

From a Renewable Electricity Transformation to a Renewable Energy System Transformation: Renewables in Heating, Cooling, and Transport

—Transcript of a webinar offered by the Clean Energy Solutions Center on 21 June 2018—
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Webinar Panelists

Hannah E. Murdock
Ute Collier
Holger Dalkmann

This Transcript

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Katie

Today's webinar is focused on "From a Renewable Electricity Transformation to a Renewable Energy System Transformation Renewables in Heating, Cooling, and Transport." Before we begin I'll quickly go over some of the webinar features. For audio you have two options: you may either listen through your computer or over the telephone. If you choose to listen through your computer please select the <mic and speakers> option in the audio pane. Doing so will eliminate the possibility of feedback and echo.

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. If anyone's having any technical difficulties with the webinar you may contact the go-to webinar help desk at 888-259-3826 for assistance.

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Finally, one important note of mention before we begin our presentation is: the Clean Energy Solutions Center does not endorse or recommend specific products or services. Information provided in these webinars is featured in the Solutions Center resource library as one of many best practice resources reviewed and selected by technical experts.

Today's webinar agenda is centered around the presentations from our guest panelists: Hannah Murdock, Ute Collier, and Holger Dalkmann, who have joined us to discuss "A Renewable Electricity Transformation to a Renewable Energy Transformation: Renewables in Heating, Cooling and Transport." Before we jump into the presentations I'll provide a quick overview of the Clean Energy Solutions Center. Then following the panelists' presentations we'll have a question and answer session where our panelists will address questions submitted by the audience. At the end of the webinar you'll be automatically prompted to fill out a brief survey as well. So, thank you in advance 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. Twenty-four companies in the European Commission are members contributing to 90 percent of clean energy investment and responsible for 75 percent 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 technologies. This is accomplished through the support in crafting and implementing policies relating to energy access, no-cost expert policy assistance and peer-to-peer learning and training tools such as this webinar. The Clean Energy Solutions Center is co-sponsored by the governments of Australia, Sweden and the United States, with in-kind support of the government of Chile.

The Solutions Center provides several clean energy policy programs and services, including a team of over 60 global experts that can provide remote and in-person technical assistance to governments and government-support institutions, no-cost virtual webinar trainings 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 over 5,500 clean energy policy-related publications, tools, videos and other resources. Our primary audience is made up of energy policy makers and analysts from governments and technical organizations in all countries. But we also strive to engage with private sector NGOs in 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 the partners are listed above and include resource organizations like IRENA and IEA and programs like SEforALL, and regional focus entities such as ECOWAS Center for Renewable Energy and Energy Efficiency.

A marquee feature the Solutions Center provides is a no-cost expert policy assistance known as Ask an Expert. The Ask an Expert service matches policy makers with more than 60 global experts selected as authoritative leaders on specific clean energy finance and policy topics. For example, in the area of energy access we are very pleased to have Alexander Oates, CEO

of SE Strategies, serving as one of our experts. If you have a need for policy assistance and energy access for any other clean energy sector we encourage you to use this valuable service. Again, this is provided free of charge.

If you have a question for our experts please submit it through our simple online form at cleanenergysolutions.org/expert. We also invite you to spread the words about this service to those in your networks and organization.

Now I'd like to provide some brief introductions for our expert panelists today. First up is Hannah E. Murdock, who is a project manager and analyst at REN21, where she coordinates the Renewables Global Status report. REN21's flagship report, published annually since 2005.

Following Hannah, we'll hear from Dr. Ute Collier, who is a senior program leader in the renewable energy division of International Energy Agency, IEA. She leads IEA's work on renewable heat and on renewable energy policies.

And our final speaker today is Holger Dalkmann, who is the interim secretary general for the Partnership on Sustainability, Low Carbon Transport. Holger has over 20 years of experience working in the field of transport, cities, sustainability and climate change.

And with those very brief introductions I'd like to welcome Hannah to the webinar.

Hannah

Thank you, Katie. Thank you also to the Clean Energy Solutions Center, as well as my fellow panelists, Ute and Holger. And as mentioned, I am Hannah Murdock. I'm the project manager for the Global Status report at REN21 and also analyst. And I'm going to go briefly through some of the main findings from our most recently launched Global Status Report, which was released earlier this month.

Katie

Hannah, I'm so sorry to interrupt. We can see the presenter mode and not the slideshow mode right now on your screen.

Hannah

Okay. I'll try to start it again.

Katie

I think what we'll do is we'll take it back really quickly and then pass it back to you. And if you just want to show your second monitor that will fix the problem. You'll see the popup on your screen once again. And if you just want to select your Monitor 2. There. It looks wonderful. Thank you so much. Sorry to interrupt.

Hannah

Okay, great. Thank you. Apologies also from my side.

Just some background on REN21 first with the Global Renewable Energy Multi Stakeholder Network that's connecting a wide range of key actors. Our goal is to facilitate knowledge exchange, policy development and joint action towards a rapid global transition to renewable energy. REN21 is bringing together government, NGOs, research and academic institutions, international

organizations and industry to learn from one another and build on perspectives that advance renewable energy. The REN21 network is supported by our LEAN Secretariat based at the United Nations Environment in Paris, France.

So, REN21, Renewable Global Status Report provides an annual look at the advances in renewable energy market, the policy framework and industries globally, and the production of the report builds on a multistakeholder community of over 900 experts who have helped REN21 produce what is today one of the most widely-referenced reports in the sector.

This year's GSI28 team marks 13 years of REN21 reporting and includes thousands of data points and documents along with personal communication from experts who are located around the world to provide the most up-to-date information available.

So, now jumping right into the findings of the report. 2017 was another record-breaking year for renewable energy with total global renewable capacity up almost nine percent compared to 2016, to approximately 2,195 GW at year's end. This development was mainly driven by solar, PV and wind, with PV representing more than 55 percent of newly-installed renewable power capacity in 2017, followed by wind at 29 percent.

This development is also reflected in global investment figures. Global new investment and renewable power and fuels, not including large hydropower, was close to \$280 billion in 2017 as estimated by DNES. This represented two percent in increase in investments compared to 2016, which means that although renewable costs keep coming down, particularly for solar, PV and wind, investment in renewable power and fuels is actually increasing.

Developing and emerging countries also widened their lead compared to investment in development countries. But also, to keep in mind from looking at that these investments don't include investment in renewable heating and cooling technologies for which data are not collected comprehensively globally. The IEA reported that global investment in solar thermal heating technologies increased federally until 2013 but then fell each year through 2016.

Renewable power technologies continue to attract for more investment dollars than did fossil fuel or nuclear power generating plants. An estimated \$310 billion was committed to constructing new renewable power plants in 2017, and this compared to approximately \$103 billion committed to fossil fuel fired generating capacity and \$42 billion for nuclear power capacity. So, overall renewable energy accounted for about 68 percent of the total amount committed to new power generating capacity in 2017.

And also, the share of renewable energy and total final energy consumption remains low. It keeps rising with modern renewables representing 10.4 percent in 2016, which is 0.2 percent more than in 2015, mostly due to the impact of growth in solar, PV and wind. We'll see, though, however, that the development differs significantly between the sectors.

As renewable uptake has mainly been driven by solar, PV and wind, the uptake is mainly happening in the power sector, and taken together renewables accounted for an estimated 70 percent of net additions to global power generation capacity in 2017 and provided 26.5 percent of global electricity demand. Again, much of this progress is due to the falling cost of solar, PV and wind, which is made possible by technological innovation and changes in markets, effective policies and new business models. But it's safe to say that the global energy transition is well under way in the power sector, which shows that it is indeed possible.

Renewable power generating capacity saw its largest annual increase ever in 2017, with an estimated 178 GW installed worldwide, raising the total capacity by almost nine percent of 2016. Solar PV installations led the way, and nearly doubled those of wind power, which was in second place. And adding more net capacity than coal, natural gas and nuclear power combined in 2017.

Total renewable power capacity more than doubled in the decade 2007 to 2017, and the capacity of non-hydro renewables increased more than six-fold. At least 98 GW of solar PV capacity was added worldwide, which is the equivalent to the installation of more than 40,000 solar panels every hour. And the total global capacity by the end of the year reached at 402 GW, which was a 33 percent increase from the previous year. In wind, 52 GW of capacity was added in 2017 which increased the global total by about 11 percent so some 539 GW.

So, the good news in the power sector is with solar PV and wind rising many countries show that high shares of variable renewable energy can and are being successfully integrated into electricity systems across the globe without affecting grid stability. And penetration reached significant levels in many regions in 2017 with the leaders being Denmark at 52.9 percent, Uruguay, Germany and Ireland.

Looking now at the other sectors the share of modern renewable energy and heating and cooling reached 8.4 percent and modest improvements were achieved throughout the year, but renewable heating and cooling remained constrained by low fossil fuel prices and a lack of policy support. In 2017 the vast majority of renewables continued to be supplied by biomass with smaller contributions from solar thermal and geothermal energy.

[Audio static] technologies, but just keep in mind that you'll be able to find a lot more detail when you are actually looking into our reports at REN21.net. For CFP 100 MW of capacity came online in 2017, bringing global capacity to around 4.9 GW. And several projects that were due to interoperation during the year were delayed until 2018 or later. But there's a pipeline of about 2 GW of projects that were under construction around the world, particularly in China and the MENA region.

Globally 35 GW thermal of capacity of glazed and *[audio static]* heating/cooling sectors was newly commissioned in 2017. The total global capacity was an estimated 472 GW thermal by the end of the year. And gross

additions for the year were down three percent from 36.2 GW thermal in 2016.

Looking now at transport, in 2017 global biofuels production, which closely tracks demand increased around three percent compared to 2016, reaching 143 billion liters. Biofuels production and use are very concentrated geographically with more than 80 percent of production taking place in the U.S., Brazil and the EU combined.

And the total renewable energy share in transport was only 3.1 percent with liquid biofuels making up the vast majority of the renewable energy share in the sector. However, electrification continues to expand and is representing great opportunities to integrate renewables in the sector, in particular in rail and road. It also offers the opportunities to facilitate the integration of variable renewable energy. Electric passenger vehicles on the road passed the three million mark in 2017, even though annual sales are still only a very small proportion of the global market, about one percent. But further policy support for renewable energy in the transport sector is needed to build on these existing synergies.

So, the power sector on its own will not deliver the emissions reductions necessary under the Paris Climate Agreement, or the aspirations of the sustainable development goal seven: to ensure access to affordable, reliable, sustainable and modern energy for all. The heating and cooling and transport sectors, which together account for about 80 percent of global total final energy demand are lagging far behind. They also account for the majority of energy-related CO₂ emissions.

Looking at a further breakdown of this figure you can see that renewable electricity is starting to play a role in heat and transport, but this is still quite small. Traditional biomass continues to make up almost two-thirds of renewable energy and heat. So, if we're serious about climate goals we need to speed up renewable energy and power, but also in heating and cooling and transport. Policy support and targets are essential to make this happen.

By the end of 2017 at least 179 countries had implemented renewable energy targets at the national or state/provincial level, up from 176 the year before. Forty-eight countries have renewable heating and cooling targets, while 42 had transport targets, and 146 countries had renewable power targets. Also, typically in the power sector these targets are more ambitious. You can see in the chart that they're reaching 100 percent. And at the same time 87 countries had economy-wide renewable energy targets.

In terms of 100 percent renewable energy targets, they're now 57 countries with 100 percent renewable electricity targets, however the number of countries with 100 percent targets for the other two sectors falls to one.

Policy support for renewable energy in 2017, as in past years, also focus mostly on power generation, whereas support for the other two sectors continue to develop at a slower pace. As of the end of the year a total of 151

countries had implemented renewable energy policies of some kind, including regulatory policies, fiscal incentives or public financing. And looking at the breakdown by sector 128 countries had regulatory policies for the power sector. This falls to 70 countries when you look at transport and 24 countries with heating and cooling regulatory policies.

Carbon pricing policies were in place in 64 jurisdictions worldwide in 2017, either carbon taxes or emissions trading system. If well-designed carbon pricing policies may incentivize the deployment of renewable energy technologies by increasing the comparative cost of higher emissions fuels and technologies by including at least some externalities. However, there's still some uncertainty as to whether these mechanisms are sufficient to drive the deployment of renewable energy, particularly in this power sector.

Although numerous measures have been adopted in recent years to scale up the use of electric vehicles few efforts have been made to directly links renewable electricity production and EV use, or to ensure that EVs work to support the integration of renewable energy into energy supplies. There are limited examples of policies that encourage or mandate the use of both renewable energy, renewable electricity and EVs. However, countries with targets for both EVs and renewable energy and power may encourage the use of renewable deployment for transport, and government also supporting EVs through public procurement.

Another big trend is increasing corporate procurement of renewables as of in 2017 corporations had actively sourced 465 kWh of renewable electricity across 75 countries. The IT sector purchased the largest amount of renewable energy through wind power and solar PV PPAs. Companies are also increasingly investing in renewables for heating and cooling and transport.

When looking at the global energy transition it's also important to look at the regional differences, for example trends in renewable energy investment varied a lot by region. In 2017 China, Europe and the United States accounted for nearly 75 percent of the global investment in renewable power and fuel. However, on a pure GDP basis many developing countries are investing as much as or more than from developed in emerging countries. Top countries in 2017 for overall investment were developed in emerging countries with China, U.S., Japan, India and Germany in the lead, while developing countries took the top spots for investment per GDP.

This is particularly important in the context of the FDGs, especially FDG 7.1 on reaching universal energy access. Approximately 1.06 billion people, which is about 14 percent of the global population, lived without electricity in 2016, though this was about 125 million fewer people than in 2014. Also 2.8 billion people lived without access to clean cooking facilities, which is 38 percent of the global population and about 50 percent of the population in developing countries. The vast majority of people without access to electricity and clean cooking are in sub-Saharan Africa and the Asia-Pacific region, and most of them live in rural areas. But renewable energy offers many opportunities to tackle this challenge in the market where distributed renewable systems are thriving.

So, all in all renewables are increasing in all sectors but the uptake needs to be accelerated and scaled up particularly in transport into heating and cooling, especially in view of climate and development goals. The overall share of renewable energy and total final energy consumption have increased only modestly in recent history. A primary reason for this is the persistently strong growth in overall energy demand as a result of economic development of emerging markets as well as population growth.

Energy-related CO₂ emissions also rose by an estimated 1.4 percent for the first time in four years. There's uneven progress between the sectors and between the different geographical regions and a fundamental disconnect between commitments and real action on the ground. So, simply put the global renewable energy transition is progression but still far too slowly.

So, what do 2017 developments teach us? That renewable energy power developments show that a transition is possible, which is good news, but we need to move from a renewable electricity transition to a renewable energy transition. This requires a more integrated systems approach and creating more of a level playing field as for *[inaudible]* fossil fuel subsidies, which are still two to five times higher than for renewables. And thinking about activities at the local level and in developing countries we need to make sure that all trends are visible. So, a lot is happening but the data is not consolidated. That means renewables at the subnational level distributed off-grid renewables, innovative business models and so on.

So, with that I will invite you to join the REN21 network. You can subscribe to our newsletter to get regular updates about renewable energy development globally and download, free of course, all REN21 reports, including the most recent global status report from 2018. We also have data packs available, all infographics and videos, and it's all online at REN21.net. Thank you.

Katie Wonderful. Thank you so much, Hannah, for that REN21 introduction to the report and we would like to welcome our next expert to the webinar, and that's Ute Collier. Dr. Collier?

Ute Hi. Good afternoon, everyone. My screen is showing, yes?

Katie Yes. It looks great, and you sound great as well.

Ute Excellent. Okay, as Katie has said, I'm from the International Energy Agency. I think most of you probably know who we are but just briefly: we are an international organization based in Paris we were have 30 member states, but another eight associated as well. And they really cover all the world's—almost all the world's _____ energy consumed as—and we work with all these countries.

So, what I want to do is really pick up from Hannah's presentation the issue that heating and cooling are incredibly important yet they are lagging behind. So, just briefly to talk about what some of the issues are and how some countries have managed to make more progress than others.

So, start with—so around half of energy is consumed this way. You'll notice that _____ is just a little bit _____ and from Hannah's side is just to do with the way you treat statistics. This is final consumption to _____ some non-energy use. But you know, _____ around 50 percent. And yet everyone talks about electricity, gets excited by electricity. But once you strip out the electricity that's used for heat, which is actually quite a lot in U.S. and parts of Europe and _____ electricity in some countries, the rest of our electricity is only 15 percent. So, you could really argue that with policy makers the focus on electricity is somewhat misplaced, notwithstanding that of course from a CO₂ perspective it is important. But clearly heat is something that needs much more attention.

And cooling as well, you saw that I mentioned cooling in my first slide. Well, at the moment cooling accounts for only three percent of energy consumption. It is growing fast, however, so it's not something you ignore, but there is a reason why at the moment we need to focus somewhat more on heat.

And then Hannah already mentioned this as well, obviously most heat is being produced by fossil fuels, _____ traditional use of biomass. And the modern renewables, well, roughly around ten percent. I mean you've got nine percent *[inaudible]* accounting, and most importantly most of it is fossil fuels or it's electricity produced by fossil fuels. And that can mean certainly _____ actually quite an important contributor to energy related to CO₂ emissions. So, almost 40 percent. *[Inaudible]* target, you better think about heat. But also, it's, as you know, _____ benefits. So, for example in China a lot of the urban air pollution is actually created by *[audio static]* burn coal _____ to put into the district heating _____ the Chinese are starting to address that. And energy security benefits is also very important because most countries depend on fossil fuel imports, so in many countries it's gas that's being used for heat and, you know, there's been many disputes around gas imports.

_____ recently published some data on tracking energy against sustainable development targets, which you can find on our website. It's called Tracking Clean Energy and it's a tool which looks at a whole range of sectors and subsectors, so anything from electricity to _____, whatever. But we have looked specifically at many of the _____ where we've taken one of our scenarios from the World Energy Outlook and looked at what, to achieve, to be on the trajectory towards the climate target and sustainable development targets where *[inaudible]* in 2030, and where are we now.

So, you can see we've got a long, long way to go and *[inaudible]* on which technologies, so similar from biomass that you in particular need to ramp up solar thermal heat and also renewable electricity that's used for heating. So, this is quite a challenge. And obviously as you already said, we're lagging behind in almost every country.

So, what is it that's so difficult about renewable heat? In fact, there are actually multiple barriers. And _____ guarantees—if you're more interested

I've got some—I'll show you some publications _____ produced which give you much more detail and _____.

So, in many cases we are talking about higher capital costs. In fact, that's something we have in common with renewable electricity as well. And of course, in some of these cases we've put high capital cost but we've got very low running costs. Solar water heat [inaudible] put in a few. And markets don't deal very well with that; consumers don't do very well with that. In some cases, the overall costs are also higher than the equivalent, which is maybe a gas boiler. But one of the problems, of course, is that you've got low fossil fuel prices.

Now they do vary from country to country. Some countries actually tax gas quite a lot. I'm speaking to you from Stockholm, as Sweden has had energy and carbon taxes for a long time. And actually, here hardly anyone uses gas for heating because it's simply too expensive for people to have either connected to district heating, which is mainly run on biomass. I'll show you later all _____ use heat pumps. But then there are many other countries [inaudible] United Kingdom, or the United States, a lot of gas-producing countries like Russia have very low gas prices and it's very difficult for anything to compete with gas heating.

There are some suitability issues. So, there are a number of different renewables and solar thermal, geothermal, biomass. Okay, you wouldn't be able to put in a biomass boiler in a _____ apartment. You would have issues of access, bringing the pellets or other fuels, there may be some limits in terms of air pollution. In industry there are lots of different temperature requirements, and especially that very high temperature, same with steel industry. It's quite difficult to heat with biomass, especially sustainably.

At the same time there are plenty of industrial processes where you can use renewables and indeed they're already used widely. And in some cases, very, very cost-effective [inaudible], especially where you have _____ products like for example in the wood industry where you have wood chip which you can then use to produce heat.

Generally, there is also a lack of awareness. People have been using fossil fuels for a long time, and especially as it's often end consumers who have to make choices. They may not even know that return heat exists and the installers don't necessarily promote it either. In fact, in some countries there's a total lack of supply chain. So, you may think you want a new pump but you wouldn't be able to source it anywhere.

And finally, just a general issue of consumer inertia. So, you only generally buy a new boiler say if your household or where your old boiler breaks down or is very close to breaking down. Well actually that's also a time where you [inaudible] purchase and then you just go and buy whatever your installer advises you, which is generally a gas boiler.

So, these are some of the barriers. And to overcome them you do need policy. And as we've seen in Hannah's presentation policies are not as common for

heat as they are for electricity, and you do need different approaches in different countries. Electricity is electricity wherever you are *[inaudible]*. And here you have countries with different infrastructures, with different heat needs, etc.

So, when we reasonably work together with REN21 and IRENA and we produce a report *[inaudible]* for energy policies we broke down the heat challenge into four different clusters where we looked at different country contexts which you commonly find and where heat *[inaudible]* distantly with heat _____ or apply different heat policy measures. So, one plus that we looked at was countries that already have a lot of district heating, again, like here in Sweden; other Scandinavian countries or _____ countries like Iceland which manage to exploit geothermal. So, the policies applied there tend to be very different.

They also often have very long-term commitments because it takes a long time to build up this infrastructure. But once you have it it's absolutely excellent because it's flexible. So, in this once you have the infrastructure you can—you might have started it on gas CHP combined heat and power boilers but these days you may have some geothermal _____ from Paris, where you drill down into the aquifer and pull up hot water. You may use some biomass and you may use lots of innovative *[inaudible]* waste heat like from the metro or data centers, etc.

Then we have countries like the United States, like the Netherlands, like the U.K., for example, where there's very little district heating and natural gas is very widespread. And then cluster-free industrial heat and hot water, very different things. You might _____ think _____ a lot of off heat, but actually it does in industry and for hot water. And then finally in cooking. And all of these will require different approaches. And what works in one country doesn't necessarily work in another country. But so, let's *[audio static]* we learned. _____ adapted.

So, just to briefly give you a few points from Sweden, for example. So, Sweden has seen amazing transformation from using lots of fossil fuels, coal, heat and oil in its district heating system in the 1990s and now you will find _____ energy, what else—obviously _____, municipal solid waste and then a number of other fuels *[inaudible]* solar heat being input now.

What are the key success factors? Well, to start with they've had a very long-term commitment to heat and building up the district heating systems. So, this goes back to the 1970s when it was very much an energy security issue because they've had to import all these fuels.

Next, ambitious targets they set all the time which are very important because you need to know where you're going. Public investment—because if you're building big infrastructure it's often very difficult to rely just on the private sector, so there's often _____ authorities involved. High energy efficiency standards, because it's very important to have efficiency buildings as well. Obviously *[inaudible]* resource.

So, Sweden is, apart from Iceland, which obviously has *[inaudible]* geothermal, it's almost 100 percent renewable, Sweden is probably the country with the highest percentage of renewables. So, then looking beyond space heating, at countries where the issue is more about hot water, or especially as populations—people get richer, they actually want the comfort of hot water. I mean obviously originally you wouldn't have had much hot water in some hot countries, but you _____ that more and more now. And many countries around the world have had successful solar water heating policies over many years.

It was actually, Israel, which pioneered this in the 1980s with building code mandates of *[inaudible]* say, "Well if you build something new you have to do it with solar water heating." And they've spread over time. And now you find them in many countries often done at city level, so some European countries, but also somewhere in the U.S.—I think it might be San Francisco has done—you find them in some Chinese cities; in fact, China is the world leader in solar water heating, and in Brazil. And it's been very successful but we do now see a global market that is declining because electricity seems to take over in some of these countries.

Renewable heating industry—there is really great potential; I always mentioned that, and some countries have been very successful at using that. But this is—if you think heat is already the Cinderella of renewable energy policy within the industry it's actually the area where you find the fewest policies. So, you see in some countries like France, which has specific instruments for promoting renewable heat in the industry they have been very successful. And in some countries they're similar to even Paris for industry. But it's still a sector where much more needs to be done. So, countries really should think about how to promote *[inaudible]* buildings but also *[inaudible]*.

So, to conclude—yeah, it is a bit of a Cinderella in energy policy. Actually, it's very hard to get policy makers excited about _____ if they like—if they like electricity I think then you can go and open a big power station where a lot of it is very decentralized, it's about consumer choices. It's far too complex. So, something where there is not a lot of awareness.

In terms of markets, if you can even call it markets it's all very complex. It's very fragmented. There are no—I mean there are few large manufacturers of say solar thermal but *[inaudible]* in the power sector. The solutions are often local, so that's why it's really important to have local authorities involved, which is something a lot of countries have done. They've been successful.

And then to go forward I think target setting is really important, how much this is an area where there are a lot fewer targets, but targets often *[inaudible]*. And you've seen that in the European Union. Since setting targets for—well, overall energy consumption, but you can own the _____ if you look at the heat sector, and countries are forced to develop strategies for decarbonization. So, we need to see many more targets. And then obviously *[inaudible]* implement strategies. And then really, really important: it just has to be linked with energy efficiency.

Finding the resources for renewable heat can be tricky and you do not want to burn biomass unsustainably, for example, but you'd like to do it if you use it in inefficient appliances and inefficient buildings. So, there needs to be a parallel effort to promote energy efficiency. And then *[inaudible]* sector coupling is actually very important to think about what role heat can play in _____ heat your house with _____ renewable power generation. Thermal storage is much, much cheaper than batteries, which everyone talks about.

So, some thoughts here. It's quite a complex area. So, for more information just a quick link to some recent reports. So, FIDA has produced a paper, "Renewable Heat Policies," earlier this year. Then the report I already mentioned, IRENA, us and REN21, and also on, "The Future of Cooling," that has just been published in the last month or so. So, please go and find—this report you find on the website of the three organizations and the other two on the IEA website.

Thank you very much.

Katie

Wonderful. Thank you so much for that great presentation.

As we bring our next guest to the webinar I'd like just to remind our audience to please submit questions at any time. And our final presentation today will be by Holger Dalkmann. Holger?

Holger

Yeah, good afternoon and many thanks, first to REN21 for inviting me and congratulations too to Hannah and to the team for an excellent report. Also, thanks to the Clean Energy Center for facilitating that. So, a big thanks to Katie.

I work for the Sustainable Low Carbon Transport partnership, which is similar also to REN21, a multistakeholder partnership which really raised the issue of transport particulars on the global agenda, and here with more than 90 members around the world from banks to U.N. organizations to large research organizations and very pleased to be here.

We heard early from Hannah the importance of sector coupling and now I'd like to dive a little bit deeper into batteries during my presentation. So, first of all, we heard from Hannah how important the transport is when it comes to the meters for the energy transition as well as particularly on tackling and meeting the rest of the Paris Agreement. And you find here, on this slide, summaries of the scenarios based on an IPCC paper submitted by SLoCaT recently and you find here, so the links—because I obviously can't get too much into detail, but bottom line is in 2010 we were around 7 Gt; now we're talking 2016 about 8 Gt out of the transport sector, and all scenarios around the world from the International Energy Agency to the International Transport _____ it shows businesses' usual scenario, a massive increase, particularly through spheres of motorization or so in the emerging economies and low-income countries. With that, at the same time, noticing like so in the UNEP, bridging the GAAP reports, if you're not substantially, years ago, if you want to achieve versus the Paris Agreement, under two degrees or towards 1.5 degrees, we're talking about having to actually bring _____ down

to a quarter of the emission and transport to even have a chance to really meet the rest of the 2050 targets. However, even in a conservative scenario, which already assume a large amounts of renewable energy, whether it would still get us. So, just with a slight increase. So, we really need a full integrated approaches on transport to really tackle transport and enablers to achieve Paris and we'll share a little bit more on that a little bit later.

Coming also to transport and renewable energy and Hannah already described that and you're here reminding us on the numbers is providing to the GSR report that 30 percent out of the energy consumption comes from transport but only three percent currently out of this is renewable, and out of that is even further down is 0.3 percent is out of renewable electricity while biofuels at least is a half, 2.8 percentage of that, that share. So, in other words transport is still heavily depending on fossil fuels and only successful energy transition can reserve, can come [inaudible] transport decarbonization _____ at the same time. So, these two go certainly as a hand-in-hand and we have a long way to go.

Here again is a reference to GSR but it's the International Energy Global EV Outlook 2018; we're currently talking about three million electric passenger vehicles on the road which represents currently only just 0.3 percent of the global vehicle fleet. We have even worse situation in the freight sector where electric vehicles are almost non-existent even if there's some promises along the roads over the next decade but still this is very early stages.

In the bus sector it's interesting to see we have an enormous increase in uptakers on electric vehicle buses, particularly in China, which has 98 percentage of the market in cities like Shenzhen use _____ so have the whole bus fleet is electric, so we'll see on the passenger side an increase, particularly on the bus sector while freight is still behind.

And the other element Hannah mentioned earlier that we only have really few countries, and mainly it's Austrian and Germany have policies to take up renewable energy in EV which is absolute crucial also to enable Paris and enable _____ so really a paradigm shift here.

Another element we've heard a lot about is obviously policy and you see here a brief overview that countries starting also to set targets and policy frameworks towards phasing out fossil fuel cars in the leadership here, certainly. Norway, who want to only allow their emission light vehicles, city buses and the like commercial bans after 2025. In other words, really so setting these boundaries we see also the high uptakers of capital in terms of electric vehicles is in fact also Norway. You see as particular here in Europe following like the Netherlands, Ireland, Scotland, the U.K. and France while we see also California, recently with Governor Brown announced the state bill to ban fossil fuel cars by 2014. Nevertheless, we need far more ambitious activities also to really enable us of that change.

There's slow progress on biofuels you see here on that map, particularly Brazil and India with a high ethanol blend mandate, and we see also the challenge and describe really nicely in the GSR report about the challenges

we have with resources _____ in biofuels in particular. So, competing also with the agriculture. So, here the overall potential with _____ so not having strict recognition of the SEGs is important.

The other element—and here you see also a quite complex table to collect the current activities in the G20 around _____ transport policies and energy policies, provided also by [inaudible] on the report which again also you'll find it under that link shows that we have in fact on the energy and transport side certainly _____ a range of policies. However, it's currently often lacking in terms of the link between transport and energy policies is at the same time, as Ute mentioned before, that report _____ will be renewed this year in REN21 is one of the partners.

We talked about Paris; one of the key pillars of the Paris Agreement is obviously also the bottom upper portion and with the commitment from countries also to reporters on and submitters of their action plans, so-called, a nationally determined contributions. The analysis let's look at—shows in fact _____ all the submitters, 75 percent of the submitted plans are actually highlighting _____ transport as _____ mitigation source. That's certainly a positive [inaudible] saying we need _____ sector action.

Nevertheless only a few NDCs have in fact currently a mitigation target, so we're lacking _____ on clarity on responsibility of the sector. And you see on the right the analysis only about 20-25 of the countries actually have any kind of biofuel policy as part of that climate action plan and it looks slightly better on the e-mobility. But overall—and that's also the second message here—if _____ donors _____ tackle _____ transport in a more holistically way, in other words _____ avoid, shift, improve so that we need also to avoid future—too much motorized transport and so too—so better integration of land use, reducing also the length of trips and allowing also better access.

Shifting also towards more environmentally-friendly transport modes, like walking, cycling, public transports, shared modes as well as there's improve also efficiency of the [inaudible] at the same time. We need also to do all of this above to really get also to the targeter.

So, I showed earlier, so particularly so on the ideas of avoiding and shifting—we don't see too much. So, here to really achieve Paris we need to raise our ambition. So, with that also closing with some key messages and we heard that we need far more attention to heating and cooling as well as to transport. We need also further to set up; we need this comprehensive .

But particularly in terms of energy without the coupling of renewable energy and transport decarbonization and transition we will not also achieve Paris. We at the same time should pay attention when we talk about energy in the transport context, how we can also reduce energy consumption, as I described in the _____ shift improve report, as well as increases our energy efficiency. So, here really appreciate also the opportunity or soul put batteries into an energy context because I think these two communities: policy makers, stakeholders, need to work far closer together and particularly on the energy and common transport transition.

So, I would like to thank for your attention. You will find all the information on the SLoCaT website, where you also find more information is about the organizations and our partners. And with that I'd like to, again, also thank you for the opportunity and give back also to Hannah. Thank you.

Katie

Wonderful, Holger. Thank you so much. Thank you to each of the panelists for those presentations. As we shift to the question and answer I'd like to remind our attendees to please submit questions using the question pane at any time. We also keep several links up on the screen throughout for quick reference that point to where we find information about upcoming and previously-held webinars and how to take advantage of our Ask An Expert program.

Our first question today goes to Holger: What can REN21 contribute to the much-needed paradigm shift in transport?

Holger

Thank you for raising the question and giving me the opportunity to speak. Again, first of all I think it's fantastic also to have REN21 as a multistakeholder to *[inaudible]* report sharing this knowledge. In terms of transport, acknowledging also that transport is a key part of that and putting more of the finger in the round to really say well we need also to bring MGM transport closer together. I would love to also see even further tracking, particularly on those related to policies and also coming up with more initiatives around how we can also further scale that. So, I think transport energy needs to work far closer together and REN21 is already a great job by raising that and _____ for me also the in-kind invitation to speak. But that can be only the beginning; we need far more _____ good practice, national policies around transport and energy. We need also the international awareness and we also need also the reporting and tracking even further down the line to really make the strong case.

Katie

Wonderful. Thank you so much, Holger.

Our next question and let me also say if any other panelists also want to comment on any question feel free to. Our next question is directed towards Hannah. Hannah, what is carbon pricing?

Hannah

Yeah, so I guess I'll start with briefly saying we haven't always tracked carbon pricing in the global status report but just started including that beginning in the 2017 edition. So, now you'll be able to find maps showing the carbon pricing initiatives worldwide in the latest two editions to the Global Status Report.

Carbon pricing is basically putting a price on CO₂ emissions. It's like a price paid to be able to emit a ton of CO₂. And it's applied to carbon pollution in an attempt to encourage reduction in emissions. Usually this can be in a carbon tax or in purchasing permits to emit. And that's the most well-known example of this is the EU, the European Union's emission trading scheme, but also China just launched a scheme of their own so not—the EU scheme is covering 1.7 billion tons of CO₂; in comparison, China's is now covering 3 billion tons. And together, as of early 2018, between 20 percent and 25

percent of global greenhouse gas emissions were covered by an excess in carbon price. Those two, plus the others that are existing worldwide. And this is up from 13 percent just the year before, with the increase mainly due to the entry, of course, of China's scheme.

But the reason that this is important is because carbon pricing can, as I mentioned before, incentivize the deployment of renewable energy by increasing the comparative cost of higher emission fuels and technologies through the inclusion of at least some externalities like the pollution that I mentioned before. Perhaps the other panelists could talk more about the impact that it might have on the heating and cooling and transport sectors. So, Holger, Ute, feel free to comment.

Ute

Just briefly I mentioned Sweden and carbon prices being absolutely essential to drive a switch to renewable heat. We just need to do—low fossil fuel prices are a real obstacle. But the one thing countries really have to consider—because obviously heat is essential if you're talking space heat in cold countries. You need to think about affordability because there are countries where there's a real problem that people cannot afford to heat it, and especially older people in low incomes. So, you need to think about other measures if introduce carbon pricing to make renewable heat more attractive; at the same time also thinking about fuel poverty issues.

Katie

Wonderful. Thank you both for answering that.

Our next question is for Holger. Holger, what renewable technology is going to be prevail in the transport sector and why? Are biofuels sustainable on a large scale?

Holger

Thanks for raising the question. First of all, I think I described also the urgency of actions and the uptakers of renewables in the transport sector very soon. That was in fact I see _____ of the main energies on the market is also the renewables and electricity, so electric vehicles are the prices are obviously going down; the capacities of the batteries is going up, and countries are also investing in the infrastructure. So, on a relatively short notice it is actually possible, like we've seen in Norway, but it's seen in other countries, with efforts from the government and the private sectors together. We will see also particulars in uptake on electric vehicle.

But again, also, the challenge here is really about also the provisioners of renewable energy at the same time and that also we have to work really on the country policies. In the medium-term hydrogen might or might not also play also a larger role. It's one of the questions also for governments in terms of will also providers or a second infrastructure at the same time and will they invest in that. But that also is something also certainly upcoming.

The challenge we will see in terms of transport is particular when it comes also to the shipping and aviation industry. We have some very small-scale experiments in the aviation sector around electricity and there's also the opportunity for renewables. That's in sectors where we might see also particularly also the opportunity also for biofuels coming also to the second

parties of the question, biofuel, on that scale, according also to IEA, which would really also need for an energy and transport transition where have been also not available also on the sustainable level. But particularly also the users in partially _____ of freight and partially particulars aviation industry is also an opportunity also to get towards this decarbonization.

Katie

Great. Thank you so much. Our next question is for Ute. Most renewable heat is produced from biomass. Isn't that worse than natural gas in terms of air pollution? And how can you ensure that biomass's source is sustainable?

Ute

Okay, thank you for that question. Yes, that's right. As I show at the moment biomass really is most of renewable heat although we see over time slight shift and certainly more renewable electricity and solar thermal can _____.

Okay, so shall I start with air pollution, then? I think I mentioned if you burn biomass increasingly you will have an air pollution problem. And in fact, you see that in quite a few places, in rural areas, in urban areas. The worst is if you have an open fire and you just put everything up the chimney, and it's not great. People think an open fire is a fantastic thing to have, you know, comfort, etc. But we are actually creating more problems.

However, if you have very efficient modern biomass stoves, or you burn biomass in efficient modern combined _____ power plants you can actually control the emissions very well. Of course, it makes it somewhat more expensive but you absolutely have to. Otherwise there's very little point. And you know that we have an air pollution problem in many cities, so we need to be very careful.

And I mentioned individual biomass boilers are really not the answer in city centers, but a combined heat and power plant with all the pollution control equipment on the edge of a city may well be. So, we have to consider these issues.

Then in terms of sustainability, again, there are many examples where things have gone wrong _____, and not just in terms of the unsustainable biomass use for cooking but also in other parts of the world where people have basically _____ deforestation to keep themselves warm. And again, using the biomass _____ just in a very inefficient way through open fires or very inefficient stoves.

So, the efficiency of the equipment is really important and that—I know there are parts of the world where that is a real issue because someone who lives in a village in Georgia in the Caucasus cannot afford a modern, say, Austrian biomass boiler. So, issues need to be addressed of building these locally and getting the cost down.

But also, in terms of the larger-scale application you need to have sustainable sourcing, and this is being addressed, for example, in the *[inaudible]* EU now we're able to just initially about the power sector and sourcing of biomass but that's now *[inaudible]* to the heat sector.

And actually, in many cases the biomass usually is very local and it's actually very efficient types of biomass. So, for example most cities actually have a lot of _____ cultural waste from the parks which _____ chipping or pellet wood industries, etc. So, there are many examples how you can do it sustainably. But I think governments need to absolutely tackle the sustainability in air pollution as part of a renewable heat policy.

Katie

Wonderful. Thank you so much. And Holger Dalkmann had to drop off, so we are going to finish the question and answer discussion with both Hannah and Ute.

Hannah, the next question is for you. During your presentation you mentioned REN21's network of experts contributing to the global status report. What are the criteria for participating and how can someone get involved in the next edition?

Hannah

As I mentioned, the REN21 network is a multistakeholder network, and it's actually made up of close to 20,000 people that are working on various energy issues: renewable energy, energy efficiency, energy access and climate _____. And those contributing specifically to the Global Status Report each year, closer to about 2,400 of those experts actually actively participate in the 2018 edition of the GSR.

So, we welcome participation by any interested stakeholders, be it as a data contributor, peer reviewer or expert interviewee. Our contributors are ranging from university students all the way to the highest levels of leadership, and in international organizations and multinational companies.

So, we're always open to participation from new people, and if you're interested in participating I would just encourage everyone to get in touch with us, either through our website or feel free to email us at GSR@REN21.net.

Katie

Our next question could be for both of you. The EU has agreed to a new 2030 target for heating and cooling. Do you think this is effective in driving deployment?

Ute

Okay. I'll take that. So, the EU last week actually agreed to a broader renewables target of 33 percent for 2030 and then _____ that is a specific target for countries having to increase the percentage share of heating and cooling by 1.3 percent per year. Is it going to be effective? Well, I'd like to think it will be, and with a couple of issues, of course. So, I mean generally the fact that the EU has set itself a renewable energy target that's been incredibly important for driving renewables [*inaudible*]. But to 2020 actually these targets were obligatory on each member state, binding on each member state. And fortunately to 2030 they're doing _____, so there is an overall EU renewable energy target and then member states have to submit their plans and it's all supposed to add up to things.

And then specifically for the heating and cooling, again, this 1.3 percent is non-binding. So, it's a bit difficult to predict whether member states will stick

to it. However, within that there is a very good process of having to submit plans, and they have to submit plans to cover energy efficiency and renewables and climate change action together, which is actually a very good thing. And I'm just hoping that the fact that this target exists will focus minds because it's the first time we've had an actual heating and cooling target. And you know, many member states, even though *[inaudible]* not binding they still feel an obligation to at least try and work towards it. So, anyway, watch this space; let's be optimistic here.

Katie

Our next question is directed to Hannah. Are there any good examples of policies integrating EVs and renewable energy?

Hannah

Yes, and I guess Holger kind of addressed some of this already during his presentation. But I'll reiterate that there are limited examples, at the national level, at least, of policies that are directly linking electric vehicles and renewable energy. And Holder mentioned that Austria and Germany are the two examples, currently the only two countries in the world that have it at the national level. Austria is offering a purchase price premium for EVs that are charged with 100 percent renewable electricity. And in 2017 Germany established a 300 million euro tendering program, providing grants for the deployment of EV charging infrastructure that sources electricity from renewables. But that being said, this is just at the national level. The certainly more local and subnational level *[audio static]*. But that data is not yet consolidated, at least as far as we've seen. And as I mentioned during my presentation, there are at least some—there's some overlap in targets for electric vehicles at the national or subnational or city level, but many jurisdictions have both renewable electricity and electric vehicle targets, but this is still a very small amount worldwide. You can find the actual list of countries and other jurisdictions in the full report online.

Katie

I think we just have time for one more question each in the final minutes that we have. Ute, is there a scope for cost reductions in renewable heat technologies, similar to what's happening in solar PV?

Ute

Thanks for that question. Renewable heat is slightly more complex in that—I mean depending on what you're talking about on sometimes the installation costs can be very high because you might need to put in a new heating system or have things like backup. Solar water heating, for example, you tend to have electricity or gas backup. However—and also some of the technologies already _____ established like biomass boiler. But at the IEA you've got a technology—we have technology collaboration programs for various technologies, and I'm actually here at—in Stockholm at the meeting of our solar heating and cooling program. And they've done some very interesting work looking at what opportunities there are for reducing cost of solar water heating systems.

There are a number of different options. I mean some of it is about materials, like heating polymers, which then are reduced to using them—some of it is about using these technologies upstairs, so in fact you're seeing more and more use in district heating schemes, which is very different to cooking things on just one roof. And there's possibilities of standardizing systems more

because at the moment there are lots of different systems, both PV [inaudible] are fairly similar. So, there's certainly more awareness amongst researchers that cost reductions need to be achieved. Whether they can be as significant as for PV I don't know.

But I mean the other thing is, you know, for solar PV we always see the cost reductions for these large-scale deployments which is achieved through auctions, but not all PV systems are that cheap. And I think we need to realize that maybe in some cases renewable heat systems will be somewhat more expensive than fossil fuel alternatives. But that we then need to address _____ other policies like carbon pricing. You know, we need to stop thinking of the atmosphere as a rubbish bin, effectively. I mean we need to put a price on the emissions to the atmosphere. And that gets around the problem of sometimes higher costs.

Katie

Our final question today is for Hannah and then we'll go into some closing remarks from our panelists. Hannah, the figure during your presentation is showing that global renewable energy investment shows a sharp decrease from 2015 to 2016. What was the reason for that decrease?

Hannah

Well it was for a few reasons, actually. I mean I have mentioned that there was a bit of a—there's been significant cost reductions in technologies. Also keep in mind that this figure shows investment in renewable power and fuels only, so it's not also including investment in heating and cooling technologies. But also, importantly there was some policy changes in some of the _____ major markets, so China, U.S., Europe. And so that explains the decrease from 2015 to 2016. But the fact that there was a subsequent increase last year, again, is a good find, but developing and emerging countries are continuing to invest alongside developed countries. And all of this is happening, despite the lower cost of renewables, particularly PV and wind. Renewable energy is just an increasingly attractive and cost competitive in increasing number of markets. And this is even without the policy support in some places.

Katie

Thank you so much to both of you, and to Holger for the great question and answer discussion. Now I'd like to provide each of the panelists with an opportunity for any closing or additional remarks before we close the webinar today. Hannah, would you like to start with the closing remarks for us?

Hannah

Sure, and I'll start by saying thanks again to you, Katie, and to the Clean Energy Solutions Center and to—again, to Ute and Holger. Basically, I'll just reiterate what I've said before, that we're seeing that the renewable energy transition is possible, based on these developments in the power sector. And this is really great news. But there's just got to be more effort put into the heating and cooling and transport sectors if we're going to meet the climate goals. When technologies are increasingly cost competitive and we're seeing increased interest by a wider and wider variety of countries and jurisdictions there will just be a more integrated and systems approach needed in policy and planning, along with creating a level playing field with the carbon pricing policies and removing fossil fuel subsidies.

Katie

Thank you so much. Ute, would you like to have any closing remarks today?

Ute

Yes, thank you. And also, thanks from me for inviting me and thanks to REN21 for producing such an excellent report. I think it's a fantastic resource, and I would urge anyone listening to read it. And it's great that we can get more and more information. For heating and cooling specifically it is very hard to find the data. And sometimes it's hard to see the progress from year to year. So, just to reiterate that PV is an area where we really need a long-term policy because the turnover is slower for appliances; people are openly—it might lead to renovating homes, which doesn't happen very often. So, it's a difficult area. But, you know, you need policy makers just to be aware that just to grab some electricity is not enough. We need to think about other sectors. We need an energy system approach, which links the deployment *[inaudible]* heating and cooling, also with energy efficiency. Which makes it all more complicated but in the end we'll be better off with what comes out.

Katie

Wonderful. Great. Thank you again, and on behalf of the Clean Energy Solutions Center I'd like to extend a thank you to all of our expert panelists today, and to our attendees for participating in today's webinar. We very much appreciate your time and hope in return that there was 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 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'd like to view the slides and listen to the recording of today's presentation as well as previously-held webinars.

Additionally, you'll find information on upcoming webinars and other training events. We are now posting webinar recordings to the [Clean Energy Solutions Center YouTube channel](#). Please allow about one week for the audio recording to be posted. Finally, I'd like to kindly ask you to take a moment to complete the short survey that will appear when we conclude the webinar. Please enjoy the rest of your day and hope to see you again at future Clean Energy Solutions Center events. This concludes our webinar.