

“Activity Report on the Zero-emi Vision Study Working Group”

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Thank you for your kind introduction.

I am Maeda from ENEOS and I am coordinating as the secretariat of the Zero-emi Vision Study Working Group, (hereinafter referred to as ‘the Working Group’).

We would like to report on our activities over the last year and would be happy to discuss them with you.

To begin with, I would like to reiterate the outline of the Working Group.

The aim of the Working Group is to develop a common vision for the industry to achieve carbon neutrality in the Tokyo Bay area.

We have set this vision to share as much as possible about what we, the corporate members, should aim for in the future.

One purpose is to share and disseminate information to those in industry, academia and government.

The knowledge from each corporate member working group is integrated, and the problems and solutions for implementing the model are organized.

The aim of the activities is to eventually lead to the creation of demonstration projects and accelerate the social implementation of the 'carbon neutral model'.

As the working group members are from the business sector, it presents two perspectives: the aim of the initiative, and the corporate viewpoint.

We disseminate the common vision of the industry field and co-create innovation by strengthening cooperation with stakeholders. Innovation cannot be achieved by individual companies working alone.

Many of companies, municipal and government officials are participating at this council.

The aim from the council's point of view is that by launching a common vision at the Council, rather than at the individual level, it might be easier to receive financial and institutional support from the government.

This is an organization chart of our activities.

The Working Group was set up in April 2021, and two new taskforces were set up in the beginning of FY2023 with the aim of slightly strengthening the structure.

Later on, I will go into further information about these taskforces.

We currently have fifteen companies involved. Eleven more companies have joined since the original four were present at the time of establishment.

Just for your information, the Working Group does not sign a Non-Disclosure Agreement (NDA) contract. Participating companies' members communicate openly and frankly with one another using information that is available to the public. And, I think this is one of the best parts of the group activity. This is the third year, and we are always looking for new member companies to join us, so interested parties are welcome.

Next, I would like to talk about the three main issues in the outline of the Working Group, in terms of what we aim to achieve as the direction of the output.

The first point is we should firmly determine the image of a realistic infrastructure that leads to a carbon neutral society.

Innovation must not end up as just innovation. Since it is necessary to implement it in society, the first issue is the need to discuss what infrastructure is suitable for the carbon neutral era.

As you can see from the list of member companies, our company, ENEOS is an oil company, but some of our members are from electricity and gas companies.

The energy industry does not usually have many opportunities to discuss common topics, but I believe it is meaningful and valuable to be able to discuss this common infrastructure together through this working group.

The second issue is that we would like to present combination of technologies that cannot be achieved by individual companies alone.

As I will explain later, many of our member companies have been involved in social implementation projects with significant support through the Green Innovation Fund, GI Fund. However, because some technology combinations cannot be realized by a single firm, discussions will also take into account synergies with companies receiving the GI Fund.

Third, we talk about how we may make people aware of the importance of this issue and increase their willingness and drive to participate in society at large.

Businesses, despite being one carbon neutral facilitator, cannot achieve carbon neutrality on their own. Because it is crucial for communities, local governments, and various groups to feel a sense of ownership and willingness to contribute, efforts to improve these efforts cannot be resolved by individual firms, therefore, discussions are underway in the group.

Based on this discussion point, the Working Group has selected four themes on the carbon neutral model, as it has done from our first year of operation. The four concepts are shown on the slide.

The first is the promotion of hydrogen utilization that contributes to the decarbonization of industrial complexes. This will be explained later.

Various projects have been formed to obtain low-cost CO₂ free hydrogen from abroad, and we are concentrating on how to use the hydrogen in the industrial complex region where it will be employed.

The second is carbon recycling/CCUS.

Numerous industries can be found in the industrial complex regions.

The second theme focuses on the carbon neutralization of applications such as heat and chemicals that cannot be replaced by zero-emission electricity, based on the idea that it is important to use CO₂ efficiently while minimizing its emissions.

The third is a little far from the Tokyo Bay area, but is a model for energy management for local production for local consumption that contributes to carbon neutrality in the Tokyo Bay area in a wide range of areas connected to the inland areas.

This is the third model, which is a menu of various models for both electricity and heat that will motivate local communities to participate in the carbon-neutral project.

The fourth and final point is digital infrastructure.

As Dr. Kashiwagi mentioned earlier, the visualization and interlinking of data necessary for a carbon-neutral society is indispensable for promoting carbon neutrality.

This slide shows the overall picture of the four models.

On the left is the supply side. The top left shows the system section that produces clean hydrogen while making efficient use of blue hydrogen and fossil resources. On the right, is a system for producing hydrogen from renewable energy sources.

Energy management technology that is compatible with the grid is written next to it.

Below left is a schematic diagram of CO₂ efficient utilization technologies. Chemical products, synthetic methane and e-fuels, all of which make effective use of carbon, as well as a model integrating them are shown.

The model's overall view indicates that common infrastructure, such as pipelines in the hydrogen complex regions and heat sources, and VPPs which are connected with the grid, are necessary.

This slide shows the results of the second year of activities carried out over the last year under these visions.

This slide shows the results of the second year of activities carried out over the last year based on these visions.

The selected activity themes are listed on the lower half of the slide. The common theme is the creation of new demonstration projects by pursuing synergies between individual company projects.

As stated in the objectives, the aim is to create demonstration projects through the GI Fund projects undertaken by each company, or through the collaboration of large projects of the companies.

The creation of new demonstration projects through collaboration between academia and business is also one of the goals.

To achieve this goal, the Working Group has organizing seminars and workshops to pursue synergies between companies, and holding roundtable discussions with academia.

We hold meetings on a monthly basis.

Besides this, there are two individual themes which are focused on CO₂-EGWR and digital infrastructure. The first is called CO₂-EGWR, a demonstration study task force that seeks to produce demonstrations using technologies owned by a Working Group member, JAPEX.

Safety assessments and suitable site investigations are among the activities, as is promoting communication with stakeholders through seminars and organizing topics for this demonstration, and addressing issues related to laws and regulations.

Another individual theme is digital infrastructure.

A taskforce preparatory group was also set up formed to organize digital infrastructure use cases through corporate hearings and workshops.

Next, I would like to introduce some of our individual activities.

This slide shows the overall picture of the GI Fund projects that the Working Group companies are pursuing. As you can see from this slide, research themes in diverse fields have been launched. The red indicates the companies participating in the Working Group this time. And, you can see that in almost all corporate fields, the member companies of the Working Group are promoting their own GI funds.

Since the GI Fund project has just started, we have only been able to share information gradually, but we are working to deepen mutual understanding by sharing the status of studies as much as possible.

Next, I would like to introduce a case study of collaboration on hydrogen utilization in an industrial complex. This is a case of collaboration project between ENEOS and Kawasaki City, and companies in the waterfront area of the Kawasaki industrial complex, which was supported by NEDO for a two-year period from 2021. This initiative is to organize research on the laying of the pipeline infrastructure required for the use of hydrogen in the Keihin Waterfront Area, and then a plan for the actual laying of the pipeline.

We also performed a survey on the intent of firms in the area about the usage of hydrogen in partnership with the local government, Kawasaki City, while drawing on information provided by the municipality. formation provided by the municipality.

By summarizing a questionnaire on when and how hydrogen would be used, the potential wide-ranging demand for hydrogen in this area has been identified.

Additionally, we have developed a strategy that considers information on the pipeline routes that Kawasaki City already established, as well as the most efficient way to connect the pipeline infrastructure to demand. We found that the area has a very large hydrogen demand potential of 2,300 t/d.

The pipeline to connect the demand is 67 km long, and the complete construction cost is a very significant sum of 150 billion yen. So, we have demonstrated the capability of installing the pipeline infrastructure systematically, by each section.

The regulatory issues that require attention have also been organized. The regulatory issues are shared with the Regulatory Committee of the Japan Hydrogen Association, and we are working with this association to address these issues.

Another example of collaboration is the specific issue of hydrogen utilization in an industrial complex area, which is the collaboration between ENEOS and JERA, a power generation company, and recently adopted as a NEDO project.

The theme of this project is "Research and Development for Hydrogen Quality related to establishment of a large-scale CO2-free hydrogen supply chain" with the aim to construct a hydrogen quality standard system for industrial utilization in the future.

One large-scale application of hydrogen is hydrogen power generation.

Until now, there has been no quality standard for the fuels used to produce hydrogen power generation,

so we decided to carry out research and development under JERA's guidance. We will not be able to aid in the early realization of a hydrogen society if each company employs its own hydrogen grade.

Developing quality standards for hydrogen is becoming essential for uses other than power generation, such as heat, methanation, and steel manufacturing. The first step is to organize the Japanese standards based on JIS, and eventually to bring them closer to ISO, the international standards. As a NEDO research theme, we are working together on a common infrastructure for hydrogen quality.

We will consider these issues up to 2025, before the full-scale implementation of the hydrogen society begins.

Next is collaboration research between Tokyo Gas and Kajima Corporation.

This is a demonstration case of the implementation of carbon negative concrete at the Motomachi Elementary School in Yokohama City.

CO₂-SUICOM, a trademark of Kajima Corporation, is a revolutionary technology used for the first time in Japan. They make concrete that absorbs, rather than discharges, CO₂ during its manufacturing process. And, it is currently being used in conjunction with a CO₂ emission source at a primary school. As you can see on the slide, this is excellent example of collaboration has achieved a carbon negative result of -27 kg/m³.

Next is a collaboration project between Nippon Steel Corporation and Resonac in an industrial complex area.

This is also related to CO₂ separation and fixation and involves the development and implementation for low-concentration CO₂ separation system technology using innovative materials.

This GI Fund project will be carried out over the next nine years until 2030. Previously, it was very expensive and challenging to capture CO₂ at low concentrations. However, both businesses will be able to demonstrate how their CO₂ emissions are fixed by applying this technology.

The technology is validated by developing the process for making chemical products that fully utilizes the CO₂ recovered by this technology as a raw material. The initiative is receiving attention as a model for future collaboration.

This is a collaborative study on a local produced and used energy management system.

This is a collaboration project of four companies: the Yamanashi Prefectural Enterprise Bureau, Toray Industries, Inc., Takaoka Toko Co., Ltd., and Tokyo Electric Power Company Holdings.

This is a demonstration project to study the production of hydrogen from unstable electric power, the development of safe hydrogen storage and transportation technologies, and the use of heat from a hydrogen boiler, in one step for local production for local consumption.

As shown here, this is an example of collaboration in which hydrogen is produced using panels from Yamanashi Prefecture and used as fuel at a boiler plant. This is a good example of one of the local production for local consumption energy models being already demonstrated.

Next, I would like to introduce a case study on the status of digital infrastructure as an individual issue. The objectives of the digital infrastructure include data interoperability and economic visualization based on this, or decision support for companies in their carbon neutral, DX and GX transition. The aim is to achieve these objectives by efficiently linking data on green certificates, CO2 emissions and CO2 recovery with each other through digital infrastructure. The taskforce preliminary meeting will first hold individual company interviews to determine the issues they are experiencing, as well as to determine whether digital infrastructure is a feasible use case. This year's action plan is to organize the problems from the bottom up, while simultaneously consulting with specialists, such as those from the public council of carbon credits and developing a clear proposal for a solution policy for digital infrastructure.

This is the overall image of digital infrastructure, and it is linked to several levels, including the service layer, the IT platform layer, the business system, and the real-world layer. We are aiming to organize the requirements for the CO2 recovery and utilization system, as well as how interoperation among stakeholders and the creation of new value will be achieved over the current fiscal year.

The next is the CO2-EGWR demonstration study taskforce. CO2-EGWR is an abbreviation. It stands for CO2 enhanced natural gas and iodine dissolved in water recovery. This taskforce was formed to demonstrate this technology.

We are identifying and organizing issues for the development of EGWR demonstration projects for carbon-neutral resource and energy development technologies that contribute to carbon neutrality. This slide shows a CO2-EGWR technology schematic. The first step is to recover resources by pumping water-soluble natural gas and iodine. These materials are contained in groundwater in the Tokyo Bay area. In the second step is to use the recovered natural gas as a raw material to produce blue hydrogen, and recover the CO2 generated. The third and final step dissolves the CO2 emitted in the vicinity into brine, returning the CO2 to the ground to prevent land subsidence. The taskforce's objective is to find solutions so that safe underground CO2 storage can be implemented, and this valuable Japanese domestic technology may be used effectively at the same time.

In addition to CCS, we have compiled an image of the CCUS chemical chain. Based on the usage models used by the chemical and oil and gas sectors, we have created our own image of utilization. Although we have only organized the links among the working companies, we hope to create a

demonstration project that will lead to a chemical chain that will generate added value, such as FT synthesis, methanation, and methanol synthesis as a feedback for renewable hydrogen from the CO2 concentrated in the industrial complexes.

The CO2 demand balance in the Tokyo Bay area is displayed on this slide. The region is anticipated to produce enough CO2 to meet future demand for fuels and chemicals utilized in the region, assuming a 60% reduction in CO2 emissions in 2050 compared to the present, in 30-year increment.

We would also like to future examine the chemical chain shown earlier to see if such data exists.

This is our 2023 activity plan.

With the help of company collaborations, we hope to develop a demonstration project for a carbon neutral model while putting our previous discussions into practice.

The taskforce will organize concerns for demonstration through individual conversations among various organizations and identify its discussions, including on specific themes like digital or CO2-EGWR.

We hope to have the opportunity to report on the results of these activities within FY2023.

The last slide is a summary by working members for this council, which is now in its third year.

As this will overlap with the content of the panel discussion that follows, I will briefly introduce it.

First of all, the organization should be one that proactively promotes and carries out demonstration and problem-solving measures that lead to social implementation.

Based on the active discussions of the Council's work, the project should be taken forward in concrete form.

The vision that has been studied in the past should also be organized and communicated, including "What are the barriers to achieve it?" and "What needs to be done to overcome these hurdles and the impact they will have?". This is the first expectation.

The second expectation, as I have mentioned several times, is that common issues which cannot be tackled by individual companies should be addressed, and that overall optimization through cross-industry discussions should be carried out.

As introduced in the case studies of collaboration, the implementation of policy advocacy on institutional development, standardization, and deregulation, etc., was a major expectation.

We would like to see more opportunities for cross-industry discussions and efforts to help unify the direction of the direction of the industry as whole. This is second.

Third, we hope to provide a place for encouraging collaboration between companies and organizations, and for public dissemination of the accumulated examples of collaboration.

It is difficult to get a clear picture by only discussion, so it is necessary to introduce examples as much as possible.

As I mentioned earlier, there are overlapping examples of collaboration between different group member companies.

It is also expected that a hub function for sharing initiatives will be set up so that these examples of collaboration can be thoroughly reviewed, and mutual publicity can be used as a reference for the next example of collaboration.

The fourth is to conduct studies on specific individual topics that reflect the issues and needs of each company. We would like the Council to be a place where specific issues are identified, and implementation projects are created that lead to social implementation.

The taskforce presented today, there was also a request for the taskforce to provide a framework for discussions focused on specific issues.

In order to meet these expectations, the Working Group would like to continue to fulfill its function as a place for realization.

That's all for the report from Working, although it was a bit of a rush.

Thank you for your attention.