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Good evening, and welcome to our session, Safeguarding the Power System, Investing for Resilience. I am a disaster risk management specialist at the Global Facility for Disaster Reduction and Recovery, GFTR, at the World Bank.

My name is Natalia Romero, and I will be moderating this session. In this session, we are gonna hear perspectives from Bangladesh, Ukraine, and Japan on understanding risk and learning how to manage the risk for our resilient power system and service.

We're gonna go over the three presentations, and then at the end of those three presentations, we're gonna have some time for questions and answers from all of you or comments. So to start, I'm gonna invite Mr.

Manzul Hazarika, director of the Geoinformatics Center at the Asian Institute of Technology. He and his team are simulating failure climate risks in Bangladesh to assess their impacts to the power system.

Mr. Manzul, the floor is yours.

Thank you. Good afternoon. So this project, actually, we are working with World Bank, and this just started the project. So we are still working on getting some data from the Bangladesh government side.

Whatever we have done here, I'm using open source data. So AIT, where I work, is the leading of this project, and also NCAR, National Center for Pharmaceutical Research in Colorado Boulder. They are our partner for climate part and RTI International for the flood part.

So this is basically, we know Bangladesh is very highly vulnerable for hydrometallurgical hazards, particular floods and cyclones. And power infrastructure and facilities exposed to flood and cyclone are highly sensitive to changes their frequencies, intensities, because of climate change in the next 50 to 100 years.

And so what we are trying to do to do this risk assessment from cyclone and flood, and how it will impact on this power infrastructure in Bangladesh, so that they can be government takes necessary mitigation measures in advance.

So these are some of these risks, disaster risk for flood and cyclone storms are published by ADBT in 2021. This is the with a course kind of map, some index they have used, but we'll be doing a little bit more detail in high resolution.

So objective of this study is to equip the government of Bangladesh and power sector agencies with the resources and facilities to facilitate a certain system level, resilience planning and policy under uncertainty in the future climate scenario.

And so for this, we will be looking at modeling for cyclone, flood, extreme weather events, and coastal inundation. And overhauling, whatever hazard maps are coming, we overhaul it with the power infrastructure assets to look at the exposure.

And then we conduct this we'll also look at the vulnerability in from different intensity of hazard and we'll do the multi hazard risk assessment, particularly mainly for cyclone and flood. So it has two components.

So first component will look at the flood hazard, wind hazard and do the risk assessment. And in part two, component two, we'll also look at the future near, mid and far term scenario for these hazards.

And we also overlay this information with the power system assets and do the get the vulnerability and do the risk assessment. So this is very common just to how we are going to do this and basically exposure and from hazard modeling, we'll get the weather and climate events.

So for past historical data, we'll see how it has been at this flood and cyclone hazard. And then we also look at the future scenarios, three scenarios I have mentioned, how this will be changed in the next 50 to 100 years.

And then we'll see how it will be affected. So for flood, for future scenarios we are using some of these climate projections, using some ECMIP and enough research products. And then also we are collecting river research from Bangladesh Water Development Board and also historical cyclone data.

And all goes to the platform called Clemada, which is a multi -hazard risk assessment platform developed by ETH Zurich. And also for flood modeling we'll be using KamaFlat. This is a flood developed in the University of Tokyo.

It's an open source. And then all these things also, like from the down below, elementary power system infrastructure, power plans, power lines, all those things will be going to this Clemada platform.

So hazard map, then your exposure map, then your vulnerability information, our curves for this different asset we put together and we get the loss and risk estimates finally. So this is historical simulations using KamaFlat.

So whatever data available in open source, we simulate using this model. And you can also see these power plants, those dot, red colored dots, those are power plants which will be in Bangla's existing power plants.

And this is for SSP126 for 2040, near term, 2070 mid -term and 2100 long -term. And for, you can see the flood maps, how it will be looked like for this particular SSP scenario. And also these power plants locations, you can see how it will be affected.

So those power plants which are exposed to the flood, we need to see how Bangla's government can do something to protect them, mitigate the risk. And there's also some too large, power plant in the downside, yellow color.

Those are not exposed, actually. Those are in a high place somehow. So they are not really exposed to flood, but definitely they'll be exposed to cyclone. So this is for SSP585 scenario, again, 2040, 2070 and 2100, and this is the situation.

This is our worst case scenario. And for cyclone, this is being done by ANCA using SAS model, so for 2035 to 45 and 45 to 55, 55 to 65. How this kind of, these are synthetic tracks they call, this made a simulation.

So these are some of the area where it will be highly concentrated of these fusar cyclones in Bangladesh. So also they have, in 2007, cyclone cedar, it's one of the very big cyclone Bangladesh had in recent years, and they have made this simulation.

And this is quite a high resolution simulation, but also ANCA, they are using some techniques called PBL, plenary boundary layer. If you use that kind of technique, you can see this very detailed wind hazard map so that your power assets will be, clearly you can mark how it will be affected.

So what we are thinking is that for wind, I think mostly power lines will be affected. Power plant will be, but mostly power lines will be affected, so how those are exposed to very high exposure and risk, then government should be able to make some mitigation measures.

So this is the kind of wind intensity and the power plant exposure. Also you can see the lines, the different colors, those are lines, power lines. So opportunities that this study will generate information about the current and future flood and cyclone hazard and risk to the power infrastructure in Bangladesh.

And the risk to the power infrastructure will be generated in geospatial in a map format so the government can prioritize mitigation measures. And particularly those power plants or power assets are highly exposed and high risk.

They can take some mitigation measures. For example, if suppose some of the power lines are exposed in future, very high wind cyclone coming up, they can think of making those power cables in those locations underground, for example.

Or some of the power plants are exposed to flood in future so they can think of, elevate them at this point when they get this kind of analysis. So salences, while climate and hazard modeling are done at national level, but risk assessment need to be done at the very high, at the building level, each power plants, right?

So this is a kind of trade off because your hazard maps are not so high resolution because of national level, whole country you are doing, but you are using. So we are trying to see how best we can solve this issue.

Securing data is always a challenge in development. It's not only Bangladesh or many of the countries. They have data, but you know, it takes time, lot of power station, lot of other things. So I think we are going to get some data.

Once this local data comes, I think this improvement will happen on these maps. Thank you.

Thank you, Mr. Masul. That was definitely a very enlightening presentation about that I'm going to study in Bangladesh. Like I mentioned at the beginning, if you have any questions, please write them down or just keep them for the end of all the presentations.

So next, we're going to learn about the shocks faced by the power system in Ukraine. For that, we're going to have two speakers. One is joining us here in person, and the second is joining us virtually.

Here in person, we have my colleague, Mr. Koji Nishida, Senior Energy Specialist, who is currently leading an emergency project to support Ukraine's restoration of the transmission facilities. And then virtually, we have connected Mr.

Olyek Palenko. He's the Chief Investment Officer at the National Power Company, Ukenegro. So Koji -san, over to you.

So, yeah, good afternoon, everyone. My name is Koji Nishita. I'm a senior energy specialist with the World Bank. So I'm going to talk about Ukraine. The country, of course, has been in a very difficult situation.

Of course, this is caused by man -made disasters. But there is similarity with the damages caused by natural and climate -related disasters. So we have lots of lessons learned from Ukraine. Of course, that situation is still ongoing.

The World Bank has been supporting Ukraine, I mean, many aspects. Why is this assessment on the damages and the needs for the reconstruction and the recovery? The bank estimates $486 billion of the needs to restore damage to facilities, houses, roads, and energy facilities, of course.

And I mean, the amount is very significant, three times of the GDP, Ukraine GDP. So this is a very, yeah, I mean, devastating situation. Energy sector is one of the most affected sectors. Particularly, recently, many energy infrastructure, particularly power generation and power transmission facilities are damaged, targeted and damaged.

So there are lots of transformers and the generation plants have been, I mean, destroyed. The main target, I mean, from the military attacks has been on the power transformers, the large one, large power transformers, which is critical in the stream of the electricity.

And then the loss of these transformers caused significant bottleneck on the electricity supply, which caused supply restrictions. And there have been many regional and national -wide outages all over the country.

So this is very, they know which element is significant, has most, I mean, for them, efficient for the enemy side, which is what is the most efficient strategy for the attacks. So they focused on the transformer, particularly in substation.

As I said, the bank has been supporting Ukraine, providing both financial support and also technical assistance. From financial perspective, we provided almost 400 million US dollars of grant and also IBRD loan to Ukraine in the energy sector to restore those damaged equipment, particularly, as I said, the transmission facilities and also hydropop lands.

And then on the analytical and advisory aspects, through technical assistance, we have been also supporting a little bit longer term from the longer -term perspective for the reform and restoration of the sector.

And one of which is power system resilience with the support from GFT -ERR. So, the question is how the power system resilience can be strength. There are two elements. On the planning side, there are lots of measures can be done.

Of course, stronger material, of course underground distribution transmission network could be an option, although it's very expensive. And also, utilities have to manage vegetation and transmission lines.

And relocation, relocate some facilities located in hazard areas can be also optional. And also, from the system perspective, the system has to have sufficient reserves to mitigate the impacts caused by loss of one element or two elements.

And definitely distributed energy resources is an option to make the system more resilient. On the operation side, we have, of course, the more accurate forecast based on the weather forecast. And visualization of the system is also one of the elements.

And for the planning side, network configuration can be also improved. And the advanced protection, and also the demand side, if we lose one generation plant, I mean, generation side, we can also, it should be, yeah, I mean, control the demand to mitigate, to ensure the power system supply and the demand balance.

And repair crew mobilization, institutional preparedness for such events also critical. And maybe emergency generation can be also mobilized as well. So with the GFDR support, we have conducted some analysis and capacity building on the power system resilience.

We have analyzed specific technologies, measures, that can help strengthen the power system resilience, which is one which is, as I said, the demand response. And the dynamic line rating, which helps TSO to tentatively increase the power system transmission network capacity.

And the drone is also very strong to detect the location of the damages and also to restore the facilities. And we also organized a study trip to Japan to exchange knowledge with Japanese counterparts, particularly utilities, of course, and the ministry on the policy level.

We visited also hydrogen site as well. So it was, yeah, quite interesting and useful for Ukrainian counterparts. One concrete example is that the visit to underground substation located in Kobe. So of course, in Kobe, the utility developed, build this underground substation due to the, I mean, the area constraint.

So it's totally different to motivation, but the Ukrainian also colleagues have learned and also wants to implement this to actually, to protect the substation in, I mean, to make this substation to be underground.

So they are constructing such, yeah, very, yeah, significant measures to protect the electricity facilities. So, yeah, this is conclusion. So yeah, we have been supporting Ukraine and, I mean, they are, as I said, very similarity with the natural and climate disasters and diversification and decentralization are also very important.

It's not only the answer, but this is also very important to enhance the power system resilience. And the JFL, JFDRL has been very instrumental for, I mean, for Ukraine to meet this goal. So I think, yeah, that's all my presentation.

I think I will pass the floor to Oleg now. He's a chief investment officer from Ukraine ago, the transmission system operator. So he can talk about more on the damages, actual damages caused by military attacks.

So can you switch to team? Team, can you cut more on this? Thank you. So, Oleg, can you hear me?

Yes, got you.

Yeah, thank you, so the floor is yours.

Yes, thank you very much. Uh, good afternoon ladies and gentlemen, and first of all thank you very much for all the support that has been rendered to Ukraine which is very crucial to keep the lights on here.

So let me give you the demonstration. I'm not sure if it's. Now on your screen. Probably not yet. Nevertheless, let me start with saying that in 2022 and 2023, Ukraine's energy workers did the impossible.

We've preserved and managed to overcome the consequences of dozens waves of massive missile and drone attacks against energy infrastructure and unprecedented event in the world's history. However, if not destroyed to the ground, Russian terrorism continues its cruel pace.

And this is exactly what is happening in Ukraine right now. Since the beginning of this year, Ukraine's power system suffered from six massive combined cruise and ballistic missile and drone attacks.

As a result, around 100 of missiles of that type and 80 chemicals and drones, heat energy infrastructure facilities all across Ukraine. This year, in addition to strikes against the electricity transmission infrastructure, the enemy focused its attacks on generation facilities as well.

Practically all thermal and hydropower plants which constitute the main part of the country's maneuvering capacities were either damaged or completely destroyed. As a result of recent Russian attacks, the share of generation from thermal power plants in total electricity production decreased from 30% to less than 5%.

Nearly 40% of all generating capacities that were available in Ukraine's power system were destroyed or brought out of operation due to that damage. This is an appalling figure for the country with the population of more than 30 million people.

Considering a significant deficit in generation capacities within the system, Ookar and Ergo's dispatch center is forced now to restrict the usual consumption. As of now, consumption restrictions for households and businesses are applied in all regions of Ukraine without any exception on a daily basis.

Next slide, please. On these slides, you might see the demonstration of what the damage looks like. Unfortunately, the upcoming winter heating season will be even more challenging for Ukraine. Terminal power plants, hydropower plants, high voltage equipment for transmission, all of that has been damaged and this is 21st century center of Europe, but almost everything is destroyed now by Russian war criminals.

Next slide, please. Here you can see the damage inflicted to hydropower plants. And on the next slide, please. You will also see what damage looks like when it comes to transmission rate. Next slide, please.

So given the current state of affairs, Ookar and Ergo is once again on the verge of being in need of help. So what we would be needing should the attacks against energy infrastructure, specifically transmission rate continue, would be the equipment which is

normally used on our substations like auto transformers, circuit breakers, disconnectors, open and gas insulated switch gear relay protection and other high voltage equipment.

Thanks to the support from our international partners and from the World Bank specifically, we have purchased the majority of the items that we have lost over the past two years. But we perfectly understand that the enemy will keep on their attempts to shut the lead off in the whole country.

So as can be seen from various strategies of Russian attacks, the vulnerability of a power system is basically in its two main components. First of course, is the transmission grid, which can be shut down by destroying sufficient number of auto transformers.

And it doesn't even take to destroy the whole substation. Auto transformer is enough. These units are crucial for operation of substation and desired effect can be achieved by the enemy when those are destroyed on substations that provide for power output of major generation units, such as nuclear power plants.

Moreover, it is worth mentioning that no transmission system operator globally has a fleet of reserve autotransformers to swiftly replace them. And we all know that lead times nowadays do not allow for fast recovery.

However, there are physical protection solutions, applications of which can resolve the issue of drone attacks. Obviously, of course, this relates to outdoor substations. Those ones which are built underground have that necessary inherent level of protection.

Combined with strong air defense systems against missiles, transmission grid can stay therefore resilient enough. But the second category is generation units. Weakness here lies in having dozen or two big generation units that cover largest part of the consumption.

Such big generation units cannot be physically protected with only air defense standing to guard them. As demonstrated by Ukrainian experience, generation shall be mainly distributed so that there is possibility to physically protect it.

In addition, it is nearly impossible to destroy, for example, 200 small terminal units of, say, 10 megabatt capacity each, as long as they are scattered around the country. On contrary, it might take just five, seven ballistic missiles to bring the two gigawatt terminal power plant to zero, as was the case in Ukraine.

And this is why Russian terrorism must cease to exist. This is why all the countries respecting the principle of international law must unite to stop the aggressor and prevent any possible humanitarian catastrophe in the future.

I would like once again to thank Japan and people of Japan for the support. We're all grateful here. And once again, thank you very much.

Thank you, Olyek and Koji, for sharing those lessons from Ukraine. I think, I mean, we all agree that the nature of shocks that Ukraine is facing are different from some of the, or most of the conversations we're having in understanding risk, but definitely some of the lessons applied to the, in the electricity sector.

I think we heard from those aspects of identifying the most critical components and also the importance of redundancy for adding to the resilience. So, with that, I want to invite our last speaker. He's the General Manager on Asset Management in the Kansai Electric Power Company, Mr.

Takayuki Doi. And he will share some of the knowledge from Japan has in the sector. So, Takayuki, over to you.

Good afternoon, I'm Takayuki Doi. Currently I'm working for the Kansai Electric Power, which is one of the Japanese utilities. I used to work for the World Bank, and then at that time my job was to recommend capital investment to my client country, and basically assist them get loans from the bank.

That's what I used to do. But today I'm talking about disaster risk management without capital investment. I'm not trying to say what I used to do was wrong. I still believe capital investment is absolutely necessary to tackle this disaster.

But I try to propose today is that there's some steps to make capital investment even more effective. Let me talk a little bit about Kansai Electric. If you look at the left side, there are 10 Japanese utilities, and Tokyo Electric is the largest, and the Kansai is the second largest in Japan.

The Kansai covers the area, Kansai area, including Osaka, Kyoto, Kobe, and even Himeji here. I would like to appreciate the organizer to use our electricity for this event. And then please take a look at the right side, and this is overview of Kansai system.

Our system includes hydropower, solar, wind, summer power plants in Himeji area, and also nuclear power plants. It's quite diversified. This kind of diversity of the power plants also enhance our disaster resilience.

If Japanese power utilities are asked about their disaster risk management, a lot of example would be provided. For example, as one example of prevention, Kansai Electric constructed eight metal toll shewars around the nuclear power plant to prevent any kind of impact that can be caused by tsunami.

This is in response to what happened at the Tokyo Electric Fukushima power plant in 2011. And then mitigation example in the middle. In some areas, we use flexible joint for the underground transmission pipes to mitigate the damage caused by earthquakes.

And on the right side, whenever we have facility damage, we try to aim to the build back better. In this example, an old hydropower plant was destroyed due to river flooding, but it was rebuilt on the elevated ground so that the river flooding of the same level wouldn't affect this power plant anymore.

This capital investment is quite effective, but should this investment be applied in other countries? Because this is quite locational issue. And also, the capital investment on the previous slide are very effective.

And also, as an example on the below, such as making power networks redundant, undergrounding of power lines, deploying bucket trucks to all locations, they are all effective, but they require a lot of investment.

Let's take a look at how many disasters occurring in Japan. We have 24 typhoons a year, quite a lot. But more surprisingly, we have 330 earthquakes a year. So almost every day, somewhere, we have earthquake.

So we are quite used to earthquake. So even if we have earthquake here right now, those who are living in Japan wouldn't be surprised that much. But we don't have block out at all. Most of people have never experienced block out.

So if they experience block out, they would be very surprised here. And then tsunamis, this is not very often, but this happens every 10 years. So we need to prepare for this kind of event, especially for the critical facilities.

So given this kind of statistics, it is spending huge budget for disaster risk management in Japan. Economically and basically makes sense. But in the real world, but it always has some certain limit.

And also we need to weigh up cost and benefit depending on the situation. And also for that purpose, we need to identify which kind of investment should be prioritized. For that purpose, I'd like to propose disaster risk management without capital investment as the first step.

Even without capital investment, we can develop a disaster response plan to enable switched response. We can also build a collaboration framework with neighboring utilities to share our resources and also to avoid redundant investments.

And also conducting regulators improve response skills and also enhance readiness for the disaster. These no capital investment measures are also quite effective and very cost effective because there's no capital expenditure.

In addition, starting with this kind of measure can identify what is lacking and also what kind of measures is truly cost effective. Conclusion, capital investments matter. In the end, capital investment is necessary to tackle with certain events.

In our case, for example, Kansai constructed eight meta -tall walls around the nuclear power plant. It was absolutely necessary because we cannot allow what happened at Fukushima to happen at our power plant.

But the insights based on our experience, before using huge budget, it's also recommendable to start with strategic planning, co -operation, and training. And the expected impact, such an approach promote organizational awareness, ensures optimal allocation, and in long run significant boost over all resilience.

This concludes my presentation. Thank you very much.

Thank you very much, I think that definitely that message of that reminding us that there are effective measures that help to contribute and contribute to resilience that do not necessarily need capital investment is something to keep in mind.

So now we're going to move into the questions and answers and also we want to invite the audience if you also have some insights on risk assessment in the sector or solutions please do also if you want to share your insights we know understanding risks brings people from the insurance industry solutions providers academia so we're also interested in hearing from your insights.

For that part of this session I'm by the speakers in person to to join me here up front so Taka, Koji and Mansoul and I also want to check that Olyek can you hear us well.

Yes, the connection is good. Thank you.

Perfect, thank you very much. I want to make sure that you can hear the questions from the audience. So what I'll ask is that if you have any questions, please raise your hand. I'll bring the microphone to you, or if you can help us please.

So we can, and then please, when you speak, introduce yourself and your affiliation. So the speakers can know who you are and everyone else here can know who you are. So do we have any questions in the audience?

No?

Thanks. My name is Paolo Manunta, Asian Development Bank. I have a question for Manzul. Of course, it was a very easy presentation to read and understand the risk in Bangladesh. As you know, we work a lot in Bangladesh.

But what is the next step? Because I understand that you pointed out that probably this is an extra step to be done. And the question is actually of two kinds. What kind of extra step is needed? And are you planning to do something more specific for single sites?

And also transmission lines?

Okay, so I think this particular work, we are asked to do the risk assessment, but when I look at all the, I mean, documents, so basically, I think World Bank probably take next step to provide financial support to make this power system more resilient to cyclone and flood.

So what I see is that how to do that is, you know, a lot of capital investment will be required. And one of the thing is probably the power plants which are near to the river where flooding is very frequent.

So I think some kind of flood mitigation measures could be taken there. And another big problem actually is also a lot of river erosion in Bangladesh, and some of the locations, it could be several kilometers wide river, right?

So that is also one thing we are looking into. Some of the power plants near the river that could be infused, it might be eroded. So some of the river protection measures could be taken. And for wind, in these documents which I have read is that if some of these power lines or area is very affected by infuse or very high speed hurricanes or tropical cyclone, they could think of, make them underground in those locations.

So depending on the location and these two, three hazards, I mean, cyclone, flood and river erosion, I think these are the major issues. But in addition to that, they are also asking us to see what is the temperature and humidity next 50 or 100 years, because that also affects the efficiency of the power line.

So that can be, that kind of high temperature, demand is very high, high temperature situation. So some of the measures could be taken in that direction, but detailed documentation I don't have, maybe World Bank, they have a plan for maybe another technical assistance or loan or something like that, they have some plan, I think.

Thank you.

Thank you very much. Do we have any other questions or comments from the audience? No? OK. Well, I do have a question, and maybe I'll start asking this question to Olyeg, and then I'll ask Taka to add to that question from the expertise in Japan is, we heard from Koji that diversification and decentralization are critical to enhance the power system resilience, right?

But we also know that that changes a lot of the norm on how to deliver on the standards of reliability of the power system. So my question to you, Olyeg, and then Taka, is if you can share some of the solutions for power system resilience in that context of when we have a system with more of that decentralized generation of how to keep that reliability

also even in the context of shocks, and how much does that change in the context of decentralized generation?

Yes, thank you very much for this question. Actually, we at Ocarinaergo have analyzed what specifically can be done in the, I would say, short and mid -term perspective to make a swift transition towards this decentralized generation.

Of course, we understand this is not only about construction. There are certain market rules which have to be introduced so that there is a big interest from private investors to come, invest, and build new generation facilities.

Although we've gone further and we have analyzed, I would say, three major technologies which would be focused on the resource vastly available in Ukraine, which therefore is very crucial to be considered, these are basically three major investment profiles.

I'll be glad to share the presentation afterwards. Giving a description of every category of such investment, demonstrating their investment attractiveness by showing the CAPEX, the OPEX, also IRRs, and other economic parameters which should be considered by private investors before stepping in.

We believe, of course, that the proportion or the overall capacity which should come to Ukraine is basically equivalent to whatever generation capacity has been lost. Although we understand this is not achievable to our deep regret by the winter which is now to come.

Therefore, this strategy will be covering a couple of years, year of 2025 and 2026. In the meantime, the energy system has also to take all the necessary actions to repair whatever units can still be repaired and obviously provide for their air defense protection as there is no other ways of providing for physical protection.

So let me share with you afterwards the presentation. I believe it will be useful. The presentation, apart from three major project profiles, will also contain the map where

such generation facilities can be built based on the availability of the grid and of the respective resource which has to be used for generation of electricity.

Thank you.

Thank you very much, Olyek and Daka, yes.

Thank you for the question, and then let me explain diversification and decentralization separately. Diversification is definitely effective. This is not only for power sector in any actions, like even stock market investments, diversified portfolio is quite good to mitigate risk, and in power sector, diversified generation resources.

That's also effective. In Japan, for example, if we rely on a single type of power resource, then one single supply chain can cause large -scale blockout, so diversification is definitely effective. But in case of decentralization, it has pros and cons, and then from the power engineering perspective, especially spread out small generators, like solar power.

It can be effective, but in some cases, it cannot hold the power system stable because the power system requires constant balancing between demand and supply, and then microgrid with solar power alone cannot fulfill such requirement.

Having said that, combining with energy storage, even solar power can sustain the power grid, and then energy storage is very expensive, but once the electric vehicles are commonplace and also vehicle -to -grid technology is advanced, then combining those technologies, probably solar power can be quite an important tool to enhance resilience.

That's the comment from my experience. Back to you.

Thank you very much. So I gather from your answers that it's also a question of thinking strategically of also the location. But also we need some additional measures to to make sure that the availability and stability of the network can be can be sustained.

And then my question, my last question, I think, is for Koji, unless I see any other follow up questions from the audience. Hands raised. No. Oh, yes. OK, then please.

Hi, I'm an urban specialist with the World Bank. My name is Deva Shree. I'm accompanying, actually, the Ukrainian delegation that's working on housing. But it's a really interesting idea about holding off on immediate capital expenditure and just taking that idea to Ukraine, where so many people have left the country, and we don't know whether they'll come back.

And there's a sectoral transformation. Businesses are moving out. We don't know whether they'll relocate at the same place that they were earlier. The manufacturing sector is moving away from the east to other regions.

So in that light, how are you strategically planning or projecting where the needs will be when you think about repairing or investing more and rebuilding all of these energy - related infrastructure?

And are there any lessons that other utility sectors in Ukraine can learn from it at this point? And this question is to, I guess, everyone on the panel.

Thank you very much. So maybe we start with Olie, and then Koji will add to that answer, Olie. Thank you. Oleg, can you hear us? Okay, so maybe we lost the connections of Goji, please.

This is a great question. In terms of the demand, electricity demand, it's decreased by 30% compared with the war situation because of the temporary relocation and also some industries also stopped consumption.

But in the west side of Ukraine, like Lviv, there is increased demand. So there should be some locational regional analysis on the electricity needs for restoration and

reconstruction. And also electricity payments, payment rate also decreased in the eastern side because people are not in the house.

But in the west, it's kept as 100% almost. So there are some strategic elements. And also on the supply side, the generation side, as Oleg said, diversification. But in the context of Ukraine, it's more on not to renewable energy because solar and wind doesn't help much in this situation.

So more on gas generators. But it takes also time to manufacture such equipment. And particularly for large power plants, it's very difficult to restore large power plants in the short term. So some level of decentralization helps.

But in the meanwhile, it's not like off -grid, separated grid, but it's still largely power system is necessary to complement such electricity supply. And also Ukraine is already connected with European power grid.

It started immediately after the start of the war. So Ukraine is now importing electricity with significant amount, which also helps. And also one element is that demand, as Oleg said, is, I mean, overall demand is significantly decreased.

So there is some, yeah, there used to be some generation surplus now. But due to the recent attacks on the hydro power plants and the thermal power plants, the situation is different. The current situation is better in terms of the season.

But for the upcoming winter, it's very difficult. So there is some exercise for the long term planning from the perspective for the long term. And also standardization may be needed and also in line with the European standards because all systems, all facilities are designed in the Soviet design standards.

So it's also important to strategically thinking. We are also helping to, I mean, minister of energy to have such long term planning. Also, yeah, I mean, considering also, of course, clean energy transition as well.

So there is some discussions ongoing, but it's very now the situation is also, I mean, dramatically changing. So the baseline, I mean, the worst case we thought is now base case. So the next winter would be very difficult.

Thank you, Koji Mansoul, I see you want to add.

I cannot respond to this question, but I just have a little bit of curiosity about our Dr. Louisan. Regarding this nuclear power plant you have and you are protecting those from tsunami. After your Fukushima, what happened?

I was always thinking, why we have to have, we know that nuclear power needs a lot of water, but it does not mean that we put that nuclear plant just in the soil within a few hundred meters. Why don't you put in five kilometers away and pump the water from the sea and take up water, I mean, whatever are required.

Why it hasn't done that way? Is there any reason for that putting in the, exactly in the soil?

Thank you very much for the question. So to take out the water from the plant side to the outside of the sea, we need to use a pump. Pump requires electricity. And what Hukshima happened is that they have some small generators.

But because of tsunami, it made it unfunctional. So in any case, we need some facilities that require electricity. And then without that facility, we cannot take out anything. OK, water, et cetera. So that's why we need to protect the area by walls first so that we can do everything with some distance, I mean, maintain electricity and facilities.

What I'm saying is that suppose you are building a new nuclear power plant, why don't you make it in five kilometer inside the land rather than near next to the sea? Is it possible? Is it a good idea?

Few kilometers inside.

Yeah, actually, technically, it's a good idea. But this is not why nuclear power is not only a technical issue, right? Because we need to get acceptance from the people who are living there. So there's no, I mean, basically, we already use the best location for nuclear power across the sea.

So that's why we sometimes need to choose some realistic location.

Thank you.

Thank you very much. You want to add? OK. I think my element.

unique in Japan is the river is not like a big river in Bangladesh maybe Europe and the nuclear pipelines are located inside the land but still near the river the river here is a bit different it's steep and it's not I mean for transportation so and then flooding could be also accelerated inside the river so I think it's a bit a little bit geographical it's constrained in Japan only option should be yeah very close to the coastal area

Thank you very much. Thank you for that additional discussion. I know that is the end of the day and I'm sure we're all tired, maybe already making plans for dinner. So we're going to wrap up the discussion.

If anyone has any other questions for our speakers, I mean we're here to connect and at least I know Koji and Mansoor will be around tomorrow and Thursday. If you have any other questions for them, please connect with them.

So thank you to our speakers. Thank you to all of you for participating. Thank you, Oliak, for connecting online and I think that definitely here we discuss how the case from Ukraine underscores the importance of the power system for the resilience of the communities and the economy and in that way it highlights the importance of better

understanding that risk and identifying the measures to address that risk to the power system and I hope that this session motivates everyone to work with us,

with the World Bank Energy Unit, with the GFDR towards a more systematic risk understanding in the sector and also identifying solutions for investments in the power sector. So thank you very much and I hope you have a nice evening.