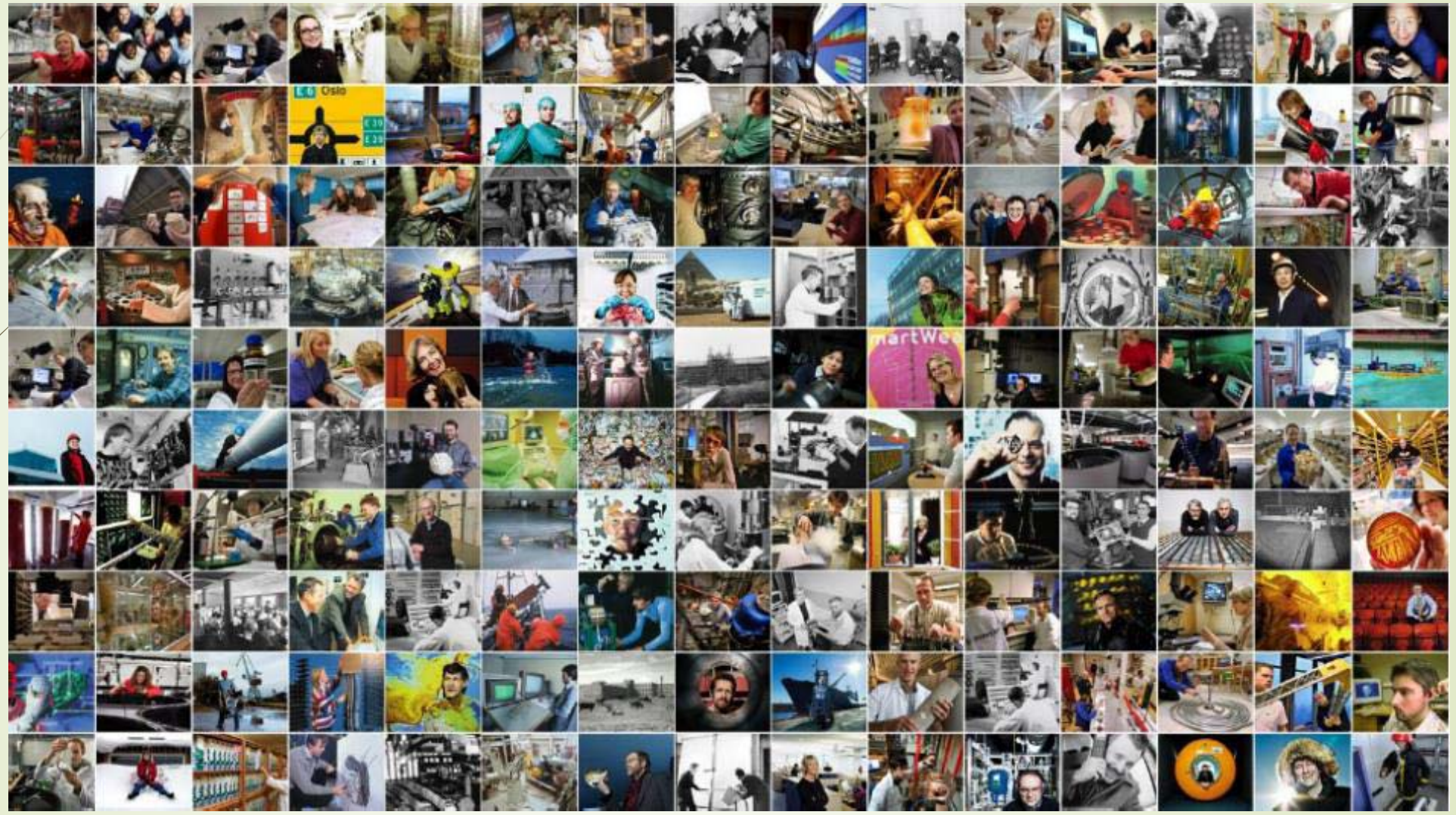
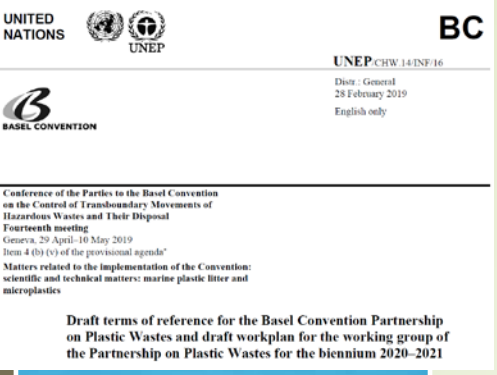
National Policy Workshop Webinar Series
On
Countermeasures for Riverine and Marine Plastic Litter in India
12 -22 May 2020

Session 4: Assessment of plastic pollution impact on natural capital and riverine and marine ecosystems needing policy intervention

Ocean Plastic Turned into an Opportunity in Circular Economy – OPTOCE

The Norwegian Foundation for Scientific and Industrial Research, SINTEF, is one of Europe's largest research organisations.

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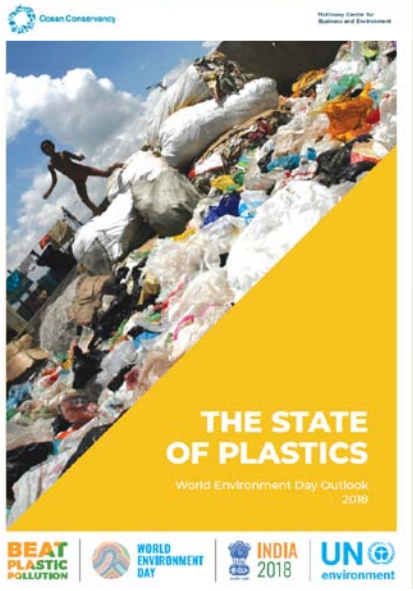
BASEL CONVENTION

Conference of the Parties to the Basel Convention
on the Control of Transboundary Movements of
Hazardous Wastes and Their Disposal
Fourteenth meeting
Geneva, 29 April–10 May 2019
Item 4 (b) (v) of the provisional agenda*
Matters related to the implementation of the Convention:
scientific and technical matters: marine plastic litter and
microplastics

Draft terms of reference for the Basel Convention Partnership on Plastic Wastes and draft workplan for the working group of the Partnership on Plastic Wastes for the biennium 2020–2021



Ocean Plastic Turned into an Opportunity in Circular Economy – OPTOCE

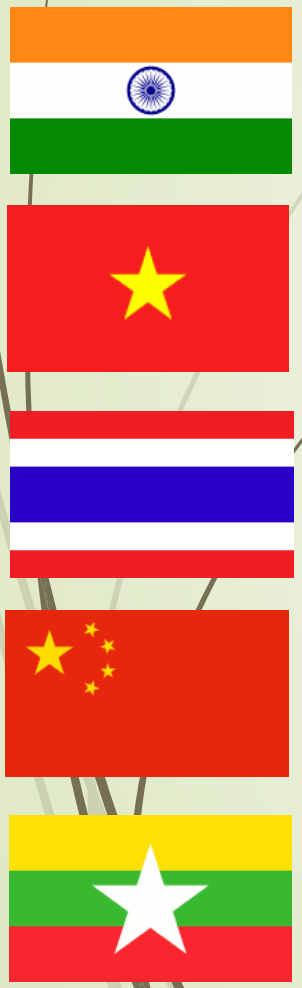
This project is a joint regional effort to address the main source of microplastics in the Ocean, namely inadequate treatment capacity for plastic wastes on land.

An estimated amount of 13 million tonnes of plastic leak into our oceans every year, harming biodiversity, economies and, potentially, our own health (The State of Plastics, 2018). It is estimated that more than 80% of marine debris comes from land-based sources and Asian countries are among the top contributors to marine litter and microplastics (Jambeck et al., 2015).

OPTOCE aims to investigate and document how the involvement of energy intensive industries can increase the treatment capacity for Non-Recyclable Plastic Wastes and thereby contribute to reduce the release of plastics to the Sea.

6.3 billion tonnes of plastic waste were created globally until 2015; out of this, only 9% has been recycled, while 12% has been incinerated and 79% dumped (Geyer et al. 2017). This implies that "billions" of tonnes of non-recyclable plastic waste is today accumulated in "dumpsites" around the world and slowly released to the Ocean!

A Super Important Region



The project involves India, China, Myanmar, Thailand and Vietnam, with the biggest rivers in the world and a population of almost 3 billion people, of which half live close to waterways.

OPTOCE countries are producing an estimated 176,000 tonnes of plastic waste every day, or 64 million tonnes/year, and have some of the highest releases of Plastics to the Sea. Large amounts of the plastic waste are dumped.

These five countries are major producer of world's cement, steel and electric power, in tens of thousands of plants using huge amounts of coal and contribute with a large chunk of the world's CO_2 emissions.

Plastic is made of fossil oil and contains more energy than coal; replacing parts of this coal consumption with non-recyclable plastic waste represents a win-win opportunity – preventing the plastic from ending up in the ocean, saving coal and reducing greenhouse gas emissions compared to dumping or incinerating the same waste.

Integrated waste management
Co-processing of wastes in energy-intensive industry

Improved waste treatment

Use of existing industry for waste management will increase the waste treatment capacity significantly.

Will be Cost-efficient.

Resource Efficiency

Will save large amounts of virgin non-renewable fossil fuels and raw materials.

Energy efficiency is much better than incineration/ WtE.

Emission reduction

Will reduce the need for building new incinerators and landfills – and contribute to reduce emissions of GHGs (methane and CO_2).

Potential pilot demonstrations under OPTOCE project

The project will investigate the environmental benefits of removing accumulated plastics from dumpsites and to use it as coal replacement in local cement plants and carry out on-site experiments to try to document what this means in avoiding future leaching of microplastics to the ocean.

The project will investigate the potential of collecting plastic waste and floating material from the Yangtze river - investigate the possibilities of using non-recyclable plastic waste from Asian paper recycling industry - investigate and showcase the potential of using segregated combustible fraction, including Plastic wastes, in local cement kilns as part of integrated waste management in several cities.

We want to showcase the potential through local proof of concept in all OPTOCE-countries – Pilot sites indicated

Planned Pilots in India

9.5 Million ton plastic waste is generated yearly in India and Municipal Solid Waste contains around 8% plastic fraction!

1. In a 18 month project approved by the Principal Scientific Advisor to Government of India, OPTOCE aims to test and compare the performance of treatment options for mined combustible wastes from the **Ghazipur dumpsite in Delhi,** in a 1) Cement kiln, 2) WtE Incinerator, and 3) Thermal Power plant.

2. **Goa** Waste Management Corporation aims to build a WtE Incinerator. OPTOCE will evaluate the cost and the environmental impacts of using a WtE Incinerator compared to the Cement kiln option.

3. Other possible pilots: OPTOCE aims to investigate and showcase the potential of using segregated combustible fraction, including Plastic wastes, in local cement kilns as part of integrated waste management in Agra (and possibly in Haridwar, due to Kumbh in 2021).

Project approved by Principal Scientific Advisor to Govt of India- 18 months Pilot Demonstration handling 75 000 tonnes of wastes

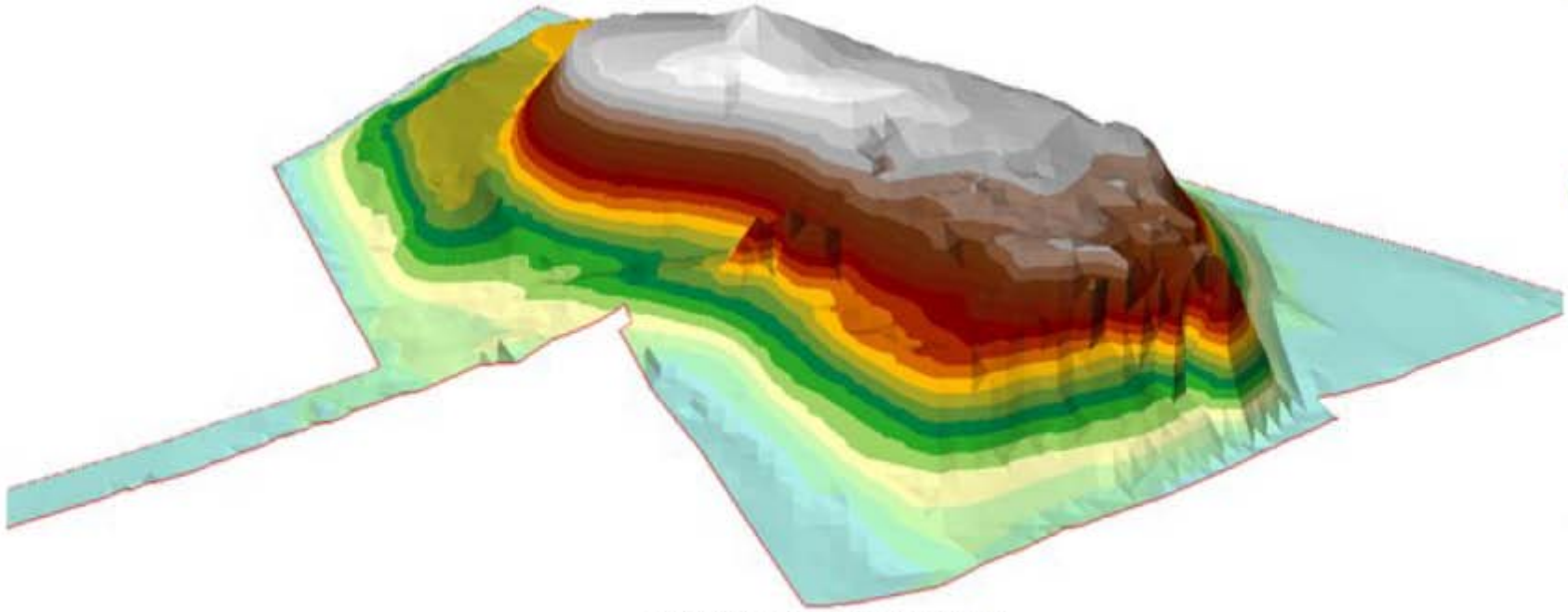
WASTE MINING & LAND RECOVERY OF THE GHAZIPUR DUMP SITE IN NEW DELHI

IL&FS Environment
IL&FS Environmental Infrastructure & Services Limited

CSIR CRRI

SINTEF

Gulmeher
Blossoming Lives



Contour Survey image of Ghazipur Dump Site , 2017

Scientific evaluation by SINTEF under the OPTOCE project

Test and compare mined Combustible wastes from Ghazipur in a cement kiln, a WtE and a thermal power plant.

Planned pilots in China 2020/2021

48.1 million tonnes of plastic waste is generated yearly in China

1. Investigate the potential of collecting plastic waste and floating material from the Yangtze river, and using it as fuel in a local cement plant in Zigui town upstream the Three Gorges dam.

2. Investigate the possibilities of using non-recyclable plastic waste from Jilin paper recycling plant located at the Songhua river as fuel in BBMG cement plant in Jilin.

Planned pilots in Thailand 2020/2021

3.3 million tonnes of plastic waste is generated yearly in Thailand

1. The objective is to investigate environmental benefits of removing accumulated plastics from four dumpsites and to use it as coal replacement at the INSEE cement plant in Saraburi.

2. Investigate how much microplastics is leaching from dumpsites into the environment and ocean by conducting on-site experiments.

กรมควบคุมมลพิษ
POLLUTION CONTROL DEPARTMENT

TEI THAILAND ENVIRONMENT INSTITUTE

Thailand PPP Plastic
Towards Sustainable Waste Management

ASIAN INSTITUTE OF TECHNOLOGY 1959

IUCN

INSEE
Building brighter futures

Planned pilots in Vietnam 2020/2021

2.8 million tonnes of plastic waste is generated yearly in Vietnam.

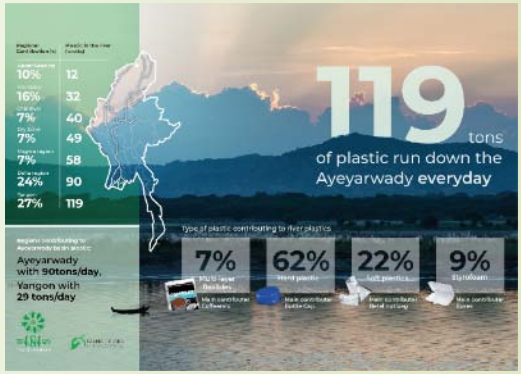
1. Investigate the possibilities of using non-recyclable plastic waste from Vietnam's largest paper recycling plant located in the Mekong river, as fuel in a cement plant in Hon Chong. It will be comparative study with the plant in Jilin, China.

2. OPTOCE will cooperate with UNDP in their project *'Plastic waste management in scaling up a socialised model of domestic waste and plastics management in five cities, Vietnam'.* The non-recyclable fraction of collected plastic waste will be co-processed in cement industry, if found feasible.

Planned pilots in Myanmar 2020/2021

600 000 tonnes of plastic waste is generated yearly in Myanmar

1. No cement plants ate currently co-processing wastes. OPTOCE aims to raise awareness, provide technical assistance and to build capacity in industry and among authorities about the potential of involving cement industry in future waste management activities.
2. If all the enabling factors are in place and cement companies invest in waste treatment and waste feeding system in kilns, a pilot demonstration can potentially be conducted in Myanmar in 2021.
3. The possible pilot demonstrations could be conducted with plastic wastes from Thilawa SEZ, segregated plastic wastes or combustibles from large dumping sites in Yangon and Mandalay or non-recyclable plastic waste from large recycling plants in Yangon.



MONREC · Environmental Conservation Department ECD · MPIA Myanmar Plastic Industries Association · SCG · APACHE · ALPHA CEMENT build your dreams · DOWA ECO-SYSTEM motivate our planet

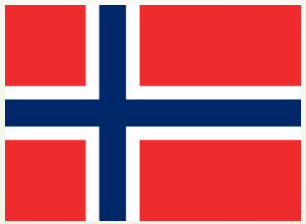


Lessons learned from the Pilot demonstrations will be shared through a Regional multi-stakeholder forum enabling awareness raising, south-south capacity building and replication.

In conjunction with the Regional Forum, SINTEF will organise the

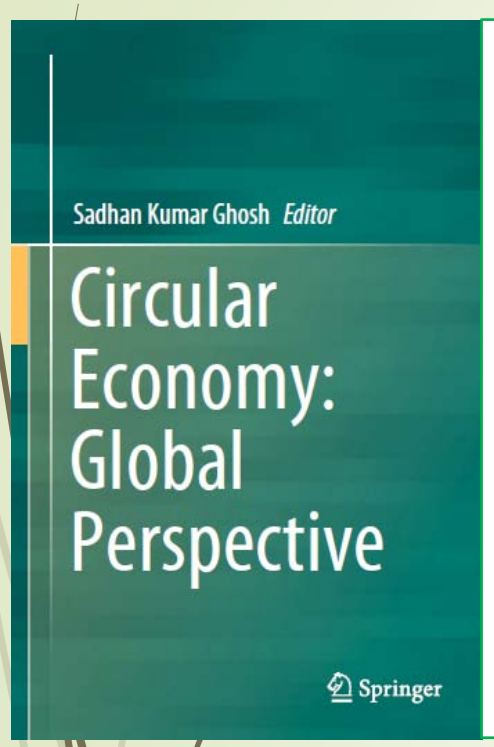
1st International Conference on Treatment Options for Non-Recyclable Plastic Wastes

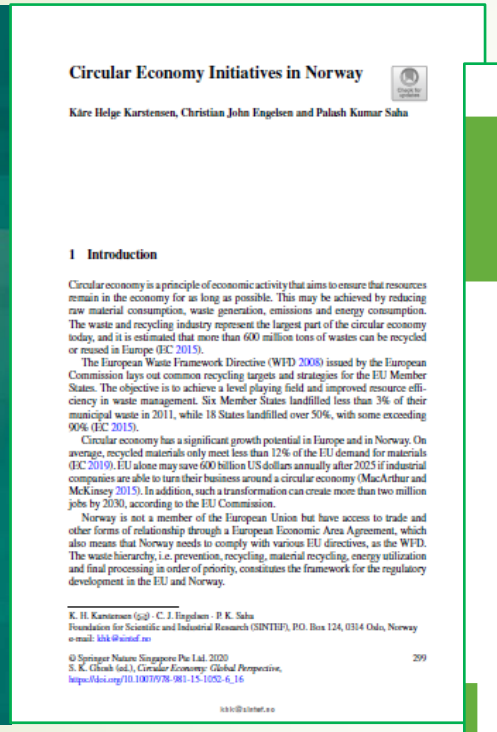
in Bangkok, 12-13 November 2020.


Project partners

We always publish our results and findings in International Journals and peer reviewed book chapters





Circular Economy Initiatives in Norway

Kåre Helge Karstensen, Christian John Engelsen and Palash Kumar Saha

1 Introduction

Circular economy is a principle of economic activity that aims to ensure that resources remain in the economy for as long as possible. This may be achieved by reducing raw material consumption, waste generation, emissions and energy consumption. The waste and recycling industry represent the largest part of the circular economy today, and it is estimated that more than 600 million tons of wastes can be recycled or reused in Europe (EC 2015).

The European Waste Framework Directive (WFD 2008) issued by the European Commission lays out common recycling targets and strategies for the EU Member States. The objective is to achieve a level playing field and improved resource efficiency in waste management. Six Member States landfilled less than 3% of their municipal waste in 2011, while 18 States landfilled over 50%, with some exceeding 90% (EC 2015).

Circular economy has a significant growth potential in Europe and in Norway. On average, recycled materials only meet less than 12% of the EU demand for materials (EC 2019). EU alone may save 600 billion US dollars annually after 2025 if industrial companies are able to turn their business around a circular economy (MacArthur and McKinsey 2015). In addition, such a transformation can create more than two million jobs by 2030, according to the EU Commission.

Norway is not a member of the European Union but have access to trade and other forms of relationship through a European Economic Area Agreement, which also means that Norway needs to comply with various EU directives, as the WFD. The waste hierarchy, i.e. prevention, recycling, material recycling, energy utilization and final processing in order of priority, constitutes the framework for the regulatory development in the EU and Norway.

K. H. Karstensen (✉) · C. J. Engelsen · P. K. Saha
Foundation for Scientific and Industrial Research (SINTEF), P.O. Box 124, 0314 Oslo, Norway
e-mail: khk@sintef.no

S. K. Ghosh (ed.), *Circular Economy: Global Perspective*,
https://doi.org/10.1007/978-981-15-1052-6_16

1 CO-PROCESSING

Ocean plastic: an opportunity in the circular economy?

Initiatives are under way to address the global issue of plastics litter in the oceans. Norway's SINTEF highlights the use of co-processing in the Ocean Plastic Turned into an Opportunity in Circular Economy project.

■ *by Dr Kåre Helge Karstensen, Palash Kumar Saha, Eirik Vigerust, Anneli Alatalo Poulsen, Dr Christian John Engelsen and Dr Mehdi Ahmadi, Foundation for Scientific and Industrial Research (SINTEF), Norway*

Mixing of plastic wastes at a dumpsite in Thailand

International action is key to addressing the most significant sources of plastics litter in the oceans, ie insufficient waste management in developing countries and emerging economies, especially connected to major world river basins, dumpsites, landfills and industrial hotspots. It is estimated that more than 80 per cent of marine debris comes from land-based sources with Asian countries among the top contributors to marine litter and microplastics.

The Ocean Plastic Turned Into an Opportunity in Circular Economy (OPTOCE) project funded by the Norwegian government seeks to showcase that the involvement of resource- and energy-intensive industries, such as cement manufacturing, may increase the treatment capacity for non-recyclable plastic wastes and constitute a fundamental pillar in the circular economy.

Recycling of plastic wastes is the preferred option, but not all plastic waste is suitable for recycling. The demand for recycled plastics is low and the recycling sector has suffered from low commodity prices. In terms of resource efficiency, it is particularly important to prevent landfilling or dumping of plastic waste, where plastics might be converted to methane and microplastics.

Energy recovery from wastes (and plastics) in municipal solid waste incinerators with waste to energy (WtE) normally involves generation of electricity in steam turbines, but the efficiency is usually poor. Moreover, such plants are expensive to build and operate, they represent an additional emission source and produce large amounts of residues (fly ash, bottom ash, etc) that still need to be landfilled. Another challenge is the incineration of wet wastes in the rainy season, which causes difficult burning conditions and results in poor emissions.

Countries with a cement industry may, to a certain degree, forego building expensive incinerators. Cement kilns are already in operation and may increase the waste treatment capacity significantly if integrated into the waste management strategy. This could represent a win-win solution as the plant would reduce their coal consumption by recovery of wastes and non-recyclable plastics, with an energy efficiency far higher than WtE plants. They are usually cost-efficient, do not produce any residues that need disposal and the emissions of greenhouse gases (GHGs) are reduced compared to landfilling or waste incineration.

Partners in OPTOCE

The five partner countries in OPTOCE – China, India, Myanmar, Thailand and Vietnam – currently have few environmentally sound treatment options for plastic wastes, but thousands of cement-, steel- and coal-fired power plants that use large amounts of coal and emit a large share of the world GHGs. Replacing some of this coal with waste plastics (and MSWs) will be an environmentally sound practice compared to dumping or building new incinerators.

Pilot demonstrations

Co-processing is still at its infancy in most Asian countries and OPTOCE aims to carry out pilot demonstrations in local plants to investigate the feasibility. The objective is to prove the concept under various local conditions and circumstances as well as to cover a range of representative scenarios, uncover limitations of the practice, and provide scientifically valid answers to common myths and perceptions.

The pilot demonstrations will document the performance, ie describe the plastic waste co-processing capacity, environmental performance, cost- and energy efficiency, the need for pre-treatment and preparation of the plastic wastes prior to co-processing, limitations in types and volumes of plastic wastes which can be co-processed, among other factors.

The overall aim is to provide a quantitative and qualitative assessment of how the involvement of private industry

76 ALTERNATIVE FUELS

Asia's plastic potential

With the highest consumption of plastic in the world and representing two-thirds of global cement production, five Asian countries provide the opportunity to address the worldwide issue of non-recyclable plastic waste.

■ *by Dr Kåre Helge Karstensen, Palash Kumar Saha, Eirik Vigerust, Anneli Alatalo Poulsen, Dr Christian John Engelsen and Dr Mehdi Ahmadi, SINTEF, Norway*

A total of 6.3bnt of plastic waste was created globally until 2015. Of this, only nine per cent was recycled, 12 per cent incinerated and 79 per cent dumped. If continued, 12bnt of plastic waste will be mismanaged by 2050.[1]

The Norwegian-funded project Ocean Plastic Turned into an Opportunity in Circular Economy (OPTOCE) is a regional effort to address the main source of microplastics in the ocean, namely inadequate treatment of plastics on land. The project involves India, China, Myanmar, Thailand and Vietnam – countries that include the biggest rivers in the world and a population of almost 3bn people, of which half live near waterways.

Combined, these countries have the highest plastic consumption in the world, producing an estimated 176,000tpd of plastic waste, or around 64Mta, of which large volumes are dumped. OPTOCE aims to investigate and document how the involvement of resource- and energy-intensive industries, such as cement manufacturing, can increase the treatment capacity for non-recyclable plastic wastes (NRPW).

Collection of plastic in Binh Duong, Vietnam, January 2020

Those five countries produce two-thirds of the world's cement, steel and electric power in tens of thousands of plants that use huge amounts of coal and contribute more than 30 per cent of the world's CO_2 emissions. Plastic waste is made of fossil fuel and contains more energy than coal. Therefore, replacing parts of this coal consumption with non-recyclable plastic waste represents a win-win opportunity, preventing the plastic from ending up in the ocean and reducing greenhouse gas (GHG) emissions indirectly compared to dumping or incinerating the same waste.

The potential of integrating the energy-intensive cement industry with plastic waste management is enormous. However, it is important to show that it works locally. SINTEF's initial estimates highlight that the cement industry in the five countries can theoretically co-process all the plastic waste generated, provided reasonable distances are taken into account. This could amount to reducing the coal consumption by more than 60Mta.

The following sections outline current plastic production, consumption, waste generation and management, as well as the potential for co-processing non-recyclable plastic waste in India, China, Myanmar, Thailand and Vietnam.

Plastic waste is sorted into recyclable and non-recyclable fractions

China baseline

China is the world's largest plastic producer and consumer, producing 81Mt

COVID-19

The generation of Covid-19 health care wastes rose by 600% in Wuhan in the middle of the Corona outbreak and there was an urgent need for extra disposal capacity. Huaxin cement reached out and made four of their kilns in Hubei and Yunnan available and disposed of in total 170000 kg of health care wastes like plastic gloves, shields, personal protective equipment and non-infected items.

Covid-19 health care wastes contained in sealed hard plastic boxes

TEXT **Dr. Kåre Helge Karstensen**, Chief scientist, Foundation for Scientific and Industrial Research – SINTEF, Oslo/Norway
Dr. Wang Jiajun, Assistant to Vice President of Huaxin Cement Co., Ltd., Wuhan/China

SINTEF | HUAXIN CEMENT CO., LTD.

Cement industry in China assisted with disposal of Covid-19 healthcare waste

1 Dried floating material from the Yangtze river to be co-processed at Huaxin Zigui cement in Hubei Province

1 Co-processing in the Chinese cement industry

SINTEF terminated in 2017 a twelve-year project on co-processing of wastes with the Ministry of Ecology and Environment and the Chinese cement industry. The project carried out pilot demonstrations and test burns with many different wastes all over China and contributed to establishing the regulatory and technical foundation for co-processing. When the project started in 2005, only one cement plant had started with initial co-processing – the number of plants practicing co-processing today is more than 100. Tens of millions of

Some examples of Press coverage

THỜI ĐẠI
VIETNAM TIMES
The Vietnam Union of Friendship Organizations

HOME | NEWS | SOCIETY | ECONOMY | EDUCATION | HEALTH
MENU | E | OVERSEAS VIETNAMESE | TRAVEL | ENTERTAIME

10/17/2019 12:02:08 AM

HOME » SOCIETY

10/6/2019 10:44:19 AM

Ocean Plastics turned into an Opportunity in Circular Economy project launched in Vietnam

Ocean Plastics turned into an Opportunity in Circular Economy (OPTOCE) Project was officially launched in Vietnam on October 4.

At the ceremony in Ho Chi Minh city. Photo: Hanoi Times

Norway-funded project turns ocean plastic into material for circular economy

Updated at Saturday, 05 Oct 2019, 13:14

The Hanoitimes **- Vietnam is among five beneficiary countries of the project, which aims to use th waste as a source of energy in local intensive industries.**

The Embassy of Norway in Vietnam has launched the Ocean Plastic Turned into an Opportunity in Circul Economy (OPTOCE) project from which Vietnam is one of five beneficiary countries besides China, Indi Myanmar and Thailand.

Norwegian Ambassador to Vietnam Grete Løchen. Photo: Norwegian Embassy in Hanoi

Attending the seminar included around 40 participants representing the MONRE, the Vietnam Environment Administration, the United Nations Development Program (UNDP), the United Nations Industrial Development Organization (UNIDO), the International Union for Conservation of Nature (IUCN), DONREs, and representatives from industries, academia and NGOs.

VnEconomy

TRANG NHẤT | THỜI SỰ | TÀI CHÍNH | CHỨNG KHOÁN | DOANH NHÂN | ĐỊA ỐC | THỊ TRƯỜNG | THẾ GIỚI

Rác thải nhựa: Cơ hội mới cho ngành xi măng, thép và điện?

Ứng dụng công nghệ đồng xử lý (co-processing) hứa hẹn mang đến tiềm năng lớn cho các ngành công nghiệp dùng nhiều năng lượng như sản xuất xi măng, thép và điện...

Tiến sĩ - nhà khoa học Kåre Helge Karstensen, Giám đốc Chương trình OPTOCE.

SINTEF

Scientists want to reduce the inflow of plastic to the ocean from Asian countries

4.2.2019 08:58:22 CET | SINTEF

Share

Plastic littering of the oceans is one of the world's biggest environmental problems. Now scientists from SINTEF will instead try to exploit the opportunities offered by the waste.

Thailands Tidende

Her fjernes plast fra en fylling i Nakhon Nayok, som en demonstrasjon. *Foto: Optoce*

14. juni 2019

Sintef skal hjelpe Thailand med plastproblemene

Some examples of Press coverage

Retter fokus på plaststrømmen fra asiatiske land

6. februar 2019 09:53 | Av Redaksjonen | Tips redaksjonen om en historie

Plastforsøpling av havområdene er ett av klodens største miljøproblemer. Nå vil forskere fra SINTEF i stedet prøve å utnytte mulighetene som avfallet gir.

Å fjerne mikroplast fra havet har vist seg å være vanskelig. Den største plastopphopningen vi kjenner til, The Great Pacific Garbage Patch, har fått mye oppmerksomhet de siste årene. Nylig returnerte et havgående fartøy tilhørende det nederlandske prosjektet "Ocean Clean-up" til San Fransisco med ødelagte lenser etter fire måneder til havs, etter forgjeves å ha forsøkt å bringe noe av søppelet til land.

Les også: Ny hydrogen-lab åpner for grønnere lakseproduksjon

– Den beste strategien er å forsøke å forhindre at plast og avfall bringes ut i havet i første omgang, sier sjefforsker Kåre Helge Karstensen i SINTEF.

De største bidragene til forsøplingen skyldes avrenning fra industriområder og avfallsfyllinger til de store elvene, særlig i Asia. Hvis avfallsbehandlingen i disse områdene forbedres, spesielt i lavinntektsland og fremvoksende økonomier, kan fremtidig tilsig reduseres betydelig.

ASIA-PLAST: Bildet viser blandet industrielt plastavfall i Gujarat i India, et eksempel på de store miljøutfordringene som forårsakes av plast. FOTO: KÅRE HELGE KARSTENSEN

Norsk forskningsprosjekt kan redusere asiatiske miljøutslipp

Sintef-forskere jobber med et prosjekt som kan løse både plast- og kullproblematikken i flere asiatiske land.

Linn Blomkvist
Journalist

Publisert 26. apr. kl. 23:34
Oppdatert 27. apr. kl. 11:18

Norway-funded project to help turn ocean plastic into development chances

| vna | October 05, 2019 04:19 PM

A project funded by the Norwegian Government made debut at a seminar in Ho Chi Minh City on October 4, aiming to help Vietnam turn plastic wastes from the oceans into chances in a circular economy.

Environmental workers sort waste on a beach of Ha Long Bay in Quang Ninh province (Photo: VNA)

Vietnam is one of the five Asian countries to benefit from the "Ocean Plastic Turned into an Opportunity in Circular Economy" (OPTOCE) project, apart from China, India, Myanmar and Thailand.

In order to rid the oceans of plastic, we first have to get rid of plastic on land. Cement factories in Asia may be part of the solution. Photo: Unsplash.com

Cement factories can put the brakes on global plastic pollution

Researchers believe that plastic refuse can be used as fuel in cement factories in Asia. If this works, it may provide a solution to two of the planet's biggest environmental problems – plastic in the oceans and high levels of coal consumption.

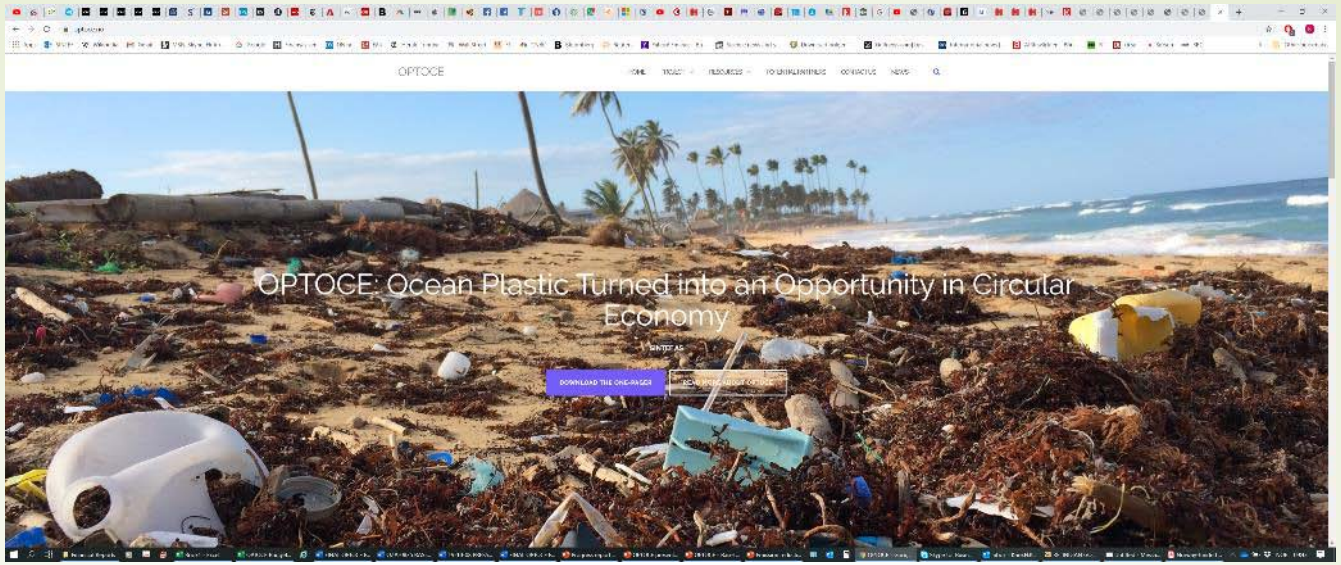
Concluding remarks

- Our initial estimates show that the cement industry in the five countries can theoretically Co-process all the plastic waste generated by replacing in average 10-20% of their coal usage, which would amount to millions of ton coal/year – a solution worth considering?

- Substituting parts of coal consumption in resource and energy intensive industries with non-recyclable plastic waste represents a win-win opportunity – preventing the plastic from ending up in the ocean, saving coal and reducing greenhouse gas emissions compared to dumping or incinerating the same waste.

- Co-processing concept represents circular economy in practice and incorporates waste treatment with existing industrial production, which is also preferred to Incineration and Landfilling in the internationally accepted Waste Management Hierarchy.

- International action is key to tackle the most significant sources of plastics litter in the oceans, i.e. insufficient waste management in developing countries and emerging economies, especially connected to major world river basins, dumpsites/landfills and industrial hotspots.



Dr. Kåre Helge Karstensen,
Chief scientist and Programme manager,
SINTEF, Norway

khk@sintef.no
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