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Net-metering and Net-billing, Part 1: Solar PV Policy: Net-Metering

—Transcript of a webinar offered by the Clean Energy Solutions Center on 19 October 2018—
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Toby Couture

Good day, everyone and welcome to this International Solar Alliance Expert Training Course. This is Part 2 of Session 6 focusing specifically on policy called net billing. The first component on Part 1 was covering net metering and provided an overview of the history and a bit more background on why net metering policies are changing and it made frequent reference to policies like net billing which are a step further in terms of the evolution of net metering as we will see. So this session focuses specifically and provides a deeper look at how net billing policies work, why they differ and what are the drivers behind them being adopted for rooftop or customer-sited solar.

A quick word about the supporters of this training series. This is part of a joint collaboration between the International Solar Alliance, which is a grouping of solar resource rich countries from around the world and the Clean Energy Solutions Center, one of the leading institutions supporting capacity building and providing no-cost expert assistance to governments around the world on clean energy policy topics. This is part of Module 1 on policies for distributed solar PD and it focuses again specifically on the issue of net billing. And as upon _____ this is Part 2 of a two-part series.

So this is a quick overview of the presentation. First, we'll have a look at the learning objectives, core of the presentation on net billing, a few concluding comments and at the end there will also be a series of multiple-choice questions to evaluate your knowledge and your grasp of the material. So without further ado, let's get started.

So the learning objectives. First and foremost, to understand the rise of net billing, what is net billing, and why is it emerging in different jurisdictions,

how does it differ from what we typically know and refer to as net metering. It also ideally help you understand how net billing has been adapted to different jurisdictions around the world so net billing in the Pacific Islands versus in the Caribbean, versus in different parts of the U.S. and Europe. And you'll understand a little bit more about the advantages and challenges of this particular policy tool.

In contrast to net metering which was first adopted in the 1980s, net billing is a more recent policy innovation and it emerged first in the 2000s in island regions. Similar to net metering, customers export their net excess generation to the grid and receive a compensation for that on their future power bill. So they get a credit on their bill. The main difference between net metering and net billing is the rate that's applied to that net excess generation. In particular, the rate at which customer-sited generation is credited is in the case of net billing different from the rate that customers actually pay. So under—if you've listened to the net metering presentation you'll recall that under net metering, the rate that customers receive for their excess generation, for their credits is effectively the same rate as the retail rate they pay. This means that a residential customer gets a certain rate, a commercial customer will technically get a different rate and an industrial customer would get a further different rate for their net excess generation.

Net billing separates those two and makes the consumption rate—the compensation rate rather different from the actual rate that you pay. So if you are an electricity customer in Gujarat in India or in Bangkok in Thailand or in Johannesburg in South Africa, your rate that you pay is going to—is different, but say it's $0.15 or $0.18 or $0.12 per kilowatt hour, your net billing rate will differ from that and will typically in most cases be lower than that. And again, there's a number of reasons why the rate is being set at a lower level and we'll get into that over the course of the presentation.

Here's a quick diagram from a recent NREL report that provides a snapshot of how net billing working. I've provided the link here at the bottom to a fantastic report providing an overview of compensation mechanisms and the mechanics behind net metering and net billing policies. And this diagram gives you a clear visual showing how it works in practice. The formula for net billing differs from net metering. So if you'll recall from net metering, the compensation rate was equal to the retail rate, but with net billing, the compensation rate is some separate predetermined rate. It's not the rate that you pay. Excess electricity is injected into grid and offsets your bill at that net billing rate.

However, it's critical to point out net billing does—also is similar to net metering in this regard, in that it does not involve a cash payment. In most cases net billing policies are just a billing mechanism. The utility will not write you a check. If they did, it would be called what we call a net fit, a hybrid between a net metering policy and a feed-in tariff that actually offers a cash payment for your net excess generation. So what really makes net billing different is that the rate at which you're erasing your own power bill is

different from the retail rate you pay and we'll see some examples of that in practice.

So in that sense, net billing is fundamentally a variation on an accounting mechanism. You could offset your rate for each kilowatt hour you inject into the grid at some specified rate. So in this case in the example, at say $0.07 per kilowatt hour. You may pay $0.10 for your electricity from the utility per kilowatt hour, but for your net excess generation you would only get paid, in this case—or you would only get compensated at $0.07. So if you had a bill at the end of the month of say $50.00, every net excess kilowatt hour that you injected would reduce your bill by $0.07 per kilowatt hour instead of erasing it at a rate of $0.10 per kilowatt hour under classic net metering.

So in that sense, net billing severs the relationship between the value of the kilowatt hour consumed from the grid and the value of a kilowatt hour that a customer injects into the grid. So it creates a new accounting mechanism. It's no longer connected directly to the retail rate you pay and that's really the fundamental difference. In some cases, net billing can even be structured more conservatively than that. In some cases, the net billing rate, the full output of the PV system is injected into the grid, so essentially there's no net billing or no self-consumption rate, but the net billing rate will apply not only to the electricity that you inject, it will also apply to the electricity that you consume.

So in other words, you are not under some variations of net billing, you are not able to self-consume your own electricity. They will take your full consumption, the utility will look at it and they'll look at your production and then they will use your production to erase your consumption bill at a separate rate, at some fixed rate. But you're not able to get a full retail rate value for even your own customer-sited generation and these net billing variations are sometimes called buy-all, sell-all arrangements and it gets a bit technical and there's some nuances here between net billing and a buy-all and sell-all and this remains fairly unusual, fairly uncommon. The net billing policies are structured this way, but it indicates a further variation on again this rapidly evolving landscape of policies to govern distributed renewable energy development.

The net billing rate can be defined in a range of different ways. As you can see here in red, the net billing rate is typically lower than the rate paid by the customer. That's really one of the basic features of net billing, but what that rate actually is differs widely in a number of different jurisdictions. So it can be the wholesale market rate, it can be the time of use rate. In some cases that time of use rate may be higher or lower. It can be the avoided cost rate of the utility. So what does the utility's average cost of generation? A fourth option is the value of solar rate which is a calculation that is used to estimate what the actual value of that distributed solar is to the power system or it can simply be some other rate as set by the regulator. So it gets fairly complicated to really consider the different methodologies behind setting this alternative net billing rate, but you can see here there are a different variations and

different regulators will use different arguments to justify having chosen one benchmark over the other.

The core idea is that in jurisdictions with fairly high retail prices, it may be considered to be overcompensating the solar customer if you pay them or you compensate them at the whole full retail rate for their generation. So if you're in an island in the Caribbean or in the Pacific, for example, your actual retail rate may be $0.30, $0.40 per kilowatt hour or even more. And under that context, if you are able to erase your own consumption and get compensated for your net excess at the full retail rate, the utility argues that that's overcompensating the customer and that that's too profitable and therefore they should be paying or compensating at some lower rate. And that's where net billing emerged and now you're seeing a number of variations looking at these different compensation structures.

Perhaps the most common is number three, using the avoided cost rate as a benchmark for compensating net excess generation. The argument there being that it is then revenue neutral in theory to the utility. So if you have a certain amount of net excess generation, the utility can pay you its average blended—or its average cost of generation and that is what you will get compensated at so that the utility is effectively revenue neutral for the net excess generation. This is actually the approach used currently in the Philippines where the net billing rate is effectively set at the average blended utility generation cost across the system.

Number five is also quite common. It's essentially just some other rate. And we see a number of jurisdictions where that's the case. This diagram provides a snapshot of how this looks in practice. You can see here the production profile, the consumption from the grid during evening hours. When there's too much solar production during the day, it gets poured into the evening hours or onto the next day and is used to offset. Now the difference with net billing is again that the rate is some separate rate, not simply the net metering—the retail rate that a customer pays.

In order to really understand how net billing or how these sometimes called self-consumption policies actually work, it's useful to look at this graphically. So on the left here you can see a residential solar customer and you can see here roughly the amount that they self-consume versus the amount that they inject into the grid. A standard household customer will have a fairly low self-consumption ratio because most people aren't home during the day or have very limited power demand during the day. And during the day when the sun is shining, that means most of the power from the solar system is being injected into the grid. So this means that residential customers are actually erasing fairly little of their consumption for the grid and are more dependent upon what the rate is for their net excess because residential customers will have much more net excess generation than a commercial customer will on average in most cases.

So the logic there makes essentially the residential customer more exposed to whatever that net billing or net metering rate is. Commercial customers, on the other hand, like a supermarket, for example, will have a fairly high self-

consumption ratio. That's because they have a high demand and a fairly stable demand over the course of a given week or month. And that means they're consuming most of the solar power on their rooftop as long as the system is dimensioned in some way closely to their actual power demand. So this means that a commercial customer is less exposed or less reliant on the net billing rate than the residential customer in this case.

Under net billing, you can see here the value of that net excess generation is de-coupled from the retail tariffs. So in most cases, this green component here is what customers are self-consuming. So they're reducing their consumption to the grid, that is being valued at the full rate that they pay. And for the grid injection they're getting something else. So if your retail rate let's say is $0.15, that's what your green component is being valued at and if their net billing rate is say $0.10, that's where your grid injection is being valued at. So there are two different rates being applied and you're being compensated differently for your self-consumption versus your grid injection.

One fundamental consequence of this is that it tends to encourage higher self-consumption ratios. It encourages households, for example, to get smarter appliances that they can turn on during the day. It may make sense to wait until the morning to turn your dishwasher on or your clothes washing machine. It may also encourage businesses to get smarter, shifting more of their demand needs to the daytime as well to the extent that they can. So there are different incentives and sort of behavioral consequences of different tariff and policy designs. And you can see here I think we're just at the beginning in a sense of really understanding how complex these behavioral dynamics can be with both net metering, net billing and now net fit policies, all of the tax implications, the new business models that are emerging on top, it makes this very dynamic and in many ways a very exciting space to be involved in and to watch.

So if we look at this a little more closely, for grid injection, typically under net metering this is compensated at the full retail or under net billing it's compensated at a separate rate. For self-consumption, as we saw, it can offset the full retail rate which is again the case is most net metering and net billing policies or even the self-consumption can be offset at some separate rate and that effectively involves the utility getting between the customer and their own solar system. And that's what we saw in the case of these buy-all and sell-all arrangement. It's where effectively the customer is obliged, is obligated to sell of their power to the utility and the utility takes that power and then uses it to reduce the bill of the customer at some separate rate. [Clears Throat]

So this is just to essentially reiterate [Clears Throat] the net billing rate can be applied in two ways, for all customer-sited generation purely as an ex-post or after the fact bill adjustment or it can be applied strictly to the net excess generation. [Clears Throat] And those two variations have very important differences for how attractive the overall policy landscape is. So a quick overview here just to—again, this session was billed as a deep dive session so you do need to work through some of the nuances and hopefully can

appreciate why, at the end of this, why these different policy designs matter, why the differences are really important and why we're seeing so much innovation and dynamism in this particular policy space.

So this table tries to synthesize what we've said so far. The four different policy mechanisms on the left: net metering, net billing and NET-FIT which you'll see in Session 7 and the classic FIT which is featured in another session of this expert training series. The relation to the retail rate under net metering, as we saw, is at the retail rate. The compensation under net billing is below the retail rate. In NET-FITS it's also typically below the retail rate although there was a first argue with NET-FIT policy was launched in Australia in the 2000s and at that time Australia—they called it a feed-in tariff, but essentially it was a net feed-in tariff because they were only paying the feed-in tariff for the net injection into the grid. For everything else, you were just wiping out your own bill.

But in Australia, the NET-FIT rate was above the retail rate so it was much more attractive to maximize your grid injections, not your self-consumption ratio. The classic fit has no relation to the retail rate. It's set at the levelized cost of energy of each technology. So that's really the key—those are the key differences. And on the far right you can see here whether there is a possibility of cash payment or not. Net metering, traditionally not. Net billing either. But under both the NET-FIT or classic fit, yes, there is a cash payment. And again, this has a fundamental impact on how bankable, how financially attractive it is to invest in a distributed solar or distributed renewable energy project.

Many banks are hesitant to lend to projects—to net metering projects or even worse, net billing projects because they don't really see a clear cash flow and it's fundamentally reliant on the credit worthiness or solvency of the owner, of the system. So often the system needs to be collateralized in part, if not in full and in many cases net metering and net billing projects were financed large with cash, people's own equity or directly on the balance sheet out of operating income. So the dynamic there is fundamentally different. Under feed-in tariff by contrast or in NET-FIT even, it's possible or typically easier to go to a bank and actually get a loan which can arguably make it easier for a wider number of customers to participate.

As we saw a moment ago in a way net billing is a more conservative, a more restrictive policy than a classic net metering and that's why there's so many battles going on, particularly across the U.S. The battles are probably most heated in different U.S. states and regulatory commissions, public utility commissions and part of the deeper shift that's happened here is one towards something like net billing and that's what many solar energy advocates and solar industry representatives have been fighting against. They argue with getting a full retail rate is the way it should because that's the way it's always been and they fight any change to that. In other jurisdictions that have less of a history with net metering, governments or regulators are starting by implementing net billing so customers have never really known a full net

metering policy and there's nothing to then fight to protect because it never—it went straight to a net billing.

Now in addition to the net billing rate being set, there's additional restrictions that can be added to further tighten the screws and further protect, for example, the utility against revenue erosion. And this is really where we see the battle lines being drawn between the different camps. The regulator in some cases can limit which components of the actual power bill can be erased with your own customer-sited generation. So in some cases, through a ring-fence, certain components will introduce what are called non-bypassable charges or were sometimes called minimum bills where essentially that means that if you are a customer of this utility you have a minimum bill or a minimum contribution of $15.00, $20.00, $30.00 to the utility every month just because of the fact that you are connected [Crosstalk] to the customer. And then everything above that is based on your consumption and your demand essentially.

But that minimal bill or that ring-fenced component of the bill is a fixed amount that cannot be erased, no matter how big your solar system is. So you could have a whole bunch of net excess generation credits, but it will not erase that basic ring-fenced revenue component and that's again the product of the battle between utilities and solar customers or solar industry in a way where the utility says we need to be protected against revenue erosion and against cross subsidization so they introduce these different kinds of regulatory mechanisms. This gets into a series of rate design considerations. There is a separate training session in this series of training modules looking specifically at rate design so if you're interested in taking a deeper dive and looking more into how all of these different solar policies connect to utility rate making and rate design, then have a look at that session and you'll find a lot more information and insights there.

Much like net metering, there are different roll-over provisions. Customers can typically bank their excess generation also up to 12 months and they can use those credits just like net metering to offset in future months. However, after the 12-month settlement period, for example, in this case excess credits would be credited to the customer at the net billing rate. So if it's $0.07 per kilowatt hour, that's what the customer would get credited. And in some cases they even offer under some net billing policies they'll say, "Okay, we'll pay you a little bit for that net excess at the end," which technically could make the policy considered a NET-FIT but it's a bit different from a NET-FIT where NET-FIT is a guaranteed payment for all of the net excess generation in every billing cycle so every month you would get a check under these net billing variations. It's only at the end of the year of that the utility will say, "Okay, if you're a positive position, then we'll agree to, for example, pay you at the avoided cost rate, some small amount. But in most net billing policies that's not the case and you just get credited at the net billing rate.

The settlement period refers to the time at which the net excess generation credits are trued-up or settled. You may remember this from the net metering presentation. Again, this is very similar in many ways to net metering. The

most common settlement period is 12 months and there are a number of different options. In particular, under net billing we'll see here in B they essentially receive some further bill credit at the wholesale rate or at the avoided cost rate. So that's the basic logic. Similar to net metering, many of the same design options apply. So in terms of designing a policy, if you're a regulator or policymaker, it's not about just setting the net billing rate. There's a number of other key design features that make up in that billing policy. So they share many of the same or similar features to net metering. Again, the key difference is it really centers on the compensation rate and the treatment of net excess generation. All of the other components cannot effectively be very similar to a net metering policy and can be shared with a net metering policy. [Clears Throat]

Now, to get out of the sort of these high level considerations and policy level considerations, it's helpful to look at a couple concrete case studies. So I've selected three. The first is Palau, a small island—set of islands in the Pacific. Roughly 20,000 inhabitants and with generation of just under 90 gigawatt hours, total installed capacity is now somewhere around 40 MW. These numbers are a few years outdated. Installed capacity or the retail electricity tariffs however remain in the range for residential customers of $0.40 per kilowatt hour and for commercial customers around $0.28 per kilowatt hour. And given that it's in the Pacific islands region, it is fairly sunny, solar resource is quite good and solar power's becoming increasingly cost competitive there.

Now the payment structure Palau has adopted a net billing policy and the payment structure is structured as follows. You can be credited for any net excess generation in a particular month at a rate that's no less than 50 per cent of the tariff applicable during that monthly billing period. So the settlement period here is monthly, now annual and they effectively say that no less than 50 per cent of the tariff applicable shall be compensated. It should be compensated with that rate. That means—and one of the reasons for this is that in countries like Palau and many other island states, the retail rates change quite frequently and as a function of oil prices because islands are often dependent heavily on diesel or heavy fuel oil in the Caribbean and they ultimately have monthly fluctuations in the power rates so you see a system here where it's much more closely linked to the utilities avoided cost of generation effectively by default.

In this case, excess generation is purchased at a significant discount to the retail rate that the customer pays. Again, the idea there is partly to protect the utility and partly to try to achieve some kind of win-win where it's still financially attractive for the customer but also financially attractive to the utility. Another case, also from the Pacific island regions, is found in Vanuatu. Vanuatu is one of the few utilities in the Pacific islands region that is privatized. The electricity system is largely owned by UNELCO and they have introduced an interesting policy to govern distributed solar and you could see here a quick overview of the payment structure.

They state explicitly that there's no cash payment, so we're not talking about a feed-in tariff here, we're not talking about a NET-FIT, we're talking about a net billing policy although it's not—if I'm not mistaken, it's not referred to explicitly as a net billing. If I'm not mistaken, they actually call it net metering. But the basic logic is of net billing. Onsite generation offsets onsite consumption first. So there is self-consumption. After that, for all net excess generation, that net excess generation offsets two components of the bill at a fixed rate. So namely the fixed connection charge as well as the grid access fee.

Only those two components of the bill can be erased with net excess generation and the offsetting rate is fixed within the law at $0.135 U.S. cents per kilowatt hour for every excess kilowatt. So you can really see how sophisticated this gets. It limits the bill, there's ring-fence in here so certain components of the bill are ring-fenced, are protected, cannot be erased and only these two specific components of the bill every month can be erased with those net excess kilowatt hours.

So that creates an incentive for customers again to right size, to design—to not overdimension their solar system, but rather design it to be about the same size as their onsite load. Again, part of the idea here and what's fascinating about many of these island policies is that they are on the one hand very innovative and very, very unique to their ecosystem, but it's also that you see the effort to try to strike a balance, to try to arrive at some kind of a win-win for both customers as well as for the utility while diversifying the power mix towards renewable energy and towards more solar power, in this case in particular in the process. And striking that balance is going to look differently, it's going to be different in every individual case.

And finally, our third example here is from the U.S. In Tucson, Arizona, TEP, has recently proposed altering the rate at which it credits solar generation from the retail rate—it used to be a net metering policy—to the rate that they recently paid for a utility scale solar PD project. So here we have yet another variation on net billing where the rate paid, they're basically used as a benchmark or proposed using as a benchmark the utility scale solar project that was recently signed. They said that reflects the actual cost of solar for—on a wholesale basis. We are prepared to use that as a benchmark and they proposed that as a mechanism to credit the net excess generation from household customers. That works out to roughly $0.058 per kilowatt hour or roughly half the current retail rate.

So that means if you're a customer instead of a net metering where you would have gotten let's say $0.11 per kilowatt hour for your net excess generation, now you'll only be credited at $0.058 per kilowatt hour which is a significant change. And again, it's yet another sign or clear indicator that net billing policies are often more conservative, more restrictive of the solar section. But they're also an indicator that solar is getting cheaper and cheaper and is increasingly lower than utility power rates. And that again is a powerful sign of the changes that are taking place within the solar section more broadly.

So a few additional considerations worth bearing in mind. As we saw, this whole issue of ring-fencing is critical, whether a customer can offset all of their bill or only portions of their bill. Under original net metering it was mostly that you could offset all of your bill, there were no restrictions. This is starting to be tightened in a number of cases. In jurisdictions that have fully volumetric tariffs, so this is basically you get a power bill and all the cost of power distribution, supply, customer service, grid repairs, environmental protection, all of those charges are bundled into one single per kilowatt hour rate. In those jurisdictions it's often possible to offset the full retail rate because the way the bill—the actual weight is designed, but in jurisdictions where the utility has a more complex rate structure, potentially even with demand charges and other things like that, it is often not possible and the utility often argues you can only regulate certain components of the bill, not others.

And that again underscores, gives you a hint or an indication of some of the complexity in these policies for regardless of where you are in the world and regardless of what your utility or your jurisdiction is working towards, every policy is fundamentally a product of its own unique ecosystem. And it's really important to underscore that. There are no two net metering, no two net billing policies that are exactly the same. They reflect and have the ability imprint of their unique ecosystem characteristics on them and you can see this in a range of different areas, in range of different design elements of which this is just one.

Another critical consideration is whether customers have to contribute to renewable energy support costs. There are often, in a number of jurisdictions, whether in Southeast Asia or here in Europe and France, Germany, Denmark, specific line items within the power bill that are designed for the renewable energy support. Even in jurisdictions like the Philippines there are special subsidy categories for low-income residents or for energy efficiency programs or for missionary electrification or even rural electrification programs. One key debate is whether household customers like the net metering or net billing customers should be able to erase their bill and even erase their contribution to these kinds of subsidies within the bill because these subsidies are designed for very specific public purposes and utilities often argue that customers shouldn’t be able to erase those because they're designed for the public good, to support a wide range of different causes.

And in a growing number of cases in fact, those surcharges, those kinds of fees within the bill are being ring-fenced. They cannot be erased and in other jurisdictions rather than specifically ring-fencing them, utilities where those fees don't exist we're starting to see the emergence of minimum bills. Hawaii, for example, has recently introduced a minimum bill policy with a fixed cost per customer per month regardless of electricity consumption. And that's essentially the cost of being connected to the utility. One risk with these policies or with these types of designs is that the more and more customers feel that they're being restricted, the cheaper and cheaper solar gets, you have the potential and the cheaper and cheaper storage gets in particular, you open up the opportunity, you open up the possibility that customers will just start to

cut the wire altogether and they'll start to self-supply all of their power needs, use solar and batteries to basically supply all of their power. And that would lead to even more revenue loss from the utility if they can't control the rate at which this is happening.

So this is yet another reason why the battle or the ongoing struggles over net billing and net metering policies are so fascinating because they really indicate that we're at a crossroads in the evolution of the power system as distributed generation becomes more cost competitive, becomes more economic, especially as solar plus storage costs continue to go down. There is the opportunity for a growing number of customers to actually cut the wire entirely and self-supply. And that is—when that happens, I anticipate that the pendulum is gonna swing and utilities will start to be much more willing to strike win-win tariff arrangements because they will rather hold on to those customers than let them fully slip away. And we're seeing some utilities in fact even starting to get into the storage business themselves and starting to offer even getting into the solar business themselves so that they can retain a portion of the revenues from those new market developments and those new business model innovations. So again, the different adaptive strategies here are—these are ongoing changes. This is a fascinating time and a fascinating landscape to observe evolve in real time.

Now let's shift to a few advantages and challenges. So first, the advantages. On the one hand, net billing recognizes that the cost of solar is increasingly below the cost that customers pay. Hence, paying them or compensating them at the full retail rate is arguably overcompensating. So in that sense, net billing may provide an option for a fair—or a way to have a fair compensation structure with fewer cross subsidization issues. Again, this is a very heated debate and it's too early to tell and ultimately the debate depends on what the actual design of the net billing policy and how restrictive it is. But that's one of the potential advantages of well-designed net billing policy.

A second advantage is that it de-couples the compensation of rooftop solar from the customer class that you happen to be in. So it's no longer if you're a residential customer or a commercial customer or an industrial customer, you're not each getting a different rate for your net excess generation. You are getting in some cases the same rate. So it essentially creates a level playing field between the different customers. In that sense, a net billing rate may be less arbitrary than a net metering policy where net metering policy you have a different "compensation rate" for a different, depending on which electricity weight payer class you are actually in. And net billing is, in that sense, an improvement over that arbitrary compensation structure.

Further advantages. It allows utilities to avoid these cross-subsidies potentially. It makes it easier also to adjust the compensation rate because the net billing rate is not linked to the retail price. Under net metering, once it's net metering it's fixed and you get compensated at the retail rate you pay. Net billing makes it possible to actually adjust the net billing rate independently of the retail price that utilities charge their customers. So in a way there can be two different regulatory processes that happen independently. One of them

is the rate setting process for customers, the other is a rate setting process to adjust the net billing rate. And that may make it easier, may have advantages both for utility and for the industry.

Net billing also offers more flexibility as a result in terms of setting the "value" of distributed generation to the system because the net billing rate can be more finely tuned to the actual value of solar to the utility or to the power system. A few additional advantages. Enables potentially to mitigate revenue losses as we saw. It also enables degression which means customers connecting to the grid in 2018 could get a certain net billing rate whereas customers connecting in 2019 would get a different net billing rate and so on. So you have the potential to actually actively track technology cost evolution by setting a different rate. And you can also adjust it based on the evolving value of solar to the system as the market evolves. So there's, again, this flexibility point, flexibility in setting the rate and adjusting the rate potentially can be a significant advantage.

It also may have the unintended effect of encouraging the emergence of new business models that enable customers to trade power with one another. If you are a residential retail customer and you pay $0.15 per kilowatt hour and the utility says, "Oh sure, we'll allow you under net billing to get $0.07 back for that net excess generation." You as a customer may well start to look elsewhere to see if maybe your neighbor is interested in buying your net excess generation instead of the utility at a rate that's closer to the retail rate you all pay. This used to not be possible for a host of technological and digital technology and utility regulation reasons, but it's now starting to become possible.

There are a number of new platforms and new initiatives in the U.K. and in Australia and in parts of the U.S. that are looking at peer-to-peer energy sharing and the possibility that customers could then say, "If the net billing rules get too restrictive and the utility isn't compensating them enough, they could start to say, 'Hey, I'm gonna start reaching out to my neighbor or to my community and I'm going to offer these kilowatt hours onto a different kind of exchange and actually fetch the best price.'" In that sense, the utility is no longer the monopoly buyer, or it's sometimes call the monopsonist, the single buyer in the market, there could be many different buyers for your net excess generation.

And in that sense you get more competition and customers would definitely then be getting—consumers will definitely then be getting a better rate, a better price for their net excess generation and that opens up the possibility for a much more dynamic, much more multidirectional, much more interconnected power system than one we've ever known before. And I think we are very much at the beginning of this particular transformation and I'm excited to see where some of the new businesses and some of the new changes in this particular space take us in the years ahead.

A further quick overview of some of the challenges. Customers may find that actually the net billing rate is unfair or is insufficiently high. They may argue that their solar power is worth more than what the utility is prepared to pay

for it. It means also that net billing customers are not able to benefit from utility rate increases in quite the same way as they would under net metering because their rate doesn't track their retail rate increases anymore. And again, net billing is more conservative. It's less—in most cases, less financially attractive than net metering. So these are all some of the downsides to net billing.

Now some key decision points. This list is by no means comprehensive, but it's designed to provide you with a quick overview of some of the key decisions that if you're a policymaker, a regulator, someone who's involved in developing a—or adjusting your policy for distributed solar, these are some of the considerations you should be looking at. These are some of the key design features and decision points that need to be made. Now a few concluding remarks. There's broadly a trend towards compensation being set below the retail rate as we saw and that change is embodied by the emergence of net billing policies. We're seeing ring-fencing becoming more common, limiting certain components of the bill and we're also seeing NET-FITS becoming more common as an evolution even beyond net billing itself. And we're starting to see a growing number of jurisdictions moving rather in that direction. And for a closer, deeper look in particular at NET-FITS, I encourage you to take a look at Session 7 specifically on that topic and also to have a look at Session 2 which provides an overall snapshot of solar policy and looks at a few different policy tools.

On the one hand, net billing can help address utility concerns around revenue loss and in that sense if utilities are deemed to be a necessary part of the future of the power system, having more financially solvent, financially stable utilities may actually be positive in the long run for the long-term growth of distributed solar. So there may be, again, the idea here that most jurisdictions are trying to strive towards is some kind of a win-win where customers can gain solar, consumers can gain and can benefit and the utility can still remain financially solvent and maintain reliable, secure power supply for all its customers.

However, as I pointed out a few moments ago, net billing may also foreshadow the rise of more disruptive business models in the future. The tighter and the more restrictive the regulatory environment for customer-sited solar becomes, the more likely it is that these new business models break through and gain very rapidly very large numbers of customers, in particular models like peer to peer power sharing. As we saw in the net metering presentation, the genie is arguably out of the bottle and there's very little that we can do to change that. The fundamental economics are now in solar's favor and it's up to policymakers and regulators in conjunction with utilities and with citizens to design and develop better policies that again try to achieve these win-wins and try to arrive at a system where solar power can flourish as a cost-competitive, clean source of new power generation and where the utility system as a whole can continue to provide reliable electricity supply for all.

With that, I want to thank you very much for your attention and for following through the presentation and hope you're able to learn something more about distributed solar policy in the process. I've added here a list of further reading at the end, including a number of recent reports and analyses that have been published and I want to thank you for your time and I encourage you to take at the end of this there's a few brief questions that has—the knowledge test that essentially is there to gauge your knowledge and test essentially whether you're grasped the essentials of these different policy tools. So with that, thank you very much and wishing you all a great day.