CLEAN ENERGY SOLUTIONS CENTER
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100% Renewables: Pipe Dream or Reality?

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Webinar Panelists

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Sean — **Hello everyone. I am Stephanie Bechler with the National Renewable Energy** Laboratory and welcome to today's webinar which is hosted by the Clean Energy Solutions Center in partnership with Renewable Energy Policy Network for the 21st Century, REN21. Today's webinar is focused on 100 per cent renewables. Are they a pipe dream or reality? Before we begin I'll quickly go over some of the webinar's features. For audio, you have two options. You may either listen through your computer or over your telephone. If you choose to listen through your computer please select the mic and speakers option in the audio pane. If you choose to dial in by phone please select the telephone option and a box on the right side will display the telephone number and audio pin you should use to dial in.

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Finally, one important note of mention before we begin our presentation is that the Clean Energy Solutions Center does not endorse or recommend specific products or services. Information provided in this webinar is featured in the Solutions Center's resource library as one of many best practices resources reviewed and selected by technical experts. Today's webinar agenda is centered around the presentations from our guest panelists. Christine Lins, Dr. Sven Teske, Kanika Chawla, and Charles Murove who have joined us to discuss the full spectrum of views as to whether achieving 100 per cent renewables by midcentury is a pipe dream or a reality. This webinar draws on over 100 interviews with energy experts from around the world.

Before we jump in the presentations I'll provide a quick overview on the Clean Energy Solutions Center. And then following the presentations we'll have a question and answer session where the panelists will address questions submitted by the audience. And at the end of the webinar you'll be automatically prompted to fill out a brief survey so we thank you again for taking a moment to respond. The Solutions Center was launched in 2011 under the Clean Energy Ministerial. The Clean Energy Ministerial is a high level global forum to promote policies and programs that advance clean energy technology to share lessons learned and best practices and to encourage the transition to a global clean energy economy. 24 countries and the European commission on _____ covering 90 per cent of the clean energy investments and 75 per cent of global greenhouse gas emissions.

This webinar is provided by the Clean Energy Solutions Center which focuses on helping government policy makers design and adopt policies and programs that support the deployment of clean energy technology which is accomplished through support in crafting and implementing policies relating to energy access, no cost expert policy assistance and peer to peer learning tools such as this webinar. The Clean Energy Solutions Center is cosponsored by the governments of Australia, Sweden, the United States with in kind support from the government of Canada and Mexico. The Solutions Center provides several clean energy policy programs and services including a team of over 60 global experts who provide remote and in person technical assistance to governments and government supported institutions, no cost virtual webinar community on a variety of clean energy topics, partnership building with development agencies and regional and global organizations to deliver support and an online library containing of 5,500 clean energy policy publications, tools, videos and other resources.

Our primary audience is made up of energy policy makers and analysis from governments and technical organizations in all countries. But we also strive to engage with the private sector, NGOs and civil society. The Solutions Center is an international initiative that works with more than 35 international partners across a suite of different programs. Several of these partners are listed above and include research organizations like IRENA and IEA and programs like SE4ALL and regionally focused entities such as the ECOWAS center for renewable energy and energy efficiency.

A marquee feature of the Solutions Center is the no cost expert policy assistance known as ask an expert. The ask and expert services matches policy makers with one of more than 50 global experts selected as authoritative leaders of specific clean energy finance and policy topics. For example, in the area of renewable energy policy—excuse me, renewable electricity policy we are very pleased to have Paul Komor of the Renewable and Sustainable Energy Institute serving as one of our experts. And if you have a need for policy assistance in any theme lists there we encourage you to use this valuable service. Again, the assistance is provided free of charge and if you have any questions for our experts please submit it through our simple online form at cleanenergysolutions/expert. We also invite you to spread word about the service to those in your networks and organizations.

Now I'd like to provide brief introductions for today's panelists. First up is Christine Lins. She was the primary executive secretary of REN21 in 2011 and she has more than 20 years of work team experience in the field of renewable energy. Following Christine, we'll hear from Dr. Sven Teske who has over 20 years of experience in technical analysis of renewable energy systems and market integration platforms. We will then hear from Kanika Chawla who is a policy specialist working at the intersection of India's renewable energy and finance markets. And our final speaker today is Charles Murove. He's an engineer with over 34 years of experience in the energy sector both in public and private sectors in Africa. And with those introductions, I'd like to welcome Christine to the webinar.

Christine

Thank you very much Stephanie. Good morning. Good afternoon ladies and gentlemen. We will get up the slides in a minute. There they are. Excellent. It's our great pleasure to be again with the Clean Energy Solutions Center and to present to you the newly released renewables global futures report, great debates towards 100 per cent renewable energy. So REN21 is basically a stakeholder network that exists since 2005 bringing together actors from the private and the public sector. We are hosted by a UN environment in Paris, France and we are most known for our annual renewables global status report that we issue since 2005 which describes market industry policy investment trends, investment trends in cooperation with UN environments, global trends in renewable energy investment.

And we have seen that according to latest studies published by IRENA 2016 has been a year of record additions of 166 gigawatts of wind and solar. However, we saw that investment was down compared to 2015 so total investment in 2016 in renewable energy was in the order of $242 billion. And that's a reflection that the cost effectively for these technologies have come down. So more was installed but less investment volume. And what was also remarkable TIH has pointed out 2016 was the third year in a row where emissions related to the energy sector remained stable while the global economy grew three per cent. And the main reason for this emission reductions are energy efficiency and renewable energy investments in the US and in China. And this is very encouraging because we clearly see that renewables are really making their way to the mainstream interest of many

countries and are a central pillar in enriching the objectives of the Paris agreement.

And the rating of these objectives means nothing less than a total decarbonization of the energy sector. If the Paris agreement is to be reached and properly implemented we need to decarbonize the energy sector which of course is a huge task. But on the other hand, we thought based on the status of development already existing we thought of interviewing experts from all around the world about what they think about 100 per cent renewable energy future, whether it's a pipe dream or whether it's reality. And these experts interviewed were actually grouped into three categories. It was 114 in total. Some of them were conservative towards their attitude towards renewables, some moderate and some progressive. So we're really trying to give a full spectrum of opinion.

And we developed the standardized questionnaire and asked people to give their opinion on the feasibility of 100 per cent renewable energy future and then also on the macroeconomic impacts of such a future. In this exercise, we covered all regions of the world and we worked on this with different regional partners. For example, with the council on energy environment and water from India where Kanika Chawla works. Also in Africa with Charles Murove. And we then really got opinions from India, from China, from North America, South America. North America we worked together with the Clean Energy Solutions Center to then and then also we interviewed people in Australia Oceania and then of course some international experts and organizations.

The report was lead authored by Sven Teske from the University of Technology Sydney. And I'm very happy to have him here with us on the webinar. Basically, what we did is to cluster the results that we got together in 12 great debates and show. Because basically what we think is that the 100 per cent renewables, this is not an efficacy report about 100 per cent renewables. It's an analytic work showing what are the challenges and what are these what we call great debates that need to be touched in order to make such a reality come true.

This is a starting point. We're launching the report here today at the Sustainable Energy 4 All forum in New York. But we really see very much a starting point to organize debates on the subject between actors of the public and the private sector in order to get the discussion going because only by informed discussion and informed decisions can policy frameworks be set in a way that this 100 per cent renewables is a reality, is becoming a reality. We see already today that we have examples where 100 per cent renewable targets existed in companies, for example IKEA, Adobe, Google, ____ all have 100 per cent renewable energy targets. Of course, they do it to a certain extent out of corporate social responsibility reasons. But I think they mainly also do it because they understand that it makes economic sense.

And in many jurisdictions nowadays renewables are cost competitive and we have that, this 100 per cent commitments also done by cities such as San Diego, by islands, for example the Cook Islands have a 100 per cent

renewable energy target. And countries such as Costa Rica just to name a few. So we see it is becoming a reality but what we are really trying to do here is to outline what are the challenges, what are the issues and then to find solutions in the dialogue on how those can be overcome. And with this I'm going to hand over to Sven Teske, the lead author of the report to guide us through the main findings.

Sven

Thanks Christine. With no further delay I will just jump in the first results. I will—hang on. We—in the first category we had 100 per cent renewables is a logical consequence of the Paris agreement. And therefore, we asked the question is the transition to 100 per cent renewables on a global level feasible and realistic. And we have a broad range of different answers. But striking was that 36 of all the interviewed experts strongly agree and 35 agree. So altogether 71 per cent actually agree with that statement. 12 per cent were not decided yet and only 17 per cent disagree or strongly disagree. So the second question in this category was what will be the share of global renewable final energy consumption by 2050 so that includes heating and transport

And the result was that again more than 70 per cent of the experts expect the renewable energy share, the global one to at least double from currently 19 per cent to over 50 per cent, which leads me to the first conclusion that all experts actually agree that renewable energy deployment is able to expand in the future and that there is a technical and economic potential for renewables which is largely untapped. However, when asked about likelihood of achieving 100 per cent renewable future there was no consensus and despite the fact that two thirds of the experts actually agreed that it's possible, many experts did not really think it's actually necessary. So the 100 per cent renewables right now is not yet the logical consequence for all energy experts of the Paris agreement.

Second category is about, the second chapter that was about global energy development. And we asked to what extent the energy demand, global final energy demand will increase or decrease by 2050 in per cent compared to 2015. And the result was that 14 per cent believe that the energy demand will not grow any further. Those experts were usually from industrialized countries. While 65 per cent expect that the energy demand will increase by about one third. And only 29 per cent, more than 50 per cent, which is quite interesting because in many energy scenarios one of the weaker parameters in terms of future projections is always the development of the global energy demand. There are energy scenarios out there with forecast doubling of the energy demand. Interesting is that there seems to be not a consensus but the majority that the global energy demand will not double in the next 30 years again but *[Break in Audio]* by around 30 per cent.

In terms of renewable electricity, we asked what will be the estimated development of global renewable power generation share by 2050. Again, two thirds of the experts believe that it will at least double within the next 30 years from 28 per cent right now to over 60 per cent. There is also almost one third agreed that it will be over 80 per cent. So there's a strong support for future growth for renewable power generation. In terms of the renewable

power generation we asked in terms of the decentralized or centralized generation what will dominate by 2050. And again, about two thirds expect that decentralized generation will dominate over centralized power plants.

In terms of heating, there is a huge debate if renewable heating will increase and whether or not renewable heating will actually go towards electrical or thermal applications. First the share, the majority of the experts or almost 80 per cent expect renewable heating, the renewable heating share on the global level will at least triple within the next 30 years which is actually quite interesting because renewable heating is not the focus of the energy debate. The energy debate is always—renewable energy debate is always focused around power and now also batteries but not about heating. So it's striking that the majority of the experts believe that renewable heating will increase so much.

And the second part of the question was that we asked do you agree or disagree with the statement that the electrification of the heating sector will continue and will lead to an almost complete electrification. And 39 per cent agreed with that statement, 41 per cent disagreed with that statement and 20 per cent are undecided which basically means the race is still wide open. That does have a huge implication in the future because renewable heating on thermal applications or on electrical applications needs very different infrastructure. So there is an urgent need for a debate in what direction renewable heating will go.

Going to renewables for transport, we first ask the experts what they believe the share of global renewable transport energy consumption will be by 2050. There are two thirds of the interviewed experts expected renewable share to grow by a factor of 14 which was really surprising for me because right now renewables only contribute to three and a half per cent on a global level. And that so many experts believe that it will be over 50 per cent. We actually asked in this survey more than 100 questions and we obviously can't present all those questions and answers. So I can only tell you that it was really interesting to see that there is almost a consensus that electric mobility will dominate the transport sector in terms of road and person transport. So there is a global wide consensus that electricity will make it.

So there are three key topics that should be included in any future debate about renewables in the sector. The one is that how can we erase immobility and how can we organize expanded to public transport. Because most experts agree that the modular shift is required. So just to replace the combustion engine with an electric motor is not enough. So we also need to organize a mode shift that leads to public transport, other more innovative forms of transport would be powered by electricity but electric mobility is far more than just replacing the combustion engine with electric drives.

The second part of the transport debate is about possibilities for renewables in aviation. There is an urgent need for increased research and development. Up until now the only option for the aviation sector is biofuels. And the third part is shipping. Shipping is the backbone of the global freight transport and basically of the global trade. But we realized that it's one of the major

nonissues in the renewable energy sector. How to actually switch shipping and ships in general from fossil fuels to renewables, there is hardly any debate about that. The sixth chapter is about interconnection of sectors and we asked if the demand and supply management in smart home will be encouraged by pricing nodes by a different time dependent tariffs. And 63 per cent see pricing as the preferred mechanism for demand and supply management. So it seems to be that those different tariffs in the opinion of most experts play a major role to implement more smart technologies in terms of energy and supply management.

Moving to the seventh part which is storage. Even though lithium batteries right now dominate the global debate about storage it is very clear that there are many different technologies and there's no one size fits all because there are technologies required for second minute reserves for several hours but also for seasonal storage. And every technology has its advantages and disadvantages. And therefore, we see that there is a broad range of different storage technologies still to come. If we move to technology versus cost we ask in the coming decades the price of oil per barrel over $100.00 per barrel is almost certain. Interesting enough is that the only certainty is uncertainty. So the experts were very divided in what direction the oil price will go.

While we asked the same question about renewables our statement was the cost for renewables will continue to fall and will outpace all fossil fuels within the next ten years. Do you agree or disagree? And strikingly 67 per cent agreed that renewables will outpace fossil fuels and that's directed to all fossil fuels within the next ten years. That means if this really happens that the majority of the infrastructure projects of fossil fuels including maybe pipe lines, mines, new oil exploration, new coal power plants, that those investments could be dead on arrival because they have so long lead times between five and ten years from the first idea, from the first decision to actually production start that the minute those new applications would start production, renewables already are far cheaper than fossil fuels and that means that those new investments are stranded assets and uneconomic from the very beginning.

In terms of the economic framework we asked what will be annual global investment volume in renewable energy will be in 2050. Currently in 2015 it's $286 billion. Christine just said that the new figure is around $250 billion for 2016. And 63 per cent of all experts assume that it will at least double in the next 30 years. And connected to that is the work force, the majority of the experts—more than 50 per cent—expect the workforce even to quadruple, which would mean that the renewable industry would be on. With an equal size of the current industry on a global level and I think that's a very strong statement. In terms of the utilities of the future, it is clear to all experts that the future utility will have little in common with today's utilities and that business model will need to change significantly. But how those future energy markets should be designed is wide open. What are the necessary policy schemes to create a sustainable and long term framework that provides the necessary policies certainty which in turn creates a stable climate for investing in energy efficiency and renewables. There seems to be a huge

debate on a global level. There is no consensus right now what's the right framework. And combined together with the storage technologies we find that as the holy grail of the energy industry, what's the future business concept.

In terms of mega cities, we asked is decentralized energy technology will play a significant role. Even with space constraint mega cities will supply the majority of the power demand by 2050 so do you agree or disagree with that statement? And almost half the experts agreed that renewable generation can play a role even in space constrained mega cities. But it's very urgent we need to have more research and development in that field and also to have more case studies to see whether or not for example wind farms in industrial areas or in harbors, on near shore, off shore wind farms will actually be feasible close to mega cities. Plus, the whole discussion about how to integrate solar best in a space constrained environment like mega cities.

Last but not least, energy access. We asked if the experts agree or disagree with the following statement, decentralized renewable energy technology will not be enough to get access to energy for all, meaning that large scale conventional power plants are still required to provide energy access for all. And 66 per cent believe that renewables can supply enough energy for developing countries. And that's a very interesting statement but also a very important debate in the expert area because up until now the majority of the discussions about household supply for renewables. So access to energy is always about solar home systems or microgrids. But what developing countries also want is obviously economic development including industry. So access to energy must also include renewables for the industrial sector, must include renewables for the business sector in order to have a full supply. And the big issue is how can a country for example like China or like India actually move into the economic development without using fossil fuels to power the economic growth but leapfrog directly into renewables.

In conclusion, more than 70 per cent of the experts interviewed consider a global transition to 100 per cent renewables to be both feasible and realistic. And that's quite striking because I think if we would have asked that like five years ago we would not have such a high agreement. Also, there is an overwhelming consensus that renewable power will dominate in the future with many noting that even large international corporations are increasingly choosing renewable energy products either for utilities or through direct investments. Numerous companies, regions, islands and cities have set 100 per cent renewable energy targets.

Again, two third of the experts expect renewables to outpace fossil fuel industry within one decade. And while most experts see 100 per cent renewable energy supply economic realistic is it unclear if this will be reached by 2050 or later. So it's not a debate about do we actually arrive at 100 per cent but more when do we arrive there. And also, which is a very important thing it is unclear if the rapid renewable energy market upscaling will develop fast enough to avoid dangerous climate change which is obviously a very important issue and a very important topic. And with that I hand back to the moderator.

Stephanie Thank you so much Sven. That was really excellent. Next, we will hear from Kanika Chawla. Kanika can you hear me?

Kanika Yes, I can. Hi. So first up I'd like to thank Sven for that really good overview and congratulate both him and REN21 on an outstanding and very thought provoking research report. CEW is very proud to have contributed to the global futures report. The Council on Energy Environment and Water where I work and lead the renewable energy work is now for several years recognized as one of India's leading think tanks and also recognized as one of the top 20 climate think tanks in the world. Now we're an independent policy research institution that's based here in New Delhi and we've been working very, very closely with the ever-evolving renewable energy story here in India.

So the renewable energy story in India is actually fairly revolutionary. In just the last two years the renewable energy market has evolved rapidly. CEW's sort of involvement with some of that growth and both to watch, analyze and contribute to that evolving renewable energy story has been significant. Our work in renewable energy has ranged from doing the first independent analysis of the national solar mission that the country set in 2010 to more recently contributing to the scaling up of the target and doing both the scenario development as well as the investment requirement calculations for the government on that front.

To talk sort of a little bit more about how the findings of the GFR that are aggregated at the global level and how sort of they reflect what's happening here in India on the ground—India's international renewable, sort of international climate commitment as per it's NDC in the Paris agreement includes an almost sort of the largest piece of the NDC is it's renewable energy commitment. India's commitment part of the Paris agreement includes a phase down or a scale down of the GHG emissions which actually would be realized if it were to realize it's 40 per cent non-fossil fuel capacity target also as for the NDC. But those international targets are actually coming off the back of very important and strong commitment made in the form of domestic policy which is to realize 175 gigawatts of renewable energy capacity by 2022. And this announcement was made when India's total renewable energy capacity not including large hydro stood at a mere 37 gigawatts.

So India committed to 175 gigawatts of solar going to adjust 37 in a span of seven years. Today we have made sort of rapid advances especially in the deployment of solar and wind. But we are still only sort of a short way into the long journey. So the big renewable energy boom is yet to come. And it was actually on these exact issues and identifying the drivers for the large scale renewable energy deployment both that has happened in the last few years as well as that we're hoping is going to come in the coming years. And the perception around that is what we try to capture as input for the GFR. The renewable energy story in India is driven by sort of three demand side drivers and three supply side drivers. So on the demand side there's energy access. India is struggling with a gap between its energy demand and supply and as many as 45 per cent of all rural households continue to have no access to

electricity. So keeping that imperative in mind renewable energy continues to be a very, very important solution to plug some of this gap.

The other demand side driver is on energy security. India has growing imports of oil as well as coal and is exposed both to supply risks as well as risks within the market. And in this context again renewable energy plays a strong and important role in bridging some of the uncertainty that comes from the geopolitics surrounding conventional sources of fuel. And then the third demand side driver is around energy efficiency. As the economy grows rapidly at more than seven per cent every year, it's important that we also grow in a sustainable way. And so, renewable energy and energy efficiency together are a very important pillar of a sustainable growth trajectory going forward. On the demand—on the supply side in order to realize the growth ambition as well as the sustainability ambitions, it's important that renewable energy be supported by strong policy, access to affordable finance and both the creation of jobs but also the provision of skill development to meet those job requirements efficiently.

And keeping all of these in mind, the perception analysis for the GFR including, included us interviewing members from industry, sort of stakeholders from within government, civil society as well people in politics. And the findings actually I'd like to summarize the findings specific to India in five points which are actually quite similar to some of the great debates that Sven just discussed but also to the drivers that I just discussed. So 50 per cent of the interviewees for India said that 100 per cent renewable energy by 2050 is likely and could be a reality. It's interesting because India has a unique development. It's sort of in a unique position where it has a rapidly growing economy. It has very strong developmental imperatives. And yet it has a commitment to transitioning towards energy mix that has much more renewable energy.

It's also interesting and important to realize that much of India's renewable energy advances are happening within the electricity sector. So there is limited use of renewable energy for heating or for other end users. There is also now some work that's being done around electrification of transport as especially in the case of the railways both in the city and sort of natural areas but also metro rail systems. But even having said that the sort of focus continues to be on electricity. But there is a very strong focus on a greater role for renewable energy within that electricity mix. However, the interviews also suggest that there is no consensus on the political obstacles. And this isn't because there aren't any political obstacles. But there is much to celebrate especially in recent years where there is political certainty on the large-scale targets which have definitely nudged the market to move in the direction of rapid growth, declining prices of both solar and wind.

But there are sort of smaller issues especially around enforcement of renewable energy purchase obligations, the sort of things around the enforcement of the power purchase agreements, things like that. So there is the need for greater political interventions to nudge the market in the direction where it has more depth and the risk profile can be lowered which

actually at the end leads me to the third point which was well identified by many of the experts that contributed to this report from India where they identified the role of finance in making India's renewable energy dream a reality and one that doesn't just last in the pipe dream.

And so, the analysis that we've done here at CEW suggests that 70 per cent of a unit of solar electricity the cost—sorry, 70 per cent of the per unit cost comes from the cost to finance. In the case of wind, that's 60 per cent. So in order to really bring down the cost of both solar and wind it's important to bring down the cost of finance. And much of the cost of finance is contributed by the high-risk profile of renewable energy projects. But that isn't inherent necessarily to renewable energy technology but much more to the forces of the market or the renewable energy market including the health of the utilities as well as the business model of the utilities that haven't adapted themselves fast enough to the growing role of renewable energy in the electricity mix.

The other and sort of a follow point from that which would be my fourth insight into what the GFR says specifically for India is that experts have recognized the need to rethink subsidies. And this is something that sort of extends beyond the borders of India but the renewable energy is becoming a competitive market based energy source. It need not continue to get the kind of subsidies that it has enjoyed so far for great connected large scale solar and wind. But those subsidies could be redirected to more underserved sectors of the market whether it be decentralizing renewable energy, sort of productive users of renewable energy say for solar pumping, water pumping or processing food, things like that. But also, redirecting them to some market making mechanisms. For example, to lower the risk within the market so that more private finance can flow into the renewable energy market.

And then the last point that I would like to make would be around costs. So in the last few weeks, India has seen the cost of both solar as well as that of wind to come down to as low as five cents per unit. This includes—I mean solar is marginally cheaper than wind and these are also large scale utility or park sized projects where costs have come down this much. But these prices are close to being competitive to thermal power or power from any other source or any other fuel. But also, internationally what is interesting—and this goes back to the point that was made both by Christine and Sven is that you need less money to deploy more. So it's a really good time to be thinking and working and watching the renewable energy sector both in India and worldwide but also to be thinking about how we can take advantage and build on some of the opportunities that we have at the moment because of the advances of the renewable energy sector has already made to accelerate the pace at which it's being deployed.

Stephanie Wonderful. Kanika thank you so much for that presentation. If that is all from you, we will hand things over to Charles Murove. Charles, are you able to hear me? It looks like you're still on mute. Charles? All right. Just a moment. We're going to try to get Charles' audio back on track. While we're waiting if anybody has a question they'd like to submit now is a good time. Please enter those in the question pain. Charles, if you see the Go To Webinar toolbar and

you just want to click the orange button with the white microphone to unmute. Charles, can you hear me?

Charles Yes, I can hear you. Can you hear me?

Stephanie Wonderful. Yes, now we can hear you. Wonderful. We are ready to hear from you whenever you're set to go.

Charles Ok. I will start in a second. I think from the interactions that we had the general consensus seems to be that 100 per cent renewable energy by 2050 is only achievable if many of the existing barriers are overcome and only if certain conditions are met. Yeah? So we are saying that the many sufficient necessary conditions include for example availability of technology such as the energy storage and it being available to the region at low cost. That's one of the main issues that did come out. So there has to be conditions that are necessary and sufficient for 100 per cent renewable energy to be a reality. Yeah. One of the key issues also is that there has to be greater political will together with supporting instruments, policies, strategies and implementation plans as well as enforcement capacity. This has been put across as one of the key issues that inhibit wider access to renewables. There has to be political coherence across Africa for 100 per cent renewable energy to be achieved.

And also, it's quite clear that there is still a lot of fossil fuels across the African continent and that is what is currently available to many African countries. And therefore, it will take time for the countries to then move away from the resources that they already have to renewable energy, especially given the target of say 2050 which is only 35 years from now. This is considered to be a big ask because the issue is not whether Africa wants renewable energy. It's simply access to modern energy sources. That is the number one priority. This is how many of the experts were looking at this particular issue. Also, the issue around the need for significant amounts of resources to assist, to overcome some of the barriers that have been identified and the barriers are in various categories, financial, technology, human capital and because of those barriers it's quite conceivable that 100 per cent renewable energy by 2015 may not be easily achievable for the Africa region.

And there's no—it's not a homogeneous region. The infrastructure is not fully developed. In some instances where it is developed it's not adequate. Access to energy is very low. Therefore, the thinking is that it's not renewable energy that is the priority but it's just access to energy. And of course, it would be a pleasure if this access could be made possible by renewable energy. But the main priority is simply access to energy. When you look at many countries—I could give you an example maybe of Zimbabwe. Access to energy is only 40 per cent. So if we start thinking about this in other countries are lower and others higher. Therefore, it's not clearly visible that given such a low base we would then easily see a transition to 100 per cent renewable energy in 35 years' time.

One of the key barriers is obviously that much of the equipment, technologies talk about the hardware. Solar module, the inverters, the turbines, not even software. They're currently being imported into the region with limited local

development and manufacture. So if that trend does not change, this will continue to affect the cost of the technologies and in particular the rate at which the region will transition to renewable energy and 100 per cent renewable energy. The priorities of the north are not exactly the same as those in Africa. For Africa, the priorities include energy for cooking and heating at the basic level. Whereas what you're looking at in the north is something totally different. You are looking at end use devices such as cook stoves and associated fuels and basic lighting. But this aspect it was felt that this aspect was not adequately covered in the interview instrument.

Also, the region as mentioned before is not homogeneous region in terms of infrastructure development and access to energy and in particular aspect to electricity. So there's inadequate in some instances antiquated and poorly maintained grid infrastructure even at local and regional level. This was cited as an example where electricity could not for instance be effectively shared nationally and across regions. So it was felt that perhaps decentralized systems would play a better role in Africa also because of the sparse nature of the economics. Ok.

There is also a perception that the region now requires an energy mix to better mitigate risks such as drought. Obviously solar and wind are not water intensive technologies but they are intermittent. But on the up-side energy storage is coming in to assist to overcome this constraint so that we would be able to increase base load supplies just looking at the _____ during the day from solar or at night using wind as well. But we're able to store energy that can then be used during periods when the son or the wind is not shining. But also, some experts believe that fossil fuels are a better supply the base load power when compared to other technologies. I think this is a debatable issue but it's a point that was raised that with fossil fuels you can supply power during even you can supply base load power.

We mentioned that geographical spread of settlements and communities in the regions means that it will be expensive to extend power grids in electricity networks. And the resources are scarce anyway. So mini grids and decentralized energy and off grid community and individual _____ systems are seen to play a key role in improving access to millions of people in the region that have poor or little access to energy services. The other issue that came through is that as the technologies continue to mature and become readily available at lower cost, there's strong feeling that private consumers, individuals, communities, small businesses too will transition from being only consumers and will become producers. They will also produce their own energy. And this is likely to disrupt the traditional utility model where some consumers could even defect from the grid. So the utilities need to change their business models so that they do not lose out in the long run. So this will affect current utility business models and those utilities and businesses that fail to adapt and transition to the new dispensation will become losers in the future energy markets.

It's also felt that barring the barriers that exist in the region, there's still an opportunity for the region to take a different trajectory and leapfrog away

from fossil fuels and energy storage is seen as a game changing technology in the short to medium term particularly where the technology costs continue to come down. How am I doing on time?

Stephanie Charles, you're doing just fine. If you could wrap up in the next two to five minutes that would be wonderful.

Charles Ok. So some of the experts felt that both the conventional and renewable energy centralized and decentralized will be required. So it won't be either or. It would be required to meet the growing energy needs for the rural communities of the region. So it's either or. And some of the mega cities identified across regions such as Cairo, Accra, Johannesburg, Khartoum and so on will require a lot of energy and it may not necessarily just come from renewable energy. It might be—it will have to be from both centralized and decentralized energy.

Preference would obviously be if renewable energy could be utilized but the experts believe that the countries in the region will begin by using what's available to them unless resources are made available to make the transition. So my understanding of this is that there appeared to be no clear consensus and agreement on many issues among the respondents, especially the concerning the price of oil, trends in road transportation and technologies. Many of the respondents also provided very little information to, for us to form a view in that regard. And I think more work needs to be done in that area. I think I'd like to stop here now.

Stephanie Wonderful, Charles. Thank you. Yes, I'll take over from here. Thank you so much to all of our panelists. Those were excellent presentations and so many wonderful perspectives. We'd like to remind out attendees to please submit any questions they have in the question pane on the Go To Webinar tool bar. We will also keep up several links on the screen throughout for quick reference as to where to find information on other webinars or previously held webinars and today's webinar. So with that, I'd like to ask the first question which is for Christine. We've had a couple people wondering if you could provide a little bit more information as to the background of the experts selected and how that selection process was undertaken.

Christine Thank you very much for the question. Yes. So in total we had 114 experts. We did these selections. We had a long list of experts in each region which were drawn up by our regional partners. So we have CEW from India here with us today and Charles who assisted us with the African interviews but the selection for Africa for example was done in close cooperation with the SE4All Africa hub. We then had—in China we worked with the Chinese renewable energy association. For Latin America, we worked with _____. In Japan, we worked with the Renewable Energy Institute. So basically, our partners, our network partners in the different regions—for Europe it was the International Institute for Applied System Studies, IIASS. They came up with a long list of partners from all different constituencies, government, international organizations, NGOs, people in field of science and academia. And then so both the public and the private sector. And we had a long list for

each region and then we tried really to balance in order from there, from where they *[Break in audio]*

Stephanie Great. Thank you so much. The next question is—so we had someone asking for clarification on the growing energy demand. You said that at least 65 per cent of the experts expect it to increase by 30 per cent. A few had more than that. Was this simply based on population growth or was there a specific area that was going to grow in the future?

Sven I think that for me the added demand projection we basically asked for the final energy demand projection. We did not give any further information about like population growth or GDP development. But those experts were actually quite aware of that because every entity took about one and a half hours on the phone so there was really time to interact.

Stephanie Wow. Great.

Sven So that was—we're basically more than three weeks on the phone all together. And what the majority of the experts in developing countries, they said that it will increase significantly. But in industrialized countries people feel that the energy demand will not—the overall energy demand will not grow significantly although there wasn't strong consensus that the electricity demand will grow. But on the expense of for example primary energy because they have less fuels required for that.

Stephanie Great and so that also kind of roles into someone was asking for clarification for thermal and transport you said the electrification would grow but that's not necessarily additional. That's just in exchange of other fuels and other energy technology.

Sven Yes, but also—yeah, but also developing countries always and that's probably what will happen is that the transport and demand overall will significantly increase.

Stephanie Ok. Thank you.

Sven In their specific countries.

Stephanie Wonderful. Can you go into detail with—so we had—it's a sort of specific question but if an electrical network has say 50 per cent wind and solar to the annual electricity supply will it be reliable when combined with less than 20 to 30 per cent storage? How do you see that playing a factor going forward?

Sven Well, I mean that was not really part of the survey. But in another study I was involved in, we did a specific survey about the storage demand of Australia by grid area. Australia has four different grid regions. And we have done a very detailed survey about storage demand in Australia. And we found up to 40 per cent, 40—50 per cent reliable power generation solar and wind, the storage demand is actually not also 50, 40 or 50 per cent but around like 10 to 20 per cent. So it always—sure it depends also on the infrastructure in terms of the power network and how good the grid capacity and the interconnection

is. But storage actually comes in actually later. So usually up to 20 per cent, 30 per cent solar and wind, there's hardly any storage required.

Stephanie Wonderful. This next question is for Kanika. Kanika, do you—how does southern Asia power utilities view the changing solar—how will it change with the solar trend?

Kanika So the utilities are not happy about the growing renewable energy in the energy mix. And that's not something that's unique to India or south Asia. It's happened all over the world. They aren't adapting as rapidly as the evolution within the energy system and the deployment of renewables. So there's several aspects to it. There is the problems which are around grid integration and therefore sort of being able to offtake some of the power that's being generated. There's also problems around the financial health of utilities and that also adds to some of the risks in the sector as I had mentioned before because you're—the sort of credit rating of your off taker is poor and therefore the renewable energy developers end up in trouble with their financers.

And then there is the trouble around tariffs and costs. And that also has multiple nuances to it. But one utility that I'm happy with a lot of their commercial and industrial users moving away to renewable energy and that means that they are losing their highest paying customers because they cross subsidize electricity for residential and agriculture purposes from commercial and industrial users. And as that base goes down the utilities cost recovery sort of goes down as well.

The other thing as well as tariffs in India as I would imagine in most parts of south Asia are not free market determined tariffs. They are politically—I mean of course they have some aspect of supply and demand but they also have—they are also politically charged topics and therefore have some aspect of determination that's driven by the politics of the region. And so, they're unable to pass on some of the higher costs from integrating renewable energy, especially renewable energy that was commissioned a couple of years ago at tariffs that were quite high unlike the tariffs now which are fairly close to the tariffs proposed by thermal power.

Stephanie Wonderful. Thank you. Another follow up question for you Kanika for—oh goodness. There's quite a few questions have come in. I definitely don't think we'll have time to get to all of them. Regarding the solar PV installations, how many do you expect will be developed in the next four years?

Kanika Next four years?

Stephanie Yes.

Kanika Yeah. So the next four years' sort of would take us to 2021. So the target really is for 100 gigawatts by 2022. We are currently at ten. And that's fairly humbling to know that we are only one tenth of the way there but I'm still very optimistic of India realizing its solar target. Perhaps if not in 2022 but shortly after. But I would imagine that we could actually get there by 2022 if

we did enough to get private investment flowing into the sector, more private investment flowing into the sector. The major point around that is the reason that I am optimistic is because we've got sort of a market going. There's depth to the market and sort of every passing day there is a movement that's taking us forward and there's really not much that's setting us back. We're identifying and working on sort of solving some of the road blocks that have been identified in the sectors. I think all of that is quite heartening.

The other thing as well is that in the last 12 months we've had more capacity addition than ever before. So if we just keep going at that pace I think we get there. And the last thing I'd like to say the reverse auction system of commissioning solar capacity actually worked really well for India. It keeps the timelines short. It increases competition in the market and it brings down costs. And I think that in keeping sort of all of those variables in mind, there's a quite high likelihood that we'll get to the target.

Stephanie

Excellent. Thank you. This next question is for Charles. Charles, so we have someone asking on business opportunities locally, even if the basic infrastructure such as solar panels or converters are imported there might be business potential for developing models on how to sell, install, finance or trade panels, turbines, etcetera. Could this be an opportunity for new—could a bank that specializes in new business models that looks to grow and take on renewable energy markets elsewhere, is this type of business being discussed? Charles, it looks like you are on, still muted if you can click that. Yes, perfect.

Charles

What is happening is that there are various business models that are coming to the fore. You have models such as what is called pay as you go solar and you are looking at tier one which is sort of the bottom rung which is the entry level where the user would simply want to have lighting in the home. They would want to charge their cell phones. This is a big issue. And they would also want to listen to the radio. And these are basic, basic systems and there is a model now. It's called pay as you go. Zimbabwe has actually launched the one intervention on the 21st of March. But this is already common. There is the _____ in Zambia. There is also MCORPA in Kenya, in West Africa. So there are various business models that are coming into play to address the issue. It's basically an issue of access where the end users may not necessarily have the capital amount to pay off for the investment all at once. So you allow them to pay over a period of time. The pay as you go model is predicated on a technology where you use a mobile platform so you have to pay into the mobile platform for you to get energy. If you don't pay in you have no power. These mobile abilities come more and more to the fore and getting a lot of popularity.

But of course, there are other models that are coming through. If you look at an extreme case of South Africa you will be aware that there's been a successful program called REIPP the Renewable Energy Independent Power Procurement Program where the country has been able to from 2011 to 2015 have been able to contract over 6,000 megawatts of renewable energy, solar, wind and this model that has been utilized in South Africa is considered to be a successful model using the _____ agreement model. And this is the

finding themselves going across to the other countries. The difficulties that other countries face is that of risk. South Africa has a fairly sophisticated financial market which is not the same in the other countries. So there is difficulty in achieving bankability for some of the countries.

But with support from the global community you are beginning to see I will say to Zambia, the case in point where a purchasers' agreement was struck in the original seven cents on the back of support by the IFC and the World Bank which is a very good outcome indeed for the country. Other countries are also learning from these experiences. So yes, there are different business models that are coming to play from the tier one—what I call the tier one is the small users, through to bigger users and where you allow access through financial mechanisms and innovations. And then also at utility scale, this is coming through. We're actually going to Nigeria last week or April. There is a conference there that is looking at some of these business models that are being applied across South Africa. So yes, there have been barriers but also solutions are being found to enable more and more access to clean energy.

Stephanie Wonderful. Thank you so much. And along the lines of energy access this question is for Sven. How does the 100 per cent renewable energy target figure in the priority list for developing countries or under developed countries where energy access is more of a concern? Sven, it looks like you're muted.

Christine I could make take this question.

Stephanie Christine, that would be wonderful.

Sven Christine, go ahead. Yeah.

Christine Yeah. So I mean what we see all around the world and we were quite positively surprised by this is that over two thirds of the experts, over 70 per cent say that a 100 per cent renewable energy future is feasible and realistic. We see of course that in the industrialized countries are more optimistic about this, especially experts in Europe and Australia and they're a bit more reluctant in Africa, in India and in Latin America mainly because there, the main focus is on the _____ agenda and not so much on the 100 per cent renewables agenda which I think is understandable. However, when you look at cost situations of renewables today we see that in many jurisdictions they are already now cost competitive. So countries actually have an interest in investing in renewables and making sure they are access provided is provided with renewables because otherwise they lock themselves in in much more expensive assets and they will have lots of stranded assets.

Having said that and I think Charles mentioned within one of his comments. Often the issue is access to technology and to technological solutions. And also, often it is a lack of awareness that renewables can provide reliable solutions for situations. Yes, they are reliable but they can be very well—their output can be very well predicted. And I think also where a program like Sustainable Energy 4 All and where we also try to help with these debates that we are aiming to create with this global futures reports is to create the

awareness that this is something that is feasible. And of course, it is important also to make sure that businesses are created, that these technologies are becoming available in all the different countries. So still a long way to go, a bit more reluctance on the developing countries. But overall I would say a very, very positive picture. I was just thinking myself if we would have done this report a decade ago, people would have not believed in it because it was—it was very abstract.

But with these commitments that I mentioned at the outset of companies, of countries, of regions to really go 100 per cent renewables, this reality has become much more tangible and I'm optimistic that the global renewable report will help to broaden the discussion and the debate. And we will definitely at REN21 carry that forward. So you mentioned that there were lots of questions. We would be happy also to answer them because we really see this offline and we see this as a start of a string of debates and debate platforms that we are aiming to initiate all around the world.

Charles Hello, Steph.

Stephanie Hello. Charles?

Charles I think what Christine has just said there, I think this is an important aspect of the work. I think we have only been able to reach out to so many, to a limited number of stakeholders. And I think there is need to expand the outreach to increase the awareness and to provide more information around these issues.

Stephanie Wonderful. Thank you so much. We have a few more questions. Unfortunately, Kanika is having to leave the webinar right now so we will forward—there's a few more questions for her that we'll forward to her after the webinar concludes. Another question right now for Christine and Sven. Can you give us some more details on the total renewable output for the future of biomass and how it might differ in future years? I think you touched on it a little bit with heating but did you have any other details on biomass from the survey?

Sven Yeah. We had actually in our survey we had more than 100 questions. We had one technical part where we asked very, very specific questions about different technologies. And we were actually a bit surprised and I personally was a bit disappointed that only one third of the interviewees answered all the technical questions which became clear that the majority of—we interviewed a lot of very high level experts, that those experts are focused on the economic aspects, on the policy aspects but are not really into the technology itself. So the technology debate sometimes is of a lower priority obviously for many experts which for me as an engineer it's a bit disappointing.

So I would actually like to see far more technical debate about what is best basically in terms of the system integration and stuff. But what these one third of the experts answered in terms of biomass and bioenergy was that bioenergy is seen especially for industrial heat applications, for transport asset which is very difficult otherwise to supply with electricity for example aviation and shipping. So biomass moved in that more difficult sector in the

opinion of many experts and will not be used for normal households let's say. Because the other technologies like electric heating or solar collectors for solar heating are available. But biomass always was the backup for everything which was not really possible to supply by electricity or by other renewables.

Stephanie

Excellent. Well, thank you so much everyone for taking the time to submit your questions. I'm afraid we still have quite a few questions and we don't have time to get to them right now. We will be exporting all of those as soon as the webinar concludes and forwarding them to the panelists offline. So now we'd just like to wrap things up. On behalf of the Clean Energy Solutions Center, I'd like to extend a thank you to all of our panelists and the attendees for participating in today's webinar. We really appreciate your time and hope in return that there were some valuable insights you can take back to your ministries, departments or organizations. We also invite you to inform your colleagues and those in your networks about the Solutions Center resources and services including no cost policy support through our Ask an Expert service.

I invite you to check the Solutions Center website if you would like to view the slides and listen to a recording of today's presentation as well as any previously held webinar. Additionally, you will find information on upcoming webinars and other training events. We are also posting the recordings to the Clean Energy Solutions Center YouTube channel. Please allow about one week for the audio recording to be posted. Finally, I would like to take a moment to ask you to please complete the short survey that will appear when we conclude the webinar. And with that, please enjoy the rest of your day and we hope to see you again on future Clean Energy Solutions Center events. This concludes our webinar.