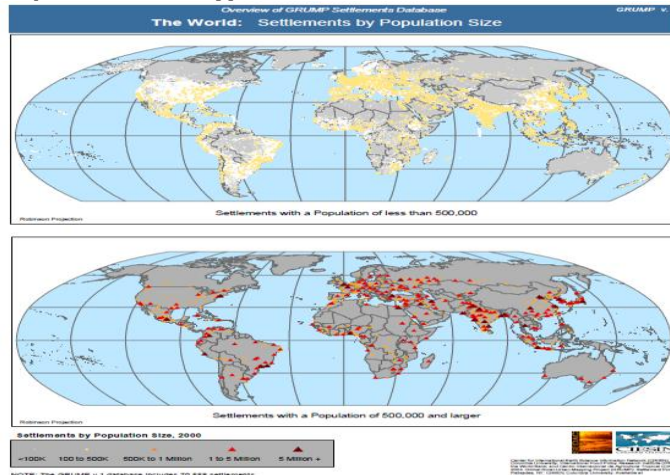


Source: OECD, Environmental Outlook to 2050

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6

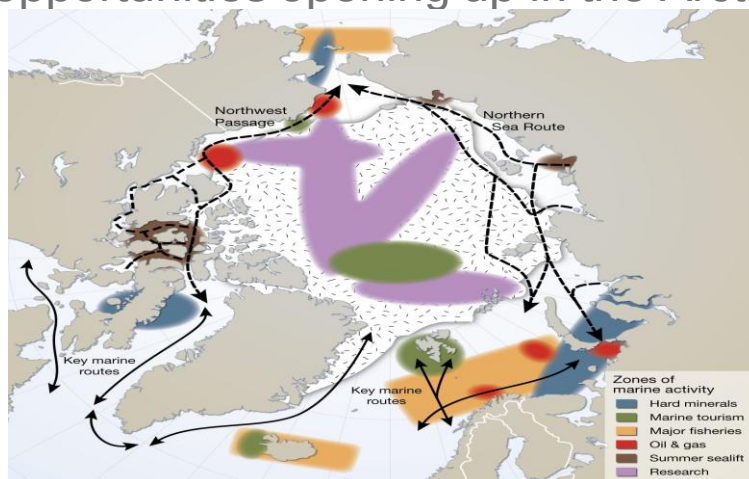
Pressure on coastlines will mount as coastal populations grow and sea levels rise



World population to rise from 7 billion today to 9 billion by 2050.
8 of the world's 10 largest cities are located by the coast. 50-cm sea level rise could result by 2070 in a tripling of the population at risk of coastal flooding and a tenfold increase in the amount of assets exposed, or from 5% of 2008 GDP to 9% of 2070's GDP.



New sea routes and natural resource opportunities opening up in the Arctic

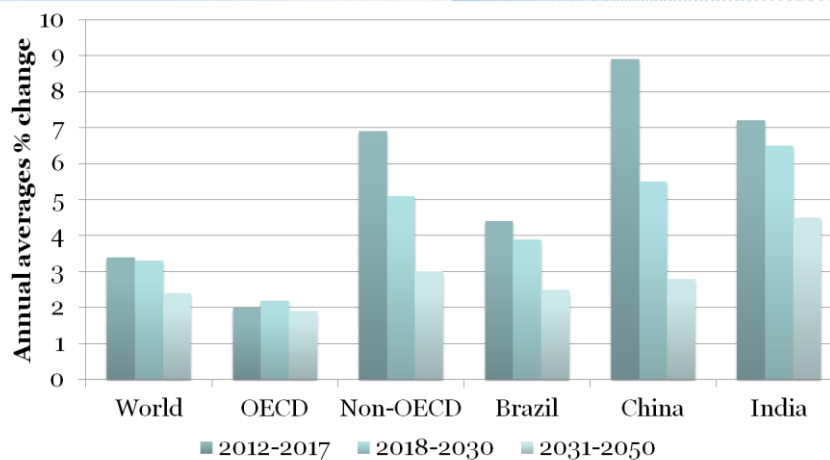


Source: Chatham House



The environmental change in the Arctic has sparked new global interests in Arctic energy, fishing, shipping and tourism.

Potential real GDP growth 2012-50



Source: Based on OECD, Economic Outlook, May 2012, preliminary version



World economic growth is set to slow in the coming decades. Nonetheless, global GDP is expected to double over the period to 2030, with GDP per capita growing by around 60%. By 2050, world GDP could grow to three to four times its current level.

9

“Green growth means fostering economic growth and development while ensuring that natural assets continue to provide the resources and environmental services on which our well-being relies.”



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10

THE CONTRIBUTION OF “TRADITIONAL” MARITIME SECTORS TO FUTURE GROWTH AND DEVELOPMENT OF THE OCEAN ECONOMY

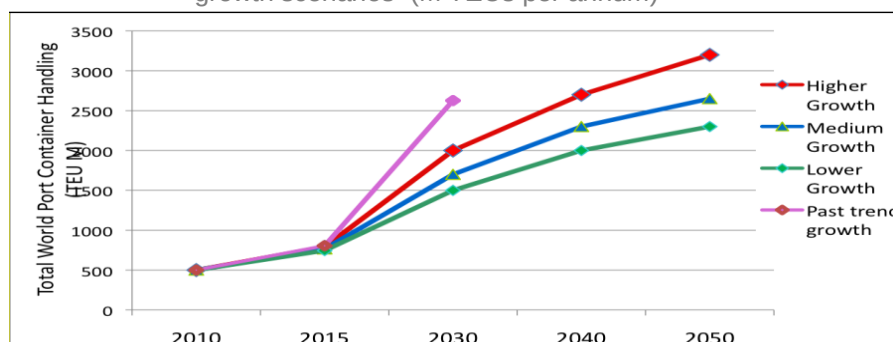


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11

Maritime transport

World port container handling – higher, medium and lower TEU growth scenarios (M TEUs per annum)



- Maritime demand for the main cargo types (crude oil, petroleum products and gas (including LNG); dry bulk cargos, including iron ore, coal, grain, bauxite/alumina and phosphate rock; and containerized cargoes) expected to continue to increase over the period to 2030 and beyond.
- Container traffic is expected to remain the fastest growing category of maritime freight on a global basis. Global container traffic could increase around five to six times by 2050.



12

Port infrastructure investment requirements worldwide 2009-2030

Table 2.3. Global port infrastructure investment needs, 2009-2030

Region	USD billions				
	Annual average investment		Aggregate investment		
	2009-2015	2015-2030	2009-2015	2015-2030	2009-2030
Worldwide					
Total	33	40	200	630	830

Table 2.4. Total port container investment needs (new berths and rehabilitation)

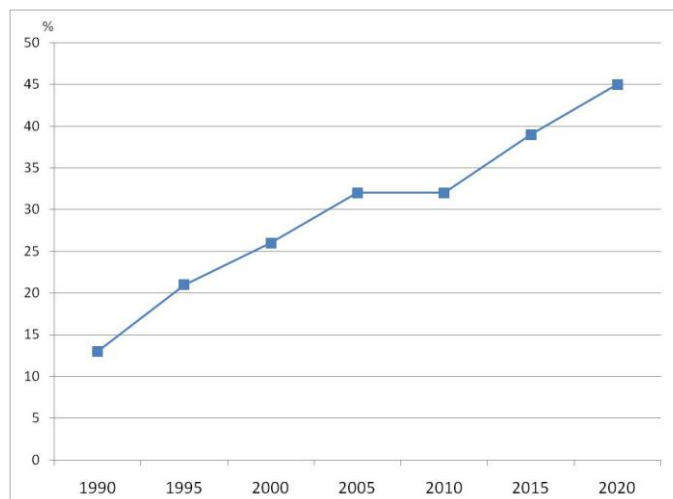
Region	USD billions				
	Annual average investment		Aggregate investment		
	2009-2015	2015-2030	2009-2015	2015-2030	2009-2030
Global					
New berths	8	12	50	190	240
Rehabilitation	3	4	17	63	80
Total	11	16	67	253	320



Source: Strategic Transport Infrastructure Needs to 2030, OECD 2012

13

Aquaculture as a % of total world fisheries production 1990-2020



Source: based on OECD/FAO data

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Cruise tourism

- \$ 18 billion per year in passenger expenditures
- Average annual passenger growth rate 7.4%
- Fastest sector of the travel industry over last 20 years
- Growth rate twice as fast as that of tourism overall
- High growth rates expected to continue in future

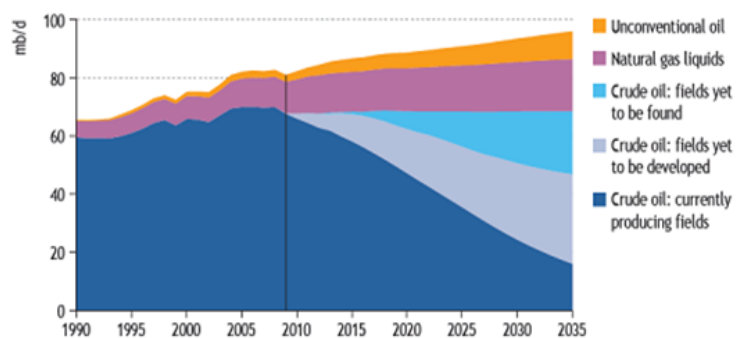


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15

Offshore Oil and Gas

World oil production by type in the New Policies Scenario



Source: IEA

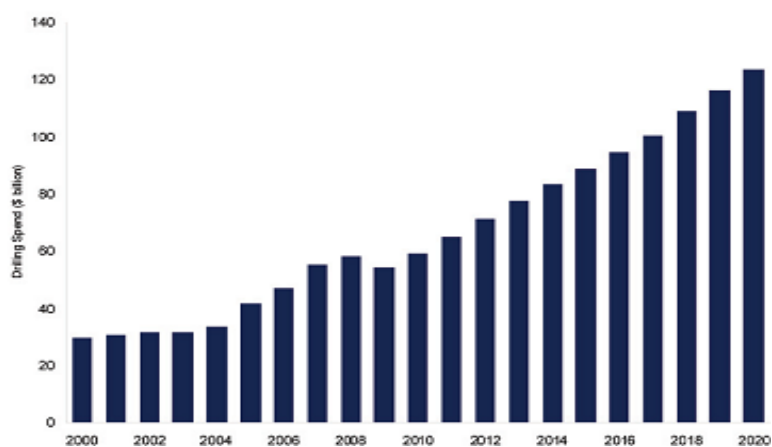
The bulk of the oil that will be produced in 2035 from new fields yet to be found, is largely in deep water.



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16

Global Offshore Drilling Spending, \$ billion, 2000-2020



Source: Global Markets Direct (2009), The Future of the Offshore Oil and Gas Industry to 2010, Global Markets Direct.



17

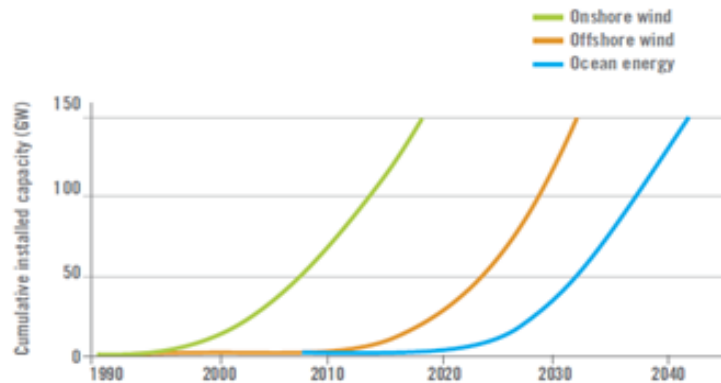
“NON-TRADITIONAL” SECTORS – OPPORTUNITIES AND CHALLENGES



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18

Onshore, Offshore and Ocean Energy Projected Growth



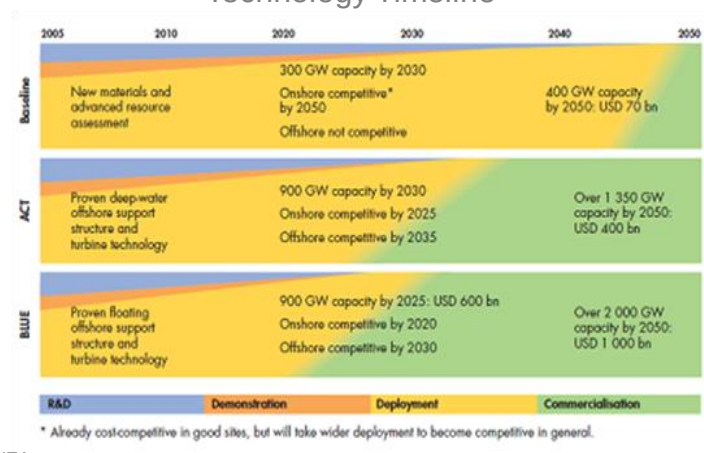
Source: European Ocean Energy Association (2010), *Oceans of energy - European Ocean Energy Roadmap 2010-2050*, European Wind Energy Association



19

Offshore Wind Energy

Technology Timeline



Source: IEA

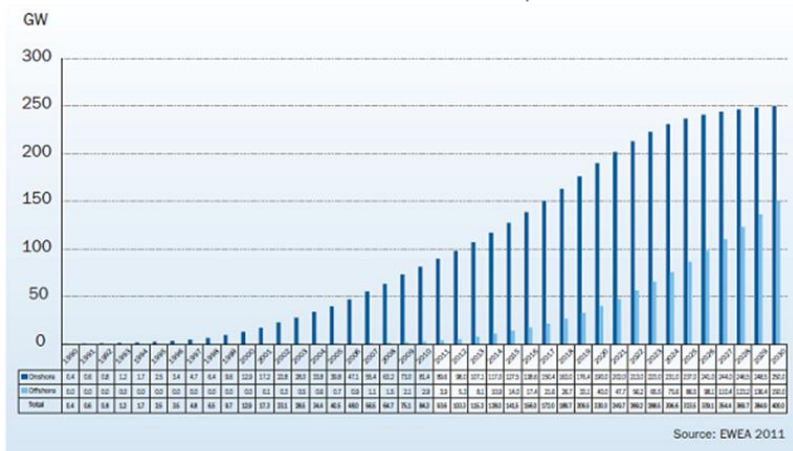
By 2050, 32% of the wind capacity located at sea, up from 19% in 2030.



20

Offshore Wind Energy

Cumulative Onshore and Offshore wind power in EU – 1990-2030

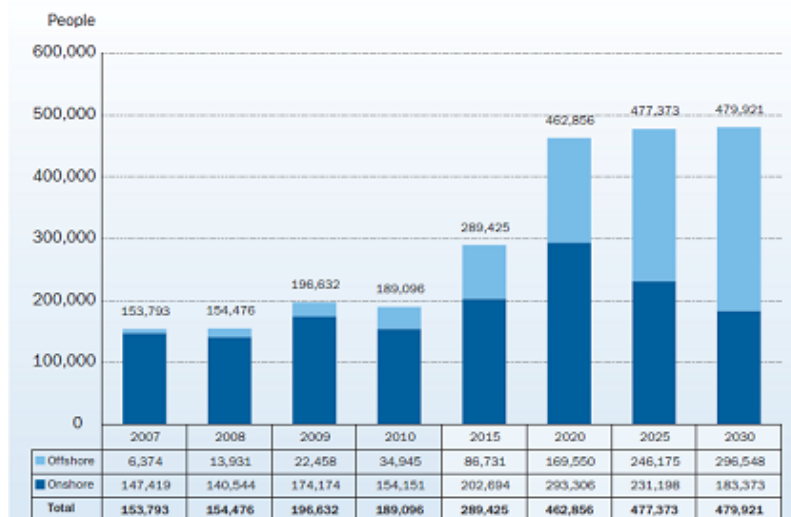


By 2030, out of 400 GW installed capacity in Europe, 250 GW will be onshore and 150 GW offshore, producing 1 154 TWh of electricity: 591 TWh onshore and 562 TWh offshore, which is equivalent to the consumption of 252 million average EU households.



21

Wind energy sector employment

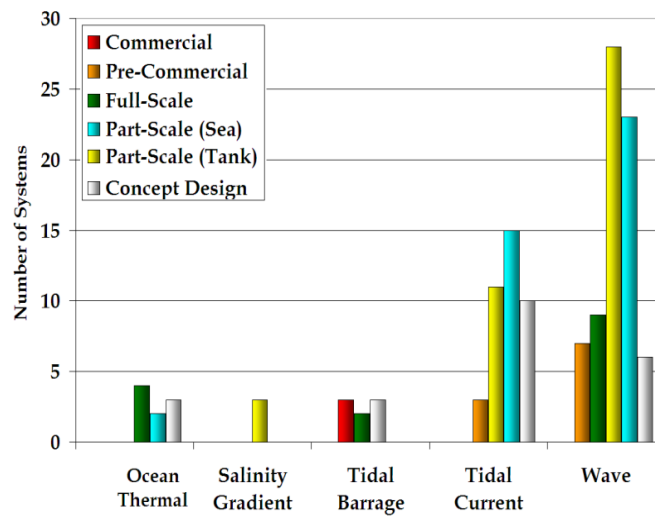


Source: European Wind Energy Association (2011), Pure Power Wind energy targets for 2020 and 2030 – A report by the European Wind Energy Association – 2011, European Wind Energy Association, http://www.ewea.org/fileadmin/ewea_documents/documents/publications/reports/Pure_Power_III.pdf.



22

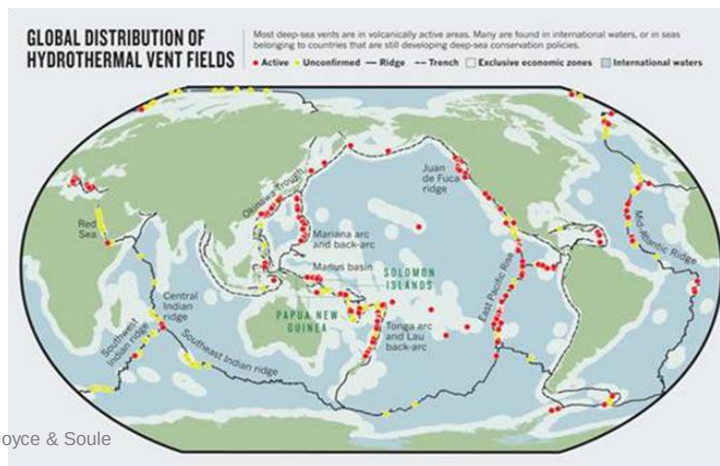
Technology maturity of various ocean energy conversion systems (IEA 2008)



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Deep-Sea Mining



Source: Joyce & Soule

Prices of metals such as copper, zinc, gold and silver have hit all time highs over the past few years.

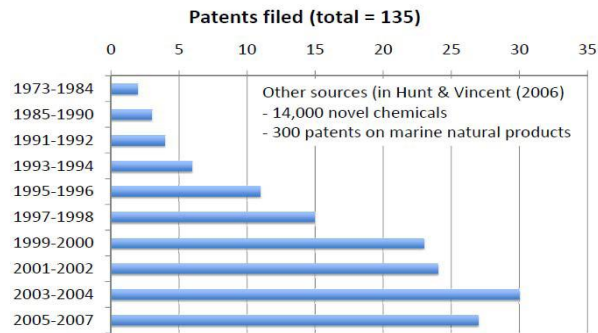
With the global demand for minerals rapidly increasing, mining of mineral deposits at deep-sea vents appears to be becoming a prime target of commercial marine mining interests with lucrative prospects for the future.

24



Marine Biotechnology

Marine Genetic Resource Patents



(adapted from Leary et al. (2009) Marine Policy 33, 183-194)

The global market for marine biotechnology products and processes is currently estimated at EUR 2.8 billion with a cumulative annual growth rate of 4-5% (or 10-12% under less conservative projections). Progress in marine biotechnology has facilitated "bioprospecting" with the number of patent claims associated with genes of marine organisms growing at 12% per year. Ten countries of the world own 90% of the patents deposited with marine genes, with 70% belonging to the top three. These 10 nations represent about 20% of the world's coastline.



25

THE WAY AHEAD



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26

The ocean economy in a green growth perspective: some next steps

- Assess the scope and value of ‘the ocean economy’ and quantify its potential.
- Value and properly price the ocean’s natural resources, biodiversity and the ecosystem service.
- Improve knowledge of the likely future development trajectory of ocean-based activities, their spread and rate of maturity, and potential to impact on and interact with other ocean activities.
- Identify and assess emerging opportunities (e.g. for science and technology, energy, minerals, local development, port city planning, etc.) as well as the requirements (investment, skills, etc.) to realise them.
- Identify and assess emerging risks, e.g. to biodiversity, fish stocks, maritime security (ocean debris, shipping lane congestion, etc.).
- Intensify efforts to improve data and indicators to measure and monitor ocean developments (biodiversity, health of fish stocks, water quality, ocean debris).
- Aim for sound regulatory and institutional frameworks and integrative approaches to ocean management with a view to resolving increasing competition for space and access, and overcoming the current fragmented state of ocean governance.



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Thank you.

Barrie Stevens

Barrie.Stevens@oecd.org

www.oecd.org/futures



28

The Future of Shipping Industries/Companies and Green Growth

해운산업 및 해운회사의 미래와 녹색 성장



Thomas Lindy Sorensen

President, Maersk Korea Limited

(머스크 코리아 사장)

Personal Information

Name	Thomas Lindy Sorensen
Company	Maersk Korea Limited
Position	President & Representative Director
Email	Thomas.Lindy.Sorensen@maersk.com
Tel	+82 2 2054 4100

Educational Background

Executive MBA in 2010 from University of Chicago

Career

Thomas Lindy Sorensen, born in 1972, joined the A.P. Moller – Maersk Group in 1991.

Thomas is currently the President & Representative Director of Maersk Korea Limited.

Thomas Lindy Sorensen started his career working at the Group headquarters in Denmark. In 1994, Thomas moved to Asia, taking up positions in Cost Management in Hongkong and later Beijing, China.

Thereafter, he went on to become Agency Manager for Maersk India in 2004. Thomas was also part of the commercial management team in Denmark for almost two years as the overall in-charge for the Transpacific service network in 2006.

Later Thomas was the Area line and Operations manager of Maersk Line in South East Asia in 2007, where he was responsible for expanding business opportunities and improving the overall business performance of Maersk Line in SEA.

Thomas Lindy Sorensen was appointed Country Manager for Thailand in February 2008. He was responsible for the development and execution of country strategy through Maersk Line Thailand.

He took up position of President & Representative Director in Maersk Korea from Jan 2012.

Thomas holds an Executive MBA from the University of Chicago. He is married to Duangdao Sorensen and they have one child.

Abstract

Title: A New Roadmap for More Sustainable World

Name: Sorensen, Thomas Lindy

Position: President

Name of Company: Maersk Korea Limited

Maersk Line is one of the world's leading container shipping companies serving customers all around the globe and operating 500 container vessels. We play a key role in facilitating trade that connects the world population and economies. We believe in the growth of international trade and the growth of our company, but we must grow responsibly allowing trade to develop, economies to grow and social wealth to spread.

As the world is in transition to develop new models for sustainable development, the role of business in society is changing. The shipping industry is also entering new waters which require hyper-transparency and regulated carbon emission. These changes will fundamentally alter the way we think about the industry in the coming years – such as an increasing focus on the green growth agenda.

A first step to changing the way we think about shipping is becoming transparent about the impacts we have and set up strategic sustainability journey to lower down CO2 emission. Our customers are beginning to demand greater transparency and better CO2 performance. To meet such needs, Maersk Line is providing customers with scorecard where customers can track their CO2 footprint with Maersk Line and compare CO2 efficiency with other shipping lines.

Triple-E class vessels are good example of Maersk Line's innovative efforts for sustainable shipping. The Triple-E class vessels, signifying Economies of scale, Energy efficiency and Environmental performance, will open a new standard of environmental efficiency in container shipping. It will reduce CO2-emissions per container moved by an astonishing 50 % compared to the industry average on the Asia-Europe trade. This reduction will be achieved through several improvements among which are new hull, engine and propeller designs – all optimised for slow-steaming. At 18,000 TEU (twenty foot equivalent unit) they will be the world's largest container vessels, capable of carrying up to 20% more containers than the previous record holding vessels. These improved vessels mean that Maersk Line's customers will continue to have access to the most sustainable mode of transportation in the world, by far. Total 20 of the Triple-E vessels are scheduled for delivery between 2013 and 2015 by Korea's Daewoo Shipbuilding & Marine Engineering Co., Ltd.

Maersk Line is a member of 'Green Ship of the Future' to develop further on environmentally improved technology. It is a private-public partnership in which the Danish maritime community joins forces in order to explore, develop and demonstrate ambitious technical solutions for cleaner, more energy-efficient and sustainable ships and maritime operations.

The future will bring further significant developments in shipping towards environmental performance and energy efficiency. This is driven by customers, regulations, technological opportunities, energy cost etc. The Maersk Group and Business Units have implemented Sustainability Strategies with ambitious targets for reducing climate, environmental impact and we are ready to discuss ideas for next generation technology.

A NEW ROADMAP FOR A MORE SUSTAINABLE WORLD

2012



**Maersk Line is an enabler of global trade,
a purveyor of the products and services
that connect the world's populations and
economies.**

**Shipping affects the lives of billions of people, with 90%
of the world's international trade travelling by sea.**



Our history is closely linked to the development of world trade

"The company's history is closely linked to the development and spread of world trade in the last century. Our anticipation of market opportunities and our determined engagement has generated prosperity for people and communities around the globe."

- Nils S Andersen,
Group CEO, A.P. Moller
Maersk



Managing Sustainability Issues - Managing Performance



"We recognize that carrying out our business in a safe and environmentally sound manner is a prerequisite to our success and our future."

• Nils S. Andersen, Group CEO

Environmental performance

Energy consumption		2007	2008	2009	2010
Fuel oil	1,000 tonnes	13,848	13,017	11,390	10,724
Diesel	1,000 tonnes	577	422	383	296
Natural gas	1,000 tonnes	908	886	767	861
Electricity	1,000 MWh	737	1,581	1,207	1,159
Energy consumption	GJ	—	—	507,801,426	479,068,238
Greenhouse gas (GHG) emissions					
GHG emissions	1,000 tonnes CO ₂ eq	53,352	47,612	42,194	39,076

Slide no. 4



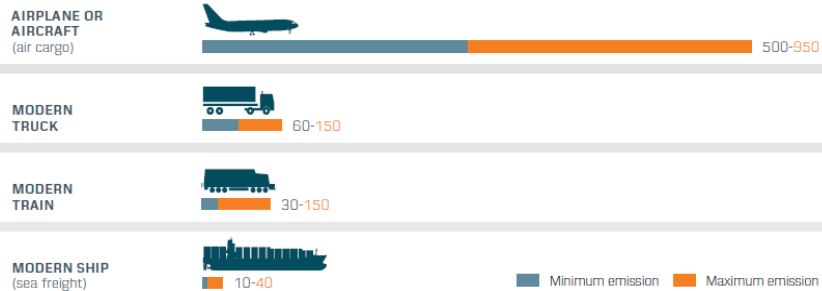
Current Market Situation – An Industry in Transition?

- Fuel costs used to be low and predictable
- Supply chain risks and impacts used to be limited to securing supply at the right price
- CO2 and climate change used to be a non-issue for shipping
- We used to think A to B – rather than think entire customer value chains
- Industry Transparency was non-existent



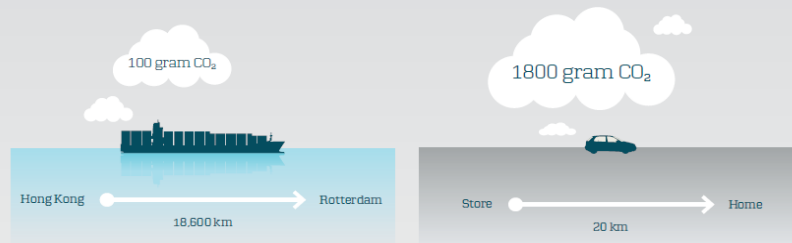
As a starting point, container shipping is already quite energy efficient...

Carbon impact from transport (range) CO₂ (in grams) emitted per metric tonne of freight per km of transportation



The energy efficiency lies in the size and scale of operation: tons of goods per km

Example: One pair of shoes

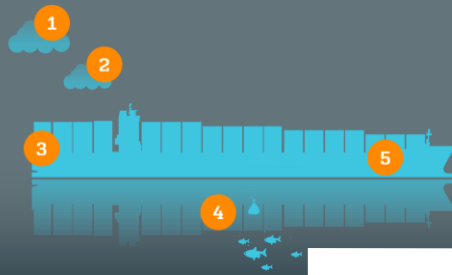


18 times the emissions for 0.1% of the distance made by a small and efficient car



Maersk Line does have Environmental Impacts

- CO₂ emissions:
33,8 million tonnes in 2011
- SO_x and NO_x emissions :
597,000 tonnes SO_x and 854,000 NO_x
in 2011
- Finite resources: **400,000 metric tonnes of steel** for 18 ships
- Ballast water, risk of discharges and spills to water and waste
- Use of paint and chemicals

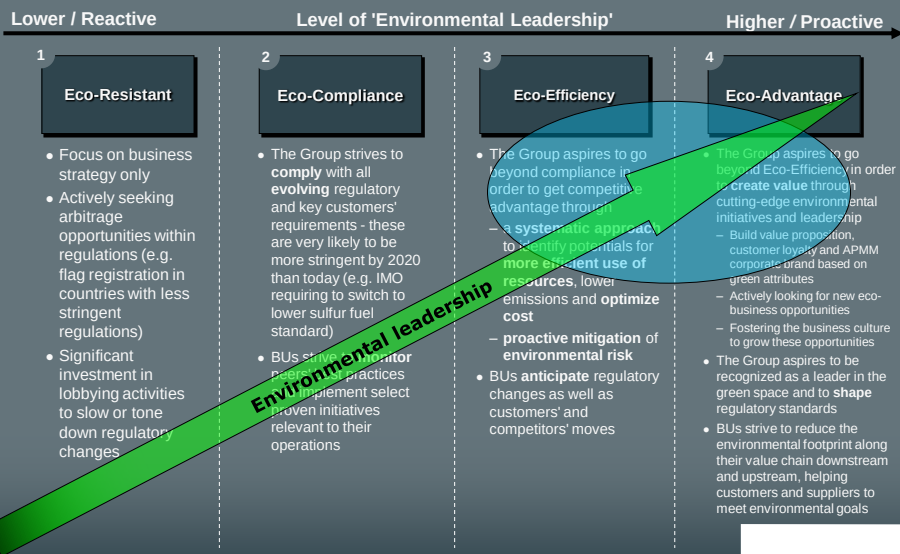


We're rising to the challenge:

- 10%** Lower on CO₂ than industry average
- 15%** CO₂ per TEU reduced since 2007
- 25%** CO₂ per TEU will be reduced before 2020 – if not more!
- 50%** 20 Triple-E vessels will produce 50% less CO₂ than the industry average on the Asia-Europe trade lane



Strategic level of environmental performance



PAGE 10

Engineering and
Projects

27 June 2012



Our customers are beginning to demand greater transparency and better CO2 performance...

“Our expectation is that our providers are permanently looking into improved ways of shipping our goods with less carbon emission but by maintaining or improving the service levels. It's not about meeting, but exceeding and setting new industry standards.”

- Volker Daut
Head of Dest. Transport & Logistics,
Adidas Group

Air freight:
5.4 kg CO₂

Ocean freight:
0.36 kg CO₂



New Order: TripleE Class Delivery from 2013



Economy of scale
Energy efficient and
Environmentally improved

Length 400 m
Beam 59 m
Height 73 m
Capacity 18,000 TEU

Maersk Maritime Technology Slide 12



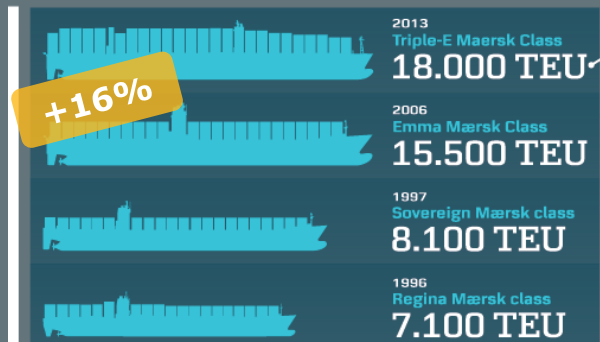
Innovating for the future: New Groundbreaking Product: Triple-E

- Economy of scale
- Energy efficiency
- Environmentally improved



Economy of Scale

... The Triple-E vessels have a 26 percent slot cost advantage compared to the 13,100 TEU vessels sailing on today's oceans considering a full roundtrip from Asia to Europe (based on a bunker price of USD 600 per metric tonnes)



Energy Efficient and Environmentally Improved

... The Triple-E will produce 20 percent less CO₂ per container moved compared to Emma Mærsk and 50 percent less than the industry average on the Asia-Europe trade lane. In addition, it will consume approximately 35 percent less fuel per container than the 13,100 TEU vessels being delivered to other container shipping lines in the next few years, also for Asia-Europe service.



Maersk Maritime Technology Slide 15



The Right Mix for Energy Efficiency ...

- Larger block coefficient
- Hull lines optimized for operational profile
- Split machinery and accommodation
- Twin skeg design
- Super-long-stroke engines
- Waste Heat recovery
- High efficiency pumps, ventilation, etc.

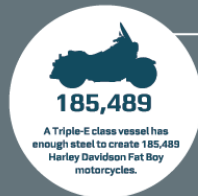


Maersk Maritime Technology Slide 16



A recyclable ship

The Triple-E class will be designed for future safe and sound recycling. We will develop a new 'Cradle-to-Cradle Passport', which will list and describe the materials used to build the vessel, where they are located, and how they can be correctly disassembled and recycled.



98%
of the Triple-E class vessel is steel

total weight
60,000 ton

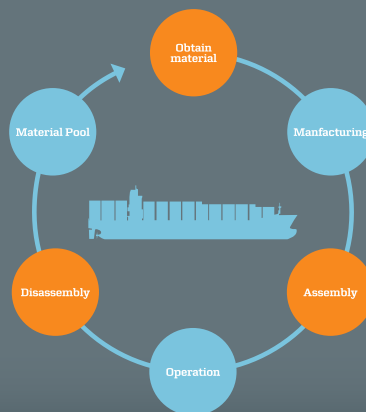


Maersk Maritime Technology Slide 17



The world's largest ship will fit into a cradle

- All new Triple-E vessels will come with a Cradle to Cradle passport
- The most comprehensive material documentation system in shipping
- This will help us cut down on resource use, pollution and waste



MMT Aspiration for Innovation



Strategic R&D must play a strong role in three different areas:

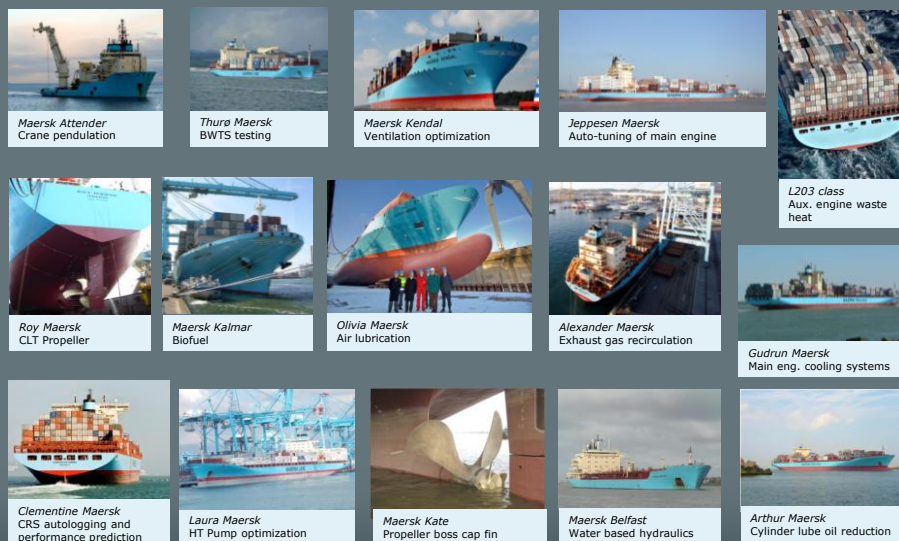
I
APMMS R&D CONTACT CENTER
TO KEY SUPPLIERS, KEY CLIENTS, KNOWLEDGE INSTITUTIONS AND R&D ENVIRONMENTS SUPPORTING INNOVATION AVENUES

II
APMMS IDEA DEVELOPMENT CENTER
OF FUTURE TECHNICAL SOLUTIONS IN COLLABORATION WITH KEY SUPPLIERS AND KEY CLIENTS

III
APMMS EMERGING TECHNOLOGY KNOWLEDGE CENTER
ON FUTURE TECHNICAL OPPORTUNITIES, CHALLENGES AND SOLUTIONS IN THE MARITIME BUSINESS



Constant Care: Innovating with Suppliers



Slide no. 20



A coming decade of dilemmas and uncertainties from regulations, customers, technologies.

Decide: What – when – where – with whom?

- **Energy Efficiency. Fuel(s) cost and CO2 regulation.** How energy efficient to build/upgrade the ship? Regulation? Energy source?
- **The sulphur challenge.** Technical/operational uncertainties. Development of price spreads HFO-MGO-LNG?
- **The NOx and PM Challenges.**
- **The Ballast Water Cleaning Challenge.** When will regulations enter into force, at what level? Availability, reliability, cost, operability of cleaning systems.
- **The Recycling Challenge.**
- **Others ?**

Slide no. 21



Alternative Energy Mix: Our policy on biofuels

Sustainable **biofuels** have the **potential** to become an important **future fuel** for Maersk Line and the shipping industry that can:

- **Reduce emissions** of CO2 and SOx
- **Diversify** the fuel supply



Green Ship of the Future

Green Ship of the Future is a private-public partnership in which the Danish maritime community joins forces in order to explore, develop and demonstrate ambitious technical solutions for cleaner, more energy-efficient and sustainable ships and maritime operations.

Approximately 30 project partners are working together in various projects focussed at improving energy efficiency and reducing emissions

- **Focus areas**

- Machinery
- Propulsion
- Operation

- **ECA Retrofit Study**

The objective of the project was to set up practical solutions as well as uncovering the financial aspects regarding installation, operation and maintenance of the three most realistic alternatives, ie. low-sulphur fuel/distillate, LNG as fuel and scrubber technology
The basis for the project was a newly built 38,500 DWT tanker from D/S NORDEN A/S.

- **Low Emission Ro/Pax Study**

The study will investigate the possibilities of reducing emissions from a Ro-Pax ferry



Maersk Maritime Technology Slide no. 23



2040 vision for the shipping industry

- Resources used efficiently and responsibly
- Dramatic reduction in greenhouse gas intensity
- Trusted and responsible partner to communities
- Financial solutions that reward sustainable performance and enable innovation and operational efficiencies.
- Transparency and accountability
- Responsible governance of the oceans



Invited to join a
group of the 50
highest companies
performing on
sustainability



Summary and Conclusion:

- Coming decade will include a series of **challenging decisions** regarding environmental technologies and a related series of **opportunities**.
- **Energy Efficiency** is good business
- The Maersk Group and Business Units have implemented **Sustainability Strategies** with ambitious targets for reducing climate/environmental impact
- **Sustainability Management** is implemented including short, medium, long-term action plans and public reporting.
- **Innovative technology solutions** are an important part of developing sustainable and competitive business.
- Ambitious, predictable, effectively enforced **regulations** are

Slide no. 26



Summary and Conclusion:

- The future will bring further significant developments in shipping towards environmental performance and energy efficiency. This is driven by customers, regulations, technological opportunities, energy cost etc.
- Competitiveness will be closely linked to making use of technological opportunities. Room for plenty of improvement (performance, safety, reliability, cost, business models).
- Globalization is here to stay; partnerships will increasingly prove its worth in technology innovation. Global markets and competition will give new opportunities and challenges to technology suppliers.
- APMM is ready to discuss ideas for next generation technology.
- It is not a matter of *WHETHER* there will be a next generation solution: it is a matter of *WHEN* - how to spot it and prepare appropriately.

Slide no. 27



Join us on Route 2

At Maersk Line we are continuously looking at ways to improve supply chain efficiency. We do so best by looking into better ways of shipping goods with less carbon emissions while continually improving our service levels. It's not about meeting, but exceeding industry standards.

Thanks for joining us on our route 2 sustainability.

www.maersklineroute2.com



The Future of Global Port Industries and Green Growth

글로벌 항만 운영회사의 미래와 녹색 성장



Choon-sun Kim

CEO, Incheon Port Authority, Republic of Korea

(김춘선, 인천 항만 공사 사장)

- Date of Birth : March 15th, 1955
- E-mail : k2232@icpa.co.kr k2232@yahoo.co.kr

- Education

1995 M.A. University of Manchester(Economics), United Kingdom

1977 B.A. Seoul National University, Seoul, Korea(Geography)

1973 Kyunggi High School

- Career

'11. 8~ Now CEO, Incheon Port Authority

'09. 5~ Senior Executive Director, Korea Student Aid Foundation.

'08. 3~ Administrative Minister, Ministry of Land, Transportation and Maritime Affairs

'03. 4~ Director General, Ministry of Maritime Affairs and Fisheries

'02. 10~ Director General, Ministry of Planning and Budget

'01. 4~ Director General, Office of Prime Minister

'91. 9~Director, Fair Trade Commission, President SecretariatMinistry of Finance & Economy etc

'82. 7~ Deputy Director, Ministry of Energy and Resources, Overseas Cooperation Committee, Budgeting Office,Economic Planning Board

'79. 3~'82. 6 Navy Officer

'77. 12 Passing of 21st Administrative Higher Civil Service Examination.

The Future of Fisheries and Aquaculture Industries: A Green Growth Perspective

수산 및 양식 산업의 미래와 녹색 성장



Carl-Christian Schmidt

Head of Fisheries Policies Division, OECD
(OECD 수산국장)

Since August 2001, Mr. Carl-Christian SCHMIDT is the Head of the Fisheries Policies Division in the Directorate for Trade and Agriculture of the OECD.

Mr. Schmidt is in charge of the OECD's programme of work related to fisheries and in this respect oversees the operations of the OECD's Committee for Fisheries. He is a member of the management team of the Directorate for Trade and Agriculture. He participates in a number of international fora representing the OECD and its work on fisheries policies, natural resource management and ocean issues. Mr. Schmidt also manages the OECD Co-operative Research Programme on Biological Resources Management for Sustainable Agriculture Systems.

During his tenure with the OECD, Mr. Schmidt has contributed to advancing the understanding of sustainable and responsible fisheries, covering a wide range of issues related to fisheries management, trade, food security and regional economic development. He has wide international exposure to fisheries and aquaculture, natural resource management and ocean policy issues through collaboration with a number of international organisations, in particular the FAO, WTO, ICES, UNEP as well as regional fisheries management bodies and research institutions. Following the years 1979-1982 when he worked for the Danish Ministry of Fisheries, Mr. Schmidt was appointed Administrator at the OECD in 1982. He was promoted to the post of Principal Administrator in 1988. In 1997 and 1998, Mr. Schmidt was on leave of absence while setting up the Marine Stewardship Council (MSC). Based in London the MSC is a non-governmental accreditation organisation devoted to promote sustainable fisheries through certification. Mr. Schmidt holds a Masters degree in Economics and Political Science from Copenhagen School of Economics and Business Administration and a postgraduate Certificate of Advanced European Studies from the College of Europe, Bruges, Belgium.

Of Danish nationality, Mr. Schmidt is married and has one daughter.

Abstract

THE FUTURE OF FISHERIES AND AQUACULTURE INDUSTRIES:

A GREEN GROWTH PERSPECTIVE³

Carl-Christian Schmidt, Head of the Fisheries Policies Division, OECD, Paris, France⁴

Introduction

Green Growth means fostering economic growth and development while ensuring that natural assets continue to provide the resources and environmental services on which our well-being relies⁵. While recognising that growth is key to achieving many policy goals, the GG concept broadens the scope of policy thinking regarding growth by:

- paying attention to all types of capital i.e. natural, human, physical and intangibles;
- incorporating the dual role of natural capital (providing capital but also impacts on the natural capital);
- recognising that public policy intervention is fundamental to managing natural capital; and
- innovation is needed to attenuate tradeoffs that arise between investing in (depleting) natural capital and raising consumption or investing in other forms of capital.⁶

In the fisheries and aquaculture sectors it is important to make a distinction between the two modes of production. Capture fisheries uses the wild natural resource (fish) and is the last modern hunter/gather activity. Capture fishing has broader eco-system impacts on both living and non-living resources. Aquaculture, on the contrary, is a man-made production system entirely under the control of the fish farmer. It is useful to think of fish farming as a continuum of human involvement in the process from extensive farming (e.g. collection of mussel spat for on-growing) to complete control of the reproduction cycle, on-growing and harvesting (e.g. salmon). In such a context fish farming can also have a range of impacts on the natural environment. While aquaculture uses natural resources (e.g. water, space and feed from marine or land-based origins) and pollutes (principally effluents from farming, medicine use and escapees) the production process remains controlled.

³ EXPO 2012 Yeosu Korea-OECD International Symposium, Yeosu, Korea July 9~11, 2012

⁴ Opinions expressed are those of the author and do not necessarily represent those of the OECD or its Member countries.

⁵ See Towards Green Growth – OECD 2011

⁶ See Box 1.1. Towards Green Growth – OECD 2011

Green Growth and Capture Fisheries

Capture fisheries can do better at delivering green growth. The FAO and the World Bank have estimated that 50 billion USD⁷ is forgone annually through poor economic management of fisheries resources around the world. At the OECD, a major undertaking is to better gauge the value of our natural capital including the value of fish stocks, in order to better manage fisheries.

Recall that the economically optimal fisheries goal in a single species fishery is determined by the Maximum Economic Yield (MEY), which encompasses both the biological and economic factors of the fishery. The OECD Fisheries Committee's earlier work on the use of economic instruments has shown that to achieve MEY the fishery needs to be managed in an economically optimal way. One such way forward is to introduce market-based fisheries management instruments. Possibly the best such instrument to achieve MEY is individual transferable quotas with few restrictions. This approach ensures efficient resource use and can promote a more positive relationship between fishers and fisheries managers. Maximising the Green Growth contribution of fisheries is a challenging exercise. However, the single biggest contributor to GG in fisheries will be a management shift towards the use of market based economic instruments.

The principal externalities of capture fishing include impacts on biodiversity, the marine food web, sea floor integrity, use of fossil fuels producing greenhouse gas emissions and space in competition with other user groups. These externalities need to be addressed by the management authority with a view to optimise the overall use of space, the acceptable level of pollution and impacts on/from other sectors.

Green Growth and Aquaculture

In aquaculture production externalities are principally nutrient discharges caused by excess feed and faeces, disease outbreaks and their possible impacts on wild fish and on other fish farms, and escapees. Good regulation of aquaculture takes into account the private benefits and private and public costs of production and thus "internalises" these externalities into the cost of aquaculture production.

Lack of complete information makes finding the optimal regulation level unlikely. In this regard, doing a good job managing aquaculture requires that sufficient funds are invested into assessing the impacts of the aquaculture activities (e.g. on the environment, economic, social) to help ensure understanding among the authorities, the industry and consumers. In most OECD countries it is likely that aquaculture is overregulated due to lack of sufficient information leading to the application of a precautionary approach.

Growth can be spurred in two ways: through an increase in aquaculture production and through a better regulatory environment i.e. better coordination, more efficient governance and less "red tape". Economic instruments for the management of externalities can be useful in this regard. For example, managing effluent through the use of transferable quotas for feed or nutrient discharges among all users of the marine environment (including but not limited to fish farmers).

Green growth: a Challenging Future

Implementing a green growth strategy in fisheries and aquaculture can bring significant benefits. For fisheries alone the lost potential profits is considerable and fisheries management reform can unleash the potential of the resource, making the fisheries sector more competitive and deliver more and better quality seafood to the market. Several countries have undertaken successful reform over the past years. They demonstrate that reform is possible and that the sector can become profitable and contribute to overall economic welfare.

⁷ The Sunken Billions: The Economic Justification for Fisheries Reform (WB and FAO 2009)

Central for the fisheries and aquaculture sectors is a governance structure that can produce economic growth while taking full account of the potential ecosystem services of the environment. This is against a background that the current “brown” growth is likely to produce unsustainable outcomes for the fisheries sector. Different governance structures and fisheries management policies lead to different socio-economic and environmental outcomes. Finding the right path requires studying the interplay between fisheries and aquaculture governance and green growth.

For the aquaculture sector a central need is to review the regulatory environment in which fish farming takes place. As noted at the COFI’s Aquaculture Workshop (2010) the sector is an important contributor to the green growth agenda but in many cases some political courage is required for this sector to reach its full potential.

The Future of Fisheries and Aquaculture Industries: A Green Growth Perspective

Carl-Christian Schmidt*

Head of Fisheries Policies,
OECD Trade and Agriculture

Yeosu, July 2012

* Views expressed are those of the author and do not necessarily correspond to those of the OECD or its Member countries.

What is Green Growth?

- Paying attention to all types of capital (natural, human, physical and intangibles)
- Dual role of natural “capital” (take but preserve – the fish stocks)
- Public policy interventions is fundamental for natural capital
- Innovation

GG important for fisheries and aquaculture?

Green Growth will help:

- Reduce impacts on the environment (green)
- Increase overall profitability of the sector (growth)
- May produce additional fish for a growing population (green and growth)
- Make the capture fisheries sector more competitive (growth)



3

The dual case in fisheries and aquaculture

Fisheries:

- Natural renewable resource
- But with potential broader eco-system impacts

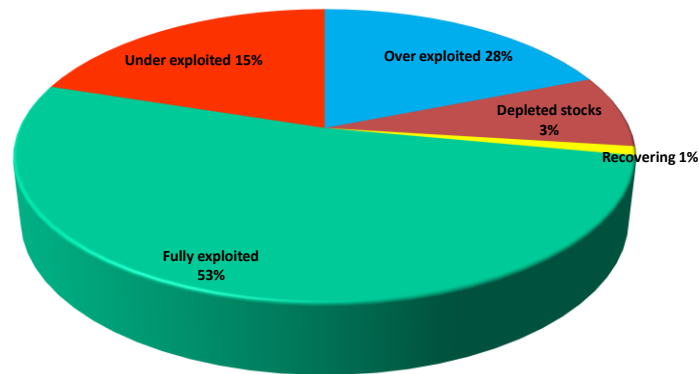
Aquaculture:

- Controlled production system
- Excess feed, medicine, escapees, space in competition with other users



4

FAO 2008 Stock Situation – the biological case



Source: Based on OECD/FAO (2007)

5

Capture fisheries – the economic case

- World Bank estimates that 50 billion USD lost annually -- “The Sunken Billions” (2008). UBC (2010) estimates world fisheries to contribute 225-240 billion USD/year
- Many fisheries are characterised by excess fishing capacity (human and ships) compared to available resources, leading to:
 - Low incomes
 - IUU fishing activities
 - Increased surveillance and enforcement costs



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How to optimise production and minimise externalities

Capture fisheries:

- Managing for maximum economic rent generation
- Incorporating broad eco-system management considerations (birds, non-targeted species, mammals, sea floor impacts etc.)
- Reduce energy use in fisheries



7

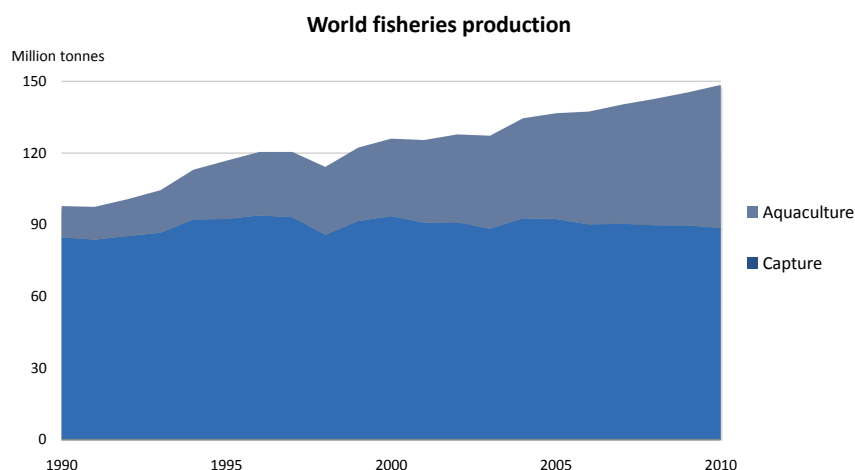
Denmark: An Example

	2005	2006	2007	2008	2009
No. of registered vessels ¹	3 265	3 134	2 957	2 890	2 834
No. of commercially active vessels ¹	1 179	1 093	846	777	703
No. of employed	2 667	2 341	1 751	1 577	1 446
Total landing value (DKK Million)	2 902	3 183	2 719	2 560	2 218
<u>Average per commercially active vessel</u>					²
Landing value (DKK 1,000)	2 395	2 785	3 053	3 076	2 955
Earning (DKK 1,000)	1 399	1 726	1 857	1 691	1 696
Operating profit (DKK 1,000)	384	620	829	609	695
Net profit (% of insurance value)	9%	15%	20%	20%	14%



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The increasing importance of aquaculture



Source: FAO

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Examples of green growth issues in aquaculture

Green Growth Challenges	Variables to control	Policy framework	Measures(examples)
Discharges	Feed, Feed conversion, Feed Components	Regulations, Innovations, Good management practices	Feed quotas, Fallowing, Cleaning
Diseases	Density	Regulations, Good management practices	Distance, Vaccine Fallowing
Escapees	Storms, Accidents	Regulations, Good management practices	Stronger cages, Sterilization, Paying local fishermen to catch the escapees
Space	User conflicts/conflicting uses	Coastal zone/ocean management	Reserved areas
Regional development	Development Planning	Permits and zoning, Environmental approvals, Investment aids, Coastal zone/ ocean management	Establishment of pre-approved zones for aquaculture development
GDP contribution	Growth of sector, marketing of product	Marketing and promotion, research and development, infrastructure investments	Support private certification schemes
Development	Capital, Skills	Education and training, labour standards	Continuing education for local populations



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How to optimise production and minimise externalities

Aquaculture:

- Ensure that the regulatory system incorporates private benefits and private and public costs of production (thus externalities are accounted for, discharges and escapees etc.)
- Over regulation vs. under regulation



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An aquaculture example

- *Strategy (2009) for an Environmentally Sustainable Norwegian Aquaculture Industry:*
 - Licensing of farms (transferable and bankable and limited entry for some species)
 - Regulates operation and installation of aquaculture facilities
 - restricts the use of antibiotics
 - addresses the disposal of dead fish
 - keep logbooks (escapees, ,medicines, feed etc.)
 - technical standard for the aquaculture installations



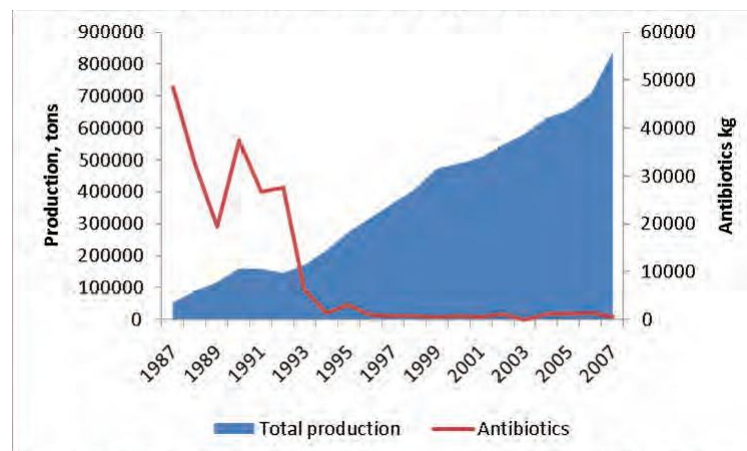
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Example: Norway 2009 Aquaculture Strategy

- Antibiotics-use was reduced from approx 50 tons in 1990 to approx 1 ton in 2009.
- Within the same time span the salmon and trout production increased from less than 150 000 tons to approx 900 000 tons.



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Green Growth: A Challenging Agenda

Fisheries

- Involve and make all stakeholders comfortable
- Not necessarily adopting a “one-size-fits-all” strategy
- Carefully designing the change process
- Pragmatically using market forces
- Overcoming the “excessive consolidation” question
- Using the “demonstration effect” (drawing on experience)
- Dealing pragmatically with trade-offs



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Green Growth: A Challenging Agenda

Aquaculture

- Risk reduction to encourage sustainable long-term investment in the capital intensive aquaculture sector in OECD countries
- Ensure acceptance of sustainable aquaculture by limiting negative externalities on the (marine) environment
- Improve the image of the industry
- Timely and effective dialogue between all stakeholders
- Translating lessons learned from best practices into specific policy action



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Fisheries is just one of many activities

- Total use of ocean and oceanic activities have increased considerably over the past decades, and will continue to do so as an important source of economic growth.
- To achieve comprehensive Green Growth we need a new way of thinking regarding ocean governance within which we can better gauge and make necessary trade-offs.



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Externalities from other sectors

Ocean and Coasts are:

- Source of food
- Source of medicine
- Major transport activities which is particularly important for economic growth
- Mineral and oil/gas extraction
- Tourism
- Dumping – agricultural and industrial run-off
- Habitat – coastal development
- Cultural importance



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Integrated Ocean Management Model

Use economics to better:

- Value activities
- Assess impacts
- Get incentives right among users
- Shape institutions and governance
- Monitor progress – the need for appropriate GG indicators for fisheries and aquaculture

For more information



Trade and Agriculture Directorate

- Visit our website: [**www.oecd.org/fisheries**](http://www.oecd.org/fisheries)
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The Future of Coastal Tourism Focused on Cruise Industries

크루즈 산업의 미래와 녹색 성장



Richard Allan Jenkins-Jones

CEO, Seadream Yacht Club in Asia
(Seadream Yacht Club 아시아 담당 CEO)

6/47 Moo 6
Kamala
Kathu, Phuket
83150, Thailand
Mobile: +66819708487

RAJJ65@gmail.com

A Senior Cruise/ Hotel Executive & Business & Development Director with extensive knowledge and ability within the International Hospitality Industry. Highly developed strategic Management & Leadership Skills including strong marketing & financial management background.

Key to my success has been Customer Service, Effective Communication, Developing Cohesive Teams, Marketing & Financial Results.

Key Attributes

- Introduced, Successfully Marketed & brought added Sales revenue for SeaDream Yacht Club to the new & developing cruise market of Asia.
- Ability to develop, implement, cost effective and highly satisfying Hotel / Cruise Activities at the Top end of the market.
- Instrumental in helping SeaDream Yacht Club achieve the Top Awards of Standards and Customer service in the Cruise Industry.
- Highly successful Business Manager having developed many interesting and highly successful Travel concepts for the Boutique Cruise Industry.

Recent Career Summary

2010 – 2012 Business & Development Director SeaDream Yacht Club Asia.

2001 - 2010 Cruise Director SeaDream Yacht Club.

1994 - 2001 Cruise Director Sea Goddess 1 and 2. (Cunard)

Business & Development Director, SeaDream Yacht Club, Asia.

Head of Marketing & Business Development for SeaDream Yacht Club in the Asia Region.

Developed new markets in China, Taiwan, Hong Kong, Japan, S.Korea, Philippines, Singapore, Malaysia, Indonesia, Thailand, India & Sri Lanka. Introducing SeaDream Yacht Club to a new region & increasing overall Worldwide Sales & Revenue.

Abstract

Managing Cruise Ship Impacts for Coastal Communities

The cruise ship industry is one of the largest components of tourism and is experiencing rapid growth. Cruise lines are seeking new routes and ports. Each year, the average size of ships is larger, with many carrying more than 2000 passengers and 1000 crew.

At the same time, smaller ships (and some larger ones) are able to bring tourists to new ports which were previously inaccessible or off the beaten path. While there are clearly benefits to be gained from cruise ship visits, there are also issues which destinations must consider, to optimize benefits and reduce negative impacts of cruise ship visits.

Destinations are not equal. The unique situation of each destination dictates how attractive it is likely to be to a cruise line. This also relates directly to the leverage that a destination may have in dealings with potential and current cruise operators.

Key issues for destinations:

1. Deciding to Seek Cruise Tourism

Cruise visits seem to have considerable potential as a source of economic development for coastal communities. The initial reaction is therefore likely to be positive – as with other tourism proposals, when cruise visits are proposed. But, as with all development initiatives, cruise tourism brings both potentially positive and negative impacts. Communities seeking new or enlarged cruise visits should carefully consider a number of factors. Because of the nature of the cruise sector, particularly for smaller communities arrival of cruise ships and their passengers may stimulate or require considerable change, and this change may involve the entire destination and its communities.

2. Assets Assessment

Potential cruise destinations need to be objective regarding the assets which they may have. Why would cruise lines and their visitors wish to visit: what is there which would keep them interested and cause return ship visits? When cruise ship firms choose destinations many factors come into play. These include:

- Key natural and cultural assets of the port and of sites which can be visited while the ship is in port. Because most port visits tend to permit from ten to twelve hours on land, sites may be considered as assets for the destination only if they are accessible on tours of eight hours or less. Variety of experiences is important – as tourists seek a range of different activities and tend to have different activity levels and capabilities. Note that in some destinations the location of port facilities is important, and may be an issue between destination values and those of the cruise line. The fact that it is possible to take small ships directly to Yacht Harbors, Private Islands, Beaches, reefs & rivers may be seen as very positive by visitors and tour managers. Docking in town may help town merchants but reduce the ability to sell tours – as visitors walk from the ship.

- Port facilities – accessibility and convenience for those embarking and disembarking. Because many cruise passengers may be older or disabled, ease of access is important. While small ships may use tendering to ports where there are suitable facilities.
- Location relative to other destinations and departure ports. Most small ships favour ports where the entire day and if possible evening can be spent in port – and passage to the next port occurs overnight. This means that ports which are less than twelve hours sailing (at about 20 Knots) from other ports or from home ports will be sought actively.
- Security is an important consideration – particularly near the docking facility and in areas where tours or pedestrians may go. Cruise and tour operators may have their own requirements for safety, insurance, site certification, tour and guide certification etc.
- Infrastructure – suitable numbers of buses, guides, police, toilets, parking to handle the tourist numbers (some Caribbean destinations like Cozumel and St.Thomas can have as many as a dozen ships in port at one time.
- Provisioning - for some lines local provisioning of food, drink, clean water is done in tour ports, particularly for longer tours. A growing trend is to carry nearly all goods from the home port.
- Port costs – in a competitive environment, cruise lines have sometimes played ports against each other – if you have high dockage fees, they shift to another port or even another country.
- Marketing – note that most cruises are marketed as a package of several destinations and experiences. Specific Small Ship cruises may alter the general formula to sell to a niche market (birdwatchers, scuba divers, Golfers) and modify the itinerary accordingly. This is less true of large lines who offer similar year-round or half-year itineraries

3. Key Success Factors for Cruise Destinations (from Cruise line perspective)

Cruise ship visitors tend to arrive in large numbers, all at once. In some ports, several ships may arrive almost simultaneously. Typically, cruise ships try to arrive early in the morning in a port, and leave late afternoon. While small ships arrive early morning & remain until midnight or overnight. This is designed to give passengers time to undertake recreational activities, take shore tours, shop, and explore the port community and to maximize their daylight & evening time for shore activities.

Tourist management is also a key factor in the reputation of a port. Where it is done well, passengers are provided with hassle free experiences, a variety of opportunities, and this enhances the reputation of a destination. The cruise lines monitor passenger reactions carefully and are very sensitive to the complaints they receive.

Recommendation: Do a reality check regarding what visitors are likely to do, how many, where? Is the community ready? What do they have to do to be prepared? Which tours can be offered? Who will guide them? Is there sufficient infrastructure? Communities and destination authorities need to be aware of what the cruise lines seek, and which factors are critical for the cruise lines e.g.

- Environmental: Economic & Managing cruise visitors.**



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Overnight Ports

Fast & Hectic

For The Masses

Jam Packed

Programmed Events

Large Crowded Ports

Departs at 6:30PM

Profile of the SeaDream Guest

- Baby Boomers – trend younger than traditional luxury cruise guests.
- Young at heart - irrespective of age.
- College educated, executive / professional, active, outdoor, boat owner, empty nester.
- Have sailed on other lines in suites or higher priced balcony staterooms.
- The anti cruise crowd – boutique hotels / villas.
- Have sailed on other small ships.



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4

Choice of turn-round ports

- ❖ Availability of good air service with international connections
- ❖ Direct flights to major US and European cities.
- ❖ Attractive docking location. Not industrial port. Preferably close to the city centre.
- ❖ Availability of all grades of fuel. Reasonable fuel price.
- ❖ Good dock access for re-supply vehicles.
- ❖ Hotel capacity of a good standard.



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5

Choice of small ports

- ❖ Anchor rather than dock if more attractive . Large expensive docking facilities not required.
- ❖ Privacy for guests onboard and for outdoor dining.
- ❖ Tender dock can often be very near the centre of village or town. Small communities can benefit from calls.
- ❖ Avoid ports where large ships dock and fill the town with tourists.
- ❖ Prefer ports that have a choice of active land activities.
- ❖ Avoid ports with substantial industrial shipping activity.



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Dubrovnik, Croatia by SeaDream



Port (top) is far from historic city.
Small vessels dock and ferry guests into city.



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7

Small Ships able to Visit Intimate Ports





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Appealing to special interest groups

- ❖ **"Footsteps of St.Paul" – Istanbul-Athens – 8 days.**
 - ❖ Connection to the Seven Churches of Asia in the Book of Revelations. Tour examples: Dikili – "Revealing Ancient Pergamum"; Izmir – Sardis & Thyatira
 - ❖ Demre (ancient Myra) exposes guests to the Turquoise Coast area.
- ❖ "Footsteps of Alexander" – another interesting option.
- ❖ "Galipoli Campaign" – considerable interest esp. ANZAC.



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11

Tours for active guests

- ❖ Yacht race on 12 meter sailing boats (St.Martin) .
- ❖ Truffle hunting in the countryside (Rovinj, Croatia).
- ❖ Hands-on cooking lesson in Greek cuisine (Santorini).
- ❖ Evening concerts in spectacular locations (Ephesus) .
- ❖ Olive oil tasting on the terrace of Hotel Splendido (Portofino)
- ❖ Ascent of Mount Etna in Sicily (Taormina).
- ❖ Sea kayaking around the walls of Dubrovnik, Croatia.
- ❖ Rafting on the Cetina River (Split, Croatia)
- ❖ Scuba diving on coral reefs (Virgin Gorda, BVI)



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12

Exclusive Arrangements

- ❖ **Always some guests seeking a special experience.**
 - ❖ Individual tours by quality cars with driver & guide
 - ❖ Tours by helicopter or light aircraft.
 - ❖ Tours by boat for fishing or bathing.
- ❖ Availability of experienced guides is critical.
- ❖ Ability to plan their own visit to get the most out of a day.



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Upper & Lower AMAZON Unique Explorer Voyages with SEADREAM



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The Enviroment.

SeaDream Small Ships maintain a very low speed and therefore we use very little fuel.

By doing this we have a reduction of CO₂, SOX and NOX.

Also, we burn most of our garbage and what we cannot burn we send ashore during our port stay. We do not dump anything at the sea.

Because of new rules we are burning a lot marine diesel instead of heavy fuel oil which is good for the climate.

In general, the cruise industry is doing a lot to reduce the pollution.



It's yachting, not cruising



There is a difference!!

The Future of New Marine Eco-biotechnological Industries

해양바이오 산업의 미래와 녹색 성장



James Crawford Philp

Policy Analyst, OECD

(OECD 정책 자문관)

DATE OF BIRTH

29.08.1959 **MARITAL STATUS** Married

WORK ADDRESS

OECD

Science and Technology Policy Division

Directorate for Science, Technology and Industry

2 rue André-Pascal

75775 Paris Cedex 16

France



james.philp@oecd.org



+33145249143

EDUCATION & QUALIFICATIONS

Oct 1977-Jul 1981

University of Edinburgh

Degree subject: BSc Biological Sciences, second class honours Microbiology.

Sep 1981-Sep 1982

Edinburgh Napier University

Higher degree subject: MSc Biology of Water Resource Management, awarded with distinction and class medal.

Apr 1983-Mar 1986

Edinburgh Napier University.

Higher degree subject: PhD, Corrosion of Steel Mediated by Sulphate-Reducing Bacteria with Reference to Nuclear Waste Disposal. Awarded Sep 1987, examined by Professor D P Kelly, University of Warwick.

EMPLOYMENT RECORD

Mar 2011-present

Policy Analyst, OECD, Paris, France.

Jul 2010-Feb 2011	Science Specialist , Saudi Aramco, Dhahran, KSA.
Nov 2007-Jun 2010	Biosciences Champion at KAUST (King Abdullah University of Science and Technology). My roles are: laboratory design; architect liaison; academic interface; construction management; economic development; supply chain management. I have also been involved with aspects of commercial development for KAUST, and setting up collaborations with external universities and companies.
Nov 2006-Nov 2007	Science Specialist , Saudi Aramco, Dhahran, KSA. This is my full-time position in Saudi Aramco.
Jan 1992- Nov 2006	Lecturer, then reader, Edinburgh Napier University, environmental and industrial microbiology and biotechnology.
2001-2006	National co-ordinator for the UK Department of Trade & Industry LINK Bioremediation Programme , a £15 M programme. Roles included: building academic / industrial partnerships; policy matters; project and programme management; post-project funding strategies.
1998-2002	Advisor to UK Department of Trade & Industry on Biotechnology means Business and BioWise Programmes . Roles included: presentation to small and large companies; consultation to companies; public perception issues.
2000-2006	Technical Director , CLARRC, the Contaminated Land Assessment and Remediation Research Centre.
July 1991-Dec 1991	Laboratory Scientist 1, Saudi Aramco.
Jan 1989-July 1991	Laboratory Scientist 2, Saudi Aramco.
Sep 1987-Dec 1988	Laboratory Scientist 3, Saudi Aramco.
Oct 1982-Sep 1987	Project in Napier studying microbiological corrosion aspects of radioactive waste disposal, with UK Atomic Energy Agency and the British Geological Survey.

Abstract

The future of new marine eco-biotechnological industries

Dr Jim Philp, Policy Analyst, OECD

The OECD is interested in marine biotechnology because, although it is currently very small indeed, it offers great potential for growth. This makes marine biotechnology a subject for policy development to prevent barriers arising that would limit this growth. At the same time, it will be more in line with OECD thinking if this growth occurs according to the principles of “green growth” i.e. that growth occurs in a sustainable manner without environmental damage. This is especially important in the oceans as the marine environment is already under pressure as a result of previously unsustainable practices, such as over-fishing, chemical pollution and the physical alteration of habitats, through, for example, seabed fishing. The Grand Challenge of this generation is climate change. There are many effects of global warming that are perilous to the future of the oceans, and therefore to human existence. Uncontrolled release of CO₂ can lead to ocean acidification, with concomitant changes to species diversity. Changes in oceanic circulation, weather patterns and rise in seawater levels have potentially disastrous impacts on humans. So the future exploitation of the marine environment through biotechnology must ensure that the foreseen benefits to humans are not accompanied by disasters as a result of negligent disregard to climate change and other negative environmental impacts.

Marine biotechnology currently has a market of around USD 2.8 billion, with predicted modest growth, to around USD 4.1 billion by 2015. To put that in context, one single recent joint venture between Cosan (Brazil) and Royal Dutch Shell for terrestrial biofuels development in Brazil amounted to USD 12 billion. And yet the addressable markets in various sectors where products could be made through marine biotechnology are very large indeed; across all the sectors the potential is vast. The sectors examined here are drug discovery, health supplements, nutraceuticals, biofuels and industrial materials. These different products and industry sectors are linked together by marine biorefining, which is at a very early stage of development, but will be a linchpin for future success.

Combinatorial chemistry has not lived up to the promise of delivering multiple new medicines. This is at a time when the global pharmaceutical pipeline of new medicines is running low, which is especially evident in the low number of new antibiotics, when multi-drug resistant bacterial strains are arising around the globe. By 2004 around half of anti-cancer drug efforts were focused on marine organisms. The addressable market for new pharmaceuticals is one of the key areas for development of marine biotechnology, and is of the order of USD 1 trillion, and pharmaceuticals are valued as low volume, high margin products that can make refining of high volume, low margin products more attractive in biorefining.

The global marine pharmaceutical pipeline consists of three Food and Drug Administration (FDA) approved drugs, one EU registered drug, several natural products (or derivatives thereof) in different phases of the clinical pipeline and a large number of marine chemicals in the preclinical pipeline. The current clinical pipeline contains marine-derived compounds that are either in Phase I, Phase II or Phase III clinical trials. Several key Phase III studies are on-going and there are seven marine-derived compounds now in Phase II trials. The preclinical pipeline continues to supply several hundred novel marine compounds every year and those continue to feed the clinical pipeline with potentially valuable compounds. From a global perspective the marine pharmaceutical pipeline remains very active, and now has sufficient momentum to deliver several additional compounds to the marketplace in the near future. Moreover, the preclinical pipeline contains a very wide range of drug types, such as antivirals, antibacterials, antitumour and anti-inflammatory drugs.

In the relatively near future there will be nine billion people alive. Given the competing uses of land, the production of high quality food is under stress. Aquaculture is very attractive as a means of providing high quality protein to help meet this challenge. In future, the strongest growth in animal production is expected to be the consumption of farmed fish and chicken. These also seem to be the animal protein sources with the smallest carbon footprint. Biotechnology can impact the growth of fish farming in a large number of ways. The impact of genomics could be particularly fruitful to the future of fish farming. One of the highest achievements of biotechnology to date has been the virtual elimination of the use of antibiotics in salmon farming through the development of vaccines. The over-use of antibiotics is particularly worrying in fish farming for the potential of the spread of multi-drug resistance. Biotechnology also offers great potential for the production of new, high quality fish feeds, especially those containing omega-3 oils.

The global cosmetics industry is strong. The European market for cosmetics is over Euro 27.6 billion per year, and the US market is USD 35 billion. Marine products find added value in various sub-sectors of the cosmetics market, especially in the skin-care sub-sector. Nutraceuticals is also a multi-billion dollar market e.g. ω -3 fatty acids market had reached USD 13 billion in 2008. Algae represent a potential vegetable source of omega oils to partially replace fish oils.

The high value chemical markets currently are of the order of Euro 77 billion. Here the potential of synthetic biology, linked to the plethora of marine biochemical transformations, represents a huge opportunity for marine biotechnology. This will be driven by efforts to uncover the extent of marine biodiversity. Currently we know very little of marine genetic diversity, and the recent trend in marine metagenomics will continue to unlock this resource. Many high value chemicals are either difficult to manufacture, or the manufacture uses fossil raw materials and causes environmental damage, such as excessive greenhouse gas (GHG) emissions. Marine biotechnology will benefit from the efforts that have been developing in industrial biotechnology for the production of industrial materials, where significant progress has been made e.g. the platform propanediols that are intermediates in the production of many organic chemicals. The bio-based plastics industry has undergone a transformation recently with the introduction of bio-based thermoplastics. This is a highly significant shift away from the biodegradable plastics that were intended for simple packaging applications. One of the challenges faced here is harmonisation of sustainability assessment and transparent certification and labelling; only those materials that truly offer GHG emissions savings and other sustainability benefits should be supported.

Marine biotechnology has long been associated with biofuels production. Here is perhaps the largest potential market for marine biotechnology, but also one that is fraught with technical difficulties. The biofuels industry more generally has found it difficult to rise to the challenge of large scale production. This will be particularly acute in marine biofuels production. Some microalgae have potentially very high oil yields that dwarf yields from terrestrial plants. There are other advantages e.g. the lack of lignin simplifies downstream processing. But extraction of the oil from biomass is a particular problem. And the use of NPK fertilisers links marine biofuels back into the fossil fuels industry. But massive research efforts, including investment by many of the oil company majors, is under way, and amongst the benefits that can be perceived is the development of the core technologies of synthetic biology, which will serve other biotechnology areas. Large-scale production relies on efficient biorefining. As in the terrestrial bio-based industries, the concept of integrated marine biorefining is emerging. In petrochemical refining, the production of chemicals and plastics makes the refining of the much higher volume, but low margin, fuels much more attractive financially. There is no reason to suppose that this will be different in biorefining, and therefore the same argument applies to marine biorefining. Marine biorefining is at an early stage of development, but concepts are arising. Some of these concepts are: co-production from microalgae of polyunsaturated fatty acids, extracted before esterification for biofuels production; co-location of marine biorefineries with sources of CO₂, such as power stations. This would be an additional climate change benefit in that waste CO₂ would be captured instead of released to the environment. The integration with aquaculture is also attractive. Nutrient-containing waters available from finfish and mussel cultivation could be used for algae production at one location, with subsequent refining of high-value products and biofuels at the same location.

There is very high potential for the trends in marine biodiversity discovery to be followed by a rise in these marine bio-industries. As noted, however, this has to be done in a fashion that protects the marine environment as it is used for many other purposes. The OECD would therefore favour strong governance regimes and the uptake of the principles of green growth into the nascent marine biotechnology industries. And marine biotechnology is currently very research-intensive. Research investments will have to continue to pour in to marine biotechnology for its potential to be realised. Currently about 90% of marine patents are filed by ten countries. The developing industry would benefit from increased research participation by more countries.

The future of new marine eco-biotechnological industries

Dr Jim Philp
Policy Analyst
OECD, Paris

What is marine biotechnology ?

Four main areas covering marine bioscience and biotechnology

Organism-based Technology

- Bioprospecting
- Marine genome sequence and bioinformatics
- Metagenomics and other omics technologies

Marine organism production

- Organism cultivation and collection
- Disease control and monitoring
- Marine biosafety
- Mass production e.g. seaweeds

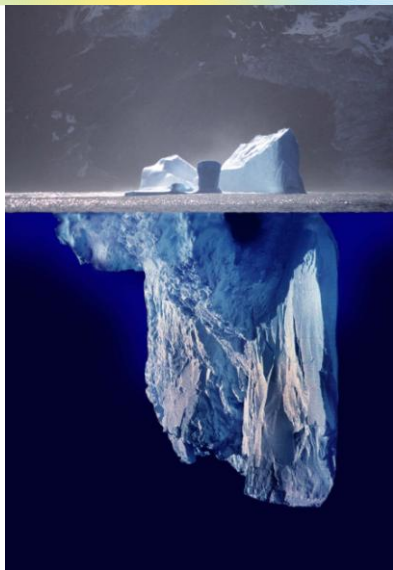
New Materials

- Drug discovery
- Industrial materials
- Health supplements, nutraceuticals
- Biofuels and bioenergy
- Biorefining

Marine conservation

- Monitoring environmental change
- Pollution prevention and control
- Biodiversity conservation and ecosystem recovery

Drivers: marine biodiversity and discovery



1/10 Gap

- In the Ocean the number of predicted species is about 10 times higher than the number of catalogued species (200,000).

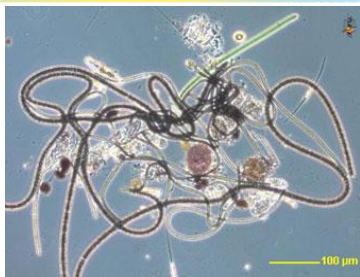
1/100 Gap ?

- How big is the gap if we add meiofauna (animals < 0.5 mm), protists, and bacteria?
- Over 1600 new marine species discovered every year
- What about **genetic diversity** ?
- Our knowledge of marine biodiversity is minute

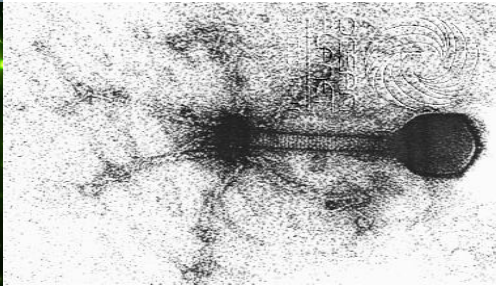
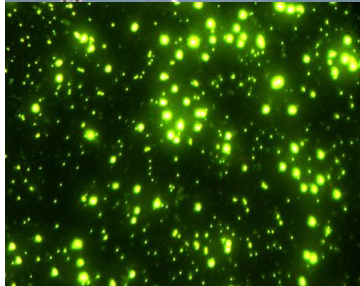


Mora et al. (2011). *PLoS Biol* 9(8): e1001127. doi:10.1371/journal.pbio.1001127
Pawlowski (2012). OECD Marine Biotechnology Workshop, Vancouver, May 2012.

Marine microbial biodiversity

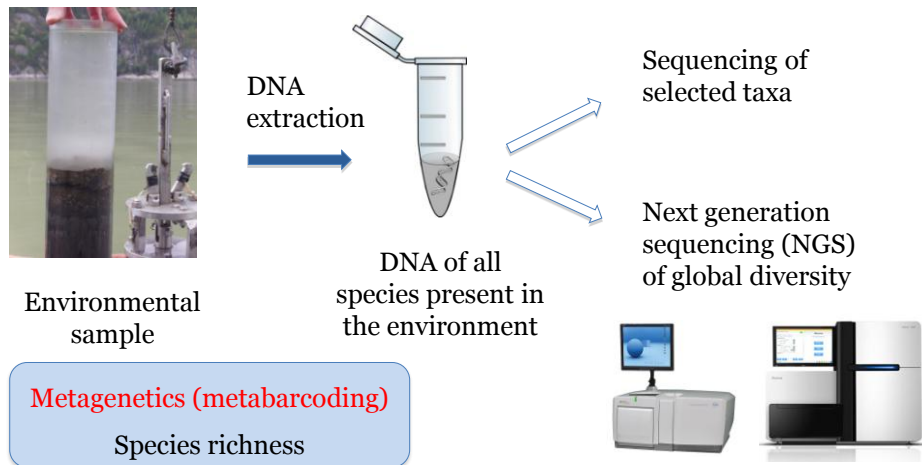


- 1 litre seawater contains (2006!):
 - bacteria: 20,000 'types'
 - viruses: vast, unknown
- In total: close to 1 billion 'types'
- **50-90% of all marine biomass**
- Essential to most life systems



Mees (2012). OECD Marine Biotechnology Workshop, Vancouver, May 2012.

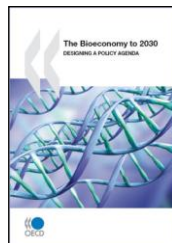
Drivers: next generation sequencing and metagenomics



Pawlowski (2012). OECD Marine Biotechnology Workshop, Vancouver, May 2012.

Marine biotechnology and the Grand Challenge

- **Protection and management** of the already stressed marine environment
- Pursuing human **health** and well-being
- Sustainable supply of high quality **food**
- Developing sustainable sources of **energy** alternatives to crude oil and gas
- New **industrial products and processes** with lower GHG emissions



Threats to the marine environment

- Fisheries operations
- Chemical pollution
- Physical alteration of habitat
- Invasion of exotic species
- **Global climate change**



Ocean accumulation of plastics

- North Atlantic Gyre: largest sample collected in a single 30-minute tow is equivalent to 580,000 pieces km⁻²
- Northern Pacific Gyre's "eastern garbage patch"
- Many obvious effects: animals killed by ingestion
- Less obvious: bioaccumulation of hydrophobic, toxic pollutants



Law et al. (2010). *Science Express*, 19 August, 2010. www.sciencexpress.org.

Where is marine biotechnology just now ?

- The global market for Marine Biotechnology products and processes is currently estimated at € 2.8 billion (2010) with a cumulative annual growth rate of 4-5% ¹
- Less conservative estimates predict an annual growth in the sector of 10% in the coming years ²

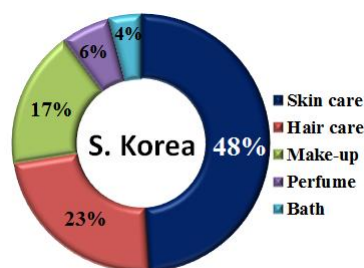
“Global Marine Biotechnology Market to Reach US\$4.1 Billion by 2015, According to a new report by Global Industry Analysts, Inc. Key factors driving market growth include growing interest from medical, pharmaceutical, aquaculture, nutraceutical and industrial sectors”.



¹ European Science Foundation, Marine Board (2010). Position Paper 15.
² Allen & Jaspers (2009). *Industrial Biotechnology* 5, 77-83.

Huge potential

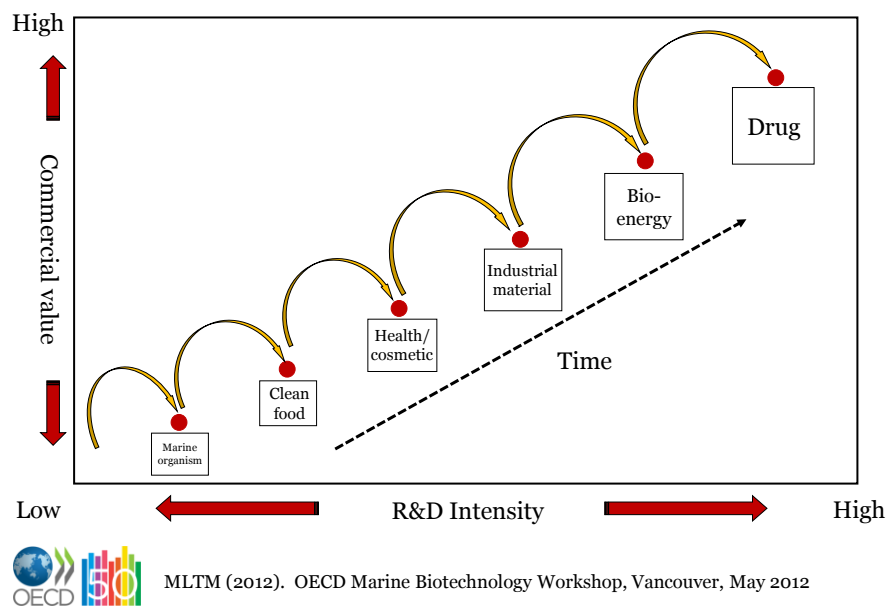
- The **DNA polymerase** world market is currently more than USD 350 million and growing (2012) (www.in-pharmatechnologist.com)
- **High value chemical markets** e.g. anti-oxidant carotenoids of around Euro 77 billion
- The European market for **cosmetics** is booming, at over Euro 27.6 billion per year, and the US market is USD 35 billion
- Multi-billion dollar **nutraceutical** market e.g. ω-3 fatty acids market had reached USD 13 billion in 2008
- Potential in **biofuels** dwarfs all commodity chemicals, but many technology barriers to overcome



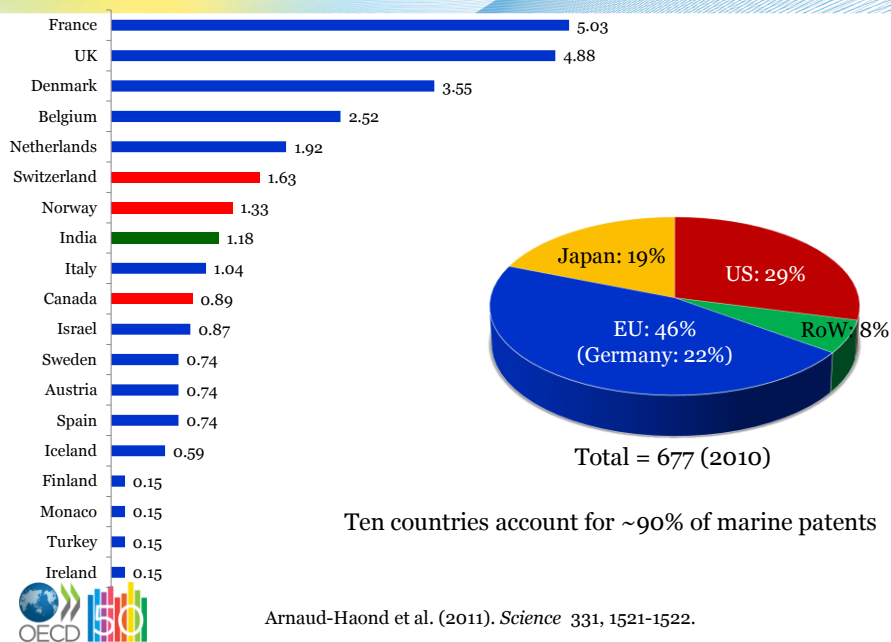
KHIDI (Korea Health Industry Statistics System)



Research intensity is high



Trends in marine biotechnology patent filing (PCT)



Drug discovery

Natural drug biotechnology

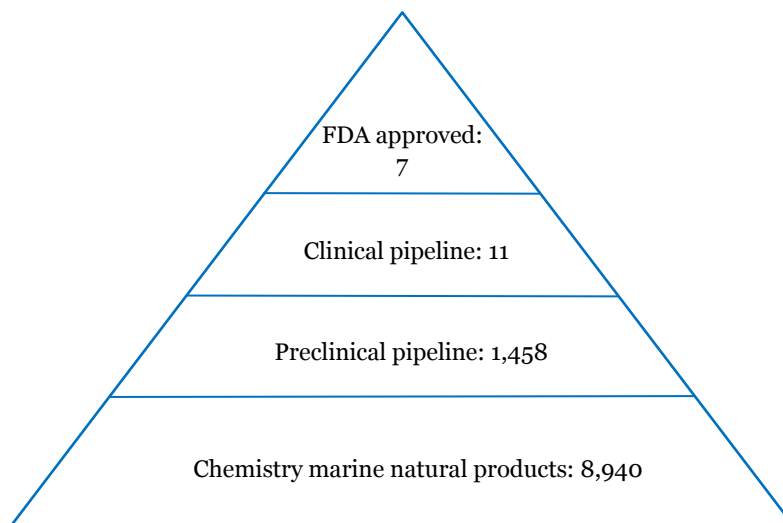
- The pipeline for new antibiotics is running dangerously low
- One of the most promising sources of new drugs is the oceans
- *Approx. half of all current anticancer discovery efforts are focused on marine organisms¹*
- Natural products biotechnology is attracting big business:

- | | |
|-----------------------------|------------------------|
| • Pharmacia | • Pfizer Inc. |
| • Mitsubishi Kagaku Medical | • Lonza |
| • Kyowa Hakko Kogyo | • BASF |
| • Sankyo Pharma | • Merck & Co |
| • Genencor International | • Bristol-Myers Squibb |



¹Weissman (2004). *Chemistry & Biology* **11**, 743-745.

Global marine pharmaceutical pipeline, 2012



Mayer (2012). OECD Marine Biotechnology Workshop, Vancouver, May 2012

Marine pharmaceuticals preclinical pipeline, 2007-2008 (197 compounds)

- Antitumour
- Antibacterial
- Antifungal
- Antiviral
- Antimalarial
- Antituberculosis
- Antiprotozoal
- Anticoagulant
- Cardiovascular
- Anti-inflammatory
- Immune system
- Nervous system
- Variety of molecular targets
 - enzymes
 - receptors



Mayer et al. (2011). *Comparative Biochemistry and Physiology* Part C153, 191-222.

Aquaculture and sustainability

“... the fish farming industry must be able to document that the production is truly sustainable. Both the fishery and the fish farming industry must have the perspective of eternity. Industry and nature must go hand in hand”

Minister of Fisheries and Coastal Affairs Lisbeth Berg-Hansen



“If Aquaculture did not exist we would have to invent it. ... the declining European fisheries stocks complicate the supply of fish. Aquaculture plays a significant role in offsetting this ever-increasing gap ...”

European Commissioner for Maritime Affairs and Fisheries Maria Damanaki



“Farmed fish is an excellent source of protein and, when produced well, helps protect the environment. I am totally convinced that aquaculture is the most sustainable way to feed the world.”

Director WWF Aquaculture Program Jose Viallon



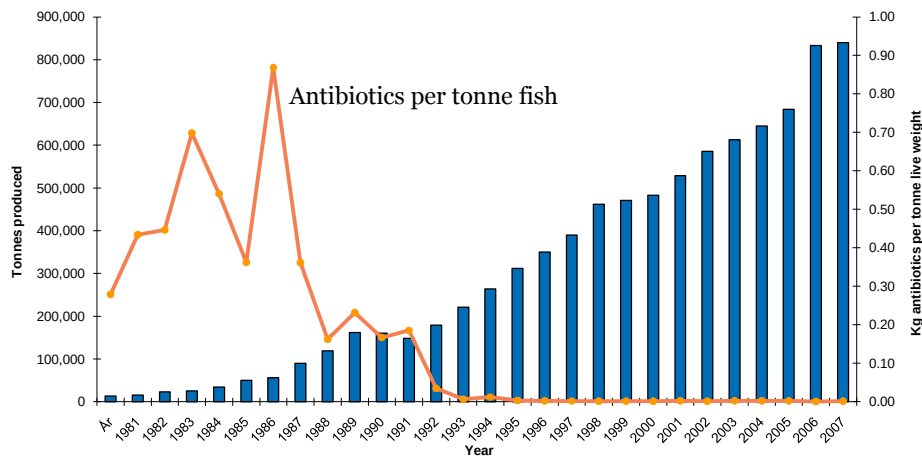
“The strongest growth (in animal production) is expected in the consumption of farmed fish and chicken. By convenient coincidence, these also seem to be the animal protein sources with the smallest carbon footprint.”

Director-General of the FAO Dr. Jacques Diouf



Arnesen (2012). OECD Marine Biotechnology Workshop, Vancouver, May 2012

Vaccines: closing the antibiotic chapter



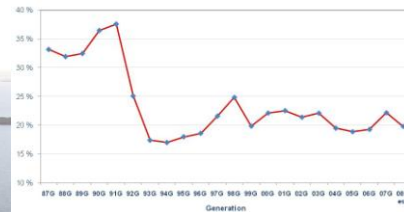
- 99% of fish have never been near antibiotics
- Norwegian agriculture used 20 g of antibiotics per tonne slaughtered weight in 2010.



Arnesen (2012). OECD Marine Biotechnology Workshop, Vancouver, May 2012

Biotechnology challenges in aquaculture

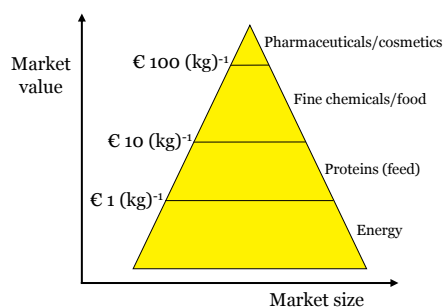
- Losses in salmon production, mainly due to viral diseases, are too high (around 20%)
 - Need vaccine development and increased resistance through breeding
- Sea lice treatments have high indirect cost
 - Need new, non-medicinal, treatments and increased resistance through breeding
- New feed raw materials must be developed
 - Especially high omega-3 materials



Arnesen (2012). OECD Marine Biotechnology Workshop, Vancouver, May 2012

Algae: disruptive technology ?

Crop	Oil yield [gallons (acre) ⁻¹]
Corn	18
Cotton	35
Soybean	48
Mustard seed	61
Sunflower	102
Rapeseed	127
Jatropha	202
Oil palm	635
Algae	10,000



Microalgal biofuels vs. Plant feedstocks

- Very high growth rates¹
- Growth at non-arable locations
- Improved solar conversion efficiencies
- High oil yields
- No lignin
- Exploit salt and brackish water supplies

BUT

- High economic costs for growth, harvesting and extraction of oil compared with biofuel crops²
- Still need fertilizers or organic wastes³

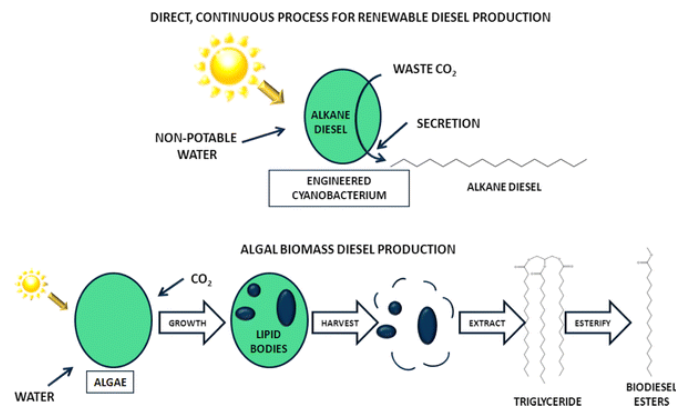


¹ Day et al. (2012). *Bioresource Technology* 109, 245-251.

² Brennan & Owende (2010). *Renewable Sustainable Energy Reviews* 14, 557-577.

³ Christenson & Sims (2011). *Biotechnology Advances* 29, 686-702.

A direct algal diesel process ?

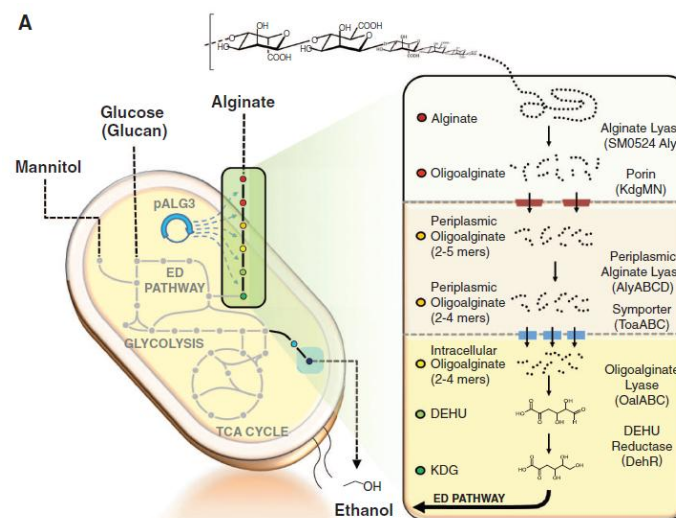


- Engineered *Cyanobacterium* with a product pathway and secretion system to produce and secrete an alkane diesel product continuously
- Process is closed and uses industrial waste CO₂ at concentrations 50–100× higher than atmospheric



Robertson et al. (2011). *Photosynthesis Research* 107, 269–277 .

Direct conversion of alginate to ethanol



Wargacki et al. (2012). *Science* 335, 308–213.

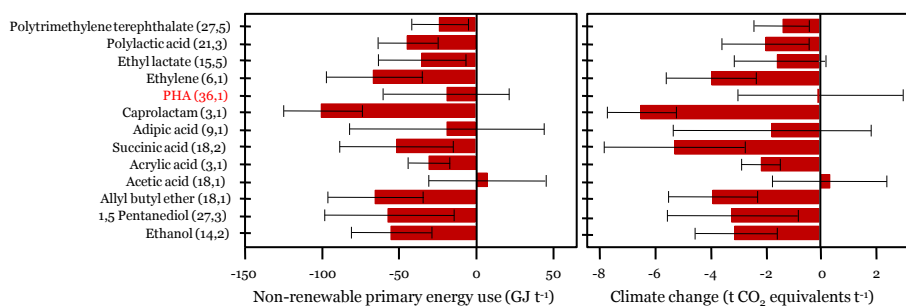
Value comparisons for algal products

Molecule	Photons required	USD per photon	Market size (per annum)
Octane	100	1	7.5 B barrels (US)
Lysine	92	5.9	700,000 tonnes (WW)
Phenylalanine	96	32	11,000 tonnes (WW)



Adapted from Ducat et al. (2011). *Trends in Biotechnology* 29, 95-103.

Env impacts of biobased products



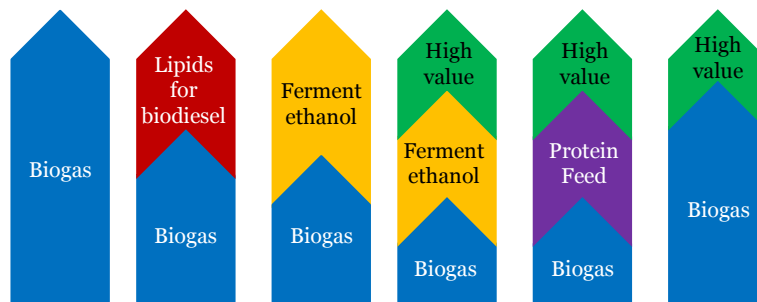
Variability in data, largely due to differences in LCA, could seriously damage the reputation of the bio-based industries

Weiss et al. (2012) found that biobased materials save, on average, 55 +/- 34 MJ non-renewable energy and 3 +/- 1 kg CO₂ per kg material



Weiss et al. (2012). *Journal of Industrial Ecology* 16, S169-S181.

Algal integrated biorefinery concept

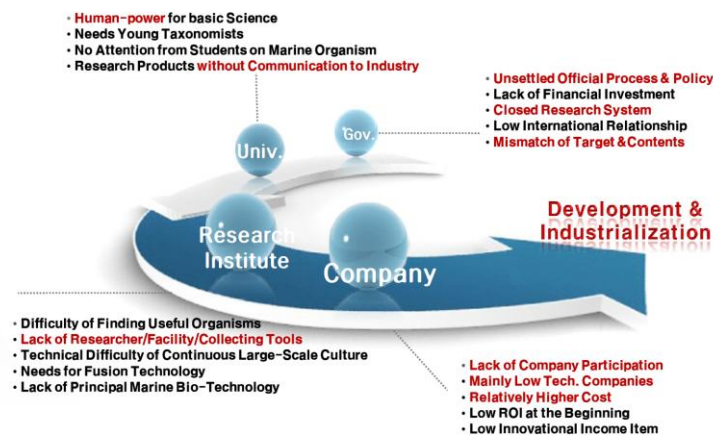


- Microalgae are rich in PUFA - extracted before esterification for biofuels production
- PUFA are vegetable alternatives to fish oils and oils rich in Omega-3 fatty acids
- High value products made in an integrated microalgae biorefinery that also produces biodiesel
- Co-locate with source of CO₂, such as power stations ?
- Integrate with aquaculture ? i.e. finfish, mussels and algae production at one location



Sustainable Energy Ireland (2009). 92 pp.

Big challenges in marine biotechnology



MLTM (2012). OECD Marine Biotechnology Workshop, Vancouver, May 2012

The Future of Offshore Plant Industries with New Eco-Technologies

해양 플랜트 산업의 미래와 녹색 성장



Ahmad Fadzil B Mohamad Hani

Deputy Vice Chancellor, University Technology PETRONAS, Malaysia

(말레이시아 페트로나스대학 부총장)

Tel : (+605) 368 8787

Fax : (+605) 368 8151

Email : fadzmo@petronas.com.my fadzmo@gmail.com

Professor Fadzil is an expert in the area of image processing and computer vision. He obtained his PhD degree from University of Essex, UK. His research activities range from fundamental pattern recognition to developing vision applications. He has authored over 160 research papers in journals and conference proceedings, filed several patents and won several awards for his work. He currently heads the Centre for Intelligent Signal & Imaging Research (CISIR), a research centre under the Mission-Oriented in Biomedical Engineering at Universiti Teknologi PETRONAS.

He was the Dean of School of Electrical & Electronic Engineering Universiti Sains Malaysia (1992-1996), and later Dean of Engineering Studies (1997-1999), Director of Academic Studies (1999-2003) and Director of Postgraduate Studies (2003-2005) at Universiti Teknologi PETRONAS. As the General Manager in Frontier Technology at the PETRONAS Research (2007-2009), he headed the R&D on renewable technologies. Currently he is also the Deputy Vice-Chancellor (Academic) Universiti Teknologi PETRONAS and a member of the University Senate.

Professor Fadzil is a Fellow and a Council Member of the Academy of Sciences, Malaysia and a Fellow of Institution of Engineers Malaysia. He is a registered Professional Engineer with Board of Engineers Malaysia and a Senior Member of the Institution of Electrical & Electronic Engineers Inc. In industry, he sits in the Board of Directors of ViTrox Corporation Bhd., an R&D and public-listed company that develops and manufactures automated vision inspection systems.

Prof Ahmad Fadzil M Hani, F.A.Sc, FIEM, P.Eng, SMIEEE, PhD

Deputy Vice-Chancellor (Academic)

Universiti Teknologi PETRONAS

31750 Tronoh, Perak, Malaysia.

Abstract

The future of offshore plants has always been consolidated with the fact that it procures the most precious, non-renewable, and non-sustainable resources in the world, oil and gas. With the expansion of existing frontiers into deepwater boundaries through blue ocean strategies, the industry has called upon huge leaps in the technological forefront to tap into previously prospective untapped reserves and basins. However, the ecological trail that it leaves behind is something that needs to be addressed along with this expansion in order to ensure the sustainability of the environment and its beneficiaries through green action. Many oil and gas majors are now embarked as much as possible on green action. While it is difficult to implement a general consensus from the oil and gas majors and policy changes that dictates the movement of such high-demand commodity, other ways can be looked into to alleviate and to mitigate this issue. They may come in the form of optimizing the components in a life cycle analysis or even stringent management of HSE standards to prevent unforeseen large-scale single event environmental disasters. In order to facilitate this change, it is highly critical that relevant eco-technologies been introduced into the life cycle of a platform. They may come in the form of reduced operation time, material optimization or even application of innovative methods and re-definition of existing design standards. This is looked upon to incentivise many procurement packages to the industry as well due to its impact resulting in the reduction in operational costs with the introduction of new eco-technological advancements. As such, this provides an exceptionally large avenue for research and development works to take place in order to cater to the industry requirements while at the same time upholding the statutes of environmental sustainability.

Global Marine Energy Industries and Green Growth

글로벌 해양 에너지 개발과 녹색 성장



John Huckerby

Chairman, OES-IA

(국제해양에너지기구 해양에너지부 의장)



john.huckerby@powerprojects.co.nz

Tel: +64 4499 0060; mobile: +64 274 946 581

Dr. John Huckerby is the current Chairman of the Executive of the **International Energy Agency's Ocean Energy Systems Implementing Agreement (OES)**. He was appointed as New Zealand representative in 2008 and has been Chairman since January 2009. OES has just published its “*International Vision for Ocean Energy*”, a document setting out its vision for the development of ocean energy to 2050.

From 2009 – 2011 John was a Lead Author of the **Intergovernmental Panel on Climate Change's (IPCC)** “*Special Report on Renewable Energy Resources and Climate Change Mitigation*”, published in June 2011. Formerly he was a member of the Royal Society of New Zealand's President's Panel for Energy.

In New Zealand he is the founder and current Executive Officer of the **Aotearoa Wave and Tidal Energy Association (AWATEA)**, a marine energy industry association formed in April 2006. He is also the director of **Power Projects Limited**, an energy industry consultancy. Since 2004, Power Projects has been involved in the **Wave Energy Technology – New Zealand (WET-NZ)** R & D programme, which has recently deployed a ½ -scale point-absorber wave energy converter.

John has a Ph.D. from Imperial College in London and an MBA from Henley Management College. He is a Chartered Engineer and a member of the Energy Institute in London, the Royal Society of New Zealand and the Institute of Directors in New Zealand.

Abstract

Title: Global Marine Energy Industries and Green Growth

Name: Dr. John Huckerby

Position: Chairman

Name of association: Ocean Energy Systems Implementing Agreement (IEA)

Marine energy offers the potential to clean, environmentally friendly power, which could also contribute to long-term carbon emissions reductions. There are seven forms of marine energy: wave energy, tidal rise and fall, tidal currents, ocean currents, ocean thermal energy, submarine geothermal energy and salinity gradients. Marine energy derives when seawater is the motive power, so offshore wind is not really marine energy but because there are synergies between offshore wind energy and a future marine energy industry it is included here.

Tidal barrages and offshore wind energy are the only generation technologies, which are currently mature. Tidal barrages have been in operation for thousands of year, although electricity generation did not start until 1966. The recent completion of the Sihwa Lake tidal power plant is a significant achievement. It is notable that both Korea and Russia are planning considerable further development of tidal barrages.

The requirement to locate offshore wind turbines on the seabed has restricted the spread of these technologies. However, there are at least three different floating wind turbine prototypes under test in Europe.

Considerable amounts of investment are currently being made in wave and tidal current power generation technologies with over 200 device designs under development. There are at least five different ways to extract energy from waves and swells but there is presently no convergence of device designs. A small number of devices have been tested at full-scale and even as arrays, which will be a necessary requirement for utility-scale developments. Submarine tidal turbines also come in a variety of different forms but there is some convergence towards an up-current, two- or three-bladed rotor mounted on a horizontal-axis turbine, raised off the seafloor. Again full-scale demonstration devices have been tested for some years and small arrays are likely to be installed in the next 3 - 5 years.

Harnessing ocean currents will require different technologies, since ocean currents tend to be slower (1 m/sec), seasonal and unidirectional currents compared to nearshore tidal currents. Given the extra infrastructure costs that will be required to harness distant offshore ocean currents, these technologies will be developed and deployed later than tidal current devices.

Ocean thermal energy conversion (OTEC) has been under investigation since the first prototype was tested in Cuba in the 1920s. Development of more sophisticated heat transfer and conversion methods has been advancing since the 1980s but the

pace of development of OTEC technologies remains slow at present. Nonetheless the widespread potential of OTEC in tropical latitudes and its close association with desalination make this technology of significant potential. Submarine geothermal energy is a special case of OTEC, under investigation in Mexico and New Zealand.

A number of R & D projects are under way to develop energy from salinity gradients, i.e., mixing seawater with freshwater. There are a number of different approaches under test, the most advanced being a pressurized reverse osmosis plant in Norway.

Presently there are only ~550 MW of installed capacity around the world (mostly in the La Rance and Sihwa Lake tidal barrages). However, wave and tidal current devices will be commercially deployed in the next five years. OES has recently completed some modelling, which shows that 337 GW of wave, tidal current and tidal barrage technologies could be operational by 2050, with at least the same again available from OTEC.

Marine energy technologies have low environmental footprints, particularly when in operation, and marine energy could provide an environmental dividend by replacing fossil fuel generation plant and even some renewable energy generation.

The IPCC's 2011 *“Special Report on Renewable Energy Sources and Climate Change Mitigation”* showed that marine energy could significantly contribute to the emissions reductions, whilst providing significant economic and social benefits. Costs are presently higher than other forms of renewable energy but these will decline as technologies become mature and are built and deployed in greater numbers.

Government policies, particularly in the OES countries, are accelerating the implementation of marine energy technologies and industrial development. An unusual feature of marine energy is the development of a number of testing centres, such as the European Marine Energy Centre in Orkney, Scotland, and the FORCE facility in eastern Canada. These centres are acting as incubators and aggregators for new device deployments and supply chain investments. There will be considerable synergies for various industries, such as oil and gas, fishing and offshore wind energy, in the growing deployment of marine energy technologies.

The Future of Marine Mineral Resources

미래 해양 광물자원 개발과 녹색 성장



Hasjim Djalal

**Senior Adviser to the Minister and
Member of the Indonesian Department of Marine
Affairs and Fisheries**

(인도네시아 해양수산부 장관 고위자문역, 전 인도네시아 대사)

Prof. Dr. Hasjim Djalal obtained a BA degree from Indonesian Academy for Foreign Service in Jakarta (1956) M.A (1959) and Ph.D (1961) from the University of Virginia, and graduated from the Indonesian National Defense Institute in 1971.

He was Ambassador/Deputy Permanent Representative of Indonesia to the UN in New York (1981-1983), Ambassador to Canada (1983-1985), Germany (1990-1993) and Ambassador at-large for the Law of the Sea and Maritime Affairs (1994-2000).

He participated fully in the Third UN Law of the Sea Conference and in its implementation thereafter.

He was President of the International Seabed Authority (ISBA) in Jamaica (1995, 1996), and currently serves as Chairman of its Finance Committee. He is the initiator and convener of the Workshop Process on Managing Potential Conflicts in the South China Sea, and has been involved in development of maritime cooperation in the Indian and Pacific Oceans.

Currently, he is a member of Indonesian Maritime Council, Advisor to the Indonesian Minister for Maritime Affairs and Fisheries, and to Indonesian Naval Chief of Staff, and lectures at universities and other high learning institutions in Indonesia.

Abstract

THE FUTURE OF MARINE MINERAL RESOURCES*

Prof. Dr. Hasjim Djalal, M.A.

The Marine Mineral Resources usually include **liquid minerals** in the form of hydrocarbon, such as oil and gas, in addition to the **hard minerals**, such as polymetallic nodules, which contained nickel, cobalt, copper, etc.

These minerals could be found in the area under **national sovereignty**, such as in archipelagic waters and territorial seas, as well as in the area under **national sovereign rights**, such as in the continental shelf. It could also be found, and in fact a lot of them, in the **international seabed area**.

The issues of minerals in the area beyond national sovereignty, sovereign rights, and jurisdiction, were issues that were deeply and lengthily debated during the Law of the Sea Conference. During the Conference, the developed countries generally argued that those minerals were parts of the freedom of the seas and therefore could be developed and made use of by whoever was capable of taking them. On the other hand, the developing countries were of the opinion that **those resources belong to mankind** as a whole, and therefore they should and could also bring benefits to developing countries that may not have the scientific and technical capabilities to exploit and take benefits of them. After very lengthy discussions, the Conference finally concluded that they were 'common heritage of mankind', while at the same time recognized the rights of 'pioneer investors' in certain areas, which states or companies had explored before hands. At the same time, the continued exploration, or exploitation, of the resources should be managed and regulated by the International Seabed Authority (ISBA) in Jamaica.

ISBA was given the power to grant and write agreements with applying states, or companies sponsored by states, to explore and exploit those areas, and to share the area that they had explored. The developing countries may also apply for the exploration and exploitation of the area. The area shall be divided by the Authority into 2 (two) parts of equal size and richness, and one part of the area shall be 'reserved' for the developing countries, while the other half can continue to be explored and exploited by the first applicant.

In exploiting the resources of the area, the contractor of the 'contract area' would share the benefit of the resources with ISBA. The share of the Authority would be 1% of the production on site after the 5th year of production, and to be increased by 1% on the 2nd year of production and continuously until it reaches the limit of 7% after 12 years of production. The Authority would distribute the share that it obtained from the contractors to the various developing countries.

During these years, the ISBA had already formulated rules and regulations with regard to exploration of nodules, and on that basis have already signed contract with several contractors to explore those nodules in the bottom of the Pacific Ocean in Clarion-Clipperton Zone with **Japan, South Korea, China, France, Germany, Russia**, and an east European Consortium managed by **Poland**. At the same time, 2 (two) developing countries, namely **Nauru** and **Tonga** have also obtained rights to explore the 'reserved area' in the sea floor of the Pacific Ocean. In the meantime, **India** has also signed and obtained contract to explore polymetallic nodules in the Central Indian Ocean Basin.

In addition to exploring minerals originated from polymetallic **nodules**, ISBA has also adopted rules and regulations with regard to the exploration of polymetallic **sulfides** that are generally found around the 'black smoke' on volcanic area on the ocean floor. On this basis, the ISBA has also granted contract with **Russia** to explore those resources in the mid-Atlantic Ridge.

At the same time, many scientific researches that have been conducted also indicated a lot of mineral resources on **seamount crust**. The ISBA has also looked into these resources and on the basis of rules and regulations that have been worked out on seamounts crust, it has granted also a contract to **China** for the exploration of those resources on the West Indian Ocean Ridge. The ISBA has not yet formulated rules and regulations with regard to the exploration and exploitation of 'methane hydrate' which are supposed to be found a lot at the area of subduction as the result of plate tectonic movement.

During the Law of the Sea Conference, some countries which are producing those minerals that would also produced from the seabed area, were worried that such

international seabed area production could harm the products and the markets of their minerals in the international markets. Those countries, consisting of developing countries, such as Indonesia, Papua New Guinea, Namibia, South Africa, Chile, and others joined the developed countries producers of those minerals, such as Australia, Canada, and others in a group called '**land based producer countries**'. The Land Based Producers (LBP) struggled and obtained their voices in the organs of the ISBA, such as in the Council. In this context, the future of marine mineral resources, particularly those that were enumerated above, would depend a great deal on the works and effectiveness of the Authority's rules and regulations.

It should be noted, however, that the adoption by the Law of the Sea Conference of the issue of seabed mining of the marine mineral sources were originally criticized by the developed countries that regarded the text of the Convention 'sounded' too much like 'socialistic regulations'. Therefore, the 'capitalistic' approach to the resources, headed and championed by the US, were reluctant to ratify the Convention. Therefore, it took more than 4 years (1990-1994) to negotiate 'implementing agreement' that could accommodate some of the concerns of the developed countries. After the concluding and adoption of the implementing agreement in 1994, most developed countries ratified the Convention and have been actively participating in the works of the ISBA since then. The US participated actively for 2 years as 'cooperating non-party', but after that failed to ratify the Convention, but continue to play and active observer in the ISBA's activities. So far, as of June 2011, 162 countries have ratified the Convention and 141 countries have ratified the Agreement, with notable exception of the US, despite the Convention (and the Agreement) enjoy great support in the American administration, academics, and non-governmental groups.

The future of the marine mineral resources would be influenced by various factors, such as the **price of the minerals**, the development of **science and technology** for its exploitation, the **environmental impacts** that it may create as well as its influences on the lives of bio-diversity in the ocean floors, and the **policies of the LBPs** with regard to the 'reserved area' and the exploitation of the land-based minerals.

In view of the depleting mineral resources on land, either of hydrocarbons or hard minerals, the **prospect for marine mineral resources looked promising for the future**,

especially because of the **increasing industrialization of many countries** that required those minerals for the development of their industries, particularly those of high technology industries.

China, for instance, has increased its import of nickel and bauxite from Indonesia to build up its supply before Indonesia put up limitation of exports of those minerals. Chinese **bauxite import** soared to around 5.3 million metric tons in March (2012), 50% more than a year earlier. Its **nickel import** jumped 73% to 3.67 million tons (Jakarta Post, 25 April 2012). Indonesia, the largest nickel-ore and bauxite supplier to China is set to ban exports of unprocessed ores, including copper iron ore, gold, and manganese from May 6, 2012 to encourage domestic processors within the context of Indonesian industrialization. In March (2012), Indonesia shipped 4.4 million tons of bauxite to China, the most since at least Feb 2008 at 2.9 million tons of nickel ore, the highest since November. The ban may reduce nickel ore and bauxite export by as much as 75% this year (2012). Indonesia shipped 33 million tons of nickel ore and 40 million tons of bauxite last year.

At the same time, with regard to **liquid mineral** of oil and gas in Indonesia, it is now left some 25 billion barrels and can no longer become the main supporter of Indonesian economic development. Indonesia has left OPEC since many years, although oil and gas still contribute 25% of the country's income, although the production of oil has been reduced from 1.3 million barrels a day in 2001 to about 900,000 barrels in 2011. It is estimated that the Indonesian oil and gas reserve is left for 23 years more and after that there will be no more oil, except if and when new reserves are discovered. For that reason, Indonesia is looking for alternative energies, particularly the **bio-mass, bio-fuel, geo-thermal** and **possibly ocean energy** from current, waves, tidal, and OTEC (Ocean Thermal Energy Conversion). Indonesia is also trying to make more use of **solar energy, wind power, hydro power** and **nuclear**, although for political and emotional reasons the choice for nuclear energy is not an easy one. And at the same time Indonesia plans to reduce the use of fossil energy by 15% at 2020.

With regard to **geo-thermal**, Indonesia is home to 40% of the world geo-thermal reserve, which potentially can produce 27,000 MW of power. So far, it generates only 1,341 MW or about 4.6% of its total potential. In this context, Indonesia has been cooperating with New Zealand since 1972 to develop the geo-thermal prospects and recently signed

agreement to continue cooperation in 24 point location in Java, Sumatera, Kalimantan and Sulawesi to the value of more than USD 1 billion.

On the other hand, China has the 3rd largest reserve (coal) of that resources in the world, 14th in oil and gas. But it consumes 20.3% of global energy consumption in 2010. So the coal reserve will be exhausted in the next 35 years, while oil will be used up in 9.9 years and natural gas in the next 29 years. In 2008 China oil import was 51% of its need, in 2010 rose to 55.8%. So China needs more alternative energy, such as wind power, hydro power, nuclear power and others.

Looking at the studies which the ISBA has done, the potential resources of the outer Continental Shelf beyond 200 miles from the baselines include aggregates such as **gravel, sand, clay, earth, shell and stone**, regardless of their composition. Most sand and gravel are composed of particles that are durable and rich in **silica** (quartz, quartzite and flint). **Sand and gravel** resources are an evenly distributed, but they are often of high volume but **generally of low value**. Most attraction of aggregate normally occurs in coastal waters less than 25 kilometers offshore and in water depth of between 18 and 35 meters. **It is highly unlikely that such deposit will be significant beyond 200 nautical miles, and the other aggregates are not likely to be viable resources for exploitation in the outer continental shelf.**

Other mineral resources are **marine placer deposits**, which can commonly concentrate to form economically viable concentration. They can contain tin, titanium, zirconium, chromium, thorium, iron, gold and diamond. They are particularly important in seabed area of Namibia and South Africa. Some **placer deposits are gold and tin**, which can be found on the shallow continental shelf at some distance offshore.

The other sub-sea resources of **phosphorite** are probably at least of the order of hundreds of billions of tons but **currently no offshore mining is occurring or foreseen** in the immediate future, mainly because land deposits of phosphorite are large enough to meet world demands. Nevertheless, the principal sites of offshore phosphorite would include the southern hemisphere margins of South America and Africa, and parts of Australasia and many of the western pacific island groups. In most cases, the deposits are located

within coastal states EEZ. **Phosporite is not generally considered a likely mineral resources in areas of the continental shelf beyond 200 miles.**

Anhydrite and gypsum (calcium sulfide), sodium chlorite and associated potash-bearing metals, are collectively described as '**evaporate deposits**'. These minerals form an **abundant, but low value resource** although it is of interest because of its association with hydrocarbons, especially oil. The presence of **geo-thermal** water sources near evaporate deposits greatly enhances their potential value. **Evaporates are unlikely to feature in the evaluation of mineral resources of the outer continental shelf.**

The majority of **polimetallic sulfide** are massive ore bodies containing both high temperature, about 250 degrees celcius or above and low temperature (below 300 degrees C) mineral assemblage. The compounds generally contain copper, iron, zync, and others, and occasionally gold as well as tin, cadmium, antimony and mercury. Polymetalic mineral deposits on the sea floor are intimately related to the formation of new oceanic crust by sea floor spreading at greater depth frequently in excess of 2,500 meters. Current exploration programs for **polimetallic sulfide** within 200 miles of coastal states, such as in **Papua New Guinea**, are reaching the extraction/exploitation phase in Bismarck Sea, to produce sea floor copper and gold mine for the region in 1,600 meters of water and between 50 km of land with a potential to move further into deeper water and further offshore as the systems are tested and economic conditions allow. There is no doubt that the **polimetallic sulfide represents one of the more promising mineral resources of the sea.**

Manganese nodules can contain economically valuable concentration of nickel, copper and cobalt and occur mainly on the deep sea floor. They could also contain molydbnum, platinum and other metals. It occurs in deep water throughout all major ocean basins, although the highest abundant and most attractive are in the **eastern central Pacific Ocean** between the Clarion and Clipperton fracture zones and in the **Indian Ocean**.

Cobaltrichfero manganese **crusts**, similar in composition to the nodules, are found in some areas as coatings or encrustations on hard rock substances, on seamounts and the submerged portions of islands. The crusts can contain up to 2% in cobalt. There is little

doubt that **manganese nodules and cobalt rich crust can occur in many coastal states** outer continental shelf areas.

Oil and gas are hydrocarbon deposits that occur naturally within thick sedimentary sequence. Hydrocarbons provide the major energy sources for modern civilization and mainly formed in marine sedimentary basins, and normally greater than and around 3,000 meter of sediment overburden. Gas may often be found apart from oil reserves. **Hydrocarbon** represent the most mature and well understood mineral resources in continental shelf areas. **Technology exists** to deal with the deposits in ultra deep water, and the **market is always hungry** for new sources. In fact, hydrocarbons have also become **a source of conflicts and confrontations between states**, especially if they are located in a disputed area or in area where boundary delimitation does not exists or is not clear.

Gas hydrate occurs worldwide as layers integrated with sediments. **Methane** is the main component of the gas. As the technology delivering effective extraction of gas from beneath gas hydrate caps is still very much in its infancy, the resource **potential of gas hydrates, while real awaits investment and development**. Gas hydrate reservoir of methane are identified as **a potential future natural resource**, possibly comprising up to 10 times the value of current conventional gas and oil resources. Thus, the **distribution of gas hydrate deposits is of growing strategic importance**.

The future of marine mineral resources also depends greatly on the **current metal market** and **oil and gas trends and predictions**.

The post 2002 upswing in global economy activity has been the strongest one for 30 years. Global gross domestic product rose by 21% between 2003 and 2007 and the volume of world trade increase about 39 percent over the same period. The recent global economic downturn, however, is likely to see a significant reduction in demand for many metals, and this has seriously hit **nickel markets**. The use and production of **manganese ore** has trended downward. About 2/3 of the output of primary nickel is used in stainless steel production.

Global usage of **copper** grew by an average of 3.5% between 1992 and 2007. The growth has been led by China and the Asian countries but **global copper prices have also been hit by economic downturn** and the prices have fallen as a result of global production. Yet analysts predict that **copper will recover faster** from the global economic downturn than many other metals. Deep sea mining will not substitute for land-based materials but contribute to the world rising need alongside new land-based development.

With regard to **oil** and **gas**, world energy consumption is set to grow by 44% between the period of 2006 and 2030. So, areas in the **continental shelf** and **continental margin** **will become more important in securing stable supplies of oil and gas**.

The other constraint for exploiting is the **environmental consideration**. Mining processes for the exploitation of those mineral resources could and would certainly cause some turbulence to seabed area that may create debris of plume of materials that may affect marine environment and may upset the living resources and biodiversity in the seabed area and its surrounding waters. These problems are being studied by the ISBA and to find a way how to manage so that the seabed mining activities will not seriously damage the marine environment. Equally the **technology for uplifting and transporting** the products from the seabed area would also have to be developed so that they would not negatively impact on the marine and ocean environments, particularly to the living resources of the ocean. The **development in some land-based producer countries** that have resulted in high tech industrialization that require a lot of mineral resources in those countries, could also affect and accelerate the exploration, exploitation, and participation of developing countries in the management of the marine mineral resources. I feel that this factor may also increase the prospect for future exploration and exploitation of the marine mineral resources.

Finally, with regard to the **South China Sea issues**, the Indonesian sponsored Workshop Process on Managing Potential Conflicts in the South China Sea has also looked into the issue of marine mineral resources. A lot of the works of the workshop process had been done through Technical Working Groups (TWG) meetings and Group of Experts Meeting (GEM) as well as the Study Groups Meeting (SGM). With regard to the Working Group on resources assessment that had met in Jakarta in 1993 and in 1999 had agreed to

appoint 3 coordinators for this purpose, namely **Indonesia** for the study of **geological basin** with regard to hydrocarbon potentials, **Vietnam** to prepare a study on **hard minerals** in the South China Sea, and **Thailand** to prepare a study on **living resources**. The various Technical Working Groups had agreed to form various Group of Experts Meeting. The Groups of Experts Meeting on hard minerals had met in Jakarta in November 1998 and had formulated a program to study and prepare a database on geo-science in the South China Sea. Some progress had been made in preparing this study, including in obtaining some funding, but some difficulties were encountered later on, especially after China indicated in Cengkareng Meeting in August 2001 that “the proposal raised a number of contentious issues and at this stage, due to the political sensitivities, the project should not be pursued”. Indonesia had also prepared a study on hydrocarbon resources in the South China Sea, primarily on geological conditions, but this study has not been pursued further because of political sensitivities, especially by China. More discussions are required on these matters, especially in view of the recent developments in the South China Sea.

* This paper is based largely on the results of the studies made by the ISBA, the SCSW, and on various public press information.

The Future of Marine Mineral Resources

Prof. Dr. Hasjim Djalal, M.A.



Contents

1. Regime on marine mineral resources
2. The importance of marine mineral resources
3. Future of marine mineral resources
4. Management of marine mineral resources
(South China Sea Case)
5. Conclusion



1. Regime on marine mineral resources

- a. Common heritage of mankind.
- b. Regulated and managed by the International Seabed Authority (ISA).
- c. Law of the Sea Conference on the Issue of Seabed Mining of the Marine Mineral Resources:
 - Developed countries: should be free under the regime of the freedom of the sea.
 - Developing countries: common heritage of mankind.



1. Regime on marine mineral resources

- d. Marine mineral resources:
 - Liquid minerals (oil and gas) in the form of hydrocarbon.
 - Hard minerals (nickel, cobalt, copper, etc).
- e. Marine Minerals can be found:
 - In area under national sovereignty, sovereign rights.
 - In international seabed area.



1. Regime on marine mineral resources

- f. The area granted for exploration (and exploitation) by the Authority is divided into 2 equal size areas; one of them is reserved for developing countries.
- g. The revenue of the “contract area” will be shared with the Authority beginning at 1% of the production on site after the 5th year and to be increased by every year until it reaches 7% after 12 years.
- h. The Authority will distribute the share to developing countries.



1. Regime on marine mineral resources

- i. ISBA had always formulated rules and regulations for polymetallic nodules, sulfides, and metal crusts but not yet on methane hydrate.
- j. 9 contractors have been assigned for the seabed of the Pacific Ocean: Japan, South Korea, China, France, Germany, Russia, and the East European Consortium managed by Poland plus 2 developing countries (Nauru and Tonga).
- k. India has also obtained contract for nodules in the Indian Ocean, China for polymetallic crusts in the Western Indian Ocean ridge, and Russia for polymetallic sulfides in the Mid-Atlantic ridge.



2. The importance of marine mineral resources

- a. Increasing demand due to industrialization in the world: e.g. China imports more nickel and more bauxite from Indonesia in recent years.
- b. Limited resources of land-based minerals: e.g. Indonesia only has 25 billions barrels of oil and gas left or about 23 years left of oil and gas reserves.
- c. Indonesian production of oil has been reduced from 1.3 million barrels a day in 2001 to about 900.000 barrels a day in 2011.
- d. The marine mineral resources is contributing to the world's rising need alongside new land-based development.



2. The importance of marine mineral resources

- e. Potency of marine mineral resources (I):
 - i. Gravel, sand, clay, earth, shell and stone: rich in silica, generally of low value.
 - ii. Marine Placer Deposits: gold and tin, can be found on the shallow continental shelf at some distance offshore.
 - iii. Phosphorite: currently no offshore mining is occurring or foreseen.
 - iv. Anhydrite and gypsum: abundant but low value.



2. The importance of marine mineral resources

- f. Potency of marine mineral resources (II):
 - v. Polymetallic sulfide: one of the more promising mineral resources of the sea.
 - vi. Manganese nodules: contain economically valuable concentration of nickel, copper, cobalt and other metals.
 - vii. Cobalt-rich ferromanganese crusts: occur in many coastal states outer continental shelf areas.
 - viii. Oil and gas.
 - ix. Gas hydrate: 10 times the value of current conventional gas and oil resources.
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3. Future of Marine Mineral Resources

Determining factors:

- a. Price of the minerals.
 - b. Development of science and technology.
 - c. Environmental impacts.
 - d. Policies of the Land Based Producers (LBPs).
 - e. Current metal market and oil and gas trends and predictions.
 - f. Strategic interest: may lead to potential conflict.
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4. Management of marine mineral resources (South China Sea Case)

- a. Indonesia sponsored Workshop Process on Managing Potential Conflicts in the South China Sea.
 - b. Technical Working Groups, Group of Experts Meetings, and Study Group Meetings.
 - c. 3 Coordinators on resources assessment: Indonesia (geological basin/hydrocarbon potentials), Vietnam (hard minerals) and Thailand (living resources).
 - d. Issue of political sensitiveness: hampering the advancement of the management of the resources of the South China Sea.
 - e. More discussions are required on the South China Sea.
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5. Conclusions

1. The prospect for marine mineral resources look promising for the future.
 2. The increasing industrialization in many countries would require more and more of those minerals, especially due to depleting land-based minerals.
 3. Nevertheless there are some factors that need to be considered and taken into account such as, metal market, science and technology, and the environmental consideration.
 4. The International Seabed Authority continues to observe and study those problems.
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Thank You



Round Table: Policy Issues for the Future



Joonsoo Jon

Professor, Business School, Sogang University, Korea

(전준수, 서강대학교 경영대학 교수)

Current Position:

Professor of Business School at Sogang University, Republic of Korea

Education:

- 1987: Ph.D. (International Transport Management & Logistics), Univ. of Wales, Cardiff (U.K).
- 1977 - 1979: M.S. (Transportation Management),State Univ. of New York , (U.S.A.).
- 1976 - 1977: M.B.A. (Marketing), Univ. of Ottawa, (Canada)
- 1967 - 1971: B.A. (English Language & Literature), Sogang Univ., Seoul (KOREA).

Professional Career:

- 1987: Adviser for the Korea Maritime and Port Administration
- 1987-1989: Research director of Korea Maritime Institute(Government Research Institute)
- 1989-present: Professor of Business Administration Department at Sogang Univ.
- 1991-1993: Dean of Student Affairs at Sogang Univ.
- 1991-1997: Resident adviser for SK Shipping
- 1995-present: Arbitrator of Korean Commercial Arbitration Board
- 1999-present: Adviser for the Federation of Korean Industries
- 1999-2002: Adviser for Ministry of Commerce, Industry and Energy
- 2002-2003: Teaching Professor at London City Business School
- 2002-present: Adviser for the Ministry of Foreign Affairs and Trade
- 2003-2004: Vice Chairman of Korea Trade Research Association
- 2005-present: Board Director of Hyundai Shipping
- 2005-2007: Dean of Sogang Business School
- 2005-2008: Commissioner of Incheon Port Authority

- 2008-2009: President of Korea Logistics Society
- 2008-present: Adviser for the Ministry of Land, Transport and Maritime Affairs
- 2008-2011: Director of Korean Association of Business Education Accreditation
- 2008-present: Adviser for the Korea Chamber of Commerce and Industry
- 2009: President of Korea Sea Lanes of Communication Study Group
- 2011-present: Board Director of Korea Maritime Foundation
- 2012-present: Board Director of Korea Institute of Ocean Science and Technology

Fields of Academic Expertise

Shipping Management, International Trade, Practical Trade Management, Multimodal Transportation, Logistics, International Logistics

※ Address:

#102 Sam Ill villa 97-2 Yonhee 3dong Seodaemungu, Seoul, Korea

Tel (O): (+82) 2-332-0985; Mobile: (+82) 10-5038-7140

Fax (O): (+82) 2-705-8519

Email: joonsoo@sogang.ac.kr

Round Table: Policy Issues for the Future



Keyyong Hong

Director, Korea Ocean Research & Development Institute
(홍기용, KORDI 본부장)

Dr. Keyyong Hong is the Director of Marine Structure & Plant Research Department of KORDI (Korea Ocean Research & Development Institute). He has a Bachelor and Master degree in the Department of Naval Architecture at Seoul National University, Korea and holds a Ph.D in the Ocean Engineering Program at Texas A&M University, USA. Since he joined to KORDI in 1994, he has been involved in various national R&D projects in the fields of wave energy converting technologies, hydrodynamic analyses of fluid-structure interactions in the ocean and marine pollution simulation and prevention technologies. He is currently the Chair of Ocean Energy Research Forum in the Korean Society for Marine Environmental Engineering.

Round Table: Policy Issues for the Future



Sang-Hoon Yeum

Secretary General, Korea Cruise Industry Forum

(염상훈, 한국크루즈 산업 포럼 사무총장)

Identification Information :

Name in Full : Sang Hoon, Yum

Age : 36

Date of Birth : 30th Oct 1976

Present Address : Club Thomas, 11F, Mireco, 80-6 Susong-dong, Jongro-gu Seoul

Telephone : +82 2 10 8287 7590

E-mail ; ceo@clubthomas.co.kr

Education and Qualifications:

University of Marvalnd

Work Experience:

CEO, Club Thomas

Secretary General of Korea Cruise Tourism Forum

Advisor of Korea Cruise Marketin Secretary General of Korea Cruise Tourism Forum Advisor of Korea Cruise Marketin