Tennessee Valley Authority
Regional Energy Resource Council
June 26-27, 2019
Meeting Minutes

The Tennessee Valley Authority (TVA) Regional Energy Resource Council (RERC or Council) convened for the ninth meeting of its third term at 12:45 p.m. Eastern on Wednesday, June 26, 2019, at the Read House, 107 W. MLK Blvd., Chattanooga, Tennessee 37402.

Council members attending:

Wayne Davis, Chair	Rodney Goodman	Jennifer Mundt
Doug Lawyer	Peter J. Mattheis	Jeremy Nails
Wes Kelley	Dan Ionel	Shari Meghreblian
Doug Peters	Michael Butler	Lloyd Webb

Designated Federal Officer (DFO): Joe Hoagland
Alternate Designated Federal Officer: Amy Henry
Facilitator: Jo Anne Lavender

Appendix A identifies the TVA staff, members of the public, and others who attended the meeting.

Appendix B is the agenda for the meeting.

Copies of the presentations given at the meeting can be found at http://tva.gov/rerc.

RERC MEETING DAY 1 – JUNE 26, 2019

I. Welcome (Wayne Davis)

The purpose of the meeting is to provide an overview of the development of the IRP (Integrated Resource Plan) and the associated Final EIS and to recommend planning directions and to gain public input along the way at the latter part of today's meeting. We also have members of the Tennessee Valley Authority Board of Directors with us today, who are also going to participate in listening to the discussions that will be held today and we will have a panel discussion, which will allow everyone to gain insight into the complexities and challenges of preparing the IRP that TVA has done and worked so hard on. Then, we will close with a listening session to the public for those people who want to make specific statements to the RERC and TVA at the meeting today.

Before we start, it is appropriate to introduce the RERC members here today: Rodney Goodman, Executive Director, Habitat for Humanity in Bowling Green, Ky.; Daniel Ionel, Professor at University of Kentucky in Lexington, Ky.; Doug Lawyer, Vice President of Economic Development, Knoxville Chamber; Peter Mattheis, Tennessee Valley Industrial Committee; Shari Meghreblian, independent business owner in environment and energy industry; Jennifer Mundt, Senior Policy Advisor, North Carolina Department of Environmental Quality; Jeremy Nails, President, Morton County Economic Development Association, Decatur, Ala.; and Wayne Davis, interim chancellor, University of Tennessee.

Skip Thompson, TVA Board Chair

We are excited to be at this RERC meeting today to hear about the work the RERC is doing. It has been a long process and you have worked hard. We are appreciate that. We also are thankful for the work that the IRP Working Group did, and also for the public. We know TVA traveled around the Valley and got public input. That is important to this process. This might be the most important IRP at TVA because of the change in our industry. Customers' behaviors are changing, businesses are committed to renewables (We have seen that in the Valley, and we have provided what they wanted), and DER is a huge change. I think a better word is disruption, for the entire utility industry, so planning for the future — while it has always been important — is probably more important now because of the disruption that is coming. From the balance sheet, grid, generation assets, customer demands, we have to be ready. I am a banker; we have been through disruption. It is difficult to predict. Doing as thorough a job as we can is important, and we thank you for your work. I am a board member and from Decatur, Ala.

Introduction of Board members here today:

Kenny Allen — TVA Board member from Kentucky

A.D. Frazier — TVA Board member from Georgia

Richard Howorth — Small business owner from Oxford, Miss. I have been on the TVA Board since 2011. I think all of the IRPs have been important and useful, and I agree with Skip that this one is most important given the rate of change. It is great to have the perspective from people in different lines of work and different aspects of this business who give their perspective to this process and the public.

Gina Lodge — TVA Board member from Nashville, Tenn.

John Ryder — TVA Board member from Memphis, Tenn.

TVA

Jeff Lyash, President and CEO, TVA

Joe Hoagland, Designated Federal Officer for the RERC

II. Safety Moment (Jo Anne Lavender)

III. Review of Agenda (Jo Anne Lavender)

Jo Anne Lavender reviewed the agenda. Today, there will be a panel discussion about the challenges and opportunities the 2019 IRP points out for TVA; and there will be a public listening session. Tomorrow, June 27, we will reflect on today's meeting, review the Recommendation, have time for RERC discussion questions, and then the RERC will form an advisory statement for the TVA Board of Directors.

IV. Reviewed RERC meeting protocols (Jo Anne Lavender) (Slide 10)

V. Today's Meeting Purpose (Joe Hoagland, Designated Federal Officer) (Slides 11 to 14)

Dr Hoagland thanked everyone for attending today. He discussed that this is 18 months of work culminating today. The RERC members have met multiple times to talk about the IRP over the last 18 months, and the feedback received from the RERC and IRP Working Group have been beneficial. Today, we will bring together all of the analysis and the results, as well as a Recommendation. We have spent a fair amount of time trying to understand your input and public input, and as you will see today, that has been factored into our final analysis.

The goal coming out of the RERC meeting this time is that once you have heard everything, had the discussion, any public input, then you will have an opportunity to form up your views and opinions to provide to the Board of Directors. Our plan is to finish the IRP in the next few weeks and provide our Recommendation, along with your input, to the Board of Directors for their review at the August Board meeting. Today is a great opportunity to ask a lot of questions to our team as they make their presentations. We also will have an opportunity with the panel of folks who see the IRP through different lens, and it will give you an opportunity to ask questions around what they see as the

positives and the challenges. We hope all of this will help you form your thoughts as you come up with advice for the Board.

VI. 2019 IRP Overview and Development Process (Hunter Hydas) (Slides 15-21)

Hunter Hydas reviewed TVA's mission and information about the IRP and EIS. He noted that yesterday (June 25, 2019) was the last meeting with the IRP Working Group. He provided a review of the project, why the IRP is being updated now, the goals, how the process has been completed, and that there will be an evaluation of the project.

TVA has produced two deliverables: The IRP, which is a study of how TVA could meet customer demands. The Recommendation is housed in the IRP. The second deliverable is the EIS, which is an evaluation of the environmental impact of the IRP. Developing an EIS is something ingrained in the culture of TVA and makes it a better process.

Why updating now? There is a lot that drove us to do the IRP now, including that consumer behaviors are changing, the way people use electricity and their preference for what type of electricity they want delivered, companies are committing to renewables, and distributed energy resources (DER). We looked at DER in 2015. Now it is more of a reality, so how can we leverage DER for the people of the Valley?

***TVA IRP focus areas have changed over the years*.** In 2011, we focused on a balanced portfolio, and introduced gas as a result. In 2015, we focused on energy efficiency and renewables. In 2019, the key word is flexibility. With so much uncertainty, how *do* we develop a resource plan that is flexible to deal with DER, to maintain system flexibility, to integrate intermittent technology and maintain portfolio diversity to capture the benefits with a diverse portfolio.

Where are we in the process? We started in February 2018 with Scoping, asking the public what we should consider in the IRP. In Spring 2018, we developed the input, then we did the analysis in Summer/Fall 2018. In Winter/Spring 2019, we presented the draft IRP and EIS for public comment and held public meetings to ask people what they think about it. In Spring/Summer 2019, we incorporated stakeholder and public input. Now, we have identified the final results and Recommendation, and will present the Recommendation to the Board of Directors in August.

How the Resource Planning Process Works

We started with the development of scenarios and strategies. TVA does planning more often than the every four or five years that we do an IRP. The IRP affords us opportunities to look at multiple scenarios of how the future might play out. What futures could we imagine? We used the same modeling tool we use in regular resource planning. We developed portfolios to share with the public, analyzed them against different metrics, including cost, environmental responsibility, etc. We selected a preferred portfolio, and that sets up the conversation for the Recommendation.

VII. Stakeholder Engagement (Amy Henry) (Slides 22-33)

Amy Henry discussed how TVA's Stakeholder engagement is a key element in the IRP planning process. It is one of the things that makes TVA's IRP unique compared to IRPs prepared in the industry. Stakeholder engagement is how we get diverse perspectives on the IRP and how we challenge assumptions and get input and create better decisions. It makes us more informed, as stakeholders are walking through the planning process with us. It helps us understand how the outcomes affect residents of the Valley. The process allows us to build buy-in by having dialogue as we go along. The National Environmental Policy Act (NEPA) is integrated into the public process, too, and that results in better public outreach and better depth of environmental analysis for the IRP itself.

2019 Stakeholder Engagement has included the general public, the Regional Energy Resource Council and the IRP Working Group. We looked at three levels of engagement — the public, the IRP Working Group and the RERC. Each level is important in different ways. Overall, we understand that people come to the process with different levels of understanding of resource planning and what TVA does. People have different levels of interest, and we approach each group using different techniques and work to achieve a couple different goals for stakeholder engagement.

Work achieves different goals. One important goal is education. It is important for us to express information clearly. The IPR can be a technical topic. We worked to keep it simple. We offered summaries, and opportunities for questions and answers. We wanted to make sure everyone had a level of awareness of when people could make comments, what the status of the IRP process was, and where they could get more info. We worked hard on website resources. One of our goals for engagement was to have dialogue with

stakeholders so we could build buy-in and understanding as we went along in the process.

General public outreach. We made information available at various levels so people could understand as little or as much as they wanted to dig into. We provided webinar meetings throughout the process, and in-person public meetings at locations in the Valley so people could come and talk to the planning team. The website was active throughout the time period, and we had a new element — an interactive report. People could go on the report and dig into the information. We tried to make it interactive and reached out to various age groups, and worked to reach as many residents in the Valley as were interested. For the first time, we used a social media campaign, with information on Facebook, Twitter and LinkedIn. Social media posts helped people understand the IRP and showed them where they could find more information around things like the public meetings, their times and locations.

IRP Working Group. One of the most important elements of stakeholder engagement was the IRP Working Group. This was a group with 20 representatives, representing diverse, Valley-wide perspectives. The group was comprised of customers, customer representatives, academia, state government, community interests, and environmental groups. Some are with us today. I'd like to say thank you to the IRP Working Group members who are here. They worked with us almost monthly and devoted a lot of time to digging into the details. They gave us their input, which helped us shape the scenarios, strategies, metrics, public outreach, the Recommendation, next steps. Yesterday, we got input from them about the IRP Working Group process itself, so we can improve that in the future. The Working Group input was important.

RERC. The RERC has given us important reviews at key areas of the IRP process. You helped oversee the process and make sure we were thinking about all aspects as we developed the plan.

Public engagement. One of the most intensive time periods for public engagement was the public comment period. We posted the draft IRP and draft EIS online, widely publicized that they were available, and invited comments on the documents. It was open for a little over 50 days. We held seven open-house meetings in the Valley, giving people opportunities to speak to us directly. We had a webinar meeting, and the interactive report was available 24/7 so people could take a look at the IRP and what it meant. We asked for comments, and over 1,200 people commented.

We appreciated the time they took to comment. With that body of comments, we looked at themes and topics that people sent their thoughts on. Those topics included things such as encouraging TVA to increase use of renewable energy, asking about the level of energy efficiency in the draft report, commenting on carbon emissions and how that might affect climate change, and a variety of comments about existing resources and new resources on both sides of issues. The list of organizations that commented highlights the diversity of groups that commented and had interest in the IRP.

Impact of public comments

TVA used the public comments in a few different ways to prepare the final IRP and EIS. One big way, as Jane will highlight, is that the public comments helped inform our sensitivity runs. We tested aspects of the model and further analyzed the IRP Recommendation. Some sensitivities included looking at energy efficiency levels, levels of solar expansion, severe weather conditions. Public comments also helped form the Recommendation. We addressed those comments about topics like the level of solar or the amount of energy efficiency we were predicting. They all went into the final Recommendation. The public comments led us to revise the IRP and EIS documents, sometimes editorially and sometimes with more clear analysis. Each comment we received will be published in the final IRP/EIS. An appendix in the EIS has them all written out with TVA's response to each comment. Each person can go in and see their comment with their name associated and understand how we took the information and used it for the final document.

TVA used the input received. It helped us develop the IRP in a way that was transparent, sharing information among many different viewpoints throughout stakeholder and public groups. It helped us ultimately build a more robust plan, one that will be flexible and useful for TVA going forward.

QUESTIONS:

Jennifer Mundt asked about environmental justice and outreach in Spanish.

Amy responded. We look through a NEPA lens on all projects. Environmental justice leads TVA to take a look at proposed decisions and make sure we are not deciding something that would have a disproportionate effect on disadvantaged populations. We want to understand where those populations are and look at what our decisions may do

to impact those populations. One aspect is ensuring that disadvantaged populations have a chance to understand planning and provide input if they choose. We offered information in Spanish. We reached out through our supplier diversity network to get information to small and disadvantaged business owners. We used some of our other networks to spread the information about the IRP such as our energy efficiency information exchange.

Jennifer asked if the interactive report will be available after the IRP is completed?

Amy responded. Yes, the interactive report will remain on the website. It will be updated with the final information and will remain a resource. The website will stay active. The entire IRP and EIS will be there, summaries from the IRP Working Group, the executive summary — all of that information will remain available.

VIII. Developing the IRP (Hunter Hydas and Jane Elliott) (Slides 34-53)

Integrated Resource Planning Process. Hunter explained that before they presented the Recommendation, he and Jane wanted to cover the process and how TVA ended up selecting the preferred portfolio. He described the early part of the process, when the scenarios (possible futures) and strategies (TVA approach to scenarios) were developed. The Working Group was instrumental in the development of scenarios and strategies. We came up with a long list of scenarios and strategies. Even though there are only six on this page, there was a long list and these are what TVA and the IRP Working Group chose.

Scenario forecasts. Scenario planning looked at what could happen over the next 20 years. Uncertainties were evaluated, and lessons learned from the prior IRPs included to stretch ourselves and the way we think, particularly on peaks and energies and commodities. The peaks in this IRP are twice as wide as in the last IRP. Energy is three times as wide as we considered in the last IRP. The idea is breadth. We talked a lot about DER with stakeholder groups. They helped up to think about if DER is coming and disruptive, how disruptive. TVA considered behind the meter impacts, including electric vehicles, renewable energy, combined heat and power, and energy efficiency. Same thing on commodity prices. It also considered gas and coal prices. Broad range of scenarios considered, and broadened it farther. And CO2 as well. What CO2 penalties could we imagine out there over the next 20 years?

Planned reductions in firm capacity. This shows what actions will create a gap of capacity that we are trying to fill with resource plan. On the left is the current portfolio and

what it looks like. We have used this chart in many presentation to help ground stakeholders on what is already taking place.

Resource options and cost assumptions. This chart shows technology in play over the next 20 years. There are various technologies in this IRP across different scales of maturity as well. We didn't want it to be just our cost assumptions. We had a lot of benchmarking that happened around the cost assumptions for different resources.

Escalation assumptions. While most resource costs will escalate with inflation, costs for resources that de-escalate through time. We have input on them – renewable energy labs, IEEE, even Tesla (batteries). Looking at different cost trajectories for some impactful technologies like solar and storage. We got a lot of public comments around those two technologies.

Programmatic DER Options and Cost Assumptions. TVA can offer programmatically through our local power companies. You've got beneficial electrification, energy efficiency and demand response programs. We also benchmarked and reviewed cost. IRPWG members challenged and brought examples from other utilities, comparing costs with our costs included in this IRP.

Retirement options. We had gas options, Shawnee (uncontrolled units), all of the other coal and Browns Ferry Nuclear 1-3. It ties back to the scenario no nuclear extension across the country. Would see Browns Ferry not be relicensed toward the end of the planning period. Not necessarily a desired outcome but something we considered in a scenario.

Strategies promote resources using incentives. One of key innovations in this IRP was the way we handled strategies. We promoted certain resources; promoted meaning to make them more attractive to the model for selection. Various levels of promotion of different resources. See on the distributed side and the utility scale side. We wanted to achieve a range of promotion, a range of resources, on both sides of the meter. You can see how achieved with chart here. We got challenges from IRP Working Group as well as the public during the initial comment period.

Strategies provide incentives to promote adoption of certain resources, with consideration of potential, adoption curve, and reserve margin. This is a key innovation; a way to handle strategies with promoted resources— making these more attractive to the model for selection. The levels of promotion are:

- Base Level Adoption — No additional incentive; incentive aligned to base case.
- Moderate Adoption — Moderate incentive; 50 percent of marginal cost.
- High Adoption — High incentive; 100 percent if marginal cost.

Strategy design matrix. To achieve a range of promotion, there is a range of resources on both sides of the meter. You can see how we achieved it, with the chart here.

Robust set of portfolios evaluated in the IRP. It all came down to looking at the six scenarios across the five strategies. We had 30 initial portfolios in the draft. Received public comments, made tweaks and did additional analysis. Additional sensitivity analysis was also performed to test the impact of changes in key assumptions, creating about 15 additional portfolios.

Update our base case. Moving from the draft report to the final report, the first order of business for us in developing results was to update our base case to reflect the Board's decision to retire Paradise Unit 3 and Bull Run fossil plants. These changes were incorporated into the primary 30 cases. It resulted in no change in capacity expansion plans for scenarios that had flat or declining electricity demand. We saw that additional solar and gas capacity expansion occurred in the Valley Load Growth and No Nuclear Extensions scenarios, and also storage. Overall, the updated base care portfolios resulted in similar costs to what we saw in the draft but better environmental performance overall.

Incremental capacity by 2038. In the chart, all of lines above the zero line are additions and below the zero line are reductions in capacity. We saw expansion in solar, with 6 to 9 gigawatts of expansion in our current outlook cases. We saw modest gas expansion in many cases; in a high-growth environment, we could see added gas expansion and some opportunity for storage if we promoted to offset the gas additions. On the retirement side, we saw coal retirement in any scenario with carbon penalty or very low load scenarios. In scenario 6, last bar in each – no nuclear extension – the Browns Ferry units are assumed to retire and unable to be relicensed beyond 60 years. In one case, strategy C, one is replaced with small modular reactors (SMRs). There is a difference in cost and impact on emissions.

Total energy in 2038. The role of the existing fleet is modified by expansion. You see various levels there. You see that scenarios drive more differences in magnitude than the strategies we employ. Statistics: Portfolios resulted in renewable energy percentage, including hydro, that ranged from 15 percent to 26 percent. Lowest in high-growth case. On average, across portfolios, carbon-free energy ranged from 60 percent to 76 percent. Growth case, challenges carbon the most, averaged 45 or 50 percent. If you take an additional look at high-growth case, it does include electrification of transportation and some other industrial processes, and there could be a carbon offset in another part of the economy.

Strategy Performance. This looks at performance of five strategies across all six scenarios, how would we characterize their performance on average relative to each other. In general, base case or least-cost planning results in lowest cost. Some of the other strategies, while having a somewhat higher cost, had a better environmental performance with respect to air, water and waste emissions. Land use would be higher in strategies that promote solar, and you see that effect as well. When additional solar in portfolio, there is reduced flexibility but indications across analysis shows it would still be sufficient flexibility; it is something to study further.

Summary of 2019 IRP sensitivities. There were public comments and conversations with the IRP Working Group and RERC. Those conversations and comments raised questions, in addition to questions TVA had from looking at the initial results. Questions were analyzed through the use of sensitivity analysis and were approached to answer "what if" questions. We evaluated what if gas prices are higher or lower? What if wind costs changed? For the most part, our analysis was based on the current outlook for electricity demand. It shows you the impacts relative to the base case. This table shows impacts relative to base case. More additions of solar, for example, are shown in green and plus sign; if less, then in red with a negative sign.

Highlights of sensitivities. We saw some patterns in these sensitivities. To hit a few: higher and lower natural gas prices affect expansion of solar. Higher gas prices, see more solar; low gas, could see less solar. With lower gas prices, there are other factors such as consumer demand for renewables that would drive some level of solar expansion in any case. If wind costs are appreciably lower, about half of the current estimate, we could see wind expansion. It would take the place of some solar and gas expansion. Regarding great energy efficiency and demand response market depth, the question in this case is what is the depth in the market? How much opportunity is out there beyond the codes and standards? But what if this market depth is more than we

think. If greater depth than we think, could see more energy efficiency and demand response and less solar and gas in that case. In the top four sensitivities, you see some tradeoffs — solar trading off with movement in gas price, solar and wind competition if wind prices come down materially, and you see solar and energy efficiency competition as well.

Integration cost and flexibility benefit. Many utilities are using cost proxies to capture cost on the system due to more ramping up and down of thermal units to handle the impacts of intermittency. We introduced it in modeling ahead of the IRP. We also introduced a cost proxy around the extra benefit of highly flexible resources like battery storage that we don't have on system today. Given efficiency of a resource like that, it could reduce overall operating cost of our fleet. So we introduced cost proxies in our modeling. We received questions around what effect did it have. So we ran a sensitivity where we pull those out and do modeling without those sub-hourly proxies, and there was minimal impact to the expansion plan. Timing differences of when add solar or flexible resource, but over the 20 years, it had minimal impact.

Solar. How we modeled ability to add solar. Typical to talk about stepping into a resource at manageable level and predict when need it and get projects on the ground. For realistic timing of what you could carry out. We received questions about could you add more solar in a given year than what you modeled. We did a sensitivity to double that, what if add at twice that pace. The result in the first line of the sensitivities chart shows how it would act in the current outlook case. The second one is a follow-on. We had discussion at the last IRP Working Group and RERC, what about in a growth case. With growth case, loads are higher and with less room before hitting turn-down challenges. Shows potential that solar could be higher in that high-growth case.

Higher operating costs for coal plants. TVA staff wanted to take a look. We saw level of solar expansion across in the 30 portfolios and in the sensitivities, and increasing solar on the system requires older thermal units to cycle more often. That puts pressure on their cost; the more they cycle, there is additional operating and maintenance on those units. We wanted to run a sensitivity: what if those costs are higher. It was 60 percent higher on average that we modeled here, and what we saw, even in flat current outlook for load demand, was additional coal retirements that were not present in the case originally of 2200 megawatts, offset generally speaking with gas. We saw similar result in another sensitivity. Received a lot of questions and public comments about concern for greenhouse gases, and what if that concern drives more push for federal or state regulation on greenhouse gases, higher than what we modeled. This sensitivity said what if twice the level of penalty; took decarbonization world and doubled it. Saw similar level

of coal retirements but occurring earlier in the 20-year window. Also saw highest level of hydro expansion — 175 megawatts. High gas case also showed hydro happening; mix of expanding existing hydro plants and run of river.

Variation in climate. We received a lot of comments in the Working Group about what if we have extreme weather. If there is an increase in temperature, more floods, more droughts, what might we see on the system? How will demand change and how will the system operate? Analysts on my team worked up mini scenario based on an EPA paper about climate change in Tennessee. Took information on extreme weather in coastal regions and did "what if" this happens in Valley. Modeled hotter and drier summers and warmer and wetter winters. The result is additional solar expansion, some accelerated gas expansion that backed that up and helped offset the derates you see operating coal and nuclear operations on hotter summer days. These sensitivities are as important as the initial 30 portfolios.

QUESTIONS:

Shari Meghreblian asked

You touched on this little bit. I am interested in how time, the function of time, is operationalizing these scenarios. Five years versus 20 years. How does the modeling take into account the difference in lead time? How is that taken into account in the modeling?

Jane Elliott responded

Modeling starts with the world we are in. How does that world evolve over time? Step into the world over the course of five to 10 years. Each of these other worlds, step into over time, too. As far as resources, logic of the strategies employed in year one. But model does know how long it takes to build nuclear versus solar versus gas. They are all discrete visions of the future, and not necessarily from one world to another world. Get breadth of outcomes that if some combination of these worlds happens, tend to be somewhere in between.

Wes Kelley asked

On Slide 49 (the capacity slide), there is a parallel on solar and gas CT. If solar up, gas CT up. We don't see the same thing on Slide 52 (the sensitivities slide). Is that because this is helping solve for energy; that solar becomes a lower cost supply of energy over time? We have adequate gas capacity but it is more expensive to operate and it would be cheaper to operate the solar?

Jane Elliott responded

That is exactly right. It would entail more cycling; same set of resources.

Jennifer Mundt asked

What do you mean by summer derates?

Jane Elliott responded

The units all have a seasonal capacity. Their output depends on the type of resource but more or less affected by the ambient temperature it operates in. In the summer, the thermal units have a lower capacity. This can be additionally lowered because it is hotter and drier. Other factors in that variation in climate is if you have near-drought conditions more often in summer, you can't discharge as much into river systems, so they have to be derated from that purpose as well. So their operation and their thermal contribution to the river temperature.

Joe Hoagland asked

Regarding energy efficiency sensitivity, why is the play off with gas and solar versus coal and nuclear?

Jane responded

Some of it is due to what you have on the system and what would be new. The model does constantly optimize – looking at whole equation – and will retire something existing if that is the cheaper course of action. But you're only paying incremental cost from today; that is part of it. Second part, the model looks at, what things can I add? Energy efficiency hits all hours to some level and solar and gas pair up to manage all hours, so looking at does solar and gas combo or energy efficiency come out as a better total cost? That is a common pairing; solar and gas, how they work together to meet demand. They can be offset with energy efficiency. See a little something similar when wind offset is there as well.

2019 IRP results indicate. All portfolios point to a TVA power system that will be low-cost, reliable and clean. What is the full gamut of what we saw across the 30 portfolios plus the sensitivities? Over the 20 years, we could experience up to 14 GW of nameplate solar additions. It averaged 6 to 9 GW in the current outlook. We could see up to 5 GW of storage additions if promoted or if costs come down, and see modest level of 2 to 17 GW of natural gas additions in most cases. High-growth environment would push gas additions to a higher level. We see cases where it is important to continue evaluating additional coal and gas retirements, particularly older units, and the balance of our coal units will be evaluated to understand impact of cycling on operating costs. Overall, across all, we are looking at a projected 70 percent reduction in carbon intensity from the 2005 baseline on average across all portfolios.

IX. The Proposed IRP Recommendation (Jane Elliott) (Slides 54-59)

We want to talk about the proposed Recommendation based on results.

2019 IRP Key Findings

- There is a need for new capacity in all scenarios, even in lower load futures, in part to replace expiring or retiring capacity.
- Solar expansion plays a substantial role in all futures. It is approaching economic parity with our marginal cost, so seeing to some degree in all cases.
- Gas, storage and demand response play a role to provide reliability, particularly at winter peak, and to provide some flexibility to add intermittent resources.
- No baseload resources (designed to operate around the clock) added, highlighting the need for operational flexibility in the portfolio.
- Additional coal retirements in certain futures, particular future that is carbon constrained or a lower load.
- Energy Efficiency levels – potential for higher levels if more market depth is there at competitive price. We have done sensitivity testing on that.
- Wind could play a role if the cost comes down materially and is competitive with solar.
- In all cases, TVA will continue to provide for economic growth in the Tennessee Valley. Some fine-tuning based on world fine ourselves in.

The box and whisker chart depicts the Recommendation. What the chart shows:

Retirements are to the left of the middle line, and potential additions are on the right. Using summer net dependable megawatts, showing solar and wind in nameplate. Colors

or legends help people understand what they are seeing. Gray bars reflect expiration of power purchase agreements and assumed retirement due to local air-quality standards of uncontrolled Shawnee units in base plan. In coal, see shaded gray bar. In some cases, IRP reflected an acceleration of assumed retirement. Solid blue bars show potential expansion path we can see in current outlook scenario, which is our best estimate for electricity demand in the future. That is another note: We found positive aspects of each of the strategies, all have positive benefits. We wanted to include all of them in this proposed Recommendation. There are tradeoffs with cost and environmental stewardship. Current outlook – think of as most likely case. However, could find ourselves in a different world or see changes in key assumptions. If things move materially, on demand side or cost of resources, you could see that broader bar – that open bar – reflects balance of scenarios and results of sensitivities.

QUESTIONS:

Michael Butler asked

The solar in 2038, is that saying that the max out of all of the scenarios, 14,000 megawatts would be the upper end of that?

Jane responded

Yes, that is in a high-growth environment. The 6 to 9 megawatts is in the current outlook for electricity demand.

Jane talked through each resource type

Coal: We would recommend continuing with announced plans to retire Paradise in 2020 and Bull Run in 2023. Evaluate retirements of up to 2,200 MW of additional coal capacity if cost-effective.

Hydro: All portfolios reflect continued investment in the hydro fleet to maintain capacity. Consider additional hydro capacity where feasible.

Joe Hoagland asked

Couple instances where that would be beneficial. Joe asked about examples. What can be added from a hydro prospective?

Jane Elliott responded

At some existing hydro plants, there is some additional space to add a unit. That is a piece of the expansion. Also, could be run of river hydro in other locations. The expansion we saw in the sensitivities is a mix of both. There are some limitations of what we could add.

Wayne Davis asked

Would that include increased efficiency of the units at the hydro plants, or is that already at state-of-the-art?

Jane responded

When they do modernization and routine upgrades of the units, do two to three a year. Upgrade equipment, we occasionally get some megawatts. Some upgrades that we already have done provided the biggest bang for the buck on the additional megawatts. Seeing additional megawatts here and there. Majority improvement is in efficiency; use water more efficiently and produce more energy. Also with hydro system, there are other objectives we have to maintain.

Energy Efficiency: Achieve savings of up to 1,800 MW by 2028 and up to 2,200 MW by 2038. Work with our local power company partners to expand programs for low-income residents and refine program designs and delivery mechanisms with the goal of lowering total cost.

One finding in results: A level of low-income energy efficiency included in every case. Some strategies promoted to a greater extent, but some level of low-income energy efficiency is a clear thing to do in any world.

Demand Response: Add up to 500 MW of demand response by 2038 depending on availability and cost of the resource.

One thing with Demand Response — A program that we saw consistently across portfolios that showed value was aggregated residential demand response. If technology advances and we capitalize on that, it is an attractive program in any future if we are able to capitalize on demand response to move it off the peak a little bit.

Nuclear: Pursue option for secondary license renewal of Browns Ferry for an additional 20 years. Continue to evaluate emerging nuclear technologies, including Small Modular Reactors, as part of technology innovation efforts.

Our findings from the analysis show increase in cost, but also increase in carbon emissions if lose some of the nuclear. Retaining some nuclear in portfolio plays an important role in a lower carbon future.

Wayne Davis asked

Does the lack of blue color in the bar for nuclear mean the current outlook is neutral?

Jane Elliott responded

That's correct. There is no change to the existing portfolio. In many futures, you don't see the need for new baseload. The only scenario considered adding to the total megawatts of what you carry around the clock is that high-growth environment, but that is one of the factors there, too. Results certainly signals to maintain.

Wind: Existing wind contracts expire in the early 2030s. Consider the addition of up to 1,800 MW of wind by 2028 and up to 4,200 MW by 2038 if cost-effective.

We ran a sensitivity, our cost projections would need to come down by half for wind to compete with solar price. One of the benefits of wind is that it contributes about a third of its nameplate at our winter peak at 7 a.m. and so it is worth keeping an eye on what the prices are doing in the marketplace.

Storage: Add up to 2,400 MW of storage by 2028 and up to 5,300 MW by 2038. Additions may be a combination of utility and distributed scale. The trajectory and timing of additions will be highly dependent on the evolution of storage technologies.

This is space where there is a lot of technology still rapidly evolving. Not clear what technologies may win out. Could be a combination. There is benefit to a system from a diversity perspective and ability to integrate renewables if storage becomes more cost-effective.

Gas Combustion Turbine: Evaluate retirements of up to 2,000 MW of existing combustion turbines if cost-effective. Add up to 5,200 MW of combustion turbines by 2028 and up to 8,600 MW by 2038 if a high level of load growth materializes. Future CT needs are driven by demand for electricity, solar penetration, and evolution of other peaking technologies.

This resource pairs well with solar to provide energy around the clock. Storage costs come down and you might add storage and add less CT. They tend to trade off.

Gas Combined Cycle: Add between 800 and 5,700 MW of combined cycle by 2028 and up to 9,800 MW by 2038 if a high level of load growth materializes. Future CC needs are driven by demand for electricity and gas prices, as well as by solar penetration that tends to drive CT instead of CC additions.

Solar: Add between 1,500 and 8,000 MW of solar by 2028 and up to 14,000 MW by 2038 if a high level of load growth materializes. Additions may be a combination of utility and distributed scale. Future solar needs are driven by pricing, customer demand, and demand for electricity.

QUESTIONS:

Wayne Davis asked

In looking at this graph, can you make a statement about the net change in carbon emissions that would be the result of your current outlook? What does it say about your intended current outlook about carbon emissions? Net reduction? Break even? Net positive?

Jane Elliott responded

In current outlook, average of 70 percent reduction from 2005 baseline. We have talked about getting to 60 percent reduction by 2020 and further in next decade. These are consistent in getting to 70 percent reduction by 2038. Some strategies may hit more than 70 percent by end of 2038; some strategies will be in that range. The high-growth case may have less reduction than that but there would be some carbon offset in other parts of the economy.

Jennifer Mundt asked

Where is TVA now?

Jane Elliott responded

It is 47 percent in 2017, and about 52 percent in 2018.

Richard Howorth asked

If you take the median outlook on this, given storage and solar, what kind of cost difference are we talking about relative to today's cost?

Jane Elliott responded

We do have metrics around average system costs or average rates. We had a couple metrics in cost space, including present value of revenue requirements. We looked at total resource cost that added in net participant costs. Also looked at system average cost, which indicates potential relative rate pressure of strategies. There was a modest increase in average costs. I don't have the percentages off the top of my head, but they are about just below $70 MWH to about $72 MWH in the current outlook. Across the various strategies, they are all a bit different. In a similar rate, for a little higher rate, you can get lower carbon. There are some tradeoffs that are close.

Joe Hoagland responded

Nominally, in this scenario and recommendation, it produces flat rates generally over first 10 years of the plan. A little bit of variability. Second 10 years it depends on other things on variables, including the cost of the technology. We are picking the least-cost scenario of the ones that are available to us.

Richard Howorth asked

There has been discussion about another Raccoon Mountain facility? Is that still a possibility?

Jane Elliott responded

We get asked that question frequently. Raccoon Mountain has a lot of value for us. A couple things: There are environmental challenges around building another Raccoon Mountain. That is probably the biggest challenge to doing it again. It is a higher-cost

option. We did offer a hydro-pumped storage option in this, but in any of the cases we looked at, we did not see it get selected. Another thing, a second Raccoon Mountain of that size would have diminishing value for the system. There could be other storage that adds storage value but in a little bit different way than Raccoon Mountain. Such as battery storage, a little more minute-to-minute response. So, we see some more value to adding that type of storage or diversity to the fleet.

A.D. Frazier asked

Aren't we in the process of uprating our nuclear?

Jane Elliott responded

At Browns Ferry, uprates were in process over last three outage seasons and those are included in all of these portfolios. We are doing uprates at Raccoon Mountain, and over the next couple seasons, we will be finishing those as well to get a bit more output out of those units.

Jane Elliott responded

One final comment regarding the blue bar in this graph. Solid blue bar is more likely case, and you get a range of what you might see. There is a follow-up question we got asked by the IRP Working Group and RERC. Can you put more context around what you might do in the near-term? What indications did we get for most-likely actions to take in the next five years. That is what this next slide addresses: How to turn what we learned during the IRP process into near-term actions.

Near-Term Actions

Jane Elliott

Renewables and Flexibility

- What did the results tell us? What does the Recommendation indicate? It does indicate that solar is approaching economic parity for us. Adding solar based on economics and adjusting timing and magnitude to meet customer demand is a prudent near-term action.
- Related to that, we are looking ahead at additional renewables and intermittency on the system — how to integrate renewable and distributed resources to be able to respond to those in real time with assets in our portfolio.
- And, in this space, we are looking ahead to solar expansion to consider evaluating a demonstration battery storage project to gain operational experience and help us quantify some of the other benefits that battery storage provides. Right now it is

all in modeling space, but some real practical experience on our own system will further inform how we would use battery storage on the system.

Existing Fleet

- Prudent to pursue the option to get second license renewal for TVA's nuclear fleet; to explore what it entails. What would that cost and what projects might be involved?
- We have an end-of-life assumption related to the uncontrolled Shawnee units due to local air quality standards. Balance of coal fleet asked to cycle more. Understand what's going on with their costs when asked to operate that way to see if it informs engineering end-of-life dates for aging coal plants and also for our oldest gas CTs. To have that inform long-term planning; more of runway to understand when that might be, the better we can plan and think about how current and new technology would be available to take their place.

Energy Usage

- It has been a while since we have done a full-blown market potential study around energy efficiency. It is time to refresh that. With change in energy usage patterns and customer behaviors, it is time to update that and better inform planning about market depth related to energy efficiency and demand response.
- We have done a pilot program around low-income energy efficiency. The program is called Home Uplift. It has been in pilot phase over the last year or so. We have gotten a good response, and we are fine-tuning it. This is definitely an area that has received interest from the RERC, the IRP Working Group and the public. It is a prudent time to build on that pilot and think about how to expand it Valley-wide.
- Looking at electric vehicles in the Valley. Doing research getting ready for this. In Valley, the time is about right to stimulate the market and work collaboratively with other stakeholders to think about how to work on that together.

Distribution Planning

- While in this IRP, we strove to understand more about distributed energy resources, how much is out there – what type of DERs are out there, how leverage in strategy to have more adoption? Explore with information we have today. But the missing pieces are locational availability and value of it. So, we will work with local power companies to understand value and support the development of distribution resource planning to inform and incorporate into our annual planning process and the next IRP.

Jennifer Mundt asked

What kind of initiatives are you looking at to stimulate electric vehicle penetration?

Jane Elliott responded

We did not get that specific. This is more “consider-how-to-do-this.” In one strategy, promote efficient load shape, we looked at a strong incentive to charge in our super off-peak load and modeled what effect that might have on how people charge. We took a look at that. That is a lever. Infrastructure, more generally speaking, was also part of conversation.

Joe Hoagland noted

We implemented a road mapping exercise with the state of Tennessee and stakeholders in the state on what are the different steps that have to occur to get electric vehicles going and an assessment of who needs to be responsible to make those pieces work. Just now getting into the stage of implementation.

Wes Kelley asked

It seems that low-income energy efficiency and DER are interrelated, because as those with the means to supply their own power leave the system, that leaves stranded assets paid for by the remainder. I would hope as we think about DER from a policy perspective, that we are cognizant of that, and I know that we are. As we get to the programmatic side, it will be an interesting point of discussion on low-income energy efficiency and DER and how they are interrelated.

Jane Elliott responded

That is an excellent point, and a primary impetus for emphasis on that.

Signposts to Guide Long-Term Actions

Jane Elliott

We also gave thought to signposts that guide mid-term and longer-term actions. Informed by analysis of what are most impactful levers that could develop over longer-term and drive some options that we choose, both along the way (where exactly in the Recommendation do we fall) and when is it time to consider initiating the next IRP. These are some of the signposts that would guide our updates every year as we look at annual planning in context of this broader compass roadmap. It is related to demand for electricity and gas prices - those are two key ones we have always kept eye on, will continue to keep eye on. Customer expectations for renewable and clean energy, regulatory requirements and understanding how they are evolving, operating costs for existing units as well as costs for other resources such as solar and wind costs, and emerging and developmental technologies. There are some new technologies where we

are seeing step changes in efficiencies or new technologies that were not options on the front end.

X. PANEL DISCUSSION

Joe Hoagland, Moderator (Slides 60-62)

Thank you. As we develop the IRP, we get multiple points of view on how we are doing it and why we are doing it, and we get those viewpoints from good stakeholders with strong opinions of what is important and what is not important. They go through this process with us for 18 months and are very engaged. We don't always agree, and that is OK, because it helps give us different perspectives as we are going through the IRP process. At this point in the process, most of the discussion has occurred in all of our other meetings. As we come down to the final Recommendation, there is value in understanding their different perspectives and where we are from a final product standpoint.

We tried to bring together folks with interest and understanding of what we are doing. They have either been directly involved in the process or oftentimes involved in the results that come out of the IRP. For the panel today, I would like to have them introduce themselves and their perspectives. Then, we can talk a bit about the IRP and challenges and opportunities they see coming out of the IRP. I have a few questions to prime the pump. I am hoping there are questions from the RERC and Board members, too. The folks here can give excellent perspectives.

Panelists

Al Armandariz, Sierra Club

Deputy Regional Director in the Sierra Club

I represent the people in the Valley through my work with the Sierra Club. I worked in EPA, and was an engineering professor, so I come to my work from a technical and science background. I have enjoyed my 18 months working on the IRP and offering our perspective to TVA staff. Our goals at the Sierra Club are to work with utilities to reduce emissions, grow renewable energy and do it in a way that makes sense for communities. One of the things I have taken away from this process is that there are a number of "no regrets" or minimal regrets strategies that are available to TVA over next 10 to 20 years. One of them that I will highlight is "steel for fuel." The price of solar in particular is at a place where you can see significant consumer benefits, especially in the summer as well as in the spring and fall, of purchasing less fuel, burning less fuel, which reduces

emissions, and replacing that energy with solar panels. With that steel for fuel switch, you make capital investments for things like solar, but you can more than make up for that with reductions in fuel costs and money that leaves the Valley and TVA to purchase fuel from other states. It has been a pleasure being on the Working Group. The IRP is not perfect from a Sierra Club perspective; we would like to see even more growth of renewable energy and reduce even more the coal anticipated to still be on the system, but it is a significant first step in terms of real growth of renewable energy in the TVA footprint. The amount of solar and batteries in the IRP Recommendation are significant growth over where TVA is today. The economics of solar and batteries that are in this IRP and the fact that you can grow them at the gigawatt scale without an impact on rates is important. I hope the Board supports that.

Pete Mattheis, Tennessee Valley Industrial Committee

Lawyer and consultant out of Washington, DC

I work with large industrial users of energy and have for over 30 years now. I have been working with industry in the Valley for 15 years now, principally with Nucor Steel and the mills in Decatur, Ala., and Memphis. Currently, I am chair of TVIC's strategic planning committee that represents direct-serve customers of TVA in the Valley. I was happy to be a member of IRP Working Group and also a member of the RERC. We continue to be grateful that we are asked to be involved in these processes. I'd like to commend TVA today. It is the only utility I have worked with in 30 years that has a process that involves customers to the level TVA does and provides the kind of information early in the process that TVA does that allows for input, whether agreeing or not agreeing. It is nice to hear early in the process that we can have an opportunity to discuss it.

Cyrus Bhedwar, Southeast Energy Efficiency Alliance (SEEA)

Director of Energy Efficiency Policy

We are a non-profit, non-partisan organization based out of Atlanta, Ga., advancing energy efficiency in 11 states in the Southeast region. In my role as director of policy, I have the opportunity to work with utilities and regulators in the region to bring win-win solutions that advance energy efficiency throughout the Southeast. I'd like to acknowledge Cindy Herron, who is a member of the TVA team and serves on our Board, is a wonderful partner and a source of wisdom for us. I have also had a chance to work with many other TVA staff on the Energy Efficiency Information Exchange and have been involved in the development of low-income energy efficiency programs spoken of today. In my role here, I hope to help participants contextualize what they are hearing in TVA's IRP with what else is going on in the region. We have a regional perspective and see different approaches to energy efficiency that states, utilities and commissions take, and I

can bring that experience to bear on today's conversation. Second, I extend an invitation to more deeply understand the role energy efficiency can play in Valley and to consider the actions you as decision makers can take in respect to energy efficiency.

Stacy Cantrell, Huntsville Utilities

Vice President of Engineering

I have been able to serve as an alternate on the IRP Working Group and have attended most of the meetings. I have a strong interest in what is going on with this because I want to help TVA to be able to help our customers and provide the best reliable, low-cost service we can. How ever the LPCs can be involved and assist, I'd want to be part of that.

Gil Hough, Tennessee Solar Energy Industries Association (TenneSEIA)

Executive Director

We represent manufacturers, large installers, engineering procurement construction companies to one person working out of their garage and family installers doing residential systems. I see myself as representing the customers we serve, which are the customers of the LPCs and you all. We believe solar is more and more popular. It is the energy source people want. Survey after survey shows that, and it is a good business decision when give customers what they want, and it is increasingly solar energy. Solar hit on tariffs. Even with that, the last couple years, prices have continued to go down, and I don't think that trend is going to stop. If anything, I think the price assumptions in this IRP are conservative. Storage is on that same trajectory; really coming down dramatically. Excited that this IRP really does recognize the changing future and the distributed nature of that future. TenneSEIA really wants to partner with TVA, with the LPCs and with commercial industrial customers to find win-wins that keep costs down, improve the environment and promote economic development. We share the same mission.

Brian Solsbee, Tennessee Municipal Electric Power Association

Executive Director

We represent 60 municipal utilities in Tennessee and 15 municipal utilities in Mississippi and North Carolina who are members of ours. We advocate on behalf of public power, at the state and federal level. That puts us in a different environment. I used to manage a local utility and worked at TVA in transmission and distributed resources. This past

weekend, as every news story was about how the power was out, our job is to make sure we are out there touching those customers and keeping the power on. You will always hear from us that the number one priority is reliability. I am happy to have had the opportunity to participate on the IRP Working Group. It was a great experience and enlightening. We are open to — as technology develops and becomes more affordable — to optimize the grid for the betterment of all.

INITIAL QUESTIONS FROM JOE HOAGLAND

QUESTION #1 — Joe Hoagland asked

Regarding the Recommendation, the IRP proposes guidelines around the things we want to add or retirements for different scenarios. It is intentionally broad to allow for us to have flexibility as we move into an uncertain future. From each of your perspectives, what are the most important things or signposts to watch out for as we consider using this IRP going forward?

Brian Solsbee

It is interesting if we look back at the last two IRPs; they were 20-year visions. The decisions and outcome of the IRP today looks quite different than what was predicted four and especially eight years ago. At that point, talking about balance portfolio and natural gas prices had just dropped in the 2011 timeframe. If the IRP had been done in 2009, everything would have said run from natural gas. But yet TVA made the correct decisions at that time; it set TVA up with good luck. Commodity prices remaining low and new technology with fracking and natural gas has allowed TVA to continue down that path and sustain low rates over that timeframe. When I think about flexibility and signposts, it is commodity prices that are what will cause things to shift. Got up to nearly $15 in 2009 in natural gas, certainly been a long way from that. With all scenarios, natural gas price is the single thing that will change the outlook of what this IRP does. That is why some of the ranges in the diagrams in the IRP are so wide. We need to be aware of that. We talked in IRP Working Group, do we need routine and annual check-in on where things are and make sure don't go four years down the road before getting back together.

Gil Hough

From a solar industry point of view, this is a great IRP. The last IRP, we were saying this is the trend. As saying now with storage, prices are coming down and you see that in this

IRP. There are a couple other things see that interesting in the future: solar is a distributed technology and there are other distributed technologies, including storage, that are different than TVA's traditional model. The Board — you wear two hats; you are the corporate governance board for TVA the utility, and you are also the regulator of utility looking out for what is in the best interest of the people of the Valley. Traditionally, what was good for TVA and low cost for TVA was both hats, and they fit comfortably. Those two hats might have more tension. Solar can be integrated cheaper on distribution level, so I can sell power cheaper to LPC than to TVA. But LPCs are on contracts. Do you want to give contract flexibility? Corporate governance hat may say no, but what is best for the rate payer? Might be better for rate payer, better for environment, better for economic development to give flexibility. I do think that as looking at the planning horizon, it will be an interesting time for TVA — not just looking out for corporation but to be open to new structures, a more streamlined business model might be what is best for the Valley. Encourage you; next IRP needs to be distributed IRP that isn't top up but bottom up and looks for opportunities for what is best for the rate payer, not necessarily TVA.

Pete Mattheis

I thought your team did a good job of delineating signposts in the document. One that I would like to highlight is customer expectation. You are in the business of selling a product, so you need to be aware of what the customer wants to buy. And if they want to buy a product, you ought to think about whether you are selling the right product and should you be expanding your portfolio. That is critical going forward. I will also mention reliability. New challenges with reliability as you move forward. Things that will improve the ability of the system to operate reliably, but also things that will pose challenges as move down paths of distributed resources, which tend not to be evenly distributed. There are new things to monitor as a utility that will pose challenges that are not quite signposts in the same way but are things to watch out for.

Stacy Cantrell

With advancements in technology — things like solar, storage, whatever is coming next — becoming more and more accessible to consumers, how will they take advantage of this and what can we watch for and what are the habits of our consumers? What is that driving toward? How can we help them and guide them to use them most efficiently? Brian mentioned gas prices and how that could swing the scenarios. This is one of those things that we can watch moving forward and that could make a significant difference.

Al Armandariz

One signpost I would flag: operating cost at existing plants. Moving forward, TVA is going to have an average age of coal fleet where boilers are around 50 years old. You look at 10-year or 20-year IRP, power units will be older than everyone in this room. Steel fatigues and corrodes and fails. I would hope the Board and executive team would hold staff's feet to fire on annual continued capital investments on 50- and 60-year-old coal units. At some point, you are talking about real money. Is it a continued wise investment to keep putting capital into very old coal units as opposed to building new generation? It is an important signpost moving forward.

***QUESTION #2* — Joe Hoagland asked**

What are the challenges and opportunities around energy efficiency? What would you say about them in the IRP, and what should we do?

Cyrus Bhedwar

I was not in the IRP Working Group process, so I was getting up to speed in advance of this conversation. I was talking to some of the other stakeholders, and through conversation and review of materials, I was struggling to find policy direction on energy efficiency as it relates to the IRP. I didn't find policy guidance that says, "This is why we believe the utility should invest in energy efficiency, the reasons, the expected outcomes" with respect to that part of the portfolio. This is an opportunity for the decisionmakers in this room to think about what that looks like, what that means and what the benefits are with respect to what you are trying to achieve. It is not easy, but hopefully this is the beginning of a conversation that helps develop more cohesive, coherent and explicit policy guidelines for energy efficiency in the IRP.

***QUESTION #3* — Joe Hoagland asked**

How can we leverage the public power model with distributed generation, recognizing that in this IRP we have tried to begin to model that but we need to get further into distribution planning. But with the fact that don't have that yet, what should we be thinking about to make sure we support the model that we've got?

Brian Solsbee

It is a complicated equation. There have been some attempts — like at Glasgow, Kentucky, where they went to an Infotricity rate. The intent was 100 percent spot-on about what we should try to do that would flatten the load curve and the betterment for

all. However, implementation is extremely complicated. In that scenario, they even installed several residential home batteries. As we talk about these things, the technology is changing so fast. Every time I pull in at a Cracker Barrel, I am reminded that there was a program that TVA and others participated in 10 years ago to add electric chargers that were going to feed the system and people would jump on. As you pull in to Cracker Barrel and it is raining and you have to park on the other side of the parking lot, you walk past electric vehicle chargers sitting empty. Were we ready? Was the Valley ready to adapt to that and adopt that new technology? I'd say we weren't; not at that point. Prices are going to come down when it comes to energy storage and these technologies. We just don't know when it is going to come down to the point that people will be ready to integrate that. That puts extra burden to make sure that programs we do are not promoted to point that it causes cost to increase to all non-participants. We want to embrace technology without punishing those who either have no desire or no economic ability to be able to keep up with that, because then that puts the asset with fewer kilowatt hours on the grid. You also have low-income people and energy efficiency, and how we can help with that. It becomes very complicated.

Pete Mattheis

One thing I would like to say about the public power model and how it impacts this area is that TVA and the Southeast in general have a lot less combined heat and power projects installed than many parts of the country. At an investor-owned utility, they make money investing in the plant and earning a return, and they don't typically like combined heat and power or any other customer-centric power installations. But that is where public power should have an advantage; you are not pursuing a return on your equity. You are pursuing a benefit for the public. That is the whole point of public power. If TVA has the pricing right so that the projects are benefiting customers that want them without burdening the rest of the system, I think public power is a great model for enabling these customer-centric projects. Better so than, I think, investor-owned utilities where there are competing interests of earning a profit versus serving your customers.

QUESTIONS TO THE PANEL FROM RERC AND BOARD MEMBERS

<u>QUESTION</u> — Wes Kelly asked

For Al and Pete, you work nationally. You talked about the ability to get access to data. How do the results compare to IRPs outside the Valley? To Al, with the Sierra Club, as you look at the results of the IRP, taken in light of TVA's balanced portfolio approach, do

you view this as a favorable or productive IRP? To Pete, I am interested in hearing your color on that, too.

Al Armandariz

I have two early thoughts. One is on the process: This ranks in my experience as one of the most-open IRP processes for members of the public. The establishment of the IRP Working Group with diverse stakeholders, holding meetings over a year-and-a-half period, allowing us to submit data recommendations and submit examples from across the country, TVA should be commended for its open, transparent process. I am not aware of another in the country in either the private IOU side or public power side that has this level of engagement, so TVA is to be commended for its process. In terms of actual results, the IRP will be published on Friday (June 28, 2019), and I will have an official position after Friday. Our preliminary assessment is that it is a big step forward in terms of what the economics are saying in terms of batteries and solar. Do we think there is even more opportunity? Yes. But I am optimistic that once TVA starts issuing requests for proposals and testing the market, TVA is big enough that it will move the needle and pull down panel prices as it starts making purchases. That is very positive. In terms of carbon emissions, I do think there probably is opportunity to do more than what the IRP will recommend. I think that for a variety of technical reasons, I anticipate there will continue to be continued capital needs at old coal plants that are being asked to operate up and down in ways they were not designed. The wisdom of running plants that way and the additional wear and tear will catch up to TVA. There probably will be economic reasons for coal retirements in the next 10 years. I was a little disappointed with energy efficiency. It is a modest amount and the demand response in the IRP is on the lower end of what I would have guessed at the beginning of the process. I am sure there are good reasons that underlie that, but I would encourage TVA to keep an eye out and make sure that it is taking advantage of working with local power companies and industrial consumers of energy efficiency every place it can. I was a little surprised that energy efficiency gains seemed to be so modest over the next 10 to 20 years.

Pete Mattheis

This is very different than what you get in most jurisdictions. In most jurisdictions, you are handed at some point a draft IRP. We had been spending 12 months of pre-work leading up to that, and that is typically where you start. At that level and that point, for people in my situation with my clients, you are not relitigating an entire document, so you focus on a fairly narrow set of things you think you can have some input on. But it is a different process and goal in mind; for many utilities, it is justifying actions they want to take anyway. I don’t want to say the IRPWG is thoroughly enjoyable, but it was enjoyable to have a voice in the process that early and to understand how it works. In terms of results,

it is a portfolio evaluation. If looking at IRP for utility that is all coal, if coal prices goes south, they are in trouble; or if a utility that is all gas and gas prices go up, they are in trouble. What find in TVA IRP is that being diversified is a real benefit. That is true for every IRP I have seen or heard of. Many utilities are somewhat hamstrung; if system is 80 percent gas, you are 80 percent gas and there is only so much you can do. TVA demonstrates there are advantages to being diversified today. Surprises — true for IRPs I have seen recently. They all included more solar than I expected. I always thought that solar requires all this backup generation and other things; found going through this, it doesn't quite work that way in the real world. All of the IRPs I am seeing do have more solar than I would have expected; even ones that are predominantly coal-fired. It is very hard to compare utility to utility.

***QUESTION* — Shari Meghreblian asked**

I have a question around reliability and portfolio diversity as it may or may not relate to grid security. Looking 20 years out and looking at different scenarios with computers and issues concerning security around the grid, is there any overlap with decisions that we might make as a result of the IRP that could implicate or need to be consistent with issues around grid security? At what level do you see that having an impact? And the answer may be none; that we make those separate.

Gil Hough

It is a separate decision, but that is a great implication question. At TenneSEIA, we did two different studies with the University of Memphis on the security of inverters. The inverters are extremely smart; they can improve the power locally, they have incredible features and they can turn DC to AC, but that is potential security risk. The National SEIA has an ongoing working group to make sure these are secure. I would flag that as a point where the industry and TVA probably need to work closer together to make sure that more distributed energy resources going on are being done in a safe way; don't want to assume minimum is good enough.

Brian Solsbee

When look at centralized generation like TVA has; TVA has a higher level of cybersecurity than many local power companies and has a full resource dedicated to that. On other side, all eggs in one basket. If one place gets hacked, may lose large generating source. If look forward to distributed generation, now if controlled through local power companies, need to bring to TVA standards to integrate for interoperability. Yet on other side, more smaller pieces, if one taken down, lesser impact. In LCP space,

we are working hard to get more up to speed on that. You still see little cyber attacks. These things are real that happen in small towns, and frankly, we are trying to catch up and get ready for, but we are behind. As talk about broader picture of integrating DER, it is a top concern we should all be aware of.

Joe Hoagland

It highlights a near-term actions we talked about. The IRP itself doesn't do a good job of addressing your question, but it is a concern. If we get in a position where we can do distribution planning at a better level and include generation at that distribution level, we will understand the problem better about how to address the security issues.

QUESTION — Wayne Davis asked

Having read newspapers and listened to the news recently, and I will use Tennessee as an example with a lieutenant governor who probably would prefer to see Bull Run operate another 25 years most likely because of employment opportunities within the region. But also looking at your table or graph, you are already looking at 2,000 megawatts of retiring coal-fired power plants, and if other alternatives move faster, you might be looking at 4,000 megawatts power plants, and that is several power plants around the region. My question is, when you retire coal-fired power plants, you do have acreage and you have an ash issue, too, but I don't want to go in that direction. You do have a people issue. People have operated the coal plant their whole life and don't have another business, and it is a site. It has been mentioned that you could consider solar capacity on that site. I wonder from the perspective of all of the folks on the panel, the IRP doesn't address that particular issue but the real criticism associated with retiring coal-fired power plants is about people. I have heard that many, many times. And I am wondering, to what level does the agency or local providers try to figure out what do we do about people? How do we retrain people? If we could have put a solar farm there, there would be some people employed there. People are generally able to be trained, so maybe you solve some of it. Is there some way to create a positive image with that aspect? It strikes me, with this IRP, heading down a path that there will not be an increase in coal usage. There is going to be a decrease unless something changes politically that forces a decision to not retire a coal-fired power plant or two. Is there a way to solve the employment issue as one is designing this for a futuristic opportunity? Can one concentrate more on that and create a better case for the fact that a coal-fired power plant may not be there next year and yet those people might have had something that could be done from an economic standpoint that might be related to the agency?

Jeff Lyash, TVA CEO, responded

Our employees, our workforce and their long-term well-being are at the center of every one of these decisions. These are very talented people who we have invested a lot of time and effort into training, and they have demonstrated their ability to perform over time. As we make decisions about closing any facility, we develop a workforce redeployment strategy, and TVA has been successful — and I expect will continue to be successful — at placing any employee who wants to remain with TVA into another position within the TVA fleet. We have had success at and I expect we will be successful with Paradise and Bull Run and will apply the same approach to other facilities. We work closely with the unions as well, not just to place them. We have a program called Homeward Bound, where if they are placed in a location that is not optimal for them, over time they have the ability to work back geographically to where they want to be. It is a good business decision to do that. The second dimension is that those jobs, while they exist for the workforce, they may not exist in that community. It has a community impact that we recognize very clearly, and we work with the local community. We have a world-class economic development team, and we look to repurpose those sites. We look to help that community develop other alternative employment opportunities that can replace some of that impact.

Wayne Davis

I do understand that, and I know how hard you work on that. But it is the number one feature in every one newspaper article, that there are going to be people who are going to lose their jobs. My comment was coming from the standpoint: One might be able to be more proactive in assuring before you ever announce that, that those types of situations have generally turned out extremely well, if they have. You have data where you have closed plants before. I just think, proactively, that one might help that situation in this advanced planning mode. I do realize that it is not just about the IRP. Although when the IRP is published, it won't take too many people long to realize that there will be 2,000 megawatts closed and there might even be 4,000 megawatts closed, so that has to put some concern on communities that you might have proactively avoided some of the criticism.

Joe Hoagland

It will be interesting to hear from a few folks here, because part of what we are talking about is the changing of technologies as we go forward. That is what the IRP is showing. To Jeff's point, while we work with our workforce, there needs to be a new workforce for the future effectively.

Gil Hough

The good news on solar is that Shoals Technologies Group in the solar industry can't keep up with the number of people being hired. They can't keep up with demand. Silicon Ranch, too. There is that balance. It is not necessarily in the same neighborhood, same community. There are new jobs, a lot of times good jobs that are giving back. The solar industry in the state, especially in large scale, is doing a ton of hiring and there are a lot of good jobs in the Valley. As we grow as expected, that should continue. And that is a story that we need to partner and tell together; that, good economic development is happening, it just looks a little different than in the past.

One small piece in there, though: The one area that has been suffering is the small installer residential market. Green Power Providers was canceled. In the last 15 years, LPCs have turned to TVA for how to interconnect their home into the system. My kids and most new homeowners are expecting to do it easily. If you want to figure out how to use new technology on the home, you have no resource. There is a resource today, and it ends at the end of the year. As solar grows dramatically, the positive story will be there. The pushback that could be happening at the beginning of next year when the Green Power Providers program closes at the end of December, suddenly TVA has left a huge void. It is a community they have been serving for a long time, and there doesn't look to be a replacement program. TVA needs to have some sort of outreach, education. We'd love to partner with you on that. You could have some bad headlines if you are no longer providing a service people are looking for. Not talking about incentives for the residential market; it is behind the system meters, you don't have net metering, it is a difficult place to play in if you don't have a program. That is the negative story you might hear. The good news is that overall, we are hiring, we are growing, and as far as IRP, that trend will be continuing.

Cyrus Bhedwar

There is a national report that has been done for a couple or three years on employment in the energy efficiency industries. They have a state-by-state breakdown of the current employment. So, I looked at where Tennessee was in terms of energy efficiency employment and then looked at the states that were nearest in population. One of those adjoining states happens to be Massachusetts. They happen to be ranked consistently number 1 in their suite of policies that drive energy efficiency. Their employment numbers for energy efficiency were 30,000 jobs greater than Tennessee, with a comparable population.

***QUESTION* — A.D. Frazier asked**

I have two questions. First, how fast are batteries going to become commercially feasible at the utility scale? We are now building gas lines to go along with solar plants. Is it conceivable that batteries will become a larger part of that, and the question is, how fast? I have a second question: There is a lot of discussion about distributed energy and what our LPC partners are trying to do to push it. Is there embedded in their assumption that TVA will backstop all of their power needs? Are we the universal backstop for these individual LPCs, and if so, how much are we going to spend trying to be that?

Joe Hoagland

We are the provider of last resort. In the IRP analysis, though, we look at a scenario where we assume 25 percent loss of load in that scenario. That is our rough way of handling a growing distributed marketplace. What we say is that we no longer have to provide that load, because it is coming from somewhere else – whether solar, combined heat and power, anything like that, we don't try to define in the IRP because of the limitations we talked about. The numbers you are seeing and the information you are seeing do reflect the fact that we are not providing backup power for that distributed generation. Now in terms of practicality and provider of last resort, that is not part of the scope of IRP and something we need to think through as we are working through our distributed generation.

***QUESTION* — A.D. Frazier asked**

What are expectations of people arguing for distributed power, and what we are expected to do?

Joe Hoagland

That is a great question for the group. Do you expect TVA to backup whatever you are doing? Where do you think batteries are going?

Stacy Cantrell

Backup is a very real concern, and something we have already had to somewhat address at the local power level. Consumers come in and want to switch to other type of generation but want us to be there just in case. It puts us in a difficult position, and not an efficient position to provide needs to the Valley consumer. This is part of why there are concerns about needing to be so flexible with our assets and being able to respond to

these things that consumers will do and will expect. We mentioned how do we get a handle on that, on distributed generation, on DER, and other things that aren't necessarily in our control that the customers may do as they gain access to other technologies and other things. Certainly going to be strong relationship between the LPCs, TVA and customers. There are wonderful success stories with some of TVA's energy efficiency programs, and we have to have that same sort of relationship and way to attack this problem as well.

***QUESTION* — A.D. Frazier**

So you are saying that you are expecting TVA to be the backstop?

Stacy Cantrell

Yes, I think there are customers expecting TVA to be a backup.

Brian Solsbee

If you look at the challenges in Texas as their reserve margins go down, deregulated market. Certainly, wind is prevalent there and wind is cheap. It all makes sense; cheap is good, until you don't have wind blowing and then you don't have power, and that creates the backstop. That is what created that issue in a deregulated market. It has caused coal plants that are not being used effectively to shut down earlier, etc. This is something to be thought about as we look forward. Is that going to be a complete upheaval of what the pricing structure looks like? If look at the pricing structure on large and small scale, residential is at a higher rate per kilowatt hour. It is a lower load factor and more sporadic load that also puts burden on during the peak times because of residential heating and cooling as opposed to that of a large industry with high load factor and operates at approximately the same power load all daylong. Is that what going to be looking at? There are those that get further away and only want backup 10 percent of the time versus those that might be 50 percent versus those that say I am happy with what I've got, my lights are on.

Gil Hough

I would add that the technology is changing with modern power electronics on this stuff that can enhance the grid and support resiliency. *S*torage is coming down very dramatically. Right now, spec'ing out with LPCs — solar and storage combined — to work together, and that is going to increase. At TVA Solar Conference on October 16, we

are bringing in the largest manufacturers of storage — at a solar conference in the United States, because we see this as a trend. We are hearing from TVA and the LPCS want it. What is one of the biggest focuses at a solar conference — storage. Because we want to be able to support the grid and have a resilient, high-efficient grid. With deregulated craziness, bad things can happen. You do want to plan and plan smartly and integrate appropriately, but with technology today, it is very doable and will enhance the future.

Al Armandariz

I don't think the DER you see in the IRP necessarily means it has to be owned by individual customers or your LPCs. There could easily be a future where TVA, if it builds a couple 1,000 megawatts of solar and a couple 1,000 megawatts of storage, that these are TVA-owned assets that are placed on transmission corridors or at sites of retired coal plants or, if smart, a little bit in each of the congressional districts sprinkled around the Valley. You could put these resources in a manner that they are TVA-owned and TVA-controlled largely. I am not saying they should do that, but there is a balance there between DER that is owned by individual customers or even LPCs and DER that can be owned by TVA and better controlled by TVA. I think where that sweet spot is is more a political decision than necessarily an engineering one.

Pete Mattheis

There are a lot of ways to structure this. On things like combined heat and power for industries, there are opportunities for TVA to partner with industry on some of those projects. Not solely customer owned and operated. But on the industrial side, there are very few industries willing to go dark. I have seen some willing to island, but none the less, shutting your plant down is generally not perceived to be a good option. Then it all comes down to pricing. Oftentimes. A lot of these things are about get the pricing right; you can get the pricing wrong in a way that stifles development or that subsidizes the development. It is a trick to get it in the right place that you both encourage what you want without burdening the rest of the system. It is a challenge but I don't think it is an insurmountable challenge.

<u>QUESTION</u> — Michael Butler asked

I believe we have a cognitive dissonance amongst the public. On one hand, they say 80 to 89 percent support open space, for example, then you have 80 to 90 percent support solar. Question for the panel: Has anybody on the panel had to deal with the social ramifications of large-scale industry solar development on greenfield sites in rural Tennessee or rural America, where adjacent land uses may be impacted, and how is that

going to happen, if, per this IRP, if you take the higher estimate, it is over 100,000 acres of impact. If you look at the Baker Center recent research on open space value in the 10-county area in Middle Tennessee they studied, the open space values around rural farmland and rural habitat was in the hundreds of millions of dollars. But when you consider the open space in those 10 counties, and 91 percent of those counties is a considered open space, and you look at the growth pressures that come from all the different development pieces in our sectors — commercial, residential, take your pick — and you look at the other pressures of road building and land-use changes. We lost 120,000 acres in open space in Middle Tennessee, and then you add on to it greenfield development of solar — which is a concern of ours. We are pro solar, but we want to do it smarter. Has anyone had that conversation or looked into the social implication in rural Tennessee or rural America as it relates to large industrial scale solar?

Gil Hough

The only real negative is the footprint. It is unique, though. Most of the projects I have done have been on brownfields, industrial sites. But I have horse trails going through mine. I don't think it is a coincidence that Silicon Ranch, a large developer in the state, announced a new program looking at how to do farm work within a solar farm. Solar is unique in the fact that you put the post up, but underneath can still be green. It is not really changing it. I have done NEPA work for solar projects. One of the things asked, is this prime farmland, how will it change it? Well, it doesn't change it. In programmatic EA that TVA did on solar, said it is not a problem because it can be taken away in two weeks and goes back to prime farmland and you can have your next crops. Unlike many things that will permanently change the nature of the ground, solar doesn't have that impact. If we come up with a better technology tomorrow, it is easy enough to pull that out. It literally pays to have it recycled. I think it is a challenge and worth putting out RFP to plan. Everything happens smartly if you plan for these things. To ask the developer, what is your plan to handle? Spray and kill everything? Crops underneath? Cattle underneath? Give them points for doing that kind of thing, for having sustainable solar projects. Industry is doing that on its own, but as you are seeing more and more solar, planning for that and encouraging that. And, make sure developers are working on that. The project I am working on now, small project, seven acres, I am going house to house. I am asking, How much distance do you want to have? Can I plant some trees to minimize it? That could be a problem if it is unregulated and left to the lowest dollar, but that large footprint is different than many large footprints, and it is less of an impact and can be managed very successfully.

<u>QUESTION</u> — Wes Kelley asked

I have often been asked by members of my Board and community about the nature of energy efficiency during a declining load period. All the questions revolve around – is our support of energy efficiency more of a moral issue or is there still a business case to be made for utilities' involvement in energy efficiency?

Cyrus Bhedwar

It is a great question, and it is one being considered by a lot of utilities right now. TVA is unique in the Southeast to model energy efficiency as a resource. Most other utilities that offer energy efficiency programs do it as an add-on at the end of the process. For me, it has been a learning experience to watch as TVA has gone through this process. It seems to me, if it models out as a least-cost resource, you would acquire it just as you would a natural gas resource, nuclear resource, solar resource. If the model is showing that it is least cost, it is reducing system costs for everybody, not just participants. Obviously, participants gain the extra and direct benefit of whatever programs and incentives are offered, but overall, as long as it models out in the cost curve, then you will see the continued business benefit for deploying energy efficiency.

Wes Kelley asked

It begs the point about whether or not it is still the lowest-cost option? This IRP, it didn't really play out that way. There was not a lot of discussion about energy efficiency. I think that one of the things we will face as an industry, say, our telecommunication peers have the Universal Service Fund and use it to help low-income people who need help paying telephone bills. I wonder if from a public policy perspective, we will end up with something similar in our industry as the business case becomes harder to make — as sources and generation go down, the load is naturally declining, so we are not talking about adding resources, we are talking about retiring resources. I wonder whether we end up with more of a public policy discussion than a business discussion.

Cyrus Bhedwar

One other point I will add. As we have watched utilities and commissions conduct their energy efficiency potential studies to evaluate how much is out there, we've seen that as a useful tool when a utility or a state is getting started on energy efficiency. It provides comfort to stakeholders that this is what we can analytically see as the available potential. Once the utility has started down the road of energy efficiency and it understands how the market is working, we have seen that getting out there and doing it is the best proof of the pudding. The best example of that has been Arkansas. They have been operating under an energy efficiency resource standard for close to 10 years now.

As they were set to potentially increase the savings target, the utilities paused and said, let's do a study and see if that prospective target is realistic. It was a challenging process, because it was seven investor-owned utilities in Arkansas that they had to get together and do this study around. What they ended up showing in the potential study is less potential than they were actually achieving at the time. Taking these potential studies with grain of salt. They have continued to increase the targets several years after that. They continue to find cost-effective energy efficiency in Arkansas. It is a state with a lot of the same economic conditions as the Valley experiences. I would caution the decisionmakers to take those analyses with a grain of salt, look around and see what is happening on the ground with respect to energy efficiency. I think there is a continued business case for that.

Richard Howorth commented

If I could just comment on that and try to channel former director Marilyn Brown, who was on the Board, taught energy efficiency at Georgia Tech and advocated including energy efficiency as a generation source in our portfolio matrix. One of the things she used to say early on is that there is a lot of low-hanging fruit out there, we will be able to get some of this, and after a while, this is not going to be so easy. The ceiling is getting lower on that, but there is still a lot of things that can be done.

Joe Hoagland responded

I agree with that, and back to one of Jane's recommendations. We do need to look. It has been a while since we have done a potential study. I appreciate the point that we have to watch it with a grain of salt, but I think there is an opportunity for us to look and see if there are other places where it is economical.

Joe Hoagland wrap-up

I want to thank all of the panelists, and also thank the Board and the RERC for your questions. I appreciate the input. As you can see, the dynamic —the questions were fairly varied, the interest was fairly varied, and the answers were fairly varied. That has been the past 18 months. Part of what the team has had to do is try to consolidate that into something that is reasonable and makes sense for the Valley. Thank you, everyone.

XI. PUBLIC LISTENING SESSION FOR THE RERC (Slides 63-64)

Speaker

Ben Edgar, with Tennessee Advanced Energy Business Council

I am here today as a member of the Tennessee Advanced Energy Business Council, but also as the President of White Harvest Energy, a company that thrives on advanced energy.

First of all, the Tennessee Advanced Energy Business Council (TAEBC) would like to reiterate our commitment to supporting TVA as it takes steps to proactively address the evolving utility marketplace. Our intent as the council is to provide TVA with economic development trends and data to inform the utility's decision on how best to meet the future electricity demand while continuing to broaden its mission.

TAEBC champions advanced energy as an economic development tool and a job-creation strategy. Advanced energy is technology neutral; anything that makes energy cleaner, more efficient, safer, more secure is included in advanced energy. At its core, we look to energy innovation as an economic development opportunity for the Valley.

TVA's approach to the 2019 IRP represents the utility's recognition of a shifting energy landscape and its role in becoming an energy company of the future. We consider this significant, and we appreciate that. However, we do feel that more can be done to fully embrace the advanced energy economy in a way that would have ripple effects across the Tennessee Valley and the area that TVA serves. TAEBC encourages TVA to consider how its IRP might either encourage or discourage that economic development, along with capital investment and jobs in our region from the advanced energy sector. This is a growing and a lucrative sector in our economy. States and regions that provide an attractive home for this industry will be able to reap the benefits. Its workforce will be rewarded with jobs and additional capital investment. In our IRP comments, we offered guiding principles for how TVA might more fully embrace advanced energy for our region's economic benefit. We've got three examples I'd like to talk about.

First

Resource planning should include both TVA-built resources and procured third-party resources as well as take into consideration customer-sided and demand-side management resources. Correctly valuing the distributed energy resources, or DER, is critical to integrating the benefits they offer both to the system and to the user. Valuing that system of DER is a challenge that has to be addressed, as net benefits may increase when certain technologies are used together. Personally, I will say that the value of a DER asset, only the utility can take advantage of all the different values that they offer. Without having the utility's participation, we are leaving a little bit on the table.

Second

If our state's economic development goal to become the top electric vehicle producer in America, TAEBC believes that TVA should complement this goal by making the Tennessee Valley the most electric-vehicle friendly region in the country so that we can fully leverage the economic opportunities from this industry. This needs more consideration in the IRP.

Third

TAEBC has seen Fortune 100 and 500 companies all across the country and within the Valley commit to reducing their greenhouse gas emissions, increase energy efficiency targets or establish sustainability goals. This means that TVA is likely to experience a scenario of Valley load growth or demand for a certain type of load growth — decarbonization, rapid DER expansion. I will belabor that last point for a second. I have personally sat in meetings where a Fortune 100 representative from the company said his CEO is putting pressure on him to meet sustainability goals, and his first of point contact to try to get help with that was his utility. So you will experience more and more of these companies coming to you looking for help in developing those solutions.

We feel a full blend of strategies can be the most effective response.

RERC MEETING, DAY 2 — June 27, 2019

XII. Recap of Day 1 (Slides 65-68)

Wayne Davis

I thought yesterday was good. I appreciated the panel discussion and additional thoughts. Some of the panel members were part of the RERC, others were not. The panel was supportive of the position that the IRP arrived at, and that is important.

I do think, from my perspective, TVA has arrived at a path forward. It is a cleaner plan. Looking 20 years into the future, there are uncertainties, but where we are is with a realistic approach to where things are relative to the different options. TVA is diversified. I particularly appreciate the summary chart we will be talking about this morning. It lays out the boundaries that the IRP identifies.

We don't know how quickly storage, DER, DR will take hold, but we have tremendous options to alter the baseload resources such as coal-fired power plants. I like where it is right now. TVA has appropriately identified the boundaries. There are still some concerns about long-term, but we also realize that three years from now, the next RERC will work with TVA based on new information. There will be a lot of new information, particularly of large-scale storage and maybe smaller-scale storage.

XIII. Observations from Day 1 (Slides 69-70)

Joe Hoagland

I'd like to offer a couple observations. Thank you to everyone. We appreciated your engagement. When we were planning the session, we hoped to get panel folks who were good at what they do and to have people ask questions. We succeeded. I appreciate everyone's engagement, and your observations were great.

My observations:

This is the third IRP I have been involved with. We have tweaked it each time. It is interesting to me how much alignment we have gotten about what things to be worried about for the future. The Sierra Club and industry were 80 percent on the same page. Six years ago, that wouldn't have been the case. I think the world is changing significantly, but it appears to me that we are beginning to figure out what we need to do to go down that road.

Another observation is not only the level of engagement from you and others involved with the IRP process, but also the understanding and sophistication of processes and what accomplished. Based on your engagement, folks thought that this is important. It is good for them to hear and understand that stakeholders care about where we are going and how we are getting there.

RERC OBSERVATIONS

Shari Meghreblian

I applaud TVA. I have an appreciation because of my former job in public participation. I commend this group and TVA for the effort and push to make sure folks had an opportunity to comment. The website offered multiple ways to reach folks. You talked to folks, gave them opportunities. You had Board members here and the president and CEO. You led the horse to water, and I applaud you all for that. Kudos.

Wes Kelley

The process was done well. You didn't forget lessons learned from four years ago. You built on them and made it better. These are challenging times. This study doesn't pretend to answer how to handle that. It defines what we do know, where data can help us and has helped us. It defines where public policy and issues are in front of us. It helps us define, helps guide us forward. It is not the path forward, but an important column as we go forward.

XIV. THE IRP RECOMMENDATION (presented to the IRP Workgroup for Adoption)

Hunter Hydas and Jane Elliott (Slides 71-77)

Jane Elliott

Yesterday felt like a rewarding culmination to the process. This IRP attempts to build on prior IRPs. It gives additional insight and covers what things we continue to work on. We appreciate your engagement in the process.

2019 IRP Results Indicate

All portfolios point to a TVA power system that will be low-cost, reliable and clean. We are more certain in the front 10 years. Over the next 20 years, we could see up to 14 GW of solar additions. In the current outlook, we see 6 to 9 GW. We could see up to 5 GW of storage, and 2 to 17 GW of natural gas additions. We will do an evaluation of additional coal and gas retirements, and make decisions where it may be economic or prudent. There is also a projected 70 percent reduction in CO2 intensity on average.

2019 Key Findings

- There is a need for new capacity in all scenarios to replace expiring or retiring capacity.
- Solar expansion plays a substantial role in all futures.
- Gas, storage and demand response additions provide reliability and/or flexibility.
- No baseload resources (designed to operate around the clock) are added, highlighting the need for operational flexibility in the resource portfolio.
- Additional coal retirements occur in certain futures.
- Energy efficiency levels depend on market depth and cost-competitiveness.
- Wind could play a role if it becomes cost-competitive.
- In all cases, TVA will continue to provide for economic growth in the Tennessee Valley.

The clearest indication is around solar expansion. To integrate that solar, we will need the reliability and flexibility to do that. What resources can do that? A combination of gas, DR and a measured step into storage.

2019 IRP Proposed Recommendation

Keep in mind what expires and retires. The blue bar is what moves forward. You see broader ranges, so if electricity demand picks up or drops off or commodity prices change, for example, we have more breadth. We know the tradeoffs from the sensitivity slide. If we see some changes in key assumptions, this is where the path would adjust across the Recommendation.

Near-Term Actions

What expectations are there? If we are adding solar in the next five to 10 years, then maybe accelerate for customer expectations.

If expire capacity, how can we leverage gas resources? How can we wade into storage? What can we do in demand response space? When I think about storage in this action area, “measured” is a word that comes to mind. We want to step in in a measured way — how we might use it, where to put it. Distribution resource plan will also help with this. Stepping into it in a measured way is good practice so we can take advantage of lower

cost as it happens. Technology is evolving, such as uses for battery storage. What about others?

We talked about policy, and had a good conversation on energy efficiency. What can we do in the rapid changing marketplace so that low-income residents are supported? It is a collaborative concern for TVA. We are all in this together. How can we address this challenge for low-income residents? We will highlight program progress in that space.

Electric vehicles are a big uncertainty for electricity demand. What have we learned so far? How can we collaborate with partners?

Distribution planning is an important part of future planning. TVA supports development of a distribution resource plan, what we can learn about distributing resources to help the system.

QUESTIONS FOR RERC MEMBERS

Joe Hoagland

I'd like you to think about this list of near-term actions and about how the world might evolve. If you were to pick three or four things to go steady or go better, what would those three or four things be? What are the key things we should do to better position ourselves as that future evolves? This isn't a formal question, but I would like to have your thoughts on that.

Jane Elliott

What are we missing out on? What are your thoughts on the Recommendation and how to implement it? What are the most important signposts? What are your observations?

Michael Butler

I have a question about discussion internal at TVA. Obviously, you have collaboration. What I don't see in the language is "leadership," and the role of TVA leading these initiatives is critical. You won't have collaboration unless TVA takes a leadership role in doing it. It is important to recognize and utilize that tone in the document. Related to resources, your organization leads discussions like this or they wouldn't be. You are

wanting to be inclusive and collaborative, and that is smart, but at some point, you (TVA) are who you are.

Joe Hoagland

That is a great comment. I have heard your comment from a number of stakeholders; the importance of making this happen. Jeff (Lyash) is aware of that. In conversations like this, TVA is in a position to bring folks together that need to be talking to solve this problem. What resources can we bring to bear on this? What leadership? We can't do it alone either. We need to do it together and bring the resources to bear.

Lloyd Webb

The IRP impacts these, but when you look at TVA and recent changes, it will have more impact than what looking at today within the context of the IRP. The RERC — should it be playing a role in that going forward? Operationalizing? I don't have a position one way or the other. Regarding the next IRP and timing, I would recommend that TVA hold to two to five years like it did before. The signposts will become key on when to start doing this again.

Wes Kelley

I noticed in the course of the IRP, there had not been discussion about rates. I know the IRP is not about rates. Is the IRP telling us the dynamic retail rate is not important as discussion was a few years ago? Amongst our LPC brethren, there is not a lot of talk about that. I wonder, as going through the IRP, surprised that this is not retail rate options.

Jane Elliott

We had conversations about that. As we saw some of how resources react, it does inform what we might do with rates. Using rates as lever. People studying pricing leverage results from the IRP. Understand how different approaches might react in different futures.

Joe Hoagland

Rates is a tool, but the tool is a solution of retail side. How manage load shape. A need to understand distribution, IRP, planning better, then retail rates will be mechanism on how that behaves.

Wes Kelley

I like that sequencing. Need to know what building. Ten years ago, using rates as leading instrument. That was not as effective. Always felt like trying to convince selves that right.

Joe Hoagland

We weren't thinking what is the problem trying to solve. It becomes a tool in toolbox but not THE tool.

Doug Peters

I echo that. Can't go further in retail rates until common set need and cap across membership. And won't be able to in integrated distribution space if more distributors don't have common cap so see these assets, visualize into operator function or TVA control center. At some point, LPC and direct serve and TVA need to talk about common technology-based system. That is not done overnight. Build toward it over a period of time in order to take advantage of balancing load with generation side and making the system as efficient as possible. Will take some leadership. Rates will drive what members do, but they won't drive members beyond metering cap until shown as assets in overall equation – then attention of greater portfolio of membership.

Wayne Davis

Looking at the Recommendation bar chart. As citizens, we all have a responsibility to improve impact society's rate issues. People can be influenced by rate charges. Keep coming back to reality. May be wrong, but see as reality. Look at energy efficiency and distributed resources, and don't see impact in blue. I see impact in grays on top line and bottom line. I see all blues labeled storage. Storage is a big blue bar. A lot of potential in some context. In my mind, I want to put the grays and blues together. That means sitting with assets going to go away; component that doesn't go away. Coal-fired … distribution in place. I don't see. Then, thought goes to why isn't storage at coal-fired plant like used to be. There is a tremendous opportunity there that isn't on the table yet. Again, correct me if I'm wrong – if one perceives 4,000 MW in storage at 4,000 MW at coal-fired plant,

then local power companies don't have to worry about that aspect. Maybe it is the person who puts solar on their roof. Identify where going but not talking about where implementing, don't know where storage going to be.

Lloyd Webb

See in other jurisdictions. Others where see wind and solar, good place to put solar. Optimize the economics of it. What haven't seen — maybe utility is doing it, but not sure. Not looking at full optimization. Maybe TVA could go into that. Issue with distribution. Don't put solar next to coal plant.

Wayne Davis

What is land loss? Might be more economic — have something don't know what to do with. What going to do with that for future of society. Might be good place to put 300 MW storage facility.

Lloyd Webb

Look at dispatch on solar facility, not an easy answer. When play with economics, not an easy answer. Look at in other areas of country; where put it.

Doug Peters

Wayne is not wrong. Leaving period where TVA had an obligation — and because no one else do it — planned system from LPC to retail customer. Challenging for planners. Customers can do, don't need to identify it, don't know until in place. Then, how do it? With central planning, put where need it from system standpoint and size it for that purpose. Challenge is what customers do. Going to take different planning process to figure it out. Then, throw in local issues. We are talking to TVA, beneficial if members put in generation when reliability issue. Least-cost planning. Trick: where customers put it with what TVA needs and what everyone needs.

Jane Elliott

Missing one piece – optimization equation. IRP does not specify siting. We use an average. We work closely with transmission planning and sharing results with them. We say this is where we are headed, let's think about optimal siting for solar, gas assets,

battery storage. We are not just optimizing one piece. All pieces. Here is our road map for siting, which will evolve.

Rodney Goodman

I thought Wes asked a good question: Least-cost strategy. Is this going to be a least-cost strategy or a strategy decision? We recently did a housing study in Bowling Green, Ky. The poverty rate in Kentucky is 18 percent; in Bowling Green, it is 27 percent. About 45.5 percent of renters pay more than 35 percent of their income in rent. Information exchange: low-income renters in the Valley pay up to 18 percent of their income for energy, coupled with 30 percent or more for rent. They might spend 50 to 70 percent of their income to have a place to live. This is where a policy versus a business decision comes in. Mike mentioned leadership. I'd like to make sure as TVA moves forward, that it considers leadership in this area. Scenarios – Look at them. That is a broad range of involvement in loan efficiency field. Make sure, like last IRP, that moving forward on low-income efficiency.

Jane Elliott

We have explored different levels of low-income energy efficiency and how much difference that makes. A finding: If can do this with other stakeholders, not economic but share in this, it shows opportunity in policy space to pursue expansion.

Joe Hoagland

Low-income is still important attribute, but have to think about how to leverage further.

Wes Kelley

This group is to advise on energy policy matters. Circumstances in the Valley. In Tennessee, Mississippi, Alabama, sitting in unique situation – rates among lowest but energy usage is highest. Total billing packs – air conditioning and electric heat in the winter. Geo and technology inspired — puts particular focus on us. We have not spent much time talking about that. This is something – spotlight needs as rate structures, supply more aligned with changing marketplace. Is there a role to address unique circumstances? High usage – mentioned service fund – that is how chose to address that problem.

Lloyd Webb

Also about building materials. American Chemistry Council— recognize that requires work. Materials out there to improve energy efficiency of these buildings. Projects that prove it – for middle income, high income – but we have not seen anyone take advantage for low income. Not sure if TVA can take leadership on this. If someone engaged, about building materials, too.

Michael Butler

At beginning of process, efficiency in lighting and efficiency in electric motors. Has TVA done a deep dive?

Joe Hoagland

So charts where flat – couple years ago, dove into that.

Michael Butler

Saved a power plant worth of electricity.

Joe Hoagland

Part of conversation – that energy efficiency is going to happen, standards into place, technology is getting more efficient, but much misses low-income communities. So question, what is it that utilities should and could do together to make sure the benefits that other folks are seeing gets to those communities?

Wes Kelley

Can't be blind to it. Don't know public – appears to me, they are losing patience.

Michael Butler

Maybe not address as low income but as poverty issue instead. This could be more than energy efficiency discussion. Gain more public value. This could be arrow in sling to combat poverty.

Jennifer Mundt

If TVA can take that on, it would bring a lot of heft to the conversation.

Doug Peters

Regarding energy efficiency, there is not a more sympathetic group than TVPPA. Be careful – even if energy efficiency programs demonstrate value to entire system, make

sure it doesn't look like one part of system is favored over another. It is a thorny issue – dollars to do it, pay close attention to that.

Joe Hoagland

Dollars – TVA, state, etc. We have to look at how to bring it together.

Doug Peters

It is difficult. Sales are flat. We want to do it. Just complicated.

Wes Kelley

Don't need complicated program. Some places have authority to do it, some places don't. If TVA exercised leadership, if doesn't have to be hard. Can have rider-type program. Some systems have opt-out versus opt-in. They have built foundations. So, don't necessarily need to come up with complicated program but you can provide leadership in that role.

Jane Elliott

Section in document relates to policy considerations around how to enable – one around policy at federal and state level, also spoke to low-income energy efficiency, we highlighted economic development and environmental justice. We acknowledged some of that in the document. Your insight and emphasis in that space is important.

XV. QUESTIONS FOR RERC DISCUSSION (Slides 78-83)

- What are your thoughts on the process?
- Was the stakeholder and public engagement extensive enough to gain sufficient input?

Pete Mattheis

Compared to what I see around the country, TVA's process has much more involvement from stakeholders and at a much earlier stage. It is much more transparent and offers much more detailed information. It is the best IRP process from stakeholder standpoint that see in the country. I am pleased to see that TVA devotes resources to it. I was in the Working Group, and there was a large team behind the scenes.

Shari Meghreblian

For the record, I agree with what Pete said. It was comprehensive on multimedia and a multi-level perspective, offered opportunities for people with different levels of understanding of use online resources, and was comprehensive with a good scope.

Lloyd Webb

I echo Pete. TVA takes the IRP seriously and uses stakeholder input well.

Jennifer Mundt

I have appreciated the transparency and ability to see the process as it progresses. That is atypical to my experience in North Carolina investor utilities. It provides for a much better outcome, when all users can see their positions represented. Regarding stakeholder engagement, you are to be applauded to reach as many communities as possible. That is fantastic. I applaud you for that.

Doug Peters

This has been my first IRP. It is overwhelmingly thorough. I was handed a three-ring binder at the start, and now it is boiled down to one chart. It was great to have Board members here. It is important to have the Board engaged in the process. I am here from an economic development lens; to talk to prospective companies that invest their capital and create jobs in the Valley. This helps me to bring jobs to the region, to raise income. It has been interesting to learn how much work goes into this behind the scenes.

Wayne Davis

I served in the previous one; this one is substantially better. I am impressed that in the last couple weeks, while TVA is in the process of drafting the IRP and EIS, that it is still responding to public comments and tweaking the report to address the issues raised about solar. I have never seen a more thorough response process. Every person got a full-written answer. It is amazing to me that you are able to do this and change things at last minute, like explaining coal retirement. The process is working really well; you have set up a pattern and are as transparent as can be.

QUESTION— Joe Hoagland asked

Did the boundaries of the 2019 IRP analysis cover what we might need to be prepared in the future?

Wayne Davis

I think you have. You try to emphasize that it is a 20-year plan, but in reality, you can go only so far into future. From my perspective, it does provide TVA with direction and sufficient information to take the next step. To me, it is a thorough evaluation. I don't see too much missing. It identifies where we are and takes a well-stated position. There are things that raise questions about what we are going to do for next few years, and you provided additional thought process. I think it is where it needs to be, and the analysis covered everything.

Shari Meghreblian

You don't know what you don't know. I think you ask yourself: Is there a process in place that allows you to react to totally unexpected situations that could pop up? People want certainty and flexibility so they can plan and prepare. Yes, the boundaries covered what you can expect.

Lloyd Webb

The sensitivities helped TVA be prepared for some of that stuff. The sensitivities, the timing, going back to stakeholders and the way you approached it was great. It all works well. The only question: In doing the sensitivities, did you adjust base cases at all?

Jane Elliott

Generally, we went off the base case. Operating off a different case made sense in a couple scenarios, like high decarbonization. We looked at solar modeling with current outlook and also with outlook for high growth.

Joe Hoagland

Final recommendation – whiskers reflect those sensitivities. Built into that chart.

Pete Mattheis

Yes. But the future for me isn't 20 years. Looking at much shorter, more like a five-year window. The developed signposts give you a view. The signposts are informed by sensitivities, incidents, and as you move outside the boundaries, then you will determine it is time for another IRP.

Doug Peters

Good. Captured input. The 20-year look won't make sense much longer. An integrated resource plan might not even be the right name for next time. Market dynamics drive this. The question is, how to be nimble in the world we are stepping into now. The industry used to do 20-, 30-, 40-year planning. The next one may be more like a distribution IRP, and even being as nimble as can be, it may not be nimble enough.

QUESTION— Joe Hoagland asked

What do you see as challenges and opportunities for TVA going forward, given the near-term actions identified?

Dan Ionel

When it comes to distributed energy storage, the trend in California doesn't apply here. Keeping close with LPCs is an opportunity to have an integrated plan.

Wes Kelley

1 – Public policy income on low-income energy efficiency.

2 – Recognition that retail rate structure is a tool, not the solution.

3 – Continue to develop collaborative approach on DER integration.

4 – Exploration of small-scale nuclear. I hope this is on TVA's radar. Emission free. Nuclear is not good at flexibility. Can technology get us to a more reactive source of power? TVA with strong nuclear program and Oak Ridge bring to the conversation.

Pete Mattheis

Pricing, as the industry changes. Five years later, pricing tells us something else. We need to be nimble as *the* industry changes. To TVA, be cognizant that as decisions are pushed to consumers, TVA wants to be the agency on top of things. I am not sure people

think of TVA that way. You don't want TVA to be thought of as a stodgy old power company; rather, you want to be on top of the industry and listened to.

Michael Butler

Tennesseans spend $11 billion a year on gas. As transfer to marketplace, opportunity to produce that system – cost around $4 billion to accomplish the same thing; that gas and diesel. Especially given the economic development arm at TVA, that is a lot of money. Even if half that, how do we leverage that? A lot of different ways. It pushes the boundaries question and gets into challenges and opportunities. That money moves the needle. Be smarter about how leverage; I don't know how to do that. The question is, is it real? If we see as much solar, then it is going to be significant economically. How does TVA get better and shape that conversation?

Wayne Davis

There are challenges still ahead. Federal/state policy pressure. I do see a combination of federal, state, policy pressures that could alter your plans. I am referring to things like where is carbon going and long-term federal policies and pressures. You could easily decide to retire combined cycle CT or coal plant, and then policies and pressures could override that. Everything I read says there is a lot of uncertainty.

Doug Peters

As we become more interconnected on distribution, we can generate how much data, figure out how data is used, who oversees it. Protect privacy issues, I think going to have to deal with big data pretty soon. Not an RERC but question bit broader.

Lloyd Webb

There is a risk to infrastructure. People have the ability to put pipeline in, and there is risk. A lot of attorneys are starting to find ways to get that domain terminated. That is a risk. Also, some states might be at risk in states where they are establishing policy by getting around eminent domain. An example is using water permitting as a way to prevent that from happening. That could be a risk. It may mean you can't put it in or it may mean it takes longer to put in.

Peter Mattheis

In the IRP Working Group, we talked about modeling around futures. As move away from a central station model, it will be more challenging as units are smaller and more are dispersed. It will be a matter of how do you stay reliable when you don't have visibility of what resources are coming on when?

Michael Butler

Analysis discussion on where to locate solar. It is important to have that in the analysis, and your leading the discussion is going to be critical. You can avoid conflicts in that area if smarter. When you get to Recommendation portion, you talk about that a little bit.

QUESTION— Joe Hoagland asked

What are the top three or four things we ought to go and study? Just to be clear; what are those top things?

Michael Butler

A question is, where do you think you have gaps? When going through everything, where are the "I wish I knew" gaps? In the 2015 IRP, there was some locational value of things on the distribution side.

Hunter Hydas said

Locational value. That is a gap when talking about distribution planning. Where do things make sense? Can we avoid some projects by using distributed solutions? One gap in my mind is needing new tools, and that it is bigger than just coordination. Traditional tools for bulk planning aren't going to be the tools that it will take going forward.

Jane Elliott said

Flexibility value. We didn't capture all the value from flexible resources. We will work, as follow on, on metrics on flexibility and how ranked. How much flexibility is enough as see deeper solar penetration, for example? How does this manifest itself?

Lloyd Webb

I am concerned about DER.

1 – Policy approach to DER. Various parties have different approaches, and that needs to be addressed.

2 – Planning side of DER. How do you bring DER to the system and make the right decision? There needs to be a foundation. I have seen too many jurisdictions that make it up on the fly. That creates problems for constituents. It makes it difficult to make things right.

Wes Kelley

Rates. Picking up on Lloyd's statement about trying to be proactive. I am proud of TVA and the team for doing that. From LPC, waiting for customer to blow up on DER. Not seeing that yet. I think we are not seeing that because rates have upward pressure but rates cushion us. If we are cresting the hill, that may mute some of the DER direction. We need to be nimble enough to realize that if continue in that direction, it might be slower.

QUESTION — Joe Hoagland

What should we look at?

Wes Kelley

I don't know what my customers are really thinking, and I need to reach out and make sure we meet their need. TVA used to do a lot of marketing work, surveys, research when Energy Right Solutions was doing its thing. When backed off on priority, lost insight into customer's mind. How do we engage market research people and dig into C&I (commercial and industry) customers so I don't need to have conjecture about that?

Doug Peters

It would be helpful if turned that around. It would be helpful if we knew the value of load flowing, frequency and could proactively go to customer. I don't know when households in the Valley are going to get new water heaters because we put in this program, but maybe the program could build capacity into the control center. Until we know what the value is, it is difficult to be proactive. For those of us figuring that out, understanding the

value of that would be helpful to take a more proactive stance. Take electric vehicles; when is the American consumer going to adopt electric vehicles in mass? They have answered the question for us; adoption will occur when that is all they can buy. If offer in a proactive way, it gives us a motivational factor we don't have today.

Wes Kelley

It is good to start by scoping out the need before developing solutions. It can be a trap if you build structures and programs and get everyone spun up before the need is articulated.

Lloyd Webb

I know that TVA has refocused from energy efficiency to strategic energy management. Not sure what the future holds for that. It is not a huge issue. If TVA sees that, it will be good to communicate that for organizations to work with.

Wes Kelley

I know this is not impacting the IRP, but as TVA looks to retire assets, I encourage TVA to not abandon all sites. Like Bellefonte. I said there was value to the river, transmission access; it was a good site for something some day. As TVA looks at its generation fleet, I encourage you to maintain infrastructure for future applications, whatever they may be.

XVI. RERC ADVICE STATEMENT TO THE BOARD

Wayne Davis

After a productive conversation about specific wording, the RERC developed the following advice statement for the TVA Board of Directors:

Tennessee Valley Authority Regional Energy Resource Council

June 26-27, 2019

Meeting Advice Statement

The Regional Energy Resource Council (RERC) was established by TVA to obtain advice and views from the public on the development and management of energy resources in the Tennessee Valley region. The RERC comprises a diverse group of stakeholders representing environmental, governmental, industrial, business, local power companies, educational, economic development, and community leadership interests.

TVA has completed an Integrated Resource Plan (IRP) to guide identification of resources to meet the energy needs of the Tennessee Valley region over the next 20 years. As part of its mission, the RERC has participated in the development of the 2019 IRP. Throughout the process, the RERC has given guidance to TVA staff on the development of the study and the resulting planning recommendation.

The RERC affirms that:

1. The IRP covers an appropriate range of future possible conditions. This allows TVA to proactively plan for the future, considering a number of scenarios and strategies in order to prepare a risk based, flexible, and reliable plan. The development of the 2019 IRP was a comprehensive and thorough process that provided multiple levels of engagement and transparency for the public. The RERC recognizes that TVA's IRP process sets a high standard and is a model for the industry.
2. Further, the RERC recognizes this plan builds on the significant carbon reduction achieved by TVA in recent years.

3. The development of the IRP was strengthened by the iterative process where a diverse group of stakeholders was engaged with TVA to shape the study inputs and refinements along the way. In particular the comprehensive work completed by the IRP Working Group, as well as the public outreach, provided a variety of ways for members of the public to receive information and participate in the process.
4. The RERC commends TVA for dedicating the appropriate level of resources to this process and the rigorous analysis that underlies this plan.

The RERC recognizes that while the IRP has a 20 year planning horizon, refreshes should occur as needed based on TVA's review of the sign posts looking for changes in the evolving marketplace.

The RERC further recognizes that TVA has a leadership role to play in addressing poverty by building on a collaborative approach with local power companies and other stakeholders across the Valley to achieve energy efficiency for low income residents.

The RERC recommends the following regarding implementation of the IRP:

1. TVA should monitor federal and state regulations, legal challenges, and industry changes that may alter the broader energy environment and take appropriate actions to mitigate risks to the power system's reliability and costs.

2. TVA should continue to work with local power companies, directly served customers, and stakeholders to collaborate on Distributed Energy Resources (DER) and distribution planning; build greater visibility into customer needs; and prepare for associated data management. Standardization of cost-effective DER smart technologies will enable the system to efficiently utilize distributed resources.

3. TVA should continue engaging with stakeholders early in any decision process on the site selection for solar, gas power generation, and utility-scale energy storage to avoid land-use conflicts, encourage the utilization of existing infrastructure assets, and maximize system benefits. In addition, TVA should continue to analyze small-scale, flexible, carbon-free nuclear resources for their potential inclusion in a diverse portfolio.

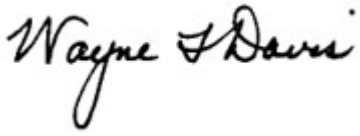
4. TVA should continue evaluating gaps in data, including customer needs and desires, the speed of technology advancement, locational value, flexibility value, etc., in order to inform and be prepared for future IRPs. TVA should also explore advanced data tools to support the analysis.

Given the aforementioned comments, observations, and recommendations, the RERC unanimously adopted the above advice statement and recommended that the VA Board approve the 2019 IRP.

XVII. Wrap Up and Adjourn (Slides 84-85)

Joe Hoagland and Wayne Davis thanked members for their participation in this meeting culminating in an advice statement, as well as for their involvement and dedication throughout the entire IRP process. This signifies the end of the third term of the RERC.

Minutes Approved:



Wayne T. Davis, Council Chair Date: ___1/23/2020_____

Appendix A
Non-Council Meeting Attendees

TVA Staff			
Kenneth	Allen	Jo Anne	Lavender
Jamie	Bach	Virginia	Lodge
Brenda	Brickhouse	Jeff	Lyash
Scott	Brooks	Justin	Maierhofer
Laura	Campbell	Khurshid	Mehta
Laven	Coffey	Mary Margaret	Painter
Jessica	Coleman	Todd	Penney
Donna	Commers	Doug	Perry
Teresa	Dillard	Roger	Pierce
Jane	Elliott	Dan	Pratt
Grace	Felker	John	Ryder
A.D.	Frazier	Michael	Scalf
Michelle	Haney	Adam	Smith
Greg	Henrich	Tim	Sorrell
Amy	Henry	John	Thomas
Matthew	Higdon	Kiki	Thompson
Joe	Hoagland	Skip	Thompson
Richard	Howorth	Rick	Underwood
Pam	Huff	Liz	Upchurch
Hunter	Hydas		
Myra	Ireland		
Cass	Larson		

Members of the Public in Attendance		
Al	Armendariz	
Rick	Bender	
Cyrus	Bhedwar	
Stacy	Cantrell	
Ben	Edgar	
Dave	Flessner	
Odell	Frye	
Jonathan	Hall	
Richard	Holland	
Gil	Hough	
Marylee	Sauder	
Brian	Solsbee	

Appendix B

Meeting Agenda

TVA Regional Energy Resource Council
June 26-27, 2019
The Read House, 107 W MLK Blvd, Chattanooga, TN 37402

June 26, 2019 – The Silver Ballroom	
12:45	Welcome and Introductions
12:55	Safety Moment
1:00	RERC Overview and Meeting Protocols
1:05	Today's Meeting Purpose
1:20	Refresh on 2019 IRP Development Process IRP Status
2:00	Break
2:15	Key Steps, Analysis and Outcomes moving to the final Recommendation. About the Final Recommendation
3:15	Break to Prepare for Panel– 15 mins
3:30	Welcome / Reconvene Group
3:35	Panel - Challenges and opportunities that the 2019 IRP points out for TVA Key 2019 IRP Themes: Flexibility DER Diverse Portfolio Panel Q&A

4:45	**Break and prepare for Public Listening Session**
5:00	**Public Listening Session** *(60 minutes, time limited to 2-3 minutes to allow more to speak)*
6:00	**Wrap Up, Conclude Session, thank all attendees**

June 27, 2019 – Ballroom TBD	
8:00	**Breakfast – at Read House**
8:30	**Welcome and Recap April 17** **Summarize meeting and Board session, panels, public comments**
9:00	**RERC Observations from Day 1**
9:30	**Recap Webinar Key points – Comments and Sensitivities**
9:45	**Break**
10:00	**More on Moving Draft to Final and Final Recommendation**
11:00	**Group Discussion Questions**
12:00	**Lunch break**
1:00	**Form RERC Advisory Statement**
2:00	**Next Steps**
2:30	**Wrap Up and Adjourn**