Tennessee Valley Authority
Regional Energy Resource Council
April 17-18, 2019
Meeting Minutes

The Tennessee Valley Authority (TVA) Regional Energy Resource Council (RERC or Council) convened for the seventh meeting of its third term at 1:00 p.m. Eastern on Wednesday, April 17, 2019, at the TVA Office Complex (West Tower) in Knoxville, Tennessee.

Council members attending:

Michael Butler	Wayne Davis, Chair	Rodney Goodman
Dan Ionel	Wes Kelley	Doug Lawyer
Shari Meghreblian	Jennifer Mundt	Jeremy Nails
Doug Peters	Stephen Smith	Charles Snavely
Lloyd Webb	Susan Williams	

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.

I. Welcome

Dr. Wayne Davis (Chair of the Council) opened the meeting by welcoming everyone.

II. Safety Moment and Meeting Protocols

Jo Anne Lavender, Facilitator, covered the meeting protocols in her presentation (see Slide 10). She also informed the Council members that TVA was not seeking any advice from the Council at this meeting, but that there would be a public open house at the end of the day (April 17). She also informed the Council that there would be two discussion questions (Slide 9) for the RERC members.

III. RERC Bylaws and Procedures (Slides 11-12)

Khurshid Mehta, Office of the General Counsel

Liz Upchurch, Enterprise Relations and Innovation

TVA is proposing updating RERC bylaws in two primary areas:

- Clarify in person attendance and process for allowing virtual attendance in extreme circumstances
- Update the definition of a quorum

The RERC has been in place for six years, since 2013. The third term of the RERC ends at the end of July 2019. The council was established under the Federal Advisory Act, which requires the designation of a federal officer. Joe Hoagland is the designated federal officer (DFO).

One of the DFO's duties is to establish procedures for running the council. The bylaws established in 2013 have worked fairly well, but there are items worth revisiting based on experience of the last six years.

Quorum Requirement

Under the current bylaws, 11 members constitute a quorum. That is the majority of the 20-member council. What we've noticed over the years is that some seats remain vacant. Some members are nominated by governors or CEOs. Sometimes there are vacancies due to resignations as people leave. It is tougher to establish a quorum when there are several vacancies, but it is important to have a quorum since advice statements can't be formulated without a quorum.

We looked at what would be a more reasonable way to establish a quorum. Under the revisions to the by-laws, quorum would be a majority of the council seats that are currently filled, but in no case less than eight members. (Slide 12)

Virtual attendance

We are looking at allowing remote participation in extreme situations. We have observed instances when it would be difficult for members to be physically present at the meeting. It is best if the member can attend in person to enable personal interaction, but in extreme circumstances, a member may participate remotely. The revisions to the by-laws allow for remote participation in exceptional circumstances.

These changes don't require a vote. They can be made by the DFO, but we wanted to keep you abreast and see if you had any comments.

Joe Hoagland

These changes are an attempt to make it easier to participate in these meetings. Hopefully everyone will see that.

Lloyd Webb comment

In terms of alternative participation, will it be Internet-based or web-based?

Audiovisual does not translate well. WebEx and webinars are the best way to do that. They are the most widely accepted, in terms of technology.

Charles Snavely

What is considered an extreme circumstance?

Joe Hoagland

There is a danger that if we let people go remotely, then it's only me left in the room. I'd say an extreme circumstance is some sort of emergency. Also, if you have to miss this time, please try not to miss the next one.

Wes Kelley

If we have a conflict, is it a choice? If we can't make the meeting, would you say we would like to participate or would you say we will need to miss the meeting?

Joe Hoagland

We try to plan ahead and get as many people who can meet on the same date. It seems lately that people commit, then fall off at last minute. That is a problem when we need a quorum. Enabling someone to call in remotely in an extreme circumstance allows for a last-minute emergency and keeps us at a quorum.

Lloyd Webb

Lloyd recommended adding wording that says that a person will be part of the quorum when calling in remotely.

Mike Butler

Do the by-laws have a provision to allow for 24-hour vote?

Joe Hoagland

There is complexity if you don't close a vote at the meeting because of the requirements for meetings to be open to the public. We would have to republish and provide an opportunity to come to the meeting for that vote. Maybe we could figure out how to do that but, logistically, it is complicated.

Charles Snavely

Is there a provision for alternates?

Joe Hoagland

No, a representative could attend the meeting to observe, but the vote may be cast only by the appointed member.

IV. TVA Update (Slides 13 to 17)
Meeting Purpose and Recap
Joe Hoagland, Designated Federal Officer

A couple of things to recap:

Bill Johnson retired, and he is taking a role at Pacific Gas & Electric Co.

Jeff Lyash, TVA's new CEO, has started his first 100 days and is meeting with employees and stakeholders as he makes his way through the Valley. He may stop in today. He has a background in engineering and utilities, and has worked in nuclear before. He understands the hard side of the utility business as well as the public side and environmental side.

We got a new board member, John Ryder, who is from Memphis. There is another nominee from Chattanooga, and there are two other board members — Virginia Lodge and Ronald Walter — whose terms are up this year.

We had record rain fall across the Valley this year. TVA folks worked really hard to protect against flooding. They did an admirable job keeping folks dry. There were $1.6 billion saved in flood avoidance. It is getting back to normal. It is already above summer pool. We think it is going to dry out, but it has been wetter than normal. The system is OK.

You may have seen that TVA put out an RFP for 200 megawatts of additional solar, which we'd like to have online by 2022. In 2017, TVA sent a similar 200 megawatt request to developers. This request resulted in nearly 675 megawatts of solar power being developed to supply new renewable energy to Facebook and Google data centers. You'll see solar continue to grow. Storage is not quite there yet from a cost-competitive standpoint. Storage demonstrations on our system are coming. We are not sure of the timing.

Recap of Term 3 Meetings

- 6 Meetings held so far in Term 3
- 4 Focused on the 2019 IRP development process:
    - **June 14, 2018**, Advice provided on focus areas and public engagement for the 2019 Integrated Resource Plan
    - **September 5, 2018**, Sentiments provided around the 2019 IRP Scenarios and Strategies
    - **December 18, 2018**, Advice provided on metrics and scorecards; Considerations as TVA applies these metrics
    - **February 19-20, 2019**: Focus on the Draft IRP and EIS; Discussion on the process and engagement; Public Open House.
    - **Today and Tomorrow**: Focus on moving from Draft IRP to Final; About forming a final recommendation

Today and tomorrow, you will be seeing results and comments. As you are listening today, please consider "Are there things here I am missing?" and "Are there things that need to be explained better?" We will want you to think about this and provide your opinions, or recommendations.

Feb. 19-20, 2019 Meeting — Recap

In February, we discussed the preliminary draft IRP results and shared more about our plans for stakeholder engagement on the draft reports. At the next meeting of the TVA Board, we will be helping them understand the IRP and its process. We will keep you informed on that.

Stephen Smith

Will TVA publish all comments and could you provide that information to us?

Joe Hoagland

Yes, they will be published with the final report in July. And we will try to share a draft with the RERC ahead of that time. *(note: TVA met this request, TVA provided a draft of the Comment Response document to prepare for an RERC webinar held June 10, 2019.)*

Today's Meeting Purpose

- Provide informational topics on the 2019 Integrated Resource Plan
    - Overview update
    - Additional analysis so far
    - Key steps to move from draft to final IRP and develop final IRP recommendation

  - Ensure you have what you need to develop an advisory statement to the TVA Board in June.
- Host a Public Listening Session
- Hear your views:
  - On the public comments received;
  - On considerations for TVA as it works to develop a final IRP recommendation.

V. 2019 IRP Update (Slides 18 to 34)
Hunter Hydas and Amy Henry

Hunter Hydas

TVA's Integrated Resource Plan

Focus Areas

- System Flexibility
- Distributed Energy Resources
- Portfolio Diversity

Discussion on how the resource planning process works

We have to proactively think about these things, about how to maintain portfolio diversity from standpoints such as fuel, operations.

The process started with considering scenarios, things that are outside our control but that are environments we might operate in over the next 20 years, and strategies, which are how we would respond to those environments.

We put them into the model and considered candidate technologies, which are new technologies we might see over the next 20 years, and assumptions about them, such are reserve margins. We combined them to develop portfolios. We are looking at additional portfolios as a result of the sensitivities. We are looking at least-cost planning, environmental metrics, Valley economic metrics. Then, with results, we will develop a preferred portfolio. We are doing that over the next couple months.

Integrated Resource Planning

- Collaboration with stakeholders to envision the generation needs of the future
  - Collaboration is an important part of the IRP.
  - RERC, IRPWG, public comments during the scoping period and during the public comment period — all of these stakeholders play a role in the development of the IRP. We have been getting a lot of public input.
- Based on least-cost planning foundation
- Provides foundation for developing long-range financial plans

    - Helps determine how we will run the business and fund the plan
- Considers a number of potential futures to help predict changes in the marketplace

A big difference in the IRP versus regular planning is that the IRP considers future scenarios. The IRP looks ahead to determine what if the future is different, then what are our plans? The IRP functions like a compass, not a GPS. It looks at ranges and resource types but specific sites aren't part of the IRP.

HISTORY of IRPs at TVA

First in 1995

2011 — Focused on balanced portfolio

2015 — Focused on energy efficiency

2019 — Focusing on flexibility

The IRPs are built on each other in terms of modeling and stakeholder engagement.

VI. Recap of Public Comment Period and Key Topics (Slides 36 to 44)
Amy Henry and Mathew Higdon

Reviewed the IRP and EIS schedule.

For IRP:

- Started in Winter/Spring 2018 with the scoping period, when people could give public comments.
- In Spring 2018, TVA and stakeholders developed the inputs and framework.
- In Summer/Fall 2018, TVA and stakeholders analyzed and evaluated the information.
- In Winter/Spring 2019, TVA presented the initial results.
- In Spring/Summer 2019, TVA is incorporating input.
- In Summer 2019, TVA will identify a preferred plan and direction.

For EIS:

- Started in Winter/Spring 2018 with the scoping period, when people could give public comments.
- In Summer/Fall 2018, TVA prepared the draft Environmental Impact Statement (EIS).
- In Winter/Spring 2019, the public had the opportunity to review the draft.
- In Spring/Summer 2019, TVA is preparing the final EIS.
- In Summer 2019, TVA will issue the final EIS.
- In Summer 2019, TVA will issue a Record of Decision.

TVA is on schedule to present the preferred plan to the Board of Directors in late August.

Stakeholder engagement is the cornerstone of TVA's IRP process. Stakeholder and public input help TVA make better decisions, consider different perspectives and improve our process. TVA complies with the National Environmental Policy Act (NEPA).

TVA uses a multi-tiered approach with stakeholder engagement, including the IRP Working Group, the RERC and the public at large. It works with the groups in different ways. The IRPWG has 20 members from diverse sectors across the Valley, and it has met almost monthly since February 2018. In its 12 meetings to date, the IRPWG has taken a hard look at input, scenario and strategy development, etc., and it has provided good input and comments that have been integrated into the documents and modeling. The IRPWG will meet with us a couple more times, and its input will be incorporated into what is presented to the Board.

The RERC: TVA values your input. Your advice and input are included and shared with the Board, as we keep them informed. We are looking for your input as we prepare a recommendation for the Board.

IRP Communications Objectives

We have worked hard to communicate with stakeholders and the public about what is happening with the IRP. As we formed objectives for communications, we wanted to make it accessible to the average person. We wanted to communicate clearly, and we tried new forms of communication to engage people and to keep them well-informed of what was happening.

We had webinars and posted them on the TVA IRP website, held a social media campaign, held public meetings, held meetings with customers to talk about the IRP, and posted information on the TVA IRP website. This year, we added an interactive report that provided information on the draft IRP and EIS, and it will be updated to provide information on the final IRP and EIS as well. We have kept track of hits on the website, and there have been hits from people within the Valley and from outside the Valley as well.

Jennifer Mundt asked

Are the hits on the website direct or indirect?

Amy

I am not sure about that, but we can look into it.

Additional response added after meeting: *Based on statistics for webpage views from the period around the public comment period, the highest percentage of hits game from Google searches (around 35 percent). About 32 percent were direct hits, about 7 percent were from Facebook, and the others were smaller percentages from a wide variety of sources.*

Matthew Higdon

TVA organized formal meetings around the Valley and provided communications, like the interactive report. TVA received 300 separate submittals. Most are on the draft IRP, and some are on the EIS. The Sierra Club provided almost 1,000 signatures, bringing the number of comments to about 1,300 for the public comment period.

For the 2015 IRP, TVA received about 200 separate submittals and 2,400 people signed on other letters or comments.

There were six IRP public meetings around the region, and one webinar, which is posted on the website. The IRP meetings were well-attended, which reflects the importance of the issue. Nashville had the largest attendance, with more than 100 people. We also had a display at the Tennessee Environmental Council Conference. For all of the meetings combined, total attendance was 379 people, which is about the same we had in 2015.

Amy Henry

TVA received comments from individuals and groups representing a broad spectrum of interests and a broad spectrum of viewpoints, which is what we wanted. For example, in addition to comments from individuals in the public, TVA received comments from local officials, state officials, federal agencies, industry stakeholder groups, and groups such as the American Petroleum Institute, solar groups, environmental groups, and the NAACP. We will do our best to share the comments with you before the next meeting, and they will be published in the final report.

In some cases, TVA received opposing viewpoints on the same key topic. For example, some people commented that they appreciated how much TVA worked to be transparent and provide opportunity for input, and on the other hand, some people commented that it wasn't enough. For every comment, TVA is asking itself if there is something we need to change.

Stephen Smith commented

Regarding transparency, it became clear that some of the supporting documents you used to base putting caps on technology like solar and cost assumptions were not provided for us to do a thorough analysis of the draft. We submitted a request and were told by the TVA staff to submit a FOIA request. By the time the FOIA ran its course, the

public comment period would be done. It was in violation of the NEPA process to withhold those documents. We worked with a legal organization to file comments on March 28th to remind you that you had to release those documents, that you couldn't withhold them based on the decision. We requested that you extend the comment period, and it was denied. Then, on April 3, we got the documents dumped and had three business days before the comment period closed. Honestly, I don't consider that a good, transparent process. It led to frustration and scrambling within our staff.

Amy Henry responded

And at the same time, other folks say thanks for being transparent. It is standard for a request for items to go through FOIA, so we handle the documents effectively. We have a process for that.

Stephen Smith

It should have been in the draft.

Amy Henry

We posted more data on our website.

(note added after meeting: www.tva.gov/irp click on 'supporting documents')

Stephen Smith

The website link is dead.

Amy Henry

We got the material together within five days of your request. My hat goes off to Jane and her team.

Shari Meghreblian asked

For the different organizations that have commented, will those comments be addressed individually or in groups by topic?

Amy Henry responded

We will collect similar themes and provide comment responses one time. We also will put all comments and names in the document. In the grouped comment statement, it will be linked to that person's comments.

Lloyd Webb commented

If you are dealing with a (private) utility, you wouldn't be getting any of the stuff, because it is all covered under nondisclosure agreements. In our comments, we commended TVA. They went beyond what they needed to be providing. I have been on stakeholder groups on a couple IRPs, and according to my benchmark, TVA is better.

Stephen Smith

In getting discovery and access to documents, we are in that process with Georgia Power. TVA self regulates. We are dealing with North Carolina, Georgia and Florida, and we get much more information through that process than what TVA is providing. If we were on the IRPWG, we could have gotten it, but we were not allowed to be on it this time, so we don't have access until the draft is provided.

Amy Henry

We strive to be transparent, and stakeholder engagement is important.

Joe Hoagland

Another thing that is important about the draft is that it's just that, a draft. We now have an opportunity to address comments that folks have. We are evaluating them and can do different modeling.

Today, you'll hear Jane talk about things that we have gone back and looked at through sensitivities. Stephen brought up a cap on solar. We are looking at if we took the cap off, how would that look. We are getting comments in and addressing them before the final version.

Mike Butler asked

You talked about the IRP being a compass, not a GPS. We talked about concerns over greenfield development. If the 200 megawatt RFP looks at 1,400 acres that is one thing, but there are concerns if you'd be looking at 58,000 acres. I'm just using this as an example. But how will it be going from a compass to a gps in an example like this.

Amy Henry

The IRP creates a long-term strategic guide. When there is a proposal to add or retire, then a detailed analysis and an environmental review are done when selecting a site. We look at green fields and what else is affected.

Mike Butler asked

Will the IRP form limitations? For example, for solar. Would there be a situation where TVA would say the IRP says can't go beyond this certain level (of solar)?

Joe Hoagland

There are a couple dimensions to this. If there is a decision to go above and beyond, there would be an environmental impact statement associated with it. So, we tried to make sure we were drawing the box big enough to allow for changes. When you think about things like the compass and gps, the IRP is like a map. It says, when making decisions, stay on this road, etc. That is what happens when we make specific decisions about resources we are going to use. The IRP makes sure we understand the map so we can anticipate those things and react as the world is shaped around us.

Mike Butler

Sometimes agencies won't revisit because of the cost.

Joe

The world is changing so fast. The cycle gets faster. The IRP helps keep us informed so we stay on the same page.

VII. COMMONLY ASKED QUESTIONS DURING COMMENT PERIOD

Hunter Hydas

Flavor of questions received:

Carbon and climate change

Comments included that penalties were too high and also that penalties were nowhere close.

We heard about Citizens' Climate Lobby.

We decided, let's look at climate change and carbon sensitivities. What if we doubled decarb penalty? We are running a sensitivity of that.

As you know, the Board voted to discontinue Bull Run and Paradise. We updated the base case to reflect that. What if the cost of coal changes? What if that is true to operate other coal units?

We did a sensitivity off that. If cost in one direction, risk in one direction – how does that change things?

Climate change – extreme weather.

The weather is outside our control; what if we look at extreme weather in the Valley and took out some of the averages and looked at extremes. We did sensitivities on weather extremes and how that changes how we operate the system.

Renewables

We heard consistently, “Why isn’t solar added until 2023?”

Joe Hoagland responded

We are filling customer demand now. Some customers are willing to pay (the higher costs) now. By 2023, it will be the right resource. If we need to meet the gap, that is how to do it. Solar is almost competitive. If customers want it, we are making it happen.

Lloyd Webb commented

An assumption I’ve been making is that there is DER built in. That some will be your solar, some DER solar.

Joe Hoagland responded

Utility scale solar. Depending on scenario. Assume that DER is what is coming on.

Jane Elliott talked about other commonly asked questions

Regarding solar, people asked about solar additions: When we start to see solar in 2023 in the IRP, what would solar additions look like? Tell us more about that.

Jane said TVA is running sensitivities on that. We mentioned including a 500 megawatt cap on the first year. That is common practice in the first year of an IRP. It reflects questions around how much solar you can get on the ground at that price and how quickly you can build those projects. You will see more on the results of the sensitivity to study the effect of the cap tomorrow.

Doug Peters asked

Will Google and Facebook be direct serve customers?

Joe Hoagland responded

Yes. Part of the next 200 MW will be direct serve, too.

Stephen Smith commented

Regarding the 500 megawatt per year cap, when looking at 22 of the 30 portfolios, 500 megawatts hit and are constrained by the model, as opposed to seeking the lowest cost to see where ended up. If more selecting solar, then I want to try to figure out where that is. More solar would have led to lower cost.

Jane Elliott responded

We will cover that in the presentation tomorrow.

Jane reviewed another commonly asked question

What is the cost for wind? Why don't we see wind in the portfolios?

There is in-Valley wind, and out-of-Valley wind. We are challenged for the transmission (for out-of-Valley wind). It adds significant cost. The technology continues to evolve though. We've seen solar efficiency evolve much quicker. Coupling all of that, there is a deficit to compete with solar. Solar is a nice fit, and the model sees the value. Wind is more variable and more challenging. Regarding the cost, we will continue to benchmark. Cost is quoted in different ways; you'll see different number of dollars out there. The National Renewable Energy Lab is looking at the lower end. The lower end of the wind case is still 40 percent higher energy price than solar. We want to run a sensitivity at the lower price. Wind has lower capacity in the winter.

Storage

There are a lot of ways storage is quoted out there. High capital cost; lower annual spend. What other sensitivities can we run? We are looking at break-evens around storage.

Lloyd Webb asked

How do you decide which storage technology to use?

Jane Elliott answered

In the earliest runs, no storage showed up. … Used lithium ion technology, which is the front runner today. Not sure for the future. The model chose it for that reason.

Energy Efficiency

Jane: We have gotten a lot of questions around EE. There is not a lot of EE in the portfolios. The main reason is that the market has improved energy efficiency standards in every day items like light bulbs and appliances. We are focused on the low-income EE sector to understand for folks without those resources, what happens if incentives are increased?

How do costs compare? That can be quoted in a number of ways. The energy that is saved from a year of measuring; 15 years energy for upfront investment.

Discount the dollars spent and energy saved. TVA benchmarks eSource and others. We are benchmarking what works in the Valley. What would we offer in the IRP? We are exploring that in sensitivities. What is the depth most attractive in the IRP? Difficult to

measure thermostats … How fast that improves … What if increased timing, pace of that? Also, looking at additional depth of EE programs.

Charles Snavely asked

How do tax exemptions affect analysis?

Jane Elliott responded

We do Power purchase agreements to capture the tax credit benefit.

VIII. PUBLIC LISTENING SESSION
Maggie Shober, SACE

High level comments.

Three themes.

Transparency

We were concerned and constrained by the level of information. We worked on other IRPs, and SACE works across the South. For comparison, Georgia Power is going through IRP at the same time – different process through docket and discovery. Example: new storage costs were determined is nowhere to be found. Information like that would have been hugely helpful.

Objectivity

In the IRP process, point is – look at what it costs. All information … costs, constraints, resources … let model figure it out.

Any kind of tinkering with inputs affects the output.

Concerns about different aspects of inputs used. Things like arbitrary constraints. EE and solar. The idea that EE is eaten away by codes is just not the right way to think about EE programs instituted by a utility. They are two different things: standards, codes, these improve the baseline. EE programs are to get them to do more than the baseline. The program is to incent the buyer. There is no relation between the two.

Another example is lighting. If the baseline improved between CFL and LED was not captured, we would not have LED program.

Questioned the use of 8 percent discount rate for EE, when others have used 2 to 3 percent.

EE

Lowest system cost is standard practice. EE is the most cost-effective response. It brings costs down and you see bill savings, rate savings. Everyone wins. If you don't include that in the IRP, you are leaving the customer behind.

IX. RERC DISCUSSION QUESTION

What key points are most interesting from the public comment topics?

Wes Kelly

The nature of TVA data availability. What about the timeline? How did length of public comment period compare to others in industry?

Amy Henry

Comparing apples to oranges.

Our process provided time for public comment on the draft document as the plan was being developed. The utility process usually waits until the document is filed, and then intervene. I don't know how long that is. We provided 52 days of public comment. That is the typical amount of time covered by the impact statement.

Joe Hoagland

We have had IRPWG meetings and webinars. People asked questions. We had people participate on the IRPWG. Dragging everyone through the sausage making.

Stephen Smith

Utilities don't get to determine who gets in, and anyone can be involved in the process. TVA hand picks who it wants in that process.

Lloyd Webb

Depending on the jurisdiction, if you don't intervene, you may not have the ability to comment at all. At least with TVA, you have the opportunity to comment at any time

Jennifer Mundt

Commented on the downstream impacts of greenhouse gas emissions (climate change).

Wes Kelley

Hunter talked about climate change and looking at extremes. A good idea. I understand why start with averages; otherwise, stacking the deck. Maybe present as top, bottom,

average. If rerun and say, 'Here is the average and extreme.' Important, because you don't want to look like you are stacking the deck or lowballing something.

Dan Ionel

Land use for solar. Large amount required, according to plans. Locational aspects of solar should be considered.

Jennifer Mundt

Jump on what Dan said. In Rhode Island, PUC legislation for new solar requires certain amount has to be on brown field. To extend consideration in Valley to developers, scoring in RFPs should be higher if redeveloping a brown field.

Wayne Davis

Also – from slide 43. Concern over small amount of EE in portfolio. Don't have full appreciation of TVA's role in EE. Not clear to what level that discussion has occurred. Might be more at local provider level versus TVA.

Wes Kelley

Particularly interested in low- income EE programs. Alabama can't extend public credit for private purpose. Hard for LPCs to implement EE programs (e.g. potential violation of Alabama Constitution) but TVA can overcome through federal pre-emption.

Doug Peters

I would add … volumetric rates, energy efficiency. Especially right now, at least across the Valley. TVA is seeing flat load growth. If recovering fixed cost out of sales, really difficult at local level to pay someone to not use product. The challenge is how to provide incentives to low-income customers.

Wayne Davis

Challenge – EE education program. TVA needs to explain why EE in IRP is so low.

Doug Peters

TVA retired 6000 MW coal, installed 3000 MW new gas. The difference (3000 MW) could be naturally occurring EE.

Stephen Smith

First of all, TVA is not doing a systemic IRP. It should be looking at lowest cost. If EE is lowest cost, should be manifest in IRP.

TVA shouldn't be putting caps on it.

It is legitimate to talk about rates. Vast majority pay bills. What they pay will be lower.

We think it is incumbent to make it visible what EE would do for customers on their overall bill cost.

Technically, the TVA board is the regulator that looks across the Valley. Not that they should be heavy handed. We think TVA should get that information in an active way and not be playing games behind the veil to not let model track EE. Once in there, to play with metrics and models, I don't think is a best practice.

Visit from Jeff Lyash, CEO

Jeff discussed that what you do is important. Getting EE on the table; it's an important discussion. We are all trying to do the same thing. I know this takes time and is a big commitment. I appreciate it.

He is excited to be part of TVA.

He has been in power business 38 years, from Florida to Canada.

Jeff discussed that he has seen different systems, planning approaches, different levels of commitment.

He believes that the Valley public power model can be a strategic advantage for the Tennessee Valley and get us to do things without conflict around quarterly earnings like other people have. Public service focused. My first 90 days have been mostly about learning, listening to what people have to say — communities, customers, employees.

Stephen to Jeff

The public power model uses NEPA versus interventions and discovery in the utility sector.

Jeff Lyash

We should be working so that all information is clear, that risk taking is clear.

Whether you need thousands of pages of documentation is another story.

Our focus: Energy, Economy, Environment

Take on different urgency and color going forward.

Decade of technological development. …

Generate more clean energy, more affordable energy, use it to drive (lowering) GHG emissions.

Together, we can figure it out.

More thoughts on public comments

Joe Hoagland

Thank you. I recognize there may be disagreement. That is part of what this group needs to be about. What is missing so we can have more conversation tomorrow?

DAY TWO — Thursday, April 18

X. Update on sensitivities — Jane Elliott (Slides 56 to 79)

Purpose of sensitivity analysis

Sensitivities performed to answer questions, such as, "What if there is a different gas price beyond assumptions?" Running sensitivities to understand those reactions on results. Typically run off current outlook trajectory for load and base case strategies. We are running them off base case revised to reflect certain retirement decisions (Bull Run and Paradise) across all 30 portfolios. Sensitivities run – for consideration when preparing recommendation.

List of sensitivities

Today – we will cover the first five:

- Retirements of older gas CT (40 years or older)
- Impact of removing integration cost and flexibility benefit (batteries, aeroderivatives)
- Gas prices (high and low)
- Solar acceleration and caps
- Break-even analysis for technologies not selected – storage, wind, SMRs and CHP

Ones at bottom of the full list — will take longer to finalize assumptions and model and will be discussed at the next meeting.

IRP Working Group – will go through the sensitivities

Older CT Retirements

Wanted sensitivity if 40-year units become more expensive to maintain and might retire, what would they be replaced with?

Looked at base case —year over year delta, and sensitivity — base cumulative delta.

Sensitivity case – If units are retired (by 2020) – as early as possible, extreme case – what is build out that we see?

Cumulative by year – what are changes and additions when subtract base case and sensitivity case – cumulative by that year.

Over course of 20 years there is an increase of approximately 700MW of CT capacity. CT capacity replaces CC capacity starting in 2021 to meet peaking needs.

Stephen Smith

By replacing capacity, are you seeing that it allows better response rates around fuel saving?

Jane Elliott

This information is available in the Appendix. There is a slight improvement in cost because they run more efficiently.

Lloyd Webb

Are you still buying power? Are you looking at surrounding markets or securing margins by relying on outside markets?

Jane

TVA maintains a reserve margin – and we look at the ability to rely on our neighbors. They might peak at different time than we peak.

Our plan will allow short-term market reliance to hit a sweet spot and build bigger CT unit.

Might fill little bit as market allows. Less than 5 percent.

Build to meet the market.

Lloyd

Are you leaning on market for contingency rather than internal?

Jane

The reserve margin considers outages as well.

Laura Campbell

We buy from PJM because it is cheap. We buy when it is less expensive. More of our purchases are because of economics.

Mike Butler

Is that a predictive model?

Jane

The model and help us see patterns. We have got about the right amount of peaking capacity.

In the Appendix, the full model information is presented.

Integration Cost and Flexibility Benefit Case — Jane

What we are trying to do – is new for us. Other utilities have integration costs. Some have flexibility costs. That is what flexibility benefit is. This helps model see sub-hourly benefit to help integrate renewables. Integration cost — Hourly models see that.

Slide 64, top right

Base case cumulative year over year. See the timing: when combustion unit is added, that popped up in one year over year. Over the course of the time period, there is little change and minimal impact.

The question can be posed: Does this matter?

Solar is economical, integration influenced in short term. Not influencing longer-term choice. If specific analysis, do you want to add CT or aeroderivative – you want to understand integration cost because it might be enough to tip the scale.

Stephen Smith

You introduced concept of total resource cost in this IRP. Can you help me understand that?

Jane

Based concept on what is total cost of resource based on EE methodology to look at resource cost. What did they spend on that resource and what did they save on bill? What was their cost? Capture full cost of resource. Cost to TVA but also total cost.

Stephen

How is that impacting total TVA cost?

Jane

Total Resource Cost is a metric. It has no influence on selection of resource.

Mike Butler

Does it consider cost for generation?

Jane

Yes.

High and Low Gas Prices

Each scenario has stochastic – covers plus or minus standard deviation

Even high and low cases.

Lloyd Webb asked

Is there a decarbonization assumption?

Jane

Yes. Increases with inflation and ratchets up another $35.

Solar: What happens in high gas world? The primary change we see is more aggressive solar build-up earlier and extending longer.

Limited opportunity to expand existing hydro units, adding some (55MW) up river. Additions – even though hydro not in primary cases, all assume having existing units and maybe see upgrades on existing units.

Stephen Smith asked

About hydro upgrades of the US Army Corp of Engineers dams.

Joe Hoagland

We are part of Southeastern Power Administration (SEPA) group, and SEPA is working with US Army Corps of Engineers to modernize hydro on Cumberland River.

Low gas prices

Base case run – seeing minimal solar showing up in low gas price world. Another sensitivity – solar and peaking capacity work together. Not surprising result: If gas prices that low, expect solar/gas competition.

Solar Acceleration and Annual Caps

Accelerated Solar

Have signed contracts for 675 MW of solar by 2021. Our objective: Perform a sensitivity case to evaluate the impact of accelerating solar builds to align with the potential timing of customer demand for renewables.

Our approach: Reflect recent Facebook and Google solar signings of ~700 MW total scheduled to come online by 2021 and assume 500 MW per year accelerated solar additions thereafter until economic solar additions pick up in the mid-2020s, then rerun models to derive impact on capacity expansion plan and metric results

Net effect – added 800 MW of solar by 2038.

Stephen Smith commented

When you look at the levelized cost of the energy of solar and wind, comparing with what is used for CCs and SMRs. We noticed that the trending was high compared to other industry sources on solar and wind. And the trending is low on CT prices. Why running high on one and low on the other two?

Jane responded

There is no intended bias in cost. Gas based information is based on recent builds – cost of money, ability to conduct projects, efficiencies found – based on ground cost for us. On solar and wind, used RFP responses delivered to us – what would cost look like? The trajectory on cost is going forward. A lot of assumptions are going into it. Example: Florida has more sun, and state incentives. A lot of assumptions around it.

Lloyd Webb asked

Is there an interconnection cost?

Jane responded

There is an average interconnection cost for each resource. If PPA, developer pays the cost.

Stephen Smith asked

On SMRs – why is the cost down compared to others?

Jane responded

Based on assumption at the time. Since then, designs have lower cost than in IRP. SMRs are not economically selected. Did break-even analysis. How much must costs come down to be economical?

Double Annual Solar Cap

The solar cap is doubled to 1000 MW and the cumulative cap on solar additions is removed. By 2038, approximately 750MW of additional solar capacity is added.

No Annual Solar Cap

The approach is to remove the annual and cumulative cap on solar additions, then rerun models to derive impact on capacity expansion plan and metric results.
Model adds about 1300 MW of additional solar by 2038.

Stephen Smith asked

Are the sensitivities run on base case? Would you expect different results if run against other sensitivities?

Jane Elliott

Yes, primarily base case. But, when looking at wind and solar in Promote Renewables, we might take a look at cap removal with promotion to see what might happen.

Breakeven Analysis: Wind, Storage, CHP & SMR Capital Costs

Objective: Perform a breakeven analysis for resources that were promoted but not selected based on economics. These resources include Wind, Battery Storage, Combined Heat & Power, and Small Modular Reactors.
Approach: Force each resource into the expansion plan at zero cost in the first year available to determine PVRR impacts from displaced energy and capacity, then derive the levelized breakeven cost or value of that resource.

Break-Breakeven analysis conducted for the following resource and target year that resource comes online.

Wind – 2023

Battery – 2023

SMR 2028

What is levelized breakeven?

WIND – about $27/MWh

IRP assumption $83/MWh

Battery storage - $62/MWh

IRP assumption is $241/MWh.

Wes Kelley asked

Have other IOUs or power folks modeled out batteries yet?

Jane

Others have. On everyone's system, the break-even cost will be different. $241/MWh is within 10 percent of benchmarks. Wide range of capital costs.

Lloyd Webb asked

Could you put systems in that improve you and partners?

Wes Kelley said

It helps LPC systems more than TVA system.

Jane

Have LPCs tell us that. We are doing a plan. Add localization value.

Wes

Batteries may be better than traditional voltage regulation.

Joe Hoagland

We are working on two demonstrations.

We are studying places on our system to look at alternatives to transmission upgrades. And looking to see if we could use it to support CT. Also on the distribution level with LPCs, is there a place where they could do non-wire alternatives and see benefits to their system.

Lloyd Webb

We encourage you to look at large industry in that mix, too.

Joe Hoagland

Yes. And TVA has been working on batteries since 1990s.

Wes Kelley

Batteries have maintenance costs. They are not just plug in and go.

Jane Elliott

Flexibility captures how we use them and factors into break-even values.

We do know that based on that study, increases more for battery than others like aeroderivatives.

SMRs

600 MW – $46-53/MWh

720 MW – $44-53/MWh

In addition to break-even, large capital investment up front. SMR investment is capital intensive and more than double the breakeven value.

Stephen Smith commented

Battery storage – several peers are finding synergy between use of school buses and battery storage. Utilities are helping schools buy buses and tap into grid.

Joe Hoagland

In the road map, have had conversations with school districts. Talked to Nashville and in Alabama. They will apply for grants to get the EV school bus.

Stephen

I liked your CEO's concept of using strategies to decarbonize other sectors.

Joe

It is a great concept. We know of two school districts that might be interested. We are beginning to understand what we ought to be engaging in related to EV. We are learning. The next IRP will have a whole lot more.

Charles Snavely asked

Have you looked at petroleum in service area compared to electrification?

Joe

We did. This is why BP is getting in market as they see electric as competitor.

Charles

WE did in Kentucky, and it is equal.

SENSITIVITIES

What's left?

- More stringent carbon penalty (Double decarbonization scenario)
    - Working on this. Becomes more than sensitivity – look at gas prices, etc.
- Increasing ongoing operating costs for coal plants.
    - What if even higher? Working with coal operations folks. Looking at cost to operate in environment.
- Extreme weather case (acute and chronic)
- Increased EE and DR market depth

Jennifer Mundt asked

Have you been considering carbon capture? Could result in higher operation for coal but also demonstrate carbon capture successfully. Are you trying to model that?

Jane

We have modeled carbon capture to select, but we are not seeing it selected.

Extreme Weather

More volatility. Hydrology — a lot of literature refers to more periods of flooding and drought. Looked at what if winter, plus or minus, gets more rain. Or summer to fall has dryer conditions. Running that through.

Increased EE and DR market depth

DR – What if more depths?

EE – Influenced by trending in EE programs.

Charles Snavely asked

Did you model any potential for new coal plant or just how long are existing coal plants going to last?

Jane

New coal plants – yes.

Joe

Most of all viable technologies are modeled in there. We tried to stay away from developing technologies.

Charles Snavely

If you didn't, you would have a gap.

Joe

Most coal plants built as baseload plants. The whole flexibility idea and way load demand is changing, it increases wear and tear on coal plants. Paradise was designed for baseload. Trying to understand what the impact will be going forward in operating coal plants in a different way.

We will have the final four sensitivities to bring back to you.

XI. DEVELOPING THE RECOMMENDATION
Hunter Hydas

When looking at 2015 IRP recommendation:

The blue box area is the recommended range from current outlook scenario

The lines or 'whiskers' –show the range from other scenarios

Considerations for developing recommendation

- Draft IRP portfolio results and scorecards
- Tradeoff considerations
- Public comments
- Sensitivity results

We consider all of these things when developing the recommendation.

Preliminary feedback from IRPWG

The box and whisker format is preferred.

Extremes from sensitivities should be included.

Two 10-year periods vs one 20-year is preferred.

Next steps

- Received public comments through April 8 and will be developing responses in the coming weeks
- Continue work to run prioritized sensitivities and review at upcoming meetings
- We will seek input from the IRPWG at May Meeting on forming the recommendation
- We will review balance of sensitivities and recommendation with you at the June RERC meeting

You will see the sensitivities in a webinar before the face to face June meeting.

In June, we will show you recommendation and ask for an advice statement.

Stephen Smith

Will this group be making a statement on the IRP?

Joe

Yes. We will ask this group will come up with a statement and recommendation. We will share what the last one was like.

XII. FINALIZING THE IRP AND EIS

Final IRP will include:

- Sensitivities and results
- Recommendation
- Implementation challenges and next steps

Final EIS will include:

- Updated analysis
- Discussion of public outreach
- Public comments

Stephen Smith commented

I assume that when you talk about the implementation challenges and next steps, you will talk about the cadence for the next IRP and how the DRP fits with the IRP?

Joe Hoagland

Great question. Triggers for a next IRP include load, gas prices, etc. There is a new world of technology. Batteries are changing fast, Internet things are changing fast. The whole DER landscape has changed.

Stephen Smith asked

This is the first time a major LPC claims to be developing an IRP on its own. What is the interplay? A distribution IRP … trying to wrap my mind around what that looks like. Are we going to see more?

Joe Hoagland

Great question. We innovate every time when developing an IRP. Innovation moving to distribution level, transmission level. How do we integrate that? On distribution side, a

research project - look at DRP (distribution resource planning). This is putting generation on distribution system. What are the economics? So, team is out there discussing the issues. They are working with a consultant.

Stephen Smith commented

The MLGW effort is more a DRP than an IRP?

Joe

Not sure if they are doing IRP. They are deciding how to do business.

Wes Kelley commented

They are looking at power sources. If I were MLGW, I would want diversity.

Means how to work moving forward. They are on boundary of the system; and have options other LPCs don't have. The data will be interesting. They are interdependent, and it is easy for both sides to take the other for granted. Hopefully, there will be a comprehensive look comparing apples to apples and oranges to oranges.

XIII. DISCUSSION QUESTION

What should TVA consider as it creates a final recommendation for 2019 IRP?

Lloyd Webb

Position not changed since 2015.

The IRP should reflect what additional costs are created in terms of ramping up and down traditional generation assets.

Wes Kelley

Strategy laid out. One part stands out – impacts LPC

Incentivize DER – Look forward to furthering discussion after IRP process about the speed of DER incentivization while staying in line with least-cost planning approach.

Rodney Goodman

Same conversation as energy efficiency. Difficult to fit energy efficiency in. Talked about that in 2015. Someone needs to drive conversation about EE. Just want to make sure that low-income issues get to the table. How are you going to do this? How are you going to bring EE on? I know your heart is there, but need the will to make it happen.

Charles Snavely

I echo what Lloyd said. Seeing things that stand out that TVA needs way to clearly, simply, communicate to members. Most significant thing in draft is impact of carbon tax.

It is upon us to communicate to the public — this is what is happening because of climate concerns, this is the cost. Planning process — this is what happens to your electricity cost.

Lloyd Webb

Charles comments on ramping up and ramping down. Also, backup is the most expensive part of the non-dispatchable resources.

Lloyd Webb

Solar – additional capacity.

IRP should also talk about scenario analysis, how you actually plan for and commit to those assets, part for renewables. Adding 200 MW could affect stability of the system.

Joe

Think about interconnection and impact to system on location. Interconnection of process and transmission and planning project. TVA would ensure that the additional solar does not affect system reliability.

Wayne Davis

It strikes me – part of what Lloyd is saying … Not as much discussion for scenarios where someone comes in and they want 500 MW of solar power, this may not be justifiable from IRP standpoint. But as an organization, trying to provide economic growth in the Valley. Maybe to that point, the IRP is planned. Maybe you could have a graph or two — might have justification beyond the plan. You might do it if customer is paying in the interest of future economic growth.

Jennifer Mundt

In New Mexico, PUC requiring Facebook to front costs to improve transmission lines. The IRP is road map, not map directions. Outside influences will change the outcome.

Wes Kelley

This is a policy decision; can't get there through least-cost planning. TVA board needs to decide what the societal benefits are. RERC needs to think about advising TVA Board on such policy implications.

Mike Butler

I offered comments on the impact of solar. Is it appropriate to have statement in IRP that looks at overall impacts of solar? Need to be foresightful with respect to solar on greenfield versus brownfield sites.

Joe Hoagland

IRP doesn't hit that directly. EIS does a little. This is more a policy point.

Amy Henry

There is an individual EA for each decision to add solar PPA. Also did a programmatic environmental assessment when we looked at small solar. Have taken a look at long-term cumulative impacts.

Dan Ionel

A life cycle assessment should be done for solar, as is done for wind products.

Jennifer Mundt

From the state side, we are in the weeds with state land use. In North Carolina, the state and locals are looking into disposal and decommissioning of solar facilities.

Wes Kelley

This IRP should reflect that EE now (because of flat load) is more of a societal issue.

Stephen Smith

EE is resource issue all the time. You make resource decisions all the time. Part of our comments were that EE brings value to system. May be different methods you look at, but lower cost. We should shift discussion off rates to people's bills.

XIV. IRP NEXT STEPS

- Evaluate and address comments
- Run sensitivities
- Analyze and develop preliminary recommendation

XV. WRAP-UP and ADJOURN

Webinar – Will cover a few more sensitivities.

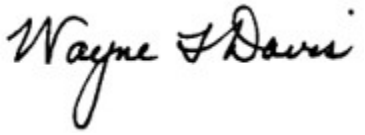
Thank you. You helped us think about things.

If you have questions, go through Amy and she'll get you to the right person.

Future RERC Tentative Meeting Dates

- June 26-27, 2019, Chattanooga, Tennessee
- Review final IRP results and recommendation
- RERC advice to TVA Board on 2019 IRP
- Term 3 of the RERC concludes July 30, 2019

Minutes Approved:



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

Appendix A
Non-Council Meeting Attendees

TVA Staff			
Jane Elliott	Hunter Hydas	Jessica Coleman	Brian Child
Amy Henry	Jo Anne Lavender	Mathew Higdon	Khurshid Mehta
Barbie Lee	Jeff Lyash	Liz Upchurch	Wilson Taylor
Joe Hoagland	Michael Scalf	Laura Campbell	Brenda Brickhouse
Ashley Pilakowski	Scott Brooks	Amy Reagan	

Members of the Public In Attendance
Maggie Shober
Jim Gaines

Other
TVA Office of the Inspector General (Jennifer Torregiano, Rick Taylor)
TVA Police (Tony McGinnis, Russell Buckner, Heather Coffman)
Mary Lee Sauder
Norris Wampler
Mark Synder
Jonathan Hall

Appendix B
Meeting Agenda

Regional Energy Resource Council

April 17 - 18, 2019

TVA Knoxville Office Complex, 400 West Summit Hill Drive, Knoxville, TN 37902,
West Tower Auditorium

Day 1 April 17, 2019	
12:00	**Lunch**
1:00	**Welcome** (Wayne Davis) Welcome (Joe Hoagland/ DFO) Introductions - Council Members
1:10	**Safety Moment** Building Emergency Plan
1:15	**RERC Overview and Meeting Protocols Jo Anne Lavender** **Overview of Agenda** **Update / Discuss on RERC Bylaws Khurshid Mehta / Liz Upchurch**
1:20	**Today's Meeting Purpose** DFO Joe Hoagland or Alt DFO **Recap RERC review and input to date on the IRP** **Recap February 2019 Meeting**
1:30	**Refresh on 2019 IRP Development Process** Hunter Hydas and Amy Henry
2:00	**Break**
2:15	**Recap of Public Comment Period and High Level Public Comment Topics** Amy Henry and Matthew Higdon
3:15	Break

3:30	**Public Comment Session**
4:30	**Recap and Adjourn Day 1**
	Day 2 **April 18, 2019**
7:30	**Breakfast**
8:30	**Welcome, Recap and Day 2 Overview**
8:40	**Moving to the Final IRP** - Use of Public Comments - Sensitivities - Forming a Recommendation
10:00	**Break**
10:15	**IRP Discussion & Questions** **Respond to Questions**
11:00	**Break**
11:15	**Next Steps and Wrap Up** **Preview June meeting -- plans**
11:30	**Adjourn**