I. Meeting Packet

State of Florida
Public Service Commission
INTERNAL AFFAIRS AGENDA
Tuesday – February 21, 2023
9:30 AM
Room 148 - Betty Easley Conference Center

1. Energy Storage: Applications and Technology Trends by Haresh Kamath, Director, DER Integration and Energy Storage (Attachment 1)

2. Legislative Update

3. General Counsel's Report

4. Executive Director's report

5. Other Matters

BB/aml

OUTSIDE PERSONS WISHING TO ADDRESS THE COMMISSION ON ANY OF THE AGENDAED ITEMS SHOULD CONTACT THE OFFICE OF THE EXECUTIVE DIRECTOR AT (850) 413-6463.

Energy Storage

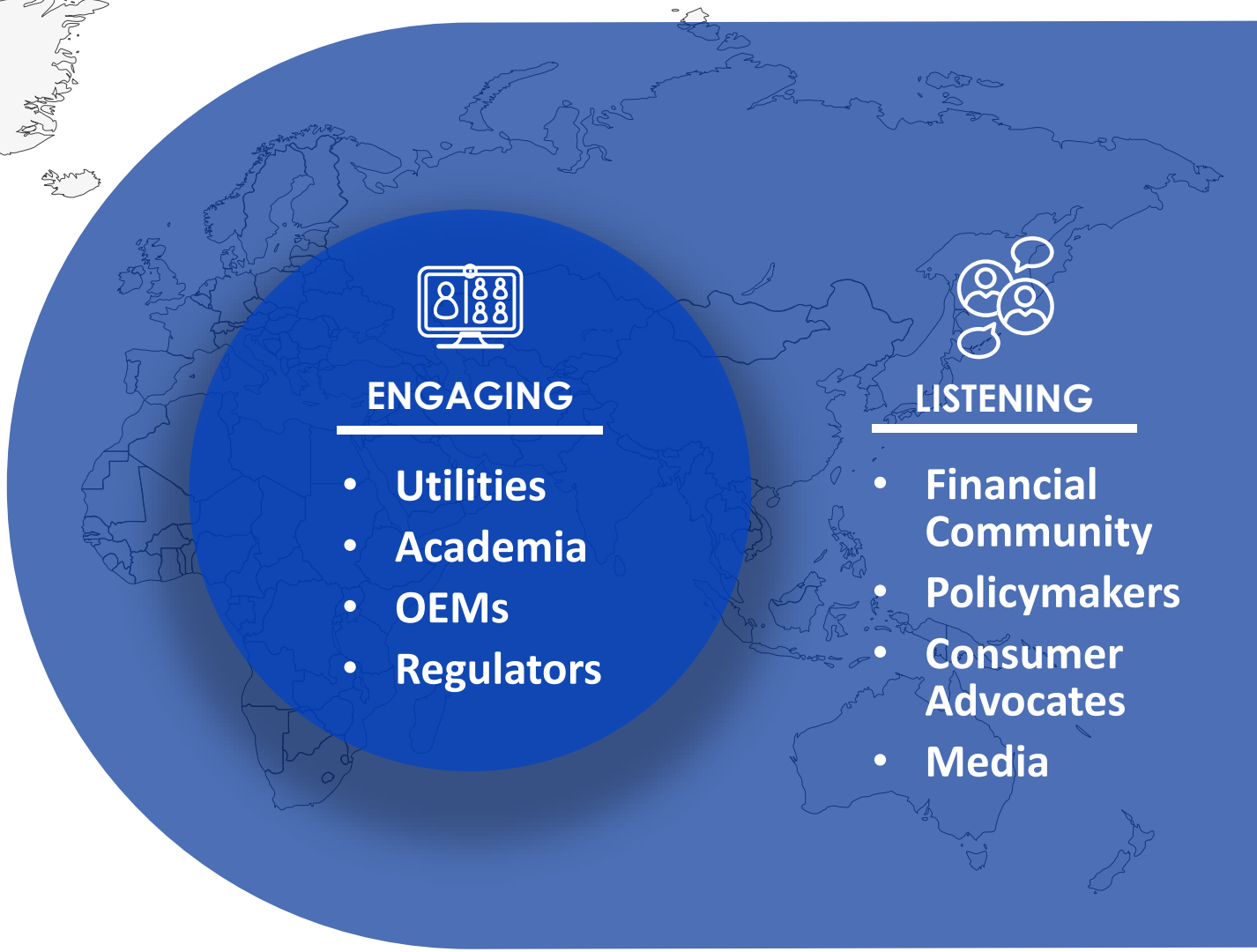
Applications and Technology Trends

Haresh Kamath
Director, DER Integration and Energy Storge

Florida Public Service Commission
February 21, 2023

EPRI: Together, Shaping the Future of Energy

Advancing safe, reliable, affordable and clean energy for society through global collaboration with more than 450 companies in 45 countries.



COLLABORATION

EPRI has worked with utilities, government agencies, and technology developers to design, deploy and test energy storage on seven continents… and soon, the Moon

CREDIBILITY

EPRI's work is guided by our commitment to science, truth and facts to address the challenges and opportunities of the future

EXPERIENCE AND EXPERTISE

EPRI staff come from backgrounds in technology development, lab testing, field deployment, and commercial operation, and have first-hand experience with hundreds of proposed storage technologies and products

EPRI EXPERIENCE

1976: BEST Facility

1984: SMES

1994: Chino Battery

1980

1990

2000

2010

2020

1992: Alabama CAES

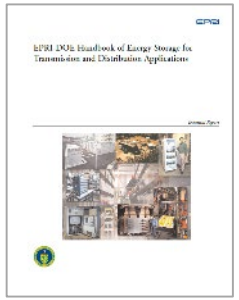
2005: Castle Valley VRB

2008: ZnBr BESS

2013: Notrees BESS

2020: DER-VET

2013: ESIC Founded



2003: EPRI-DOE Handbook

2015: Cedartown BESS

2020: Fire Prevention and Mitigation

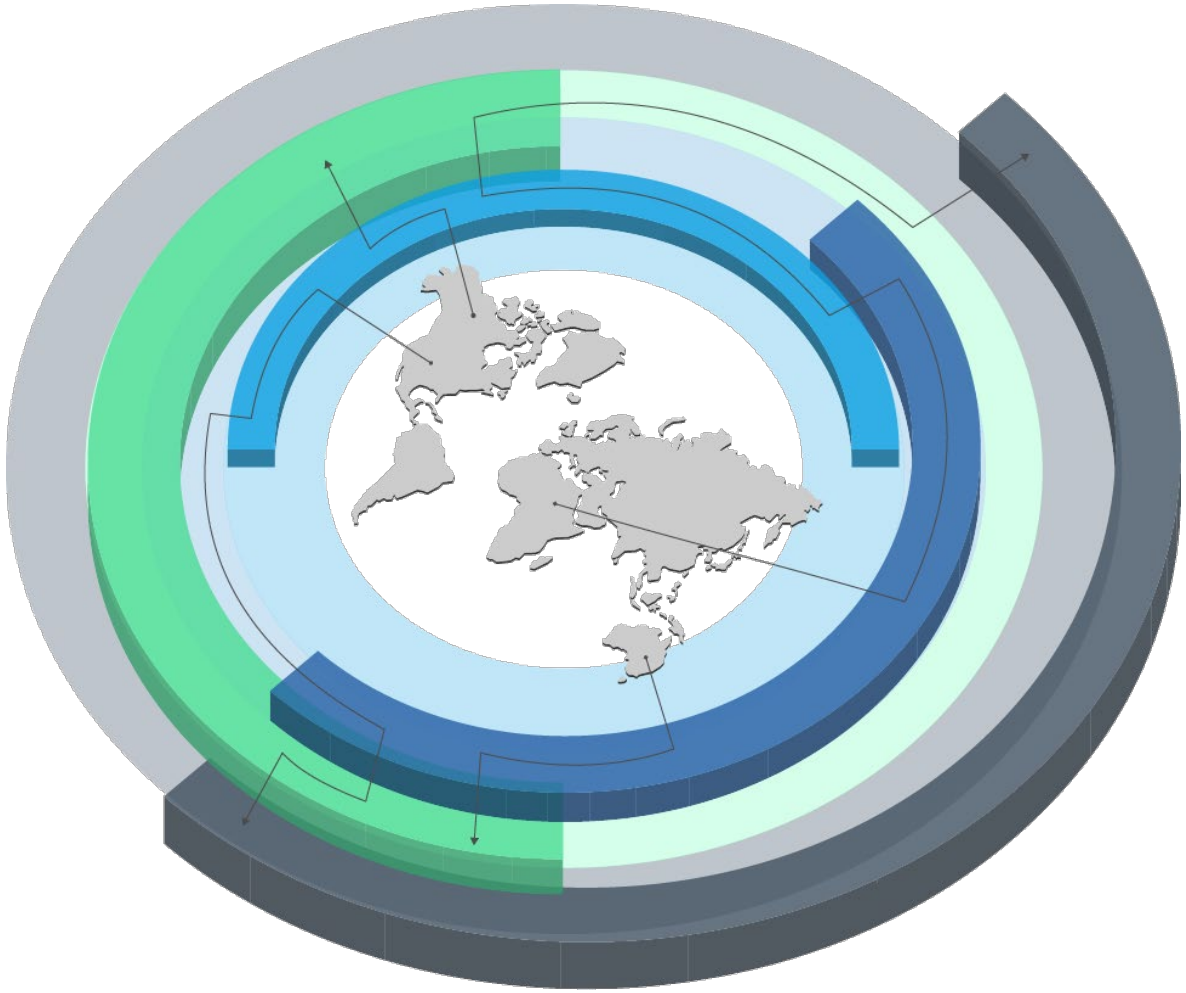
2021: Vanadium BESS

2022: Thermal Storage

2022: MORBUGS

FOR 50 YEARS, EPRI HAS BEEN AT THE FOREFRONT OF ENERGY STORAGE

ENERGY TRANSFORMATION



ENERGY SUPPLY

Ensuring low-cost access to energy
Regional mix based on available resources
Evolving as societal priorities change over time

INTEGRATED SYSTEMS

Efficiency and Reliability driven by societal needs
Flexibility and Security growing priorities
Consumer engagement with the Energy System

COMMUNITY AND ENVIRONMENT

Air, Land, Water, and Wildlife Resources
Public Health and Safety
Environmental Equity and Justice

ECONOMY-WIDE DECARBONIZATION

Implementing economy-wide carbon reduction strategies
Enabling low/zero-carbon technologies
Transitioning assets, networks and systems
Growing need for energy system resiliency

Need for Energy Storage

Enabler

- Energy storage is an enabler for a low-carbon future. As more renewables are installed, it will be needed to help provide grid stability and reliability.

Need

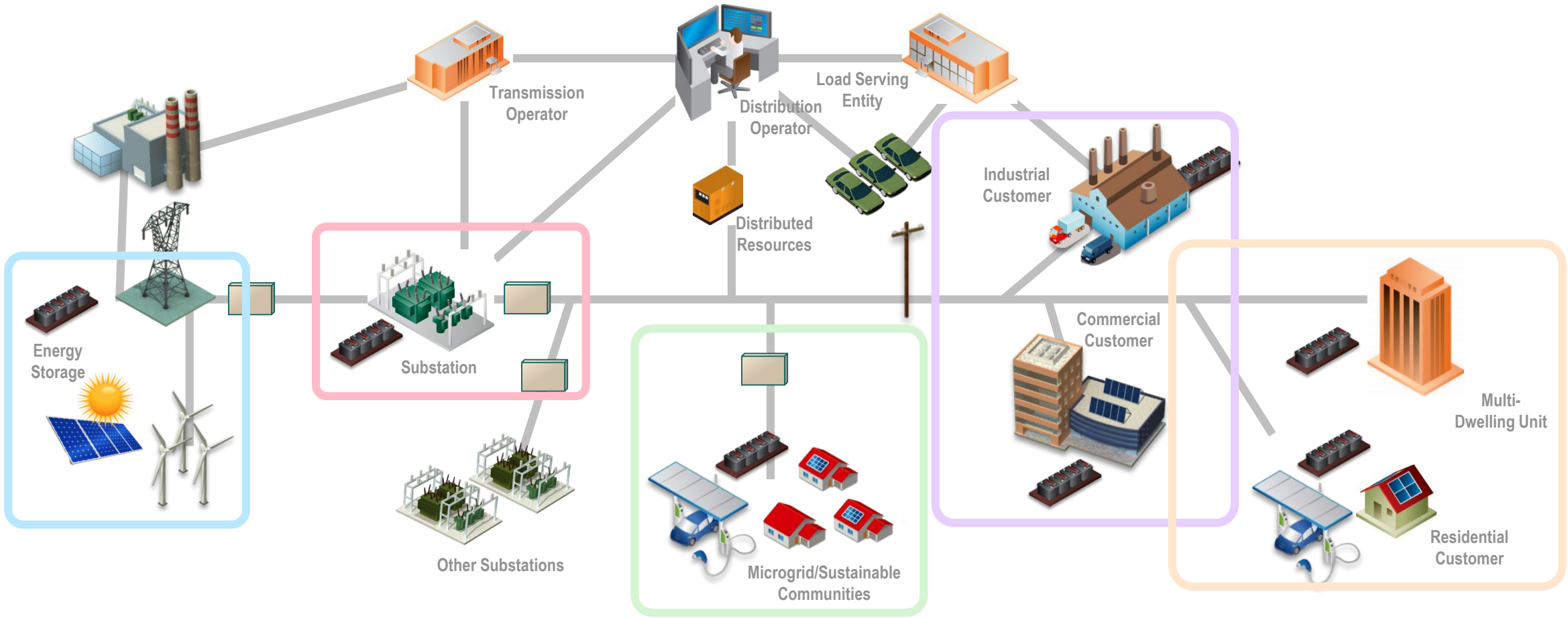
- A substantial amount will be needed: 125–680 GWs of new energy storage is projected for the U.S. by 2050.* Globally, energy storage is also predicted to grow significantly.

** "Economic Potential of Diurnal Storage in the U.S. Power Sector," NREL, July 2021.*

Options

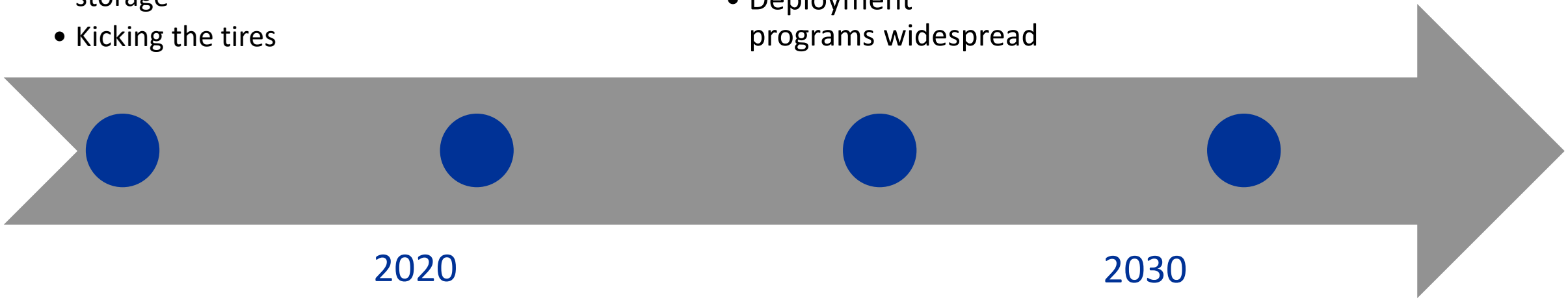
- Energy storage comes in a variety of types and durations, and we will benefit from a portfolio of reliable technologies

Energy Storage Application



Energy storage has potential applications across the entire electricity enterprise value chain

Evolution of Energy Storage



2015

- "Grid-ready storage"
- Kicking the tires

2020

- "Storage Anywhere"
- Pilot projects in real world conditions

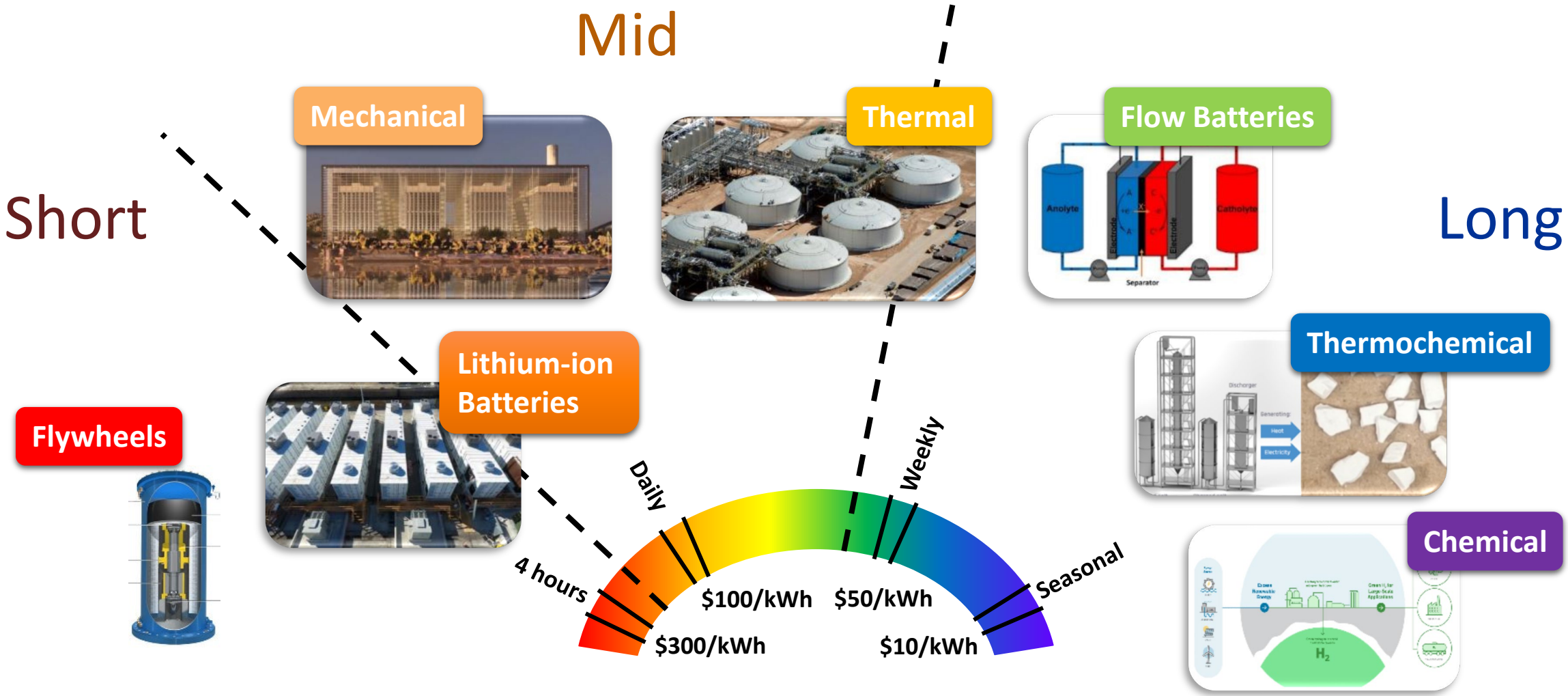
2025

- "Storage Everywhere"
- Deployment programs widespread

2030

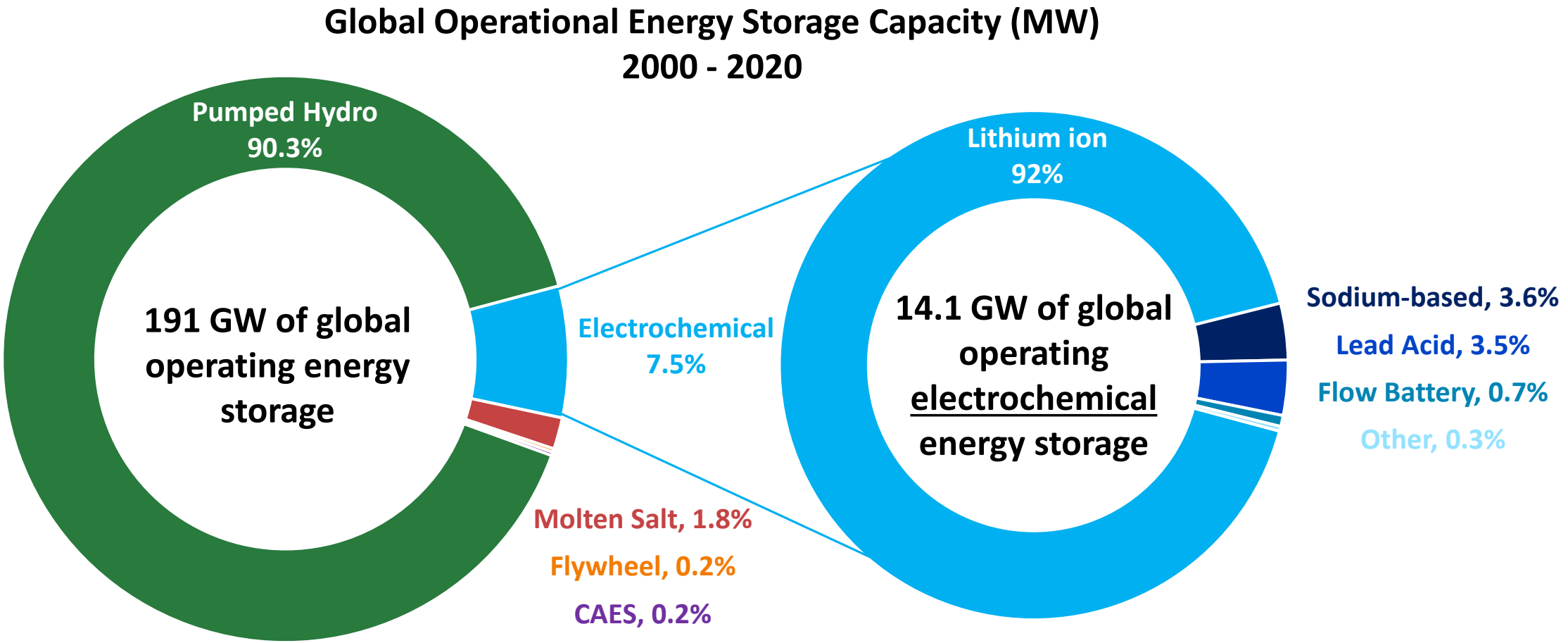
- "New Landscape"
- Beyond lithium and current planning

Energy Storage Technology Spectrum



A portfolio of storage technologies to suit different needs

Technology Trends | Lithium ion continues to dominate new energy storage deployments



Source: China Energy Storage Alliance, Energy Storage Industry Whitepaper 2021 Summary Version

U.S. Government Legislation Driving Storage Adoption

BIPARTISAN INFRASTRUCTURE LAW (BIL)

- $505M for energy storage demonstration

INFLATION REDUCTION ACT (IRA)

- 30% investment tax credit (ITC) for standalone storage
- “Direct pay” available for tax-exempt entities
- Additional credits for domestic content, siting in “energy communities” or low-income communities that can boost ITC to 50%
- Battery manufacturing credits: Up to $45/kWh for domestic production

Technology is Just the Beginning

Energy Storage Technology

- Exploring technology tradeoffs: Performance, efficiency, materials
- Understanding trends: Cost, performance, maturity

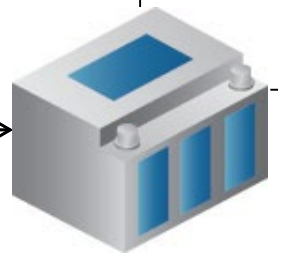
Thermal Storage

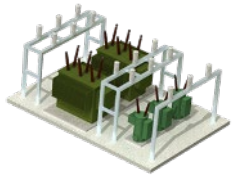
Batteries

Hydrogen

Balance of Plant

- Establishing requirements for auxiliary components
- Understanding impacts on performance, cost, reliability, safety, and environment





Grid integration

- Standardizing the interface with the grid
- Modeling and analyzing the benefits and costs of storage

Communications and Control

- Defining interoperable protocols
- Developing operational and dispatch algorithms

Storage Installation

- Ensuring clean, safe, reliable operation
- Understanding safety and environmental issues
- Developing protocols for operations and maintenance, and for disposal at end of life
- Training and education to make storage a part of the electric power enterprise

EPRI Energy Storage Roadmap: Vision for 2025





SAFETY	ELECTRICITY RELIABILITY	ECONOMICS	ENVIRONMENTAL RESPONSIBILITY	INNOVATION
Safety practices established	Energy storage asset reliability characterized and enhanced	Planning and operational modeling validated and applied	Reduced emissions with energy storage applications	Cross-industry disruption awareness and integration
Asset hazards characterized and minimized	Energy storage controls integrated and interoperable	Multi-use applications enabled	Sustainable life cycle implemented	Future workforce available and trained
Community resilience and public safety applications viable	Energy storage integrated into grid planning and portfolio management	Total cost of ownership reduced	End-of-life impacts minimized	Technology advancements accelerated

Source: 3002019722

EPRI's energy storage roadmap guides research and collaboration

Conclusions

Portfolio

- A portfolio of energy storage technologies will be needed: short-, mid-, and long-duration

Near Term

- Battery safety, reliability, and cost-effectiveness are improving but still need work

Long Term

- More research is needed into long-duration storage technologies that address system needs

Publicly Available Resources for Energy Storage and Batteries

- EPRI – http://www.epri.com
- EPRI Energy Storage Roadmap – https://www.epri.com/research/products/000000003002019722
- Energy Storage Integration Council, Publicly available guidelines, tools, and templates – http://www.epri.com/esic
- Storage Value Estimation Tool (StorageVET) – http://www.storagevet.com
- DOE/EPRI Energy Storage Handbook – SANDIA REPORT SAND2015-1002 http://www.sandia.gov/ess/publications/SAND2015-1002.pdf
- Energy Storage Technology and Cost Assessment: Executive Summary. EPRI, Palo Alto, CA: 2018. 3002013858. https://www.epri.com/#/pages/product/000000003002013958/
- Recycling and Disposal of Battery-Based Grid Energy Storage Systems. EPRI. Palo Alto, CA: 2017. 3002006911. https://www.epri.com/#/pages/product/000000003002006911/
- EPRI Commercial & Industrial Battery Energy Storage Fact Sheet, https://www.epri.com/#/pages/product/3002015438/
- EPRI Residential Battery Energy Storage Fact Sheet, https://www.epri.com/#/pages/product/3002015437/
- DOE OE Energy Storage Monthly Codes and Standards Update – https://www.sandia.gov/energystoragesafety-ssl/codes-standards/status-of-codes-and-standards/
- NFPA 855, Standard for the Installation of Stationary Energy Storage Systems – https://www.nfpa.org/codes-and-standards/all-codes-and-standards/list-of-codes-and-standards/detail?code=855
- International Fire Code (IFC) – https://codes.iccsafe.org/content/IFC2018
- Cost-Effectiveness of Energy Storage in California– http://www.cpuc.ca.gov/NR/rdonlyres/1110403D-85B2-4FDB-B927-5F2EE9507FCA/0/Storage_CostEffectivenessReport_EPRI.pdf
- DOE Energy Storage Database – http://www.energystorageexchange.org/
- DOE/Sandia Labs Energy Storage Program – http://www.sandia.gov/ess/

II. Outside Persons Who Wish to Address the Commission at Internal Affairs

Note: The records reflect that no outside persons addressed the Commission at this Internal Affairs meeting.

III. Supplemental Materials for Internal Affairs

Note: The records reflect that there were no supplemental materials provided to the Commission during this Internal Affairs meeting.

IV. Transcript

BEFORE THE
FLORIDA PUBLIC SERVICE COMMISSION

PROCEEDINGS: INTERNAL AFFAIRS

COMMISSIONERS PARTICIPATING: CHAIRMAN ANDREW GILES FAY
COMMISSIONER ART GRAHAM
COMMISSIONER GARY F. CLARK
COMMISSIONER MIKE LA ROSA
COMMISSIONER GABRIELLA PASSIDOMO

DATE: Tuesday, February 21, 2023

TIME: Commenced: 9:30 a.m.
Concluded: 10:15 a.m.

PLACE: Betty Easley Conference Center
Room 148
4075 Esplanade Way
Tallahassee, Florida

REPORTED BY: DEBRA R. KRICK
Court Reporter and
Notary Public in and for
the State of Florida at Large

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P R O C E E D I N G S

CHAIRMAN FAY: All right. Good morning, everyone. We will get started with this morning's Internal Affairs agenda.

First up on the agenda, we have a presentation on energy storage from Haresh Kamath, the Director of DER, Integration and Energy Storage, essentially known as EPRI. Let's see, we've got a slide presentation for you this morning.

If we could just recognize you for a brief introduction and then we will go to your presentation. And typically for the Commission, we may interject if, on a specific slide, we have a question, but often, we wait until the end of the presentation if there is a follow-up from me or any of my colleagues.

So with that, you are recognized this morning. You just hit the button in front of you, you will get a green light. There you go.

MR. KAMATH: Great. Thank you very much. Much appreciated this opportunity to talk to the Florida State commission on the topic of energy storage.

As is said, I am Haresh Kamath, representing EPRI. We are A nonprofit organization doing public

interest research in energy and the environment, including energy storage. I will give a brief introduction about our company, and then talk about how we see energy storage fitting into the energy structure of the future.

EPRI is, as I said, a nonprofit. We do public interest research in collaboration with our member utilities, other energy companies, academia, equipment manufacturers, government agencies and regulators to try to understand how to advance safe, reliable, affordable and clean energy for all consumers.

We focus heavily on electric power, but we do look at many other aspects of energy. Increasingly, as many of the different types of energy that are being used by society are increasingly intersecting and becoming part of a bigger whole. We are working with companies in 45 different countries, and of course, all 50 states.

Particularly in energy storage, we have worked with utilities and government agencies, technology developers and other entities to design, deploy and test storage on seven continents. That includes Antarctica. And in fact, we are working with NASA to actually develop distribution systems on the

moon that will incorporate energy storage. So we are going beyond the earth.

Our staff comes from several different backgrounds in clean technology development in batteries and storage, as well as applications in utilities, and deployment of energy storage and other technologies such as solar. We have firsthand experience with hundreds of storage technologies and products.

We are -- our work is guided by our commitment to science and fact. We are not advocating for any specific technology. We are -- our interest is in making sure that the overall infrastructure is as safe, reliable, cost-effective and environmentally responsible as possible.

For the last 50 years, we have been investigating energy storage technologies of one type or another, starting with our testing activities in the 1970s through our deployment and development activities in the '80s and '90s, and most recently with lithium ion systems since their inception about 20 years ago.

We have been working with other technologies as well, and trying to understand what the benefits of those technologies are, what the risks are. And

making sure that any deployment that occurs is done as effectively as possible.

We are in the middle of a big transformation in the way that energy is being used across our entire society, starting with the generation of energy, the transmission and distribution of energy, and the storage of energy, particularly in the electric sector.

In the electric sector, we are seeing an increased use of renewable energy, and a transition to decarbonized generation away from fossil generation. And we are simultaneously looking at a society which requires that energy more reliably and more resiliently than ever before.

These purposes are not mutually exclusive. We can create a more reliable and resilient electricity infrastructure while decarbonizing the system. It does require us to investigate new technologies and apply those new technologies as effectively as possible. One of those technologies is energy storage. The best analogy that I have for energy storage is refrigeration.

In the past, when we had -- when you look at the food supply and the food supply chain, we had to move food as quickly as possible from the point

of production to the point of consumption because it would -- otherwise, it would rot along the way. With the development of refrigeration, we were able to make the food supply chain increasingly more reliable and more resilient, so that now you can get produce from all over the world wherever you happen to be. It's also possible to be able to store that product for a significant length of time, and that can help reduce supply chain impacts the same way energy storage can provide increased reliable and resilience in the electricity network to ensure that regardless of what the source of electricity is, that that electricity will be available where it's needed and when it's needed as effectively as possible.

This need for energy storage will increase in the future as we see our energy infrastructure shift towards a low carbon future. With more use of variable solar and wind assets, we will need some energy storage to provide good stability and reliability.

Our projections indicate that a significant amount of storage will be needed NREL, for example, has done a study looking -- that -- that estimates that we will need 125 to 680 gigawatts of new

energy storage by 2050, and that's in the U.S. alone. Globally, a significantly larger amount of energy storage will be required. That energy storage will come in a variety of types and durations, and we will benefit from having a diverse portfolio of reliable technologies.

I am often asked where the energy storage should go. Should it go closer to the supply, or should it go closer to the use? And I say, yes, it's required all the way across the supply chain. Just the same way that refrigeration is. We use refrigerators at the point of supply, and we also have refrigeration all the way along the food supply chain, and you have refrigerators in your homes, and in our businesses as well, the same way energy storage can bring special value all the way across the electricity supply chain, if located close to large-scale renewables, then it can be used to store energy and deliver it whenever it's needed. If it's close to the end use point, then it could provide reliability and resilience advantages in the case that the -- that there are disruptions on the grid.

As we have progressed in energy storage in the last few years, we've increasingly seen it become a

commercial technology. As recently as 2015, it was still very much in the developmental stage. We saw some large-scale deployments, but we were really just kicking the tires. About two or three years ago, storage became a reality in many peoples minds, and we started seeing larger and larger pilot projects in real world conditions.

We expect that by 2025, deployment of energy storage products, especially -- especially lithium ion based systems, will be widespread. And by 2030, lithium ion may be a relatively mature technology, and we will begin to shift into other technologies that go beyond lithium ion in terms of deployment.

As I mentioned before, we are really looking for a portfolio of storage technologies. I mentioned lithium ion, because that is the one that has attracted the largest attention in the last few years. Lithium ion has seen tremendous reductions in cost as a result of, first, tremendous infrastructure in manufacturing because of the consumer electronics revolution, followed by tremendous investments for EVs in the last 10 or 15 years, with a reduction of cost 80 percent between 2010 and 2020.

That cost reduction is continuing, and we expect that lithium ion costs will decline further. However, because of the relative expense of lithium ions, it's really most cost-effective for relatively short durations. Somewhere between four to six hours at present. Perhaps as long as 12 hours, or even 24 hours by the end of this decade.

However, for longer durations beyond that, we expect that other types of technologies may be necessary. And you may have heard of some of these technologies in development. Gravity-based storage, thermal storage, flow batteries and chemical storage, such as hydrogen.

We believe that a portfolio of technologies is, again, the strongest way to provide value, just the same way that we have a diverse supply network right now of electricity-based on a number of different generation sources.

In terms of technology trends, I must point out that there is already a significant amount of energy storage on the grid. Most of it is pumped hydro, which has been in existence for several decades. These are very large hydro stations that pump water up a hill to store energy, and then run it back down through turbines to discharge it when

it's needed.

Most of the new interest in energy storage that's occurred in the last decade has been in batteries, most of which is lithium ion. On this graph, which represents the state of the deployment in mid-2020, we see that there were about 14.1 gigawatts of batteries on the grid. However, in just the last two years, that has almost doubled to 24 gigawatts of batteries on the grid. We are expecting that to continue to grow in the next few years.

Much of this is being driven by government legislation, especially here in the U.S. Of course, we have seen a significant investment in energy storage demonstration as part of the bipartisan infrastructure law. But more recently, from the Inflation Reduction Act, we anticipate that there will be a continued increase in the deployment of energy storage.

There has already been an existing investment tax credit for storage when it is connected to solar or wind. That investment tax credit has been responsible for a great deal of the deployment today. The Inflation Reduction Act extends that tax credit to stand-alone storage as well, so it

makes that storage much more cost-effective. In addition, it extends the tax credit to methods that make it available for tax exempt entities such as municipal utilities.

There are also additional tax credits for domestic content for batteries that are generated or produced here in the U.S. Right now, most of the batteries come in overseas, mostly Asia, either Japan, Korea or China. But there are factories being built in the U.S. to deploy these systems to actually produce these systems here.

Also, additional tax credits are available for siting in energy communities, that is communities that presently have a fossil plant that may be retired in the near future and may be replaced by solar or wind, or just by energy storage. There is also some advantage in placing it in the low-income community. All together, these tax credits can boost -- can be boosted up to 50 percent of the value of the storage system.

There are also manufacturing tax credits on top of these tax credits that allow manufacturers based in the United States to sell their product for lower price. All of these together mean that, more than likely, energy storage is going to be

increase increasingly deployed in various parts of the U.S.

I do want to emphasize that I don't want to make this sound like a done deal. There are lots of things that we still have to do to make sure that energy storage is a safe and reliable option for the future.

We often talk about the energy storage technology itself, the batteries or the hydrogen. But there are other components of that storage system that also have to be addressed. The power conversion systems. The balance of plant. The communications and control, which affect all aspects of the grid. Integration with the rest of the grid, which has been an issue in the past for solar, and, will be even more of an issue for storage in some respects. And making sure that we understand fully what are the issues related to energy storage. And in particular, what communities that host an energy storage system need to know about the risk that they face, and preparation for the issues that may arise during operation.

We are still learning a great deal about energy storage. And many of these -- the lessons

that we've learned in the last seven or eight years must be applied to the storage systems in the future.

At EPRI, we have been working with the industry to develop a roadmap for the future, to make sure that issues such as safety and reliability, as well as the economics and environmental responsibility are being addressed in a effective way. We have been working with entities, including utilities here in Florida, on making sure that this information is available to all entities that are installing energy storage.

So in conclusion, we believe a portfolio of energy storage technologies will be needed. We are working a great deal in batteries, but batteries should not be considered the only option for energy storage.

For batteries themselves, we do expect that we will see a lot of lithium ion battery deployment in the next few years because it is the technology that is cost-effective at the moment, but there are still issues with safety and reliability that can be addressed.

And we are looking into -- across the industry, we are looking into more research into

long-duration energy storage technologies that address the system needs of the future, especially the needs that will arise beyond 2030.

We have a number of publicly available resources that have been developed, not only by EPRI, but also by other entities, particularly the DOE and our various national lab partners which are available here. And I'm open to any questions that the Commissioners may have.

Thank you very much for this opportunity to speak to you.

CHAIRMAN FAY: Great. Thank you for being here in morning. And thank you for this resource page that you provided -- or resource slide that you provided. I find it to be helpful. It's kind of a centralized component of some of these topics.

So with that, Commissioners, I will take any questions for Mr. Kamath.

Commissioner Graham.

COMMISSIONER GRAHAM: Thank you, Mr. Chair.

Thank you for your presentation. A couple of questions.

You spoke a lot about the lithium batteries. Are those the batteries that are the ones in the EVs that people use quite a bit?

MR. KAMATH: That's right, Commissioner. They are the same type of battery.

COMMISSIONER GRAHAM: Now, didn't we have a problem for a while with those things exploding, catching fire?

MR. KAMATH: There is a risk with all batteries, in fact, of fire, and many of those issues are being taken very seriously by the industry. Certainly, there have been a number of incidences. And I think the number of incidences, certainly on the utility scale batteries, has been concerning.

I think we have to make sure to take -- the industry has to be sure to take the lessons learned from the incidences of the past and reduce the hazard. Identify those situations under which these batteries can present a risk, and make sure that those risks are diminished as much as possible, and mitigated, if, in fact, an incidence occurs.

COMMISSIONER GRAHAM: What's causing those fires?

MR. KAMATH: Many of those fires occur because of manufacturing defects, or, in some cases, because of the way that the product is integrated.

In some cases, it's also created by the way that the systems are operating in the field.

There are a number of different causes and, you know, it depends very much on the -- on which incident. We've identified a number of different ways in which these, you know, issues can occur. And we are -- the entire industry is working to reduce the incidence of that -- of those -- of that kind of safety hazard.

COMMISSIONER GRAHAM: Now, we have one of our utilities just south of us, I believe it's Orlando, that's looking to do molten salt for storage. What's the cost difference between the lithium and the salt, do you know, roughly?

MR. KAMATH: That's an excellent question. At present, the molten salt is probably a little bit more expensive than the battery technology. But in that scale, in full maturity, it's very likely that the molten salt technology will be significantly lower cost than the lithium ion. We expect that, in the long run, scale molten salt systems may be as much as 25 to 50 percent lower cost than the lithium ion system.

COMMISSIONER GRAHAM: Now, as far as how much space is available, how much space is needed, do

you need quite a bit more for the molten salt than the lithium?

MR. KAMATH: That's right. The molten salt systems are less energy dense than the battery systems, so they are a little bit less flexible in terms of placement, but that's made up in the cost difference. So if you do have room for it, then the molten salt system may be more cost-effective than the lithium ion system.

COMMISSIONER GRAHAM: So would you think or guess that the molten salt will start to be more on the rise because of eventually it's going to be cheaper and safer?

MR. KAMATH: I think it depends a great deal on whether the molten salt systems reach, you know, commercial viability, and whether the costs actually become lower than lithium ion.

As I mentioned, today, the molten salt systems are still more expensive, and their ability to rescale will determine how quickly they are deployed in relation to lithium ion.

COMMISSIONER GRAHAM: Is there a -- one last question.

CHAIRMAN FAY: Sure.

COMMISSIONER GRAHAM: Is there, like, a purity

level for that salt that has to go into those systems?

MR. KAMATH: That's right. Actually, that's a great question, Commissioner.

The -- it depends on the system, as it depends on the types of salt that are needed, but contamination is a concern that occurs as the salt ages and contaminants may find their way into the salt system. You know, depending on what's being used, there are various different types of mechanisms by which that can be reduced, and that the lifetime of those systems can be extended.

COMMISSIONER GRAHAM: I can't imagine you have got any kind of a skimmer that's going to take the impurities off of the molten salt.

MR. KAMATH: It's -- right. No, most of it is preventing the salt from being contaminated in the first place, and making sure that, you know, it's not -- that -- that those contaminants don't make their way into the system. But also finding salt that is more tolerant to those kinds of -- those kind of impurities if they, in fact, occur.

COMMISSIONER GRAHAM: Okay. Thank you.

CHAIRMAN FAY: Great. Thank you, Commissioner Graham.

Commissioner Clark, you are recognized.

COMMISSIONER CLARK: Thank you, Mr. Chairman. Just a couple of observations, questions.

I noticed in your presentation, I saw a depiction of the early Alabama case plant from 1992. I had some experience in working with the development. After the development of that project, I came to the co-op world in that time period.

We've seen that unit on-line for about 30 years now, I guess, and we've seen the benefits that this type of technology has yielded us. Go back to the days of the hide hydro pumping as well.

I know we are looking at technology to be the leader and to be the future, but can you say anything about the old technology and the benefits that we've seen from it? Have we abandoned those -- the research into that type of energy storage?

MR. KAMATH: Thank you, Commissioner, for asking that. I am actually delighted to know of your knowledge of the case plant. That plant has been operational for 33 years, and EPRI was a key part of constructing it.

Actually, I believe that those technologies,

pumped hydro and compressed air, hold a significant amount of promise for the future if they can be extended. The challenge with pumped hydro, at least in the U.S., is that many of the best spots have already been taken, so it's very hard to find these sites. And those sites take a very long time to implement. So if you begin today, in 2023, then maybe we will have a plant in 2043. That's a very long time. So it's difficult to do.

That said, we are actually seeing many folks, many utilities and many energy developers actually taking existing sites, existing pumped hydro sites, and improving them with variable speed drives to make them more flexible and to increase the capacity.

Just as an example, Duke, in North Carolina, built an addition to their Bad Creek facility that significantly increased their capacity there from 1,300 megawatts to 1,600 megawatts. And that, you know, is a big deal. 300 megawatts in energy storage just out of pumped hydro is a significantly lower cost than a battery plant.

A compressed air energy storage plant can also be a very good way of storing energy. Unfortunately, this technology has not really

picked up since this construction of the Alabama case, but we believe that there is a lot of potential. We are seeing some interest as a part of the bipartisan infrastructure law projects, and so we hope to see some deployment of case as a potential technology for the future.

COMMISSIONER CLARK: Thank you.

CHAIRMAN FAY: Great. Thank you.

Commissioner La Rosa.

COMMISSIONER LA ROSA: Thank you, Chairman.

Maybe just some clarification. You mentioned gravity-based storage. Is that a pumped hydro, is that what you were just referring to to Commissioner Clark's question?

MR. KAMATH: Pumped hydro is one variety of gravity-based storage, but there are other media, including in addition to water that can be used to store energy. For example, some companies have proposed using large concrete weights and lifting those concrete weights to store energy in that way. Other companies have proposed using railcars, you know, various types of ways of heavy objects, basically to lift them up to an elevation and lowering them down to regenerate the energy.

COMMISSIONER LA ROSA: Any facilities like

that that are currently in operation?

MR. KAMATH: Other that are not pumped hydro, I am not aware of any facilities at present beyond a pump couple of pilot projects that have been done that are not presently cost-effective. They have been -- they -- they are technology demonstrates intended to demonstrate the technology at a smaller scale, and have -- I think they are -- those companies are awaiting more investment to actually be able to scale their systems up.

COMMISSIONER LA ROSA: Lithium ion batteries obviously are becoming more and more popular, and I think a lot of it because of their size, or their ability to be very small. Where are the majority of those batteries manufactured?

MR. KAMATH: So most batteries today, I think the largest single manufacturing country is China. Japan and Korea also have significant installations, and there are quite a few fact that's are being built in the U.S. and in Europe. But for the foreseeable future, we think -- I think China is far in a way the largest manufacturer of those systems.

COMMISSIONER LA ROSA: Is that based on cost or -- I mean, just, like I said, your opinion?

MR. KAMATH: It's really based on investment. China -- the China production capacity was actually significantly smaller even just seven years ago, in 2015. And then essentially, the country put in place certain requirements that batteries and EVs sold in China were required to be manufactured in China by Chinese companies.

Those government requirements incentivized a significant amount of investment in manufacturing plants in China, and also gave them a natural advantage in negotiating with companies that wanted to sell products in China.

Of course, those companies also turned around then and immediately began to export those products to the rest of the world, having an advantage with a home market that subsidized their own product.

COMMISSIONER LA ROSA: Sure. Sure.

Does being located in a certain region for a manufacturer such as that make more sense? Like, for example, if there was -- there are, as you are saying, U.S. based manufacturers that are starting to become established. Is there a certain region that makes more sense for the mobilization and operations?

MR. KAMATH: That's a very interesting

question. In fact, the U.S. government looked into just that question about 10 years ago in a study that was done by NIST.

There -- the battery manufacturing is highly capital intensive. There is no real requirement for specific labor associated with it, so it can be placed anywhere. And, in fact, we have seen that there is a significant capacity in the U.S., of course nothing quite as large as what's in China or in Japan, but that have been installed, for example, in Georgia, in Michigan, in Nevada, in Texas, in many places in the country, and right here in Florida, I should say. For some time, much of the lithium ion that was being used by, for example, the U.S. military, was being produced here in Florida.

COMMISSIONER LA ROSA: Thank you.

CHAIRMAN FAY: Great. Thank you.

Commissioner Passidomo, you are recognized.

COMMISSIONER PASSIDOMO: Thank you, Mr. Chair.

I just have one question. You mentioned that EPRI now has a bunch of different partnerships with, you know, governmental organizations and utilities. And so I am wondering if you help guide them -- your organization helps guide them to have

a properly value energy storage. I think know we know that, you know, energy storage itself can kind of transcend those traditional grid classifications. So I think regularly, we are seeing different pilots come in, and things like that, I think we want to know, like, how to value it beyond those traditional metrics.

MR. KAMATH: Yes. Actually, we have been working with a number of entities, including the California Public Utility Commission, the Commissions in Washington state, Minnesota and New York, to value energy storage in various different contexts.

We have developed some tools that are available free to the public. And we have been working with utilities and commissions to try to understand what applications are suitable for specific areas and specific locations.

Of course, every state, every location has a different requirement for energy storage. And it's important to recognize that the local grid and the local generation mix can influence the value of energy storage depending on what the specific requirements of consumers in an area are.

COMMISSIONER PASSIDOMO: Okay. I would

appreciate -- I don't know if any of the other Commissioners would also appreciate seeing those tools, but just as a background information, if we can -- if that's on your website, or somewhere we can access that.

MR. KAMATH: We do. It's actually on this list up here. It's called the Storage Value Estimation Tool. The fourth bullet down there, storagevet.com. You are free to go right up to that and look at it.

We also have some public documentation for work that we've done for some of these other states that I would be happy to make available to you.

And if you are interested in a demonstration, we would be happy to come down and give it to you at any time.

COMMISSIONER PASSIDOMO: Thank you.

CHAIRMAN FAY: Great. Thank you.

And I agree with you, Commissioner Passidomo. I am very interested in that. And once again, appreciate the resources that you have provided.

Commissioner Clark, follow-up.

COMMISSIONER CLARK: Yeah. Commissioner La Rosa and Passidomo made me start thinking about something that has not crossed my mind. But when

you look at the development of energy storage, it's typically been based off of an excess capacity that we had during off-peak productions. We are using those kilowatt hours to create the thermal storage, or mechanical storage, or whatever.

As we've changed our fuel sources, and we begin to see maybe some of that additional capacity that we had in normal base-load operating times go away, and as we've got the ability to ramp up generation and ramp down generation with other sources of fuel now, is there a point in time where thermal storage, or more storage, battery storage, doesn't actually make sense anymore? Will we get to that point? Is that something that's being considered?

MR. KAMATH: That's a great question.

I don't know. I mean, it really depends on what the electricity system looks like in the future. If we have tremendous amounts of transmission, and we have tremendous amounts of, say, demand response, and other methods by which we can make the system flexible, then we can reduce our requirement for energy storage accordingly.

In many ways, transition and energy storage are there to, you know, as partner technologies.

And the more transition we have, you know, it's quite possible that we don't need as much storage.

The storage closer to the end-use point is probably something that will be required in the future to enhance reliability and resilience. But, you know, the larger scale storage, it's -- it does depend on what those investments look like.

COMMISSIONER CLARK: Hasn't most of the storage that we are talking about, hasn't it been used primarily in peaking instances instead of for base-load performance?

MR. KAMATH: That's right. Most of the application for energy storage at present has been to provide capacity where required during peaking times, or to provide reliability and resilience to applications rather than to actually shift energy.

COMMISSIONER CLARK: Thanks.

CHAIRMAN FAY: Great.

And I have just two quick questions for you. The first being your evaluation on some of is the storage and the cost components, when we look at just the basic sort of discussion about batteries, and the mining of the components that we need, the costs associated to disposal, are you looking at sort of the entire life of that process from

storage, from the beginning to the end, which also would evaluate environmental impact and cost?

MR. KAMATH: That's right. A great deal of our research is looking at the supply chain for these systems, going all the way back to the environmental impacts of the mining of various components, as well as the transportation and processing of those components.

We also look at the end of life, and what happens to these batteries at the end of their life, whether it's an automotive application or in a utility scale application, to understand what the possibilities are for recycling, and to reuse those materials in a future generation of battery.

CHAIRMAN FAY: Okay. Great.

And then on your slide 9, you had a chart that essentially showed the different types of storage, short, mid and long, and the mechanical thermal, the different options that were present. There is a cost component at the bottom of that. I will give you a chance to --

MR. KAMATH: Yes.

CHAIRMAN FAY: So that composite component looks at sort of the short-term and then mid and then long. When you look at the way those costs

move, they go down towards the more long-term storage.

Can you just explain sort of the -- the basic concept to me would be the longer storage components would be the higher cost because they are more beneficial and require, you know, more complex technology and advancements; whereas, some of the short-term components would seem cheaper and easier. How did you come you with this bottom component?

MR. KAMATH: So the bottom component is what we have calculated to be the price point at which those two technologies become viable. As -- you know, for relatively short needs, for a few hours, you actually can find a great deal of value for your storage system in reliability and resilience applications. With each additional hour, the storage becomes less valuable on the grid, not just because it's, you know, just the margin -- you have diminishing returns in terms of the value of the storage, but also because you have to find the time to charge it. And charging the storage can be difficult.

If you have a 10-hour system, just as an example, you have to be able to do -- you can

discharge that battery for 10 hours, but then for -- once it's depleted, for it to become useful again, you will have to find 10 hours in which to charge it, and that can be a difficult thing.

So from a cost standpoint, the longer you want the storage to last, the cheaper it has to be. For a weekly duration storage product, it really cannot sustain a system cost of greater than $50 a kilowatt hour if it's supposed to be cost-effective on the grid. For seasonal storage, actually shifting the power from summer to winter, for example, those costs have to be extremely low, down below $10 a kilowatt hour.

CHAIRMAN FAY: Okay. Great. Thank you.

And then my last question for you, you have got some content in here about the bipartisan act, and some of the funding that's going out on that. We, like every state, are looking at components of that and what might make sense for us.

It looks typically, with most of these things, to your talking points, that they are driven by either the municipality or the entity that would essentially be applying for those funds. Are you looking at the way the commissions would be potentially involved or engaged in that to find

some way to incentivize that?

And just to clarify my question, there -- there seems to be some discussions about regulatory decisions and structures that would either incentivize uses of that or not. And until we see specific examples in front of us to make decisions on, it seems sort of complicated to be able to create that structure.

MR. KAMATH: I would say that's true. Many states are looking at this need in the specific context of their grids, in specific context of their electricity infrastructure, and the way in which the business is set up.

Of course, again, it's different in every state, and there is a different history in every state, but commissions are making their own decisions based on what they see as the needs of the future in light of their -- of the generation mix, and the needs with respect to reliability and resilience.

For example, as a result of extreme climate event, or extreme weather events, or similar other circumstances, and they have put in place their own incentives that may play off of some of these federal incentives to encourage energy storage in

their area.

CHAIRMAN FAY: Okay. Great. Thank you.

I know that's the case with the EVs, you are seeing some states aggressively sort of incentivizing on top of what's out there, and I guess that's one regulatory option, which essentially is just a way to hedge some costs that are applied to that so --

MR. KAMATH: That's right. I think that the work that's been done on the grid -- on grid storage is less visible than EVs, since EVs are, you know, a consumer product, and, in effect, can potentially affect everyone. I think that there hasn't been quiet as much work done by as many states in terms of grid-based storage, but there are quite a few states that are looking at that.

CHAIRMAN FAY: Great. Thank you.

Commissioners, any other questions or comments at this time.

From the entire Commission, I really appreciate you taking the time to travel and be here and update us on this content. I know EPRI is involved in a lot of different issues, and we were just in DC to hear some about what -- what you are doing, and so greatly appreciate that work, because

it's very helpful to us, and once again, appreciate the resources that you provided.

So occasionally, maybe one of our offices will have a follow-up for you, and we will make sure that we have that contact information distributed to them. But once again, thank you for being here this morning.

We have other items on our agenda, and so you are not required to stick around for those. You are welcome to head back home. But once again, thank you for your time.

MR. KAMATH: You are very welcome. And thank you for the opportunity.

CHAIRMAN FAY: All right. Commissioners, next we will move to our other items on our agenda.

We are going to be take up the legislative component within our Executive Director's report, so I will next recognize our General Counsel for the General Counsel's update.

MR. HETRICK: Thank you, Mr. Chair, and good morning, Commissioners. I have no report this morning.

Thank you.

CHAIRMAN FAY: Great. Thank you, Mr. Hetrick.

Mr. Baez, you are recognized for the Executive

Director's report.

MR. BAEZ: Thank you, Chairman. Good morning, Commissioners. And thanks for indulging the change in the lineup.

I just wanted to introduce Lance Watson, who is our new Legislative Affairs Director. He just joined us last week, and he is already hard at work keeping us out of trouble in the hallways downtown. I am going to hand it over to him, but Lance, as one alert Commissioner pointed out, is an FSU grad, and we -- I certainly forgive him for that.

He has -- he comes to us with a fair bit and a broad range of experience at the, both federal and state levels. He worked for Senator Rubio once upon a time. And most recently was working at the state level for the Fish and Wildlife Commission, so some good agency experience there. And we hope we will bring all of that experience to bear in our benefit. Already happening.

Without further ado, if you -- I urge you all to reach out and say hi, introduce yourselves. He is not at a loss for meeting new people and making new friends. And so if you want to know anything more, by all means, I dare you to ask him.

Without further ado, I am going to hand it

over to Lance to give you a quick update on legislation that we have been watching.

CHAIRMAN FAY: Great.

You are recognized.

MR. WATSON: Thank you, Braulio. I appreciate that. Chairman and Commissioners, good to see y'all this morning.

I won't take up too much of your time today, but I just wanted to kind of give y'all a brief update on what's happening in and around the Legislature.

We are currently in our last week of committee meetings before session officially starts in two weeks, on March 7th. It will run for nine weeks, and end on Friday, May 5th, unless they need to extend that for budget reasons, whatever it may be.

There are a couple of bills we are monitor -- keeping a close eye on this year, one being a Senate Bill by Senator Anna Rodriguez. This Bill authorizes the PSC to designate commercial mobile radio service providers, which we already -- my understanding is that we already have authority for the wireless, but -- oh, we already have authority for the landlines. This would be mostly for the wireless. This bill has been assigned committee

references, but has not been heard in committee yet.

Probably the biggest one we are taking a -- keeping an eye on this year is House Bill 125 by Representative McClain, and Senate Bill 194 by Senator Ed Hooper. This is what we have deemed the fair market valuation bill.

This bill would authorize a water or wastewater utility to petition the PSC to establish a rate base of a purchased system using an alternative valuation methodology. This bill was heard last week, last Wednesday, February 15th, in the House Energy Communications and Cybersecurity Subcommittee, and was voted favorably, unanimously, 18 to zero, out of committee. Its Senate companion has not been heard yet.

And then lastly, we are also taking a look at House Bill 821 by Representative Yeager. This bill authorizes public utilities to recover prudently incurred renewable natural gas and hydrogen fuel infrastructure projects costs through the appropriate PSC cost recovery mechanism. This bill was just filed on Valentine's Day, and has no movement so far.

Other than that, the House and Senate have

requested nine bill analysis from the Commission. We have submitted seven of those, and currently are working on the other two.

I am sure you all got my email last Friday, but be on the lookout for those. They will happen weekly starting, you know, week one of session, all the way through session wrap, recapped in week nine.

And other than that, please feel free to reach out to our office if you have any questions specifically. We would be happy to sit down and discuss anything with y'all.

So other than that, I just want to say thanks to everyone welcoming me last Monday. I had a good first week. Excited to work with you all and the great staff here at the Commission. So I will take any questions if y'all have any. But again, just want to say thanks. I am excited to be here.

CHAIRMAN FAY: Great. Thank you.

Commissioners? Commissioner Graham.

COMMISSIONER GRAHAM: Just is a quick question. Are they speaking about -- are they talking about any sort of funding mechanism behind those two bills?

MR. WATSON: That I might defer to Braulio on

that specifically, but I don't believe so.

MR. BAEZ: Nothing included in the text of the bill, Commissioner.

COMMISSIONER GRAHAM: Thank you.

CHAIRMAN FAY: Great. And I am excited to have you onboard, beside the FSU Seminole connection. I joke with our General Counsel a lot about our recruitment of, you know, four and five star recruits, and how essential that is to building our team. And I think we are -- we are ironically starting to look more like FSU, and I consider you more a transfer portal kind of acquisition in that you already have a significant amount of experience and are extremely qualified to be here. So we are glad to have you as part of the team, and know that you have jumped right in being downtown last week and everything, so we appreciate that, and look forward to working with you.

Commissioners, any other questions?

With that, that will conclude our Executive Director's report, unless you have anything else, Mr. Baez.

MR. BAEZ: A quick reminder. PURC starts tomorrow, and many of you have program -- part the program, so we look forward to seeing everyone

there.

CHAIRMAN FAY: Great. Down in Gainesville, Florida, is that correct?

MR. BAEZ: Down in Gainesville, Florida.

CHAIRMAN FAY: Thank you.

With that, Commissioners, any other matters for the IA meeting?

Seeing none, that will conclude our IA meeting. We will be back here at 10:25 to begin the Special Agenda.

Thank you.

(Proceedings concluded.)

CERTIFICATE OF REPORTER

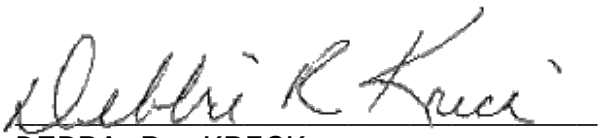
STATE OF FLORIDA)
COUNTY OF LEON)

I, DEBRA KRICK, Court Reporter, do hereby certify that the foregoing proceeding was heard at the time and place herein stated.

IT IS FURTHER CERTIFIED that I stenographically reported the said proceedings; that the same has been transcribed under my direct supervision; and that this transcript constitutes a true transcription of my notes of said proceedings.

I FURTHER CERTIFY that I am not a relative, employee, attorney or counsel of any of the parties, nor am I a relative or employee of any of the parties' attorney or counsel connected with the action, nor am I financially interested in the action.

DATED this 6th day of March, 2023.



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