

TERI KAS Energy Dialogue – Diginar I & II

Climate change and sustainable development in India's energy security agenda

18th & 19th November 2020

Diginar I & II



2020

Diginars I & II - Climate change and sustainable development in India's energy security agenda

18th & 19th November 2020 – DAY 1

This is the first set of diginars I & II of TERI-KAS virtual Energy series. The Energy and Resources Institute (TERI) in partnership with Konrad Adenauer Stiftung (KAS India Office) are organizing these diginars. This particular diginar is focused on climate change and sustainable development in India's energy security agenda as well as looking at the larger resource specific issues in each of the sub-sectors within the larger energy sector including coal, nuclear, natural gas, oil and gas etc. These diginars will be followed by the next set of diginars in January 2021 and also many of the presenters are also contributing papers to an edited volume which is going to be developed after completion of this virtual series and the national conference in March/April 2021.

Opening and Welcome Remarks

Mr. Pankaj Madan, *Deputy Head, India Office, Konrad Adenauer Stiftung*



Mr. Madan welcomed all speakers and participants to the first set of diginars in the TERI-KAS Energy Dialogue series. Talking about the TERI KAS cooperation, he highlighted that after the 9/11 attacks in New York Trade Towers, KAS was assigned some special funds by the headquarter to deal with security issues and during that time environment security was brought ahead as a topic and ahead of its time into the strategic arena.

That's when KAS and TERI joined hands. We started with the environment security aspect and quickly sailed into energy dialogue. There were five energy dialogue that were conducted by us. Those dialogues received significant interest as they were addressing a critical issue. The current dialogues are examining contemporary issues in energy security and have resumed very renewed importance. The importance have increased and the need for action in this has also increased.

Mr. RR Rashmi, *Programme Director and Distinguished Fellow, Integrated Policy Analysis Division, The Energy and Resources Institute (TERI)*



Energy security the way it has been looked at, it has been a traditional security concern. Climate and energy security both are equally important in a modern world in which we live today especially when we merge or marry these dominant concern of our time, it is critical to analyse how they play out in terms of developmental challenges and meeting the environmental goals. The question is 2040 and beyond, in this time frame how does the energy scenario play out is essential. Is it going to be consistent with our environmental goals or it is going to be different particularly in the growing country like India? Now we have at least a 2030 time frame available with us laid down by the policy makers in our country. We have NDC which says that by 2030 we do at least three things. We will ensure that 40% of our energy generation capacity comes from Renewables, we have also talked about forest carbon stock and the emission intensity of our GDP. Leaving aside the emission intensity of GDP and forest carbon stock, the question which will have immediate impact on our energy security is that of the renewables as a proportion of total energy generation capacity and demand. We have made substantial progress in this field no doubt in the last ten years. We have been able to bring down the cost of generation of variable renewable energy but that is the first order of economic challenge. There is the second order of economic challenge as well. We have to ensure that the upfront investment keep continuous in the same rate as it has happened in the past and the investment which had already taken place in the existing technology like that of coal or oil and gas, those investment do not go completely waste. There are serious economic issues stranded asset in these sectors. So while we have an optimism in the renewable energy sector, in fact one of the TERI study does show that we can even go up to 47% in high reliability scenario in terms of integration of renewable energy into the overall energy system compare to 40% which government has committed. But despite this optimism there are issues with the stranded assets so we have to make sure that the future investments do not get locked up and what are the policy changes which will ensure that it happens. The kind of signals that we are getting are, some people might get concern, for example you must have seen that the government has come up with the target of raising its coal production up to 1 billion tonnes by end of 2020 whereas the coal production was around 550 million tonnes 2015-2016. There is clearly a goal of doubling the coal production there also, while old coal plants are been shut down and new and more stringent thermal emission norms are in place there is clearly a need for balancing the grid. For balancing the gird you need to have stable grid system which depends on hydro power perhaps also coal power, so there are challenges here. At the same time you have bigger challenge in supplying energy to the transport sector. In fact there are three challenges one is that of supplying energy to the transport sector, supplying energy to the industry sector where you cannot replace coal for example in steel or in cement or in metal industry and thirdly you have the challenge of ensuring universal access of energy to everyone. That will again depend in large measure on supplying LPG, oil or depending on electricity which comes from coal or some sources until you are able to establish dependable system or integrate the renewable to the larger extent.

So there are different kinds of challenges. Despite these challenges the future doesn't look as worrisome as it was five years ago. I think the future is bright because of the kind of energy transition that we have made in the past and if we are able to ensure the required policy prescriptions, I think the momentum which we have picked up in terms of greater integration of renewable energy into the grid will keep going and it will ensure that we are able to meet not only our climate change goals but also the goals of universal

access. The things which will be required for this are – 1. We ensure that the policy of just transition are in place and we invest new technology like hydrogen, in fact TERI study do show that by 2040 the hydrogen costs may sufficiently come down to be integrated to the energy system, not only into the industry but also to the transport sector, long distance trucking as well as other areas where it can supplement the renewable energy. So both kinds of actions will be required and the future is certainly brighter one ever. On this optimistic note I conclude and hand over to Swati.

Presentation of Discussion Paper by TERI

Shailly Kedia, *Fellow, Centre for Resource Efficiency and Governance, The Energy and Resources Institute (TERI)*



It is a framing presentation and it will aim to give an overarching picture of the energy situation in India specifically from the domestic lens for these two webinar series and the next one will focus more on international cooperation issues. When we talk about energy, economic growth and development for India the Energy consumption per capita is 1/10th of the OECD countries and 1/4th of the world average. There is ample amount of literature which shows that even a small incremental rise in per capita energy use or consumption can lead to relatively larger increments in human development. There is enough empirical evidence that shows that increase in energy consumptions leads to many multiplier effects leading to higher energy development. There is also like the Growth or feedback hypothesis which is like more energy consumptions lead to higher economic growth and higher economic growth in turn leads to higher energy consumption again this has been tested empirically across the countries but however if you look at economic growth not in terms of conventional monetary measures of GDP but rather as the sustainable or Green GDP then one can argue that actually the GDP is decreasing specially one considers the economic costs related to energy resources or the raw material.

In primary energy supply coal is the highest share if you can see the top right hand side table coal 62 % followed by crude oil which is 31%, natural gas 6.5% and actually RE & others are negligible when we consider primary energy not power. Of course when we cover power we have almost 1/4th of our installed power generation capacity to be renewables, so the picture there changes. Then Ministry of Statistics and Programme Implementation (MoSPI) of Govt. of India has develop a very comprehensive framework which it regularly and annually reports on energy which covers both the energy use and productivity as well as the security aspect in terms of import dependency for example.

India is very dependent on Imports, whether it is crude oil, whether it natural gas, coal and to some extent very negligible amount electricity. So even though we have a very well framed information and knowledge that is produced for policy consumption what one can say that what really informs sustainability or the environmental aspect of domestic energy policy in India is more related to power.

Again when one talks about electricity while we see household in India are seen to be electrified but then again the key question pertains to the reliability of power and power infrastructure itself When we look

at the energy demand in India, if we were to look at the trends there has been the growing share of energy consumption in industry sector on the demand side as well as the transport sector. Transport sector is going to increase in the coming year. Also the percentage share of solid biomass in the total energy consumption has gone down over the years in terms of percentage share only but not in terms of absolute value rather it has slightly increased as per the IEA statistics and even according to MoSPI 61% of our households had access to clean cooking fuels in terms of LPG connection...

Then according to national sample survey, TERI analysis 67% of rural households still rely on firewood and chip as a cooking fuel. So the high reliability on biomass still continues especially in rural area. So this broadly like the overall situation and I will hand over the slide to Swati from now onwards.

Swati Ganeshan, Fellow and Area Convener, Centre for Resource Efficiency and Governance, The Energy and Resources Institute (TERI)



While India has actually been able to provide energy access to a huge population, there is still 13% population does not have access to off grid electricity or do not have connection. Largely due to last mile connectivity concerns which has not been addressed as yet. The other part is also the affordability of it, what it adds on monthly basis to individual/ family expenses has been one determinants for many people not to go and access as well. Also quite lot of percentage of population living in high remote areas require off-grid solutions to be deployed. Burden Discoms, as we know that we do have high payables at the end of Discoms so has to get through this year as well. A bail out which was proposed around may June for DISCOMs due to the lockdown will still does not cover need of the population.

According to TERI's own study post pandemic, at least next few years there would be reduced power demand to 10% and can go up to 15% in certain scenarios. So yes the demand for power will actually come down for the next few years and also we do have regulatory challenges which we have not just in whole but we have been within context oil gas and other sectors as well.

From the SDGs and climate change point of view India has been on road and quite on track in reducing its emission intensity. This has been acknowledged not only by our own documents but also by other by including climate transparency brown to green reports which looks at G20 countries. We are on target as well. The 2019 SDG report by NITI Aayog also has been quite promising in terms of overall progress and specifically in context to affordable and clean energy Goal 7 we have done quite extremely as well. The two goals which are highly linked to clean energy and affordable energy which is SDG 7 are Goal 2 and Goal 5. WE have done much better in agriculture and many other areas but here is there is huge amount of improvement for the country and we are scoring quite below and I think tomorrow when we discuss the linkages between the different goals and how energy plays a significant role in them, I think this is where we probably be able to build and discuss those linkages in an in depth way. From this context you will see, it is very interesting is that SDGs are been adopted nationwide, international but at the end of day it is more at the state and local level that it needs to be implemented and how will that SDG goals will be implemented and how would it be taken forward specifically at the state level and even including energy as a key sector is something that would be very interesting to see in the coming years as we try

and achieve 2030 agenda and with the pandemic right now what we the challenges is going to be big question mark as well.

Shailly Kedia: So as you can see if you were to look at the feedback hypothesis between energy and economic growth, it is applicable when we consider the conventional measures of wealth or GDP or economic growth. However if you were to look at the green GDP or inclusive wealth in the GDP doesn't increase then also the SDG interpretation is evolving if one were to look at even the global SDGs framework there is emphasis on few indicators which also need to further evolve along with the concept of wealth which not many countries yet adopted. Then the discourse on sustainable development in climate change in India is very much driven by the diversifying the fuel share in electricity mix and not the diversification in primary energy mix. So for example LPG is certainly an important policy issue against scheme such as Ujwala Yojana however they don't really seek to inform the sustainable development and climate change aspect of energy policy rather they inform more like the development and political discussion around it and this is very evident if one were even examine the parliament discussions on sustainability and energy in India. Again like the solid biofuel consumption on the demand side does continue to remain one key issue where in the consumption of solid biomass in the sense is actually even greater than coal if one were to look at in the volume sense. So certainly there has to be much greater focus on biomass related aspects in India which is currently not receiving the adequate attention and certainly technological changes and innovations have to considered in the purview of energy security even when one were to look at the fuels like nuclear which can even have smaller modular technologies or even renewable energy.

Session I - Conventional to Alternatives – Examining India's Fuel future

CHAIR: Nitya Nanda, Director, Council for Social Development



There was time when coal was unconventional and coal was something that fueled first industrial revolution. And then it was oil that became the flavor of the day and it also bought lot many geopolitical changes and we see probably now we are going into a very different direction and what we consider unconventional now will determine probably the geopolitics of the future years. But one thing is important when we had energy transitions in the past they were almost autonomous. They were not so much of a policy driver. The transitions were technology driven and or resource based with one of them proving better, going ahead with it. Now things have changed. We are not talking about what is good for the economy, what is good for the cost consideration, what is good for quality of life, but now we are talking about the sustainability of the nature, of the environment. Obviously the earlier transition and the current transition that were seen or proposing or trying to push forward is very different and that is where we have to focus our energy on.

SPEAKER: R. B Grover, Member of AEC and former Vice-Chancellor of Homi Bhabha National Institute



To begin with the Status of nuclear technology in India is based on robust research and development framework which has been established along with industrial capacity that has been established in pursuit of a closed fuel cycle. India has a desire to utilize thorium and pursued a closed fuel cycle. We are developing technology in that direction and have established complete chain of activities in India uranium exploration, mining, milling fuel fabrication, heavy water production, designing and setting up of nuclear power reactors sent fuel reprocessing important for pursuit of a closed fuel cycle the partitioning and vitrification of high level waste which ensures that waste is not a problem as it incase of open fuel cycle. We have a strong industrial base for manufacturing equipment and component for pressurised heavy water reactors (PHWRs) which are the mainstay of nuclear power programme in India as on today.

We have 220 MW reactor, 540 MW PHWRs and the first 700 MW PHWR achieved first criticality in the month of July 2020 and we expect that it will be connect to the grid in two to three weeks. Three more reactors of 700 MW are under advance stage of completion and 12 more approved for construction. All these PHWRs are fully indigenious. Our industry is fully capable of making of all the components and equipment.

Again another technology we are pursuing is that of fast breeder reactor 500MW. Prototype fast breeder reactor (PFBR) is under commissioning in Kalpakam which is few Kilometers south of city of Chennai and technology for future is also under development. There was the issue of availability of Uranium in the country which was coming in the way of expanding the pressurized heavy water reactor installed capacity that has been addressed by intensifying exploration of uranium in the country as well as by taking diplomatic initiative to enable import uranium from international market and this happened in 2008.

Role of nuclear in future electricity mix- Electricity already said earlier is an essential requirement for the society today and if we see in terms of total final energy consumption the share of electricity is continuously increasing and is projected to go as high as 27.2% in 2050 which if you look in terms of primary energy use will be almost 50% and in India the strong upward trends in the requirement of electricity space conditioning, appliance use, cold storage capacity and so on and already pointed out by earlier speaker there is issue of electricity supply for rural area and load shedding in urban areas and captive diesel sets in demand. While India has made good progress in improving energy efficiency, one has to account for rebound effect as well and as earlier speaker was trying to give data from MoSPI, the total generation in 2019-20 was about 1600 billion KW per hour and CAGR during 2009-10 to 2018-19 was 5.49%. And if we look at relationship of HDI with per capita annual electricity consumption and Uranium issue has been addressed.

Basically nuclear has a lot of role to play in the electricity mix and we see the relationship between per capita electricity consumption and HDI we know that we have and HDI of 0.9 we need something like 5000 KW per hour in the country. 5000 KW/hr/annum/per capita in India then only we can get 0.9 or so and this 5000 target is very modest target and if see countries around India, country like Malaysia are already close to it and if we have to have 5000 KW-hr per capita in India assuming a population of 1.6 billion which is the latest estimate that where India's population will peak in 2048 and transmission and distribution

losses at say about 7%, so what we need in this country is something like 8700 billion KW-hr per annum and if we look at the total generation you can get from solar, wind and hydro it will be not possible to go anywhere near 8700 at the best they can give us a quarter of that number. Rest has to come from coal and nuclear. Nuclear has to slowly increase and coal has to slowly defer to provide that kind of electricity.

So in all the future electricity mix we have to keep this issues in mind that nuclear has to provide a significant share of electricity and various issues which have to examine evolving future electricity mix are – Number one is Determination of tariff – if we see currently for determination of tariff for comparison, the matrix which is used is leveled cost of electricity generation and this particular matrix does not have any parameter to look at intermittency aspects. When earlier this parameter was used all the resources were despatchable, available 24X7 so absence of this parameter was immaterial and when now we are trying to integrate solar and wind which are intermittent sources to the bridge. Continue use of LCO as a parameter is obsolete. Well this parameter is so embedded in the practices that any change will be torturous for the planners and change will be slow to come by but one has to go by system wide analysis in place of LCO. The system wide analysis can identify benefits of new capacity, cost to existing generator because of having integrated new capacity. We have seen the way coal plants are working in low capacity factors in recent years that is only because system wide analysis is not been done in our country.

Grid level cost is the one which has become important and the cost of grid extension is significant in case of intermittent sources, cost of width balancing is also significant and those issues are to be really looked into and one has to also examine can we operate renewable energy sources in full flexibility mode which can provide many benefits. Coming to another parameter is external cost of one is health externalities which has been extensively studied and studies done in European Union which estimates that external costs are low for solar, wind and nuclear, very high for coal and again the study which was done in India also where included in the economic survey of 2017 were estimated that the cost of integrated renewables is very high in the grid. There was a strong backlash to that particular statement but the fact remains fact. So in these areas nuclear has certain advantages but it is one particular aspect which has never been discussed in India much that is the energy returned on energy invested (EROI). The new sources which are been integrated now they have very low return on energy invested. Those sources which have very high EROI is important for the society as the society has to have enough flexibility to operate. One study from Princeton university, estimated the dynamic value of EROI very high for coal 38, nuclear 62, large hydro 57 and wind 39. Its value is low for solar photovoltaic that is about only 6 and here one can think of EROI in terms of individual scores or in terms of grid as whole. This is something where work is going on, but various structures are given figures like 10, 11, 15 as a grid as whole EROI should be as high as that and this something which may not be possible if we have predominantly low EROI sources in the grid.

For future energy mix we have to evolve it in such a manner that we have energy security, we have high EROI and that will call for that we integrate various sources together. Certain sources while they have low EROI, they can have other positive externality and they have to be adopted. Here the approach has to be embraced on all technology options something which was first advocated by Sokolo and Pakala and targets for individual generating options should not be set in silo based approach. Complete system wide analysis is needed to set the targets by various derivative based options. System wide analysis is also

needed to know the level of subsidies and where they are going. Currently this new system wide analysis that is been done, one doesn't know where exactly the subsidies are going. Nuclear has to be a part of the mix on a rising basis and coal on a tapering basis to ensure that we are able to maintain EROI in energy mix. In case of nuclear, technologically we have managed all challenges but locating sites for setting up of nuclear power plants remains a challenge and that requires addressing issues of perception. Perception in the case of nuclear revolves around two narratives. Many nations do not want nuclear energy as it would proliferate nuclear weapon technology and to convey their point of view to public they combine it with the issue of nuclear safety. Nuclear proliferation is not an issue for India as India strictly follows export controls. Safety argument revolves around nuclear waste management and nuclear accidents. India follows a closed fuel cycle to address the issue of waste management. If you want to minimize the waste which arises from a nuclear power plant per kilo watt hour of electricity generated where closed fuel cycle is way to follow rather we have made further innovation in this by use of portioning and plasma fusion technologies. Advance technologies are under development to minimize accident and to prevent release of radioactivity in case of any accident.

The second narrative revolves around cost of electricity. Generator costs is different from the consumer cost. The cost of intermittency also has to be borne by the consumer and this has to be accounted for when we compare different technology options. And addressing all these issues, particularly issue of perception regarding safety requires deep engagement with civil society and making available evidence based explanations to balance various narratives and this is something nuclear establishment in India has to do. Sustainability has become key words since 1970s, 1980s however the concept of sustainability has been used or misused for greenwashing and rhetorical purposes and it is used in dichotomous mode. When used in a binary mode it does not stimulate a proactive ethical reflection regarding development of technologies. The Binary view of potential sustainable feature of a technology is likely lead to case to be dismissive or endorsing a technology. I here want to emphasize that we have to embrace all technologies then only we can have security of supply, resilience against severe events and stability of the grid that can be provided by embracing all technologies and nuclear has to be the essential part of the mix and nuclear capacity has to be ramped up fast which supply chain also already been indigenized. Research and development needs has been established and we have capacity for required manpower playing. Thank you

Nitya Nanda: The tariff regime needs to take intermittency of power in consideration but we have been discussing about that for long time and discussions are ongoing that solar roof should be considered. The way we are moving it seems that market will be given more importance and if policy of tariff is important, market is more important certainly intermittence aspect needs to be taken up by the market. Of course the other energy sources which are regular they will get premium in the market. It would be difficult for only renewable power meet our energy needs and the consumption is low and has to go up and at the same the our energy transitions has to be much more cleaner so in that context replacing coal with nuclear can probably be one of the solution.

SPEAKER: *Shebonti Ray Dadwal, Former Senior Fellow, MP-IDSA*



This is about a sustainable dialogue what energy resource can sustainably harness to resolve India's energy issues. So the good news is that India is on course to cut its emission and bad news is that due to the pandemic the reduction in emission is because of reduction in demand and the reduction in demand is because of reduction in demand from Industry especially from key state like Maharashtra and Gujarat. The challenge therefore the government really faces is to sustain emission cuts without effecting energy consumption and in India's case the challenge is many fold and as post Covid we can anticipate demand to increased and so where would this kind of energy going to come from?. The government took forces to focus on lot of renewable energy because it is sustainable form of non-emitting energy resource but the intermittency is an issue unless of course storage is bought into the mix and that raises its own issues, so what are the other alternative.

Let's reiterate that fact that this is more like a rich fuel because of its flexibility and use in across sectors whether it is power, whether it is industry, whether it is transport. It has large supply sources and in the power sector it can provide the base load factor that RE without storage cannot really provide. Now the sustainable factor, it is of course less carbon emitting than coal and oil in the power and in the transport sector. The fact is it is still a fossil fuel and it does that is really problem that natural gas has but every energy resource as we know gain its efficacy because of the policy push that the government gives and right now the government has decided it is going to giving making or doubling natural gas in our economy. So gas based economy is going to stay. There are of course challenges. Let's talk about the energy security part of it the supply part of it. From 2003 onward we have seen the gas imports have been growing, today we are importing more gas and producing indigenously. So, on the other hand our production is decreasing. It is not so much because of the use of gas is growing but because our production is decreasing. In the pricing factor gas cannot compete with RE mainly because of the policy push that RE has got in terms of subsidies, pricing subsidies and of course coal and the infrastructure for gas delivery especially is still very inadequate. So what really needs to be done to make gas much more popular amongst the users. The first problem we have to address is the supply factor, so reforms. Pricing is very important, every business I think has to be economically viable therefore in the case of gas right now is viable because global prices have come. Because of the global pricing have come down because of the strange pricing mechanism that is prevalent in India right now, four types of gas, that is average price taken four kind of international gas the price. Domestically produced gas is far more than what we are importing but because of the priority sectors, everybody want to use domestic gas now because of administer price (Administered Pricing Mechanism (APM) that is put on this while the users are very happy basically fertiliser sector and industrial sector and the city gas sector but the producers are not able to sustain the economy scale because the prices are too low the production costs are higher than the price which has been sold. So pricing issue is the crux of whether gas going is to be picking up in term of its market share.

Then we have the delivery issue, the government has done a lot in the accessibility of the gas through pipeline system. It is been augmented and it is been further augmented. In terms of actual supply fiver energy terminals are already activated and will be having eleven more terminals. So we are anticipating much more import. The connection to the city grid, the natural gas grid is inadequate right now. If it has

to be pushed further it has be augmented much more swiftly. So the point is can in the future given the emission level of sustainability in terms of climate change can natural gas reach --- energy. In the short term I say it is a rich fuel. In the short term the primary importance of gas will switch from coal power to less emitting gas power based power and in the transport sector of course oil can be substituted by gas fuel constituted by gas in terms of CNG from LNG. In the medium term while development and deployment of gas based energy can facilitate RE integration back into the system like hybrid systems in EVs and also in the power system and in the long term you can look at hydrogen. Everybody is talking about specially Europe and lot of Asian countries. Right now hydrogen is produced through the use of gas and coal CCS technology. So in the long term that is where we look at using gas perhaps in the success of renewable energy system is about the policy support that is given. We could undertake swift deployment of RE (Renewable Energy)in India, It would not happened without the policy. Now government has declared that we are going to have gas based economy, gas having 15 percent share. So we have to invest in gas infrastructure and that is critical. The reforms has to be sustain and have to be imposed in a very committed manner. Finally and this is relevant for all kind of energy, for a country like India where we are staring at huge energy demand for energy and power, technology has to provide the solutions to energy problems and challenges and industry part is also required for innovation, development and deployment of new technology and also to commercialize it to make it economical viable.

Nitya Nanda: You brought up natural gas which is very important also a kind of intermediate energy base load and also it has distinct advantage over coal whether it is cleaner but it is much more fixable compare to coal, switch on and switch off. Another dimension that you have brought is that nuclear can only for electricity, gas is for transport fuel. The point you made is very pertinent that policy making has not been favorable to push for gas and also the latter one, government is putting up appropriate infrastructure specially for decentralized use and innovation, commercialization.

SPEAKER: D K Tuli, DBT-IOC Chair on Bioenergy



As you know transport sector is showing a very large increase in this Covid situation and transport fuels are responsible for the 24 percent of the total emissions which come out. One thing is clear we can meet our NDC emission intensity but the transport sector has to be looked into two different aspects. One is the emissions which it gives and the second is the energy security. Most of the transport, almost all of the transport sector are on fossil fuel and there has been talks of adding some amount of biofuels into the transport fuels so much so that India first made its biofuel policy in 2009 and in 2008 the national biofuel policy said that we replace 20 percent of petrol gasoline and 20 percent of diesel in next ten years but we all know that our performance has been extremely poor in this sector, so we need to find out why it was. And now in 2018 a new biofuel policy came up where they have limited that it could be twenty percent in gasoline but only five to ten percent in diesel, so much more attainable.

For petrol we have asked for ethanol as an addition and one thing is definitely sure that even in next twenty years the amount of fossil fuel in transport sector will remain predominant. This is what IEA is saying and BP analysis and internal analysis also says. How we can be make mission compliant by adding

some amount of biofuels into this. Now ethanol in our country has been derived only from molasses because food grains were not allowed just like there have been using corn and in Brazil they have been doing by sugarcane. So the molasses were limited we don't have much of alcohol. If we make a policy of having 20 percent gasoline, we can't actually have because we don't have so much of molasses. A new biofuel policy of 2018, stated that even when the sugar production is very high and we have to export sugar at subsidy then those sugarcane juices can be directly, converted to ethanol and last year 5.6 percent addition of ethanol into gasoline. After all we will not have very high surplus of sugar, so how do we go about this. So biomass is one thing. People talk about biomass coagulant this is called "Cellulosic ethanol". This government in last five years has done tremendous work of supporting this technology. You collect biomass mostly retro-aldol and Cotton stalk into this and with the technology convert that into ethanol. Now government as a first step has planned twelve large plants. Large plants in the sense, 100 Kilo litre of ethanol per day in each plant so that we get the cellulosic ethanol. As the new technology there are issues as well such as where is the biomass supply chain, how do we collect it, how do we store it, how do we transport it, what is the pricing structure of it. So all these things are being looked into it very minutely and hopefully some of the plants will come in next two three years.

The other big thing which is happening in transport sector is gas. I am talking about the compressed biogas that is CBG. Government has issued an instruction for five thousand large CBG, even an EoI have been issued. Large number of people have applied and instructed the oil companies that they will buy as much gas as is produced in the country. So about 40-45 billion metric ton of biomass will be converted to biogas and it is estimated that in another five year times we will have sixteen million MT of biogas which comes into the system. The third big thing which people have been taking about is hydrogen. Hydrogen presently is been made from natural gas by reforming so that is not the clean hydrogen if we have because each molecule of hydrogen gives each molecule of carbon dioxide as well. Hydrogen can be done by electrolysis but LCA is not good because It needs about for one Kilogram a huge amount of electricity which gets into it. Solar can be one source but again it is economically pricier. Now another is gasification of biomass. Gasification of biomass gives same gas that through water shift gives large amount of hydrogen. But again the problem is each molecule of hydrogen gets each molecule of carbon dioxide along with it. So globally people are talking about hydrogen will come on a larger scale but IEA has estimated and others have estimated that until carbon dioxide sequestration technologies have also to come along with it. Then there is huge talk about electric mobility.

In Europe everyone has given figures, but we believe in India electric mobility is still far away because of the infrastructure and if hydrogen has to be used in internal combustion then it has to be through fuel cell technology which presently is very expensive, even will take lot of time to come through. There are few sectors in which bio fuel become mandatory and one of them is aviation. In aviation rules have come that aviation fuel must contain small amount of, small percentage of biofuel. So biofuel will become mandatory though they will be little expensive to start with it but will see the light of it. If we talk about diesel which is four times more than petrol in India specifically then we do not have much for substitute as such. We all know about the Jatropha story, didn't get much of good results but now government has come up with regulation for used cooking oil. We believe that 8 million tonne of used cooking oil will be available because of the FSSI regulations and that can be easily converted to biodiesel.

Government of India through the PARIS agreement -mission innovation programme in which there were eight challenges for clean energy is taking part in the initiative. India is member of all the eight challenges and one of the mandate of mission innovation was that each country will double its R&D spending within five years that is from 2015 level to 2020 and India has committed very large amount of fund in clean energy areas and large numbers of technologies are getting developed and matured into this. So another eight to ten years we will actually know how fast we are progressing into this transport sector by having these clean fuels into this but in past our performance was not very good because biofuel policies were made but microplanning and micromanagement was missing which has started from last four or five years and hopefully in next five to seven years we will meet our mandate of biofuel addition into transport sector of compressed biogas and hydrogen but there is another way using hydrogen in CNG mixture which has already started in Delhi on trial basis. So each of technologies not one technology but each of the technologies will contribute to the transport sector that is electric mobility, biofuel, hydrogen, large amount of compressed biogas will contribute.

SPEAKER: Souvik Bhattacharjya, Associate Director, Integrated Policy Analysis Division, TERI



What I am going to present today is the justification of cleaner energy sector, the way it should be ideally done so that we are not only able to address the environmental pillar which in any case we are doing and the economic pillar but also the most importantly the social pillar which we quite often ignore towards addressing environmental sustainability.

Now why coal, because it has been backbone many economies, India is no different and the mining sector contributing almost two percent to the Indian economy and coal in fact contributes to one third of that mining sector contribution to the Indian economy roughly around .7-.8 %. If we look at the contribution of coal in the overall power generation, it has been estimated somewhere around 73% out of the total thermal generation of around 78% and the installed capacity is around 56% vis-a-vis total thermal capacity around 62 to 63% and the power sector which is the largest consumer. At the same time we do have other sectors the steel, the washery, the aluminium which are also like major consumers of coal. Now the importance of coal if we look at it is definitely source of energy for economic growth but at the same time it has also been source of livelihood for many people and even more importantly the kind of royalties that many of the coal dependent states have been receiving over a decades that has been extremely important in the overall revenue generation if not from the developmental perspectives because there are a lot of debates and discussion around how much of that revenue is getting channelled into the local development aspects and that has been one of the reasons behind the recent amendment of the MMDR act in 2015 where the district mineral funds were created in order to ensure that these resources are used for local development based on the local planning. Nevertheless if you look at the kind of contribution that coal royalties have in some of the major coal mining states so it had in fact increased from almost 10,000 crore in 2014 -15 to almost 15,000 crore in 2019 which is significant, growth is significant around 8.1%. So this indicates that the coal royalty has a very important role to play and in some of the states in fact the royalties are like into two parts particularly in Bengal that we have looked at. That has been also one of the reasons why the central government has been pushing some of the state governments with the new coal blocks being allocated to different mining companies and the first round of the auction had already

taken place few days ago when five companies participated so this still remains a kind of a main point of attraction for bringing coal or ensure coal retains in the system for quite some time because of the huge revenue.

Apart from the revenue contribution to the government it also has significant contribution to employment. If we look at the official estimates there are almost like 3,55,000 workers were employed in the coal mines but if we look at the entire coal value chain that might be in fact three to four times more than the numbers estimated. If we look at the environmental impacts we do have the impacts associated with soil contamination, agricultural productivity loss, water contamination, health impacts, and that has been also a reason for why a greater push on emphasis had been given on a transition to renewable energy and with the introduction of the PARIS agreement coming into force from 2020 among all the countries having India too submitted its NDCs which said that it would reduce its overall emission intensity of the GDP between 33 to 35% of what it was in 2005. It also pledged to increase overall renewable energy capacity to 40% by 2030 and in fact increasing its carbon sinks from the current level to almost to between 3.5 to 5 billion tonnes which is humongous. But given the fact that many of the economies including India have been so much dependent on coal and the kind of ecosystem that particularly at some of the major coal mining states that have developed such a transition may have significant impact particularly for countries like India where the major renewable energy generation is away from these major coal locations, so in the process there may not be a good opportunity for the people who will get affected because of the transition. These coal locations would experience livelihood vulnerabilities, there would be economic vulnerabilities and infrastructure vulnerabilities. Infrastructure developed for the villages and the local communities in the mining locations will get affected because of coal or no maintenance because obviously those locations won't be of like areas of investment for the investors. Just transition is a terminology looking at distribution equity implications which is very much predominated in the resources sector. Just transitions has become very important particularly a lot of literature or recent thinking is around how to make this entire process more equitable and ensuring justice to the communities, other people who are involved whose livelihoods depending on the coal mining operation right from the mining activities to power generation.

So it is a kind of a principle, process, a practice while the principle of the just transition is that a healthy economy and clean environment can and should coexist. The process for achieving this vision should be fair and should not cost workers or community residents their health, environmental and jobs and finally it encompasses range of social interventions to secure worker's rights and their livelihood while economics are shifting to sustainable production consumption framework or set up while combating climate change and protecting biodiversity. One framework which has come up is was looking at basically three aspects the procedural justice, the recognition as well as the kind of engagement that the transition or transition request such kind of engagement mandatory and many of the examples which have come up in recent times they are in a way able to touch upon some of those frameworks. Two such examples that I'm going to briefly highlight – Batla solar park in Rajasthan as well as REVA solar park in Rajasthan which as a part of this CSR activities they have been able to really create employment for local people and at the same time the CSR funding have been able to create infrastructure development, water access, schools and health care facilities. Recent literature shows that there are seven key elements which

includes the active encouragement of decarbonization, avoiding the creation of carbon locking, identifying the major losers in the sectors what kind of support that are needed at this specific or affected regions, what kind of support is needed even to the workers, their families or wider communities and the cleanup of environmental damage and ensure that the related costs are not transferred from the public from the private to the public sector and addressing existing economic and social inequalities and ensure an inclusive and transparent planning process.

So as a part of our recent project a simpler way of presenting all this framework is being undertaken in this five pronged approach and when we identify these five approaches, it includes essentially the livelihood diversification, the capacity development, the dialogues, the institutions and the governments as well as the financing and when we're talking about the livelihood diversification what kind of skill development and livelihood or even local entrepreneurial opportunities can emerge from the local communities is something that needs to be tapped or possibly given more emphasis particularly in those locations. Capacity development in away is connected with Livelihood but what we feel that people who are actually coming out from those places or willing to come out of those places what kind of additional training can be provided so that they can be absorbed in the renewable energy space, dialogues definitely about when we're talking about shutting down mine are we communicating to them well in advance so that they are mentally prepared or it's just a kind of a sudden disclosure to them that tomorrow it is not going to exist so that kind of smoothening effect can be established through dialogues. Institutions and governance obviously will play a very important role particularly in the development process of the entrepreneur opportunity, the skill development and establishing that dialogue process and finally the financing possibly certain seed capital or creation of infrastructure at the local level to ensure that the existing kind of facilities are not affected and people do not migrate because that will have a very different application on the overall migration scenario.

Special Remarks

Frank Umbach, *Research Director of the European Centre for Energy and Resource Security (EUCERS), King's College, London*



The German government has recently made the decision for phasing out coal in Germany's largest consumer actually of coal at latest by the year 2038 and there is of course a heated debate and in regards to what is needed for stopping the climate change and these calls are not just by the EU and in Germany and by environmental organizations but also by the UN. We are currently experiencing the 2nd wave of pandemic which may even hurt us economically even more than first one. Nonetheless the EU has already in December prior to the pandemic decided on the

European Green Deal which has the overall objective of fostering the green energy transition and has become an official policy objective. It has even been enshrined in law such as in Germany and it has been agreed on a new target of reducing emissions up to 55% by 2030 for the mid-term perspective and that is changing from the previous objective of 40% and has also offered concrete pathways and strategies for achieving that although that might be still disputed and the uncertainties to be realized but in this respect EU went ahead globally and still uncertain continents and countries will follow it. All governments have to define new priorities in the light of the pandemic and the big question is whether the planned investments for renewables and the green energy transition will be maintained, can be fast and or will decline in the coming years contrary to the overall strategic objectives of mitigating the climate change. In an overview of the targets the EU agreed prior to the European energy deal and I should add critically that not all of the objectives have been achieved. EU has not achieved all target for this year but is also happy with the creation of European Green Deal, it has become even more ambitious for the targets of 2030. So this is an overview how the EU sees and how to achieve the process of green energy transition by the year 2030 and there's a recognition that overall decrease of 55% of emissions by the year 2030 can only be achieved not just by focusing on the energy sector which means we have to transfer our economies at whole and the industry as such particularly also the energy intensive industries.

The EU has enshrined its policy in a more concrete way and has offered a mid-term perspective with targets for 2030 in regard to a green energy transition. Number of other countries of course has also announced emission reductions most recently China by the year 2030 but most of the countries have not offered a long-term concrete pathway and strategies for achieving the climate change mitigation down to two the 2% or 1.5 decrease Celsius targets nor the other countries have offered a concrete pathway for the mid-term perspectives by the year 2030 which is essential for achieving the longer term target. So it remains to be seen whether other countries and governments will follow the European example of offering concrete pathways and new ambitious targets for the mid-term perspective of the year 2030. The huge changes which are needed to achieving the Paris agreement targets as outlined here with the missions need to fall dramatically from the year now and not just after 2030 or 2040 and that's a huge challenge.

Looking ahead in the context of the Europeans declared energy Green Deal and ambitious policies there are of course a number of new opportunities and not just for the European industry but also for the energy Cooperation between the EU and major emitters and countries such as India. This is not just related to the climate policies as an overall recognition on the EU side on the side of the German government to enhance our policies far beyond climate change issues with democracies in Asia as the result of the deteriorating relationship on our side with China for variety of reasons and that brings me to three areas

which I will shortly address for cooperation with India. The first one is on digitalization which leads to systemic changes of the energy sectors and it's certainly not related to a digitalization technologies alone but of course digitalization technologies are an area where I see the EU and India can really work closely together and I will refer to larger study done for KAF foundation in 2018 which is addressing the studying and analyzing the broader impact of the expansion of renewables as well as digitalization technologies and I came to the conclusion of these five geostrategic implications which we need to take into account in the coming years and one of those areas. The second very important area for cooperation between EU and India that is relation to battery storage technologies which will become ever more important for the future energy supply security in the years ahead. So EU has introduced the so-called battery alliance which means building up mega factories for producing batteries but also putting a lot of money into the research of the next generation of batteries and so that has become very important industry policy in substituting the European energy green deal and EU has considered the need for building up a complete radical change beginning from research even also addressing as much needed critical raw materials for the batteries etc.

Why is this important for India? The battery storage capacity in the share of variable renewables and selected regions and so projection here of IEA is that India has a need for expanding battery storage capacity more than any other country by the year 2030 so there is an urgent need on India side for expanding the use of batteries for stabilizing the electricity grids and for also enhancing its energy security alongside the expansion of renewable. So that gives another explanation why there's a growing interest for cooperation in this field from India side. The third field after following digitalization technologies and batteries battery technology is hydrogen. Hydrogen has been highlighted as one of the most important instruments for achieving longer term perspectives for a clean energy transition. It's almost the only alternative for the energy intensive industry to become cleaner and greener and so that has been very much highlighted and also concrete programs and massive financial investments in the coming years will go in building capacities and countries such as China, Japan, South Korea and number of other countries also offers new perspectives for cooperation.

Why hydrogen is also improved not just for expanding hydrogen projects in Europe alone there is a recognized need that Europe and Germany would not be able to supply hydrogen alone for its huge demand it will face in the coming years and decades so it will be forced to introduce huge volumes of hydrogen from all over the world and here again when it comes to energy security you need to address a number of fuel political risks as we had been done that for decades in respect to fossil fuels. For example one of the restriction is space, it is constriction in Germany because we would have to expand to renewables to such an extent that we simply do not have even the space for having sufficient renewables available for producing the hydrogen volumes.

Concluding Session- DAY 1

Peter Rimmele, Resident Representative, Konrad Adenauer Stiftung India office



In an ever accelerating impact of climate change and the necessity to change our ways have already been put up in front although the stubble burning is going on in the front unfortunately. The coronavirus and political instability around the globe have taken the limelight yet we should not be fooled by the selection of new topics or diverted by other priorities into thinking that climate change has suddenly stopped being a threat. In that sense we at KAS are very glad that despite the current circumstances this venue offers an opportunity to talk about climate change and India's energy security agenda. As we

have seen energy security is an issue that sits uneasily at the crossroads of multiple broader topics. It belongs to environmental politics yet we also have to talk about Foreign Relations, National Defense and the labor market and its effects to it. In 2011 the Fukushima reactor disaster struck Japan and had repercussions around the Globe. In Germany that meant that practically overnight nuclear power was no longer palatable as an answer to fossil energy sources and also overnight decided in the end date in clear power the last reactor will cease to operate at the end of 2022. So this development spoke a series of problems first what good would it do for German when just across the border France would be keeping its reactors working regardless of Fukushima. This is the European perspective that provides all debate on European national politics today at a national level, the end of nuclear power begged the question of what could and what would replace it and how soon?. Renewable energy, it is a constantly growing at 42. 1% only 2019 it is still far from quenching the Germany's thirst for energy. With 2022 as the end date for nuclear power that can only mean that coal plants as elsewhere and as in India would still have to remain as a part of the solution, some part of the choice is to take into account the labour market. The phase out of nuclear energy in Germany, the end of coal mining along the Rhine River area and the North stream pipeline, a controversial project that will have profound implications for a significant portion of the labor force in the country. German government is investing heavily to make that change as easy for employee when making these transitions.

Energy security is also security politics in a more traditional sense pipeline project is one of Germany's most current political debates. The project will upon completion if that ever happens allow Germany direct access to Russian gas via pipeline submerge the Baltic sea. Issues with lots of political instability may be one of the reasons why one decided for another project. This project promises to create a village of new jobs in the sparsely populated northern state of Mecklenburg provision and open up new business opportunities for a territory as well as providing Germany cheap gas on the downside its critics at home and abroad long argued that the pipeline project compromises Germany's ability to deal with Russia's imperialist behavior on European eastern border and the pipeline has already created tensions between Germany, its European partners and strategically even more virtually vital with US. So we have to see what solution will come up for that.

Undoubtedly the topic under discussion being India with its very own problems, Germany is just one single example and similar experiences are occurring all over the world as we have seen. Yet the German situation illustrates well the interconnectedness of things when it comes to sustainability. This might seem as a takeaway but it's vital for our discussion. Let us keep in mind that we are trying to square a circle here that we need to take into account our economies demand for energy, mother- nature's demand to look after the resources with care. The demands of growing work force and our political demand to remain

unsusceptible. This is quite handful, yes but we must all take this demand and many more that have been mentioned today to account when we think about India's energy security agenda. Not only US, as I have shown Germany or India all have their challenges with old energies related transitions if we want to tackle the issue of climate change .

Diginars I & II - Climate change and sustainable development in India's energy security agenda

18th & 19th November 2020 – DAY 2

Opening session

CHAIR: R R Rashmi, Programme Director and Distinguished Fellow, Integrated Policy Analysis Division, The Energy and Resources Institute



There is a general feeling that one knows the SDG goals, the kind of ambitions which are implicit in implementing the SDG mechanisms and achieving SDG goals are different from the kind of goals that we pursue in relation to climate. In many senses partly it is true because there are implementation issues here. The ambition and the goals may actually be the same. There is a widely recognized truth that unless we protect the environment, none of these SDG goals can actually be achieved in totality and comprehensively. So in the long term, all these goals are actually converged. Whether it is SDG or whether it is climate goal or any other goal which we have to monitor internationally.

But in the short term, there are divergent approaches here. Some of them may require a degree of compromise here and there. For example, the SDG Goal 7 focuses on universal access to energy, which in our country would mean a large shift from the biomass or bio fuel which is retrieved either from the biomass forces or from fossil fuels away towards renewable sources of energy. This will take time. This might happen over a period of time, as we have seen in case of LPG distribution, which is less emission intensive but moving away from biomass. It is good for environment, but it also involves costs and it also involves time frame which may not be consistent with the time frame in which we want to achieve carbon neutrality or a full realization of our planet codes.

So the issues of universal access to energy, the promotion of jobs making transition in a manner away from coal or fossil fuels to other renewables in a manner that it protects the jobs and incomes and makes the development really sustainable is also an issue. So there are divergent approaches required, but all of them will have one common goal that are protecting the environment and achieving sustainable development over a period of time.

SPEAKER: Jitendra Roychoudhury, KAPSARC, Saudi Arabia



The SDGs had about 15 years to act and given that its 2020 we are now in the last decade towards achieving the SDGs and we are still quite a distance from actually achieving them. In terms of our per capita income, in terms of our per capita availability to health services, education, there are several aspects which are still lacking. But there has been significant movement in terms of achieving some of them. NITI Aayog SDG-dashboard illustrates India is moving forward achieving at least some of that set for goals. A lot of our speakers probably focus on the goals that are from SDG-1 to 5 or energy access. Let me focus on the SDG goals that are at the latter end of the SDG spectrum specifically SDG-17, SDG-13, SDG-9 and SDG-7.

These goals are the ones which are going to be critical for India as it starts to move up the energy consumption value chain. If we were to look at SDG-17 strengthening the means of implementation and revitalization of global partnership for sustainable development- We have a very good example in this particular one in terms of the International Solar Alliance which India has been leading for some time and that reflects on India's ambition to be as Mr. Modi had said the OPEC of solar for India. Now that is an ambition on which we should be moving forward because it allows us to not only implement the learnings that we achieved from solar within the country but also share them across the globe. There are several aspects wherein Indian engineering or Indian skill sets in terms of setting up certain projects with a certain financial constraints are helpful for other countries to also learn from. In SDG-13 context, there is a transition in India in terms of a gradual shift towards including more and more renewables now whether that is going to actually curb fossil fuel demand is something we will see as we progress, it is too early to call for the demise of the fossil fuels in India. The legacy infrastructure that already is present in the country for maintaining and supplying fossil fuel is a huge investment. Most of the renewables that are coming in to the electricity is variable in nature and until we have an economic solution in terms of battery storage its inputs will be limited by the financial constraints that the DISCOMs will have.

Looking forward to SDG-9 the resilient infrastructure promotes inclusive industrialization and faster innovation. This is where we are seeing not only in industrialization but other aspects also. A classic example being if you look at it FINTEC lot of the Indian innovation in Fintec enables lot of people able to make payments through mobile gateways and this allows for rising of energy to be more granular which people can access the electricity which will over a period of time enable greater acceptance of greater availability of energy for those people allowing SDG to circulate and become more achievable. SDG-7 is about access affordable and reliable sustainable and modern energy for all. India has UJJWALA and LPG schemes there are multiple examples that India is trying to achieve in this sector. SDG-6 which ensure availability and sustainable management of water & sanitation for all and this visible in the new Drinking Water for All project that current Government has kicked-off. Over a period of time and this along with the affordable housing scheme will allow larger number of people to be able to access health services to and access societal services and gradually move up the economic value chain and become more productive members of the society. SDG goals are at the end of the day are goals. It will take a lot of effort

and it will take a lot of collective time to be able to achieve it. What matter it this general direction that we are continuing on is the right one or not and that I believe is that we are on the right path.

SPEAKER: Ajith Radhakrishnan, Senior Specialist, World Bank



I am the Country Co-coordinator for the Water Resources in the World Bank which is a public private participation forum that is pursuing partnerships largely on private sector partnership and further to water security goals. And this is specifically looking at NDC commitment that look at reduction in agriculture water demand. Most specifically this would be a demand side management criteria that we are looking at and to address the Water Security challenges at the demand side perspective is more important because largely In India water security is looked at from the supply side. This also has large impact or bearing for the energy side. We have what we call a Multi Stakeholder Partnership Platform, MSP platforms, that bring together the Government, the private sector and the civil society under the Government's leadership _most importantly to act on water security issues that would target efficiency from an urban industrial and natural resources management process. The Multi Stakeholder Partnership platform at State level chaired by the Chief Secretary and we do have the joint Secretaries of the line department along with the private sector CEOs and the civil society leaders from the state who jointly and co-create policies, co-create fast tracking of implementation of projects. These are flagship projects of Govt. and also civil society and then bring the private sector and try innovation in the development programmes. So this has been quite effective in the four states where we have piloted- Karnataka, Maharashtra, Uttar Pradesh and now in Madhya Pradesh where there has been Multi Stakeholder platform under the leadership of Chief Secretaries of the respective Chief Secretaries. So this is driving the water efficiency narrative and more so from the energy dimension.

Because the largest intervention of the pilot started in Karnataka was to convert 26000 hectares in to micro irrigation area. So this has now resulted in approximately 2.7TMC of water savings which is also translating in to energy savings that is avoiding pumping and energy saving from the agriculture sector. The Govt. has seen the success of this initiative and now piloting 2000 thousand hectares in Karnataka and this is also going to be created by the Maharashtra Govt. They have now tested this out in 100 thousand hectares as pilot, where again we see approximately 30-45% of water saving. Private sector innovations & pvt. sector is working hand and in hand with the farmers in Maharashtra highlighting a kind of model that is moving away individual farmers from the subsidies and creating the impacts that could be scaled up and lead to savings. In terms of economic entities it creates right incentives for the farmers and right incentives for the Govt. because you have subsidies either from Energy or from water and in most cases a combination of both and then you also have the savings being diverted into other sectors of drinking water or industries which will further improve the water productivity for the economy. Now very important question of renewable energy and the transition towards the sustainable energy pathway is also being lead in states like Maharashtra where there is also an initiative by other partners like ADB such as looking at high voltage distribution system that would overlap the Micro Irrigation Grid. The distribution grid when it would be probably developed will triple the energy gains and the water savings gain from the agriculture sector would further incentivize the transition to move off towards the sustainable regime. But the key is SDG 17 which is about creating sustainable partnership on the ground

for a sustainable transition to a regime that would create incentives for the masses and also for the Govts. to look forward to overseas policies. As a result the Govt. will fully incorporate circular economy goals like waste water use in agriculture and transition to waste water into a regime. So this is also now catching up in places like Aurangabad Municipal Corporation has entered into an MoU of partnership agreement with the Water Research Association and the Farmers Association in Aurangabad, who will sell the treated water from the STPs around Aurangabad for Agriculture purposes. It is another pathway that create further incentives around adaptation because you also have water scarcity issues that need to be eventually managed. There is obviously an incentive risk created by looking at water savings, water efficiency by creating a collection action plan platform and successfully incorporating the goals of circular economy to achieve the SDG Goals-6 and 17 and in extension at food security also under SDG Goal 1 where you can tackle poverty through this collective action plan.

Mr. R R Rashmi – World Bank is taking the support of SDG Goal-6. You have specifically talked about promoting water efficiency which would be an instrument of achieving SDG-6 as well as you know environmental goals of natural resource conservation. We will have questions certainly and the participants would like to raise, ask questions on the kind of programme that you are implementing at this stage just for clarification I want to clarify – you talked about shift from individual subsidy base to area based subsidy approach in promoting water use efficiency. What is the area of your experience has subsidy burden gone done in this case as a result of this shift or what is the financial implication of this kind of shift?

Mr. Ajit Radhakrishnan - Here the shift has been from the project infrastructure financial, where the private sector is also brought in and there is a service delivery story that comes around it ,so you have 70% of project infrastructure cost been undertaken by the Govt. upfront and the 30% is annualised over a period of 5-7 years and the service delivery happens and based on successful performance of this operators which is again evaluated and audited by the farmers, water user association in conjunction with the Govt. and the project management unit. The annualized payments are to the service provider. So this has been a success in Karnataka but there is also the element of uncertainty when there is a recovery question coming in. So to address this issue the Govt. of Maharashtra has innovated an MoU with the private sector and then there is no question of recovery. Then Govt. investment happens only on the back water transformation from the dams to the farmers and the farmers ensures efficiency by taking the private sector investment.

SPEAKER: Mr. Chandra Bhushan, IForest



am very optimistic about this future because of two things; one that the history shows that transition is never lenient it is exponential. If you look at the history of technology over the last 200 years since industrial revolution you will find that all the major technologies that we have today have grown exponentially. They have never grown leniently, mobile phone, start with the internal combustion engine in the early part of 19th century it just took the world 15 years to move from horse carts to cars. The same example you can see in all the technologies, mobile phone 10 years, television similarly, wherever mature technology had entered the market the transition has been is really been explosive and I do see that we are reaching that

tipping point of technology in energy sector as well as the automotive sector. Now automobile is prime for exponential growth, internal combustion engineering and to electricity mobility. In the next few years telephone lines will be obsolete many of our energy infrastructure will become obsolete and new infrastructure will come that is much more cleaner much more affordable and accessible to people. If we start with this historical context then we will have to challenge some of our exemptions that we are making today. For example, one assumption is that gas is a bridging fuel. Now gas is a bridging fuel if electrical cooking is not there. Now anywhere in the world you go to New York City or any European city there is electric based cooking apart from the fact India has a joint family or our cooking habit that require other energy sources- there is potential for electrical cooking. The moment electricity is available people in urban societies prefer electrical cooking than LPG. Now that this is visible globally, therefore a valid question to ask is do we need to invest in LPG pipeline in our urban areas? And if we are investing in that infrastructure now what is going to be the life of that infrastructure? What I am trying to say is that we are at a tipping point of technology and we are doing investment thinking about things that are happening in the past. Not about what is likely to be happening in the future.

I do not believe that gas is a bridging fuel for India. It could be a substitute for a certain point of time may be for 10 years but of course we don't have that. We import gas from outside, our resources are very limited we are building large LNG infrastructure for imported gas without examining the life of that infrastructure will be. We have to be very careful about how much investment we do in developing this national grid on gas, once electricity is universally available. And it will be universally available. Why do we need 5 types of energy infrastructure?. We will have a gas infrastructure, an oil infrastructure, electricity infrastructure to bring a unit of energy whereas the modern world that we are looking at will be able to meet our energy with one infrastructure. Electricity is sufficient whether you want to drive your car, cook your food, run your industries so the point is that we are at the tipping point where many of the assumptions that we have made in the past will not be applicable in the future. The second point is this transition period is not happening in tomorrow. From climate perspective we have about 20 to 25 years if you see IPCC 1.5 degree report we have about till 2040 to 2050 to say reduce our dependence on coal based electricity. So one of the challenges that I always talk about is the challenge in energy transition.

The challenge is politically economic transition in coal areas. That is going to be much more problematic for us. Solar and battery storage are least power problem that will happen. The biggest problem that going to take place how can we tell politician in Jharkhand to close coal mines. And will they agree to close all coal mines. I think the whole concept of just transition is going to be far more politically challenging. Then the simple technological shift that will happen. So also the areas where we need to walk on energy security and SDG is going to be on issues like just transition in coal mining area which is going to be very important, then just simple notion of energy transition because the political challenges in these areas are far more complicated. The overall picture of coal that comes out at national level is very different in the picture of coal at sub national level. The sub national challenges of coal is far greater than the simple notion that we need to have coal because we are highly dependent in coal. 50% of coal mines in Jharkhand are already closed. In certain districts coal mines have closed completely and therefore a large amount of unemployment in that areas. The idea of energy transition also amount to have just transition in those areas which were dependent resources like coal. The last point is on Biomass. We have

about 500 billion tonnes of biomass produce from agro residues alone. Now even though the solid biomass are not to be burnt as cooking fuel or burnt on plant but we need a very clear transition and technology solution to use that 500 billion tonnes of biomass. Unfortunately, all the biomass missions that we have done so far has not been very successful. Whether it is of biogas in a plan of 1970s or biogas gasification program by MNRE. 500 billion tone of biomass is equivalent to 250 billion tonnes of coal or about 100 million tonnes of oil. So the amount of energy that is there renewable source of energy that we have in biomass. We will have to really think seriously from energy security perspective.

SPEAKER: R. Srikanth, Professor and Dean School of Natural Sciences and Engineering, NIAS



World Bank has published a report couple of years back that actually shows that 67% of all the SDG targets are actually affected by SDG 7 and therefore, and what is the main thing that actually drives the other 67% of targets is energy access and energy affordability. Now in all this climate change transition dialogues there is complete ignorance of the affordability factor. And affordability is the true cost of power.

The problem in India is that there is huge supply demand mismatch. In the state of Karnataka alone what is actually happening is that the State has said that in the FY 21, the estimate before COVID there is a Nov. 2019 indicates the State Govt. DISCOMs have tied up nearly 30 GWh (Gigawatt hours) of more electricity than what actually is required as per the current demand or Nov. 2021. And therefore the DISCOMs are actually informed the regulator but they are going to pay 4800 crore rupees in one year FY 21 for power they are not going to offtake and therefore they requested the regulator to basically enable them to pass on the cost to all the consumers and what is actually happened is that this month there has been huge tariff increase for all the consumers in Karnataka. And if you can look at Maharashtra, the scenario is that the Maharashtra State Distribution Corporation is paying about 10000 crores for 2 thermal power plants with whom they have a PPA but they don't have offtake.

So now the situation about affordability, the whole problem basically it that all these costs are actually being passed out to consumers and therefore it is hurting people particularly industries and commercial establishments badly. If you are looking at a scenario of economic development, if you don't address our economic growth our demographic dividend is going to turn to a demographic disaster, leaving COVID aside for some time the job creation in this country as come down dramatically. May be because of technology may be because of India's growth rate has go down even before COVID or consecutively both.

If you want to have an atma nirbhar Bharat you cannot happen with the energy tariffs and we have done this again in detail for 3 states __ Telangana, Karnataka and Andhra Pradesh. We have papers which have been published in the Energy Policy last month what we have actually come across from the regulatory policy that in the year 2018-19 alone more than 1500 crores has been paid to procure RE more than the RPO that is in the Southern State actually produce as you know nearly 50% of the renewable energy of the country. That is 50% of the renewable energy in the country. But what is actually happened is most of the states in the Northern and east is not compliant with the RPO and as result people in South India are disproportionately being bearing the cost of actually mitigating climate change because we have very high proportions of RE in our total basket. But at the same time due to faulty planning in the past the

projections made by the Govt. many goals and target have never been achieved and they are not going to be achieved for another 5 or 10 years. As a result what has happened is that there are far more thermal power plant capacity than what we actually need.

The Govt. plants such as the NTPCs Sholapur plants is a brand new plants but they do not know or have offtake of last year, before COVID NTPCs band new created Megawatt plants had 32%, Shobapur plant less than 10%. So the whole problem is who is going to pay of this plant. Unfortunately what has happened is that the high escalating cost of generation which is one of the key reasons for DISCOMs yet, DISCOMs failure is not actually being talked about and this is not just because the thermal price or coal prices are increasing of course the coal is a cash--- for the Govt. How much of the money garnered as coal cess is going to be used for the national clean energy fund, how much money has gone to that now? After 2017 every cent of this cess is going to GST compensation and because it falls in GST, the Centre has got no way of compensating the states now. If the centre cannot compensate the states where will the states are going to provide welfare measures to the poor. So the issue basically is that we have to look at the different angle of coal that actually sustaining our economy. 48% of our railways freight is coal now and with reductions in coal, what would happen to this infrastructure. The question basically is what would be cost impact of freight on other commodities? What would be the cost impact on passenger movement? So the issue basically is that I think if you talk about sustainable development goals we need to look at the impact of coal in the broader aspect of economy. If you look at royalty, if you look at the district minerals fund the states are going to be doing with this funds. Thousands of crores from royalty to district mineral fund now the question is whether the state has a capacity to utilize this money usefully? I don't think so. That is a different story.

But the point is that it is actually coal that is sustaining a lot of Govt. revenues and this cannot be discounted. Now do we have something to replace Govt. revenues? We need transition plan and look at what is actually happening in the ground and how our DISCOMs going to survive and going to reduce cost of financing.

Mr. R R Rashmi – We have touched upon number of issues, we feel that energy transition is possible but raised the issues of reforms in the DISCOMs, the impact of shut down of coal mines and in terms of revenue loss of State Govts, as well as impact on freight.

Qn.: Mr. Roychoudhury- How he look at the concept of one sun one world one grid does it think that something which is realist and is it achievable?

Mr. Jitendra Roychoudhury: Let me give you an example US and ASEAN has been talking about having a regional grid that hasn't come to a conclusion. None of the countries will be willing to have a grid where it is possible that it is going to lead to more dilution or export of their subsidies electricity in some countries heavily subsidized. So it is going to be a big challenge managing the entire infrastructure. I mean thinking about the world is very fine- it feeds the ego, it makes everybody feel nice but at the same time somebody has to pay for it.

Mr. Rashmi: Absolutely right, you have emphasized the issue of reforms of the transmission infrastructure – may be tariff is an internal issues but some of these issues are not economic issue they are geopolitical issues and therefore there are different dimensions to them.

Mr. Radhakrishnan talked about water extensively and there is a question addressed to him in terms of the pricing of natural resources and how does collective action plan bring down the cost of natural resources or a product which is based on natural resources – or energy?

Mr. Ajith Radhakrishnan: Water associations are slowly accepting the need for pricing water which is part of a service. So that has been one level of change that is happening- acceptance of tariffs in water, this is now at least being inculcated in to the kind of culture of the extension of water and accepting the service and cost . The other is the circular economy. There has been an acceptance by the farmers who have been forth coming in terms of approaching the Govt. with the objective and with the option into price and so they understand that the treated water released back to the agriculture sector has got a new nutrient function, nutrient value. So in such cases the farmers and farmer associates have been much more forthcoming and much more opened to the idea of water pricing.

Rashmi: How coal should be treated, how industry should be treated in terms of tariff? What kind of reforms are required? And so the one question of specific questions which has also been put to him in this context since he has raised about the cost of energy, energy services. What should they do in terms of reforms of the distribution companies and the energy services so that they can supply energy at affordable costs to the poor and yet protect the industry and protect the DISCOM as well?

Dr. Srikant: Number one. I think it is futile to talk about the distribution companies unless you address the cost of supplying. The problem in our country is that 80 to 85% of the distribution companies costs for power procurement. Now, which means it is practically out of their control because they're procuring power through PPA. There is no way that the cost of power is going to come down and there is no way that DISCOM losses are going to come down. The reason why DISCOM will not come down is because in the Central Electricity Regulatory Commission does not even deal with a single consumer rather than the corporate consumer. It only sits in Ivory Tower in Delhi only deals with the lawyers, whereas if you come to the states, the state regulatory commissions have to deal with the common man. And there basically obviously there is a huge resistance to tariff increases. By not utilizing our thermal power capacity today, we are depriving all Indians of the potential for getting lower cost power.

This is the key thing and we are the verge of quantifying that. We have done it for some states we are going to do it for other states we are actually depriving Indians of the potential for lower cost.

The white problem is that power is so important because it is connected to various segments of life. We need to look at it in a more holistic manner. It is also a Concurrent subject to the Constitution. It is also something that the sector should start actually working with the states rather than giving propaganda statements against state governments. We return about the Electricity Amendment Act and this actually is encroachment on state regulators to basically take away their powers to even appoint their own regulators, just because you know some RE developers are not getting their money on time.

There is a need for a National Electricity Council. There is a need for politicians from all parties, all governments to work together. To basically look at our local state sector, look at what can be done to basically make SDG 7 functional while ensuring affordability as well as emissions.

RR Rashmi- We need to create a conducive situation for all the players to play their part in the system both at the central government level, state government level producers and consumers, and the discoms so that right balance has to be found. What kind of political work is required to address this just transition issue at the state level and what institutions should be involved? Who would be best positioned to address this?

Chandrabhushan- I think just transition will have to be at all three levels of the government. National, state and local. One of the big part of just transition will be the national policy itself on just transition. As you know that the state financial powers are quite small compared to central. And central government has used its financial power to give economic incentive for development of areas that are going through transitions. There was a special economic package given to many states for 10 years of you know, tax rebate and other things. Many of the cold districts are actually depressed districts. You know, if you look at the socio economic conditions of those district, take a map of India. Put coal mines and put poverty, and they're likely to match, so most school districts are also poorest districts.

Now, in those poorest district, coal is the only major economic activity. If that economic activity is also diminishing, then you need a policy which will revive and in many ways reinvent the economic architecture of the district itself, away from coal and that states can't do on their own. They don't have the wherewithal to do it in terms of financial resources, so it is all three levels of government that need to work together.

R R Rashmi- The question is what are the impacts of fluctuating global natural gas prices on India's plan to establish a gas based economy? All the contribution has clearly ruled that out. For investment to be locked up in a natural resource which is not going to be, you know, the promise of the future. So what do you think needs to be done by India in terms of gas pricing or investments ?

Jitendra Roychoudhary:

The investments that India is making in exploring methane gas hydrates along with the natural gas within the country accessing other gas reserves is ongoing. Companies are still investing in developing city gas districts. They're bidding for it. So it's one person's input versus another person's input. So finally, the market will decide if whoever is right in that time. Someone is putting in money to invest in city gas distribution licenses. Somebody's putting in money to set up the entire infrastructure to supply gas cooking gas to domestic households. Somebody is making a business call and putting in money, somebody from financial sector is also investing and putting in money, so it's easy to look at it in terms of a transition, but that transition is not going to be that everybody stops using.

One day people may move from over to electricity. It's going to be gradual. It's going to be piecemealed. It's going to be transitory. It's going to take a lot of time. Pricing is going to play a critical role in it, and if you see how the Government of India has looked at pricing petroleum products with pricing changing on a daily basis. That allows people to understand the volatility of the markets.

So if people understand that, then you could still have a situation where prices would fluctuate on a daily basis. Depending upon the consumption pattern, the bills will change. For city gas consumers, for larger consumers like fertilizer plants or this, it's just an input cost. They can manage it. They've been already doing that with their other diesel consumption and others. I don't think that it's going to be that big of a challenge unless until natural gas prices really rise, which is not going to happen in the near term future. The transition which is going to happen is going to happen on a gradual scale over a period of time. It's not going to happen very, very fast.

Mobile phone expansion and uptake didn't happen overnight. There were policy changes where incoming was made free, outgoing was charged more. There are several things in play. So the Transition is going to be a long one. It will take a lot of policy support from the government. It will take a lot of policy support for the market. It will take a lot of entrance into the market to support it. Pricing is a key aspect. The market will finally decide.

Rashmi: Pricing is always key issue in any transition. I think the point that Chandrabhushan had made was that the pace of these transitions is increased in this century. Unprecedented scale in some cases. Something which took centuries to happen has taken just a few decades in our century, so there are issues, and ultimately the market plays its own role the pricing is naturally the most fundamental economic signal to every player, and that will always play a Key role. Technology plays a role at the same time, the markets have their own internal logic.

Why government and industries are not thinking towards carbon capture storage. Does it have any potential or there are any or there are political, economic or environmental barriers?

Chandra Bhushan: Carbon capture carbon capture storage has been found to be non-economical in most of the cases other than in cases where you have an exhausted oil well, an infrastructure already available to transport CO₂. Some of the successful case examples of carbon capture and storage are where there is already an available infrastructure and exhausted oil well. Otherwise, the cost of capturing, concentrating, transporting and then of putting in an underground is a very expensive proposition and it might not be feasible for majority of the cases. The costs of renewables have come down significantly. The storage technology is becoming very viable. Market is realizing that there is a long term future or even massive investment that will be required in Carbon capture and storage, so that's not going to happen. Also, geologically speaking, it is impossible. Despite you know there are two carbon storage technology that one needs to understand. One is a chemical storage where you convert carbon dioxide into carbonate, almost like a rock and that is much more secure. And then there is storage within the geological formation itself in gaseous form, which is not very secured. So whereas the carbonate technology where we convert carbon dioxide into calcium carbonate and store it is much more secure, the other technology has many questions and carbon technology a little more expensive than the other one.

R. R. Rashmi: You have pointed about the economic and the physical issues. Geological issues involved in urban capture and storage, but this is something being talked about at the global level very frequently. Do you think in the context of this zero carbon or carbon neutrality or net zero carbon goal, which people

are talking about in 2050? You think this issue is going to remain alive and then going to be something which will not go away despite the fact that this may not be?

Chandra Bhushan: Politically or economically infeasible for us. People will keep talking about it, but in the larger scheme of things there will be some examples of it, but this will not be a major player in reaching 0 carbon world or net zero carbon world. I think far reaching net zero carbon forestry is going to be a major issue. In IPCC 5 report there was a lot of discussion on bioenergy and carbon capture and storage. So carbon capture and storage is out. But Bioenergy is still a major part of Net Zero discussion that is happening. And that's where the opportunity cost of land in developing country is going to be a major issue because we have our forests that grow faster. We are tropical sunny part of the world. We can capture sustainably much more carbon in our land and forests. Also, our soil, the capacity of carbon capture in soil is tremendously high. So rather than geological storage, subsurface storage in soil and biomass will be a much bigger player in reaching net zero emissions. I think there is a very clear goal between cooking energy and health that we need to consider, and that's where the biomass equation becomes very, very important and that integration has to be very clearly understood.

R. R Rashmi: OK, thank you Mr. Chandra right Audrey, do you have any rules on this? This integration of these diseases for health and as G for NRG.

Roy Choudhary: Mr. Bhushan raised regarding CCUS. So even though he said that it's not feasible, CCUS is already in action. It's being used in enhanced oil recovery here in the Kingdom and in the recent shipment that was made of blue ammonia to Japan, 50 tons of carbon dioxide will be captured and turned into methanol, and also used in enhanced oil recovery within the Kingdom. So it is being used in continuing wells which are producing oil, so it's actually being feasibly used within operating and ongoing projects.

R. R Rashmi: OK, well that's an interesting piece of information. Doctor Srikanth. Would you have any thoughts on this? The kind of challenges we have in the health sector and the challenges in the energy sector?

Dr. Shrikant: I think a very important thing that needs to be done is how do we make our coal mines and coal power plants more environment friendly? Unfortunately, there is very little discussion on that. It seems to be a sort of 0-1 approach, you know. Shut down coal or continue with coal. I think there is a great need to basically improve the environmental performance of our coal mines and unfortunately our current regulatory system doesn't allow that because our current regulatory system does not have the capacity to basically perform adequate governance. There is a need for a more capable, more independent and more empowered authority to take care of coal mines. I think what needs to be done is basically we need to make it more environment friendly, less polluting and countries like Australia have shown how it can be done. But we are not doing it. I think that is something that actually will help people living around coal power plants.

R. R Rashmi: With this we have come to the end of our session. It has been extremely rich and enlightening discussion and must say and on some issues I have personally gained a lot from the thought of the panelists, so let me thank Each one of them, once again for your extremely insightful comments and interventions. Sometimes this is an area which touches upon development as well as social

development, human development, economic and environmental issues. So it's a mixture. They all look at the future of energy transition very well. They think that energy transition will happen totally, no doubt about that. It will happen at a faster pace than we have thought, and but there are challenges which we need to take care. And contribution has pointed to the challenges of just transition the challenges in terms of moving away from biomass based energy system in the rural areas, this will need to address very clearly. Dr. Srikanth has pointed out about the kind of freedom the states required to plan their own or energy policies so that they can meet these SDG goals at the same time they can provide energy to everyone including the industry at an affordable cost.

Mr. Roy Chowdhury is quite optimistic about the use of gas and oil in the intermediate future. And he pointed out about the, you know the role which market plays in determining the kind of actions that we take in the short to medium term. So all of these natural resources have their own uses. The mix of policies and the technology will play its own role in their adoption. Mr. Radhakrishnan was very emphatic about the positive impact of the policy changes and then the models which we implement in the area of water. So all of these experiences are quite positive and we are moving towards a bright future at the same time we need to be conscious of the challenges. That is what all the parents have told us, the issues, the social issues, the issues of transition and protecting the jobs incomes. This is integral to the overall question of making energy transition.

Closing Remarks & Vote of Thanks

Swati Ganeshan, Fellow and Area Convener, Centre for Resource Efficiency and Governance, The Energy and Resources Institute (TERI)

I think we have covered quite a lot of ground from the perspective of policy from the perspective of pricing range, reforms and in terms of public perception on how it reacts to certain types of energy services. Also in terms of how market determines quite a lot of some other choices that we make as well, this is not the only point of you know discussion. There has been yesterday it was more of discussion on the sectoral aspect of the resources, including coal, where we also looked at just transition. We also discussed nuclear energy, gas and the kind of policy aspects that requires regulatory and pricing issues needs to be solved. There was also the discussion on nuclear energy which has always been on the sidelines largely since 2011 post Fukushima and also how discussed it was very interesting remarks on how technology is adopted or absorbed in itself is quite subjective. How the technology is deciphered, interpreted how it is perceived itself is a big thing on how certain technologies would be and operate much faster than certain technology did not. The focus of Shebonti on natural gas and the fact that there is this whole thrust by the government to try and push for natural gas is there. However, regulatory aspects of it, the pricing aspects need to be addressed.

In the context of coal, there was quite a lot of discussion. It's almost seems like it's the elephant in the room that nobody is actually picking up, and what happens to all the resource rich areas which actually then move towards scarcity? Much of the debate also as highlighted today on the SDG part is that the

localization of SDGs and specifically the role of energy in that context will be very critical over a period of time because energy, as everybody has already highlighted in terms of the goals as well is very, very critical for different activities in different points and for different indicators and different to achieve different goals. I think the aspect of localization of SDGs and the local and state level SDG frameworks need to be taken into cognizance. It is more visible to people that all these SDG goals have Inter connectivity to each other and the financial impetus which was discussed under the SGD. 17 rolls the ball across all industries.

Dr. Umbach also brought in the aspect of Green Deal especially from the energy sector. It was quite interesting because he focused on decarbonization issues. He also looked at aspects of how some of these things, specifically from the energy security and resilience aspects and what the EU Green Deal will mean for India as well. He also discussed the techno economic competitiveness that the Green Deal will probably also put forward was also discussed.

Pankaj: Thanks to all the panelists, the sessions were excellent and we even had European and German participation yesterday and Mr. Rashmi deserves special thanks for having steered both days. I would like to bring in the resilience aspect of the mankind, the human kind- humans is a better word. Humankind will survive all kinds of transition. It survived the transition from Bullock- automotive. Its ability to adapt to new circumstances works wonders for them, and that's how we have progressed. I will say thank you all for being with us and hope to see you in the next edition.

Draft Agenda

November 18, 2020 (Day 1)	
11.00 am–11.30 am	<p>Opening and Welcome Remarks</p> <ul style="list-style-type: none"> • Mr. Pankaj Madan, Deputy Head, India Office, Konrad Adenauer Stiftung • Opening Remarks- Mr. R R Rashmi, Programme Director and Distinguished Fellow, Integrated Policy Analysis Division, The Energy and Resources Institute (TERI) (TBC) • Special Remarks- Dr. Frank Umbach, Research Director of the European Centre for Energy and Resource Security (EUCERS), King’s College, London (tbc)
11.30am- 11.45am	<p>Presentation of Discussion Paper by TERI</p> <ul style="list-style-type: none"> • Ms. Swati Ganeshan, Fellow and Area Convener, Centre for Resource Efficiency and Governance, The Energy and Resources Institute (TERI) • Ms. Shailly Kedia, Fellow, Centre for Resource Efficiency and Governance, The Energy and Resources Institute (TERI)
11.45am- 1.00pm	<p>Session I - Conventional to Alternatives – Examining India’s Fuel future.</p> <p>Chair- Winfried Damm, GIZ/Nitya Nanda, CSD</p> <p>Speakers</p> <ul style="list-style-type: none"> • Dr. R. B Grover, Member of AEC and former Vice-Chancellor of Homi Bhabha National Institute (Confirmed) • Ms. Shebonti Ray Dadwal, Former Senior Fellow, MP-IDSA (Confirmed) • Dr. Dr. D K Tuli, DBT-IOC Chair on Bioenergy (Confirmed) • Mr. Souvik Bhattacharjya, Associate Director, Integrated Policy Analysis Division, TERI
1.00 -1.15 pm	<p>Concluding Session- DAY 1</p> <ul style="list-style-type: none"> • Mr. Peter Rimmele, Resident Representative, Konrad Adenauer Stiftung India office

	<ul style="list-style-type: none"> • Ms.Swati Ganeshan, TERI
19th November 2020 (DAY 2)	
11.00 am- 11.15 am	<p>Opening session</p> <p>Key issues discussed on Day 1</p>
11.15 am–12.30 pm	<p>SDGs for energy security and governance- Examining impact of energy on other SDG goals in India</p> <p>Chair- Mr. R R Rashmi, Programme Director and Distinguished Fellow, Integrated Policy Analysis Division, The Energy and Resources Institute</p> <p>Speakers -</p> <ul style="list-style-type: none"> • Mr. Jitendra Roychoudhury, KAPSARC, Saudi Arabia • Mr. Ajith Radhakrishnan, Senior Specialist, World Bank • Mr. Chandra Bhushan, IForest • Dr. Srikanth, Professor and Dean School of Natural Sciences and Engineering, NIAS
12.30 pm- 1.00 pm	<p>Closing Remarks & Vote of Thanks</p> <ul style="list-style-type: none"> • Ms. Swati Ganeshan, Fellow and Area Convener, Centre for Resource Efficiency and Governance, The Energy and Resources Institute (TERI)