

**ICT-based social communication
on collaboration of
renewable energy and nuclear
for Carbon Neutral 50**

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Climate change by global warming

- In recent years, large heat waves have hit various parts of the world causing large-scale forest fires and unprecedented damage from hurricanes and floods. In Japan, the number of human deaths is increasing due to the disaster-grade heat stroke, and big typhoons and heavy rains which occur once every several decades hit Japan every year causing serious damage.
- In response, the world has set greenhouse gas emission reduction targets under the Paris Agreement and is strengthening its efforts. However, even if the goals set by each country are achieved, the amount of reduction required is far short, and the world is facing a situation that can be called a climate crisis.

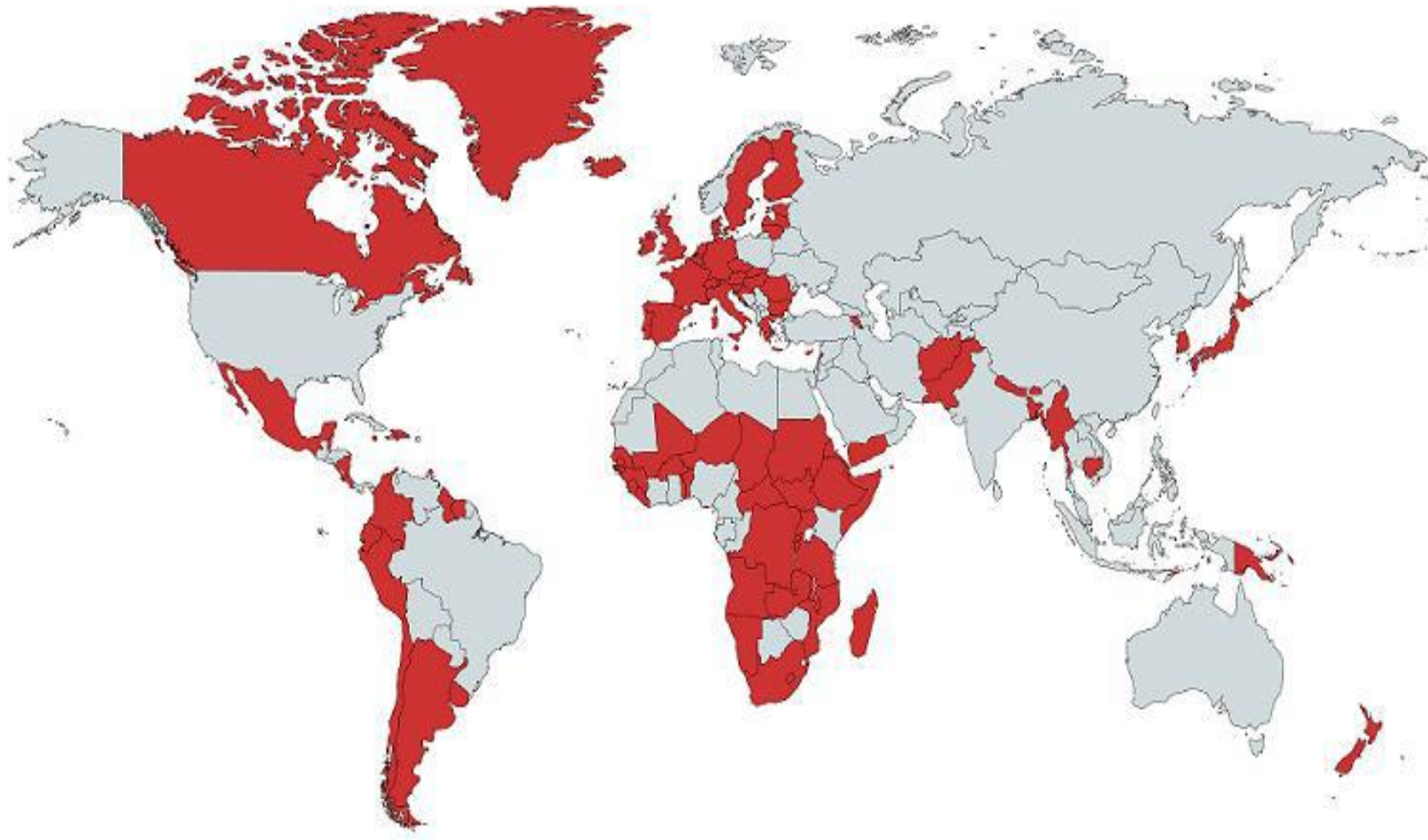
Carbon neutral 50 and nuclear energy

- The Japanese government has set a virtuous cycle of economy and environment as the pillars of its growth strategy in October 2020, and declared to aim for that she will reduce greenhouse gas emissions to zero as a whole by 2050, that is, to realize a carbon-neutral, carbon-free society in 2050.

Countries that support carbon neutrality in 2050

123カ国・1地域

全世界のCO2排出量に占める割合は23.2%（2017年実績）中国は2060年ネットゼロを表明。米国のバイデン大統領、2050ネットゼロの長期目標を公約。



Divided views on Nuclear for Carbon Neutral 50

Anti nuclear campaign is prevailing not only in Japan but also in COP arena of United Nations

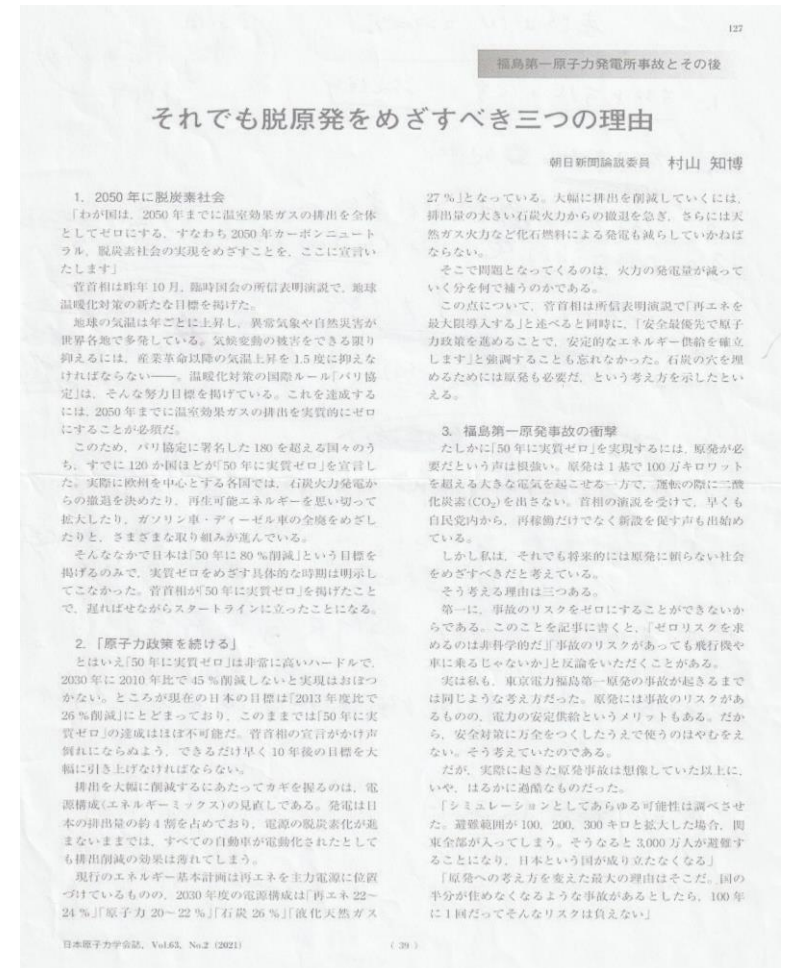
Three reasons against nuclear power by Asahi Shimbun, one of Japan's leading newspapers (Fukushima 10 year anniversary issue of AESJ)

1. nuclear severe accident will destroy the foundation of the country. The enormous risk of nuclear accident is unacceptable,

2. The government explained nuclear power is cheap but it was liar, as was seen by the Fukushima accident.

3. High risk of underground disposal of high level radioactive waste is unacceptable because the radioactive level will not decay even after 100,000 years.

Anti-nuclear campaign by mass media has been affecting public opinion in Japan towards nuclear phase-out after Fukushima Daiichi Accident in Japan.



TOP STORY : American Nuclear Society SmartBrief, October 29, 2021

COP26 turns a cold shoulder to nuclear power

- The COP26 management organization in Glasgow has declined the exhibition of World Nuclear Association (WNA) in the Green Zone for the exhibition of clean energy NPOs and companies.
- COP26 organizers' decision to exclude nuclear industry officials and advocates from the meeting's public Green Zone shows that anti-nuclear sentiment continues to permeate across the globe and illustrates the lack of confidence in the solutions proposed by the industry for the next decade.

IAEA Releases Report on Nuclear Energy for a Net Zero World ahead of COP26 Climate Summit, October 21, 2021

- After not even being allowed to attend last year's COP25, the International Atomic Energy Agency plans to set up in the Blue Zone and use this year's meeting to send a message to the public that "nuclear will be a very useful element in the [decarbonization] equation, whether you like it or not," said IAEA Director General Rafael Mariano Grossi.
- The special report highlights nuclear power's critical role in achieving the goals of the Paris Agreement and Agenda 2030 for Sustainable Development by displacing coal and other fossil fuels, enabling the further deployment of renewable energy and becoming an economical source for large amounts of clean hydrogen.

Organization of IAEA report



- Foreword by Rafael Mariano Grossi, Director General, IAEA
- COUNTRY STATEMENTS from the government representatives of nine countries (Canada, China, Finland, France, Japan, Poland, Russian Federation, United Kingdom, and United States of America.)

Contents of IAEA reports

- ROADMAPS TO NET ZERO: THE CONTRIBUTION OF NUCLEAR ENERGY
- MOVING AWAY FROM COAL: NUCLEAR POWER FOR A SUSTAINABLE AND JUST TRANSITION
- DRIVING ENERGY SYSTEMS TO NET ZERO: NUCLEAR–RENEWABLES SYSTEMS INCLUDING HYDROGEN
- NUCLEAR POWER AND CLIMATE RESILIENT ENERGY INFRASTRUCTURES
- NUCLEAR ENERGY INVESTMENT FOR A SUSTAINABLE POST-COVID WORLD
- NUCLEAR TECHNOLOGY AND SUSTAINABLE DEVELOPMENT

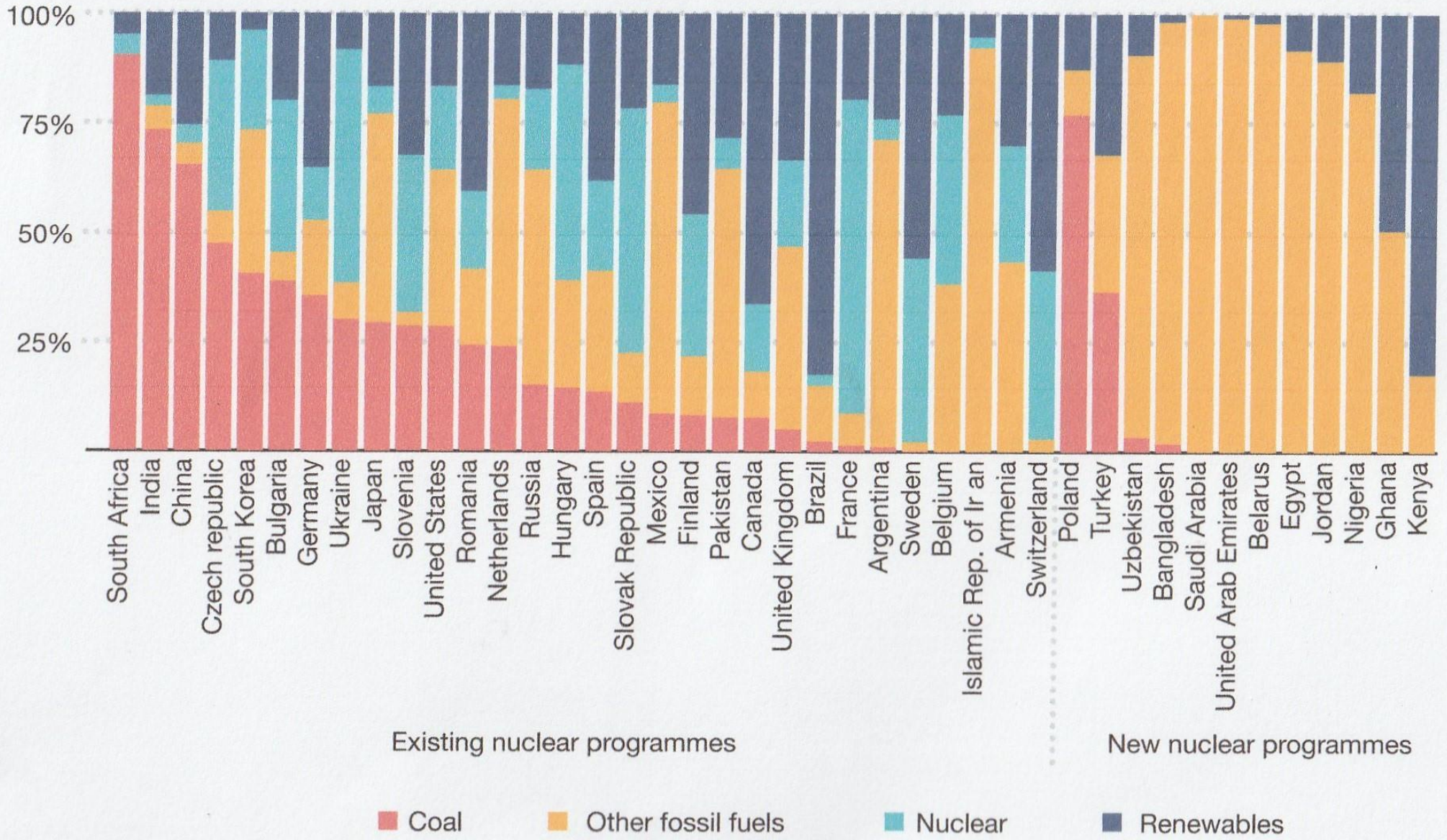


Figure 4. Electricity generation mix (2018) in countries with or planning nuclear power programmes [27].

A bit on SDGs

- SDGs stand for Sustainable Development Goals.
- The SDGs were formulated by UN on September 15, 2015, when the 2030 Agenda for Sustainable Development was adopted together with the SDGs.
- There are two pillars of the goal formulated: eliminate poverty from the world and to transform the modern unsustainable society, economy and environment into a sustainable ones by 2030.
- With 17 goals, 169 targets, and 232 indicators, the SDGs are inseparable and integrated goal that summarizes all social, economic, and environmental issues of the world.
- It does not legally bind UN member states like treaty, but it is a work of all the developed, emerging and developing countries of the world with "spirit of equality" that no one will leave behind in realizing it.
- The salient concept that goes through the 2030 Agenda is to transform our world on a sustainable, strong and supple (resilience) path.

A bit on SDGs

- It is also noteworthy that the driving force for the adoption of the SDGs was not the already developed countries in Europe and the United States, but many countries that have traditionally been called developing countries.
- Unlike the internationally enforceable efforts of the COPs on individual issues such as climate change and biodiversity, the SDG has been working on social, economic and environmental issues.
- It emphasizes the spirit of "people, by people, for people" participatory democracy, which recognizes wholeness and indivisibleness and provides an integrated solution without leaving anyone behind.
- And as an approach to change, the word resilience appears in many goals of the SDGs under the definition of resilience, restoring force, tolerance, supple strength. It aims to diminish the gap between rich and poor and to achieve resilience in agriculture, urban environment, social infrastructure, resource development, and marine environment with consistency.

1 NO POVERTY



2 NO HUNGER



3 GOOD HEALTH



4 QUALITY EDUCATION



5 GENDER EQUALITY




6 CLEAN WATER AND SANITATION




7 CLEAN ENERGY



8 GOOD JOBS AND ECONOMIC GROWTH



9 INNOVATION AND INFRASTRUCTURE



10 REDUCED INEQUALITIES



11 SUSTAINABLE CITIES AND COMMUNITIES



12 RESPONSIBLE CONSUMPTION



13 PROTECT THE PLANET



14 LIFE BELOW WATER



15 LIFE ON LAND



16 PEACE AND JUSTICE



17 PARTNERSHIPS FOR THE GOALS



THE GLOBAL GOALS

SDGs linkages with nuclear energy and other nuclear technologies.

Nuclear energy directly contributes

- Goal 7 Clean energy
- Goal 8 Good jobs and economic growth
- Goal 13 Protect the planet
- Goal 17 Partnerships for the goals

Nuclear technology contributes

- Goal 2 No hunger
- Goal 3 Good health
- Goal 6 Clean water and sanitation
- Goal 9 Innovation and infrastructure
- Goal 13 Protect the planet
- Goal 14 Life below water
- Goal 15 Life on land
- Goal 17 Partnerships for the goals



Path to carbon neutral 50 through collaboration of nuclear and RE

In short, there are many people in Japan and in the COP arena who simplifies the matter as “both fossil and nuclear power are bad while only RE is good.”.

In Japan, no news of IAEA report has not been reported in any mass media but the news that Fossil of the Day Award was given to Prime Minister Kishida for his presented Japanese CN50 policy at COP26 in Glasgow.

The author of this paper will introduce our newly started outreach activity by using ICT technology for promoting carbon neutral 50 through the collaboration of nuclear power and RE.

The real worrisome energy situation in Japan (After Prof. Narabayashi, TIT, Japan)

- (1) Before the Fukushima nuclear accident, Japan's power composition was nuclear power 25% and thermal power 65% in 2010, but after the accident nuclear power 1.7% and thermal power 84% in 2016. After that, nuclear power 6.2% with only 9 nuclear power plants in operation. Solar power now accounts for 7.6% of total electricity due to the preferential policy of feed-in-tariff (FIT). Both nuclear power and solar power increased by 4% in three years. As a result, CO₂ emissions has fallen by 9% in three years.
- (2) The capacity factor of solar and wind power is low (solar power 13%, wind power 20%), and so the other power sources are necessary absolutely. It is difficult to use RE as the main power source. As an extreme example, if you try to meet 100% of the electricity demand with sunlight alone, you have to install solar panel with installed capacity of 770% of the electricity demand and store all the surplus electricity. It must supply electricity in the time zone when power generation is not possible. For that purpose, 1,000 trillion yen of electricity storage, livestock energy, hydrogen production equipment, and pumping equipment are required.
- (3) Abnormal weather (cold waves, typhoons), strong earthquakes collapsed steel transmission towers to bring about power plant failures (windmill freeze, thermal power / nuclear power plant shutdown), and they occur one after another. Resilience measures are needed to deal with the spread of various power system accidents and power outages.

To sum up Prof. Narabashi argument and beyond

- In Japan resources are scarce. There are many mountains and natural disasters. Establishing resilience to realize Carbon Neutral 50 in Japan requires very complex systems thinking. It is not so easy to solve the problem simply by nuclear phase-out, as the biased media insisted loudly.
- It is necessary for us to promote collaboration between nuclear and RE for the goal of carbon neutral 50 in Japan .
- The author of this paper believes that it is necessary to raise the knowledge level of general public and enlighten the next generation who will contribute to solve problems. The authors are going to organize outreach activities to society by advanced energy researchers.

Why and how public outreach by expert ?

- What is **active learning**? This is a new **educational concept** that can **exploit mutual growth** through the **interaction between teachers and students**.
- **Improve information literacy of general public** through public outreach by advanced researchers on one side, while **improve ELSI (Ethical, Legal, Societal Implication) issues** for social introduction of **advanced science and technology** such as nuclear, AI, biotechnologies.
- Use of SNS for active learning
 - By **on-demand** type SNS —YouTube
 - By **real-time** type SNS —ZOOM

Why and how public outreach by expert ?

- To conduct on public outreach activities by university researchers by using social network system (SNS), it is necessary to create a platform for mutual interaction with various layers of society, in addition to mutual interaction with students in the classrooms.
- The authors are going to conduct on a symposium by using ZOOM to be held in December 1st, 2021. The subject of the symposium is “**collaboration of renewable energy and nuclear for Carbon Neutral 50**” by reflecting on the recent COP26. The authors are introducing the following ways to enhance the effect of active learning.
 - (1) Take advantage of ZOOM's chat function and recording function to record mutual interactions between lecturers and audiences during lectures.
 - (2) Before and after the lecture, take questionnaire to the audience to see the change of interest and understanding of the theme.
 - (3) Analyze the data in (1) and (2) above and utilize them to improve the effective lecture method and lecture implementation by the instructor.

Concluding remarks

- Currently, the Japanese government has announced plans to achieve carbon neutral 50 by increasing RE to 46%, with assuming nuclear power ratio of 20-22%, notwithstanding environmentalists and their supporting media speaking loudly total nuclear phase-out. However, the government's carbon-neutral 50 plan is impossible to realize their said nuclear power ratio.
- In this paper, we proposed the practice of outreach activities by advanced energy researchers. It is hoped that this will deepen the general public's understanding of carbon neutral 50 and spread interest on this issue in the next generation, leading to an increase in the number of researchers on this issue and the development of research in the future.

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