MRV Webinar Series

Measurement, Reporting, and Verification (MRV) Best Practices for Biogas Projects

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Nick Elger:

Welcome everyone. Thank you for joining today. We're really excited to have you all join us on a series of discussions on measurement, reporting, and verification best practices for biogas projects. Today's webinar is hosted by the U.S. Environmental Protection Agency, in partnership with the Global Methane Initiative. Before we start, I want to go over a few webinar software tips.

First, there are three ways to connect with the audio today. You can either listen through your computer speakers, use a call me feature to receive an automated call, or use the call me number listed in the webinar invitation. All participant lines will be muted during the duration of the webinar regardless of the audio method that you choose. If you have any questions, you can enter them into the Q&A panel. When submitting questions, please select "all panelists" from the drop-down menu before hitting "send." This will ensure that all of the speakers see your questions. In the text of your question, please identify which speaker your question is for. Questions will be moderated at the end of today's session. Final materials, including a recording and webinar slides, will be posted to the Global Methane Initiative website.

We will also be asking several poll questions during today's webinar. The slido panel will appear when we open the first poll. To respond, select your answer and hit "send." We also have feedback questions at the end of the webinar and would appreciate your feedback about today's webinar.

So, with that, let me first introduce myself. My name is Nick Elger and I am a program manager at the U.S. Environmental Protection Agency's Climate Change Division, where I work on methane emissions mitigation efforts in the US and globally in the agriculture, waste, and oil and gas sectors.

With me today is Gerardo Canales, executive director of ImplementaSur, and Zach Eyler, vice president of Ruby Canyon Environmental.

We have a great agenda planned for today. First, I will kick things off with a high-level discussion on MRV Best Practices and dive into some of the high-level best practices from GMI's Policy Maker Handbook for MRV. I'll then hand it over to Gerardo Canales to discuss practical applications for measurement and reporting, and then pass it over to Zach Eyler to discuss best practices and applications for verification.

And we'll close today's session with a Q&A session. I encourage everyone to drop in their questions in the Q&A box throughout the webinar.

Before diving into the best practices for MRV, I'd like to just provide a quick overview of the Global Methane Initiative, or GMI for short. GMI is an international public private partnership focused on reducing methane emissions and capturing and utilizing methane as a source of clean energy. There are 46 countries that are members of GMI and over 700 project network members. And together, the project network members and countries work to abate methane emissions in three main sectors in anthropogenic methane emissions: the biogas sector, which includes agriculture, municipal solid waste, and wastewater, coal mines, and oil and gas.

So, why focus on the biogas sector? The biogas sector, which encompasses the agriculture, municipal solid waste, and wastewater, accounts for approximately 20 percent of global anthropogenic methane emissions. There are a number of benefits associated with capturing and utilizing biogas, including mitigating greenhouse gas emissions, producing renewable energy, and improving public health. There are many technology options available on the market to capture and utilize biogas, including landfill gas collection and control systems and anaerobic digester systems.

Establishing an effective measurement, reporting, and verification system for biogas projects is really critical for accounting for the emission reduction benefits from biogas projects. Measurement refers to the tracking and documentation of data and information on GHG emissions and emissions reduction from a project. For biogas projects this can involve installing a biogas flow meter for directly monitoring methane emissions. Reporting involves disseminating the measured greenhouse gas emissions and emissions reduction data and information using standardized methods and formats. And verification involves independently assessing the reported greenhouse gas emissions and emissions reduction to ensure completeness and accuracy. This is typically done through an independent, third-party verification body.

MRV can be designated at different scales. At the international level, the purpose of MRV is to promote trust and accountability while fulfilling any international reporting obligations, such as those under the United Nations Framework Convention for Climate Change. At the national level, MRV provides a comprehensive picture of national emissions, through national greenhouse gas inventories, which would feed into any international reporting obligations, and inform national goals and priorities. And then, further down at the organizational, facility, and project level, MRV can support policymaking by providing emissions and emissions reduction data. This is helpful to assess the impacts of mitigation projects and track progress toward mitigation targets.

Today's webinar is focused on project-level MRV. This is considered a "bottom-up" approach because it's tracking emissions and emissions reductions at the ground level.

You are now going to see the first polling question for today on the right of your screen.

The polling question is, on a scale of 1 (low) to 5 (high), how would you rate your knowledge of measurement, reporting, and verification for biogas projects?

Please select your answer and hit send.

Great, it looks like some answers are coming in. Most folks are on the relatively low side, so we're really happy to be here and happy to have you here today and hopefully get your comfort level with biogas project level MRV up a little higher.

So, now we want to dive into some of the best practices for MRV in the biogas sector. Largely, the next following slides, are going to explore some of the contents from the newly developed Policy Maker's Handbook for Measurement Reporting and Verification in the Biogas Sector, which was developed by the Global Methane Initiative. The purpose of this Handbook is to help countries and organizations establish MRV systems for the biogas sector. The Handbook focuses on best practices at the project level, including anaerobic digestion projects or landfill gas projects and draws on technical guidance and tools from existing protocols and knowledge from MRV experts.

But, before we dive into the Handbook, we have another polling question for everyone.

What can biogas project-level MRV data be used for?
A. To develop national inventories
B. To enhance mitigation targets in nationally determined contributions (NDCs) and track progress toward national development goals
C. To increase access to external funding sources
D. All of the above

We have many smart test takers on the call today. Most people said all of the above, which is the correct answer. If you did answer the other ones, you're also correct. But, all of the above is the correct one.

Ok, so let's dive in. Biogas project MRV can be used in several ways. First, it can be used to develop robust national inventories. Many governments use Tier 1 methods for estimating emissions in the biogas sector, which have very low certainty because they are based on generic models and default values. Governments often rely on Tier 1 methods because of the limited data availability. By collecting and using project-level MRV data, governments can move beyond Tier 1 methods into Tiers 2 and 3, which have higher levels of certainty because they involve country-specific and facility-specific data. Project-level data can be used to help refine methane recovery rates, develop country-specific emission factors, and improve the accuracy of data on activities that contribute to or avoid emissions.

In addition to developing national inventories, biogas project MRV can also help countries enhance mitigation targets, policies, and actions. It can also increase access to external funding sources by demonstrating to financiers and funders the prospective and actual mitigation benefits from those investments.

And really, the most important component of MRV is the measurement of data. Developing and implementing a comprehensive measurement plan is a critical first step in this process. A measurement plan provides a facility personnel with a blueprint of the key steps in collecting and managing data on emissions reductions from a project.

The plan should include general information on the facility and operations, the role and responsibilities of facility personnel, and a description of the mitigation project or activities.

It should also describe what data and information is needed to be collected on the project or activities and discuss how that data and information can be collected. The method to quantify emissions reduction should be detailed in the measurement plan as well.

Speaking of quantifying emissions reductions, the first step of quantifying emissions reductions is establishing a baseline. The baseline is really a measurement of the emissions without the mitigation project. This baseline serves as a reference point to help calculate what the change in emissions are.

And so, with this baseline, emissions reductions can then be estimated either before project implementation or after implementation has begun.

Emissions reductions estimated before project implementation can be useful as part of a project feasibility assessment or a project proposal. These estimates are based on modeling and will have a significant margin of error. However, this uncertainty could be reduced by using historical values or by sampling a subset of the population for key parameters. For example, although biogas generation at a landfill cannot be accurately measured without a biogas collection and metering system, a first-order decay model, which is based on annual disposal rates at landfills, estimated waste decay, and methane generation rates, is useful for estimating potential methane emissions over time.

Emissions reductions estimated after project implementation can be useful to track progress in mitigation efforts. This can be directly measured, through biogas flow meters, for example, or it can be modeled. And, of course, direct measurement will be more accurate.

Emissions reductions quantification should occur at least annually. During the course of a given measurement period, certain data parameters should be monitored at a frequency that is really representative of what's needed to accurately calculate emissions reductions.

A recommended best practice would be to install flow meters to provide biogas flow measurements on a continuous basis. These flow meters should be maintained and calibrated to increase data accuracy. Project operators can also develop targeted sampling strategies that detail the best times of the day and season to sample. Typically, greenhouse gas mitigation programs will provide guidance on the frequency of data measurement. In the handbook, we have a full list of cost-free biogas project emissions quantification tools, including GMI's Solid Waste Emissions Estimation tool, which can be found on the GMI website.

Ok, we have another polling question on the screen.
What is the best practice for dealing with missing data when monitoring or data recording equipment fails?
A. Estimate values that look reasonable
B. Follow guidelines by GHG mitigation programs for substituting missing data
C. Follow methods for resolving data gaps in IPCC Guidelines for National Greenhouse Gas Inventories
D. B and C
E. A and B

Ok, great. Yes, the answer is B and C. If monitoring or data recording equipment fails, project operators should check if their greenhouse gas mitigation programs have specific requirements and methods for substituting missing data. They may also refer to the IPCC Guidelines for National Greenhouse Gas Inventories for methods for resolving data gaps. This may include methods for interpolation, or trend extrapolation.

The next component of MRV is reporting the emissions and emissions reductions data. Project operators can report this data to a range of reporting program administrators, depending on whatever their specific objectives are.

For example, reports might be submitted to national government agencies, as mandated under national greenhouse gas emissions reporting programs. They could also be reported to local governments as required under municipal emissions inventories. Or they could be reported to voluntary programs, such as the Carbon Disclosure Project, or financial institutions or carbon offset program administrators. And, really, the type of information to be reported and the level of detail will vary depending on the reporting program.

The final component of MRV is Verification. Verification for all biogas projects involves the same basic steps, which Zach will later discuss in greater detail in his presentation. As a best practice, greenhouse gas data and information should be verified by a third-party verification body to ensure impartiality and reduce risks. Verifications should be conducted using a standard and criteria.

While it is best practice to report annually, verification may occur every other year, every three years, or even less frequently if an initial verification is conducted early in the project's lifecycle. The frequency of verification is often dictated by the program or at the request of the project developer or owner.

That was a high-level overview of the best practices for biogas project MRV from the GMI Handbook on MRV best practices for the biogas sector. Again, this resource is available on GMI's website. There's a lot of other great information on MRV in the biogas sector on the Global Methane Initiative website.

So now, I'm going to turn it over to Gerardo Canales to talk about the measurement and reporting best practices.

Gerardo, to introduce you quickly, is the Executive Director at ImplementaSur with more than 20 years of experience in climate change, waste, circular economy and clean energy policy and implementation. Presently, he works with countries and cities in Latin America, Africa and the Pacific to identify, develop and implement mitigation actions, develop NDC implementation strategies and other climate related initiatives. Thank you so much for being here, Gerardo, and I'll pass it over to you.

Gerardo Canales:

Thank you, Nick. Thanks so much to GMI, EPA, for this invitation and also for the constant technical assistance and guidance that you have provided to different work in the region in the last decade. Always a pleasure to share with you some ideas.

So, I'm from ImplementaSur, as Nick said. ImplementaSur is a consulting firm based in Santiago, Chile. We focus on climate change issues and, basically, we try to help organizations identify what can they do to tackle climate change, and how to get to those goals. We work with organizations through diagnosis strategies, and implementation, which is really our focus, given the crisis that we have. We have clients in the private sector and also work a lot of international cooperations and organizations.

So, today I'm going to talk a little bit about MRV in Chile, particularly some MRV work that we developed within the Reciclo Organicos program. So in general, MRV in Chile, there are some 13 MRV initiatives in the country at the present—3 classified as emissions initiatives, 5 classified as mitigation action initiatives, and 5 MRV systems that address both emissions and mitigation actions.

Some examples of these types of MRV. We have HuellaChile Carbon Management Program, which is basically a platform provided by the government where any organization can go in and report their emissions, and for mitigation actions, we have, for example, the Reciclo Organicos program, which is the one that I'm going to cover today, where we developed 3 MRV protocols for the 3 main technologies: Anaerobic digestion, landfill gas capture, and composting. And basically, to have a methodology, or 3 methodologies, that are tailor made for the country and of course, they are based on internationally recognized methodologies. But some emission factors or type of indicators were set specifically for Chile.

So Reciclo Organicos was a program funded by the Canadian government. A 7 million dollar program over 5 years. And basically the main objective was to help Chile achieve their NDCs for the waste sector. It was a very successful program and now has expanded to over a dozen countries in Latin America and the Pacific with the same objective. We are very happy that the program is expanding.

Within this program, as I said before, we developed 3 different MRV protocols. Today, I'm going to focus a little bit on the anaerobic digestion one.

So, of course, like any methodology, we have to identify which activities were included in the protocol, or the scope of the protocol. So basically, we focused on organic waste streams that were diverted from landfills or waste disposal sites. And also for manure diversion, we defined which systems were eligible as the ones from where the organic waste could be diverted from.

Also, during the development of the methodology, of course, we have to define which were the boundaries of the projects that could be included in the methodology. Defining basically what will be considered within the project estimations and what could be left out. So that's important to know in advance. It's important to note that this methodology was built together with several stakeholders. So a technical working group set up, including representatives from governments, from the private sector, and from universities. So, it was a discussion that took, I think, over 2 years, since the first meeting until we got the final protocols. But, it was very interesting and fruitful and I think everybody who participated learned a lot.

Also, we have to define the baseline, which is basically where was the waste going today, and that was the baseline that we defined for this methodology. Also, in terms of how the destruction of methane would happen, of course, we would need to define what's the kind of equipment that

we need to measure the destruction of methane. So we included in the methodology details, for example, on the flow of biogas been delivered to each destruction device, measured continuously and recorded every 15 minutes or totalized and recorded at least daily. So, we had to include all these details into the methodology, so it was a very prescriptive guidelines for users.

Then, also, we defined other information on the efficiency of the destruction devices. We based these factors on available international literature and other methodologies. So, as I said, we analyzed different methodologies that already existed, and we took from them what we considered was the better option for Chile.

Also, we had the opportunity to test a block chain application. So, the Reciclo Organicos program, in addition to the development of this methodology of course, we were supporting the specific projects. So, we took two of the projects that we were supporting, on landfill gas and one anaerobic digestion plant, and we set up some pilots of some block chain applications at these facilities. Of course, the methodology behind these block chain applications were the methodologies that we developed for the program—these protocols.

So, in simple terms, a block chain application is basically, like a real time monitoring and recording of information. So, the different instruments that are measuring the methane flow at the plant are connected to a computer, and that information is sent to a digital MRV platform in real time, and encrypted for any other use. So basically, each ton of CO2 equivalent that has been reduced, it's communicated and reported in real time in a very secure and cost-effective way. Also, this platform, we built the platform, where basically you can go in and check the information. There's information on each of the projects, where you can see the location, and of course, what has been the emissions reductions over time. So, it's a really friendly interface that users can go in and check the emissions and emissions reductions at any time. So, in the interface, you can set up different graphs, and take different information. Also, you can access a virtual tool of the plant where you can zoom in on different destruction devices or measurement devices and see how they are working.

What are some pending task for the future to make use of this methodologies? Well, probably to have a framework document for the country providing all policy decision surrounding the use of these methodologies could be developed, basically to guide potential users on GHG quantification and what can they do with these reduction units. In Chile, for example, we have a carbon tax, that is in the process of being enacted. Sorry—an offset system that's soon to be implemented. And having this methodology for specific technologies also opens opportunities for project developers to participate in that offset market that is being created.

So, potential next steps for the country, as I said, is developing this GHG framework, developing additional GHG Quantification Protocols for other high priority sectors—basically Chile would have our own methodologies for different typologies of emissions reductions projects. Hopefully, we could extend the monitoring periods for the projects that we are already working in. And also apply the digital MRV system to other facilities—it's not very complex and it's really a useful tool. As I said, these kinds of methodologies and systems allow the participation on different emission reduction schemes, like the internationally transferred mitigation outcomes (ITMOs), or any other similar schemes. And also, to have good MRV increases the confidence and transparency

on reporting national emission reductions. So, hopefully some day these emissions reductions can feed into the national inventory for instance. So, that's from our side, and thank you so much for being here today. Thank you.

Nick Elger:

Thank you for your presentation, Gerardo. Ok, so our next speaker is Zach Eyler. And Zach is going to discuss best practices for biogas verification. Just to introduce Zach quickly, Zach is the Vice President at Ruby Canyon Environmental and oversees operations of Ruby Canyon's GHG assurance work worldwide. Zach has over 15 years of experience with GHG programs and markets, having conducted hundreds of verifications for offset projects and GHG reporting clients. He has worked in numerous carbon offset programs across a wide variety of sectors and project types. Thank you so much for being here, Zach, and I'll pass it over to you.

Zach Eyler:

Alright, thanks Nick. Thanks everyone. Glad to be here and to share some of our experience in being a verification body, and best practices as it relates to biogas projects.

Really quick, about Ruby Canyon Environmental. We were founded in 2005. We were actually recently acquired by Tuv Sud Americas in December of last year—a large international testing and inspection certification company. Our role in the marketplace is typically as a third party validation and verification body, providing third party assurance, both for greenhouse gas reporting for clients and facilities, but also, more of our focus today, for greenhouse gas reduction projects—carbon offsets as more commonly known. Over our history, we've completed over 1,500 assurance engagements worldwide since 2009. We're accredited by multiple groups that accredit validation and verification bodies. I'm based in Grand Junction, Colorado. We also have a subsidiary company, Ruby Canyon Mexico, that's based in Mexico city and leads all of our Latin America work.

We do work in all kinds of different sectors, but on today's webinar, we do have a lot of methane capture experience with coal mines, landfills, livestock operations, and wastewater. But we've also worked in forestry, land use, renewable energy, and other types of sectors. We try to be in most programs that are out there in today's world, both in the compliance market, and in voluntary markets.

So a quick slide on sort of the verification overview—I call in the basics. Nick touched on some of these things, but I mean at a high level, when we conduct verification, we're providing assurance both on the methods that a project is using to quantify how many credits they are going to get—the emission reductions, so the numbers. And we're also working to assure that the project is meeting any program rules. I mentioned that there's a lot of programs out there that have a variety of different requirements that projects need to meet to be eligible.

Verification—no one likes to be audited—but in our opinion, the verification process does provide opportunities for projects to improve their overall MRV, which is very valuable, I think. Nick also mentioned the frequency of how often verifications occur. This does vary by program, and it can be all over the map like Nick mentioned—1 year, 2-year, 3-year, and even longer for some land use and forestry projects. But it is important early on in the project cycle to, I think,

conduct a verification, because again, it does provide value and the findings that we raise can help a project going forward in the future. A physical site visit is usually required for verifications, especially the first time a company like ours would conduct a verification for a project. Whether it is required in the future depends. But a physical visit, and I'll talk about it in a future slide, is very valuable, in our opinion, during the verification process to confirm that the project is doing everything correctly. While a verification is viewed as a partnership with our client, it is not consulting—it is done as a third-party in an impartial manner. And so, we can't tell our clients the answers. We can tell you when it's incorrect, but we can't tell you the answers because then we would end up auditing our own answers. So, it's important that it's done in an impartial manner and that provides integrity to the verifications we conduct.

A little bit more on the verification overview—this is focused on the criteria and standards. Nick also mentioned this at a high level. We conduct verification to specific standards. One is ISO standards. This is, I mentioned, 14064-3: 2019. This is a process that us, as the verifiers, follows to conduct verification and we're audited against that. So the auditors get audited once a year to maintain our accreditations, and that's what we get audited against—that standard. And then all the programs have their own requirements in program standards and guides.

There's really 2 main criteria that is also very important. Two main ones that are very consistent across all kinds of carbon programs. One is materiality threshold. And this is—when we conduct our review of your measurements—I'm sorry, your calculations—of emissions reductions and your final credit numbers, we need to ensure that they are within a certain materiality threshold, which is usually set by the program. The most common is plus or minus 5 percent. And so if we confirm that your final credit number is within plus or minus 5 percent, you are all good, and we can sign off on it. We do sometimes see different thresholds. 1 percent, 3 percent—that's typically for very large projects that generate a lot of credits.

The other one is the level of assurance. And pretty much standard across all carbon credit programs is a reasonable level of assurance. This is an auditing term, and, you know, that level of assurance require us to see source documentation and evidence to support and back up your numbers and any other requirements of the program. There's also a limited level of assurance, but that's more for greenhouse gas reporting and not really relevant in the carbon credit space. It's all reasonable level of assurance because these credits are being transacted. They're being used for compliance obligations, and so that high level of assurance is require from our side.

It's important, finally to agree to all of these items above before you start the verification. It's actually not allowed at this point following new ISO standards. We can't start our verification and then all of a sudden change criteria halfway through—we'd have to start over again.

Here's a quick diagram of the verification process. I'll sort of quickly go through these. So at the start of any engagement with one of our clients, is the receipt of the initial data and documentation from them. And often times, we'd send them a list of what we'd like to see. And so they share all of these documents and data with us, we start to review it and the first step that we would conduct is a strategic analysis. This is sort of a high-level review of the project, who's involved, what is the criteria, what sector is it in, and just, you know, in terms of, it sort of blends, and leads into our risk assessment. And the risk assessment is where we focus on specific aspects of a project to determine if it's a low risk, medium risk, or high risk. For example, if it's

the initial verification for a project, the baseline assessment in reviewing the baseline to ensure it's accurate is a high risk—it's a very important step. And so we would mark that as a high risk. And so based on our risk assessment, based on high risk or medium risk, that goes into how we design our verification and sampling plan, or now called evidence gathering plan. And that's our plan for what we're going to look at and how much we're going to look at it. So, if a baseline is high risk, well, in our evidence gathering plan, we're going to say we're going to look at the baseline, the numbers that go into it, the data that goes into it, documentation that supports it, and we're going to sample and review that in detail. Whereas other areas that are low risk, we might not look at it as much so that's sort of our guide in this risk assessment in terms of how much we look at.

So we conduct that review after our plan is set, we conduct the review of the data and documentation, we conduct a site visit, if required or if warranted, and after that, and I'll show you an example here in a minute, we put together a document noting any issues that we found and we sort of go through that with the client. If there's issues that, you know, the risk assessment can change, it's sort of an iterative process, if we find something new, that we didn't realize, we can actually go back and revise our risk assessment and sort of the cycle doesn't start over, but it feeds back into it. But ultimately, once all the findings are closed, and we are assured that you've met the materiality requirements and all the other requirements of the program, issue you a verification statement or an opinion that is usually a 1 to 2 page document that says, Ruby Canyon reviewed this project for this time period against this criteria and ultimately, we're signing off on a certain amount of credits. And that's usually the final document that you would give to a program that they would then issue credits against.

This is basically just what I just said but more in detail. I'm not going to read through it and just skip over, but you can look at this later on if you would like.

So, focusing on site visits, specifically. This is a really key important part of the verification process. Like I mentioned, so these are some of the example topics that we would cover on a site visit. Typically, a site visit to a biogas project would last no more than 1 day. Only if it was really complicated or involved, maybe with multiple entities, would it last longer than that. But we would, you know, for example, I mentioned baseline scenario already—we would review that onsite. So at a livestock project, if we're talking with the farmers, we would talk to them about, ok, you know, again this is what the scenario what would happen prior to a digester being built, for example, how did you manage your manure before the project happened? Did it go 100 percent to the lagoons? Was it managed and, you know, in open lots? Dry lots? Did you have a solid separator on site? And so asking those kinds of questions to the farmer directly is very valuable during the site visit.

At a landfill, the question could be talking to, you know, landfill operations staff. Did you collect gas ever prior to the collection system being installed? Was it destroyed? Was there passive flares on site? Solar flares? Those kinds of questions. And it's important to talk about those face to face and one on one—usually very valuable, we think.

On site, you also want to review data management. If we're talking about biogas flow, methane concentration, etcetera—how is that data recorded? What is the equipment? We want to also review your information control system. So, tracing data from start to finish. So it's recorded by

this device at the flow meter and then it ends up all the way at then end in the emission reduction calculations, where you're getting your final credit numbers. So how does that process work? You know, having the client walk us through, step by step, how that data flows from start to finish.

Obviously, reviewing monitoring equipment is important in the QA/QC of it. So reviewing calibration certificates for flow meters or methane analyzers, talking to the staff, or whoever is conducting that work. How are you calibrating the equipment? How are you checking the accuracy? What is your ongoing operation and maintenance like. Those questions are important on the site visit and then finally just touring the project and getting to see the equipment itself. Inspection of all the GHG sources, sinks, and reservoirs. We saw that graph earlier of all those boxes that Gerardo showed, you know, seeing the different types, where the manure is being managed in the project would be very important. Sometimes, fossil fuel and electricity consumption, need to review those meters, seeing the actual monitoring equipment flow meters and method analyzers, reviewing the serial numbers on site to make sure they match up to the documents that you've been provided, and also seeing data collection equipment, which I already mentioned.

So these are some of the common problems we see during verifications. You know, after 1500 of them, we've seen lots of different problems over the years. So, you know, basic things like using wrong emission factors, unit conversions being incorrect in the spreadsheet. You know, at a higher level, oftentimes people have very complicated calculations. And, you know, there'll be ten spreadsheets that we need to look at and that can be very difficult to trace if they're all, you know, intermingled, and are not connected well enough because, again, like I mentioned, we have to trace data back to its origin and if it's hard to do that, and very complicated, takes more time, and also important to our clients—takes more money.

Also, we see an example I call a black box calculator tool. These are great for clients, because, you know, they've hired someone to put together a great tool where it collects data and auto calculates the amount of, you know, emission reductions and credits they are going to get. So from the client side, that's great. It makes their life easier. But from our auditor's side, it actually can make our life more difficult because it's a black box and I can't see in there. I can't see under the hood. And again, tracing data and tracing calculations is very important and so that can be difficult for us to overcome. You can overcome it, but it just might take more time.

A couple other quick ones, for QA/QC, manufacturers need to follow, you're supposed to calibrate your meters, and you should be doing that. Not have an internal QA/QC program for calculations. And then just lacking source documentations. You know, reasonable level of assurance, we need to see source documentation.

This is an example findings document from a project—I've obviously changed the name. It's not actually called cow's biogas project, but, these are real findings from a verification and so there's a couple different buckets here. A corrective action request is something that has to be corrected or we can't complete the verification. So, in this instance, there's data substitution, so they're missing some data. They're missing data for biogas flow, and there's procedures that you're supposed to follow to substitute for that missing data and they were doing it incorrectly and they needed to correct it. There are some non-material findings and so, I mentioned

materiality threshold earlier. So, these are errors that we found that are less than 5 percent. So, it's up to the client. They don't necessarily have to correct them. They can if they want. Most clients correct everything because they want to be accurate, but it's up to them. So, these are like typos that we found in the calculations, or something that they just did incorrectly. Here they had some, you know, in terms of herd count—this is a livestock project—they just had some typos in terms of the number of animals at a certain time. Additional documentation request—this is something that we want to see more data on. And then in the final bucket is a clarification request, so it's something more that we want to discuss with the client and just walk through to figure out what happened here. So in this case, this is a digester project. There was a venting event where the cover came off. There's a way to calculate how much methane was vented and we just wanted to discuss that with them.

So these last two slides are sort of key to success for verification. This is sort of going back to some of the original principles. You know, completeness. So we need to, the client needs to provide us with all of the data and documentation that we need to see. And a good way to do that, and Nick already mentioned this, is to have a measurement plan, a monitoring plan, that ensures that all the data and documentation is recorded, saved, and organized in a manner so that the verification body can look at it easily. Transparency. We've already talked about this. We need to trace data from its start to its finish. And so, designing your calculations, designing your program, in a way that is easily traceable for the verifier from a data and equation standpoint. Accuracy. Obviously, it needs to be accurate to the materiality threshold. So have an internal QA/QC program for the calculations.

And the last one, I think it's important that when you start verification, make sure that everyone is on the same page in terms of who is responsible for what, and what the parties are involved. Communication is really important during the verification process. You know, it always ensures that a good audit occurs. Presenting the data and documents in an organized manner. Now, I've seen clients drop 200 into a folder and not organize, and that makes my life really hard. So presenting the data in an organized manner. And then responding to any questions we have like, that list of findings document, in a timely manner. If we don't hear from our clients for multiple months to return it, it's hard for us to pick back up the verification process because we have to relearn it and it just sort of drags the process on. So ensuring constant communication, frequent communication, is important in viewing this whole process as a way to improve your system. Like I've said before, no one likes to be audited. But if you use our findings as a way to improve your system, so that it's more accurate in the future, that's a great way to view an audit, I think. And then, Nick mentioned this as well, but as carbon markets are expanding, you know, there's more projects out there. I think it's very valuable that when you do have a verifier and hire them, they are accredited, which ensures that it's a high quality review that you. And that is it for me. Thanks so much.

Nick Elger:

Thank you so much, Zach. And thank you, Gerardo as well. Those were fantastic presentations on some of the practical and real experience from folks that are measuring, reporting, and verifying projects. Before going into the question and answer session of today, I just want to, you know, wrap up and kind of summarize today.

So in the first segment, I shared an overview of the Policy Maker Handbook in the Biogas Sector and talked through some of the high level guidance on MRV best practices. And again, that resource is available on globamethane.org/resources. Gerardo talked about the anaerobic digestion protocol for the Reciclo Organicos program, which is an excellent case study for MRV for biogas projects. And Zach talked through some steps for verification success, which involves following the original MRV principles, and clearly communicating the verification processes.

Just as a reminder too, this webinar today is part three of a three part MRV webinar series that GMI has hosted. And to see parts one and two, you can visit globalmethane.org/MRV.

So, that brings us to the question and answer session for today. We have a few questions that have come in. Encourage you to continue to type in your questions, if you have them. But we'll open up the floor now for those questions. I'll start with the first one. This one's from Joe. What are recommendations for estimating the percentage of methane in biogas when using a flow meter. Maybe I'll turn that over you Zach.

Zach Eyler:

For the flow meter, we'll just measure the flow of the gas, but in terms of the percentage of methane. There's two options that we see at projects. One is a continuous methane analyzer. So this is a inline device that is continuously measuring the methane content of the gas. Those are more expensive, but they provide, typically more accuracy and definitely more frequent recordings of the methane percentages. And also, some programs allow the use of handheld methane measurement devices. These are portable devices like Landtec Gem, for example. And that's where a person would go hook up their machine to a sampling port and take a sample of of the methane that Gerardo, you mentioned, in that protocol you discussed, you just have to take a methane sample once a quarter, every 3 months, and so that would be using that type of device. So obviously, you get less measurement amounts with that if you're doing it by hand, but they're also much less cheaper. So there is that kind of trade off, between those 2 types of devices.

Nick Elger:

Great, thank you, Zach. Question about the recordings – yes this webinar will be recorded and we'll post it on globalmethane.org/MRV. The next question—what other emissions quantification tools would you recommend. I can start out with that one. I mentioned the Solid Waste Emissions Estimation Tool from the Global Methane Initiative. That's a great tool for quantifying emissions and potential emissions reductions from landfill gas capture systems or anaerobic digestion systems, or diverting the waste to a composting facility. There's a number of tools in the U.S. Environmental Protection Agency's biogas toolkit, which can also help quantify emissions and the emission reductions. In the pre-feasibility stage, those are the Anaerobic Digestion Screening Tool, looking at emissions and emission reductions from anaerobic digesters. There's also the Landfill Gas Screening Tool, which is again sort of a pre-feasibility tool that can help estimate emissions and emission reductions from projects. Those are some of the ones that I would recommend from EPA. Zach or Gerardo, do you have other recommendations?

Zach Eyler:

A lot of our clients actually develop their own tool, so no I think the references you mentioned are the ones I would say too.

Nick Elger:

Ok. Another question, how do you deal with fugitive emissions on lants?

Zach Elger:

Well, I guess I'll try to answer if I understand the question. I would say that most of the protocols that we, and methodologies that projects follow to generate their amount of carbon credits and emissions reductions, the fugitive emissions are not calculated directly and they might be, in some of the default factors that are included in the calculation. Like, the destruction efficiency numbers that Gerardo showed or open flares, or an engine, for example, that's assuming that not all methane is combusted. And so some of it might be captured in the default factors that are included in the calculation. But, typically, you don't see any kind of direct measurement or requirement for a few years of emissions.

Nick Elger:

I think there's a follow up question to that. Which program or protocol does the example you gave follow? And I think that was referring to Zach, your presentation.

Zach Eyler:

Let's see. So. Maybe the example list of findings. I'm not sure what example they're referring to, but, yea I guess some of the voluntary carbon market would be the Climate Action Reserve, the American Carbon Registry, and then Vera, the Verified Carbon Standards. Those are the three most prominent voluntary caron markets that we work in today.

Nick Elger:

Thanks! Another question is, based on your experience, which is the main barrier to projects in developing countries have a successful third party verification, mainly for waste projects.

Zach Eyler:

In our experience, I think, it's really, not necessarily different between developing countries and developed countries. We see a lot of the same problems, regardless. And it's most that source data and documentation and ensuring, you know, every program or every project has its specific protocols or methodology they have to follow, and when we audit a project, we're going to go down the list and we're going to review every single requirement of that protocol that the project has the document or data to support all of the requirements. That is usually one of the biggest issues—is that they just don't. And so then they have to go try to find it, which can take time, or you know, sometimes they can't find it, and then we have to, if allowed, come up with another solution for us to verify it. And so having that source data and documentation for all the requirements is really the huge piece of it, right?

Nick Elger:

I think we have time for just 1 more and we'll be happy to answer and follow up on the questions that we didn't get to today.

But the last question is, is the emissions baseline plant specific. I can just start off, I can say that it's important to get baseline to estimate emissions from a project specifically. There's a number of tools that I mentioned that can help you estimate those emissions, but really, you need to understand each project is unique and has different emissions profiles, so it would be plant specific to get that baseline.

Gerardo Canales:

Yep, Nick, maybe you can add something, for instance, in the protocols for Chile, there are different situations for different regions. In Chile, organic waste in the north of Chile doesn't decompose in the same way I think in the South, where it's much more humid and rainy. So we did incorporate into the protocol specific emissions factors for the different regions. Also, for instance, in Santiago, most of the waste goes to engineered landfills, which is not the case, -- sorry in engineered landfills that already have destruction devices, even for electricity generation, that's not the same situation in our areas of the country. So we could say that there is some relationship between where this is located and the specific baseline that you're going to use for it.

Nick Elger:

Thank you, and there are a few outstanding questions, which we will try our best to respond to in a follow-up email. So with that, I just want to thank our speakers again. Gerardo and Zach, thank you so much for being here and sharing this information. And thank you everyone for joining today. And please stay on if you have an extra minute to respond to the feedback questions at the end of the session. Thank you so much.