

Benchmark Analysis with RETScreen

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Webinar Panelists

Dinesh Parakh CanmetENERGY
Kevin Bourque CanmetENERGY

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Katie

Hello, everyone. I'm Katie Contos, and welcome to today's webinar, which is hosted by the Clean Energy Solutions Center in partnership with CanmetENERGY. Today's webinar is focused on the benchmark analysis with RETScreen. Before we begin, I'll go over some of the webinar features. For audio, you have two options.

You may either listen through your computer or over your telephone. If you choose to listen through your computer, please select the mic and speakers option in the audio pane. 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 will display the telephone number and audio pin that you should use to dial in. If anyone is having technical difficulties with the webinar, you may contact the GoToWebinar's helpdesk at (888) 259-3826 for assistance.

If you'd like to ask a question, we ask that you type the question into the question pane. Also, the audio recording and presentations will be posted on the Solutions Center training page within a few days of the broadcast, and will be added to the [Solutions Center YouTube channel](#) where you'll find other informative webinars, as well as other video interviews with thought leaders on clean energy policy topics. Finally, one important note of mention before we begin our presentation is that the Clean Energy Solutions Center does not endorse or recommend specific products or services. Information provided in this webinar is featured in the Solutions Center resource library as one of many best practice resources reviewed and selected by technical experts.

So, today's webinar agenda is centered around the presentations from our guest panelists Dinesh Parakh and Kevin Bourque, who have joined us to discuss benchmark analysis module of the RETScreen expert, a clean energy management software system for energy efficiency, renewable energy, and co-generation project feasibility analysis, as well as ongoing energy performances analysis. Before we jump into the presentations, I'll provide a quick overview of the Clean Energy Solutions Center. Then following the panelists' presentations, we will have our question/answer session where 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 April of 2011 under the Clean Energy Ministerial. The Clean Energy Ministerial's a high level global forum to promote policies and programs that advance clean energy technology, to share lessons learned and best practices, and to encourage the transition to a global clean energy economy. 24 countries in the European commission are members covering 90 percent of clean energy investment, and 75 percent of global greenhouse gas emissions. The 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 and crafting in implementing policies related 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's co-sponsored by the governments of Australia, Sweden, United States, with in-kind support from 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 supported institutions, no-cost virtual webinars, training on a variety of clean energy topics, partnership building with development agencies in regional and global organizations to deliver support, and an online library containing over 5500 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, and civil society. The Solutions Center is an international initiative that works with more than 35 international partners across its suite of different programs. Several of the partners are listed above and include research organizations like IRENA and the IEA, and programs like SEforALL and regional focused entities such as ECOWAS Center for Renewable Energy and Energy Efficiency.

A marquis 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 efficiency analysis, we are very pleased to have Farah Sheriff, project engineer at RETScreen International, serving as one of our

experts. If you have a need for policy assistance in energy efficiency analysis or any other clean energy sector, we encourage you to use this valuable service. Again, this assistance 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 word about this service in your networks and organizations. Now, I'd like to provide a brief introduction for today's panelists. First up today is Dinesh Parakh, who manages strategic partners, communications, business development and training, and capacity building for RETScreen International at Natural Resources Canada/ENERGY. And our second speaker today is Kevin Bourque, who is the part of the development team for the RETScreen Clean Energy Management software. And with those brief introductions, I'd like to welcome Dinesh to the webinar.

Dinesh

Thank you, Katie. Let me get my screen on here. All right. Can you see my screen?

Katie

Yes, we can.

Dinesh

Okay. Wonderful. Thanks very much. Okay. So, good morning, good afternoon, and good evening to all of you.

Welcome to everyone from around the world and thank you for making the effort to attend this webinar. So, as Katie mentioned, this is the latest in a series of webinars on the RETScreen Clean Energy Management software, provided as part of Canada's contribution to the Solutions Center's Ask an Expert service. I am first going to provide a brief overview of the RETScreen software and RETScreen International. Following this, Kevin Bourque, who is a senior engineer for RETScreen International, will be doing a live software demonstration of the benchmark analysis module of RETScreen Expert. So, to start, what is RETScreen?

Well, briefly put, RETScreen is the world's leading clean energy decision making software. RETScreen can undertake benchmark, feasibility, performance, and portfolio analyses. And, again, just to note that previous webinars on these topics—feasibility, performance, and portfolio—are available on the [Solutions Center YouTube channel](#), as well as on the RETScreen e-learning channel. The technologies covered in RETScreen include energy efficiency, heating and cooling, power generation, and co-generation. RETScreen handles both renewable energy as well as conventional fuels. And RETScreen can be used for a wide variety of facilities, including residential houses, commercial and institutional buildings, industrial facilities, and power generation facilities.

RETScreen is also available in 36 languages, covering two-thirds of the world's population at the click of a button. And Kevin's going to show that to you later. RETScreen's mission is to empower cleaner energy decisions worldwide. RETScreen has over 575,000 users in every country and territory of the world, and this number is growing at about 50,000 new users every year. Over 1,000 universities and colleges, that we know of, use RETScreen

for teaching and research, and RETScreen has been responsible for well over \$8 billion in direct user savings since 1998.

RETScreen is developed by the government of Canada, with the contribution of numerous partners, including Ontario's independent electricity system operator, the Renewable Energy and Energy Efficiency Partnership, based in Vienna, who are actually the funders of the original benchmark database on which the benchmark module is based. Other partners include NASA, the United Nations Environment Program, and the Global Environment Facility. The next generation of the software was released in September 2016. This new software is called RETScreen Expert, and that is what you are going to be seeing today. And just as a quick reminder that you can download the software free of charge from our website at www.RETScreen.net.

So, why benchmark? Why are we spending more than an hour this morning on this topic? And why is it so important? So, again, just very briefly, energy benchmarking helps designers, facility operators, managers, and senior decision makers quickly gauge a facility's energy performance. So, why benchmarking does that—it allows you to estimate the expected energy consumption or production compared to a reference facility and get an idea of the scope for improvements.

So, that's a quick answer to the basic "why" of benchmarking. Kevin is now going to present the actual benchmark analysis module, which is going to include how to establish your own benchmarks and use RETScreen's extensive benchmark database; how to use the various tools available in the software to establish, validate, and update your benchmark; and what is required at each step of project analysis to keep your benchmark relevant. What you see on your screen here is a screen shot of the home page of RETScreen Expert, which is going to be the starting point for Kevin's demonstration. And finally, I'll just remind you again, as had been mentioned, that there will be a question and answer session at the end of Kevin's presentation. If you have questions during the presentation, please feel free to submit them through the question window, and we'll be sure to address them at the end of the presentation.

So, with that, over to you, Kevin.

Kevin

Thank you very much, Dinesh. Let me just set up my screen sharing. And here we are, within the software itself. So, hello, everyone. My name's Kevin, and today, I'm going to take you on a tour of the benchmark analysis in RETScreen.

And we're going to do this together right within the software itself. So, we're going to work with the software and demo it live to show you how to do all sorts of different benchmark analysis in RETScreen and to keep them relevant as your project progresses through different stages of a project. The key message I want you to come away with today and for you to remember is that RETScreen's benchmark analysis module is a super easy way for you to do benchmark analysis. It's flexible, as well. It will let you integrate it with other benchmarking tools which you may be using or that you may be mandated to

do, and it can also integrate well with other more detailed energy performance monitoring projects or feasibility projects or energy auditing and those types of things.

So, why would you want to do benchmarking with RETScreen in the first place? Well, first of all, RETScreen lets you quickly establish the reference climate conditions for a site anywhere on Earth. It lets you compare the energy performance of various types of reference facilities with the estimated or measured energy consumption of those facilities. So, either of those—either the estimated or measured values—can also come from your RETScreen feasibility or your RETScreen performance analysis if you want. It also helps you to gauge a facility's energy performance, including the scope for improvement.

So, it does this by helping you compare the expected energy consumption or production versus reference facilities. As well, it provides you with a first guess at the energy situation for your facility. And last, but not least, you can leverage our extensive benchmark database which has well over 4,000 listings—and we'll take a closer look at that in a minute or two. So, I'm here within the software on the home page, and you'll see on the right-hand side here, I have a list of different facility types. And all the types of project listed in this right side can have a benchmark analysis, including different types of buildings, factories, and even power plants.

So, for example, you could do a benchmark for buildings—like schools or hospitals or office buildings—over all different types of industrial manufacturing. You could even do benchmarks for electricity generation. So, for example, for a clean power production—including wind and solar energy, affordable _____. You can do it for gas turbines, landfill gas, bio-gas, and more. Now, this circle in the middle of the page shows the RETScreen project analysis workflow, and it shows the different project types that you can do, and the worksheets associated with each of those project types.

Now, you'll see in the upper right-hand quadrant that the location and facility page are key parts of the benchmark analysis. Now, one important thing to remember is that the location and facility page are available for all project types in RETScreen, including any performance and feasibility analysis that you may want to do. So, what that means is that benchmarking is automatically a part of every RETScreen analysis that you may do. So, let's get right into the benchmarking tool and see how you do that. So, one of the easiest ways is here on the left-hand side.

We have different project types, and you'll see if I click on this button here that says, "Benchmark", RETScreen will load a benchmark analysis for me—a blank one. And the first place it brings me to is the location page. So, as I said a couple of minutes ago, that one of the important things in benchmarking is having referenced climate conditions for a site anywhere on Earth. So, whether you're doing power production or analyzing buildings, it's important to know where your project is and what conditions your project is subject to so that you're comparing like with like. So, I'm going to show you just briefly how to select a location.

Today, let's pick a project. I've clicked on the "Select Climate Data Location" button, and I won't go into detail on how to do this; we have that in another video. But, let's suppose that our project today—let's do an analysis in the greater Toronto area, let's say, around Oakville, and we're going to say, pick our projects, which are going to be, say, around here. And we can zoom in and we can actually go to satellite mode if we want and actually select the very precise location of our project, but suffice it to say that we're now picking the place of our project and RETScreen will automatically pick the best climate data location. And when I click "Okay" that data is updated on the location page. So, you'll see here, the map has been updated.

I have some updated location information—both for the facility itself and the climate data—and, as well as the climate data itself. So, it's important to get the location info set up properly for the first time for any future types of analysis you might want to do. So, if you decide to continue with RETScreen doing either feasibility or performance analysis later on, it makes everything easy since it's all in one place and it's already done. So, it's important to get this right from the beginning. Choose where your project is.

So, the next thing I'm going to do is the second tab as part of the benchmark analysis and that's the facility page. So, I'm going to click on the facility page, and you'll see here that RETScreen automatically opens, and the first thing we see is a power plant. And it's important to remember that the benchmark analysis in RETScreen can be done for all sorts of facilities, including power plant. Now, we're going to come back to power at the end, but let's start with a facility first. So, if I click on the facility type drop down here, I see the different types of facilities that you can you do RETScreen analysis on.

I'm going to click on the—I'll start with an industrial type, and you'll see that the page changes. We get a new image. This data below has been updated. And let's look at some subtypes. So, we'll see here different types of industrial manufacturing processes, as well as their subtypes, and let's click on "Dairy" as an example.

So, you'll see that the image is updated to show a dairy plant. This is just an example so that you know what you're working with, and you'll notice here at the bottom that the numbers have changed again. When we changed that, then this graph was updated as well. Let's go through this quickly. So, notice that we have a benchmark data available instantly.

So, all we've done is we've selected what facility type and subtype, and RETScreen has automatically gone into its database and picked out a benchmark for us. Notice, also, that we have the minimum typical/maximum typical benchmarks for that. And below that, we have a base case energy use intensity as we as a target. And the target here is set at 15 percent. And that helps just to start the conversation and says, "Well, what would the energy use intensity be if we were to reduce it by 15 percent?" And then, RETScreen can calculate the proposed case.

You'll notice here that the units are in kilowatt-hours per employee, and we have right here the units—the energy units—for this energy use intensity.

And if I click, you can see that you can change those units. So, we're using kilowatt-hours, but you could have megajoules or a million btu or other units that are of interest to you. And similarly, for the facility side, the default benchmark is measured in kilowatt-hours per employee, but if had other metrics that you wanted to use for your benchmark—for example, the number of kilograms or pounds of product or even tons of dairy being produced by this industrial application—you could do that. Let's keep it as "Employees" since that's what the benchmark is, and let's type in a number here, and let's say, "Well, what if this dairy facility had 125 employees?"

And as soon as I click here and press "Enter", you'll see that some values will be calculated here at the bottom. And as soon as I do, you see here that we're now able to calculate the base case on the plan based on this energy use intensity for the base case. We're now able to calculate what the overall annual fuel consumption would be for this dairy facility in the base case, and if we reduced it by 15 percent, what the proposed base is. And RETScreen can calculate the fuel saved. Let's actually jump into a different type of benchmark.

I want to show you how quick and easy it is to explore benchmark. So, we looked at an industrial facility—how about a residential project? So, if I click on "Residential", you'll see, once again, the image updates. And look at the different types of residential benchmarks we can explore. Let's look at—let's say a single-family home.

So, the image updates, so we know what we're working with, and the benchmarks, of course, have updated as well. You'll notice here that the units have marks for this single-family home are available in kilowatt [Break in audio] square meter. And you can, of course, change those units as well. So, if you change these units here, RETScreen will handily convert them for you. So, if we wanted to know what the typical energy fuel end use consumption was for a 1600 square foot home?

We type in "1600" and just like before, RETScreen is able to now calculate the base case and the proposed case and used fuel consumption. So, remember before, there was 31 million kilowatt-hours, and now, it's just under 20,000. So, we're already starting to get an idea of how much fuel consumption and what the benchmarks are for these different—very, very different types of facilities. You'll also see here that once again, RETScreen has automatically put in the benchmark, and the minimum typical and maximum typical value at 12.45 kilowatt-hours per square foot. And, as before, if I change that into square meters, RETScreen calculates that as well.

So, that's for this home, but what do homes in general—what are different types of benchmarks for homes? So, one thing that you may want to do is you can consult the RETScreen benchmark database. And, if I go into the menu here, you'll see a button that says, "Benchmark Database". And, if I click on "Benchmark Database", the RETScreen benchmark database will open, and you'll see here that here, we're looking at residential projects in Australia. But we can filter this list here.

And we have a full benchmark database here with about over 4300 different entries in it. So, now, we're just looking at residential projects, but we have all those commercial projects and those industrial as well, and for all sorts of countries all around the world and all different units. So, the way that this benchmark database works is that it aggregates and collects different benchmarks from around the world, and it lists them here in these rows where we have the country—where it's from—what the benchmark value is itself, and what unit it's in, what the category—the facility type and type of that facility are, and lastly, the reference. So, if you want to find out where that value comes from, you can follow this reference. The references are also available in the bibliography in the RETScreen software, and any notes or the source of that benchmark are available as well.

So, let's look at residential benchmarks. So, you see here that we now have—I've used this filter by clicking on this button here and only selecting "Residential" and so now, we're only looking at residential benchmarks. And you see, there's many, many, many of them. So, we've picked Oakville, Ontario, and Canada. What if we only looked at Canadian benchmarks for this?

So, now, if I click on "Canada", now my benchmark database is only showing me residential benchmarks in Canada. And you'll see that the units are quite different. We have kilowatt-hours per square meter, but we also have kilowatt-hour per household and per person. So, RETScreen is very flexible in allowing you to choose the units and the benchmark that you want to refer to that you may want to use. So, I'll get out of this now by clicking on the X button, and maybe just a note before we move on.

If you want to use some of those benchmarks in your analysis, a trick in RETScreen is if you go onto "User Defined" as the project type, you'll notice now that this button appears beside your benchmark, and if you click on that button, you do get access to the benchmark database. And then, by selecting any of these and click on the "Pace" button, you can actually pace this benchmark data directly within the software. And there's a space for notes here, and that's how you can use the benchmark database directly within RETScreen if you want. Let's get back to exploring the benchmarking tool. So, we've looked at some industrial facilities, the residential.

We've now looked at user defined and how to do the benchmark database. What if we went to commercial institutional? You'll see here that we have "Education" as the first one and all the different subtypes. So, remember, I mentioned you could do offices and hospitals and shopping centers and grocery stores and what not. Let's stay with a school, and we'll stay with this example for the rest of this talk.

So, let's look at—dive a little bit more into detail in the benchmark analysis on all the things you need to put in the software. So, the first thing I've glossed over so far is this section at the top called "Facility Information". And this facility information—it's important to get this right from the beginning, since this information is used extensively within the portfolio module and other places in the software—especially if you want to compare

with other buildings or group your analysis in a portfolio using RETScreen Portfolio Analysis, which I'll show later. It's really important to take a couple of minutes to fill in this information, and we'll do that now. This step can be seen as part of sort of setting up your facility in RETScreen and can be an important step in your energy master plan.

It's really crucial to get this data, because you're starting to structure your file. So, let's say that this is an elementary school that we want to analyze and we're preparing it for this webinar, and prepared by us here at RETScreen. You'll see there's these little buttons to the right-hand side, and if I clicked on those, we get some extra information about these prepared for and prepared by fields. So, it's important to get this in, because if you want to, say, for example, contact the people later, you get to—you can use this. So, this webinar is being recorded by Seth.

They're based in the United States, so you can put in the details there, and same for "Prepared by". You could put the details of who's doing this benchmark analysis. So, right now, I'm doing it, and my name's Kevin, so I can type that in and put in more details as I see fit. I click "Okay". The next thing is now, we're starting to fill out this database that's going to be used later, so now, we start putting information about the facility itself.

So, let's say that we're interested in this Oakville primary school. So, Oakville Primary School and again, if I click on this button to the right, now, I get to put in some details about the facility itself. So, maybe we're preparing a benchmark analysis for the school board, and they have several schools and they want to look at their elementary school division. And this is in their Halton region of Ontario, and you can fill in information about who runs the facility, et cetera. And notice, also, that we have this "User Defined" field here, so that's going to be very flexible and that you can categorize your facilities how you want.

So, maybe the school board has many schools scattered across the region, and they want to compare their western region versus the northern or the southern grouping or ones that are close to the lake, or ones that maybe have different administrative structures, or ones that are heated with different fuels. So, you can really add all sorts of different categories and subtypes here. I'm going to leave this here as a group, and when I click "Okay" that data is then stored within the file itself and is accessible, as always, by clicking on the button again. So, what we've done now is we're now starting to structure the data around the benchmark analysis. The last thing I want to do up in this "Facility Information" section, is I might want to put a picture of the school.

So, let's click on that "Change Image" button, and I'm going to pick the school picture. And you can change the image and you can re-size it and put the image of the school as you want. So, that's the facility information. As I said, it's important to get it right from the start. Now, let's go into the benchmark and look into more detail each of these _____ that we were looking at before.

So, the first thing, as I said, is RETScreen asks for the size and the unit. So, the units are selected automatically by the software based on the facility's height and type that you've selected in the facility information about. You notice that some of them were per employee, some of them are per size, and in the benchmark database, there was all types of different units. So, let's say that we're—this school is 4500 square meters. So, RETScreen will now calculate the fuel consumption. We'll get that to a moment.

As before, the energy unit we're using is a kilowatt-hour, but we could have this a million Btu or megajoules or kilojoules per unit that we have here. Let's leave it like that. And you'll see that RETScreen, once again, has automatically put in a benchmark value. So, RETScreen will automatically display a benchmark based on the facility type and the type selected in the facility information above, and it displays the average value for the United States as well as the typical minimum and maximum values. You can overwrite these values, of course.

For example, as I showed before, benchmark values can come from the benchmark database. They can come from corporate benchmarking efforts. It can come from company targets or, in this case, a school board target. They can come from industry averages or any other appropriate metric, which will help you compare your facility with the performance objectives that you have. So, we don't have any extra information about what the benchmark may be for this school, so, we're going to leave these ones here.

Now, these come from the United States Energy Information Agency, and so, this is an average value for benchmarks for schools in the U.S. So, this is our starting point. So, now, let's look at the base case and the proposed case. So, now, RETScreen is asking us, "What do you want to do? Where are you actually starting from?"

So, this is our starting point, and you'd enter here the estimated base case for the facility, and you use—it's in the same unit—the energy use intensity units—as the benchmark. So, this number is then used to roughly calculate the base case annual fuel consumption in the plan section below. By default, RETScreen will display the benchmark data in the cell as sort of as a first guess. Since we don't have any extra information, and we don't have a specific school building yet, so, let's just use this value for now. It's the same value as the benchmark.

We'll come back and change it as we get more information, as we get more detailed in our project. You can, of course, overwrite this value as before, and you can use a base case based on other more detailed data such as energy modeling or billing data. And we'll get to that in a minute. You can also type the target for the fuel saved. So, you'll see here that the target, as before, the default is 15 percent, so it's prompting the question, "What if we reduced our fuel consumption by 15 percent?"

It's just a starting point to get us to start thinking about reducing our fuel consumption. And you can either type in a new value here—I can put in 13 percent—or you can use the "Select" by the drop-down button, and you can

also use the slider over here. So, that brings me to this graph to the right-hand side. This graph is actually showing, in a visual format, the same information which is here in these numbers. So, what's happening is that we have here this horizontal line which shows our benchmark, and also, the base case.

And you'll see that it's right here at 262, and that's our benchmark and our base case. And then, from the base case, we then show how if you had various different reduction targets, how the energy use intensity would decrease. And this little slider here with this dotted line that goes up will show you where the target is currently set, and this dotted line across shows where that would end up for your proposed case energy use intensity. So, for example, we could look at what the proposed case energy use intensity would be if we wanted to go 50 percent or even higher, or even a net 0 energy or even positive energy where you'd be including renewables and so forth. So, let's leave it at 15 percent for now.

And you'll see now, now that we have the proposed case—so, you'll see here, it's between 210 and 245—in fact, it's 223, which is what this value is right here, so that's that 15 percent. Now, the model can calculate the proposed fuel consumption based on the target that we set in this cell—in this target cell. Notice that the units are the same as the benchmark in energy use intensity. So, the base case and the proposed case—the units are the same. So, now, let's move to the plan.

And now that we have the—we can calculate the total fuel consumption for the whole building over a year. But since we have the energy use intensity for the base case and the proposed case, we can multiply it by the facility size—above—to get the total estimated fuel consumption for the base and proposed case and also show the fuel saved. So, note that this is for the entire facility on an annual basis. This serves as a rough guide and this is what we call the end use fuel consumption for both the base case and the proposed case. So, you'll see that—this is why it's important to get your facility size in.

That screen will multiply the facility size by the base case and the proposed case and yield our fuel consumption. And, of course, if you ever want to know more about what RETScreen is calculating or what you should be putting in, you can always click on the tiles to the left of the cells and you will open up the help manual in RETScreen and RETScreen will tell you what that cell is about. So, the last thing to look at for the benchmark analysis before we move on is that there's a report page as well. So, you automatically get a report—a benchmark report—in RETScreen. You click on "Create Report"—a benchmark report—and so, you can automatically do your benchmark reporting using this tool in RETScreen.

And remember, of course, that RETScreen's available in 36 languages, so, you can have your report in 36 languages and send it off, say, for example, to a colleague or a company which may be working in Chinese. And, of course, all the benchmark data itself is in 36 languages. I'm going to switch back to English for now. So, we now have an idea about elementary school. Now, what if we want more detail?

How does a school actually consume energy? So, how does it get this 262-kilowatt-hours per square meter? And what kinds of things can we do to save energy? We put in this 15 percent as a first guess, but what is actually a reasonable target? Can we do less?

Can we do more? We've looked at a broad benchmark for schools in general. What about the school in my neighborhood? What about the school in Oakville? So, let's go back to the homepage, and I want to show you that within the quadrant of the benchmark, you'll see we have the virtual energy analyzer.

And so, the virtual energy analyzer gives you access to RETScreen's archetype database. So, you should leverage the RETScreen database of model building archetypes to really give you a better idea for the base case and the proposed case energy use intensities. So, I'm going to click right now on the virtual energy analyzer, and this is how I get my access to the archetypes, and you'll see here that we have the facility type and type—same drop downs as we had before—and RETScreen—we have an archetype for elementary school, a high school, and even classroom buildings in university and college. So, let's keep on the elementary school. We're not going to change the location of my project, and I'm going to put this archetype into my existing benchmark effort.

And when I click on "Okay" I want to use the benchmark from the archetype, and I click "Okay" and RETScreen now will update my file. So, a couple of things to notice. First thing is that the information I have—my facility information is intact, so that proves what I said before—is that it's important to get that information right up front. A couple of extra tabs have appeared, 'cause now we have a feasibility analysis. We actually have modeled a school using the archetype.

And, more importantly is—for benchmark analysis—is now some of this benchmark information has changed. So, notice how the benchmark information itself is the same as before. However, now, the base case and the target are based on the actual energy model for the archetype. And this proposed case is based on the fuel consumption savings from the various energy efficiency measures that we've modeled on the energy page. And notice, also, that there's a facility size for the archetype.

Remember before we put in 4500 square meters? Well, now, this archetype itself is 3600 square meters. So, this allows RETScreen to calculate the total fuel consumption for this archetype, so we can see what the total estimated fuel consumption for the base case and the proposed case is, and what the fuel saved is. So, those numbers are 568,000 kilowatt-hours in the base case, and less than the proposed case, and the fuel saved. So, the difference between those two.

So, look at this base case energy used intensity. It's 158 kilowatt-hours per square meter, and RETScreen's telling us that this target is -32 percent. So, a 32 percent reduction in energy use intensity. So, how did we get this 158-kilowatt-hours per square meter and how did we get this 32 percent target?

Well, as I said, they come directly from the archetype, and this is the power of using RETScreen's archetype database as a great starting point for any project—even benchmarking analysis.

So, even if you're just doing benchmarking, it really is worth it to use the archetypes, 'cause at least you get a great starting point. So, I'm going to go now and click on the energy model of RETScreen, and I'm not going to go into detail here, but you can see that we've gone ahead and modeled an elementary school, modeled a primary school, and we have all the different components here. And within each of these, we have a base case and a proposed case. We have energy efficiency measures, including cost and so on. But what I want to show you is if I go to the comparison section in the menu here, if I click on this comparison, I now get a summary of how the fuels are being used in my building.

And specifically, if I show you this middle section here where it says, "Savings", you'll see that for the—we list the fuel consumption in kilowatt-hours for the base case and proposed case, and we break it down by how that fuel is being used. So, we have fuel being used as heating. You could have fuel being used as cooling—in this case, we don't—and fuel being used as electricity. And when we sum them up, we get the total fuel used for this school. So, from the base case—568,000 kilowatt-hours; that's exactly the same number that we have in the plan on the facility plan—and the savings, which are calculated here.

And look at the percentage of the fuel saved. It's 31.6 percent. Rounded up, it's 32 percent. So, this is where our 32 percent comes from on the facility page. It's actually modeled within RETScreen using the base case and the proposed case, and the savings are marked as 32 percent.

So, this is what the model is showing us, and this is what the plan is on the RETScreen facility page. So, these numbers won't change based on the energy model. This is what is on the facility information page. And you'll notice that the variance is zero percent. So, our archetype follows the plan. Or rather, the plan is set to be equal to the base case and the proposed case of the archetype.

Another thing I want to show is in this section below here that says, "Benchmark". You'll notice here that the benchmark—the units are the same as before. We have this 3600 square meters, and once again, we should break down the fuel consumption for the energy use intensity for the base case and proposed case for how it's used. So, the energy use intensity is for heating, for cooling, and electricity, and then the total. And you'll notice here—158 kilowatt-hours per square meter. That's exactly the number that we have on the facility page.

RETScreen will also show the benchmark from that facility information page here so that you can compare what the current building is—in this case, the archetype—how that compares with the benchmark. Notice, also, that you can change the units here. So, if we wanted, for example, to change the units just for reference purpose to see what is the energy use intensity per student or per

classroom—well, perhaps the school has, I don't know, 250 students in it—you can get the energy use intensity on a per student basis. And it will also update the benchmark. Well, it'll pull the information from that benchmark and display it here.

We aren't changing anything on the benchmark page yet. If we want to reset that, we can click this button, which says, "Copy from Facility" and we'll bring that 3600 per square meter back over. So, we now have our base case and proposed case, but what's in our proposed case? So, let's go back to include measure, and here's all the different things that we can do to our project, and let's suppose that this measure right here—we're not able to do it this year. So, if I uncheck it, I don't include the proposed case in there.

And if you want more information about how this model works, you can look at the feasibility analysis with RETScreen video either on the RETScreen e-learning channel or on the Solutions Center website as well. Now, I'm going to go back to the comparison section and look at this middle section where I have the fuel saved. You'll see now that the proposed case is different. It used to be 388,000. And especially that the fuel saved is no longer 32 percent, but 30 percent.

So, now, we see that there's what I've modeled—what I'm able to do in my proposed case is different from my plan. So, in this case, we're going to consume more energy on the proposed case, and that we have a five percent reduction compared to what our plan is. So, what if we want to now update that plan on the facility page? So, let's go on the facility page and just show you that the plan here is 32 percent reduction and 108 kilowatt-hours per square meter on the proposed case. I'm going to go back to the energy page, and I'm going to click this button here which says, "Update My Plan" and RETScreen's going to warn me—basically saying, "You're changing something on the facility page."

And I'll say, "Okay." You'll see now that the plan here is 30 percent and the variance is back to 0. Let's go back and look at the facility page, and we can confirm that the plan has been updated to 30 percent. Now, what if we want more detailed information than this? So, like, how much can I actually save on natural gas versus how much can I save on electricity?

You may have a goal to reduce your greenhouse gases, for example, but your electricity might come from mostly clean sources already. So, you need to focus on fuel instead. Or perhaps you'd like to install photovoltaics, but you need to reduce the electricity consumption as a priority. So, what you may want to do, once you get more information, is you want to start setting the benchmarks and targets for each of the fuels, not for the facility as a whole. You'll notice that, so far, I've stayed in level one, and if I look at the menu up here, I have—on my benchmark, I have level one.

Level one will typically be used to get a first guess at the energy situation for the facility or for a pre-feasibility analysis where less detailed and lower accuracy information is typically required. However, if I click on level two, you'll see that the benchmark page changes, and now, I get much more detail.

So, level two allows me to set a consumption, a target, and even a benchmark for each of the fuels in my building, so I can have separate benchmarks, separate targets for electricity, natural gas, and any other fuel you have in your project. So, level two will likely be used for existing buildings, where more detailed and higher accuracy information is available, as a result of either a feasibility study or a performance analysis that you could do in RETScreen. So, by default, you'll see there's values already here.

RETScreen uses the base case fuels, which we set in the archetype on the energy page, and these fuels come from the comparison section that we just looked at. You can also enter the fuel consumption found on electricity or fuel bills, if you're using an existing building. So, what if we did have an existing building? So, let's say that you're an energy manager, and you want to benchmark your actual school that you're responsible for. You can use the actual fuel bills and enter them here as well.

Also, if you're doing any kind of energy tracking as part of an energy monitoring program, you can use the information that you get from that, including RETScreen's performance analysis. So, let's take a look at how to do that. So, I've loaded up another project here. It's actually the same project. It's the same school.

But in this time, you'll see that I've done the performance analysis. I'm just in RETScreen, so I've actually gone and collected the utility bills, the natural gas and electricity bills, and I've entered them here, and I've gone and done a performance analysis, including regressions and so on. And, if you want information about that, you can look at the performance analysis video that we have on the RETScreen e-learning channel. So, within the analytics page, I can create this annual bar graph, and this annual bar graph is very, very powerful, because it shows me the annual fuel consumption for each year on an annual basis. And you'll see here that I've set a reference here as being this fiscal year here—2013 to 2014.

And if I click on "Format Graph" up here or right click, you'll see that I can actually change this bar graph. And there's a benchmark section right within the performance analysis of RETScreen. So, if I click on "Benchmark Analysis", I'll then going to be graphing some of this information in RETScreen. So, if I click "Okay", you'll see that we now overlay on this graph some different lines. We have the total energy usage and energy use intensity units—or kilowatt-hours per square meter—as well as the target and the benchmark and the base line, which are graphed here.

And these values come straight from the facility page. What's interesting, as well, is we can see here—RETScreen, in the table below, has now calculated the total energy use intensity in those same units. So, this particular school board—they wanted to put their 2013-2014 year as their reference year, and RETScreen shows us that the reference year energy use intensity is 127 kilowatt-hours per square meter and that, through the years, they've managed to reduce their energy use intensity, and for the last complete year, we have 106—just over 106 kilowatt-hours per square meter. So, let's see how we can now adapt the benchmark for this building to actually reflect what we have.

So, I can go to the facility page, and let's say that the benchmark—they want to get this building—the benchmark—to be what they had in the last full year.

So, we had 106 kilowatt-hours per square meter, and the base case for that base case for their reference year was 127. And they can target 17 percent, but perhaps they want to see if they can achieve a 20 percent reduction in their energy use intensity. You'll see that the graph has now changed. We have the benchmark here at 106, the base case is up at 127, and our target is down 20 percent less at just over 100. Now, let's go look at the graph here.

And again, if I go on "Format Graph", I can now click this button that says, "Copy from Facility", and update all that information into RETScreen's annual bar graph. I click it; you'll see the values have changed. And when I click "Okay", now we can see where the new benchmark is of 106 where their referenced base case—the baseline is—at 127—and where their target is. So, I've gone now and shown you how you can use the performance analysis within RETScreen and how that links with benchmarking. So, I've mentioned at several points now that the information you enter on the facility tab can be used as part of your energy master plan for a portfolio wide benchmarking effort.

And, if you're using RETScreen for your benchmarking, you automatically get a great portfolio benchmarking tool. So, let's see how that works. So, I've actually—this school is part of a larger portfolio of schools for this school board, and I've listed it here. So, you'll see here, this last one is this Oakville Primary School that we've been working on for the last little while, and I have here a portfolio of schools for my school board and notice how some of the schools are elementary schools, others are high schools, and there's even some office buildings in here. So, here are all the buildings that I'm interested in for this school board portfolio, but I can also create these subgroups on this left here, and then look at the aggregate benchmarks on the dashboard.

So, if you want any information on how to build a portfolio, we do have that video that we recorded on portfolio analysis with RETScreen, and I encourage you to check that out to get into details. So, I have here this portfolio, and if I go on the dashboard page, you'll see at the top section, I have some portfolio level benchmarks that are already done for some of the groups. So, let's look at the primary school. So, I click on "Elementary School" and you'll see here that for each of the facilities in that subgroup, we have the base case and proposed case. You have the base case and the proposed case for energy use intensity, and if I hover over them, you'll see that you get the base case total energy usage and the proposed case total energy usage.

This graph here shows the facility size on the x-axis, and the fuel consumption on the y-axis. And this line here is the benchmark—the energy use intensity benchmark for this portfolio. Also, interestingly, is below, we have this great table now for each of the facilities in this portfolio or sub-portfolio. We list the size, what the benchmark for that facility is, and what the base case and target are, and then calculate the proposed case as well. And then, since we have—as always, since we have the facility size base case,

we're able to calculate the total end use base case fuel consumption, as well as the proposed case, and any savings.

So, just to show you how you could do this on your own, if you click on "Benchmark" up here in the menu, you get to pick what type of benchmark dashboard you want. We're going to do buildings and factories. We're going to look at the "All" subgroup, and if I click on—we can also check our unit, and if I click "Okay" we get this graph with all of the buildings. So, the elementary schools, the high schools, and the office buildings are all listed here. And we see here the base case and the proposed case for all of those facilities.

Now, if you click on this button in the menu called "Set Benchmark", you can actually put the benchmark for this facility. If I click on "Okay", it will show you what the current benchmark is, and if you want to override that with your own. And when I click "Okay", we're going to draw this benchmark line. You'll notice that the colors of these—of the base case and proposed case—has changed. When the base case is below the benchmark, it will be green.

And when it's above the benchmark, it'll be red. So, you can—this gives you a very quick visual way to see if you—to see where you stand in terms of your benchmarks for your whole portfolio. So, the last thing I want to do in the few minutes that I have remaining is I want to show you—we've looked at buildings so far—I want to show you how to do it for power plant. So, I'm going to go back to my main RETScreen file here, and we're going to look at—as I said before, one of the best ways to look at benchmarks is to use a virtual energy analyzer to start us off. So, I'm going to click on the virtual energy analyzer, and now, we're going to look at power plant.

So, let's look at photovoltaic solar energy power plant. Let's do a fairly large one, and let's say that this one is in Texas. And let's see where that brings us. And we could go in and refine this, but let's just say that our PV plant is going to be here, and when I click "Okay"—what we're doing now, is we're leveraging the power archetypes to do our benchmark analysis. And I'll show you how we do that.

So, once again, we have the location page and the facility page, and this is now how we look at benchmarks for power projects. So, you'll see that we have above, same as before, the facility information and the graph, but the benchmark database now looks quite a bit different than we had for buildings. So, on this section, you can prepare a quick benchmark analysis for various types of power plants. So, RETScreen's power production benchmark shows as a range of what we call "Energy Production Cost", and sometimes this is called "Levelized Cost of Energy"—or LCOE—and these are done for different power technologies under a variety of operating conditions and for a range of installation and operating costs. The energy production costs include installation and operating costs for central grid projects.

So, this is how much it actually costs to produce one kilowatt-hour of electricity for each of these technologies. So, let's take a look at this graph. So, you'll see that we have a list of technologies here on the left, and the one

that we selected—we're doing photovoltaic—is highlighted, and that the range of energy production cost is shown by this bar. And if I hover over the bar, we're going to see the minimum and maximum values in terms of dollar per kilowatt-hour for the energy production cost for each of those technologies. The minimum is the left side of the bar, and the maximum value is the right side of the bar.

You'll see that our current benchmark is set where this tab and slide are with this vertical line, and that that's echoed now here in this benchmark cell here. So, the key assumptions used to calculate the minimum and maximums for each of these, are available up here in this benchmark database. So, how did we come up with this benchmark database? So, for each of these technologies, we're able to know what the typical commercial very large size and very small size, what the costs are, what the fuel rates—typical fuel rates around the world—the range of fuel rates—and capacity factors. So, when we run these for multiple scenarios, we did a big study, and we're able to get the energy production cost for each of these technologies under a bunch of different scenarios.

And when we take the minimum and maximum, that gives us our range. So, this includes the power capacity or the size of the system, the fuel cost for combustion power systems where we're burning fuel, the capacity for renewable energy systems, and other—any general assumptions that we have are down in this table below. And so, for example, let's take our photovoltaic line here. If we have a small PV system of 10 kilowatts with a relatively low capacity factor, say, of 13 percent, we know enough—we have enough information given the cost of these systems to calculate what the energy production cost would be for that system. The small, expensive, relatively low-efficiency system would give us the maximum energy production cost.

Conversely, if we take a very large commercial system with lots of economies of scale, much lower cost per unit, and really good efficiency, we get the lower value for the energy production cost. So, you can enter any benchmark reference point that you prefer. For example, it might be the wholesale electricity price—in RETScreen, we call the "Electricity Export Rate" paid to a private developer or merchant power plan or a spot electricity market. It might be the retail electricity price paid by consumers in jurisdictions where net metering is allowed, or it could be the value for a higher feed-in tariff or other subsidized or premium rate paid by utilities or government for promoting the deployment of clean energy power project. The idea here is to get a benchmark for a value, for a project developer, would likely get paid for power plant electricity production.

It's then easy to make a comparison with a range of comparable energy production costs for various power technologies. So, this provides you with an easy way to compare different power generation technologies and do a quick check to see if a potential project could be financially viable, and if it warrants further investigation using further RETScreen feasibility analysis. So, just as for buildings, benchmarks are really useful for comparing projects.

Same here for power projects. This allows you to compare different power generation technologies.

Now, since we used an archetype, RETScreen was able to automatically calculate the energy production cost for us. And it's shown here by this green dash line, which I have here is 20.5 cents per kilowatt-hour. And, just like in buildings, you can slide this around to change it, or use the drop down, or type in your own value. So, where does this value come from? So, let's actually go from the—in the finance model.

So, if I go to the finance model here in RETScreen, you'll see that we have—we've modeled the complete photovoltaic project, and you'll see here, in the bottom right-hand side, we have—in the "Financial Viability" section—we have the energy production cost for this power plant. And that's where that 20.5 value came from. So, what if we had different parameters for our projects? So, what if we, for example, changed the debt of our project to 50 percent and had only a 9 percent debt interest term, with a debt term of 8 years? You'll see now, that the energy production cost is no longer 20.5, but rather \$0.22 a kilowatt-hour.

So, if I click on this button here, just like we had in buildings, I can update the information on the facility page. And this is warning me that I'm going to change something on another page, and I click, "Okay". And if I return to the facility page, you'll see that this now says \$0.22. It's been updated. So, this value can be updated automatically and is calculated automatically through the finance page using the energy model.

So, we've gone through quite a bit here in benchmark analysis. We've gone through buildings, we've gone through power. We've looked at feasibility analysis, portfolio analysis, and performance analysis, and I hope now that you're able to see how benchmark analysis is really easy in RETScreen and that it's really flexible, allowing you to integrate it with lots of different sources, including RETScreen itself, but other tools and detailed performance analysis and so on. So, with that said, I'm going to turn it over now to Dinesh for some question and answers, 'cause I'm sure some of you have questions about how to do this.

Dinesh

Excellent. Thank you very much, Kevin. That was very comprehensive. A number of questions have come in, and now, some of them came in earlier, and you already explained some of these points, but I think I'm going to go through them, because it'll be a useful refresher for people, maybe who have joined late, or just in general. So, I'll just go through them.

Some of them may be quick answers for you. The first question is, "What is the source of the benchmark data? How can we get a copy of benchmark sources to use as reference?"

Kevin

Right. So, remember, there's two sources of benchmark data. So, the benchmark data in power projects is right within the software itself. If you click on this "Benchmark Database" button, you'll get all the consumptions

for the benchmark database. And actually, if you plug these values into the RETScreen model, you'll actually get these values.

So, that's one source. And the source for these capacities and the fuel rates—those are different assumptions. The other assumptions are listed in the bottom here, and then the cost data comes from our cost database. What you're probably asking, though, is the facilities' or buildings' benchmark database, so let me switch now over to the facilities database. So, if I click here on the "Benchmark Database"—same icon, same button—it opens up a different database, because this is for buildings now.

The sources for each of these is listed in this column called "Reference Here". So, you'll see here that the value for this value—it comes from NRKenOE2011. So, if you either click on that link or, if you go in the RETScreen help manual and look under the bibliography, you'll be able to find where that data comes from. RETScreen also has a description of the source. So, some of these are surveys, some of these are models.

In this case, they're all surveys, but you'll see that the source is where the information comes from. And we spend a lot of time to make sure—to harmonize all this data to make sure that it's all compatible and comparable, and that's where the data comes from.

Dinesh

Okay. Great. Thanks, Kevin. For power, can you show the units in U.S. dollars?

Kevin

Yes. So, that's an excellent question, and actually, was one of the things had I had a little more time, I would have showed. So, absolutely. So, for power projects—both in the benchmark database, but also within this graph here—if I click here and go to "User Defined" or if you have gone in RETScreen under "File Settings" and set your software in to use U.S. dollars as well as a conversion rate between U.S. and Canadian dollars, you can do that here. But, if you click on "User Defined", you can actually change this so that it reflects in U.S. dollars.

So, let's suppose that we had put this into U.S. dollars, and that the exchange rate is—I don't know today, but suppose it's 1.25 Canadian dollars per U.S. dollar, you'll see now that this value is—these ranges are updated. And, if you do that in the "File" section as well, the whole model will calculate according to the current unit that you have. You can also do adjustment factors as well. So, even within one country—say, for example, in Canada or the United States—projects that are in the far North or in Alaska could have very different cost attributes than projects that are in the south or more populous areas. So, you can actually adjust all that there.

So, these databases are, by default, in Canadian value, but you can convert them to any currency that you want.

Dinesh

Okay. Great. Thanks, Kevin. A sort of a related question here. This one also came in earlier.

"How does RETScreen decide what the benchmark is, given the maximum and minimum? Is it just the average?"

Kevin

So, I'm assuming here, we're talking about the—so, let's cover two parts. If we're talking about power production, the maximum and minimum are dependent on the cost and operating conditions on the size of those facilities. So, like I said, a small, relatively inefficient, relatively costly photovoltaic system will have a higher energy production cost compared to a very large industrial scale—say, gigawatt scale PV plan—where there's huge economies of scale and the cost of running it are quite low, where you would get a lower value. On the buildings side—let me go onto this building side—so, here, we also have the minimum typical and maximum typical. So, like I said, these values come from the benchmark database.

So, if you go into the benchmark database and filter for the United States and Canada, you will actually find these—a typical values, and then a minimum typical and maximum typical. We've not included outliers, because you can always have projects which are—so, for example, net zero energy. One could argue that the minimum is zero. So, we will—we use the minimum typical and maximum from the benchmark database. So, the sources of those numbers are, like I said before, within the reference value/reference column of the benchmark database.

So, if you want to find out where we get these numbers, you can follow these references here.

Dinesh

Okay. Excellent. All right. Is the benchmark database constantly updated?

Kevin

Yes, the benchmark database is frequently updated as we see fit. So, some technologies don't evolve as quickly as others, but yes, we do keep the benchmark database updated. In fact, we're currently updating parts of the power benchmark database. So, for example, for certain projects—specifically, photovoltaics and offshore wind—the costs and operating costs have reduced quite dramatically in the last couple of years, so we're updating that. We're always keeping an eye on the market to see what technologies and what areas we should be updating. So, yes, all those databases are kept up to date.

Dinesh

Okay. Here's an interesting one, which may be on many people's mind. "What's the difference, Kevin, between the benchmarking capability of Energy Star's Portfolio Manager and RETScreen? Is there an advantage to using one or the other?"

Kevin

Yeah. That's a great question. So, RETScreen Expert and Portfolio Manager are complimentary tools. In simple terms, Portfolio Manager tells you the what of energy consumption for your building, whereas RETScreen will help you answer the how and the why of energy consumption. So, Energy Star's Portfolio Manager and the Energy Star score is to help you understand the energy performance for buildings and especially let you identify those which are candidates for improvement and recognition mainly through their Energy Star score.

However, it doesn't, by itself, explain why a building is performing a certain way or how to change that building's energy performance. RETScreen, in addition to benchmarking and the customize portfolio—which we saw—your analyses can be based on a customized performance or feasibility study. So, RETScreen's Performance Analysis goes far beyond just a consumption summary. It allows you to do really professional measurement and verification or MMV under the global IPMVP standard. You can also do monitoring, targeting, and reporting—or MT&R.

You can cue some analysis. You can dive into the regression model and statistics to really accurately characterize and optimize the relationship between the energy consumption and the energy drivers in your building. So, that's a key word there is RETScreen really allows you to optimize that relationship and understand and really explain the how and the why. So, the fact that RETScreen lets you have a benchmark analysis, a feasibility analysis, and a performance analysis and a portfolio analysis, all in one tool, really make it quite a different tool than Portfolio Manager. It really, like I said, gets you to understand the why and how of your energy.

And remember, also, that RETScreen isn't just for buildings, but we can also do benchmarking on power plants, industrial facilities, single family homes, and even individual measures. You could benchmark, just say, a heat recovery process and so on. And, of course, it's available in 36 languages, and used all around the world. Portfolio Manager's only available in a few select countries—like Canada, United States for now. So, I guess in summary, RETScreen Expert and the Portfolio Manager are essentially companion tools.

That being said, the output of Portfolio Manager can be used as an input into RETScreen on this facility page that I have up on the screen here. The same can actually be said for other benchmarking methodologies—so, if you're using Green Globe or corporate benchmark targets or other things like that. We found that organizations generally don't need to choose one over the other, because they each ask different questions. They're complimentary. You really—if you need to use Portfolio Manager, you really should use it side by side with RETScreen to leverage the strength of each.

Also, while I'm on the topic, one of the things we've also done in RETScreen is we've incorporated some of the elements of the ISO 5001 Compliance Monitoring System. So, that's another—not exactly benchmarking, but it's another standard that you can use with RETScreen. We've also added different forecasting tools and event logging and other things like that. Another thing to remember is Portfolio Manager is a web-based tool, and it really shines when calculating that Energy Star score, whereas RETScreen is more of an integrated desktop application for lots of different project types. And, also note, that you can integrate the two, and we're working on automating that.

So, over the next while, the connection between Portfolio Manager and RETScreen Expert is viable to be easier and easier so that you can just click on a button and have the data shared between the applications.

Dinesh

Okay. That's really helpful, Kevin. Great. There's still questions coming in here, so we'll try and get through as many as we can. Just to assure people that if your question isn't answered, we'll certainly try to answer you offline after the webinar.

But, we'll get through as many as we can. We have about—a little less than 10 minutes. The next question here is, "Does RETScreen show or include greenhouse gas emission benchmarks?"

Kevin

So, yes. So, for now, if you're doing—so, on this benchmark page, we're looking at adding that in sort of the short to medium term. In the interim, if you're using the feasibility analysis—whether that be for a building or for a power project—you do get the benchmark page here. Now, I actually don't have—I don't have the project loaded, but if you do have—on this "Emissions" page, you will have your emissions analysis, and you can use that as part of your GHG benchmarking efforts.

On the performance analysis side, of course, in RETScreen—so, when you're doing your performance analysis, you do have your total GHG emissions broken down by fuel, and you can use that as well on your—I showed the annual bar graph, but you could also have this—I have it on energy, but you could also do it on GHGs. In fact, we're working with many government departments that have exactly that, that have precisely GHG benchmarks, and all these government departments are using RETScreen. So, you can do it now, and we're looking to keep adding features and to make that easier as time goes on.

Dinesh

Okay. Next question, Kevin, is, "What is the difference between a benchmark value and a target value?"

Kevin

That's a good question. That depends. They often get mixed up in their meaning, but a benchmark and a target are actually different things. So, a benchmark value is usually set in reference to other similar facilities. So, a benchmark can be external to your specific facility as something you want to compare to.

Your target may be set by your organization, and your target may be that all your buildings have to meet, at minimum, the benchmark value. So, your target would be the benchmark. In that case, they'd equal. But, your target could also be you want to have 30 percent reduction below the industry benchmark. Or, you want—in the case of this school that we said—you might want to set your benchmark to be 20 percent below a reference year.

And so, the benchmark and the target are different things. They can be the same—and sometimes, they are—but they are actually different things.

Dinesh

All right. Thanks. We'll try and get through a couple more questions here. The next one is, "Can you change the set point of a building before a proposed case? For example, if you want to make the building cool less or heat less during the seasons?"

Kevin

Yes, you can. This is actually more of a performance analysis question, and we deal with this briefly in the performance analysis video and webinar that we did. But, when you're doing a feasibility analysis—so, this is a feasibility analysis question, and it's in that feasibility analysis video—you can set up your set point there and have it exactly like you say so that your building will heat less or cool less, depending on where that point is. There's actually—there's quite a bit of detail on how to get there. It gets quite technical.

So, it probably would be best to—we can discuss this by e-mail offline, because it really—it can get quite technical, and it doesn't really have much to do with benchmarking at this point.

Dinesh

Okay. This actually may be related to that. Another question is, "Can you show how we can access the other videos that you mentioned?" You said something about the home page, so perhaps those other—that may be useful for some of these questions, the e-learning channel.

Kevin

So, several times throughout this talk, I mentioned some of the other stuff, and we're building up quite a nice e-learning channel. So, if you on the "File" home page in RETScreen and click on the "Help" page here, you'll see here that we now have a growing library of video content here. So, the feasibility analysis—so, that set point—is addressed in part under this video. The performance analysis and how to do that is addressed here in this performance analysis video, and how to build up our portfolio is in this one here. So, if you go to—in the software itself, "File" "Help"—it's right in this "Help" and "Contact Us".

You can also go to the YouTube channel and type in "RETScreen E-learning" and you'll find us there.

Dinesh

Right. And Kevin, maybe you can just show, too, just on the home page, the actual link directly to the e-learning channel. Sort of the shortcut.

Kevin

Yeah. Right over here. Actually, if you go over here to "E-learning" and click that, it will open a browser window right to the YouTube e-learning channel directly.

Dinesh

Okay. Wonderful. Now, I'm conscious of the time. We only have about three minutes left, so we'll try and get through one or two more here. "How does the baseline predict energy consumption in a building and how does the formula predict energy consumption?"

This may also be a little more on the performance side, but maybe you can give a brief answer, Kevin.

Kevin

Yes, that is definitely on the performance side. So, your baseline in performance analysis is—you can find that—you can use a baseline from a benchmark. You can also use a regression as your baseline. And what RETScreen will do—it will create a relationship between your energy drivers and your actual energy consumption. So, yeah, that definitely is more performance analysis.

Maybe I can provide a little more detail in e-mail after, but basically, in RETScreen, when you're doing performance analysis, you can create a baseline either using regression or you can use a benchmark as your baseline as well.

Dinesh

Okay. Great. Let's try and do one more. Again, this may not be able to—it's sort of a one-minute answer, but you can just try a quick one. "What is the difference between the archetype data and the data used to create the benchmarking database? And what's the source of the archetype data?"

Kevin

So, the archetypes are full facility archetypes that have been developed with tons of industry experts and costing experts and modeling professionals and engineers and research experts all around the world. And they're continually growing that database, so these are full facility archetypes or typical buildings, including cost and cost-effective energy efficiency measures. For the power archetypes, similarly, they're validated, full project analysis, including all the cost. The relationship between the benchmarks is that you can use the archetypes as—in fact, even if you don't have a building, you should be using the archetypes to make that link between the benchmark and a real project so that as you move forward in your analysis, you can always refer to the archetype. So, for example, we had—we started off—remember, we started—"Well, what if we actually reduced 15 percent?"

But, for a school, we found that using these archetype database and the virtual energy analyzer, that you could reasonably achieve a 30 percent reduction in Oakville. And remember that the archetype database is dynamically calculating. So, if I were to put that project in Miami or Alaska or British Columbia or Southern California, that number is dynamically calculated. So, in some places, 30 percent might be easy; in other places it might be a stretch. So, that's the relationship between those—the archetypes and the benchmark database.

Dinesh

All right. Thank you, Kevin. There are still a few questions left, but I'm conscious that we've come to the end of our time, so I'll just be sure that those whose questions haven't been answered, that we'll do our best to answer those offline. And, at any time if you have questions, feel free to contact RETScreen customer support. We get back to you as quickly as possible, and we welcome all sorts of questions about the RETScreen software.

You can find their customer support e-mail on our website—www.RETScreen.net. So, with that, I will hand it back over to Katie to close the presentation.

Katie

Great. Thank you again. On behalf of the Clean Energy Solutions Center, I'd like to extend a "Thank you" to all of our expert panelists and to our attendees for participating in today's webinar. We very much appreciate your time and hope, in return, that you have some valuable insights that you can take back to your ministries, departments, or organizations. We'd also like to invite you to inform your colleagues and those in your networks about Solutions Center resources and services, including our no-cost policy support through our Ask an Expert service.

I invite you to check out the Solutions Center website if you would like to view the slides and listen to the recording for today's presentation, as well as previously held webinars. Additionally, you'll find information on upcoming webinars and other training events. We are also now posting the webinar recordings to the [Clean Energy Solutions Center's YouTube channel](#). Please allow about a week for these recordings 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 we hope to see you again at future Clean Energy Solutions Centers. This concludes our webinar.

DRAFT