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I am quite happy [inaudible]. It shows the diversity of solutions and the diversity of needs and utilizations. Last year on the same panel, I provided the energy industry perspective and I presented the three races shaping the energy payers' strategies in this era of energy transition. I put a focus on profitability and costs, on integration and scale, and on technologies and the race towards commodities to maximize those technologies. However, this year, I would like to take the discussion a bit further by discussing the crucial role of investors, and Tanaka-san alluded to that in his presentation. It is to align the world, which is at 1.5-2°C, with the alignment that we need.

I will address four key questions in this regard, if you do not mind. The first is this. If we assume and agree that consumers are leading the change and have a role in leading this transition by the choices that they are making, governments and technologies are enabling the transition, then somebody has to absorb the risks, and this is where the investors come into play.

The second question is: if we agree that the changes are already happening, and I insist on the fact that the changes have to happen at scale. I will insist on that for the rest of this workshop. If we agree that multiple solutions are required, and Olivier has given us just one of the multiple solutions that have to be part of the energy mix, from an institutional investor's perspective, where should we invest?

I will finish my presentation briefly with what is left for governments to do in this area. Mr. Laurent Fabius and Patrick Pouyanné have already hinted at the fact that we all agree that carbon pricing has to be agreed on, whether we like it or not. However, there is an agreement in that regard. I will finish with what is left for companies to do. The energy industry has been pushed to do more with less, and to go for more vertical integration and capital efficiency. This is where here again, institutional investors are coming into play. This is in that marriage between finance and energy.

Let me start with the first one. When it comes to risks, we can all agree today that the momentum to reinforce national contributions is possibly the highest that we have ever seen. However, it has been highlighted again this morning that it is not sufficient. There are a few issues that I would like to highlight here, from the perspective of an institutional investor and from the perspective of the energy sector. The first issue is that global climate governance is very deeply questioned. I will not delve into the details of why it is being questioned. We are living in an era where we are questioning multilateralism. We are questioning free trade. We are questioning security. We also have a crisis of leadership, but I guess that is a discussion for a different session than this one.

However, the point is that even in October 2018, when the IPCC report was issued, even though it was alarming enough, it did not accelerate the changes that are required. That is probably the change this year. There is a growing realization across the board of the complexity of the task. There is a growing realization of the wide interests and needs of the different stakeholders involved. These go from consumers to taxpayers, citizens, vulnerable populations, and the industrials, the energy producers and consumers.

From where I sit, there is a growing realization that the existing energy system that we have today has seen costs that cannot simply be written off. I would like to remind you that we probably took a large part of the 20th century to build it. The energy system that we have today has seen costs in it that we cannot write off, and from the investor's perspective, that is a key part.

However, do not get me wrong. Changes are already happening, in leading companies and energy companies, cities, mayors, populations and economic sectors. I work a lot with the maritime industries and they have been taking concrete actions to either decrease their emissions or fully decarbonize. As you all know, shareholders, insurance



companies, and institutional investors have been raising the pressure to align the corporate strategies with the climate reality. That is something that we have to deal with.

One of my favorite graphics from the BP's energy outlook shows how long it takes for energy transitions to occur. Our mutual friend Spencer Dale likes to remind us that renewable energy may reach 10% of world energy demand by 2035. This is less than 30 years from the point when it provided 1% of world energy. If that is the case, if we just extrapolate that trend, it means that the renewable energy would have penetrated the energy system more quickly than any other fuel in history.

Even then, even with that 10%, if you reach that 10% of renewable energy, you still have 90% to cover. 90% of the world energy needs will need to come from other fuels. My personal take from this information is slightly different, particularly if I isolate the two fastest-growing technologies, renewable energy and nuclear. The conclusion that I take from it – it is a very quick conclusion that I am sure Cosmin will probably challenge – is that impactful change occurs first within these two particular examples when the debate has been depoliticized, aka nuclear. There must be a combination of intensive R&D, government incentives and also enabling market mechanisms and, I am insisting on this one, free trade. Only free trade enabled solar panels to move from one continent to the other and to reach the decreasing cost that we have witnessed in the last decade.

The same dynamic is happening in other areas, at a slower pace I must say, and it is happening in this order. It is number one in energy batteries and storage, and we discussed it extensively last year. Second, it is happening in the area of mobility and third, it is happening in process and heavy industries, which Tanaka-san started hinting at in his presentation. Here again, from an investor perspective, this lack of visibility on the sequencing is probably the first missing link that we have in our climate change governance toolbox.

We need targeted instruments with optimal risk/return ratios for the various emitting sectors with various utilizations, to accelerate this transition. The governments can guide energy mix and ensuing investments through their toolkit of various policy mechanisms. However, only institutional investors can help absorb the market risks, but also the technology risk that I am talking about here.

So, if we all agree that change is already happening, at scale, I repeat that, multiple solutions are required. From an investor perspective, where should we invest? Vaclav Smil reminds us that after we dramatically increased our energy and power-density needs, we now want to find solutions to totally reverse those past trends. There is a simple way to say this, for those of us here who are not energy geeks like us, to address energy emissions in the different utilizations: different technologies will be required.

You will need solar PV, but you will also need CSB. You will need solar PV, but you need some storage with it. You will need massive energy efficiency programs and heat recovery in the industrial sector. You will need nuclear, and the reason why I am pointing at nuclear is that you have the wider electrification that we want in the economy, and that is beyond EVs. I am talking about end-edge computing, Internet of Things, artificial intelligence, smart homes etc. At the end of the day, that puts additional pressure on the utilities to decarbonize first and to decarbonize faster.

Nuclear energy provided 4% of global energy in 2018. That is 2,700 terawatt hours. It has not grown since 2002. Cosmin, I would be more interested to hear your thoughts on where we stand in research on fusion and fission. Is it going to solve our problems on the utilities side? In terms of technologies, there are a few counter-intuitive trends that I want to highlight here. These have been driving investments for more than a decade now. When I say counter-intuitive, it is for anyone who believes today that all the investors are deserting fossil fuels altogether.

The first counter-intuitive trend is that we still have massive efforts and massive investments to recover more hydrocarbons in terms of production. We are trying as much as possible to optimize the efficient use of hydrocarbons produced, and a lot of money is going into that. A lot of money is going in, especially when we try to increase the focus on low-cost fuels but also low-carbon fuels. The reason for that is very simple. Today, you have less than 20% of hydrocarbon molecules extracted from the earth. That is oil, gas and coal, but less than 20% of that turns into useful end use, energy, plastics etc. It is only 20%. The rest is wasted.



Today, the industry has realized that, and there are tremendous efforts happening to restructure the business models and reward optimization and efficient use of fuels, instead of rewarding the volumes of hydrocarbons produced. There are efforts of vertical integration, at scale, into refining, into petrochemicals, by several large players. That is one example of these efforts. I will cite one last extreme example of the crude-chemicals scheme that is being looked at in Saudi Arabia. The aim is to reach 70% conversion rate from crude to plastics.

The second interesting dynamic is happening in mobility, and here I will get into the internal combustion engine. Here again, there are massive R&D efforts and investments happening in the area of ultra-low emission fuels and engine technologies. With that, you can assume that the internal combustion engine can still enjoy a few years of monopoly in the transportation sector. In parallel, there is a drive among cities and among politicians to ensure that transport prices are better reflecting externalities, internal costs and other things. It is to have a view of the real cost of transportation, the real cost of urban and road transportation.

With the development of all those technologies and solutions that we see in Europe and the US etc. including smart charging schemes, ride hailing and bike sharing, there are increasing calls, especially among cities, for the right pricing framework, a fair pricing framework for the use of public space by these charging stations, for the utilization of commodities and the scarcity of resources that go into those technologies. When you run the numbers, at the end of the day, you find liquid fuels might actually be the winners, from these approaches of saying, 'Let us all cost in everything.' I am just saying.

The third point is in addition to solar and wind and storage in its different forms. We discussed this extensively last year, but here again, I want to highlight it in a context of continuously decreasing costs, in storage as well. There are uncertainties about which technologies will win, beyond lithium ions and redox flow batteries. There are concerns about the commodities that are being mined in tricky places in Africa, needed for specific storage technologies. Even when regulators show enough creativity to reward flexibility, investors remain concerned. They remain very concerned. They remain very concerned and wary of rigorous costs in those technologies.

I have a couple of points to conclude. What is left for governments to do? That came today in the discussion between Patrick Pouyanné and Laurent Fabius. At APICORP, we organized a recent strategic industry roundtable, where we brought people from the energy sector and the financial community together in a single room under Chatham House rules. They addressed the question of what instruments are needed to accelerate this energy transition. These two communities do not talk to each other most of the time, so that is why we thought it would be interesting to bring them together.

The very first recommendation that came up was the need to formalize a price on carbon, any price, but just formalize a price for carbon. That was considered as the single most effective mechanism to really enable a level playing field between the different technologies and the consumers' choices. The problem is in the absence of carbon trading mechanisms, and I am thinking outside of Europe and some other places; what is being proposed for example in the American Green New Deal, when we started estimating the social cost of carbons, it ended up producing ridiculously wide ranges. When we leave it to the economists, we end up having very complex calculations when it comes to carbon prices, even if carbon taxes should in theory be an easy form of carbon pricing.

I agree that the calculation is complex. I agree that non-marginal changes related to climate change have to be factored in. I agree that tax has to be revenue neutral, but the first steps are required. You hear that from both communities alike, and from the governments as well. What is left for companies to do? I will finish with that. I have summarized the dilemma facing the energy sector. I have indicated that the energy sector is one of the sectors that provided the lowest returns to shareholders during the last few decades, just among the S&P 500.

It is a fraction of what IT and real estate have provided. The energy sector is really competing with other sectors that are deemed much more attractive for investors in terms of returns. The problem is that the gap is really wide. Energy provides less than 10% of returns, while IT or consumers have provided more than 300% over a decade. The other problem is that in terms of valuation, some parts of the energy sector seem undervalued. I am mainly talking about the upstream side of it, but there is always that persistent fear of stranded assets, because we do not have that clarity on the climate change trajectory.



In parallel, returns are also being squeezed in the different parts of the value chain. I took the example of the gas sector, but the same is true across the board. If they want to survive through the energy transitions and continue to provide an attractive value proposition for the investors, energy companies have no other choice than to embark on vertical integration at scale. That is not only vertical integration as in the past, to stabilize the earnings by benefiting from the country's cyclical profits in upstream and downstream. That is also to maximize the margins across the value chain.

On top of that, there are the national oil companies in particular, with the 80% reduction that Patrick Pouyanné was referring to earlier today; they are directed and they are instructed to extract additional value from the sovereign and finite oil and gas resources. For corporate strategies, a low carbon-world is translating into more integration, more scale and more optimization. Then I would just like to remind everyone that the journey of integration is a marriage between two different business models, two different operating cultures, returns expectations and time horizons. The reason why I am saying that is that after the integration of different segments of the value chain, the next step is to seek growth by optimizing the balance sheets even further. That is the pressure that we are experiencing also in terms of financing the energy sectors. In some areas, US shale benefited, as you all know, partly from long-term commitments from private equities.

If you start considering oil and gas resources as just any other investment asset class, the same could happen at a larger scale between large oil and energy companies and investment funds. What type of industry structure will we get in that drive for a low-carbon world? After all, within the infrastructure sector, the energy sector remains the preferred industry for institutional investors. I will finish with that.

Nobuo TANAKA

Thank you very much, Leila. I cannot agree more that governments should use carbon prices or carbon tax to give a clear message to the business sector. Unfortunately, the discussion over the decades did not lead us to any official carbon price or carbon tax. That is a problem. It is definitely the best way to reduce carbon, but unfortunately, it did not happen. In a way, for the green financing as you say, one of the criteria for investors is, do corporations have internal carbon pricing regarding decisions for investment?

That is happening. Regarding the TCFD, the Taskforce for Climate Financial Risk Disclosure, an internal carbon pricing is one of the things they request. Many major oil companies like Total, BP and Shell are the signatories to the TCFD and are doing it. Is the internal carbon pricing ambitious enough? That is the question, but figures of USD 40, 50 and 60 have been set. There was an interesting discussion in the ICEF in Japan. Last year, at exactly the same time, at the ICEF meeting, I raised the issue of internal carbon pricing by saying there are only one or two Japanese companies who had internal carbon prices at that time.

Now, the CDP representatives told me in the public discussion that there are 70 companies in Japan which now have internal carbon prices. This is the huge difference, because as I said, 200 Japanese corporations are now signatories to TCFD. This means they should have a kind of energy scenario for the future and a sustainability scenario. This definitely contains or includes the carbon pricing. Eventually, this kind of pressure from the financial sector, requesting disclosure, will lead the corporations to what is desirable in terms of the carbon pricing. That is my observation. Do you think so?

Leila BENALI

Yeah, I fully agree. In all the models that I have seen in various energy companies, international and national, you have three main frameworks. You always have a cell with carbon pricing on it. Whether you fill it in or not is another question, but conceptually, you usually have two main methodologies. You may just follow blindly what you have in the ETS, thanks to Europe, which provided a sort of framework for a carbon price. That can be used in other areas of the world conceptually, or as you mentioned, you can just decide to have a flat price. This is what you think is an assumption for future pricing.



That is the reason why, at the end of the day, we end up having that focus that I mentioned, not only on low-cost fuels and hydrocarbons, but also low-carbon crudes and hydrocarbons. That is not an idea that just came up yesterday. The major oil and gas producers have been working on that for the last decade or so. However, at the end of the day, people like to think of the idea of carbon and other fuels as a stock as well. That is a stock and you just need to put a price on it. When you decide to deplete that stock today or in 30 years' time, that is an assumption that you have to make. I totally agree that most energy companies today have a carbon price assumption.

Nobuo TANAKA

Thank you very much, Leila. I have one additional question for you. What do you think about this climate change and gender? I cannot stop asking this question.

Leila BENALI

Last year, it was, 'what do you think about climate change in Saudi Arabia' This year, it is, 'what do you think about climate change and gender' Not much. I do not feel like an expert in the area, to be honest with you. I will leave it to my male colleagues to comment on it.