Renewable Energy and Climate Action:

The Future of Japan and Sweden Cooperation

SPECIAL PAPER
September 2022

Institute for Security & Development Policy

一般財団法人
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Kajima Institute of International Peace

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Abbreviations

4IR	Fourth Industrial Revolution
BBB	Build Back Better
CBD	Convention of Biological Diversity
CCUS	Carbon Capture, Utilization, and Storage
COP	Conference of the Parties
DES	Deep Eutectic Solvents
EIA	Environmental Impact Assessment
ESG	Environmental, Social and Governance
EU	European Union
EWN	Engineering with Nature
FCHV	Fuel cell hybrid vehicles
FCV	Fuel cell vehicles
GHG	Greenhouse gas
GRI	Global Reporting Initiative
IAS	Invasive Alien Species
IBA	Impact Benefit Agreement
IDC	Internal Displacement Monitoring Center
IFRS	International Financial Reporting Standards
ILO	International Liberal Order
IPCC	Intergovernmental Panel on Climate Change
IRENA	International Renewable Energy Agency
ISDP	Institute for Security and Development Policy
ISSB	International Sustainability Standards Board
KIIP	Kajima Institute of International Peace
MCS	Monitoring, Surveillance and Control
NBS	Nature Based Solutions
NDC	Nationally Determined Contributions
NFRD	Non-financial Reporting Directive
PV	Photovoltaic
SIA	Social Impact Assessment
TCFD	Task force on Climate change-related Financial Disclosures
TWh	Terrawatt-hour
UN	United Nations
UNEP	United Nations Environment Program
U.S.	United States
USGS	U.S. Geological Survey
WMO	World Meteorological Association

Contributors

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Mr. Tatsuo Shikata & Dr. Jagannath Panda

Foreword

In 1966, four years after the Cuban Missile Crisis, a year after the beginning of the strategic bombing of North Vietnam by the United States Navy (Operation Rolling Thunder), at the height of the Cold War in Northeast Asia, Kajima Institute of International Peace (KIIP) was founded by Dr. Morinosuke Kajima. A former diplomat, member of the House of Councilors, chairman of the Kajima Corporation, and a renowned diplomatic historian, he founded KIIP to help Japan adapt to a changing environment and contribute to world peace through research, study, and publication. Dr. Kajima's *A History of Japanese Diplomacy 1894-1922*, won the Foreign Minister's Prize in 1973. In addition, the Diplomatic Studies Group, which has met almost monthly since its establishment, now counts 616 meetings as of February 2020, although it has been forced to suspend meetings during the COVID-19 pandemic.

After Dr. Kajima's death in 1982, KIIP was taken over by his son-in-law, Wataru Hiraizumi (the author's father), a former diplomat and member of the House of Representatives, fluent in English, French, German, and Russian. However, as a member of the House of Representatives from a highly competitive rural district with 27 general elections in the 75 years since the end of the war (actual term of office was about 2 years and 10 months), my father curtailed KIIP activities, which involved research and study of foreign policy that "does not win votes".

After my father's death in 2015, KIIP was taken over by the author. Unlike the previous two generations, the author was neither a diplomat nor a politician, only a businessman. However, he was appointed by the Board of Trustees and the Board of Directors as the 'custodian' chairman, so to speak, because he had assisted his predecessor for some 20 years and was director of the Kajima Corporation, landlord of the building where the foundation resides. In the six years since, the author has been engaged in research group activities to make bold and impactful proposals in important but unnoticed policy areas. Not as a famous government-

affiliated foundation that cannot deviate from the administration's policies, but as an unknown independent foundation that can take risks. Our goal has been to make bold, impactful recommendations in important policy areas that otherwise receive little attention. To borrow a phrase from one of our trustees: "Get out *The Limits to Growth*," a 1972 report published by the Swiss think tank, the Club of Rome. But this is not easy, we already have 25 research projects on a cumulative basis.

The objective of this project were to recommend policies that would encourage the private sector—which makes up the bulk of the economy in both countries—to take an active role in combating climate change. The ways to achieve the ends were through lectures and question-and-answer sessions with experts on relevant subject matters. The schedule and titles of the lectures (only the titles of lecture are given; it would be too cumbersome to list the lecturers and their affiliations due to protection of privacy) are shown in the table.

Month	Agenda	Lecture Title of ISDP's Lecturer	Lecture Title of KIIP's Lecturer
May	Kick-Off: Presentation by Members	"Climate Change and Environmental Policies"	"Proposal for Objective, Strategy, and Agenda of the Project"
June	Sweden-Japan Climate Cooperation (Open Online Lectures)	"How Sweden Takes on Climate Change!"	"Achieving Net Zero GHG Emissions by 2050 in Japan"
July	**Summer Vacation**		
August	Presentation by Members II	"Regularity Designs on Climate Change & Renewable Energy: Juxtaposing the EU, Swedish and Japanese Model"	"Global Warming; All Emissions, Heat, Wastewater and Ocean"

Month	Agenda	Lecture Title of ISDP's Lecturer	Lecture Title of KIIP's Lecturer
September	Climate Change Accounting	"Accounting Practices and Climate Change Cooperation between Sweden and Japan"	"Several Discussion Points for Evolving a Common Framework for a Sustainable Disclosure System"
October	Climate Change Related Technologies that Japan & Sweden Have Competitive Advantage	"People Friendly Cities in a Data Rich World: Implications for Sweden and Japan"	"Japan-Originated Technology Assets to Solve Climate Change-Driven Problems"
November	*ONLINE SYMPOSIUM: Renewable Energy and Climate Cooperation*		
December	**Winter Vacation**		
January	Green Finance with Emphasis on Private Equity	"Green-Transition Investments in the North of Sweden"	"Green Finance in the World & in Japan"
February	Roles Central versus Local Governments Play	"Cities and Climate Change in Sweden"	"Inter-governmental Relations in Japan: Administrative and Fiscal Issues"
March	Climate Change and Public Private Partnership	"Innovation and Collaboration as mechanism for sustainable development Urban Innovation governance - Part of a New Narrative for Economic Growth"	"Climate Change x PPP"

Month	Agenda	Lecture Title of ISDP's Lecturer	Lecture Title of KIIP's Lecturer
April	International Sustainability Standards	"ISSB's Draft on International Accounting Standards"	"How ISSB Would Pave the Way for Climate Finance and Sustainable Finance Globally and Nationally"
May	Putting Together Policy Recommendations		
June	Concluding Symposium in Stockholm		

In my opinion, as far as Japan is concerned, the only policy recommendation I could propose was to "adopt the European version of the sustainability standard (different from the International Sustainability Standards Council's under the IFRS), which will be mandatory in the EU from the fiscal year beginning January 1, 2023 without triggering drastic mitigation measures and delaying its introduction." The effects of the system change will be felt as they were in the accounting Big Bang of 2000. We believe this has the potential to become the 'Reiwa-Era Black Ship,' triggering the opening and modernization of Japan as Commodore Perry's Black Ships did. However, depending on the impact of Russia's invasion of Ukraine on the global and European economies, there is no denying the possibility of indefinite postponement.

The one-hour lecture and Q&A session on this project did not provide enough information on industries and technologies that have a competitive advantage where climate change is concerned, and it was not possible to discuss which industries and technologies should, and to what extent, receive preferential tax treatment and accelerated depreciation. However, Hajime Kobayashi, a project member, one of the lecturers and director of the Kajima Institute of International Peace, introduced *Drawdown*, edited by Paul Hawken in 2017. The book offers a variety of climate change countermeasures. These policy proposals should broaden horizons, not

only encouraging consideration of renewable energy alternatives, but also reducing refrigerants, and eliminating food waste, and so on.

Green Finance is a growing field, but its future is unpredictable in this period of slowing economic growth caused by COVID-19, Russia's invasion of Ukraine, and the stagflation seen for the first time in 50 years. Therefore, we do not believe that this is the right time to make policy recommendations.

As former Ambassador to Japan Lars Vargö pointed out, the relationship between central and local governments and the nature of public-private partnerships are complex structural problems, and solutions to these problems in Japan will require new research and development. A research project is underway at the Kajima Institute of International Peace to make policy recommendations on the division of roles and relationships between central and local government, primarily against the backdrop of population decline.

In my view, the project did not achieve the desired results within the original one-year timeframe. As research progressed, more issues emerged, and the project seemed to lose focus. We knew that the task of formulating policy recommendations promoting climate change action in the dialogue between Japan and Sweden was a major one. And although we narrowed our focus to listed companies in the private sector that should comply with international accounting standards, this alone was not enough to bring a coherent set of recommendations due to differences in institutional context (e.g., the relationship between central and local governments). In addition, as far as the Kajima Institute of International Peace is concerned, the fact that the Institute had fewer contacts in the Agency for Natural Resources and Energy, the Ministry of the Environment, and climate change scholarship than in the diplomacy and security fields was a major problem. I am not sure if we could have arranged the best possible lecturer for the theme, or if we should have filled the team with members besides board members and visiting researchers.

Nonetheless, I believe that we were able to gain valuable knowledge on climate change in Sweden and Japan. First, on climate change, the creation

of the International Sustainability Standards Board. Without this project, we would not have been aware of its existence before its announcement on November 3 during COP26, and although it was only about five months ahead of schedule, it was very helpful in exchanging views with stakeholders and establishing our perspective on its impact.

Another major finding was the Summary of Solutions by Overall Ranking published in *Drawdown*. I had never heard of this book, published in April 2017 in the US and in January 2021 in Japan, because my usual bookstore visits were interrupted by COVID-19. The book was outside my orbit and published in Japan by Yamatokeikoku-sha, publisher for mountaineers, not Nikkei or Tokkei, management and economics book publishers. I only learned of it at a lecture given by Mr. Kobayashi in October. The lecture was very insightful, expanding the scope of climate change countermeasures to include banning of refrigerants, reduction of food waste, plant-based diets, etc., things diminished besides the usual calls for renewable energy and nuclear power.

Although not directly related to climate change countermeasures, I was able to gain a glimpse of Swedish society through the ISDP members participating in the project and Swedish expert lecturers brought in by ISDP. Equally beneficial was that my view of Japanese and Swedish society in comparison could be reinforced and revised. In a nutshell, Sweden is an 'adult country' that recognizes environmental changes as soon as they occur, logically and scientifically discusses countermeasures, and adapts to the new environment. On the other hand, Japan is a 'child country' that attempts to ignore environmental changes and eludes adapting to them. Japan rejects, resents, and resists, per Elisabeth Kübler-Ross' death acceptance process. Both society and the media sympathetically tolerate this indignant inaction, postponing inevitable adaptation and passing the bill to the next generation. Sweden can remain 'mature' because its population is just ten million, 1/12th of Japan's. The impact of increased immigration, therefore, should be closely monitored. Conversely, for Japan, an examination of the appropriate size of local governments in the age of the Internet, social media, and AI leads us to believe that we should consider a federal system that divides the country into twelve

municipalities each with a population of about ten million and the right to self-determination. Unlike at the time of the Meiji Restoration, Japan now has a per capita GDP of roughly $40,000, and individuals can pursue happiness if allowed a more diverse way of life.

Finally, although this project did not achieve its intended purpose, it did make us realize the significance of conducting joint research with an institution in a country with a different historical and cultural context. It gave us hope that the clash of values will produce groundbreaking results. Therefore, we have decided to accept ISDP's proposal for joint research and to present it to the Board of Directors meeting in September this year for approval to discuss the possibility of conducting a joint research project in the field of diplomacy and security, where KIIP has a strong reputation and personal connections, starting in January 2023 (KIIP's fiscal year runs from April to March of the following year).

Nobuyuki Hiraizumi, President
Kajima Institute of International Peace
June 30, 2022

I

Renewable Energy and Climate Action in Sweden and Europe

Sweden and Renewable Energy: Context of Carbon Tax and a Vision for Circular Economy

Lars Vargo and Eerishika Pankaj

Sweden's carbon tax

Climate change is one of the most pressing challenges facing the international community. A broad range of policy instruments can be used to curb carbon emissions, and economic instruments such as taxes and emissions trading are critical elements of any comprehensive mitigation strategy.

Pricing carbon emissions is a way of applying the 'polluter pays' principle, in which the costs of pollution are borne by those who cause it. This ensures that emissions are reduced in the most cost-effective way, while stimulating the development and deployment of new, clean technologies.

Energy sources were first taxed in Sweden in the 1920s. A carbon tax was instituted in 1991, alongside an already existing energy tax, and it remains a cornerstone of Swedish climate policy. Over time, the carbon tax has increased in importance, contributing to a broad range of environmental and climate objectives. For example, the carbon tax provides incentives to reduce energy consumption, improve energy efficiency and increase the use of renewable energy alternatives.

The carbon tax is levied on all fossil fuels in proportion to their carbon content, as carbon dioxide emissions released in burning any fossil fuel are proportional to the carbon content of the fuel. It is therefore

not necessary to measure actual emissions, which greatly simplifies the system. Combustion of sustainable biofuels does not result in a net increase of carbon in the atmosphere and hence are not subject to carbon taxation.

Swedish carbon tax rates

The carbon tax was introduced in 1991 at a rate corresponding to SEK 250 (EUR 25) per ton fossil carbon dioxide emitted, and has gradually been increased to SEK 1,200 (EUR 118) in 2022. By increasing the tax level gradually and in a stepwise manner, households and businesses have been given time to adapt, which has improved the political feasibility of tax increases. A lower tax rate has historically been applied to industry outside the EU Emissions Trading System (EU ETS), while industry covered by the system is entirely exempt from carbon tax. As of 2018, however, the industry rate outside the EU ETS is the same as the general rate.

Sweden's carbon tax generates considerable revenues for the general budget (there is no 'earmarking' of tax revenues in Sweden). General budget funds may, however, be used for specific purposes linked to the carbon tax, such as addressing undesirable distributional consequences of taxation or financing other climate-related measures.

Transport sector transitioning for the climate

Sweden's ambition is to be the world's first fossil-free welfare nation. Currently, the transport sector accounts for almost one-third of greenhouse gas emissions in Sweden. It is the sector in Sweden with the best chances of quickly being able to transition to become fossil free. Therefore, it is logical that the transport sector makes this shift. The entire sector must come together, and both the public and private actors must do their share.

Swedish parliament has decided to reduce greenhouse gas emissions from domestic transport (aviation excluded) by 70 percent by 2030 at the latest, compared to 2010. The general national objective of zero emissions by

2045 means that greenhouse gas emissions from several sectors, including transport, have to be part of the equation. Therefore, Sweden aims to rapidly electrify the transport systems and transition to sustainable renewable fuels, in combination with increased transport efficiency. In a transport efficient society, the most suitable mode of transport is used for every specific transport, each mode of transport is used as efficiently as possible, and unnecessary transports are avoided.

A circular economy

The transition to a circular economy has great potential to reduce resource use, thereby limiting climate and environmental impacts. Enterprise and innovation, based on circular material flows and business models, can strengthen the development of a resource-efficient, non-toxic, circular and bio-based economy throughout the country. Virgin materials must be replaced as far as possible by resources used efficiently in circular flows. Account must be taken of the need to use additional virgin materials in enabling the climate transition and recycling of materials.

This Swedish strategy provides support and direction for actors in the business sector, the public sector, universities and other higher education institutions, and civil society, as well as for private individuals who want to realize business opportunities and make conscious choices on the basis of the circular transition. Regardless of who is in power, the Government must clear away obstacles, strengthen competitiveness, increase incentives and contribute to long-term conditions for the circular transition of society.

The transition to a circular economy is a tool to achieve national and international environmental and climate objectives, not least the Sustainable Development Goals in the 2030 Agenda. Progress needs to be tracked through a selection of the indicators in existing tracking systems for these goals and objectives.

The present environmental objectives consist of one generational goal, sixteen environmental quality objectives and several milestone targets.

The generational goal – to hand over to the next generation a society in which the major environmental problems have been solved, – is an overall goal for Sweden's environmental policy.

Circular economy contributes to several of the 17 Global Goals for Sustainable Development in the 2030 Agenda. The Agenda's Goals cover all three dimensions of sustainable development: the economic, social and environmental dimensions.

In a circular economy, material of both biological and non-biological origins circulate in the technical cycle. Biological material can first circulate in the technical material cycle and then, when the value of the material can no longer be maintained, be returned to nature in the biological material cycle. In the technical material cycle, products can be handled through rental, leasing or return systems for reuse to prolong their lifespan and increase the use of every product, reducing the need to manufacture new products. Promoting innovation and new business models along the whole circular flow is an important step towards succeeding in this transition.

Handling materials in a more circular way in the biological and technical cycles can reduce value leakage from the material flows in society, as well as the quantity of waste that needs to go to disposal and therefore cannot be used as a resource.

Bio-based products that replace fossil-based products play an important role in a circular economy.

Companies that see waste as a resource in various ways – for instance through 'industrial symbiosis' in which one company uses another company's waste as a resource in its own production and processes – is also essential. In a circular economy, companies design their products and components to be long-lasting, so that they can, when needed, be repaired, modernized and finally recycled when they can no longer be reused. In combination with digital and service-based business models

that make more efficient use of the products – for example, through rental or reuse as well as optimized product use – a transition to a more circular economy can increase the efficiency of resource use. Physical products can be replaced with digital equivalents that can be combined to further reduce materials use. This is important since all use of resources, of both renewable and non-renewable resources, leads to various forms of environmental impact.

In the past five decades global population has doubled, material extraction has grown threefold and GDP has grown fourfold. The UN International Resource Panel has concluded that the extraction and processing of natural resources has greatly increased in the past two decades, and is now the cause of more than 90 percent of biodiversity loss and water stress, as well as around 50 percent of our global climate impact. Therefore, it is of the utmost importance to change our resource use to protect ecosystems.

However, the economy is still to a great extent based on rapid consumption of raw materials. When the cost of virgin materials does not reflect their full impact on the environment, the incentives to make good use of the resources are weakened.

In 2017, greenhouse gas emissions from Swedish consumption totaled nine tons per person and year. No later than 2050 global emissions need to decrease to an average of less than one ton per person. Two-thirds of Swedes' emissions come from households, while investments and public consumption account for the remaining third. Households' consumption-based emissions are dominated by emissions from transport, food and housing. The remaining emissions come from investments in, for instance, buildings and machinery, and public consumption, i.e. the goods and services bought by public activities. Greater circularity and resource efficiency are needed to achieve the climate objectives.

Sweden's prosperity builds on innovative and successful export companies which have been capable of renewing and transitioning their

products and production processes in pace with market change. Sweden therefore has great potential in several of the material streams (textiles; packaging; plastics; and batteries and vehicles) identified by the European Commission in its Circular Economy Action Plan as the areas where most action is needed to achieve the overall environmental and climate objectives.

Against this background, it is important to also focus on these areas, since they involve material flows with short product cycles, large volumes and a low level of recycling.

In the coming years, priority in the transition to a circular and bio-based economy will be given to plastics; textiles; renewable and bio-based raw materials; food; the construction and property sector, including building and demolition waste; and innovation-critical metals and minerals. If a country can take a leading position in the transition, it will of course also favor both its business sector and other actors, giving them competitive advantages.

Plastics

Littering on land and at sea and other negative environmental effects, such as the difficulty of recycling plastics and emissions of greenhouse gases from combustion of plastics, make plastics one of the major environmental challenges of our time. The global increase in recent years in single-use plastic products has taken place alongside the increase in plastic littering. Fishing equipment also contributes to marine littering. The unsustainable use of plastics needs to decrease at the same time as plants are developed and established to recycle plastic waste. To facilitate recycling, products need to be designed in a way that makes it possible to recycle plastic. Moreover, source separation of plastic waste needs to be improved to increase the quality of plastics in recycling.

Textiles

Sweden currently consumes around 15 kg of textiles per person and year. Around 8 kg of this quantity goes to combustion and around 3 kg is reused by charity organizations. The remaining quantity of around 3 kg is accumulated (in wardrobes, for instance) or managed in other ways where quantities are difficult to measure. The flows of textile waste are small in terms of weight but have a great impact on the environment. New textile production gene- rates around 15 kg of carbon dioxide per kg of textiles. The manufacture consumes large quantities of water, energy and chemicals, and is a risk to both the environment and human health. There is a need to optimize the use and reuse of textiles from an environmental perspective. New cost-effective methods of textile recycling need to be developed so that the textiles not suitable for reuse can be recycled. Moreover, new textiles should be designed for reuse and/or recycling. Further steps that make recycling and reuse easier for households should be taken, for example by an introduction of producer responsibility for textiles.

Renewable and bio-based raw material

Sweden has good access to renewable resources, technical cutting-edge skills and industrial infrastructure, providing excellent conditions for developing a circular and bio-based economy of high standards. Bio-based products and bio-energy can replace fossil alternatives in many applications, not least plastics, textiles, and construction products. Products based on paper and cardboard are already alternatives to fossil-based plastic in many applications. To reduce their climate and environmental impact, it is important that bio-based materials are also recycled. However, paper fiber gets worn when used and recycled and eventually needs to be replaced with new fiber. Since bio-based products and bioenergy also have some environmental impact, the bio-economy needs to be developed in a way that is consistent with work to achieve other environmental and societal objectives and takes account of the consequences for carbon sinks over time. The Swedish Government has said that it intends to produce a Swedish bio-economy strategy along

with the green industries that contributes to greater access to biomass and employment throughout the county and also generates environmental and climate benefits. This national strategy must promote collaboration between central government, universities and other higher education institutions, and the business sector to facilitate the transition required. The transition to a socially beneficial, circular and bio-based economy requires active participation by societal actors and research and innovation along the entire value chain.

Food

In an international comparison, Swedish food production is relatively resource-efficient and environment- and climate-friendly. Of the greenhouse gas emissions caused by Swedish food consumption, 75 percent take place outside Sweden (Swedish Environmental Protection Agency 2018, report 6842). Increased food production in Sweden can therefore contribute to a lower global climate impact in cases where it replaces imported food with a greater climate impact. Production of discarded food in Sweden is estimated to generate some 2 million tons of carbon dioxide. Food production can also cause other environmental problems such as eutrophication and residues of crop protection products in the environment. The food sector is also one of the sectors requiring most water. Reducing food waste and fostering the development and use of Swedish food, which is less resource-intensive and environmentally demanding, can achieve considerable environment benefits. A national food strategy must cover the entire food chain.

Construction and property sector

The construction and property sector accounts for around 20 percent of Sweden's consumption-based emissions. The environmental impact from this sector can be reduced by using the property stock more efficiently. The construction and property sector generates large quantities of mixed waste that could be reused and recycled to a greater extent. The sector also generates considerable quantities of hazardous waste. To be able to improve the management of this waste in the future, construction

materials must be manufactured in such a way that they can be separated and sorted, that their content of hazardous substances can be restricted and that information about what materials and construction products are included in a building is made available.

Innovation-critical metals and materials

Innovation-critical metals and minerals are a selection of metals and minerals that are critical to environmental and technical innovations. They include rare earth metals and other materials that are, in fact, generally used in small quantities at present but that nevertheless are essential to products like wind turbines and electric car batteries whose use will increase when the world transitions to a fossil-free future. The extraction of these metals and minerals is not only energy-intensive but is also often associated with environmental and human rights problems. Since they are concentrated to a few countries, their mining also creates vulnerabilities in supply chains. Circular solutions for these metals and minerals are therefore important for several reasons.

The recycling of innovation-critical metals and minerals from mining waste, waste consumer products and other sources is a growing alternative to primary extraction. Even though rising global demand for these metals also means that recycling is increasing, global demand will still exceed the supply of recycled material for a long time to come. In general, however, the share of innovation-critical metals and minerals recycled remains low, often under 1 percent. When it comes to innovation-critical metals and minerals, batteries and electrical products are two streams of interest for increased reuse and recycling. Mining waste from previous mining operations has also been identified as a potential source of innovation-critical metals and minerals in Sweden – rare earth metals, for instance. The electrification of society involves greater use of batteries, especially in the transport sector. Even though circular business models such as car-sharing, can help to reduce the need, it is also important to ensure that batteries can be reused and recycled. The European Commission intends to revise the Battery Directive as part of the transition to a circular

economy. The collection of waste electrical and electronic equipment (WEEE) in Sweden is at a relatively high level, and even though the trend is downward, there is potential to further increase collection, especially of small electronics. Product design is of great importance for the possibilities of reducing the environmental impact of the greater quantity of electronic products in society.

Central actors in the transition to a circular economy

The national parliament, *the Riksdag, and the Government* adopt legislation and policy instruments and represent Sweden through active participation in the EU and in international cooperation to promote the move towards a circular economy that contributes to achieving environmental and climate objectives.

The Government's role is to be an enabler of the good work already under way in regions and municipalities, the business sector, universities and other higher education institutions, and civil society. It is of central importance to put in place long-term and technology-neutral policy instruments, including legislation, promoting work towards a circular economy. Increased collaboration between actors in different sectors and industries is critical in order to enable them to continue to contribute to prosperity and employment through sustainable solutions to societal challenges – be that at local, regional, national or global level.

The *EU* has an important enabling role for a circular transition in the EU single market. Much of the legislation regulating eco-design, chemicals, waste, etc. is adopted at EU-level.

The *business sector*, including manufacturing industries and relevant industry organizations, contributes to the transition to a circular economy through new circular business models and sustainable product design and production. Through large companies and small- and medium-sized enterprises (SMEs), the business sector has an important role for the use and development of existing and new innovative solutions

and technology development as well as for innovation in general that enables the transition to a circular economy with non-toxic and fossil-free production and consumption.

The *Delegation for Circular Economy* is the Government's advisory body tasked with being a knowledge center and a coordinating force for the business sector's transition to a circular economy. It is also supposed to identify obstacles and act as a catalyst.

Fossil-free Sweden is a lobby group which brings industry representatives together to formulate industry commitments and identify measures that the Government needs to take.

The *Government's strategic innovation partnership program 'Climate transition in the business sector'* brings together key individuals from the business sector, academia, civil society and the public sector to contribute to joint action and work together on solutions that contribute to the climate transition and the Swedish climate goal for 2045.

The *National Innovation Council* is the Government's advisory body tasked with using innovation to contribute solutions to major social challenges and work for a long-term competitive and sustainable Sweden.

The *Committee for Technological Innovation and Ethics (Komet)* works to create good conditions for innovation and competitiveness at the same time as the development and dissemination of new technology takes place in a safe and secure way with a long-term societal perspective.

The *public sector*, consisting of the central government, the regions, and the municipalities, has an important role in the transition to a circular economy. Public actors can, for instance, contribute through public procurement and by being active in innovation projects and in cooperation where new solutions are developed.

Several *government agencies* are of course responsible for and run actions in specific areas that contribute to the transition to a circular economy:

The *Swedish Environmental Protection* Agency provides guidance about how more can be done to prevent waste and use waste as a resource and is tasked with working for a transition to a circular economy. The *Swedish Chemicals Agency* works to phase out substances of very high concern and to reduce the negative effects of hazardous substances so that more and more material flows can be circulated as a resource instead of being managed through energy recovery or landfills.

The *Swedish Agency for Economic and Regional Growth* supports the work of the regions and the municipality of Gotland on sustainable business development at SMEs. *Vinnova (Swedish Agency for Innovation Systems)* contributes to strengthening Sweden's innovation capacity mainly by financing research and innovation projects. The *National Agency for Public Procurement* provides guidance about the possibility of promoting circularity and sustainability in public procurement. The *Swedish Energy Agency* is responsible for action in energy efficiency, energy labeling and eco-design. The *Swedish Consumer Agency* provides guidance for consumers about how they can contribute to sustainable consumption.

Formas (Swedish Research Council for Environment, Agricultural Sciences and Spatial Planning) is a research council for sustainable development that finances research and innovation in environment, agricultural sciences and spatial planning.

The *universities and other higher education institutions* and the research institutes conduct research that can contribute to a circular transition. The *IVL Swedish Environmental Research Institute, the Royal Swedish Academy of Sciences, Research Institutes of Sweden AB (RISE), the Forestry Research Institute of Sweden (Skog forsk) and the Stockholm Environment Institute (SEI)* are research institutes that, in their various ways, conduct activities to promote the transition to a circular economy.

Sweden's 290 municipalities are important actors in the area of waste management and make a major contribution to the transition to a circular economy, including through information, innovation and technological development to promote waste management that contributes to circular and fossil-free material flows. By doing so, they make it easier for households, businesses and services, including municipal services, to contribute to a circular economy. The municipalities are also responsible for physical planning and urban and rural development, of great importance for people's ability to contribute to a circular economy. The regions have the task of drafting, adopting and implementing a regional development strategy that can also include the transition to a circular economy.

Private individuals and civil society

Finally, an ambitious national environmental policy cannot avoid engaging private individuals. In fact, they have a key role, since it is also through their insight and daily behavior that the environment can be improved. Individual initiatives, voluntary associations and consumer organizations are crucial for ambitions at all levels of society to be kept high.

Hydro-Technology, Renewable Energy, and the Swedish Future Generations by 2050

Ashok Swain

Introduction

Despite irrefutable evidence of severe impacts of climate change, the world continues to ignore its urgency. The leaders are ignoring the crisis altogether or being busy with the blame game. The lack of seriousness by the political class to see and realize the current destruction by changing climate leads to repeated failures of the Conference of the Parties (COP) and all other negotiations related to climate change. It has even become a cliché for the world's leaders to discuss that climate change needs to be stopped as we need to protect the planet for future generations. This pretentious messaging does not help the critical and urgent need for the global fight against climate change. The world erroneously believes that the impacts of climate change are something to come in the future and not of concern at present.

Wreaking Havoc

The global average temperature has already increased by 1°C since the beginning of the last century. However, the rate of warming has more than doubled in the previous 40 years compared to the earlier period.[1] The uneven pattern of warming has already affected some regions more than others. For example, the Arctic region is warming at a faster rate than the rest of the world. The Middle East, another region where the situation has worsened, has faced an increase in warming that is twice as fast as the global average. The Gulf countries have consistently been recording a temperature over 50°C in the summer months, and urban centers have been facing agonizing hot temperatures. Extreme temperatures and

severe droughts have already affected economic activities and agricultural production in the region.

Recent climate change-induced extreme events, such as heavy rainfall, heatwaves, and high floods, have broken historical records. According to the World Meteorological Association (WMO), the number of climate and weather-related disasters has already increased five times over 50 years.[2] While improved early warning saves lives, economic losses have become massive. Political leaders and media keep saying that climate change will force people to migrate in the future. However, the reality is that climate change has already forced people to leave their homes and move to other areas. In addition, the Internal Displacement Monitoring Center (IDMC) has pointed out that the number of people displaced by climate disasters reached 23.7 million by the end of 2021.[3]

Moreover, in 100 years, the sea level has approximately increased by 16-21 centimeters, and almost half of that increase has taken place in the last three decades.[4] According to NASA, the current rate of sea-level rise is unprecedented compared to the past several millennia. While small island countries and coastal plains are not underwater yet, warming seawater and climate change-induced coastal erosion have brought significant changes in their human settlement pattern and socioeconomic conditions. Climate change has already brought changes to water supply and demand patterns. Disputes over shared rivers have increased between countries. The existing arrangement of water resources between and within countries in the arid and semi-arid regions has become more conflictual. Climate change-caused natural disasters are also playing an increasingly vital role in causing civil wars. Thus, the impact of climate change is not something to be worried about in the future only, it is already here and creating huge ecological, economic, social, political, and humanitarian crises. Therefore, world leaders must give climate change their topmost priority and address it now. They must listen to the Chair of the Elders, Mary Robinson, while negotiating at COP26 in Glasgow: "Now is the moment for decisive action, not obfuscation or half measures".[5]

Politics has Failed

The reality is that despite the science and evidence being unequivocal over climate change, political leaders are primarily engaged in politicking instead of donning the leadership mantle to take concrete measures against climate change. The developed world leaders are talking big, but most are trying everything to avoid any commitment. On the other hand, the leaders of the poor countries are indulged when taking the cover of history and blaming the rich, rather than planning for the future and preparing themselves to adapt to the changing planet.

As per the Global Climate Risk Index 2021, the ten most affected countries by climate change in 2019 were Mozambique, Zimbabwe, the Bahamas, Japan, Malawi, Afghanistan, India, South Sudan, Niger, and Bolivia.[6] However, if the climate risk gets calculated in the long-term index, from 2000-2019, the ten most affect countries or territories were Puerto Rico, Myanmar, Haiti, the Philippines, Mozambique, the Bahamas, Bangladesh, Pakistan, Thailand, and Nepal. All these countries, besides Japan and possibly Puerto Rico, are struggling to develop, both economically and politically. It is a cruel irony that people and countries in Asia, Africa, and South America are the ones who are suffering the most from climate change but have done the least to cause it. Considering their economic strength and political maturity, different countries in the climate-risk regions are responding differently to these challenges. The most affected regions are still split between the haves and have-nots. Some are better at planning and implementing mitigation and adaptation strategies to meet the survival crisis posed by climate change. For example, Japan has already announced a 46 percent reduction in its greenhouse gas (GHG) emissions by 2030, almost double the target that was committed after the Paris Agreement.[7]

However, the United Nations (UN) Climate Conferences (COP) have failed to meet the challenge. Political leaders keep discussing, debating, and differing over the rules and regulations. The United States (U.S.) is trying hard to keep its polluting industries protected from any liability or paying compensation. Meanwhile, countries such Brazil, China, India,

and South Africa are asking for carryover of unsold carbon credits under the Kyoto Protocol to the proposed carbon market scheme. Furthermore, countries have pledged, since 2009, to mobilize US$100 billion annually, however, that is yet to be achieved. While the world has spent more than $2 trillion on the military in 2021 alone, it is still reluctant to commit $100 billion annually to save the planet, whose survival is under serious threat from climate change. Thus, it is not the money for climate finance that is in short supply, but the willingness and commitment of the political leaders.

The Paris Agreement binds the signing countries to contain global warming to *well below* 2°C above pre-industrial level, with an aspirational limit of 1.5°C. However, the commitments made for cutting emissions during the Paris Agreement were too weak to reach that target and therefore, there has been an agreement among parties to return every five years with a revised Nationally Determined Contributions (NDC). Currently, there are 197 parties to the Convention, but 191 Parties to the Paris Agreement. However, there are only 151 first NDCs recorded in the UN's interim NDC registry, and the total number of second NDCs is merely 11. To limit the rise of global warming to 1.5°C, the planet needs a 45 percent reduction in GHG emissions. Nonetheless, the countries' commitments made under the NDCs will instead result in an increase of 16 percent in 2030 compared to the 2010 level.[8]

Moreover, the UN's Intergovernmental Panel on Climate Change (IPCC) report, released in August 2021, suggests that climate change is already widespread, rapid, and intensifying. The UN Secretary General has described the situation as "a code red for humanity" and urged the world to act decisively to keep the hope of limiting global warming to 1.5°C alive. For that, the G20 economies need to join the net-zero emissions coalition and provide credible, concrete, and enhanced NDCs.

At this point in time, only a few major emitters like the EU, UK and the U.S. have submitted their second NDCs which are updated with more cuts since the Paris Agreement. Other countries such as Australia, Brazil, China, Indonesia, Russia, and Saudi Arabia have not yet followed suit

which is extremely problematic because to successfully counter climate change, the world must come together. In particular, active cooperation and coordination between the two largest emitters, the U.S. and China, is a must.

Political leadership cannot afford to waste time in the battle with climate change, and yet efforts such as COP26 in November 2021 continue to disappoint. Since then, public and media attention has turned away from climate change, with events like the Ukraine War taking precedence. Though world leaders may choose to ignore it, the devastating impacts of climate change are becoming more pronounced and irreversible in the background, and the effects are taking shape faster than predicted.

The next opportunity for leaders to discuss the climate will be COP27 in Sharm El-Sheikh, Egypt, in November 2022 and it is increasingly important that world leaders take sufficient action. Even with the, albeit compromised, pact reached among 153 countries at the Glasgow Climate Summit, the United Nations Environment Program (UNEP) Emissions Gap Report 2021 clearly shows that achieving the 1.5C target remains highly unlikely. The World Economic Forum's 'Global Risks Update Report 2022' also finds climate change to be the dominant risk over the next ten-year horizon, and by extension the greatest threat to humanity. It is inconceivable that decision-makers are not aware of these grave predictions and yet they have continued to let political will keep the world from taking concrete and decisive steps in addressing climate change.

Now, however, there is increasingly recognition among people about the climate risks, and they expect their governments to act. The World Risk Poll of 2020 reveals that 41 percent of people globally consider it a 'very serious threat' to their country, 28 percent are 'somewhat concerned' and only 13 percent don't find climate change a threat. As such, growing climate movements are demanding concrete actions from political leaders, and even school children are mobilizing across the world, demanding policymakers take it seriously and work to secure their futures.

Sweden and its Energy Transition

The energy transition in Sweden is well underway and the country is increasingly using renewable energy. In 2020, Sweden generated 50 percent of its energy from renewable sources – a target that was met an impressive eight years in advance of the original target of 2020. Now, Sweden aims to have 100% renewable electricity production by 2040.[9] The success of the Swedish transition is largely down to the use of bioenergy for heating, and the use of hydrogen power for electricity production – currently accounting for 45 percent (nuclear power is 30 percent). The large-scale construction of dams began in the 1890s, but experienced major expansion in the post-WW2 period. Sweden now has nearly 1,800 hydropower dams and 600 regulating dams. The 203 dams above 10 MW provide 93 percent of all the hydropower.

The development of hydropower has, however, arisen with some ecological and social consequences in Sweden. Firstly, the dams have led to water regulation in 4,000 river water bodies and 1,000 lakes, causing the submergence of land and blocking the migration of fish, as well as creating connectivity issues.[10] A movement led by the Älväddarna (The River Savers' Association) that aims to 'rewild' Swedish rivers has emerged in response. Secondly, 80 percent of large-scale hydroelectric power generation in Sweden is located on traditional Sámi lands – known as Sápmi. The historical exploitation of the Sámi population is an ongoing debate in Sweden and hydropower is unfortunately impacting reindeer husbandry by fragmenting pastures and obstructing migration routes.

The Youth Climate Movement – Hope Against Climate Change

In 2019, 16 children from across the world, including Sweden's Greta Thunberg, filed a global lawsuit petitioning the UN Committee on the Rights of the Child to hold five of the world's leading economic powers accountable for inaction over the climate crisis. This came on the back of the climate strike movement which has grown over the last three years into a network of global campaigns demanding a systemic change

to address climate change. While school strikes are not new, the Youth Climate Movement has reached an unprecedented global scale, targeting economic and political establishments for producing violence and injustice in many forms, and now relating to climate change too. Greta was by no means the first young climate activist, but social media has given Greta and her colleagues the power and reach to mobilize millions of young people that was not possible before.

Sweden has made several positive moves to engage the youth into their climate response through organizations such as: Fältbiologerna (Nature and Youth Sweden), Global Shapers, Climate Students Sweden, the National Council of Swedish Youth Organisations, PUSH Sweden, Sáminuorra, Guides and Scouts of Sweden, Svenska KyrkansUnga (Church of Sweden Youth), we change and WWF Sweden Youth. Swedish youth organizations often give the Swedish government feedback on its domestic climate policy and advise on how to formulate a position in the global climate conferences. They now also form part of Sweden's official delegation to these UN conferences. The Swedish youth's engagement is not surprising given that Sweden has a long historical and cultural tradition of children and youth participating in social and political issues. This continues to be encouraged by the country's policy system built on democratic consensus, and where climate change dominates the political agenda. Young people are especially concerned about climate change and so are working to instigate action both domestically and globally through international solidarity.

The youth have contributed much less to climate change but are disproportionately bearing the brunt of its impacts. Thus, this intergeneration inequity is the basis of their strong moral argument for climate action. Being that the youth population in the global South is significantly high, the strength in their numbers will be advantageous in ensuring that the youth are heard. Ultimately, the climate movement is going to be long battle because climate change is not going to disappear soon, and so, the rise of the Youth Climate Movement brings some hope.

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The Status Quo and Future Outlook on Low-Carbon Technologies in Sweden

Avi Jakhmola

In 2017, the Swedish government announced its ambition to reach net-zero greenhouse gas emissions by 2045.[1] This was followed by its 2022 Electrification Strategy, which further elaborates that this transition will require massive electrification of Swedish transport and industry.[2] The Swedish electricity system must expand to meet this additional demand. In keeping with its targets, Sweden's national electricity demand is projected to triple or quadruple by 2040, all of which is to be met from renewable sources.[3]

Sweden's present electricity system is quite an exception. While the country counts amongst those that consume the highest amounts of electricity per capita globally, its emissions intensity of electricity (the amount of GHGs emitted per TWh of electricity produced) is at par with Namibia on the other end of the development and energy-use spectrum. It is remarkable that fossil fuels have almost always contributed <5 percent of Sweden's annual electricity production over the last three decades.[4] This has been possible due to a heavy dependence on two low-carbon electricity sources – hydroelectricity and nuclear power.

Now, given a new global paradigm dominated by stringent climate commitments and a changing technological landscape, how will the Swedish electricity system evolve to meet burgeoning demand? Here, we look at four key low-carbon energy sources – two stalwarts in hydroelectricity and nuclear power, and two emerging technologies in wind and solar power – to begin answering this question.

The low-carbon veterans

Hydroelectricity

Hydroelectricity has been at the heart of the Swedish development story, almost single-handedly powering its industrialization until the late 1960s and continuing to generate close to half the country's electricity to this day. Sweden has around 1,800 hydropower plants and 600 regulating dams operating currently, which together generate over 70 TWh of electricity every year.[5] In 2021, hydropower generated approximately 43 percent of the country's electricity.

Hydroelectricity serves the twofold role of generating baseload power to meet steady demand, as well as balancing power to meet variations in demand. Its inherent flexibility allows it to function as a 'water battery', and its role in the Swedish electricity system is expected to become increasingly important as more variable wind and solar power are introduced into the mix.

Despite its importance to Sweden's energy history, present, and future, the prospects of expanding hydropower are severely constrained. In fact, Swedish hydroelectric capacity may diminish over the coming years as more stringent environmental regulations come into place. Compliance with the European Union's Water Framework Directive has necessitated the implementation of a new national strategy for reducing the ecological footprint of Swedish hydroelectric plants.[5] While the strategy will improve river ecology and hydromorphology for different water bodies, it might limit hydropower's role in Sweden's energy future.

Nuclear power

Starting with the first experimental R1 reactor in 1954, nuclear power has had a long history in Sweden. In its heyday during the latter half of the 20th century, nuclear power accounted for as much as half of Sweden's annual electricity production, even amidst a turbulent policy environment.[6] First, a 1980 referendum after the Three Mile Island incident in the United States halted the development of new power plants making the Forsmark

reactor built in 1985 Sweden's last commissioned nuclear plant. Later, an accompanying plan to phase out all nuclear energy by 2010 was reversed in response to growing electricity demand, a changing climate policy context, and the need for low-emissions power. However, the technology's role in the Swedish electricity system has gradually diminished with the retirement of ageing power plants over the decades.

As of 2022, Sweden has six operational nuclear reactors based at three power plants which are expected to continue generating electricity into the 2040s.[7] These plants together generate about 49 TWh of electricity every year which is still approximately a third of the annual Swedish total. While Sweden decided against prematurely retiring its remaining power plants unlike neighboring Germany, it has no current plans to expand its fleet and commission new reactors. This means that in addition to building capacity from other sources to meet expanding demand, Sweden also needs to plan how it will plug the gaps left by these plants' eventual retirement.

Emerging technologies

Sweden's ageing nuclear fleet and saturating hydroelectric potential raise important questions about its ambitious plans for large-scale electrification while staying on track to get to net-zero by 2045. One answer is increased adoption of emerging low-carbon energy technologies such as wind and solar power which are undergoing rapid growth globally. But first, a framework to study the growth of these technologies is needed.

The scholarly tradition of studying the growth of new technologies through a sociotechnical lens posits that their adoption follows three distinct phases. Nascent technologies first go through a turbulent formative phase where high costs and uncertain conditions yield slow and erratic growth. The formative phase ends when the technology can expand steadily following the stabilization of sociotechnical 'regimes.' One way to define this end point, which allows for cross-technological and cross-national comparisons, is when the technology's share in the annual electricity supply surpasses 1 percent.

The end of the formative phase sparks the start of the growth phase where positive feedback loops in profits, technology learning, and policy support lead to accelerating growth. This continues all the way to a point where the mechanisms driving and opposing growth counterbalance. The technology grows the fastest at this point, and henceforth, growth gradually slows down as barriers such as increasing marginal costs, geophysical constraints, integration challenges, and socio-political resistance begin to dominate. Eventually, growth enters the saturation phase where the technology's market share peaks.[8]

Wind power

Over the last decade, wind power has been the most rapidly expanding power source in Sweden. Spurred by the oil crisis in the 1970s and a national discussion on the use of nuclear power, Sweden installed its first wind turbines in the early 1980s with a cumulative capacity of about 5 MW. While it didn't become a global pioneer like neighboring Denmark or Germany, as of 2021, Sweden had the 10th largest installed wind capacity in the world at 12.08 GW which generated 16 percent of its electricity.[9]

It is important to note however, that 'wind power' consists of what are in many ways, two different technologies – onshore and offshore wind. With over 2 per cent of its installed capacity located off the coastline, Sweden is also a global leader in offshore wind power.[9] But both these technologies are at very different stages of adoption in Sweden – while onshore wind is a relatively mature technology that exited the formative phase in 2007 and whose growth stopped accelerating after 2017, its nascent offshore counterpart is yet to enter the growth phase.

The Swedish Wind Energy Association expects wind power generation to expand to at least 120 TWh by 2040, with 45 TWh coming from offshore wind.[10] This will require deployment increases of 72 times for offshore and 3 times for onshore wind, respectively. Though declining technology costs and increasing momentum for climate-friendly development is helping drive loftier policy ambition, the transition is not without roadblocks.

There is already increasing public resistance to the installation of wind turbines from residents of local municipalities who have been vocally

opposing the development of new projects that would mar their landscapes, coastlines and tourism.[11] With grassroots dissent further fueling political polarization on the issue, the future of Swedish wind power will have to contend with emerging obstacles to fulfill its potential.

Solar power

Solar photovoltaics have become the poster child of the global transition to low-carbon power following their tremendous growth over the last two decades. Though overshadowed by wind power, solar PV has undergone impressive growth in Sweden with installed capacity expanding 168 times between 2009 and 2021.[9] Most of this growth was through residential and commercial arrays supported by a Swedish Energy Agency rebate scheme worth around SEK 4.8 billion ($511.2 million).[12]

While these numbers impress, in 2021, Sweden's 1.59 GW of installed panels generated 1.5 TWh of power – slightly <1 percent of the year's total. This indicates that solar power is still only on the cusp of exiting the formative phase, and the right policy and market conditions could bring in a period of sustained yet dynamic growth. With a colder climate that helps panel efficiency and a similar number of sunny days to solar leaders Germany and the Netherlands, the technology can contribute significantly towards Sweden's renewables goals.[13] Moreover, given its more modular nature, distributed solar power in the form of rooftop installations might avoid some of the barriers plaguing its utility-scale counterparts.

Looking ahead – a dynamic future

The next few decades will mark a period of change and dynamism in Sweden's electricity sector. With diminishing nuclear, stagnating hydro, maturing onshore wind, and ascending solar and offshore wind power in the backdrop of ballooning electricity demand, an evolving political economy and an interplay of countervailing mechanisms, much will change. Regardless, Sweden's low-carbon power transition will hold important lessons for the world.

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Laws, Regulations and Climate Risks in Sweden

Maria Pettersson

Climate change has an undeniable impact on various natural, managed and human systems. While mitigation is critical to reducing and delaying climate impacts, it cannot effectively address the needs of the day. Therefore, adapting to climate change through capacity building, training, education, and public awareness has become a necessity for the achievement of the United Nations Millennium Development Goals, including eradicating extreme poverty and hunger, and safeguarding environmental sustainability

When it comes to governance towards the set goals, laws and regulations play a significant role. Binding legislation has a strong governing effect as it sets the framework for (permissible) human activity. Thus, through formal institutions, important mitigation and adaptation measures can be implemented. At the same time, however, the legal system is typically slow-paced and reactive rather than proactive and easy to change, which can lead to conflicts in relation to the need for flexibility and rapid adaptation instigated by climate change. Thus, while laws and legal rules can function as a lasting and change-resistant way of ensuring (purposeful) action in the environmental- and climate area, there is also a risk that these instruments fall out of step with the development, and/or that contradictions arise within and between different levels of regulation.

There are several examples of this in a Swedish context and a few cases in point are presented in this short paper. Many (most) environmental issues are transboundary in nature, meaning that addressing them typically requires action that goes beyond national administrative borders. Most obvious is perhaps issues related to water. Subcategories of 'water-issues'

also include flooding as is evident by the strong connection between the EU Water Framework Directive, aiming to secure 'good ecological status' for all waters within the Union,[1] and the Floods Directive,[2] which aims at reducing the negative health, environmental, and economic consequences of flooding in the European Union. Another growing transboundary problem is the issue of Invasive Alien Species (IAS). IAS has an unavoidable impact on biodiversity; they can spread rapidly, out-compete native species, and cause devastating effects on native biota.[3] IAS can be deliberately introduced via fish farming or horticulture, or as stowaway in land and water transportation of goods. This issue is also tackled at all governance levels; IAS related legislation is present in international law[4] as well as in EU- and member-state legislation.[5]

Water, water quality, flooding and IAS are all strongly related to climate change. Phenomena like more extreme weather, for example, increases the risks of flooding, and by extension, gross human, and economic impacts.[6] Similarly, changes in snowmelt can cause an increased risk of leaching of nutrients and impact water quality. The spread of IAS is also expected to increase with the effects of climate change – a warmer climate means, for example, that cold-sensitive species can migrate further north. The negative effects of IAS are thus further exacerbated by climate change, pollution, habitat loss and other human-induced disturbances.[7] Coupled with the growing forces of globalization, these impacts will only enhance.[8]

There is thus more than one reason to address these (and other!) issues across national and regional borders through (binding) legislation. At the same time, regulation presents multidimensional challenges when it comes to implementing primarily climate adaptation measures. The complexity stems both from the legal system's inherent inertia and unresolved norm conflicts, and from the specific geographical and ecological conditions.

Needless to say, all laws and legal rules are not always coherent and consistent in relation to each other. To avoid unnecessary norm conflicts, legal systems typically include explicit norm-hierarchies aimed at clarifying what norm takes precedence in a specific situation. In essence, a norm hierarchy thus refers to the relationship, i.e., the mutual ranking,

between different norms and system of norms.[9] Nevertheless, 'unsolvable' conflicts can arise both within and outside, and in relation to, the national legal systems.

Research has shown that the issue of Invasive Alien Species in particular has been caught in the crossfire between different legal norms. When it comes to the control of IAS, the need for caution is often overshadowed by the importance of free trade as is evident by the differences between the precautionary principle in the Convention of Biological Diversity (CBD) compared to the World Trade Organization's Agreement on the Application of Sanitary and Phytosanitary Measures, also known as the SPS Agreement or just SPS. While, according to the CBD, the precautionary principle entails that where there are threats of (serious or irreversible) damage, lack of full scientific certainty must not be used as a reason not to take precautions, the SPS agreement prescribes that such measures may only be taken if necessary to protect the environment, and that they must be "based on scientific principles" and "not maintained without scientific evidence".[10] The Swedish Environmental Code rests on an even stricter precautionary principle,[11] and the implications of this stands in stark contrast to the high threshold to restrict free trade that follows from the SPS Agreement. Even the EU regulation on IAS – which aims to strengthen the preventive protection against damage from IAS – is subordinate to the provisions of the SPS Agreement, limiting the possibilities for individual member-states to take legal measures to protect against the threat to biological diversity that the introduction and spread of IAS may imply.[12]

Furthermore, research shows that the hierarchy of norms on the national level can affect the possibility to take adaptation measures in different sectors. This is, for example, the case with environmental considerations in forests in Sweden. Here, the principle of *Lex Specialis*[13] implies that the relatively limited rule of consideration in the Forest Protection Act takes precedence over the general rules of consideration in the Environmental Code, which means that neither the general rule of caution nor the precautionary principle will be applied in decision making regarding forest management.

The laws that govern the work of the municipalities are often framework laws that leave room for necessary assessments and local considerations.[14] At the same time, this means that the municipal authorities can opt out of certain measures. Such a strategy may have financial reasons – it is costly to invest in flood mitigation measures – but may also depend on public opinion. A general resistance to wind power can for example trigger a municipality to use the right of veto that exists for the establishment of wind power.[15]

Another legal institution which is highly ranked and thus often prioritized is property rights. In many legal systems, property rights are deeply rooted, and while it is certainly true that private ownership can motivate environmental or resource consideration, economic interests, for example, to harvest resources may stand in contrast to necessary precautions and long-term environmental measures. The legislation in Sweden that targets forests, specifically, the Forest Management Act, starts out from the assumption that you take care of what you own, and that this "freedom under responsibility" will lead to sustainable forestry. There is much that speaks against this, not least the long termism required to implement climate adaptation measures, as these are rarely compatible with the cultivation of production forest. Formal protection of forest land is instead established with the support of the Environmental Code and the EU's nature conservation directives.[16] The EU believes that far more forests need to be protected within the Union in order not to further threaten the conservation of the biological diversity and has come up with a plan to this effect.[17] The EU does, however, lack legislative competence when it comes to land-use issues and has therefore targeted related activities,[18] such as the production of biomass, proportion of protected areas, etc.[19] The deeply rooted notion of property rights is put up against more new founded ideologies of what constitutes a sustainable development and what this requires of individuals, states, and organizations.

To conclude, laws and regulations can indeed be a powerful tool for implementing ambitious environmental and climate goals, both nationally and globally. The authority that comes with legislation is hard to muster in

any other way. At the same time, the process of making laws is necessarily slow – legal certainty is still a flagship in these contexts. The flexibility that is often requested can furthermore both promote and hinder desirable development. Too much scope for assessments reduces legal certainty and the rigor of implementation and we risk missing the target. Too little assessment space makes the system rigid and difficult to maneuver. The path dependency that characterizes the legal system moreover implies that changes are incremental rather than transformative. The capacity to deal with future climate risks must therefore be considered limited, as are the opportunities to act independently to integrate climate change adaptation. All in all, it is reasonable to assume that the law alone will not secure the targets, but carefully designed and together with other policy instruments, it can help lead us towards it.

Endnotes

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2 Directive 2007/60/EC of the European Parliament and of the Council of 23 October 2007 on the assessment and management of flood risks.

3 United Nations Convention on Biological Diversity; COM (2013) 620 final.

4 For example, the World Trade Organization's Sanitary and Phytosanitary Agreement (SPS Agreement) (Art. 2.2 and 5.7), United Nations Convention on Biological Diversity (Art. 8), International Plant Protection Convention, and United Nations Convention on the Law of the Sea.

5 As a regulation, Regulation (EU) No 1143/2014 of the European Parliament and of the Council of 22 October 2014 on the prevention and management of the introduction and spread of invasive alien species, is applicable in all EU member-states. As further transposition measures, in Sweden, changes have in addition been made to the Environmental Code (1998:808) and through the adoption of a Swedish Ordinance (2018:1939) on invasive alien species.

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9 See Dinah Shelton, "Normative Hierarchy in International Law," *American Journal of International Law* 100, no. 2 (2006): 291-323, https://doi.org/10.1017/S0002930000016675.

10 World Trade Organization, SPS Agreement (Art. 2.2 and 5.7).

11 It follows from Chapter 2, section 3, para. 2, the Swedish Environmental Code, that "Everyone who undertakes or intends to undertake an activity or take an action must take out the protective measures, observe the restrictions and take the precautionary measures in general that are necessary to prevent, prevent or counter that the activity or action causes damage or inconvenience to human health or the environment. For the same purpose, the best possible technology must be used in professional activities.

[Para. 2] These precautionary measures must be taken *as soon as there is reason to assume that an activity or action may cause damage or inconvenience* to human health or the environment." (Emphasis added).

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s13280-015-0748-3; M. Pettersson, "Kontroll av främmande arter (i skogsmiljöer) – Behovet av rättsliga reformer" Europarättslig Tidskrift, Nr. 3, 2013; M. Pettersson and E. C. H. Keskitalo, "Forest Invasive Species and Climate Change – The EU and Swedish Regulatory Frameworks," *Environmental Policy and Law* 49, no. 1 (2012): 63-73.

13 The *Lex Specialis* doctrine means that when a particular situation or issue is governed by two different laws, the law targeting the specific area will override the law that governs general matters.

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15 Swedish Environmental Code, Chapter 16, Section 4.

16 The protection typically means that the ongoing land use is thwarted, which in turn means that compensation of 125 percent of the market value is paid to the forest owner. The compensation is paid by the state: Chapter 32, Section 4 of the Environmental Code and Chapter 2, Section 15, of the Instrument of Government.

17 https://www.forestindustries.se/news/news/2021/07/fit-for-55-five-proposals/.

18 Consolidated version of the Treaty on European Union Title I - Common Provisions Article 5 (ex Article 5 TEC), C 202/18. The exercise of powers by the EU is regulated by principles of subsidiarity and proportionality. These principles set boundaries within which actions of the EU member-states, as well as their institutions, are defined. Instituted in Article 5 of the EU Treaty, the principle of subsidiarity means that "in areas which do not fall within its exclusive competence, the EU can act only if, and insofar as, the objectives of the proposed action cannot be sufficiently achieved by the member states, either at central level or at regional and local level, but can rather, by reason of the scale or effects of the proposed action, be better achieved at EU level." "Subsidiarity (EU)," Thomson Reuters Practical Law, https://uk.practicallaw.thomsonreuters.com/4-107-7336?transitionType=Default&contextData=(sc.Default)&firstPage=true. Similarly, the principle of proportionality dictates that EU action "must be limited to what is necessary to achieve the objectives of the Treaties", and that it must be in keeping with the collective aim of the bloc. "Proportionality principle," EUR-Lex, https://eur-lex.europa.eu/EN/legal-content/glossary/proportionality-principle.html. In this context, the implementation of statutory laws, ordinances, prescriptions and policies is left to the member-states, and the differences in the choice of measures – such as the differences in the level of protection in different member-states – influence the outcomes.

19 https://www.forestindustries.se/news/news/2021/07/fit-for-55-five-proposals/.

II

Renewable Energy and Climate Action in Japan

Thoughts and Proposition on Renewable Energy and Social Changes

Hajime Kobayashi

Introduction

Non-renewable resources have long been warned against given the destruction of the global environment and resource depletion due to dependence on fossil fuels. And the demand for social change is now higher than ever, especially in the developed countries after World War II. However, an international framework for cross-border transformation of a modern society which is heavily dependent on fossil fuel-based and optimized energy infrastructure and the penetration of plastics, has not worked. The ringing alarm bell continues to echo in the emptiness.

In order to overcome this obstructive situation, we expect the solutions to lie in the penetration and evolution of technology. Research institutes and private companies in each country are already developing and implementing solutions that have the potential to solve drastic problems. In this article, we describe the solutions we are focusing on and the potential for social change.

Our Standpoint

In this paper, our standpoint, in the social implementation of renewable energy, is to focus on curbing demand in addition to substituting fossil fuels on the premise of (otherwise) growing energy demand, through revolutionary and challenging but promising solutions.

In the next section, solutions (1) to (5) focus on reducing the enormous waste generated on the demand side, and the selected solutions are truly innovative ones in our view. Carbon Capture, Utilization, and Storage

(CCUS) (6) is different from other solutions in the sense that carbon emitted can be sequestrated and / or reused.

Our point of view is neither representative nor recommended for any particular country or company, and is neutral to any vested interests, and this paper has actually worked on solving problems with domestic and foreign companies and technology in the practice of management consulting. This is a proposal based on the findings.

Solutions of Interest

Based on our standpoint noted above, we focus on six solutions. These are by no means exhaustive, but in their essential importance, we believe that their development, penetration and evolution should be prioritized over other solutions with concerted efforts among administrators, academia, and corporations.

(1) Hydrogen
(2) Mobility Infrastructure
(3) Structural Electronics
(4) Air Conditioning Load Reduction
(5) Food Distribution
(6) Carbon Capture, Utilization, and Storage (CCUS)

(1) Hydrogen

Hydrogen is a representative of true renewable energy. It has the highest energy density of all known energy sources, becoming water after combustion (bonding with oxygen), and producing no by-products that are harmful to the global environment.

Kawasaki Heavy Industries has already extracted hydrogen from peat in Australia, remodeled an LNG carrier that is a component of fossil fuel infrastructure, and is conducting a demonstration experiment of hydrogen power generation. The automobile industry is also cooperating and Toyota is the most active in the utilization of hydrogen in the industry.. In addition, Yokohama Rubber and others are proceeding with research and development of hoses and valves that are indispensable for hydrogen storage, distribution, and common use.

Hydrogen does not completely replace fossil fuels, but depends on the region and application of energy sources such as solar power, wind power, geothermal power, biofuels that are rapidly being adopted in recent years, along with conventional nuclear power. Hydrogen adds diversity to the mix, which is much required.

(2) Mobility Infrastructure

Large cities such as Tokyo, Jakarta, and Atlanta are still in a situation where automobile-related life cycle CO_2 emissions due to traffic congestion cannot be suppressed.

We would like to highlight the implementation of V2V, I2V (vehicle to vehicle, infrastructure to vehicle) data management, which is by no means a new concept. In the first place, the average speed of car movement in cities is lower than that of bicycles, and the main cause of traffic congestion is not the number of cars but the stoppage and uneven distribution. Automobiles as a means of low-speed transportation will be lighter and lighter because it is easier to ensure the safety of drivers and pedestrians, and if constant speed driving is possible with the V2V / I2V system, fuel efficiency will improve.

Regarding mobility, it is necessary to talk about EV as well as related infrastructure. Here the power performance of current automobiles is not required, and therefore batteries can be miniaturized. Although the development of EV charging infrastructure is not progressing in Japan, it is more realistic in terms of business and technology, such as the development of removable batteries that transcend the boundaries of manufacturers, on the premise of reviewing regulations and business practices. This can be expected to be a good solution. However, it is necessary to consider CO_2 and toxic metal/chemical substance emissions in the life cycle from EV production to operation.

From the point of sustainability, Japan, which has been quite slow in mobility transformation, has a lot to learn (and implement) from Sweden's goal to achieve 70 percent fossil-free mobility society.

(3) Structural Electronics

Electronics, which are the main components of automobiles, industrial machines, home appliances, portable communication devices, etc., are becoming more advanced, but the basic design and production method still utilized the same complicated process of individually manufacturing, bonding and assembling various parts.

As consumer needs become more demanding, the product life cycle is shortened. In the present age, it is necessary to design and produce a wide variety of small quantities in a short period of time and the production process requires a large amount of chemical substances and manufacturing machines as before. As a result, life cycle CO_2 emissions and harmful substances have not been suppressed, but only increased.

A solution can be found in structural electronics that basically uses a 3D printer as a means of production and in virtual engineering, is consistent from planning, designing to prototyping and mass production. Products that make heavy use of electronic components are modeled at one go using sensors, etc. 3D printers continue to evolve, improving accuracy and product strength, and supporting composite materials, and cost reductions are progressing as the market expands.

(4) Air Conditioning Load Reduction

Cooling for air conditioning accounts for about 40 percent of the electricity demand in production facilities, offices, and homes, and improving cooling efficiency is directly linked to curbing electricity demand.

Daikin Industries, Ltd. of Japan, which is one of the largest air-conditioning systems manufacturers for home and business use, is continuously improving the cooling efficiency, which is leading the industry, including the improvement of refrigerants. Improvements in the environment and productivity are being realized in a more “environmentally friendly” manner.

In relation to air conditioning, there is a lot of room for buildings to reduce the air conditioning load, especially in Japan. For example,

external insulation and the adoption of resin sashes that are popular in other countries can be encouraged. Aluminum sashes, which are the mainstream in Japan, have extremely high heat transfer coefficient and are a cause of increased air conditioning load in winter, so it is necessary to change this aspect in the industry as a whole.

(5) Food Distribution

The fifth point, but one that would have a large expected impact, is innovation through food distribution technology. It is said that food waste accounts for 30 percent of the total energy demand (Project Drawdown estimate). Waste at the distribution stage including retail is not generally recognized – mostly, the expiration date of fresh food and delicatessen is enforced. The more the disposal rules in fast food stores, the more the waste amount will increase.

Product tracking using NFC tags and packaging innovations, such as vacuum packaging, has the potential to significantly reduce, for example, efficient delivery of meat and fish and disposal of unsold products at stores. For example, the vacuum packaging technology called Hymilan developed by Mitsui Dow Chemical can more than double the storage period of fresh food.

(6) Carbon Capture, Utilization, and Storage (CCUS)

Last but not least, we look at CCUS, which is a technology that directly contributes to CO_2 reduction. Europe is leading the way in CCUS, and the Japanese government and private companies are also willing to promote it. At present, the degree of CCUS' contribution to global carbon neutrality by 2050 is unknown in terms of technology and cost, and its role in negating global annual CO_2 emissions, in the order of giga-tons, is equivalent to just a drop in the ocean.

Nevertheless, many innovative solutions have been refined in the process of being implemented in society and have achieved a cost level sufficient for widespread use. We believe that CCUS is one of the solutions with enormous potential, and that it should not be judged by its technological sophistication and economic rationality at this point in time.

With that said, Japan should actively and openly collaborate, learning from CO_2 capture efforts from European colleagues in Switzerland, Sweden, Norway, and Iceland.

Our Proposition

So far, we have outlined six solutions from the perspective of sustainable economy, extending the viewpoint on renewable energy. In this paper, I will not dare to mention the timeline of realization and the return on investment. This is not because of space constraints, but because the timeline and return on investment vary greatly depending on the entity that is working on it.

What the six solutions have in common is that even if they are being developed large companies, they are almost private efforts, and represent the vested interests that are the main constituents of the previous system (industry, government, and academia).

As an extension of the current situation, it is difficult for these solutions to be implemented in society and create value. In order to overcome the above two points, the requirements for successful social implementation are to first draw a blueprint for a smart society realized by these solutions, spread awareness, and lead human resources and organizations that transcend national borders and specialized fields. It is all about collaborating internationally and interdisciplinarily.

Therefore, I would like to ask all readers of this article to pay attention to these solutions and their possibilities and inevitability, and to join the team that considers the promotion of social implementation together, regardless of their position or nationality.

As an immediate action, Japan needs to learn from Stockholm, just recently named the world's smartest city, and from its leadership in the Grow Smarter European Project, and to work together to make our societies smarter, better, and happier, leveraging this international joint study.

Use of Nature and Ecosystem of Land/ Sea: Relationship between Restoration, Nature and Global Warming

Masayuki Komatsu

What is global warming?

It is not only warming in the atmosphere but also in the ocean. The use of land and biodiversity loss, including loss of wetlands and salt marshes, will also be the major causes for global warming too. The causes of atmospheric warming and pollution are as follows:

Emissions to the atmosphere

Carbon dioxide: CO_2, methane, alternative CFCs chlorofluorocarbon)

Heat generation from thermal/coal-fired power plants and nuclear power plants, automobiles, industrial refrigerators, etc.)

Emission and pollutants to the ocean

As the ocean and seas accounts for 70 percent of the global surface, warming of oceans with pollutions are of a grave concern.

Heat dumping to the coastal seas and rivers for cooling

Both thermal and nuclear power plants, many of which are located at the sea coast or river banks, discharge heated water to the ocean and river waters. The current levels of technology, however, cannot fully utilize the generated power at the plants so 60 percent of thermal power plant heat and 66 percent of nuclear power plant heat shall inevitably be discharged to the seas and rivers for maintenance of the plants. This wasted heat adds up negatively to global warming and temperature rise. In addition,

seawater temperature rises and ocean oxidation leads to the decrease of marine living resources and fisheries resources.

Factors of negative impacts on terrestrial and marine ecosystems

There are many factors that affect global warming:

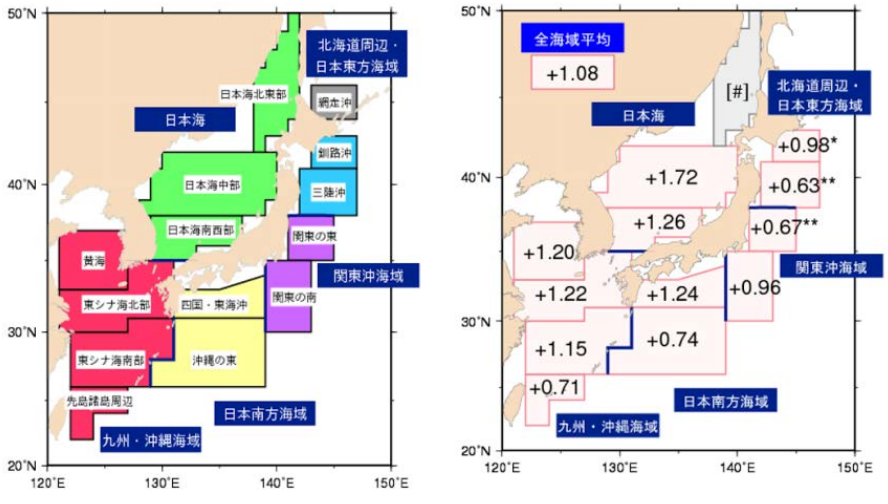
- Loss of broad leaved forests, grassland and coniferous forests as well as deforestation. After logging, there is no reforestation and afforestation thereby ensuring loss of vegetation.
- Loss of wetlands, boglands, swamplands, tidal flats and marshes, which contribute to absorbing CO_2 and methane gas, produce oxygen and nurture biodiversity and nurseries for juvenile fish and marine living creatures.
- Armored and cemented river sides (straightened river flows from meandering, construction of river embankments and heightened riversides, construction of multiple purpose dams and river side barriers to prevent landslides).
- Construction of sewage treatment plants and discharge of chloride ridden and poorly oxygenated sewage water into the sea and bay.
- Construction of seawall, breakwaters, dykes and levees to change the direction of waves and tide and lessen the velocity of currents causing and facilitating poor water quality.
- Discharge of manure from livestock industry and agriculture, and chemical/pesticide and herbicide and fertilizer residues from farming.
- Overfishing and discards from aquaculture.
- Outflows of chemicals and plastics, including micro-plastics.

Sea water temperature rise

The seawater temperature increases from 1900 to 2011 around the Pacific Ocean and the Sea of Japan have been at an average of 0.56 degrees

centigrade over the 100-year term (Figure 1). Usually, one degree of a temperature rise corresponds to more or less 10 degrees of a temperature rise in the atmosphere in consideration of the different nature of density of atoms among liquid and air.

Figure 1: Changes in sea surface temperature in Japan's coastal water in the past 100 (1900~2011) years



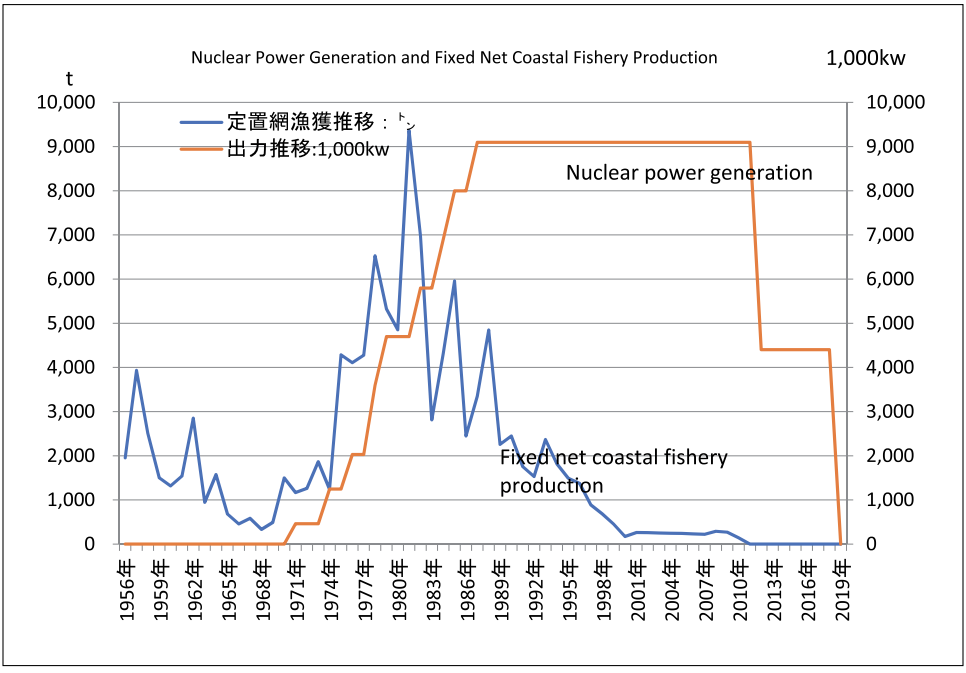
(Source) Japan Meteorological Agency

A case in point is the effect of nuclear and thermal power plants' discharges of high temperature treated water. A nuclear reactor heated up to 285° is cooled down by seawater and this seawater is discharged into the ocean. At that time of the discharge of the heated water, the water temperature should be under 7~10°C higher than the normal seawater temperature. The question is whether this is observed or not.

The amount of the water discharged from nuclear power plants is estimated to be 100 billion tons. My calculation demonstrated that the discharged water raises the seawater temperature by 0.5~0.7°C in 14.3 square kilometers of waters (off 3 miles from the coasts of Japanese

territorial water) where coastal and offshore fisheries are conducted and aquaculture is operated (1,430 billion tons of water on the premise of 10 meter water depth). It is presumed that this would negatively affect the production of fisheries.

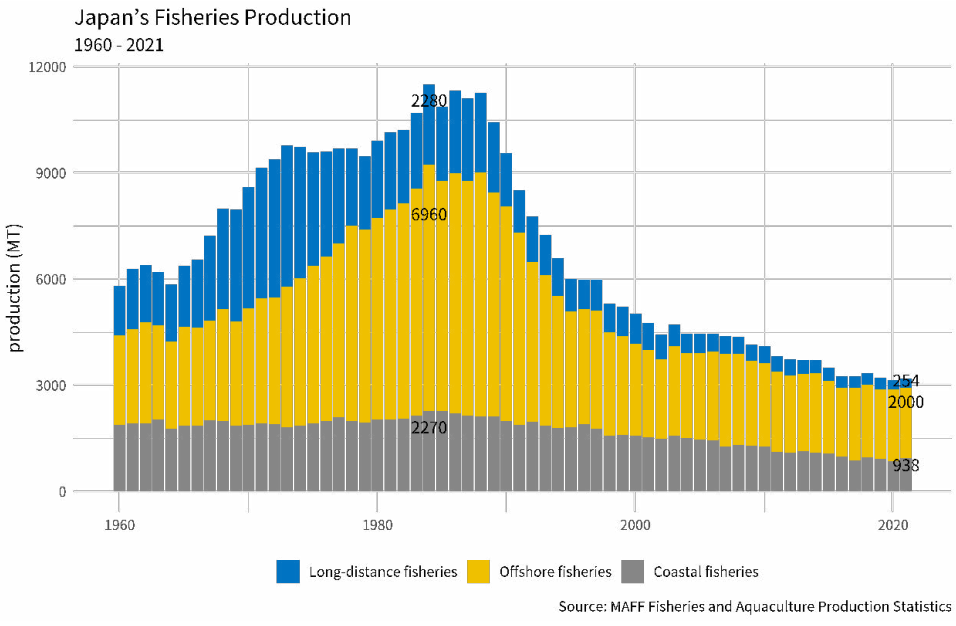
Figure 2:



Decreasing trend of fisheries production

Japan's fisheries production by sector (1,000 tons) is shown in Figure 3. At the peak, Japan's fisheries production was 12.8 million tons in all of the sectors for long-distance fisheries, off-shore fisheries, coastal fisheries and marine aquaculture and inland water fisheries/aquaculture. However, production continuously decreased till 2021 to the 4.17 million tons – 80 per cent of the loss occurred just in the Exclusive Economic Zone of Japan. Japan could have made efforts to remedy the situation and recover production but the Government did not take initiate any effective policies to revert the decreasing production trend. It also did not introduce strict science-based management and MCS (Monitoring, Surveillance and Control).

Figure 3:

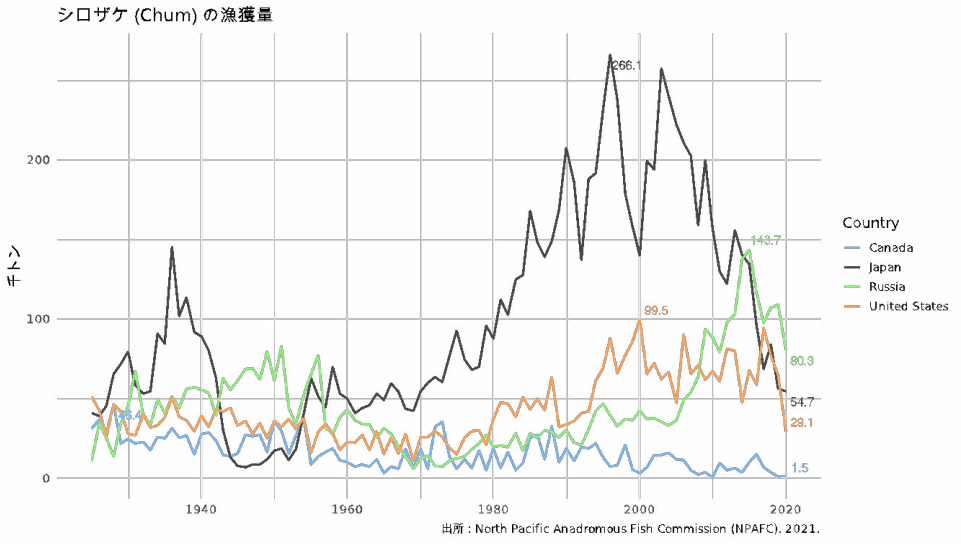


World production of fisheries and aquaculture has expanded and increased since 1950, however after the late 1980s, the increase of world fisheries production is attributed to aquaculture and not capture of wild fish. The production of wild catch has been flat since 1980s to the present whereas aquaculture production has significantly increased from almost zero in the 1960s and 1970s to over 100 million tons in 2020.

The number of salmon returns to the rivers in Japan last 20 years has also drastically decreased. Japan's hatchery production of fingerlings and raising them up to a smolt size before release to the river neglects the nature of salmon returns and of salmon's spawning in the natural river environment. The U.S. and Russia depend on escapement programs to allow the majority of salmon to spawn at river beds under the natural river environment. The hatchery salmon will have a couple of problems such as genetic degradation and genetic biodiversity loss, and hatched fingerlings and smolt of salmon may not adapt to climate changes and habitat degradation. The escapement programs together with the nature habitat recovery and restoration with the nature-based solution will be

one of the remedies towards the restoration of decreased salmon returns to the rivers in Japan. But these trends of lesser returns of hatchery salmon are similarly demonstrated and observed in Washington, Oregon and California. Also, in British Columbia of Canada and South East Alaska, the same trend has been observed for many years (see Figure 4).

Figure 4: Production of chum salmon (unit: 1,000 tons)



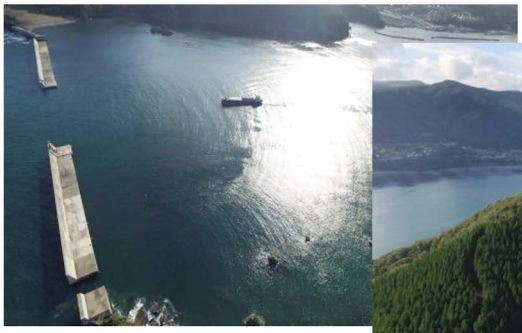
Iwate Prefecture (shaded area and a dotted area shows both Ofunato Bay and Hirota Bay) is located in the northern part of Japan (see Figure 5 above). The area has experienced three major tsunamis in about 120 years. One was in 1896 when 15,000 lives were lost and the second one was in 1933 where the death toll was 3,500 people. Both resulted in devastating damage to the many coastal cities and villages in Iwate Prefecture. The latest one, on March 11, 2011, devastated the coastal areas and loss of lives of nearly 20,000 people.

The seawalls which were constructed to protect the lives and properties of the cities and villages in Ofunato Bay and Rikuzentakata City collapsed instantaneously in the face of the formidable waves. However, without

any scientific data regarding the effect of the protection, the seawall was constructed at the mouth of Ofunato Bay again in 2017. The seawall at the beach and along the coast of Takatamatsubara Pine Forest was also constructed without any scientific and technical evaluation but based on the political decision of city officers and budget availability.

Figure 5: Forestry, Wetland and Biodiversity Losses due to Reconstruction after 2011 Tsunami

Ofunato bay with the construction of Gigantic Bay Wall completed in 2015 after 4years of Great Earth Quake in 2011 September 2021
The Sea Wall affects water quality and speed of currency



Ofunato Bay inner part September 2021
The View from the Mouth of the Bay

The height of the Takatamatsubara seawall was calculated arbitrarily at 12.5 meters reflecting the budget availability. The actual height of the tsunami in March 2011 was 15.5 meters. There was no environmental assessment before the construction of the seawall even though it destroyed a wide range of the tidal salt marsh or wetland of the Furukawanuma Marsh. About a half of the entire marsh area was lost and the current area is reduced to 173,995 square meters due to construction of the seawall and the reclamation of wetland for a walking path and building of the tsunami memorial hall.

There are apparent and substantive losses of biodiversity, nursery ground for fishery production, natural power to create clean water for the sea and wetland, and capacity to absorb carbon dioxide (CO_2), methane and nitrous oxide (N_2O). Wetland, marsh and bogland are to be considered as equivalent to forests that discharge oxygen and absorb carbon dioxide but the tidal salt marsh and wetland could be equipped with more powerful and diversified functions to contribute to the solution of climate change issues.

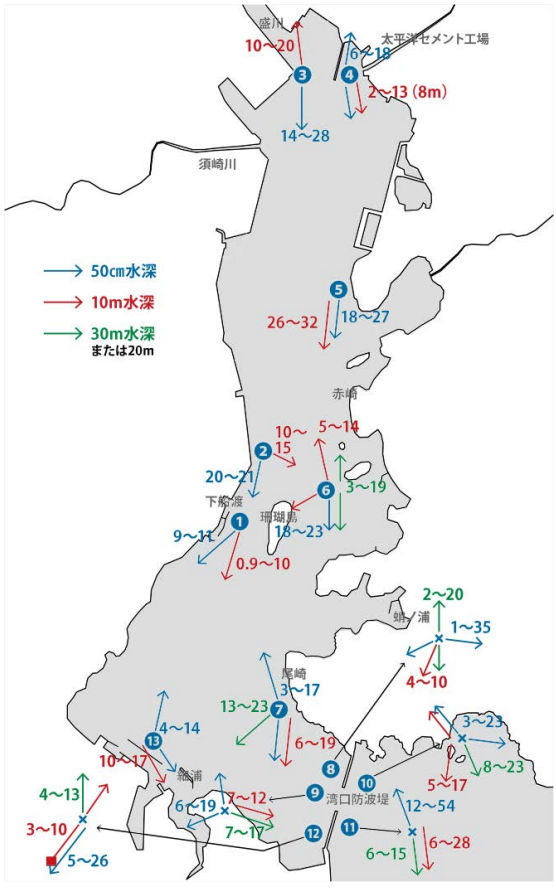


Figure 6: Locations of current velocity check points in Ofunato Bay

September 28, 2021

Blue – surface water, red – 10 meter depth, green – 30meter depth

(Source: Ecosystem Research Institute)

It is clear and evident that the current velocity outside the seawall was faster than that inside the seawall. The current velocity inside was just 54.6 percent compared to 65.5 percent outside (see Table 1). The difference of velocity will affect the dissolved oxygen level and turbidity or contaminants. The water quality inside is getting poorer because of the stagnant water inside the bay. This will damage the oyster aquaculture and salmon runs in the bay and to the Sakari River.

The waste water treatment facility is located at the mouth of the Sakari River, and it pours the treated water into Ofunato Bay. However, the data provided by the Ofunato City treatment facility demonstrated that the pouring of treated water contained only 27 percent of dissolved oxygen that apparently means dead waters.

Table 1: Comparison of Current Velocity Inside and Outside of Ofunato Bay

Unit: cm/second

Surface water

	Apr 2021	July	September	December	Mar 2022	Total
Inside (A)	10.5	19.0	12.5	9.1	32.4	83.5
Outside (B)	30.0	19.5	33.0	11.2	59.1	152.8
(A)/(B)%	35	97	37.9	81	54.8	54.6

b

	Apr 2021	July	September	December	Mar 2022	Total
Inside (C)	5.5	17.8	6.5	4.6	19.4	53.8
Outside (D)	11.0	18.0	17.0	9.8	26.4	82.2
(C)/(D)%	50	99	38	47	73	65.5

Source: Ecosystem Research Institute

Note 1: The above table is prepared based on the 2021 Shimanto River and Ofunato Bay/Hirota Bay Survey Report (published in August 2022).

Note 2: The average of current velocity was calculated from the respective upper and lower limits of the current velocity outside the bay and the current velocity at survey points inside the bay in April, July, September and December in 2021 and March 2022 (see the diagram of current directions and velocity in Figure 6).

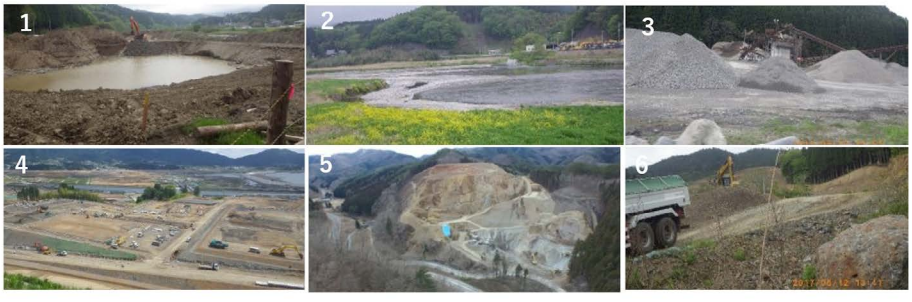
Note 3: Total figures are obtained by adding the figures for each month.

Land use and destruction of land, riverbed and forest

In Rikuzentakata City, the shapes and natural functions of the different types of landscapes were drastically transformed and destroyed (see Figure 7). Since the timber is so cheap, the soil and gravel under the coniferous tree forests are collected for the construction business and related works. The trees are logged but not for sale. The river bed provides gravels, pebbles and stones but they are taken for reconstruction and restoration of the tsunami-hit areas such as Rikuzentakata City and Ofunato City. It demonstrates the fact that in order to restore the cities and villages, there are so many interventions in nature and the ecosystem, disruptions and destructions to the natural environment and functions. In the immediate and long run, these should be researched and evaluated for the future generations.

Figure 7:

Destruction of land by quarrying and extracting soil and gravels for reconstruction projects in Rikuzentakata City after the Great East Japan Earthquake



Extraction of gravels and soil for reconstruction works inRikuzentakata City
1: Gravel extraction site (former rice paddy) 2: Site after extracting river bed gravelsKesen River) 3: Extracted gravels piled up (Kesen River) 4: Land is raised using soil from mountains to develop residential areas$anriku Motorway running in front) 5: Mt. Iimori quarry site 6: Soil extraction site

Future plan with nature-based solutions

Nature Based Solutions (NBS) or Engineering with Nature (EWN) is the idea and principle of using the natural power of nature and services of the environment and ecosystems in reconstruction projects. The aim is to restore and rehabilitate the once lost nature and create nature resemblance to improve water quality, beautiful scenery and comfortableness and

connectedness to the nature and environment. NBS does not resist the power of nature like tsunami or typhoon and strong low-pressure systems as well as a gigantic amount of flows of waters but intends to set free the power and waters of nature to the larger spaces like floodplains or to the river courses they naturally flow to. NBS will use the mature power of ecosystem services to clean the wasted, contaminated and poorly oxygenated water before being discharged to the river systems or coastal waters.

A sort of NBS example in Japan without a clear concept: An artificially restored pond with vegetation in Koiwai Farm in Iwate Prefecture (June 1, 2022)

River restoration case in the US after a small dam was removed

Source: Underwood & Associates

The idea of NBS has been applied without recognition in many Japanese cities and villages. A typical example of NBS is found in the Japanese gardens in Kyoto. We plan to design and implement the first conceptualized NBS in Japan. This NBS plan relates to Furukawanuma Marsh in the tsunami-hit area which was reclaimed and covered with concrete.

Photo of Furukawanuma Marsh; the tidal salt marsh is surrounded by the construction of a 12.5-meter-high and a 2-km-long seawall.

Future Furukawanuma Marsh designed by Dr. Masayuki Komatsu

The NBS plan of the Furukawanuma Marsh, which is artificially constructed with cement, bulkheads and ripraps, has the following main elements:

1. The sewage treatment facility and Furukawanuma Marsh should be connected with a stream, and a creek should be created with natural vegetation of local plants, pebbles and natural sand.
2. The coastal shores should be transformed from the current ripraps and stone wall-covered shores to sand beaches with gentle slopes where water plants or hydrophytes will grow.
3. All tributaries pouring into Furukawanuma March will be modified with a stream restoration method with vegetation which will help improve water quality and increase fauna and flora biodiversity.
4. A beach and a walkway between two sides of the marsh with crossing over the tidal flat that appears at low tide will be created for the purpose of swimming and recreation.
5. A research institute for the study of the effect of NBS: Situations before, during and after the NBS will be introduced in collaboration with other environmental institutes.
6. In the middle of the 2-km-long seawall, a 40-meter wide and 2-meter deep water gate should be created to improve water exchanges between Furukawanuma Marsh and Hirota Bay for improvement of biodiversity and water quality and enrichment of Hirota Bay waters to help and facilitate the production of oyster and other shellfish.

III

The Practices and Reporting

Role of Mining in a Green Energy System and the Paradox of its Negative Impact on the Environment

Michael Goodsite, Volker Hessel and Paula Angerstein

Most of us have a sense that reaching net zero for all of humanity is a big job. But few truly appreciate—with over 80 percent of global energy use still derived from fossil fuels—just how hard it is going to be to achieve without inflicting further environmental harm.

One fact brings the immense scale of the task into particularly sharp focus: to build and operate all the clean-energy technology the world needs to reach net zero carbon emissions by 2050, we are going to have to access a staggering amount of critical minerals. We need to move to from a society whose primary energy source are fossil fuels to one where materials, metals and minerals are crucial to making an energy system 'green'.

Looking at copper alone, a recent S&P Global study[1] predicts we will need to access more of it between now and 2050 than has previously been consumed in the world between 1900 and 2021; by 2035, global production will need to virtually double.

Similarly daunting estimates have been highlighted in various studies, including one by the International Energy Agency.[2] We are facing this situation at a time when the latest Australian *State of the Environment* report nominates mining as one of the top few contributors to serious environmental decline over the past decade.[3]

The technological and engineering know-how exists to mine more, however the ability to do this sustainably is not yet documented. Mining complex elements in a polymetallic geologic matrix, as many of the elements find themselves in, requires more water and more energy, as well as a means to handle deleterious elements in a safe environmental manner'.[4] So how are we going to get that much copper—and other vital commodities, such as nickel, lithium, and cobalt—without further damaging the very thing we're trying to save?

One possible solution could be the use of designer and specialty solvents that have extraordinary dissolution properties. These could open new horizons in the purification of leached metal mixtures from mined ores. These solvents allow high efficiency in the purification and in the selectivity to carry one metal preferentially over the other. Beyond conventional solvents, Deep Eutectic Solvents (DES), which are mixtures of solid materials made from natural resources and available in large amounts and thus considered 'green', are believed to be a more sustainable solution.

One could ask, why haven't scientists, industries and policy makers already acted? How are we going to meet the demand of the materials required for a green energy system without causing greater harm to our natural habitat than the benefit of extracting the materials from the earth in the first place? How are we going to measure, report, and benchmark our efforts to proof improvement? The solution can not only be delivered by technical and engineering advancement but must focus on solutions coming from the humanities and social sciences as well.

The answer, indeed, as is the case with every sustainability-related challenge, is that there isn't just one answer. We are going to have to innovate, bring together and integrate expertise from different backgrounds, in every facet of our activities, every step of the way. Engineers must collaborate with ecologists; computer scientists with geologists; policy influencers and social license specialists with communities and traditional

landowners and cultural leaders. New ways of measuring and accounting across systems and international markets must be enacted. We must find a way to educate, engineer and ultimately enforce actions that must be taken and verified to reach our aims.

To continue our copper example, we cannot rely solely on finding and extracting new deposits, and particularly not using traditional techniques. The current global average for progressing a new deposit from discovery to production is 16 years; time we do not have if we are to meet the global net zero emission targets by 2050. We are going to have to get much better at recovering and extracting from ores that have already been mined. Re-valuing abandoned mining operations could provide numerous benefits for all stakeholders such as better health, safety and social outcomes for the community, financial profits and the environmental impact from cleaning a contaminated site.

When we do initiate new extractions, we must do so in ways that are culturally respectful by engaging in a meaningful way with communities while drastically reducing environmental harm—extracting in place, for example, by 'mining the mineral', not the ore, and we will need to make constructive, efficient use of every gram of material we produce.

Every link in the mining value chain—from deposit discovery and ore extraction, to refinement, processing, and transport—should be optimized through advanced sensing and machine learning to achieve maximum performance output with minimal energy use or wastage. We must be able to trace 'green' copper and trust its provenance through international markets.

Who can we look to, as an example of best practice?

Nascent large-scale mining operations in countries with strong mining policies may be worth looking towards, as well as long term operations in countries with well-established Environmental, Social and Governance (ESG) principles in the resource sectors, such as those found in the Nordic countries.

One good example is Greenland, which although it has been talked about for the past decade as a relatively new resources opportunity, has actually had mining activities since the 1840s and the first drilling of oil off of its coast in the 1970s.[5] A part of the Kingdom of Denmark, Greenland is a self-governing constituency (Greenland Self-Government Act, 2009). Petter Hojem in 'Mining in the Nordic Countries A comparative review of legislation and taxation' (2015)[65] noted: '*Of all the jurisdictions compared, Greenland is the most obvious outlier. For example, Greenland* [in addition to EIAs, (Environmental Impact Assessments)] *is alone* [when compared to mining in the other Nordic nations] *in demanding that companies perform SIAs* [Social Impact Assessments] *and sign IBAs'* [Impact Benefit Agreements]. … He further notes that Nordic countries with international mining operations may perform SIAs but [that] '*Overall though, it seems fair to conclude that legislation around social issues seems to be less developed than economic and environmental aspects, not least with regards to company reporting requirements.*'[7]

Much has been studied and reported relating to the environmental component of sustainability and the impact of human activities on the planet. Environmental issues have been improving, due to stricter legislation and stakeholder expectations. However, more recently the emphasis has shifted towards the social and governance aspects. ESG is the way sustainability is increasingly referenced in corporate and financial contexts, with defined accountabilities linked to quantifiable performance metrics as a way of managing investor and operational risk across a broad range of matters. For the mining sector, this means adopting strategies and activities that meet the needs of the enterprise and its stakeholders today while protecting, sustaining, and enhancing the human and natural resources that are needed for the future.

Even though still under development, Nordic countries are collectively ahead of many jurisdictions with respect to their focus on ESG collaboration and collective efforts. The Nordic countries are an example of cooperation across jurisdictions with respect to policy, market, and innovation.

The moment it becomes possible, around the world, wherever we are able, we must immediately begin restoring habitat and nurturing biodiversity. To keep all these wheels turning, we have to grow and enhance our sovereign circular economy capabilities, in every country, or across trusted partners, so that our abundance of natural resources produces sustainable value throughout society for generations to come. Mining must become part of the solution and society needs to understand and believe that it is a part of the solution. We should look to operations in the Nordic countries where countries operate across boundaries, companies have done well, and been able to gain societies trust.

Just as importantly, we must not be afraid to call out and recognize where companies have not done well. Learn from mistakes and fix our errors in an honest and transparent way. Stakeholders expect this of us and it is the only way to build trust across society. The Nordic countries recognize this: for example, EIAs have been opened for public feedback by companies and governments and reported back to the public as to why or why not feedback was not actioned.

Meaningful and long-term trust building is essential between resources companies and communities, people must come along for the journey and be assured of the positive outcomes. If we want the societal and environmental health and wellbeing that net zero can bring, we can no longer afford a divisive 'us and them' mentality. All constructive voices must now be heard, and it is imperative that we work together to collectively solve the challenges we face.

We must become Generation 'us'.

The Authors acknowledge Matthew Hardy, Senior Copywriter, the University of Adelaide, for his contributions to copywriting the article.

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Regulatory Models of Community Energy (CE) in a Multi-Regulatory Approach: Juxtaposing the Global, the EU, the Japanese and Swedish Cases

Sandra Cassotta

Introduction

The changing landscape in climate and energy law has accelerated new energy projects and advancements within the technological and economic sphere. The climate targets introduced by the Paris Agreement, the Sustainable Development Goals (SDGs), the Glasgow Climate Pact at Conference of the Parties 26 (COP26) and the European Green Deal emphasizes the importance on the participation of citizens and communities in energy transitions. Most notably, they focus on the bottom-up approach. However, the current situation requires initiatives to effectively support the transition from fossil fuels to renewable energy and increases engagement within society to find innovative ways, within the regulations, to use and consume energy.

Community Energy (CE) has emerged as a new form of 'collective energy actions' that involves the participation of citizens in the energy system. CE projects are characterized by various degrees of involvement in decision-making and benefits-sharing and may describe a community limited by a geographical location or a community of interest.[1] Examples of CE include energy cooperatives, eco-villages, and small-scale heating organizations. CE is a way to reach social transition from the bottom up and therefore serves as a good reason to link CE to climate change. However, while the engagement of CE has increased over the past years, a legal framework is yet to be fully developed, most notably within the regulatory comparative

and contextual systematic fashion. In addition to this, there is currently a limited amount of research within this domain.

This article seeks to define the challenges and opportunities for new regulatory models in relation to CE and will do so by analyzing the phenomena in a multi-regulatory approach. This study will use the EU regulatory level as the primary focus and for its comparative element use Japan and Sweden as two legal model cases. Due to their ability to have a close cooperation between national or regional level of governance and local governments, Sweden and Japan are considered to be 'hybrid' regulatory models, which are key in regulatory climate and energy action. The concluding section of this article will identify how these regulatory models – from EU, Japan, and Sweden – can be a source of inspiration for new regulatory designs.

Community Energy in the EU Model

Within the EU, CE is seen as an 'economic and operational participation and/or ownership by citizens or members of a defined community in a renewable energy project'. Within the EU law, there are currently two definitions of CE provided by two directives: (1) The Internal Market Directive (IMD) defines CE as 'citizen energy community' and (2) the Directive RED II identifies it as 'renewable energy communities'. The main difference between these two directives is that the first one includes new roles and responsibilities for the citizens' energy community in the energy systems covering all types of electricity while the second one covers renewable energy communities.

The membership is voluntary, as it is believed that no one should be forced into CE projects, and furthermore it should be based on a non-discrimination policy to remain fair and transparent. It also aims to eliminate barriers within administrative, bureaucratic, or financial aspects. There is a support system in place, known as the FIT scheme, which targets businesses who use methods that do not consume natural resources to generate electricity.[2] The EU model also allows for simple notification procedures for grid connections of installations at less cost. In general, the EU framework creates a space in which the CE can be

entitled to own, establish and purchase or lease a distribution grid and autonomously manage it. As such, this model can serve as a source of a legal environment for CE, as it includes critical issues such as membership, non-discriminatory treatment, barriers, support schemes, and grid management.[3]

However, official documents have shown that there has been limited commitment and participation in the sustainable transition of energy systems.[4] Hence, it reflects the need for improvements in this regard in order to accelerate the development of CE further. In addition to this, it is important to mention that CE projects require funding that many local communities lack. There are some EU countries that have such financial resources in place, however many do not.[5] As such, developing a regulatory framework within EU countries has been a slow process.[6] This shows that there is a lack of conditions in place as well as an understanding of who and what measures can be taken towards an effective legal framework that can serve as a guide in energy transition in the pursuit towards climate change.

Community Energy in the Japanese Model

In Japan, CE is already a part of the Japanese energy sector, although it is not currently formalized within a legal framework.[7] The Japanese model demonstrates a combination of 'bottom-up' local prosumer movements, alongside 'top-down' action. Currently in Japan the trend of decentralization is essential to understanding how legislation is calling on local governments to act.[8] Energy liberalization through national reforms in 2016 have seen the emergence of many small-scale municipal power producers and suppliers of renewable energy serving local areas.[9] Nevertheless, citizen-funded energy installations have been present in Japan since the 1990s, with the first solar power plant constructed in 1994, and then wind power in the 2000s.[10] These community-owned projects have varied in location, from urban to rural communities, and in their scale, but the overall growth in their numbers has been linked to various national policies and incentives, such as the New Sunshine Program.[11]

However, Japan's photovoltaic (PV) market has recently faced a decline as solar subsidies have been cut and other voluntary incentives have not been successful in promoting projects.[12] Therefore, to expand CE in Japan, an adequate regulatory framework needs to be developed. This could be adapted from the EU's model, given its solutions for grid concerns, administrative barriers, and non-discriminatory treatment among other things.[13] CE in Japan could also potentially be strengthened by several other national factors. These range from the collaborative approach the government is promoting to achieve carbon neutrality by 2050, to more specific projects for large-scale PV installations at old farms,[14] hydrogen promotion, and disaster prevention initiatives that CE can play a large role in.[15]

Community Energy in the Swedish Model

The Swedish Climate Act entered into force on January 1, 2018 and establishes that the Government's climate policy must be based on climate targets and specifies how the implementation is to be carried out. Sweden presents the singular situation of having a high share of renewable energy in its territory but also, paradoxically, weak development of CE. Sweden is, however, an interesting model for CE owing to its smart cities, high-tech society, and the 'hybrid regulatory model'. It is also characterized by the strong role in energy transition projects that is given to the municipal level, which is made up of many local governments that compete. There are 140 identified CEs in Sweden,[16] mostly consisting of wind cooperatives and some solar. These have developed in a bottom-up fashion with ownership belonging to both the public and private sectors.

Nevertheless, in general, CE projects have not been well developed across Sweden due to uncertainties relating to regulation, the structure of the energy market, and the involvement of municipalities. They are especially lacking in citizen engagement, which is a very important aspect of CE. Therefore, it is important to develop new regulations and a legal framework for CE in Sweden which focuses on initiatives that encourage citizens to engage as it would benefit production and consumption. One

way that Swedish CE projects are already attempting to engage with more citizens is through digital platforms that allow citizens from outside of the CE's immediate location to participate. This is an interesting feature that could be adopted in future CE frameworks.

Conclusion

The multi-regulatory approach has been used to show how the regulatory framework for CE at the EU level can be developed by taking inspiration from law and policy at the global and national levels. At all levels, a focus on the involvement of citizens in the transition is imperative.

Juxtaposing the EU, Japanese, and Swedish models can enable these governments to develop their institutional legal framework and knowledge on CE. As such, dialogue, and cooperation between all three is necessary to help create a new regulatory framework for CE, which will build on multi-regulatory governance that empowers citizens. Sweden and Japan both have 'hybrid' frameworks as their national or regional level works with local governments to create two-way learning, but they have differences which can inspire one another. One area where the Swedish model could draw from the Japanese model is how to implement legislation that calls citizens into action in a more proactive way. Increased cooperation and mutual inspiration between Japan and Sweden could easily be effective in that both possess high levels of technology and industrial competitiveness. Such cooperation would have significant influence in the international community. This could in turn open a path for a new kind of diplomatic dialogue within the frame of EU-Japan cooperation based on the improvement of new regulatory solutions for new forms of climate change and regulatory patterns that empower citizens.

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Accounting Practices and Climate Change Cooperation between Sweden and Japan

Svetlana Sabelfeld

Swedish Institutional Traditions and Environmental Reporting Practices

In this essay, I will highlight Swedish companies´ accounting practices related to climate change and draw some comparisons to the context in Japan, reflecting over the possibilities of how Sweden and Japan can learn from each other during their journey towards net-zero greenhouse gas (GHG) emissions target.

Before presenting the Swedish approach to accounting on climate change, it is important to emphasize some institutions, past events and regulations shaping the development of sustainability accounting in Sweden.

First**,** a social democratic tradition in Swedish politics placed social and economic welfare in focus and shaped a stakeholder-oriented accounting practice in Sweden. It defined the purpose of Swedish accounting serving the society in a broader sense, and not just the interests of the capital market.

Second, Sweden has a tradition of developing laws to protect nature and local environment. For example, the first Nature Conservation Act came in 1964, and this was followed by the Environmental Protection Act in 1969.

Third, Sweden early on established collaboration with United Nations concerning environmental issues. In 1972, Stockholm hosted a UN Conference on the Human Environment, which was the first international conference to make the environment a major issue. This conference

started an international dialogue focusing on the links between economic growth and the pollution of the environment. The outcome was an Action Plan, including a Global Environmental Assessment Program, a plan for environmental management activities, and development of international measures to support these activities.

Some decades later, the Environmental Code was adopted for companies that conduct environmentally hazardous activities in Sweden. It was incorporated in the main accounting regulation, requiring companies with hazardous activities to disclose their environmental impact in annual reports.

Furthermore, in 2005, the Swedish Corporate Governance Code was introduced, and the Stockholm Stock Exchange required all listed companies to apply it. The code stipulates that major owners were to be actively engaged with the boards and take responsibility of strategic corporate decisions. Such a responsibility motivates strategic decision-makers to take long-term oriented sustainable decisions. Also, Swedish corporate boards of directors have several seats for employee representatives, which makes the boards more diversified in terms of perspectives, knowledge, experiences, and backgrounds.

Finally, in 2007, the Swedish government required the boards of state-owned companies to ensure that companies present a sustainability report according to GRI international guidelines for sustainability. The guidelines have been largely used on voluntary basis almost everywhere in the world, but in Sweden, they became mandatory for state-owned companies. This positively influenced even private listed Swedish companies´ sustainability disclosures.[1]

Transnational Regulation

In 2016, the Swedish government adopted the EU Directive on Non-financial Reporting (NFRD) and made it a part of national accounting legislation. Originally, the EU directive was made for large public companies with over 500 employees. However, in Sweden, the government decided to be more ambitious and include even smaller private companies (with over

250 employees) in the target group. The logic was simply to push more Swedish companies to start reporting on social and environmental issues. Consequently, from 2017, nearly 1,600 Swedish companies became subject to the new law.

What did the recent adoption of the EU directive mean for the Swedish companies´ environmental reporting practice?

The new law, which became part of the existing Annual Accounts Act (Årsredovisningslagen), requires companies to publish a non-financial statement containing information about sustainability, including *environmental* matters. Here, I will only outline the requirements related to the environmental dimension of sustainability:

1. To describe the business model and how environmental issues relate to it;
2. To present the corporate policies related to environmental matters and the outcome of those policies;
3. To describe the principal risks related to environmental matters and how these risks are managed by the company. The risks also need to be linked to the company´s operations, products and services.
4. To present relevant environmental performance indicators in the report.

The principle of double materiality lies at the core of the NFRD. At the time companies implemented the directive, the Swedish government announced the National Climate Policy Framework and introduced the Climate Act to implement the Paris Agreement. This framework was seen as the most important climate reform in the country, setting out the aim for Sweden to have zero net emissions of greenhouse gases by 2045.

There are some clear positive effects of the above mentioned directive, such as the climate issue moved up to the board level.[2] Companies started recruiting people with competencies in environmental management and reporting to be able to integrate climate change issues in management and reporting practices. However, there is also some critique on the way the directive was designed.

First, it was designed as a soft law, so that companies must comply with it or explain why they choose not to comply. Researchers call this soft approach "smart regulation",[3] as it opens a big space for interpretation and maneuver, which often results in a rhetoric creating a green façade of corporations.[4]

Second, in Sweden, the auditors don't need to assess the *quality* of the information provided according to the directive. They only need to check that the information is disclosed, without checking its quality. Auditors explain that the quality assessment is not possible, because there are no clear national reporting standards in place. Third, there is no sectoral guidance that would help different business sectors to adopt the directive in a comparable way.

Finally, there is currently no link between the mandatory sustainability reporting regulation and internal corporate governance mechanisms, enforcing the quality.[5] Regulation can have a good effect on minimum-level environmental disclosures, but existing voluntary governance mechanisms motivating companies to improve sustainability reporting practices should also be considered and linked to the new regulations.

Currently, the following international reporting frameworks inspire Swedish companies´ environmental (including climate change) reporting:

Global Reporting Initiative (GRI) is typically used at the level of environmental performance and compliance with the NFRD.

Greenhouse Gas (GHG) protocol is often combined with the GRI standards, and used at the level of environmental performance in corporate sustainability statements.

Task force on climate change-related financial disclosures (TCFD) is used at strategic and managerial levels. In 2017, the EU introduced guidelines on reporting climate-related information, which are aligned with the NFRD and the TCFD. Therefore, the TCFD framework is often referred to and used by companies to comply with the NFRD in Sweden.

Integrated reporting framework (<IR>) is used at the front pages of annual reports to illustrate company´s value creation model.

At the level of environmental performance and compliance with NFRD, companies typically use the GRI standards. Often, the GRI standards are combined with the use of GHG protocol (scope 1-3) when Swedish companies report on direct emissions, energy indirect emissions and other indirect emissions. Reporting of indirect emissions (scope 3) is however challenging. According to the GHG protocol, other indirect emissions, such as extraction and production of purchased materials and fuels, transport-related activities in vehicles (not owned by the company), electricity-related activities (not covered in scope 2, outsourced activities) and waste disposal are issues a company itself cannot fully control. This problem leads to a fragmentation and poor quality of the scope 3 GHG reporting (compared to scope 1 and 2). It is found to be time consuming for companies to collect this data, which explains why many Swedish companies are still not reporting according to scope 3.

Currently the NFRD is under revision and the new European sustainability reporting standards are under development. Simultaneously, the IFRS Foundation formed the International Sustainability Standard Board in 2021, and is currently developing future international sustainability disclosure standards with intention to tackle sustainability, and particularly climate change, by assessing the "related opportunities and risks".[6] Such international standards are justified by the argument that "investors require high quality, transparent and globally comparable sustainability disclosures that are compatible with the financial statements".[7]

Comparisons between Sweden and Japan

This section will articulate some comparisons between Swedish and Japanese contexts, and the possible ways Sweden and Japan can learn from each other.

Historically, both in Sweden and in Japan, the purpose of accounting is much broader than just serving capital market and shareholders´ interests. Furthermore, in both countries accounting is a stakeholder-oriented practice. So, traditionally, accounting is serving the interests of owners, employees (both in Sweden and Japan) and, in addition, interests of the State in Sweden. It means that Swedish and Japanese companies have

a tradition of embracing a more long-term oriented multi-stakeholder perspective on accounting and governance.

When it comes to the regulation of non-financial reporting (NFR), it has been less regulated in Japan compared to Sweden. However, Japanese companies are more conscientious about adopting (and adapting) voluntary frameworks to local needs and problems. For example, many listed companies are rigorously using the IR framework to improve the dialogue between corporate governance and investors, especially, with international investors who previously struggled to understand business models and value drivers in the Japanese companies.[8] Thus, adjusting the global frameworks and using them to address local needs and concerns (not just for compliance) is an approach that, I believe, could inspire Swedish companies´ reporting practitioners.

In 2014-2015, the Stewardship Code and Corporate Governance Code were introduced in Japan as part of Prime Minister Shinzo Abe's "New Growth Strategy: Japan Revitalisation Strategy"[9] agenda, pushing companies to reform corporate governance tradition in Japan towards an Anglo-American corporate governance model. The Japanese companies are managing to find a balance between western and traditional corporate models. In this context, I believe, that cooperation between Japanese and Swedish companies could be fruitful in a search for new and creative internal corporate governance mechanisms enabling the transformations needed for the achievement of climate goals.

It is also important to emphasize that Japan has a unique culture when it comes to the relationship between human and nature. For example, in line with the Japanese traditional (Shintoism) values, there is no concept of superiority of human in Japan. For example, Japanese people appreciate and respect the power of nature; they do not take natural resources for granted. Japanese companies also show awareness about their interdependency with nature, as a limited resource. And, I believe, this is something Western corporations could learn more about.

Given the challenges that regulators and companies currently face in climate change reporting, some future-oriented initiatives and directions

for possible collaborations are as follows:.

- Improving corporate governance mechanisms and establishing the links between corporate governance and accounting for climate change;
- Strengthening institutions for independent quality assessments to ensure the quality of the reported information.

On a final note, accounting and reporting can assist organizations in the process of achieving climate change goals. However, reporting and climate change related disclosures alone cannot suffice. As articulated by Quattrone (2021), we need institutional arrangements, where there is "a stronger voice representing Nature, to check on the behavior of corporations and shareholders.[10] This means that nature needs to be seen as a stakeholder, equal to other important stakeholders such as shareholders and employees.

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IV

Sweden and Japan in the Geopolitics of Climate Change

Regulation as a Catalyst for Climate Action: How the Adoption of the TCFD Recommendations is Driving Net-Zero Goals

Merlin Linehan

The adoption of the Task Force on Climate-Related Financial Disclosures (TCFD) recommendations is being led by Japan and many EU states, including Sweden. The TCFD recommendations help companies to identify climate-related financial risks and opportunities. The adoption of the recommendations along with the other climate regulation can allow companies to identify and reduce climate-related risks as well as drive the adoption of low and zero carbon products and services.

Introduction to TCFD

The Task Force on Climate-Related Financial Disclosures (TCFD)[1] was introduced by the Financial Stability Board in 2017 as a set of recommendations that companies could disclose financial-related climate risks and opportunities. This information can be used by insurers, investors and lenders to help understand the impact of climate change on a specific set of assets or financial portfolio.

Over time, more banks and companies from across the globe have started the process of adopting the TCFD recommendations. The recommendations allow companies to understand the climate risks faced by an organization and identify how their assets will be impacted by climate change.

Companies will face physical risks, such as more intense and frequent heatwaves, floods, and hurricanes. These have the potential to damage assets such as buildings, factories, infrastructure, and supply chains. These climate risks can reduce revenues, increase insurance premiums, and destroy balance sheets. For example, the California-based Pacific Gas and Electricity Company suffered US$24 billion in damages and legal settlements resulting from climate change induced drought and wildfires in the state. The scale of the damage eventually resulted in the firm's bankruptcy in 2019.[2]

Considering physical climate risks can lead to improved long-term planning. Roads can be built to withstand more frequent flooding. Ports can be developed with sea-level rise in mind and buildings can be designed to withstand more extreme heatwaves.

Companies also face so called transition risks. The transition to a low-carbon economy means shifts in climate policy, consumer sentiment and the emergence of new disruptive technologies. These changes may create costs for businesses. For example, if a state bans the further exploitation of national oil and gas reserves, oil companies face lost revenue as it is no longer able to utilize those reserves (aka stranded assets).

Climate Opportunities

The TCFD recommendations also call on companies to look for climate opportunities. Around 80 percent of states across the globe have committed to a net-zero carbon economy (for example, Sweden has pledged to be net-zero by 2045[3] and Japan by 2050).[4] The shift to a net-zero world requires massive investment in low and zero carbon technologies and services. The most obvious sector for transition is energy. Renewable energy in the form of wind, solar and now other forms like hydrogen are gaining in popularity thanks to their role in supplanting fossil fuels.

However, for the world to reach net-zero goals, every sector of the economy will require decarbonization. Construction, transport, agriculture, and

heavy industry are just a few heavy carbon emitting sectors that require innovation and heavy investment to successfully decarbonize. For the corporate sector, this is a both a daunting challenge[5] (to fundamentally change the global economy in just over two decades), but also a major commercial opportunity.

The demand for goods and services that are low or zero carbon will soar in the coming years. Companies and states that provide these low/zero carbon goods and services will gain a significant competitive advantage.

For many companies, the TCFD and other climate regulation are the catalysts that will drive innovation. Since the TCFD recommendations require board level oversight, CEOs and corporate boards will develop a narrative around climate change and how they will adapt to a world that is decarbonizing and facing up to runaway climate change. These shifts will make them consider adopting products and services that drive decarbonization or head to obsolescence.

Swedish Zero Carbon Steel

Sweden is often seen as climate leader and the Hydrogen Breakthrough Ironmaking Technology (HYBRIT) project[6] is an example of this. This is an ambitious attempt to create carbon free steel and at the same time reduce Sweden's overall carbon emissions by 10 percent.

Swedish steel producer SSAB plans to invest almost €40 billion over the next two decades in emissions-free steel production. Essentially, they will use hydrogen instead of coal as the reducing agent. This process will significantly reduce carbon emissions and boost the adoption of hydrogen technology.

Projects like HYBRIT are driven by business innovation and the need to maintain a competitive advantage. They are also driven by the reality or prospect of new regulation such as the TCFD and the Paris Agreement.

Becoming a TCFD supporter encouraged Japan Airlines (JAL) to consider innovations that would reduce its overall carbon emissions.[7] JAL purchased more fuel efficient aircraft as well as taking measures in landing and take-off operations in order to reduce fuel usage and carbon emissions. JAL is also experimenting with the use of sustainable air fuels, with the aim of reaching net-zero emissions by 2050.

Regulatory Framework

The TCFD is just one part of the regulatory puzzle. The Network for Greening the Financial System (NGFS), and the Bank of International Settlements' (BIS) Taskforce on Climate Related Financial Risk (TFCR) have all emerged to create a global regulatory framework for identifying and managing climate risk. Ensuring financial flows align with falling greenhouse gas emissions as set out in Article 2.1 c of the Paris Agreement[8] and requires the development of global markets for sustainable finance.

Climate change was seen as something far removed from the three- to five-year planning horizons of most companies. The TCFD recommendations have taken climate risk and reporting to the heart of the decision-making process for many banks and companies across world.

Japan and Sweden

Currently, the UK, the EU member-states and Japan lead the way in global TCFD reporting. Japanese firms have demonstrated leadership with over 500 supporters (Japanese companies signing up to the TCFD recommendations) in 2021.[9] In contrast, China counted for just 6 TCFD supporters in 2021. The Japanese finance regulator, the Financial Services Agency (FSA)[10] is encouraging all members of the prime market on the Tokyo Stock Exchange to report climate risks by 2022 or explain why they are not adopting the recommendations.

Sweden along with other Nordic countries has a reputation for climate leadership. In 2020 there were 37 companies[11] supporting the TCFD recommendations (in a proportionally much smaller economy than Japan

or China). Sweden is a member of the European Union (EU) which also pressing ahead with making TCFD recommendations mandatory. The EU has not officially adopted the TCFD for its member-countries, but it is implementing the Sustainable Finance Disclosure Regulation (SFDR),[12] which will align with the TCFD as well as incorporating broader sustainability goals.

The Rise of TCFD

In many parts of the world climate regulation is not a priority. This can be the result of reliance on fossil fuels and hostility to any threat to the status quo, or because other short-term risks appear more pressing. Despite this reality, mandatory TCFD reporting is being implemented or discussed in nearly all major economies, the EU, Japan, U.S., China, and Australia are all applying or contemplating mandatory TCFD reporting. This may be initially limited in scope to larger banks or companies, but the momentum is clear. In 2021 there were 2,616 TCFD supporters (an increase of 99 percent on 2020) with total assets of US$ 194 trillion globally.[13]

Understanding Climate Risks

With many companies reporting on the TCFD recommendations, they are now gaining a deeper understanding of climate risks on their portfolios and assets. This in turn is promoting a deeper understanding of climate change in the corporate sector, creating a virtuous circle of knowledge which means that companies will increasingly avoid investments that are exposed to climate risk and will explore the opportunities of investing in low carbon products and services.

Geopolitical Tensions

The latest IPCC[14] report painted a bleak picture of climate risks, predicting the mass die off of species and food and water shortages for billions. Climate change is a force multiplier, making existing problems worse, like more frequent and extreme heatwaves, more damaging and regular flooding or more deadly hurricanes.

As these climate risks materialize over time, they will stoke geopolitical tensions between different states. Climate leaders will increasingly blame laggards for not embracing the rapid transition to net-zero while many emerging economies will point the finger at developed states for not providing adequate funding for climate mitigation and adaptation.

Cooperation on climate will also be stymied by existing geopolitical splits that already exist between democratic and authoritarian states, the global south and north.

Climate Catalysts

Climate change will also act as a catalyst for geopolitical risks. Drought will lead to famines, flooding and heatwaves to mass deaths and sea level rises will result in mass migration. New waves of migration, mass starvation and economic dislocation will result in unpredictable geopolitical shifts. For example, water and food shortages will spark conflict in and between states. These costs will fall across the globe but will be perhaps felt most keenly in the global south which will too often lack the resources to react to disaster and ability to adapt to a fast-changing world.

Countries like Sweden, Japan and others that embrace the TCFD will act as drivers for innovation by stimulating the growth of low carbon technology, companies, and products. This shift will help reduce emissions and push the world towards the net-zero goal. The more countries that adopt this approach, the more climate risks will be mitigated.

Countries and companies that utilize the TCFD recommendations and other climate regulation will gain a significant competitive advantage as they will be able to identify and avoid at least some climate risks. While it will be impossible to fully adapt to climate change, firms that identify and plan for climate risks can reduce their risk profile and survive or even thrive in a world facing climate chaos.

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Building Green Hydrogen Value Chains in the Indo-Pacific: Prospects for EU-Japan-India Cooperation

Ramu C. M. and Dhanasree Jayaram

Green Hydrogen as the 'Fuel of the Future'

The labeling of hydrogen as 'the fuel of the future' has resonated closely with the evolving discourse on the global energy transition, especially in light of the worsening climate crisis. Green hydrogen is therefore emerging as a potential area for cooperation between countries engaged in climate diplomacy. The European Union (EU), India, Japan, the United States (U.S.), Australia, and other countries are closely looking at cooperation on green hydrogen in their Indo-Pacific strategies. This is critical to the achievement of these countries' net zero commitments and Paris Agreement goals. Moreover, when viewed through the lens of energy security, a unifying concern for the EU, Japan, and India is the fact that they are all significant importers of hydrocarbon fuels, virtually rendering them susceptible to the vagaries of geopolitics, supply shocks, and recurring price volatility. In order to contextualize a potential axis of cooperation (modeled on developing resilient renewable hydrogen value chains) between the EU, Japan, and India, it becomes imperative to identify the synergies through a better understanding and leveraging possible areas of collaboration and co-innovation from a multi-stakeholder perspective.[1]

Given the emphasis on electrification as central to energy transition, the long-term sustainability of the process depends on the degree of decarbonization of the energy-conversion systems. In the 'hard-to-abate'

sectors with more obdurate emissions, such as the steel and chemical industry, or aviation and long-haul freight transportation, green hydrogen produced from electricity (generated from renewable sources) could act as an alternate carbon-neutral energy carrier. A molecule of hydrogen has a higher energy density (energy content per unit weight) over conventional petroleum derivatives such as petrol and diesel. Hydrogen fuel cells could therefore be a superior competitor, both for energy storage and as an energy carrier, to not only internal combustion engines but also Lithium-ion batteries used in electric vehicles. Even though hydrogen has been produced from various fossil fuel feedstocks for years – with varying nomenclatures such as black or brown (produced from coal and lignite) and grey (produced from natural gas through steam-methane reforming) – the very carbon-intensive nature of the process long shadowed its potential benefits. Sustainable hydrogen is ideally characterized by no or negligible carbon emissions, all the way from the supply chains to its miscellaneous end-use applications.

European Union

Following the EU's announcement of the Green Deal in 2019, sustainably produced hydrogen has been identified as an integral component in sector coupling – an industrial jargon that implies the creation of linkages between energy producing systems and traditionally disparate recipient sectors such as power/electricity generation, industry, transportation, and buildings.[2] A key deliverable is the creation of a European Clean Energy Alliance that seeks to incentivize European stakeholders for boosting hydrogen technologies domestically and via partnerships involving international stakeholders. One of the primary objectives of the action plan is to enable competitively positioned companies and research institutes (from constituent European member-states) to disrupt the fledgling hydrogen value chains with cutting-edge innovations. It seeks to fast-track the commercialization of existing pilot hydrogen technologies and reduce the cost of production of the green fuel.[3]

This is expected to be achieved through a combination of policy and monetary support and leveraging market instruments to drive competition. Acknowledging the limitations of domestically producing green hydrogen on a large scale, the strategy envisages that the EU will have to rely on future imports of the fuel from overseas production hubs. This further meant assuming global responsibility in fostering a hydrogen alliance with prospective production/export hubs spanning continents – say for example, in Australia, Africa (Morocco and Namibia), and Latin America (Chile).[4]

Japan

Japan declared its official national hydrogen strategy back in 2017. Long dependent on the import of hydrocarbon-based fossil fuels, which only saw an uptick following the Fukushima nuclear accident, hydrogen is widely seen as the answer to the country's desire to improve upon its otherwise poor energy self-sufficiency rate. Japanese heavyweight, Toyota Motor Corporation is spearheading a revolution in the automotive sector using hydrogen-based mobility. Following some success with hybrid internal combustion engines and battery-powered electric vehicles, the Japanese carmaker is making good strides on its plans to introduce a hydrogen-powered fleet of fuel cell vehicles (FCVs) and fuel cell hybrid vehicles (FCHVs), not to mention refueling stations.[5]

In the industrial sector, companies are actively innovating with existing energy conversion technologies to expand the application of hydrogen and ammonia as industrial feedstocks. One significant area is power generation where companies such as Kawasaki, Mitsubishi, and Iwatani Heavy Industries are pooling their expertise and resources to develop and commercialize co-fired (having 30 percent hydrogen in the fuel mix) turbines, with the subsequent goal of manufacturing 100 percent hydrogen fired turbines.[6]

In 2021, the Japanese Ministry of Economy, Trade and Industry (METI) made certain amendments to its national hydrogen strategy. It now seeks

to develop a domestic hydrogen market of 3 million tons per year by 2030, up by a million tons from the earlier estimates, and touted to touch 50 million tons by 2050 (the year chosen by the government for committing to carbon neutrality). The cost of hydrogen produced is expected to fall by two-thirds by 2030, whereas further reductions are anticipated as it moves closer to the target year of 2050. This is a crucial prerequisite for hydrogen to become a mainstream fuel with an expanding market base.[7]

Just as in the case of the EU, the METI expects Japan's hydrogen strategy to piggybank more on imports from potential hubs that both fit the essential criteria and offer a conducive environment for the large-scale production of hydrogen. With assistance in the form of subsidies and stimulus packages from the government, Japanese industrial majors are already investing in the requisite technologies, know-how, and infrastructure in anticipation of scaling up imports of liquefied hydrogen and ammonia (aboard specialized vessels) from overseas production hubs.

India

Prime Minister Modi's announcement in 2021 of a National Hydrogen Mission clearly signaled India's intention to become a global green hydrogen production and export hub. The Green Hydrogen Policy was formulated to boost the production of green hydrogen and its associated compounds such as green ammonia and green methanol. It further seeks to incentivize their downstream applications as industrial and chemical feedstocks respectively.[8] India is already a leading destination for renewable energy investments and has witnessed a rapid expansion of photovoltaic solar and wind energy generation capacity over the past decade. However, the intermittency of renewable energy sources renders them inflexible to fulfill the cyclical pattern of power demand within a huge country such as India.

Some reformative measures have been announced by the Ministry of Power to reward those green hydrogen developers as well as stakeholders across multiple energy-consuming sectors (most significantly, refineries and

fertilizer plants) that are willing to comply with the government's green hydrogen and green ammonia purchase obligations. The concessions range from financing assistance to transmission and distribution privileges. For instance, the central government this year announced a 25-year-waiver on inter-state transmission charges for green hydrogen and ammonia projects commissioned before June 30, 2025.[9] This will help reduce the cost of green hydrogen substantially over the coming years – with a projected target of bringing it down to $1.5/kg by 2030.[10]

The idea is to put in place a conducive ecosystem for green hydrogen that woos potential investors and at the same time incentivizes operations across the fledgling value chain. As the government goes about with the phased execution of its green industrial hydrogen roadmap, the response from the industry's top guns has been noteworthy. They are actively aligning their strategies – across multiple tiers and verticals of the energy supply chain – with the bespoke objective of promoting India as a prospective hub for affordable and sustainable hydrogen. Some of them include public sector giants such as Indian Oil Corporation Limited (IOCL), National Thermal Power Corporation (NTPC) Limited and Gas Authority of India Limited (GAIL) as well as the big names in the private sector such as Reliance Industries Limited (RIL), Larsen & Toubro (L&T), and the Adani Group.[11]

Geopolitics of Green Hydrogen in the Indo-Pacific

A free and open Indo-Pacific is a common priority of the EU, Japan, and India. From battling the headwinds of climate change to the COVID-19-induced supply chain risks, this region is also witnessing a dynamic shift in pre-existing security and economic configurations. The latter is largely attributed to the decoupling from China, a process that, from a global perspective, kick-started with the investigation by the US Trade Representative (under the Trump administration) of alleged manipulative trade practices by China. The investigation had concluded that "China uses foreign ownership restrictions, such as joint venture (JV) requirements and foreign equity limitations, and various administrative review and

licensing processes, to require or pressure technology transfer from U.S. companies."[12] One of the consequences of this strategic shift was in turn a shift away from offshoring (outsourcing production to countries with cheaper costs of production) to 'onshoring' or 'reshoring' (bringing production back to the parent country).[13]

However, acknowledging the limitations of reshoring from a business perspective, the subsequent Biden administration came up with a more pragmatic strategy, often referred to as "friend-shoring" or "ally-shoring".[14] This basically means to encourage outsourcing production to friendly countries/regimes with whom the U.S. or its allies share common values and ideas. India is therefore considered a natural candidate in the long-term relocation of existing supply chains from China. This is all the more crucial as Chinese companies continue to exercise a monopoly over the supply and distribution of critical rare earths and other indispensable industrial metals such as aluminum and copper.

China is already the largest producer and consumer of renewable energy as well as unabated fossil-based hydrogen. As the country tactfully transitions from its focus on economic growth to economic control/ domination, the latter could very well extend to clean energy technologies too.[15] On the lines of a deterrent security architecture to check Chinese expansionism in the Indo-Pacific, the EU, Japan, and India ought to strengthen cooperation in clean energy technologies, and more so in developing a robust value chain for sustainable hydrogen. This would at least ensure that no single monopoly or cohort of monopolies holds the trump card over the supply and conduit of critical materials and resources that are key to not just global energy security, but also the security of its populations from catastrophic climate change.

Opportunities and Challenges

The incipient focus on green hydrogen is an upward progression in India's clean energy ambitions – one that seeks to utilize the vastly underutilized and decentralized landscape for renewable electricity generation. The

cheaper cost of renewable energy generation in India makes it an ideal destination as a future export hub for green hydrogen. This is also clear from the recent initiatives of Quad, such as Quad Climate Change Adaptation and Mitigation Package (Q-CHAMP), announced in Tokyo in 2022.[16] Today, the EU, particularly Germany, and Japan boast of some of the leading companies dealing with research and innovation as well as commercialization of existing electrolyzer technologies. At the 14th India-Japan Annual Summit, both countries agreed to collaborate on green hydrogen.[17] Similarly, India and the EU are also looking to collaborate on green hydrogen through the EU-India Clean Energy and Climate Partnership and several other initiatives with individual EU member-states.[18]

As mentioned before, the existing limitations on indigenously producing green hydrogen on a large scale have already pushed the EU and Japan to forage potential export hubs in friendlier countries that meet the necessary requirements. Immediately after formalizing its national hydrogen mission, India expanded its clean energy partnership with either side to include green hydrogen. Working groups involving multiple stakeholders from the private sector, industry and research institutes have been set up to optimize the strengths and experiences from the respective energy transition pathways of the parties. Moreover, business models could also be discussed and forged in a manner that accommodates the practical realities of the energy ecosystems and regulatory/pricing environments of the constituent parties. This is a great opportunity before the three sides to combine collaboration with co-innovation, or for that matter, product innovation with process innovation and frugal engineering. There is a need to transcend the traditional vertical and horizontal models of technology transfer to one that further incorporates mutually beneficial spill-over of sustainable technologies, exchange of bespoke synergies (including endemic skillsets and business ideas) and reinforced by joint production. Such an approach would both appreciate and adopt values predicated on the emerging paradigm of earth system governance for sustainable development.

Despite the new-found optimism for green hydrogen, the path to achieving economies of scale in electrolyzer production is filled with potholes. The Russia-Ukraine conflict has already sparked a shortage as well as rise in costs of critical materials, which are essential to the manufacturing of materials that goes into renewables, batteries, fuel cells, and electrolyzers.[19] In addition to these strategic metals, the protracted nature of the conflict, combined with the sanctions against Russia, has disrupted traditional fossil energy supplies, and raised oil and gas prices exponentially, thereby prompting an alarmist response from petroleum importing countries to offset the shortages.

An unintended consequence is having to choose expediency over sustained long-term thinking. It is as simple as saying that one cannot have an energy transition amid an energy crisis. The crisis does not bode well for the low-carbon transition, as any investment cycle intended towards scaling up green hydrogen technologies needs to start immediately so as to play a vital role in the decade-end emission reduction goals.

Even if one were to take into account the grim prospects generated by the Ukraine crisis, it is less likely that the sudden revival in oil and gas exploration projects would seriously jeopardize the ongoing research and development in renewable hydrogen technologies. As outlined in the EU's REPowerEU action plan, there is a broad consensus among member-states and other stakeholders for a three-tier approach that consists of prioritizing energy savings (by reducing demand), energy source diversification (by systematically replacing Russian gas with sources from elsewhere), and most importantly, accelerating investments in clean energy technologies, with a focus on green hydrogen.[20]

Provided that there is a well-coordinated action plan involving key stakeholders from both sides, India is conveniently positioned to seize the early-mover advantage in the race for sustainable hydrogen. Challenges exist in terms of bringing down the cost of not just renewable energy generation, but also the material and manufacturing costs of critical

green hydrogen technologies such as electrolyzers and fuel cells. Hence, it may likely take at least another decade before hydrogen production would achieve sufficient economies of scale – a crucial determinant for a commodity to become mainstream and gain broader acceptance.

This gives India ample time to develop a sustainable hydrogen ecosystem. One possible way of doing so is by leveraging cooperation with countries that are intent on consolidating their global leadership in renewable hydrogen technologies. The existing higher investment costs for renewable energy generation/electrolyzer production in a highly regulated EU, or for instance, in a geographically saturated Japan, could mean that high-end technology providers based out of these countries may be more inclined towards entering value-based co-production arrangements with their counterparts in friendly low-cost destinations such as India.

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Geopolitical Risks of Climate Change Mitigation

Takashi Sekiyama

Introduction

As climate change becomes more apparent, there is growing interest in its economic and social impacts. The risk of conflict and violence between groups or nations caused by climate change has been vigorously debated in the international community for more than a decade.[1] Environmental change, extreme weather events, and natural disasters are not the only pathways through which climate change may lead to conflict. Some point out that geopolitical changes brought about by climate change itself or by measures taken in response is another important pathway linking climate change and conflict.[2]

What geopolitical risks could climate change mitigation pose? Can climate change action and international peace be compatible? This study discusses the geopolitical risks of climate change mitigation through reviewing the latest literature.

Methods

To investigate the latest findings of existing research on geopolitical risks of climate change mitigation, this study reviewed related articles published in leading international journals. Scopus database, and the keywords "climate" and "geopolitics," were used to search for articles published from 2020 through May 2022. Consequently, 119 papers were identified. The titles and abstracts of all initially sorted papers were scanned for the search. Whenever the relevance could not be confirmed, the full text of the paper was scanned. Through this manual process, the number of papers

was reduced to 30. This study investigated the scientific progress in the field mainly by reviewing the 30 papers and articles cited in them.

Results and Discussion

Geopolitics of renewable energy

Oil, natural gas, and coal reserves are geographically unevenly distributed, and, therefore, over the past two centuries fossil-fuel energy has been central to geopolitics.[3] Although fossil fuels are still the dominant source of energy, their share of the world's energy supply is expected to decrease significantly as a result of climate change action. According to estimates published in 2021 by the International Renewable Energy Agency (IRENA), fossil fuel consumption in 2050 is projected to be 75 percent lower than today's levels if countries work to promote renewable energy and improve energy efficiency to limit global temperature increases during the 21st century to within 1.5°C.[4]

Since fossil fuel-producing economies are often heavily dependent on their exports, the reduction in export revenues from such de-fossilization could be a matter of life and death for their economies and societies.[5] Particularly at risk are countries with large ratios of fossil fuel exports to GDP and low per capita GDP with limited fiscal capacity. Libya, Angola, the Republic of Congo, Timor-Leste, and South Sudan belong to this group. The destabilization of these oil-producing countries is one of the main geopolitical risks of the energy transition.

Renewable energy sources, in contrast, potentially exist almost everywhere in the world in varying degrees and types. For example, Japan's renewable energy potential is not large compared with other countries in the world. With regard to wind power, Japan has some power generation potential in coastal areas, but not as much as in Europe.[6] When it comes to solar power, Japan's potential is relatively small compared to Australia, the Middle East, Africa, and South America.[7].

The uneven regional distribution of renewable energy sources may not be as much of a driving factor in international politics as fossil fuels.

However, with increasing global pressure on companies to take action against global warming and disclose information about climate change risks, many companies may no longer locate in countries where they cannot easily procure inexpensive renewable energy. If this happens, it could have implications for the rise and fall of a nation's economy and industry. Thus, as the shift from fossil fuels to renewable energy sources gains momentum, we can expect a rewriting of the geopolitical balance of power and a reshaping of international relations.[8]

Geopolitics of rare earths

Rare metals and rare earths are strategic resources that are essential in a decarbonized society. For example, the widespread use of photovoltaics has increased the demand for silver and silicon, while the proliferation of lithium batteries has increased the importance of lithium and cobalt. In addition, many other rare earths are essential for improving the performance of electronics products such as light-emitting diodes and super-strong magnets. Countries with large reserves of such metals and minerals would benefit from the energy transformation. In addition, countries that gain an advantage in new renewable energy technologies may increase their influence on the international community.[9]

Just as the 19th century was the era of coal and Britain, and the 20th century was the era of oil and the United States, some believe that the 21st century will be the era of rare earths and China.[10] Deng Xiaoping, China's former supreme leader, stated that "the Middle East has oil, and China has rare earths," and he proposed that rare earths should be strategically used to China's advantage.[11]

Although rare earth deposits themselves are distributed across the continents of Eurasia, Australia, North America, and South America, the U.S. Geological Survey (USGS) estimates that China accounted for 58 percent of global rare earth production in 2020, while the United States and Australia accounted for only 16 percent and 7 percent, respectively.[12]

In fact, China sometimes uses rare earths as a diplomatic card. In 2010, Beijing stopped rare earth exports to Japan due to the conflict over the Senkaku Islands in the East China Sea.[13] In 2019 also, Chinese President

Xi Jinping visited a rare earth plant in Jiangxi Province in the middle of the U.S.-China conflict, leading to widespread speculation that Beijing would restrict rare earth exports to the United States.[14] Countries are increasingly concerned about such Chinese rare-earth diplomacy from an economic security perspective, as the country would not be able to mass produce renewable energy equipment or electric vehicles if it could not import rare earths.[15]

Geopolitics of green industrial policies

Since countries that can gain an advantage in the technologies needed to promote new renewable energies will increase their influence in the international community, this has increased the international political implications of each country's green industrial policy.[16] An economy that aims for sustainable development that balances the environment and economic growth is called a green economy. Industrial policy for this purpose is accordingly termed green industrial policy. It includes public investments, incentives, regulations, and other policy support to stimulate and promote the development of environmental technologies.[17] What distinguishes green industrial policy from other industrial policies is its objective of transforming and restructuring the economy into a green economy. As green industrial policy becomes more central to climate change mitigation, climate policy is shifting its character from environmental policy in the narrow sense to economic and industrial policy.[18]

Geopolitically, green industrial policies would reposition countries in global supply chains and reconfigure the balance of power. Demands for environmental technologies are likely to increase in the coming decades. International competition for intellectual property rights in green technologies is expected to be fierce. Green industry policy is an important approach to ensure a country's dominance in this competition. By fostering domestic green industries, countries would be competing for industrial competitiveness and economic growth.[19]

The EU is at the forefront of international efforts to fight climate change. The European Commission in December 2019 announced the Green Deal,

a policy package aimed at combating climate change, creating jobs, and promoting innovation. Similarly, Japan also launched its green industry policy in December 2020. Following Prime Minister Suga's declaration to achieve carbon neutrality by 2050 in the same year, the 'Green Growth Strategy' was compiled as the industrial policy to realize this goal. In addition to promoting the spread of renewable energies such as solar power and biofuels, the strategy also outlines a policy of creating 18 million jobs by 2050 by mobilizing fiscal expenditures, tax incentives, regulatory reform, standardization, international collaboration, and other policies centered on 14 priority sectors, including transportation, manufacturing, housing, and others.[20]

It was China that first clearly articulated a policy of balancing climate change mitigation and industrial development and has actually succeeded in its implementation. China launched its green industrial policy as early as in 2007. China has set a goal of "raising the ratio of renewable energy to 10 percent of primary energy" in its 'National Plan for Coping with Climate Change' in 2007. Since then, the realization of a low-carbon economy through the improvement of energy efficiency and the spread of renewable energy has been one of the key pillars of its industrial policy. In addition, since 2007, the Chinese Communist Party has incorporated not only economic growth but also the achievement of energy conservation and decarbonization goals into its personnel evaluations of local government leaders and executives of leading state-owned enterprises. This has strongly promoted the industrial development and introduction of renewable energy. As a result, China has rapidly increased its manufacturing capacity for solar panels and wind power generation equipment. Now China has the largest market share in the world.[21]

Conflicts over green technologies and industries: Green industrial policies can lead to conflicts over technologies and industries that are key to the green economy. In fact, exports of Chinese solar cells and modules, which have surged as a result of Beijing's green industry policies, have sparked a trade dispute between the United States and China. As early as 2012 under the Obama administration, anti-dumping measures were invoked and then in 2018, the Trump administration invoked safeguard measures under

Section 201 of the U.S. Trade Act. In addition, the Trump administration included large magnets for wind turbines in the list of its trade sanctions against China. These measures have significantly reduced exports of Chinese-made renewable energy-related products to the United States.[22]

Threats to liberal international order: Green industrial policies are threatening free trade and economic integration also.[23] Countries with aggressive climate change policies force their companies to invest in decarbonization. Such countries tend to protect their domestic companies from imports produced at lower cost in countries that neglect to invest in decarbonization. The threat to free trade from green industrial policies arises in such a situation.

A typical example is "carbon border adjustment measures" (CBAMs). CBAMs are a policy that aims to minimize the risk of carbon leakage by imposing a carbon tax on imported products from countries where emission policies are not strict. In July 2021, the EU announced its intention to introduce a CBAM. Also, U.S. President Biden mentioned a possible introduction of CBAM in his 2020 presidential campaign.

The problem is that CBAMs could impede free trade, although the EU insists that its CBAM still maintains compliance with WTO rules. Looking back in history, however, there is an example where policies for a sustainable society, like CBAMs, distorted free trade and led to conflicts. A case in point is the abolition of slavery. Britain abolished slavery earlier than other countries, and even used its navy to force France and the U.S. to stop the slave trade. In the U.S., the conflict over slavery led to the Civil War. It cannot be denied that similar dynamics arise in CBAMs. While some countries act aggressively to reduce greenhouse gas emissions, others do not. If the former creates economic borders against the latter, free trade will be undermined and could eventually create conflicts between countries.[24]

The post-World War II free trade regime has promoted industrialization and provided a preferable environment for economic growth in many countries around the world. On the other hand, such industrialization and economic growth have also led to increased greenhouse gas emissions

and climate change. It is ironic that climate change brought about by the free trade regime is now threatening the free trade regime itself through green industrial policies.

Conclusion

This paper discussed geopolitical risks of climate change mitigation. As stated, the reduced dependence on fossil fuels and the spread of renewable energy sources, the monopoly of rare metals and rare earths, and nationalistic green industrial policies are likely to have a significant impact on the global geopolitical power structure.

Needless to say, climate change mitigation must be steadily implemented. It is becoming apparent that human impacts have warmed the atmosphere, oceans, and land.[25] Anthropogenic climate change has caused widespread adverse impacts and related losses and damages to nature and people beyond natural climate variability.[26] It is imperative to reduce the impacts of climate change as much as possible.

On the other hand, this study reminds us of the risk that climate change mitigation may lead to conflicts among countries. Russia's invasion of Ukraine and the resulting energy crisis have strongly reminded the world of this point. If some countries use climate change as an excuse to push through nationalism, it may even bring about military conflicts, another serious tragedy to this planet.

How, then, can countries proceed with climate change mitigation in a peaceful manner? First of all, national leaders should clearly recognize that climate change actions and international peace could be mutually contradictory goals. Then, there should be opportunities for discussions to ensure that climate change mitigation does not lead to conflict among nations. One idea is to establish a high-level policy dialogue to discuss the geopolitical risks of climate change and its resolution at a forum such as the Conference of the Parties to the Framework Convention on Climate Change. All efforts must be made although it is not easy to simultaneously address climate change and achieve international peace.

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Optimum Uses of Solar Energy: A Cross-Continental Overview

Ashis Basu

The invasion of Ukraine by Russia changed geopolitics and caused a huge dent in the energy sector. The price of crude rose dramatically, forcing a switch to coal in many countries. It also brought home the fact that the world cannot depend on one country for its petroleum and gas needs. In the coming winter months, countries will face increased costs, adversely affecting millions of people around the globe who are already struggling from the pandemic.

Now, more than ever, the focus on renewable energy must be intensified, not just for mitigating the climate crisis but also keeping inflation in check. Inflation rates across the globe have been rising steadily compelling central banks to raise interest rates, which will a have domino effect in the financial world. In Canada and other countries, house prices have dropped from the astronomical levels of just a few months ago but higher mortgage costs are deflating sales. Rents are rising and in some cases are over 25 percent, forcing renters to move further from their workplaces, increasing transportation costs, which are also rising. In short, there must be a concerted effort to expedite the development of renewable energy sources.

Solar energy is one option, and many countries are establishing large solar farms. China and India are good examples. Solar energy at current prices is the cheapest option to generate electricity as long as good storage options exist. Li-Ion batteries have dropped in price but are still relatively expensive.

Solar energy projects are also being promoted in Europe; Sweden is taking a lead and increasing its generation of clean energy using both solar and wind.

The giant furniture group IKEA is now providing clean energy:

"At IKEA, we want to become fully circular and climate positive by 2030, built on renewable energy and resources. We believe the future of energy is renewable and we want to make electricity from sustainable sources more accessible and affordable for all," says Jan Gardberg, New Retail Business Manager, Ingka Group. The electricity from fossil fuels used at home has an impact on both our health and our planet. One simple action we can all take is switching to more renewable energy at home. IKEA offers more sustainable solutions that can be integrated seamlessly into our everyday lives. In addition to STRÖMMA in Sweden, IKEA offers solar panels to customers in 11 markets, with the ambition to enable customers in all our Ingka Group markets to use and generate more renewable energy through our energy services by 2025.Through the STRÖMMA offer in Sweden, customers can buy affordable, certified electricity from solar and wind, and use an app to track their own electricity usage."

Most **European** countries now have solar energy installations and are continuing expansion in installed capacity.

Annual solar energy deployment in **Greece** has more than tripled to an all-time high of 1.6 GW in 2021, up from 0.5 GW linked to the grid in 2020. In 2021, none of the EU's Top 10 solar markets grew as much as **Denmark.** The latest solar shooting star in the European Union increased annual installed capacity by six-fold to 1.2 GW, up from 0.2 GW in 2020. A COVID-19 recovery fund-supported 110 percent tax break sparked increased demand for residential and storage solar installations in **Italy**. Strong demand for modest residential and business rooftop installations up to 50 kW has led to another strong solar year for **Hungary**. **Sweden** is the newest addition to the Top 10, with tax incentives and grants continuing to stimulate demand. **Norway** has become one the largest manufacturers of photovoltaic cells. It has also become an expert in designing solar energy solutions in out of the way places, to cater to Norwegians who love the outdoors. **Iceland** is big in geothermal power, not solar; the abundance of power has led to the largest data firms setting up data centers there. Companies mining crypto currencies have also set up operations; they consume large amounts of power, not the most "green" process.

The next four years until 2025 are expected to be marked by continued high growth. While researchers predict that inflated module costs would return to "normal" levels in the second half of 2022, it is unclear when that will occur. In any event, the higher module prices are expected to have a detrimental impact on some projects in 2022, perhaps even more so than in 2021, when developers and EPCs still had volumes on hand that had been bought at considerably lower prices, even though the actual amounts received were sometimes less than planned.

However, with yearly growth rates of 16 percent, hopes are strong that 2022 will be another record year for solar in Europe, surpassing the 30 GW mark for the first time. With costs returning to normal and Germany's large new plans for increasing its solar energy capacity even further gaining traction in 2023, a 28 percent growth rate to 38.5 GW in the EU is expected – for the first time achieving a 10 GW annual market size. Despite the fact that growth rates are anticipated to be slow in the following two years (16 percent in 2024 and 11 percent in 2025), experts are of the opinion that there will be enough to push annual solar deployment volumes above 40 GW – 44.6 GW in 2024 and 49.7 GW in 2025, nearly reaching 50 GW.

Recent reports in the media record the growing concern in Europe over the Ukraine crisis and diplomatic efforts are under way to mitigate the energy supply situation as winter approaches. Renewable energy projects take time, so are not a viable option to meet immediate needs. Unfortunately, countries are turning to coal by reopening mines and increasing production in others. The effects of increased carbon emissions will push back goals set at the COP conferences. It is imperative that governments do not drop the ball on renewable energy projects, solar where most effective with wind a close second.

The major constraint in establishing solar farms is the availability of land, without encroaching upon the agricultural sector, which is also reeling from the Ukraine crisis. On a retail/consumer level, the price of solar panels and installation costs is a constraint, and in some situations the lack of trained technicians is a limiting factor.

Governments have an obligation to improve the lives of their electorate without causing economic hardship by raising taxes. The challenge here is that politicians pander to their billionaire benefactors many of whom are climate deniers. This can be mitigated by activism at the grassroots level in a sustained, consistent manner, without causing altercation between society and politicians. The disruptive actions of Extinction Rebellion and youth activists are laudable, but turns off many people in the cities affected.

So, how do we promote the increase in solar power generation?

Let's examine the possibilities of transcontinental cooperation in solar energy on the same lines as hydroelectric power is shared between countries. For instance, if India overcame its political conflicts with its immediate neighbors, it could sell power to them.

Now, more than ever, globalization is the key to a better world. The recent Sydney Energy Forum started a dialogue between industry, governments and international organizations on securing diverse and reliable clean-energy supply chains in the Indo-Pacific. It is through such initiatives that global cooperation can be enabled and maximized.

The annual COP conferences are a major platform for bringing together leaders from government and industry, scientists, climate experts and activists. It is in forums such as these that passionate and forceful efforts must be made to move to renewable energy sources. The world is running out of time, and as this year to date has shown, conflict, drought, floods, and disease have affected countries adversely, leading to food insecurity with famine in many parts of the world, while raising food prices exponentially. Tied to all this is the burning need for a concerted push to renewable energy. Given that the sun is visible in most countries around the world, it is in my opinion, an excellent option. The cost of solar panels has dropped, and continues to drop. The science of photovoltaics has also progressed. China is the market leader, but other countries should explore the setting up of manufacturing facilities. The need for cheap, clean sources of power is critical, as the world's population grows, as does the climate crisis. Solar energy is the perfect solution.

In conclusion, for those of us involved in advocating the promotion and development of solar energy, we must work to promote cooperation between counterparts across the globe to optimize benefits. This can be done by IDSP organizing workshops, panel discussions and seminars bringing together global experts.

Climate Realism: The Geo-economics of Net-Zero in a Hobbesian World

Jeremy Maxie

On his first day in office, President Joseph R. Biden Jr. signed an executive order recommitting the United States to the Paris Agreement thereby reversing former President Donald J. Trump's previous decision to withdraw the U.S. from the international climate accord. That same year, Biden announced aggressive greenhouse gas emissions reduction targets, proposed the Build Back Better (BBB) framework (an expansive social and climate agenda) and appointed former Senator and Secretary of State John F. Kerry to a new cabinet-level position as climate envoy. These actions raised expectations that the U.S. would lead globally on climate policy and the energy transition.

Such optimism was short lived as the COP26 ended in widely perceived failure and disappointment, the BBB died in the Senate while pitting progressives against moderates in the House, and China's Foreign Minister Wang Yi made it clear in a meeting with Kerry that bilateral climate cooperation could not be separated from broader U.S.-China relations.[1] Meanwhile, the pandemic continued to drag on the global economy, supply chains remained disrupted, and inflation proved anything but transitory. Then came the war as Russia launched a large-scale invasion of Ukraine that accelerated and aggravated an existing energy crisis.

The war, energy crisis, persistent inflation, lingering supply chain disruptions, and intensifying strategic rivalry with China set the stage for a last-minute compromise in the Senate led to the enactment of the Inflation Reduction Act (IRA). While significant, it is a less expansive piece of energy and climate legislation than the envisioned BBB. And if

history is any guide, the Republicans are expected to retake the House and/or Senate in the upcoming midterm elections, which would limit any further climate change action for at least the next two years.

Rather than a perfect storm of highly contingent events, the primary drivers and constraints undermining the Biden administration's ambitious climate and energy agenda are structural. The post-Cold War phase of the U.S.-led international order (commonly referred to as the international liberal order or ILO) is evolving while the domestic political arrangements that upheld it are eroding. Whereas the ILO was exemplified by U.S. hegemony, globalization, multilateralism, and economic interdependence, the emerging multipolar order is being forged by great power rivalry, revisionist state behavior, resurgent nationalism, and economic protectionism, as well as populism on the left and the right.

Against this backdrop, heightened concerns over national economic security and energy security have surged to the forefront, reframing the strategic context and dominating political narratives. As a result, global cooperation on achieving net-zero greenhouse gas emission by 2050 and transitioning to renewable and low-carbon energy will be increasingly subsumed under, rather than compartmentalized from, these growing security concerns and strategic competition.[2]

Systemic, Global, and Protracted Rivalry

Despite the disruption caused by Russia's invasion of Ukraine and the much needed shake-up of European thinking on energy and security policy that it has triggered, the primary structural driver of global change remains the re-emergence of China as a great power and strategic rival to the United States.[3] This strategic rivalry is global in scope, systemic in nature, and likely to be protracted in duration. China's rapid military modernization and growing economic might coupled with its revisionist and coercive behavior indicates that Beijing seeks to establish hegemony in Asia while shaping the broader international order to the fullest extent possible. In response, the U.S. as a status quo power seeks to maintain its

leading global position by pursuing a strategy of domestic strengthening at home while rallying a counterbalancing coalition of its allies and partners against China's hegemonic ambitions.

Beyond geopolitical rivalry in the Indo-Pacific, U.S.-China competition is centered on the struggle for the commanding heights of the global economy (the so-called fourth industrial revolution) and global governance (institutions, laws, norms, leadership, legitimacy). The fundamental questions are who will dominate the advanced technologies and strategic industries of the future and who will write the rules that govern them? Which system will shape the emerging global order and restructure global capitalism over the next several decades? Will it be some form of U.S.-led democratic capitalism or an authoritarian-state capitalism that conforms to Beijing's rules? Is the global economy entering a period of de-globalization and fragmentation or re-globalization and deepening economic interdependence?

Whether the U.S. will be successful in formulating, executing, and resourcing a sustained grand strategy in response to global change will depend on domestic political developments. The liberal internationalist elite consensus that dominated thinking during the post-Cold War era is being challenged by various political factions and interest groups on both the left and right with competing visions about national strengthening and the U.S. role in the world. In its place is a growing chorus for greater "restraint" abroad and an "America first" agenda at home, albeit by other more palatable names ("foreign policy for the middle class").[4] This suggests that while Americans may be concerned about the potential long-term effects of climate change, they are reluctant to foot the bill for climate policies that undermine domestic energy security and economic competitiveness while making the U.S. dependent on industries and technologies dominated by strategic rivals such as China.[5]

Transformations in Energy, Tech, and War

Net-zero is best understood as industrial policy and social policy.[6] It may very well prove to be international liberalism's last grand modernizing project or *mission civilisatrice*. In contrast to previous energy transitions which have been "energy additions" of ever-growing consumption, meeting 2050 targets would require a top-down restructuring of global patterns of production and consumption on such a scale and time frame that it presupposes aggressive state interventions in both the market and society.[7] Hence, the emergency or crisis framing to justify such large scale government interventions as Build Back Better or European Green Deal. Meeting aggressive emission targets by 2050 also requires close international cooperation premised on the efficacy of global governance. Yet despite concerted efforts by leading developed countries, major developing countries such as China and India clearly have other strategic and domestic priorities.

The means to accomplish net-zero's ends include mandating and subsidizing preferred industries and technologies while taxing and regulating disfavored industries and technologies into obsolescence or out of existence. This incentive/disincentive structure has led to "preemptive underinvestment" in fossil fuels and supply shortages despite growing demand.[8] Meanwhile, the U.S. along with its allies and partners are far from having leading positions in renewable energy and low-carbon value chains, which are increasingly dominated by China. As the current energy crisis demonstrates, this "net-zero first" approach is strategically misguided and reflects the narrow interests of specific advocacy and industry groups rather than sound energy strategy grounded in broader national interests.

Indeed, the materials (e.g. rare earth minerals) and technologies (e.g. semiconductors, energy storage, magnets) essential to net-zero often have dual-use applications that are considered vital to national security.[9] This is where the net-zero energy transition intersects with the so-called fourth industrial revolution (4IR) and the transformation of war. The 4IR,

a Davos buzzword, refers to the anticipated fusion of rapidly advancing technologies with the potential to transform society in unprecedented and unforeseeable ways. Such emerging and disruptive technologies include artificial intelligence, 3-D printing, machine learning, and quantum computing among others. This matters since achieving net-zero by 2050 will require the global diffusion of advanced technologies that are either still not commercially viable or do not yet exist.[10]

Advanced and rapid technological change is seen by many military analysts as driving the so-called transformation of war which is widely anticipated to change the character of war by altering military conceptions of time (speed of kill chain) and space (weaponization of cyber and space).[11] The advanced technologies needed for the 4IR, the net-zero energy transition and the transformation of war depend on a growing list of critical materials, the demand for which is expected to increase exponentially.[12] These technologies and materials depend on globalized supply chains which, as the past two years of war and pandemic have demonstrated, are highly exposed to numerous dependencies and vulnerabilities that pose significant risks to energy, economic, and national security.[13]

We may refer to these critical materials, critical technologies, and critical supply chains at the intersection of net-zero, the 4IR, and the transformation of war, as the 3Cs. Whichever country (coalition or alliance) controls the 3Cs will wield enormous geo-economic leverage in the twenty-first century. China has already established leading or dominant positions (monopolies in some cases) across several renewable energy and low-carbon value chains such as rare earth minerals, lithium-ion batteries, solar PVs, wind turbines, and electric vehicles.[14] Beijing is equally determined to lead or dominate in advanced technologies such as AI, autonomous systems, quantum computing, semiconductors, and biotechnology among others.[15]

Getting the 3Cs Right

The most prudent strategy is a competition-based geo-economic approach rooted in realism that focuses on the 3Cs: critical materials, critical technologies, and critical supply chains.[16] This approach prioritizes national economic competitiveness and energy security rather than achieving net-zero carbon emissions by 2050 above all other needs and priorities. With the understanding that energy transitions are in reality energy additions, this approach also embraces an all-of-the-above energy strategy that recognizes the continued role of oil and natural gas in meeting global energy demand and ensuring energy security. Renewable energy and low-carbon technologies should only be scaled up when and where commercially viable to the extent that doing so does not undermine energy, economic, or national security.

Unfortunately, the net-zero political project puts the cart before the horse. As a matter of timing and sequencing, renewable energy and low-carbon technologies should be scaled up no faster than the U.S. along with our allies and partners are able to establish leading positions across the entire net-zero value chain. This means that the U.S. along with its major allies and partners need a focused and committed strategy to selectively decouple from China while onshoring, reshoring, or "friendshoring" as much of the 3Cs as possible.[17] In addition to strengthening energy and economic security, this prioritizes creating quality jobs for the working classes and middle classes while revitalizing domestic industrial capacities that have been hollowed out by decades of globalization.

However, this requires the political will to overcome powerful interest groups that benefit politically or financially from the net-zero agenda or whose political and financial fortunes are tied to continuing business-as-usual with China. Some of these efforts may be shepherded through platforms such as the recently formed U.S.-EU Trade and Technology Council (TTC).[18] Yet, much of the heavy lifting will likely need to be done by building a flexible and adaptive network of bilateral and minilateral arrangements with allies and partners (in partnership with the private

sector) tailored to address specific materials, technologies, or supply chains rather than overly broad multilateralism under the guise of global governance. While some efforts are being made in this line of direction, it still gets priorities and sequencing wrong.

As politically challenging or unpalatable as this paper's proposal may seem to many, the current approach prioritizing net-zero greenhouse gas emission by 2050 risks compromising national economic security and energy security thereby weakening overall national strength and national security during a time of intensifying strategic rivalry and global reordering that will likely last for decades. Alternatively, should the U.S. along with its allies and partners determine that they are either unwilling or unable to selectively decouple from China while prioritizing the 3Cs, then perhaps they should rethink the wisdom of net-zero commitments ahead of COP27.

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Summing Up — Policy Recommendations

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A solution-oriented approach was adopted while distilling the recommendations of the one-year joint study between KIIP and ISDP. We would hereby like to present our policy recommendations to grapple with climate change as follows:

1. New International Accounting Standards

The International Sustainability Standards Board (ISSB) was established by IFRS Foundation Trustees on November 3, 2021, during COP26 in Glasgow, and has presented its draft of new international accounting standards to reflect on climate change, which will be a game changer in the global business environment, particularly in Japan. The International Financial Reporting Standards (IFRS) were established by the International Accounting Standards Board and are now applied in more than 130 countries/areas at present as a de facto global standard. ISSB's Standards will also become a global standard in the same way as IFRS, and almost all publicly traded companies in the developed economies will follow the new standards by materializing/accelerating concrete measures toward net-zero GHG emissions by 2050.

In 2021, the EU published a proposal for the Corporate Sustainability Reporting Directive, which will amend the existing Non-Financial Reporting Directive. This revised directive will support the European Green Deal, which reflects the EU's ambition to be the first carbon neutral continent. The new EU standards will require "Double Materiality", which means that companies should provide not only information material to investors (or other capital market actors) but also information material

to other stakeholders, practically, sustainability information according to the EU standards. Companies will need to conduct a double materiality assessment by gathering evidence on assessing and explaining why issues are material from the social and environmental impact (stakeholders) perspective and from the financial impact (investors) perspective.

Unlike Sweden, Japan is a very difficult country to change by herself, and new international accounting standards will be another "Black Ship (Commodore Perry's visit to Japan to enforce her to open doors in 1853 after the 260-year closed door policy)" to drastically change companies' behavior to tackle climate change. Major industrial countries, particularly Japan, should introduce the strictest EU Standards to achieve the goal of the net-zero GHG emissions by 2050.

2. Governance

New international accounting standards must be linked to corporate governance mechanisms. Namely, in the context of climate emergency, climate issues need to be integrated into high-level strategic discussions and decision-making on corporate boards. It will be necessary to include board members with the relevant expertise who can address perspectives of nature (or future generations), and viewing it as "one of the major stakeholders" can be an approach needed for the achievement of climate change related goals.

At the same time, an independent quality assessment would mitigate the risk of "greenwashing" or "boilerplate" disclosures. There are different ways to enforce the quality assessment, for example, through the mandatory audit of disclosure quality or through voluntary internal corporate governance mechanisms. It is worth reflecting over what could be the most efficient way in a specific country and how institutions for the independent quality assessment can be created/strengthened to ensure the quality of reported information.

3. Incentives to Private Sector

The private sectors must be a driving force to materialize/accelerate climate goals, but environmental disclosures still entail huge costs and companies are hesitant to improve their disclosures unless they see clear impacts on their financial/shareholders' value and the burden of companies is decreased. Besides the above mentioned new international accounting standards, central/local governments should offer incentives to the private sector such as subsidies, tax exemption/reduction, relaxation of laws/regulations, opening of special economic zones, etc. In addition, public/private financial institutions should offer attractive green financing for the development of renewable/transition energy, cutting-edge technologies such as green hydrogen, etc., so that the private sector recognizes climate change as business opportunities rather than costs.

4. Holistic Approach

Besides the private sector, central/local governments, academic institutes, civil societies, etc., should work together for the same climate goals, and we should pay consideration to many different interests in order to come up with a consensus. "Green vs green dichotomy" has come up from time to time, and localization is one of very important factors to step forward. However, localization may lose economies of scale, and a balance needs to be found. At the same time, we should recognize there may lie a fundamental conflict of interests between the public sector and the private sector, in that the public sector is looking for benefits to societies (or welfare, equity, justice) and the private sector is seeking profits (or efficiency). In case of public-private partnerships, both the public sector and the private sector should make clear their purposes together with their ways/means to achieve such goals well in advance.

5. EU/Japan Cooperation

Japan may take a lot of inspirations from EU laws/regulations/directives, etc., to enhance her policies on climate change/energy mixture, and Japanese companies need to improve their knowledge, internal rules, strategies, etc., to meet new aggressive international standards. Japan/Sweden and Japan/

EU should open a path for a platform to extend a diplomatic dialogue for new regulatory solutions on climate change and energy.

6. Marine Environment

In the North Pacific, global warming has been progressing, and we recognize a remarkable increase in the sea surface temperature in Japanese coastal waters, the North Pacific and the South Pacific. Terrestrial, river and marine ecosystems have been affected by urbanization, and we find the aggravation of fishery resources and the northward movement of fish that inhabit in waters where overfishing occurs (the southward movement in the southern hemisphere). For example, salmon has been disappearing from the waters around Japan, the southern half of Sakhalin Island, California, Washington, Oregon and British Columbia, and it has been concentrating in the Russian and Alaskan waters.

We should have more holistic and broader views to grapple with climate change. Namely, we should pay attention to not only CO_2 but also total emissions both in the atmosphere and in the ocean. At the same time, we should pay consideration to not only emissions of gases but also wasted heat like heat discharge from power plants to the ocean.

7. Climate Security

Climate change mitigation efforts as described above may lead to conflicts among countries. Russia's invasion of Ukraine and the resulting energy crisis have strongly reminded the world of this point. In particular, (1) the reduced dependence on fossil fuels and the spread of renewable energy sources, (2) the monopoly of rare metals and rare earths, and (3) nationalistic green industrial policies are likely to have a significant impact on the global geopolitical power structure. If some countries use climate change as an excuse to push through nationalism, it may even lead to military conflicts, another serious tragedy to this planet.

National leaders should clearly recognize that climate change actions and international peace could be mutually contradictory goals. Japan/EU should work together to systematically analyze the situation and stand up to the new challenge.

Afterword

Discussions on climate change, sustainable development and renewable energy are not just becoming mainstream debates but are also increasingly perceived as an interdisciplinary issue connecting various fields of the academic and political world. The man-made climate change caused primarily by human emissions of greenhouse gases and other industrial interference with nature is not just responsible for direct effects like extreme climate conditions or rising water levels. It is the secondary effects of these climate calamities that add complexity to the problem of climate change.

Mass displacement, economic disruption and cross-border water management elevate the problem to a political and national security level. It is on this level where international cooperation is needed the most. With Japan and Sweden, we have two highly developed countries that take on the climate crisis in different multifaceted ways. While Japan because of its size, geographic location and economic power has a huge leverage when implementing measures against climate change, Sweden has become somewhat of a leading climate campaigner in Europe. Ranking fourth in the European Union (EU) in the Eco-Innovation Index, Sweden manages to successfully implement its climate policy programs. Sweden's climate policy framework to have net-zero emissions of greenhouse gases by 2045 is considered a role model among the EU members.

In this context, the institutional research and project-based cooperation between the Institute for Security and Development Policy (ISDP) and the Kajima Institute of International Peace (KIIP) becomes an important bridge. Japan has a wonderful occasion to learn and implement practices from Sweden, while the latter profits from stronger cooperation and technological exchange. This cooperation between the ISDP and KIIP brings the opportunity for a strong cross-continental partnership between Sweden and Japan to a think-tank level, setting a strong reference of research cooperation between EU and Asian think-tanks. Bringing together

top subject experts, ex-policy practitioners, corporate leaders and next-generation thinkers together from research and politics provides a perfect opportunity to share and generate new knowledge based on the other's experience and discuss the different approaches of each country. The goal is to combine one's strengths to contribute to global climate action in both the private and the public sphere. The importance of this ongoing partnership of two leading think-tanks for over a year now is not only reflected in the exceptional output of new and innovative knowledge but also in the vital connection of different views from experts from various fields. This echoes the framework of institutional collaboration and the need for a closer knowledge-based partnership between EU and Asian institutes. More importantly, this think-tank based cooperation lays the foundation of an interconnected climate consciousness that transcends national and cultural borders, encouraging an open flow of ideas and solutions.

Between Sweden and Japan, there have been continuous discussions on the critical areas of climate change, renewable energy and sustainable development. In fact, Sweden, as the pioneer of environmentally sustainable law, regulations, and green steel production, sets an example that industrial cooperation and public-private partnership can positively promote renewable energy and sustainable development. Solar energy, wind energy, and sustainable mining are indispensable in the discussion. Importantly, Sweden and the EU are experienced promoters of replacing the usage of fossil fuels and decreasing greenhouse gas emissions through implementing regulations that not only focus on reducing emissions but also value the long-term economic prosperity in the region.

With the ambition of the EU Green Deal, the EU (or some of its member-countries) has the capacity to offer a potential resolution, framework, and model for Japan to establish a sustainable community. However, future challenges, such as industrial decarbonization, the competitiveness of green industries, the transition of the electricity system, etc., need more support from the engagement of local initiatives and public participation.

Meanwhile, ISDP-KIIP project calls for future cooperation in renewable energy that focuses on building partnerships between like-minded countries to reduce dependencies and vulnerabilities. This research project has been beneficial for both sides, and it has seen an exchange of ideas and thoughts on how to face the climate challenge, promote the transition to renewable energy, and practice sustainable development that need serious deliberations in both the countries.

It is an immense pleasure and great satisfaction that this joint publication is out now. Such a joint effort will undoubtedly generate plenty of debate and discussion for scholars, politicians, and next generation thinkers. This publication perhaps does not entirely cover every aspect, perspective and struggle that Sweden and Japan face today due to climate change. But it undoubtedly can start new debates in the field of climate change, renewable energy, and sustainable development. These new debates would enable the EU, Sweden, Japan, and the rest of the world to keep evolving and brainstorming the resolution of climate-related issues. I compliment all the contributors and hugely appreciate the partnership with the KIIP.

The collaboration between the KIIP and ISDP provides a great platform for Japan and Sweden to exchange practical experiences, values, and prospects for net-zero emission goals. Last, but not least, the partnership between the KIIP and the ISDP shows the importance and crucial value of cooperation between Europe and Asia. With this positive outcome, a net-zero community is not a dream; it is a foreseeable future that can be accomplished by cooperation.

I hope and wish that the partnership and intellectual exchanges between ISDP and KIIP will mature and strengthen further with the conclusion of this one-year research outcome.

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