Meeting Minutes

April 16 – 18, 2024

GWAC Members

Ron Ambrosio, Independent Energy Transformation Professional, Acting Chair

Kay Aikin, Founder, CPO, Dynamic Grid/Introspective Systems

Andrew Bordine, Sr. Practice Manager, Grid Automation, Actalent

Shawn Chandler, Director, Guidehouse

Marc Costa, Dir. Policy Planning, the Energy Coalition

Lorenzo Kristov, Principal, Electric System Policy, Structure, Market Design

Ahlmahz Negash, Sr. Power Analyst, Tacoma Power

Mark Ortiz, Lead Architect, Snyder Electric

Farrokh Rahimi, Executive Vice President, Open Access Technology International, Inc.

Aaron Snyder, Dir. of Grid Technology Consulting, EnerNex

Leonard Tillman, Partner, Balch & Bingham, LLP

GWAC Associates & Emeritus

Mark Knight, Emeritus

Ken Wacks, Emeritus

GWAC Guest Speaker

Chris Irwin, US DOE OE

Ali Ipakchi, OATI

John Lundstedt, OATI

Jim Jones, Great River Energy

John Reinhart, Great River Energy

GWAC Friends

Larisa Dobriansky

Doug Houseman

Anthony James

Harry Peterson

Alaa Mahjoub

Stephan MacDonald

Dave Wollman

PNNL Support

Jaime Kolln, PNNL GWAC Administrator

Ron Melton, PNNL GWAC Administrator

Susie McGuire, GWAC Coordinator

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GWAC F2F at OATI May 16 – 18, 2024

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Thank you to OATI for hosting us at the Microgrid Technology Center!

OATI - Day 1

Chair Ron Bernstein opened the meeting with Quorum. He thanked OATI for hosting the meeting.

Jaime Kolln gave a brief review of the day's agenda. He asked for a motion to approve the March GWAC meeting minutes.

The March GWAC Meeting Minutes have gone out to the Council. David Forfia gave a motion to approve the minutes and Kay Aikin seconded the motion. With no objections the minutes were approved.

New Member Welcome

Jaime Kolln introduced new GWAC member Marc Costa and Shawn Chandler.

OATI Welcome and Introduction – Mary Brown, Sr. Executive Vice President, and Chief Legal Officer

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Marc Costa with the Energy Coalition introduced himself to the Council. He is a director of Policy and Planning with the Energy Coalition. He noted that the Energy Coalition is a non-profit that has been in business for 45 years and serves over 300 public agencies

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What we do

TEC is creating the building blocks for a **new energy economy** in which communities become energy-producing networks and clean energy becomes **affordable and accessible** for everyone.

Program Design & Project Implementation	Education & Workforce Development	Marketing & Outreach	Policy & Planning

He noted that the world is not on track to achieve the Paris Climate Accord. California is not on track to meet its own goals

Marc looked back at where technology in 1996. He commented that most technology is rolled out with a siloed approach.

He commented that the OATI Facility is a good example of where we need to go.

We have tools in our toolbox, but we need to use them. To modernize the grid, we will need different results than what we have.

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Where we are today

- Fixation on efficiency first
- Siloed funding buckets
- Single-trade workforce
- Rising energy prices
- Extreme weather events
- Financial hurdles for projects
- Customer dissatisfaction with status quo

DER is like a medicine for our ailments

Sequencing is what matters. Many affluent homes have solar now.

The Energy Coalition looked at doing solar for just water heater and cooking. Then if adding heating and cooling it made a huge difference.

Marc noted they look the intersection of people and buildings.

NEW

Loading Lanes

Energy Efficiency
Electrification
Demand Flexibility
Renewables
Storage
Virtual Power Plants
Grid Services

The simultaneous pursuit of all cost-rational and efficient integrated decentralized energy resources required to achieve economy-wide decarbonization and optimize expenditures related to power systems infrastructure.

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Why rethink our mentality?

- We need different results
- We have a complete toolbox, but are only using one tool
- EE isn't the only path to reduce carbon in buildings
- DERs are absent in many local government climate action plans
- DERs are a gateway intervention for electrification
- Value stacks are being left on the table that address financing hurdles
- DERs induce customer decisions to electrify (TECH CA Heat Pump program)
- The grid needs buildings to play a larger role in our power system

Marc presented some data on how and why sequencing matters. The Energy Coalition has some ideas about how to use data to forecast how changes could impact energy usage. They are looking at helping people out of energy poverty.

Marc's talk stimulated a good deal of discussion. Restructuring the order of operation is how Chris described Marc's perspective and the energy coalition perspective.

Ron Melton said people have to figure out how their piece of the puzzle fits with someone else's piece.

Jaime commented that guidance on how to bridge between systems requires system architecture. Looking from the bottom up; how to look at one capability and describe it in an architectural way and make recommendations.

Ron M. said bringing various organizational representatives to the Council to cross network and give their perspective is a way to foster energy system architecture.

Kay Aikin stressed the need to help regulators understand. Kay asked Chris about the issue.

Chris said that DOE can follow best practices, but they don't have the power to tell utilities what to do. DOE Is trying to have a convergent perspective on all the grid edge capabilities. In the guidance they help groups become sophisticated entities as they understand grid edge. We can provide in our guidance as we build the maturity model for Grid Edge. The guidance needs to be non-judgmental.

Marc gave a few examples of savings and said that even though they lean on regulators, there's only so much power in what local governments can do.

Kay said that great buildings integration won't happen unless there is value transfer.

Chris said some of the conceptual things you lay out in the order of opportunities to consider; if efficiency is like carving closer and closer to the bone and confining your capabilities to a smaller and

smaller envelop over time then you neglect so that the additional extended benefits of flexibility. So, if you have a building that is flexible during blue sky and resilient during black sky then you have that kind of liquidity perspective. That's the kind of thing you are getting to is the need to rethink the order of operations.

Ron M. said this underlines the point made earlier; you need to have the four holistic architectural viewpoints to understand how all these things act on others. It seems like there is a tendency for any given group to want to be the hero who saves the planet, so they start chipping away at what they think they can do to be the hero. In doing that they put blinders on without being aware of how what they are doing relates to everybody else.

Ron Bernstein commented that the problem is so big that it can't be solved by any single entity. No one is going to change everything they do to meet some coalition's goal. No one has global authority. You have to pick and choose your battles to move the needle. He said that this is the first time he's seen anything on the code level starting to get into communication interoperability and it covers things that the Council has talked about including integrated systems. He gave ASHRAE as an example and they are starting with the scope that they know which is heating, air conditioning and refrigeration. It's a big piece. But they are not going to adjust what they do for a goal from multiple organizations.

It just doesn't work that way. We're dealing with a bottom-up problem, not a top-down problem. Somehow, we've got to meet in the middle. You just have to pick your battle in order to move the needle.

Jaime Kolln introduced new member Shawn Chandler.

Professional History

- **Director at Guidehouse, Solutions Lead for the North America Western region**
- **Chair of IEEE's P2418.5 Blockchain for Energy – Interoperability Taskforce** since 2020 advancing the application of distributed ledger systems in our industry. Leading the editorial team for the standard development process, standard guide to be released 3Q 2024. Also member of IEEE P2030.14 VPP WG.
- **Founding Chair of the IEEE PES Smart Buildings, Loads and Customer Systems technical committee**, advancing standards for grid interaction with distributed energy resources behind-the-meter.
- **Past Chair of IEEE Smart Cities steering committee**. Invited participant in both the U.S. National Governor's Association *Smart States* initiative, and the U.S. Congress *Smart Cities Caucus*. Contributing author to the United Nations 2050 Roadmap for Sustainability.
- Serving on **the editorial board of the IEEE Internet of Things Magazine as an Associate Editor** since 2019. Adjunct in PSU's graduate power systems EE program.

44:16

GRIDWISE Architecture Council
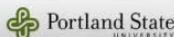
Shawn Chandler is the Director at Guidehouse, Solutions for the North America Western Region. He gave an overview of his involvement with IEEE, and he noted that he is an adjunct professor at Portland State University since 2012.

Shawn shared an IEEE definition of Blockchain:

DEFINING BLOCKCHAIN DLT INTEROPERABILITY

"Blockchain DLT Interoperability" in power and energy is the **ability of distributed ledger computing systems to interconnect and represent** multiple intra- and inter-DLT blockchain DLT-enabled power and energy systems and sub-systems **to register, create, transfer, and ultimately validate digital energy information, services, assets and transactions, across multiple ledgers** in a secure, scalable, trusted and administered consensus approach."

Source: IEEE P2418.5 WG

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We're going to just talk a little bit about blockchain for energy blockchains which more recently has gotten a bad name because of failures in the system to govern that the way that financial markets and blockchain integrate; this is completely different.

He read the IEEE definition of Blockchain in the energy industry as defined by IEEE.

Shawn said if we pause for a moment and talk about this – it is a consensus approach which is really important when we start to think about blockchain. He went on to say there are the IEEE blockchain work group recommends a "proof of authority consensus," which he described. It means that a regulator would run the blockchain and they get to say exactly what data is on the chain. So, there would not be a proof of work done. This would keep the amount of energy needed for the process to be incredibly low. This would mean blockchain participants would be regulators, market participants, consumers, utilities and so on.

Shawn stressed the need for transparency to every member of the chain – everyone has the same information. He said perfect information is what everyone wants. They want to find equilibrium to achieve lowest cost – so perfect information is needed to make the right decisions. In this ledger you can exchange tokens of value with no money involved. He sees the value of blockchain to energy management with nothing to do with say bitcoin.

He said that operational tech, Enterprise IT, customer facing, the DLT market all require– ledgers for processes and transactions and smart contracts.

A smart contract is code inside of a blockchain.

The system needs to know what membership the information has.

Seeing everything all together at the same time, and to have trust in it – if the edge changes quickly then the system needs to note that it's no longer available.

He noted the whoosh of the dot.com boom, the use of http was an "ah ha" moment; everyone wants to use the same technology all at once and it affects civilization. But it takes energy and interest to adopt it. We have to really pay attention. Distributed Resources today are tough to control because of the communications path. Planning and modeling is really slow. Blockchain crosses these barriers to give success in reliability and operations. It gives smart contracts and distributed resource transparency about what is happening at the edge. When the resources are available it can be written, but it takes time to copy to everyone. Maybe between reliability and distributed resources there is a bridge. He noted that transparency gives trust.

Chris Irwin said with ORNL he's been looking at blockchain for substations to create a ledger, so that there is an immutable record of sensory data within the substations. They are looking also at protection of this equipment; can it be an attestation of accuracy such as with other people's data from sensors.

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Once you create a high value source can it work for multi-user domains and secure immutable citadels of data using blockchain.

Ron B said buildings industry people are not talking about blockchain. Is there value beyond the mathematical?

Shawn replied that we don't find many groups discussing blockchain. Just a few people are discussing it in industry. He shared his experience with IEEE and has seen some new interest in adding it to standards but moving it to practice in the industry is a challenge. The value proposition is in linking regulators with market participants, utilities, and consumers into the same data store.

Shawn said that the term Oracle is for a device that is trusted by the blockchain and can put data from any source onto the chain. It's an administrative consensus method. Right now, there are no standards for how the Oracles act. Smart meters and their calibrations accept data from any resource. He related it to Chris's sensors at substations. Blockchain records data but it is not a calibrator.

Ron B read Alaa's question aloud:

Alaa Mahjoub (Guest) 4/16 7:53 AM

Thank you for the presentation. I have the following question:

The sheer volume of transactions generated by millions of devices constantly exchanging data in a smart grid can overwhelm traditional blockchains. This can lead to slow processing times, hindering real-time operations. Does this pose a serious challenge for integrating blockchain technology into smart grids?

Shawn replied saying that it can and he could refer Alaa to others with more expertise in this area of communications. It presents a question as to why we would want to point millions of data points on the chain when there are other devices to hold them. We may need to be more selective about what goes on the chain. He said we have to be careful about what goes on the chain and make sure that we are fulfilling the ledger. There are other places to put data.

Ron Ambrosio added that blockchain doesn't lend itself to be part of the control layer. He agreed that the types of uses are correct and added that we need to have high performance control layers that can elaborate for ledger purposes.

Shawn agreed and said the importance of the control function in the sub-second layer –might be hindered by time – you make the decision and then after the fact you record the time and date the decision was made and supporting info. Certain things can be automated. Safety and reliability are a concern.

Shawn said that perhaps the most important thing in the energy industry is how time works. We must pay attention to reliability and operations and that is happening at the subsecond, and he gave an overview of time across the industry saying that blockchain crosses all of the time domains and can allow us to administer data in a new way that gives success on the side of reliability and operations. It

supports smart contracts; it gives us a vision into what's happening at the edge. There may be a bridge between reliability and operations to distributed resources. There would be a tremendous amount to do in planning and modeling. It can provide transparency and thus trust.

Shawn thanked everyone for their time today.

Chris Irwin said one of the things he's been exploring with ORNL is trying to confine the DLT exploration. They began with inside the boundaries of a transmission substation. The question they were trying to resolve is can you secure the data and put it into an immutable ledger and tasks of that sort in a way that regardless of anything that happens you would have an immutable record of all the sensor data and decisions made on sensor data within.

Chris went on to say that with substation boundaries and things like that, we've tried to create an attestation framework. Within the transmission substation, you have a high integrity of expensive equipment, and you can afford expensive protections there. If your cyber security is good, your immutability is off the charts and your sensors are highly calibrated, high functioning things. So, you can use that as an attestation point; as a trust anchor to them.

I don't know if that is different from Shawn's talk, but the idea is that once you create a high integrity data source, you can use it to validate other data sources with more unknowns associated with them. It's a way of exporting one of the values of blockchain beyond its own boundaries into a sort of user domain.

This could then broadcast trustworthiness and the credibility of other data sources beyond the noted boundaries.

Chris Irwin told Ron Bernstein that he gave his permission for GWAC to publish his previous talk on the GWAC Website. And he gave permission to record and post today's talk. Min. 1:53:52/3:22:29

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Jaime Kolln shared a recent PNNL publication on Common Grid Services: Terms and Definitions: https://www.pnnl.gov/publications/common-grid-services-terms-and-definitions-report

Chris Irwin presented "GWAC Salon" which he explained reflects how he sees the GWAC which is an assembly of very smart people who care very deeply about the electric system and how participate in various parts of it.

He noted that we re all deployed to different parts of the elephant and biased towards progress and innovation.

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Surely you jest, Messieur Irwin?

GWAC Salon – Inspired by the 18th century definition

- Salons are social places where we discuss with spirit and where we find out about the latest literary, artistic or scientific works.
- **Data – Macro and Micro Perspectives**
- **Grid Edge and Grid Services**
- **Degrees of Observability and Degrees of Controlability**
- **The Regulator's Dilemma**

He explained his use of the word "salon" for our purpose today. He refers to the 18th century definition which refers to social places where we discuss with spirit and where we find out about the latest literary, artistic, or scientific works

He noted that the stakeholders at the DOE OE are trying to articulate the best language.

For data he will review micro and macro perspectives.

Data – Macro and Micro Perspectives

- **An Electric Sector Data Strategy**
- **Total Available Data**
- **ODIN**
- **Green Button**
- **Grid Transparency**

Chris said that large scale data strategy interests him, and some current EU initiatives interest him. If data is the new oil and everyone on the planet is producing data, then it is essential to our economy.

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We need that perspective to choose the way we work in society. We have done some work in exploring an electric sector data strategy. He noted that there have been some good webinars on this topic arranged by his DOE colleagues Sandra Jenkins and Roshi Nateghi. We ended the webinars with an in-person Data Summit where some big thinkers came together to tackle the issues.

We need the data strategy because everybody has data, but no one has enough data to accomplish their own objectives. You always need data from somebody else. That didn't used to be the case. Utility creates its own data and uses its own data to work on and everything worked fine. As we move into the future the building operator and microgrid operator is no longer complete. Everyone now needs data from others, and we have the worst mechanisms for sharing data. We have to create a platinum level of trust with each person. It's not a good strategy.

That's the first macro perspective that we are trying to move out – a big picture articulation of what a data strategy for the entire electric sector.

Data originates in devices that permeate the grid. Every second of every day data is created and originated at a specific place and time so there is a mathematical definition of the amount created on a per second per square kilometer basis that is relevant to the electric grid.

Once you have that every meter, every recloser, every substation, every inverter beyond that. All of how this data is being originated. Some of it is being used right there and it never goes any further.

A small percentage of it is moved so we move that data back towards our enterprise and things like that.

Until you know the total data picture you are incapable of deciding what information and how much needs to move and how to plan your communications network for the next five years.

So, with that total available data ground floor, you can decide how much data do I move today with the emergence of renewable assets, how much new data will exist in the new landscape, and how can I plan my communications needs and rely on the communications capabilities of others?

With that, those are the two macro perspectives.

He will pause and get some thoughts and feelings from you.

Ron M said about the entities noted and what they would need to do is not clear.

Chris said he may have fixated on this in a previous GWAC discussion; if they are an engineer, they *know* in their hearts that they need all the data. He said it's like NERC, they need all the data that they are charged with to be responsible with their charge.

Chris said there is no comms network that could handle all the data. So, it's trying to teach people to think about acknowledging the existence of data and then thinking strategically about what information derivatives do I need at my level of the TD interface to understand the transmission distribution prior actions and things like that.

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Ron M. asked what is the lifecycle of the data? He referred to work he had done with Don Hammerstrom about ten years ago about this question. With the Smart Grid Demo project, they observed that for the data they were dealing with it seemed to have a useful life of perhaps minutes or days. And do we need to save the data after that or discard it.

Kay added that she also noted her first project with Chris looked at communications. More recently, at the meeting in Ireland, she noted that the building sector in the UN is really concerned about data centers and how much power is being set up in the system. The hard drives needed. The key is to figure out our data requirements and eliminate as much data as we can to optimal flows. If and we really need as much data as we can get to operational levels. If I'm working on millisecond stuff that stays in the micro control, there's no reason to kick it upstream. If I'm staying at the building level all we need is services provided.

There is a concern about how much power we are setting up in the system to save all of this data. We're going to have to have drives and more stuff. We have to make data centers more efficient but that is not the solution. The is to figure out our data requirements and eliminate as much as we can.

We don't' need to send all the data, so we really do a poor job with that.

Chris agreed and said we have to determine how far the data needs to go and does it always need to be the source or the raw data or can it be a derivative product? And what is the lifecycle of the data.

Lorenzo Kristov asked - Architecture question about roles and responsibilities? Who's responsible to do what. He feels that data follows roles and responsibilities. Who needs what because they are responsible to do something. In a changing environment with DER Technologies, we can't just take the existing roles and responsibilities of the existing actors as a given. It may not stay the same. He's thinking about 2 things; one is the distribution utilities and that goes to the TD interface, but it also goes to the third-party DER developers who may be developing microgrids and local energy resources. The industry, particularly in the US hasn't come to grips with what the responsibilities are for a distribution utility in the new world.

To what extent do we want third parties to develop micro-grids? Do we want microgrid at all? To what extent do we want to retain the traditional monopoly structure of utilities versus to enable competition to move forward. We need to discuss these kinds of things to determine what things are needed and for what functions?

Chris Irwin thanked Lorenzo and added that we could start with asking what data to they need, what data do they think they need and what data do they deserve?

Chris added there are multiple ways to approach that and once we have acknowledged that rich data exists, it doesn't mean that we should move it. It also doesn't mean that everybody should have it.

Jaime added that it might include compensation. That might be upstream.

Farrokh Rahimi added that there is no shortage of data. The main issue is data classification for easy of acess.

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Farrokh asked if provisions must be included to identify useful data from erroneous or suspicious data that if you use it, you might get the wrong results. He said, I don't see any role listed here for AI or machine learning and how you could massage the data to extract information useful from the data and then the information may be relevant if I'm an institution, utility, or an aggregator and so on.

Chris agreed and said there are some large-scale things that will need to be discussed in terms of the expected utilization rate of data. We don't maximize the use of the data that is created because it's so cheap. No one knows what responsible utilization rates are. Without strategy we are a bit in the dark.

Ron C had a chat comment – he said he doesn't see anything here about data sharing or availability and making it open but not freely give it to our enemies, domestic or foreign who may want to destabilize the grid. We have to balance against data and information that needs to be protected. Can info be generalized for use?

Chris thanked Ron C. for bringing this up. There are real and perceived threats in the data discussion, and some are artifacts from old worlds. We don't choose to live in a totalitarian world. We don't want to discuss overly conservative perspectives. He will discuss this more later.

Chris had an answer to a question that Mark O hadn't asked yet: Being in a strategic position with the grid to see how entities are gathering and receiving date and how to use data do you have insights into evolution of the utility perspective on data today?

Mark said yes and that like cyber security, zero trust architecture. Cyber security is embedded in the first phase before you are developing things. He added that typically how apps or platforms are developed with personas, you can have these use cases and then you think of your data models and how you integrate.

Mark said he thinks that we need to think differently and have the data models well defined across the entire landscape. It's not just with grid or buildings and how things connect; and have that as your first start. Then everything is built on top of that.

If you flip that, I think you will find that you can create new application capabilities a lot quicker versus everything we do with data transformation and scalability. It amazes me that we are still dealing with the same problems for so many years. If we can shift our mindset, I think we could have a different way of development.

He said if we could have a semantic model for different placements and create a unified model and then everything from platform services and edge services are all derived from one common model and then we could extend it. Like with IEEE 2030.5, they are based on a CIM model and that's a good start.

He said when you get to the building side and those points of coupling, the way he likes to work with a lot of R&D – they way they develop the models are not part of the first stage of development platforms.

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Andy added that he thought the data itself is pretty well defined but getting rid of what you don't need would help. The speed at which it's needed, is increasing. Ideally, we could be operating in a real time environment.

Chris – Gil Bindewald has shown is that with a straight road, like a slow dynamics grid, you don't need a lot of control to stay on the road. But then with a curvy road, like with more dynamics, it takes more to say on the road. The metaphor is interesting. We don't have a way to predict the amount of information we need for a net increase in the dynamics of the system. For now, it's like we'll know when we get there. That's not a strategic vision.

Chris mentioned the ODIN – a Nationwide Outage Data Initiative – it's an interoperability play – a way for utilities to in a standardized way get outage data reporting feeds at the OMS interface. The idea is that a utility can post its outage map and that would be a data destination and it could be a data service

It's been one of the most successful open data initiatives ever, far more than even Green Button.

At the present time there are two families of standards under ODIN. IEC 61968-3 which has got outage data terms. The other standard is MultiSpeak. So, we have an IOU path and a Muni and a co-op path to achieve interoperability. The data on ODIN is the real time outage data. It gets the utility to provide the fee. It's right now serving 130 utilities including very small entities to very large investor-owned utilities. It covers about 100 million customers.

Real time outage data that can be archived. We have a really big footprint. The number of use cases where the data arrives and fuses with your own data is powerful.

One application is the SNAP program. When we have a power outage of over 6 hours SNAP replaces food that has spoiled. SNAP has to call the utilities to see if there has been an outage. If we could change this onerous process to be automated that would save time and be more efficient.

TESLA is interested in data for resilience. Charge network operators could use this data.

Green Button is a customer data access initiative. It creates lots of great customer empowerment, but it has not really taken off. Utilities fear sharing data. They fear of being held responsible in case of a breach. Afraid that they may be missing opportunity. So, utilities are slow to implement this. There are huge benefits for developers if they could use this data.

Customers should not be made blind to the system. The level of blindness at the grid edge is too high. Grid Transparency can be a reimbursable service, but the problem is how to address vulnerabilities.

Kay recalled from the last GWAC meeting that there is a lack of understanding. We need this data for gas and electric power.

Chris noted that Ontario Canada has set mandatory green button data requirements for gas and utilities. They need to be Green Button certified. Connect my data says were the data goes.

Lorenzo asked to what degree of granularity does ODIN go?

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Chris replied that this is a concern. We have asked for county or zip code level outage data. Some utilities do offer this. A finer level of detail would have to be reviewed.

ODIN has its own agenda which is to make data available for the social good. And it can teach utilities what it would be look to be both an energy and an information service provider which could be a wonderful innovation and may change the way utilities think about themselves.

Chris replied to a question from Farrokh saying they have had discussions about power safety shutoff and things like that. We considered outage prediction, outage announcements and unexpected outages, plus restoration messages. ODIN could, if curated in real time and massaged to be an automatic filing of the OE 417 form, that could save a lot of effort.

Ron M said sometimes data shows that there was an outage but no information about the length of the outage.

David looked at the ODIN map. It plays more at a geographic scale. There are geographic smart hub maps – we can see there was an outage and a response. The use case is to limit trouble calls.

Chris sees it as able to send a text to the repair center or even response truck.

David said the human element is still needed to know what equipment would be needed to resolve the outage (what happened, what is needed).

Chris said Ford Motors could be the customers friend in thinking about home energy needs, and Tesla also, storage for home energy needs and applications. He added that the amount of rolling energy storage with EVs will forever morph stationary energy storage.

Utilities are defending the grid against DER. How can we change the relationship so that it doesn't erode the assets of the utility grid. If new edge devices are seen as driving chaos it will hamper what could happen.

Chris talked about monopoly grid serves vs those that are negotiable.

Lorenzo commented on the mix of monopoly vs competitive saying; as far as the utility goes, I see regulators and states stuck in a revenue model rooted in kilowatt hours. How should the services be priced and paid for? Maine has started a statewide DSO study. Non-energy benefits, 100% carbon free goals – the conventional cost-benefit for DERS is also the ability to be carbon free and for energy and equity benefits. He asked what do local resources do to advance local justice and equity?

Lorenzo said there will be a CC proceeding starting this summer to look at ways to measure non-energy benefits. And it was prompted by a very smart petition filed by the Center for Biological Diversity. He would be happy to share that information.

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Stephan McDonald commented that he liked this slide and asked Chris if he can comment on the value of demonstrating this? He said a lot of demonstrations do well with scoping value, but they don't do anything to make it long lasting.

Chris replied that A demo or pilot is a construct. It gives people enough space to not take the next step.

It comes back to the willingness of the participants. Is their pain hypothetical or real? To reach a decision point that can be informed in a timely manner with the demonstration. The flexibility to pursue these ideas is more possible in the cooperative and municipal space given their permission structure and their business operating position. These entities are more likely to look at this as a co-optimization opportunity. For me the proving grounds is in these smaller entities or with those that you know are well-intentioned and driven and innovative, larger utilities, but those have to deal with a lot more hoops and have a lot more people to satisfy in order to do something aggressive that could then be turned into a scaled program.

Degrees of Observability and Degrees of Controlability

- ## The Illusion of Direct Control
    - Direct, Delegated, Indirect, Influence
    - Proof of Control vs Evidence of Control
    - Contracted Control
- ## Sensing and Observability
    - Direct, Indirect, Delegated
    - Contracted Observability
    - Observability Products vs Direct Sensing

When receiving grid services – I could have a high-quality service, with direct control (an easy button). Most utility grid operators are used to physical control. The illusion of direct control (the switch is thrown).

How can we move forward to make the unreliable become reliable. He gave Uber as an example; the system creates reliability. Likewise, a thermostat can be overridden by humans.

Ali Ipakchi with OATI asked how we can operate a VPP with 30K to 40K in individual assets. He gave the example of operating a power plant. He asked how can you ping every asset every hour to ensure it is still there? The details are composed of 1000's of assets. How do we ensure that most capacities are available.

Ron M – said with the finger on the button, can you compose a reliable system?

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The Regulator's Dilemma

- **Broader Societal Optimizations**
- **Proliferating Alternatives**
- **Sector Interdependencies**
- **Loss of Influence**
- **Computational Impartiality**

break

We are the Council – presentation by Aaron Synder

Aaron Snyder gave a brief presentation on ideas to gain recognition for the GWAC and to distinguish it from the GridWise Alliance.

He suggested that GWAC members work to create weekly LinkedIn posts featuring each member with a standard template or outline and plug in individual content to let people who we are and what we are about, why each of us is on the Council and ideally to add something humorous. Humor is a good way to get people to remember who you are and what you're doing. It would be particularly good to do something like this in the 20th Anniversary year of the GWAC.

Aaron Synder went over this proposal for naming future GWAC conferences while including the GWAC name.

Ron B. suggested we get some marketing focus on the long-term face of GWAC on the website.

Aaron suggested that the LinkedIn posts be created soon to promote the GWAC/RE+ event with a weekly post by one member per week and that it also advertise the GWAC 20th anniversary as well as invite everyone come join GWAC activities at RE+ 2024.

Marc Costa said there could be some small tweaks to differentiate GWAC and GridWise.

Volunteers: Ron B, Shawn C and Andy B will be the first 3 linked in posters.

Mark Paterson joined the meeting.

GWAC Symposium Planning

The Council moved on to discussing plans for the fall conference.

Mark Paterson suggested "leading from the prospective future, rather than "back from the future."

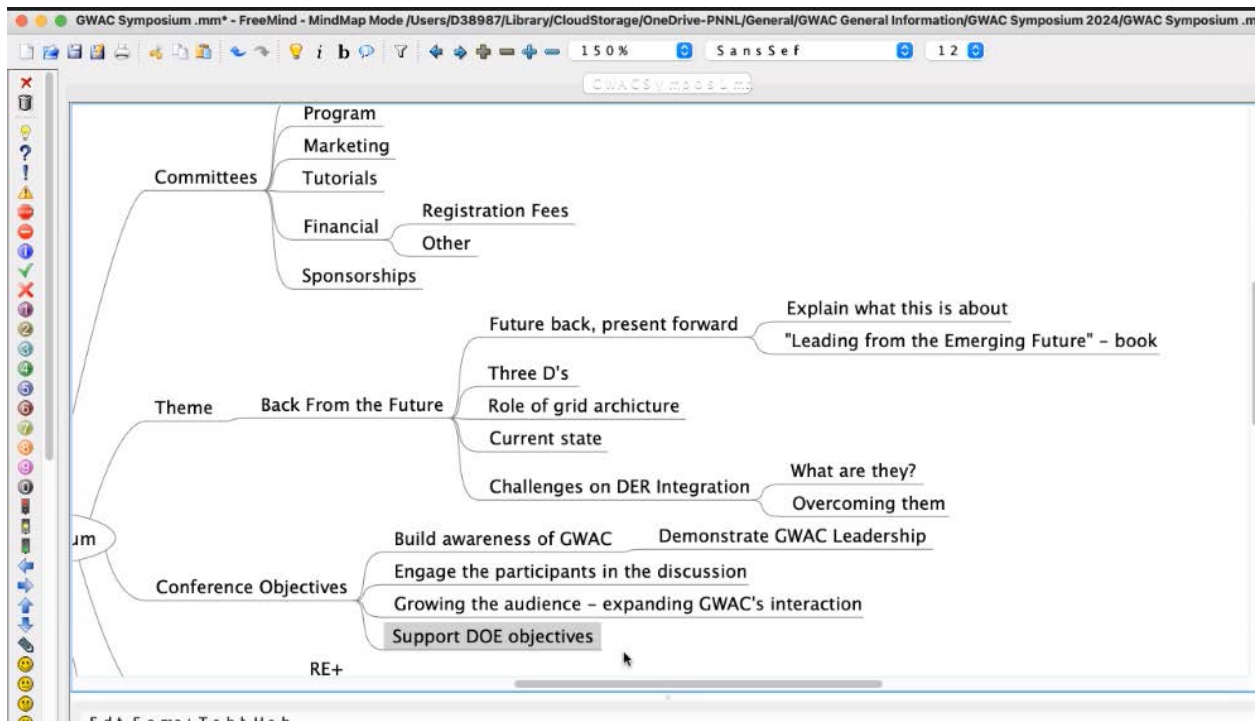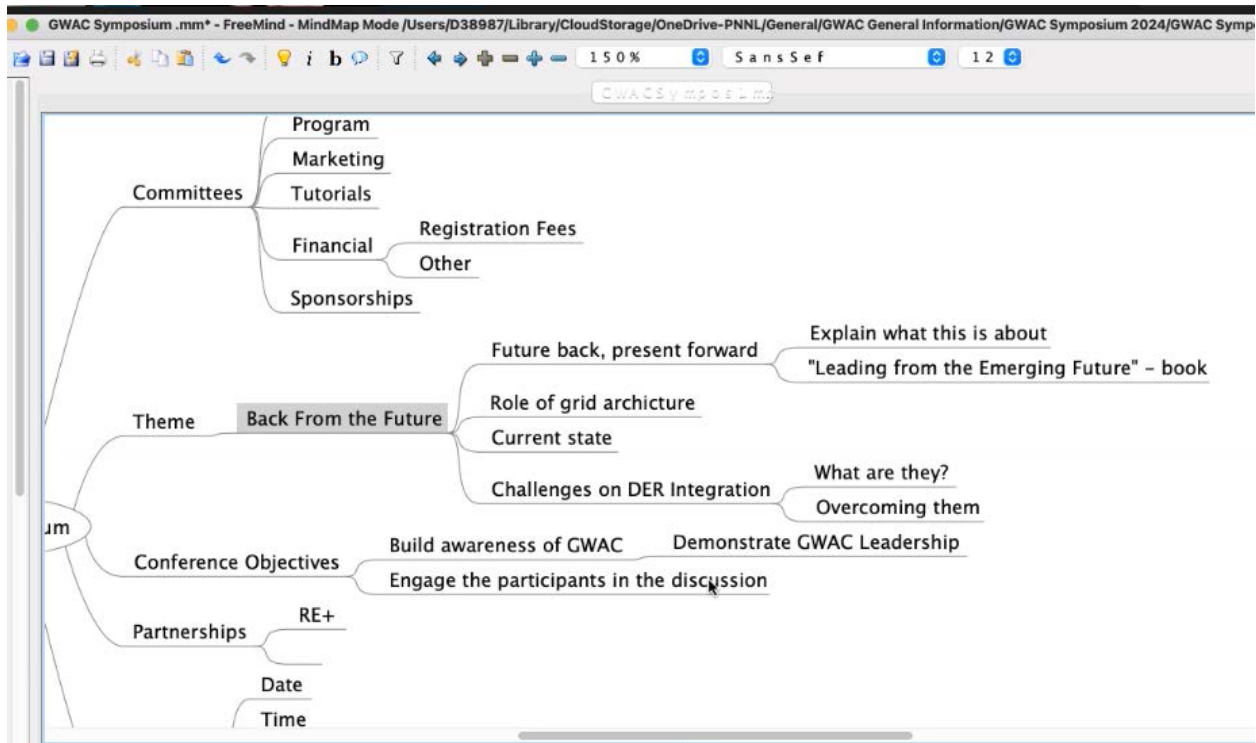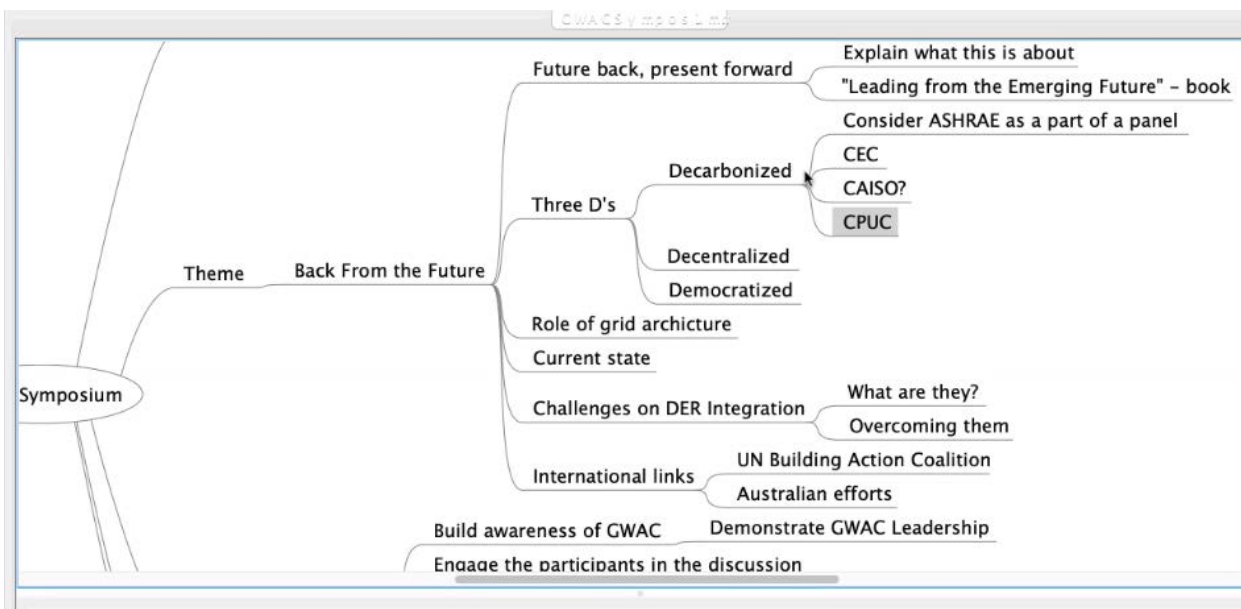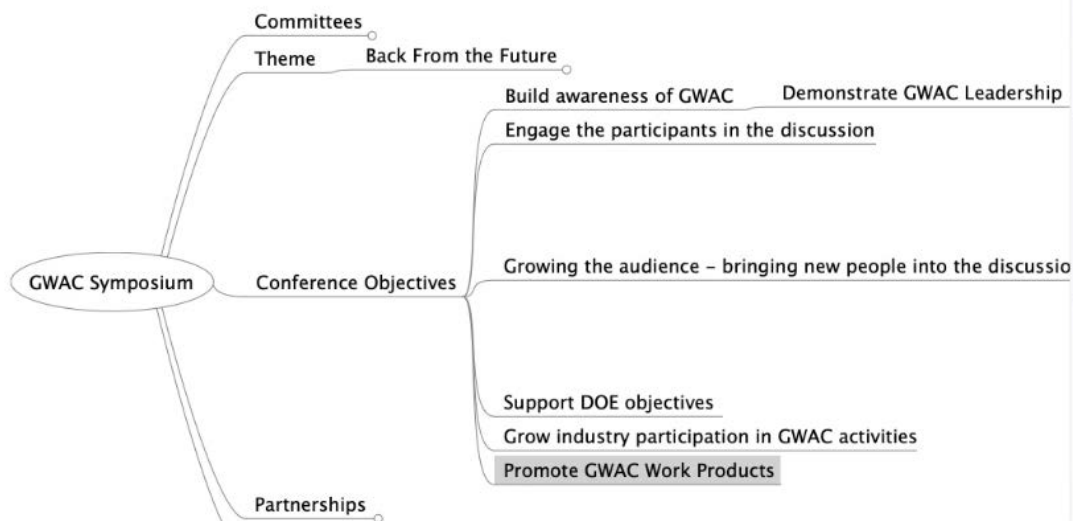# Meeting Minutes
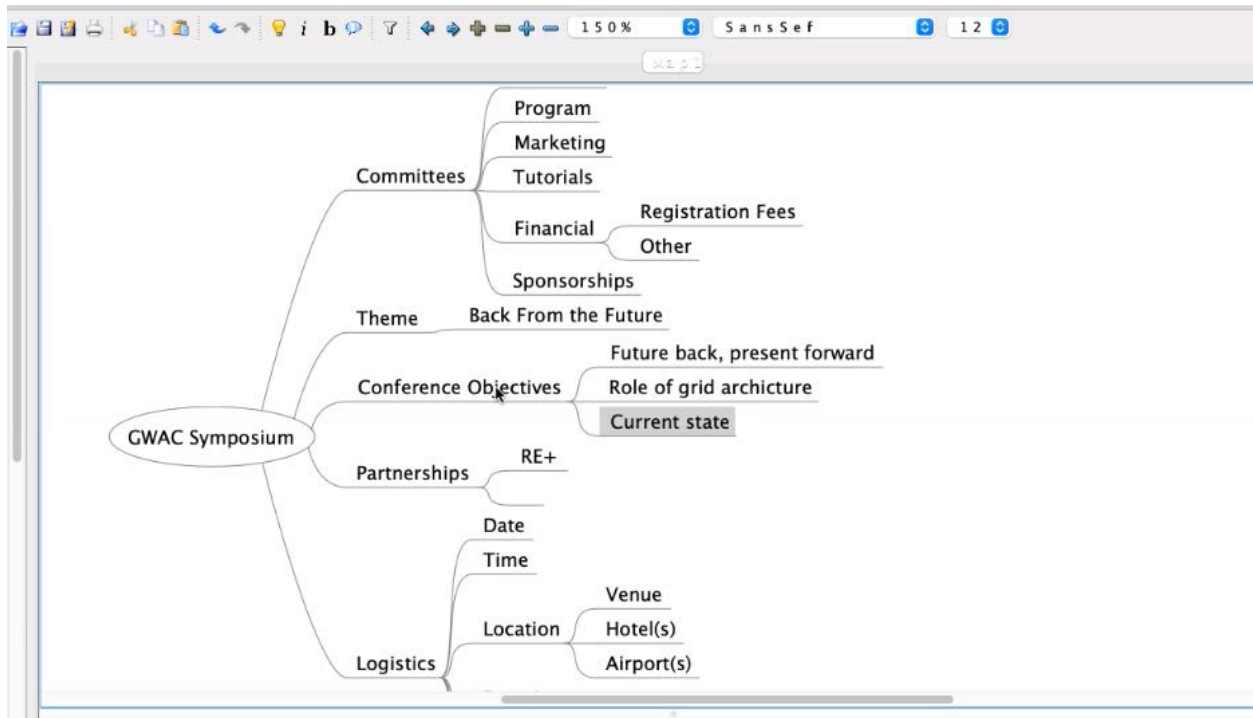
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David Forfia checked and the housing block for RE+ is indicating that only 3 of 43 hotels still have availability.

Scoping Discussion #5 – Proposed Document Structure: Working Draft #1

1. Where is your grid going?

2.1 **Each jurisdiction is different** (different priorities, future visions and trade-off choices – refer to balanced scorecard of outcomes.
2.2 **The important role of future scenarios** (i.e. uncertainty / intro future-back concept)
2.3 **Future scenarios are not enough** (to enable action)
   - Key future requirements must be inferred that are sufficiently common to all plausible scenarios
   - Transition planning requires a future-back process
   - Trade-off choices need to be considered / resolved
2.4 **Recognise the scale of transformation involved** (between current and future grids)

2. Where is your grid now?

1.1 **Traditional grid characteristics**
1.2 **Grids are some of our most critical and complex systems** (incl. NOS)
1.3 **Operational issues now emerging**
1.4 **Conventional approach to change** (present-forward, incremental, no NOS mapping)

3. How will you get there?

3.1 **Understanding how complex systems transform**
3.2 **Confronting the nature of the transformation** (intro 'the chasm' concept)
3.3 **Understanding the contours of the chasm**
3.4 **Key tools for crossing the chasm**
3.5 **Economic, technical and societal costs of using the wrong tools**

Dave LeVee gave a recap of his recent presentation to IREC which covered many aspects of the future grid.

Ron M said GWAC should understand the tools that are needed to execute a process to understanding the future. GWAC is not tasked with predicting the future.

Several ideas for a theme were posted in the chat:

- Architecting the path to the possible (DF)
- Creating the future grid
- Building the path from the future
- Future ready electric grids
- Empowering the grid
- Future grid
- Energy Grid Design
- Transitioning or Transforming the Grid to the Energy Future X
- Architecting a no regrets energy future
- Supercharging Grid Transformation
- Sustainably Transforming the Decarbonization Effort
- Transforming the Grid back from the Energy Future

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- Grid Transformation for Energy Transition X
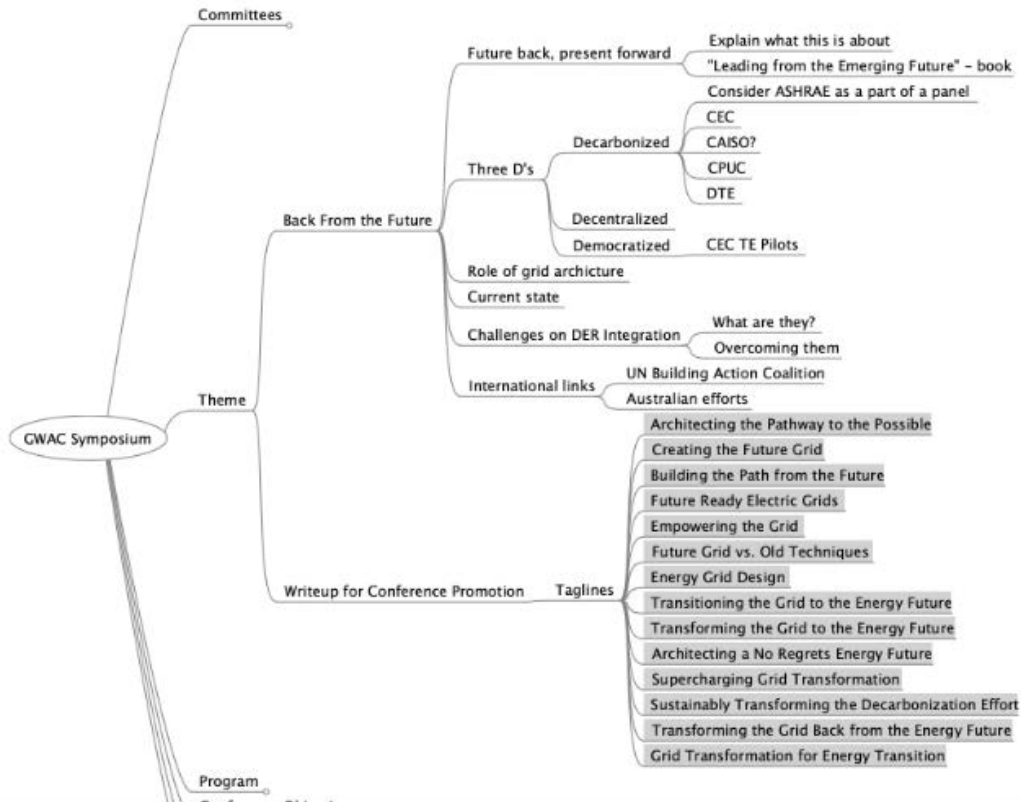
The group took a vote by a Teams Poll.

Chris Irwin said that he liked to see the word "Grid" in the title.

After the vote there were more discussions about the theme.

A new suggestion was put forth:

- Grid Transformation to the Energy Future

This created another set of discussions about the title.

Final discussion:

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Back From the Future

1. Creating the Future Grid
2. Architecting the Pathway to the Possible
3. Transforming the Grid to the Energy Future

Grid Transformation: Future Energy States

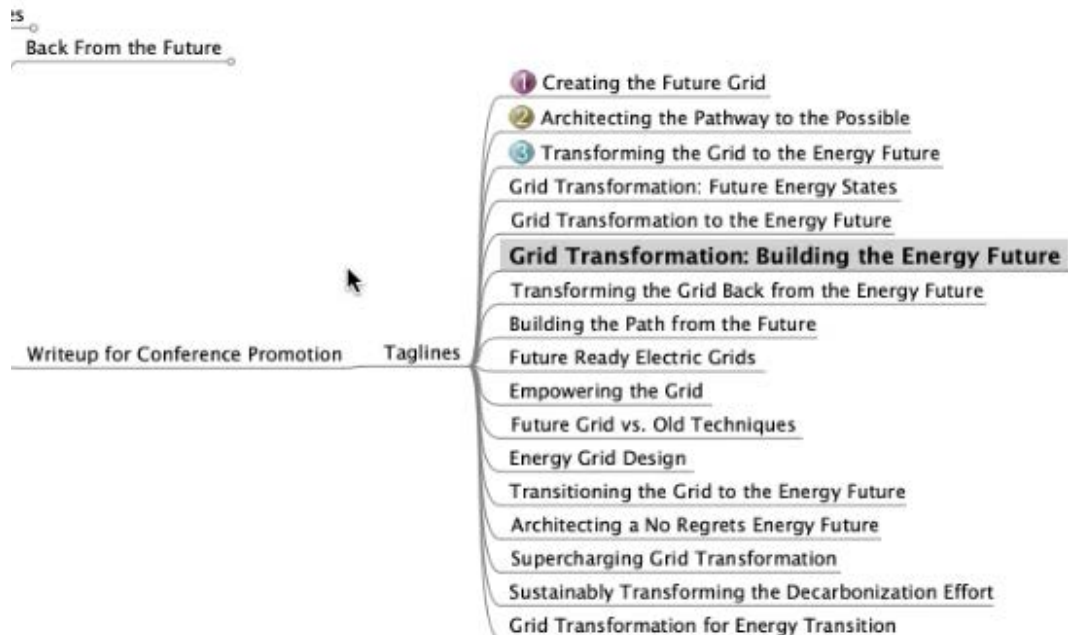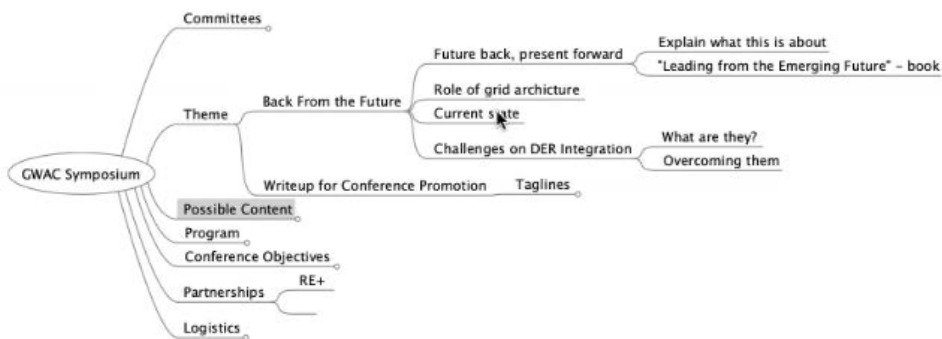Grid Transformation to the Energy Future

Grid Transformation: Building the Energy Future

Transforming the Grid Back from the Energy Future

Building the Path from the Future

Future Ready Electric Grids

Empowering the Grid

Future Grid vs. Old Techniques

Energy Grid Design

Transitioning the Grid to the Energy Future

Architecting a No Regrets Energy Future

Supercharging Grid Transformation

Sustainably Transforming the Decarbonization Effort

Grid Transformation for Energy Transition

Writeup for Conference Promotion | Taglines

e Objectives

GWAC Symposium
- Committees
- Theme
  - Back From the Future
    - Future back, present forward
      - Explain what this is about
      - "Leading from the Emerging Future" – book
    - Role of grid archicture
    - Current state
    - Challenges on DER Integration
      - What are they?
      - Overcoming them
  - Writeup for Conference Promotion | Taglines
- Possible Content
- Program
- Conference Objectives
- Partnerships
  - RE+
- Logistics

Mark P. agreed to be on the organizing committee and noted that he is also is planning to attend the conference.

Action: Add Mark Paterson to the GWAC Symposium Organizing Committee

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David F. said we will talk about the survey that Ron C. put together.

Jaime said the concept of 3D's is laying the groundwork.

Stephen M. added the importance of covering where is the grid headed and the shared value in grid services. Stephen added that that non-technical people don't understand the decentralized grid of the future with assets not owned by traditional centralized utilities.

Ron M said the soon to be released white paper explains complexities of the grid of the future and the need for formalizing the approach using architectural processes and practices.

Jaime said that democratization and decentralization would be the place to include that discussion.

Ron M. said the scale and complexity of the electric grid demands that we not approach the transformation with incremental small steps. Instead, it will require the vision and the execution of large-scale steps after planning, and observing what is needed, and taking into account risk mitigation, modeling of various aspects and more.

Stephen said we have to address sharing the costs; in the future the assets that provide flexibility and generation will be owned by non-utility vendors. It was taken from a discussion at Cal-Fuse and was questioned. We need to get in front of it and be pragmatic. How you frame it will be important.

Ron M. agreed, adding that it will be a transition for moving from single large power generation and those assets to a complex variety of distributed assets.

Jaime noted that there are many methods but it's about thoughtful design. TE will be a part of it but it's one of many elements.

Jaime thanked today's presenters.

Jaime presented Chris's first slide for today; Data and data visibility – Chris opened with that. Grid Edge and Grid Services. What's behind the secret sauce. How to cut the fruit without revealing the secrets.

Marc said people are interested in how you can do both, how to do both, equity in investment.

Jaime agreed and added the question of much data is enough; equity and justice, how do you put a value to it. He's seen some data on it. He has some references on it.

Ron B. suggested that we try to bring in speakers on these subjects and he said it might be best if the GWAC Council members were the moderators for panels to coordinate the panels but not necessarily to be the speakers.

Jaime suggested that GWAC find a way to comp the registration cost for speakers, particularly those from non-profits that may have more need for travel support.

****** end day 1 *****

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Tuesday 4/17/24

Wed. April 17th	Day 2, 8:30am to 5:00pm
8:00am – 8:30am	Check-in/Morning Refreshments provided by OATI
8:30am – 9:45am	OATI Presentation and Demo "High DER Grid Transformation & Energy Orchestration: OATI Capabilities & Offerings" • Farrokh Rahimi, Exec VP OATI • Ali Ipakchi, Exec VP OATI • Demo Segments - Jeff Anderson; Dave Stangler; John Lundstedt; Mehdi Moghadasi • Q/A
9:45am – 10:00am	Break
10:00am – 12:00pm	OATI Microgrid Tour • Microgrid Intro Presentation and Tour • Discussion

Presentation by Ali Ipakchi and Farrokh Rahimi with OATI:

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Conventional Utility Operations

Customers

IT

- Demand Side Management / Demand Response
- Customer Enrollment Mgmt
- Tariffs and Incentives
- AMI / Metering
- Meter Data Management
- Customer Bill Management

Distribution Network

OT

- Network Model
- State Estimation
- Volt/VAR Control
- FLISR / Switching
- D-SCADA
- OMS
- Mobile Workforce Mgmt
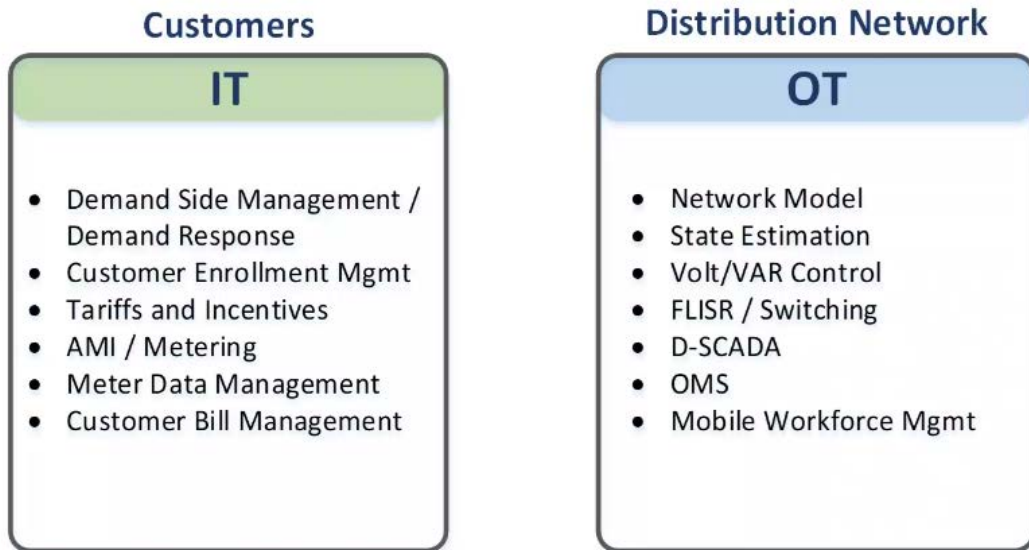
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OATI Deployment Approach

Customers, 3rd Parties and Distribution Network

IT | **OT**

- Demand Side Management / Demand Response
- Customer Enrollment Mgmt
- Tariffs and Incentives
- AMI / Metering
- Meter Data Management
- Customer Bill Management

- PV, EV, BESS & Microgrid Mgmt
- Contracts and Agreements
- Forecasting: DER, VPP, Net Load
- Virtual Power Plants
- Grid Services: Dist. & Trans.
- Market Interactions
- Dynamic Operating Limits
- Optimization
- Dispatch and Control
- Settlements

Distribution Network

OT

- Network Model
- State Estimation
- Volt/VAR Control
- FLISR / Switching
- D-SCADA
- OMS
- Mobile Workforce Mgmt

DERMS | **ADMS**

(OATI) (Guest)

Data Accuracy and Timeliness are Central

- **Data accuracy, and consistency:**
  - Examples: assets validation and qualification, customer validation, tariff qualification, customer/aggregator relationship, customer move-in/move-out, meter swap...)
  - Anecdotes
    - Typical Distribution Utility penalty ($1,000/day/customer)
    - MISO's Aggregator penalty ($66M)
- **Data Security**
  - Access control
  - Malicious attack protection
- **Settlements**
  - Performance based
    - Contract
    - M&V
    - Incentives/penalties
  - Incentive-based
    - Availability
    - Opt-outs

So we are kind of highlighting that this, this concept of distributed energy resource management is kind of an evolving into different flavors and different sets of functionalities and different functional level at different organizational or different jurisdictional levels and and then formalization of roles and responsibilities at each level and the data exchanges at each level for these different entities is becoming important and and I think the the, the, the structure of the industry kind of jelling in terms of a who are the players and what are the organizations.

DERMS Configurations and Enablers
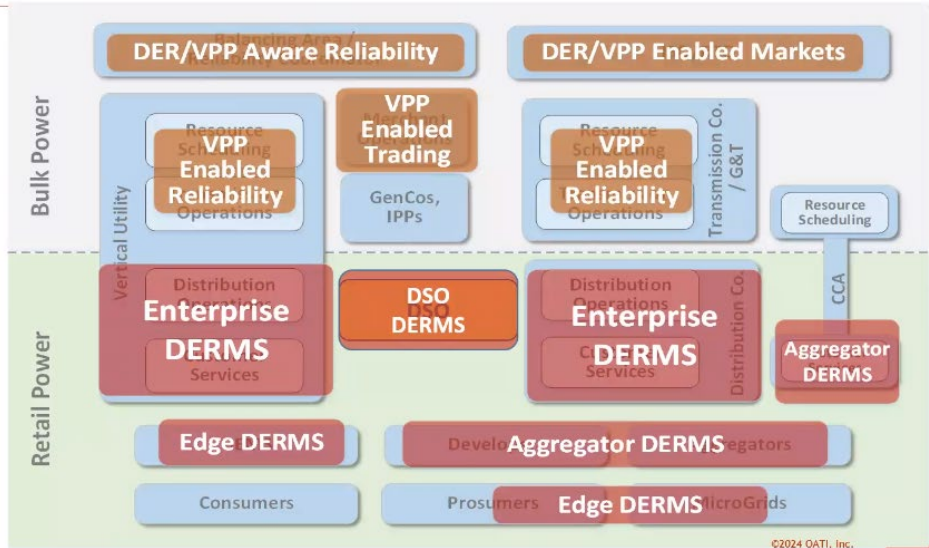
Ali Ipakchi (Guest) 6:52 AM
And then identifying data flows and responsibilities and functional requirements at each level is it's something that kind of a kind of an emerging in a in a default fashion but certainly requires some formalization and be kind of see many utilities have moved in that direction the formalize those, those those responsibilities and and then data flows between them.

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Chris Irwin the presenters to explain the controls the registry and who controls the access.

After the presentations several questions were asked about who needs access, who controls access, what benefit there is to the data owner to share the data with others.

Marc Costa asked if there should be a GWAC initiative to educate people on these issues and their impact.
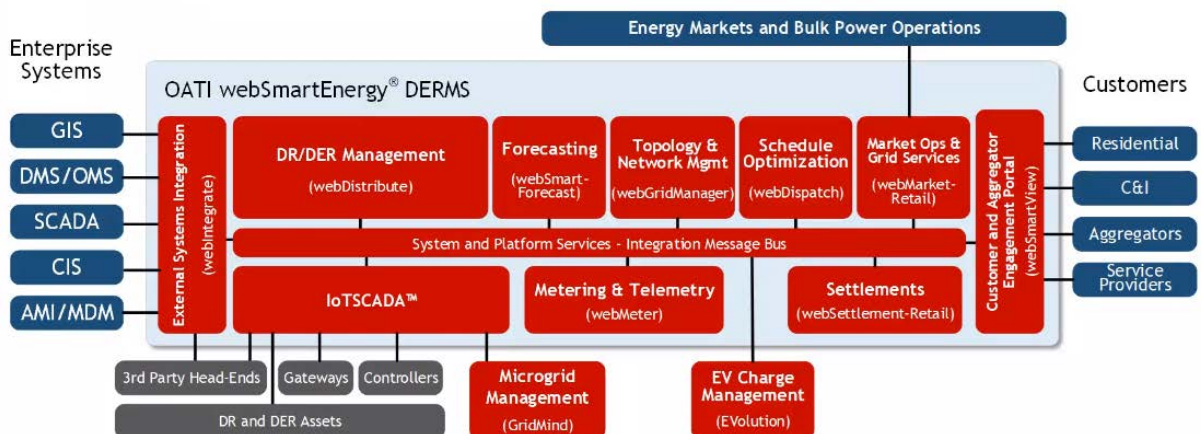
Ali Ipakchi replied that aggregators should have the access that they deserve but they must register and be vetted by the utility in advance. He added that "Once you start peeling the onion you are in uncharted territory."

John Lundstedt gave a second OATI presentation:

Jaime asked if the software, which is one layer of the architecture, is where you see what customers are enrolled in?"

Farrokh replied and confirmed that we can configure the program to restrict assets and set priorities. The program lets you virtually cut the data…

Ali said it is organized by zip code; aggregation by services, and with VPPs there are a lot of specifics about what services you can provide. We need to know when you call a VPP what portion of the circuit is impacted? There are a lot of details. As you peel the onion, there is a lot of information. With the ISO pricing point for example.

Meeting Minutes
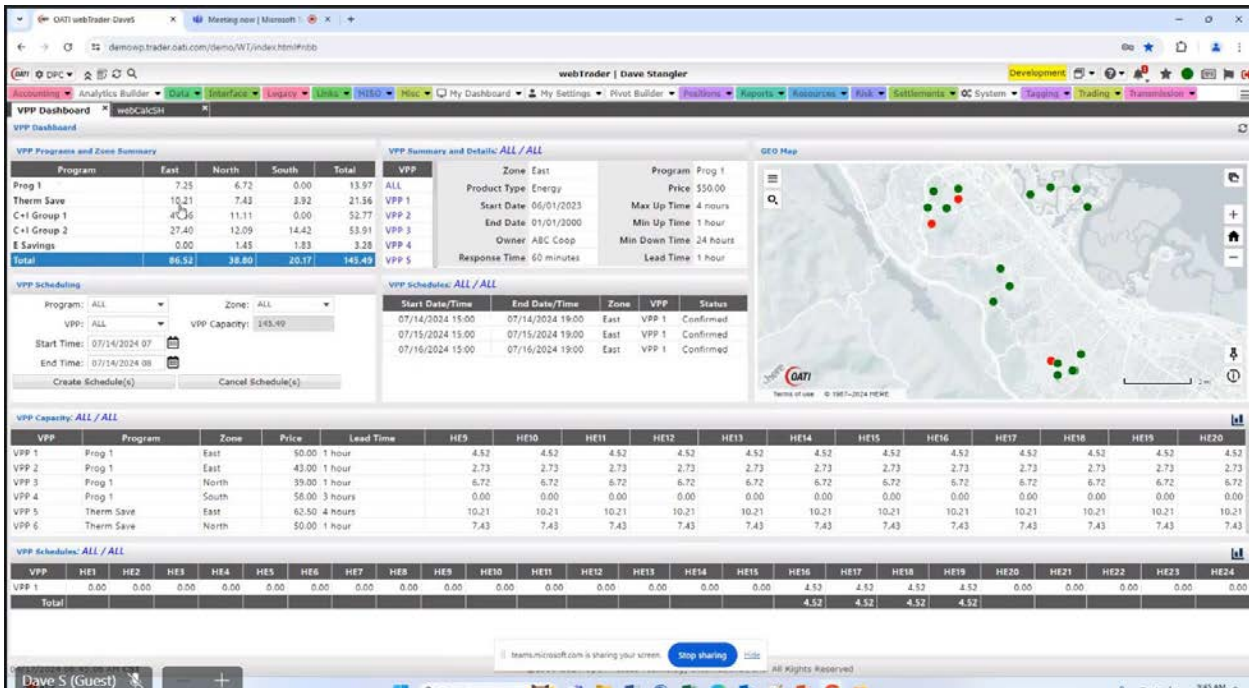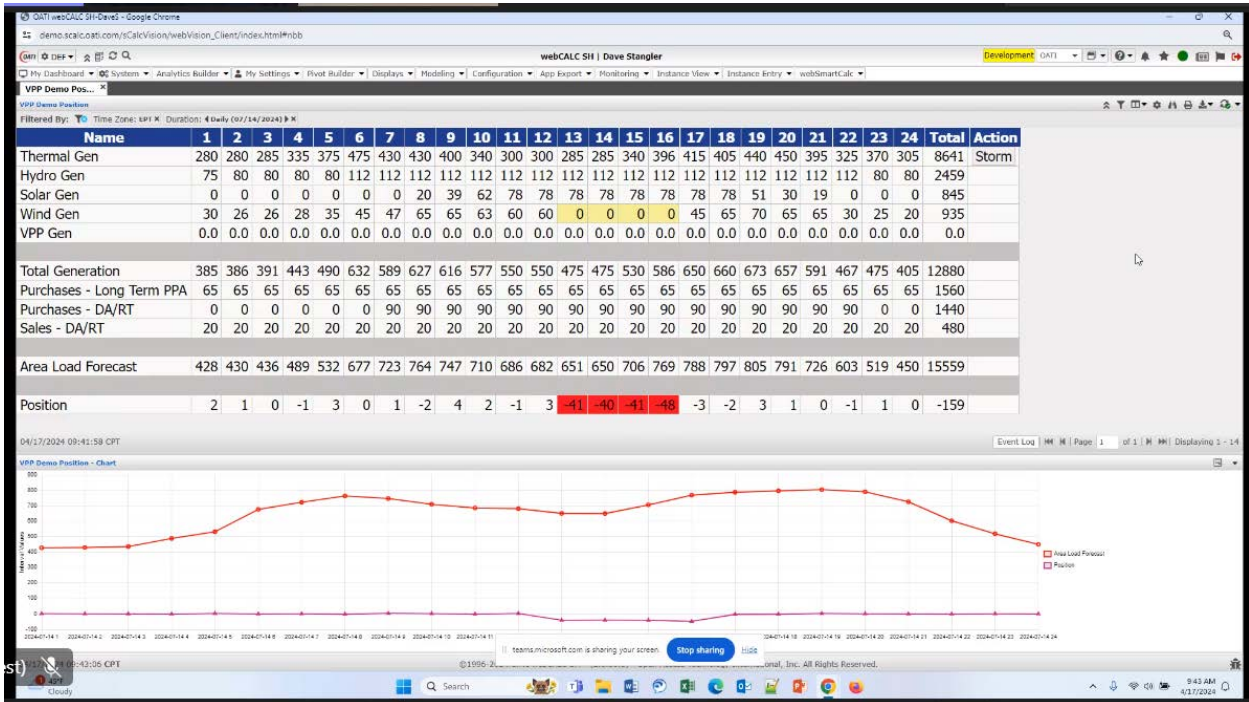
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3rd~ OATI presenter, John Lundstedt

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Shawn Chandler commented that an aggregator may not have the same system and may not be able to draw in the information. For the registry to be updated in real time – there could be a deficit if the aggregator gets a signal that tells it to opt out; and he added that the timeframe is very critical as you move to real-time operations. It is very critical in how the operator has the perspective to be correct. Even when enrolled and incentivized, they may be reluctant to use it if the data is not true in real time.

Ali replied to Shawn and agreed that this is a very important element, and it speaks to the technology architecture. He also added that it takes a tremendous amount of energy if you don't automate all of these processes.

Alaa Mahjoub posted in the chat:

Regarding the DER Registry discussion: The landscape of the DER registry may involve multiple entities, each fulfilling a distinct role. Examples of key players and their potential roles are outlined in the following table. https://1drv.ms/b/s!ArdEwi8tEbMBhdAMGafvOwoNnJU5Uw?e=xc5Kho

OATI hosted tour of microgrid operations.

Great River Energy
Grid modernization and DER

Jim Jones
John Reinhart

GREAT RIVER ENERGY™

Afternoon Session:

Jim Jones and John Reinhart of Great River Energy, Maple Grove, Minnesota Presentations:

Jim Jones:

GRE and members-owners
Our collective strengths
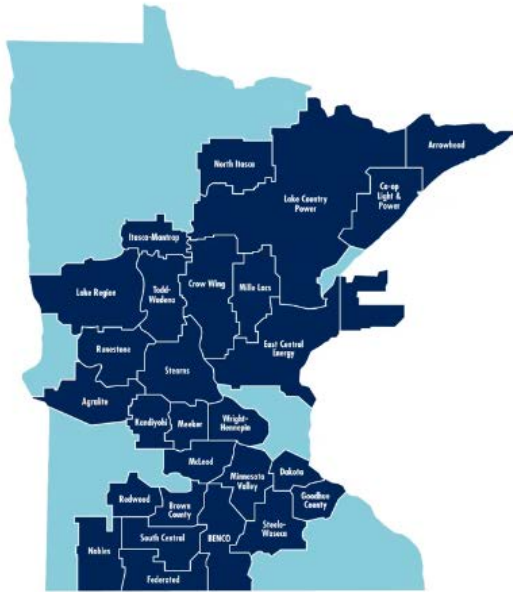
- Diversified, innovative membership
- Strategic, forward-looking
- Collaborate within many user groups
- People, process and technology
- Plan, deploy and learn together

Principles to create enabling platforms

- Leverage the pretty-smart grid in place today
- Coordinate investments to complete the full picture
- Collaborate to develop sharable systems
- Leverage information across all systems
- Preserve data privacy for the individual systems
- Implement integration and automation that is repeatable

Grid Mod Leads to DER

▶ Technology Roadmap
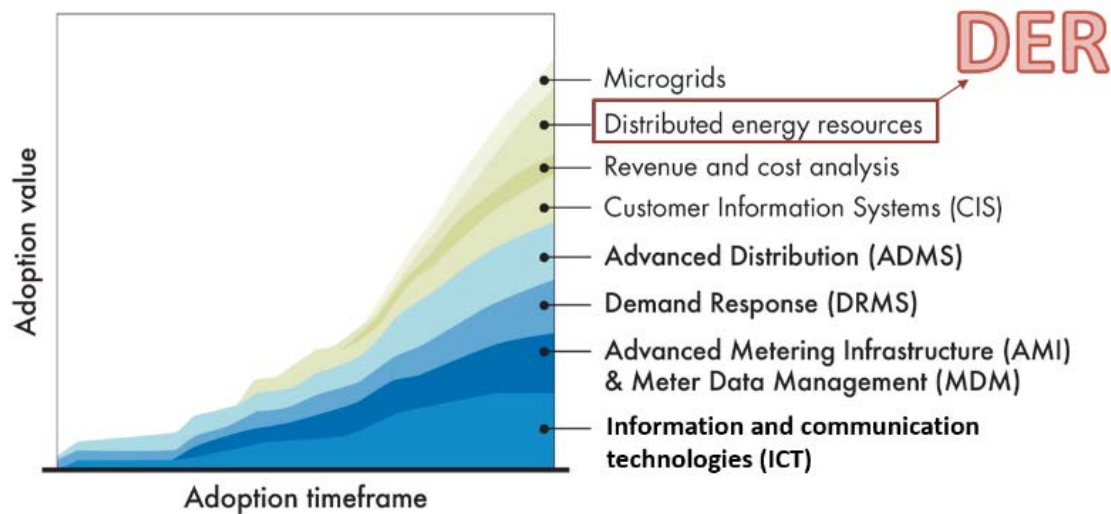
This is precisely what Transactive Energy (TE) presents. TE is the framework that "shares" the value (the cost recovery value) to operate the grid. Has Great River Energy thought about the TE dynamic retail market design? I didn't see it in the roadmap. Stephen MacDonald FCR = fixed cost recovery is an allocation effort based upon findings in a revenue requirement study. Customer-sited assets (and the workforce that services these BTM assets) can simply be considered in this analysis/determination. Stakeholders can simply wrap the 'valuation' into recovery (cost/settlement) process.

Stephan MacDonald chat: Find all information/discussion on Transactive Energy deployed through CA @

https://apps.cpuc.ca.gov/apex/f?p=401:56::::RP,57,RIR:P5_PROCEEDING_SELECT:R2207005

Second Presentation by John Reinhart, GRE:

Distributed energy resource (DER)

▶ DER defined - any resource located on the distribution system, any subsystem thereof or behind a customer meter

- May include, *but not limited to*, resources that are in front of and behind the member meter, e.g., electric storage resources, intermittent generation, distributed generation, demand response, energy efficiency, thermal storage, and electric vehicles and their supply equipment
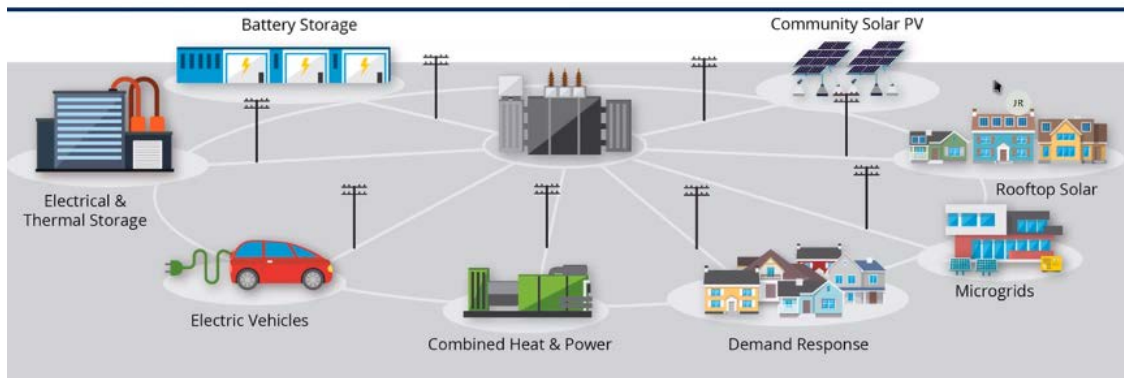
The members own the assets. It's flexible load.

Member-owned DER is an asset

▶ GRE continues to see value in DER technology and new data science.

- Flexible load is **tool for grid management.**

▶ As a **virtual peaking power plant**, DER technologies have created a common vehicle for improved member reliability and diverse economic savings.

▶ Coordinated orchestration of grid mod technologies in a **connected ecosystem** of software, hardware, & people.
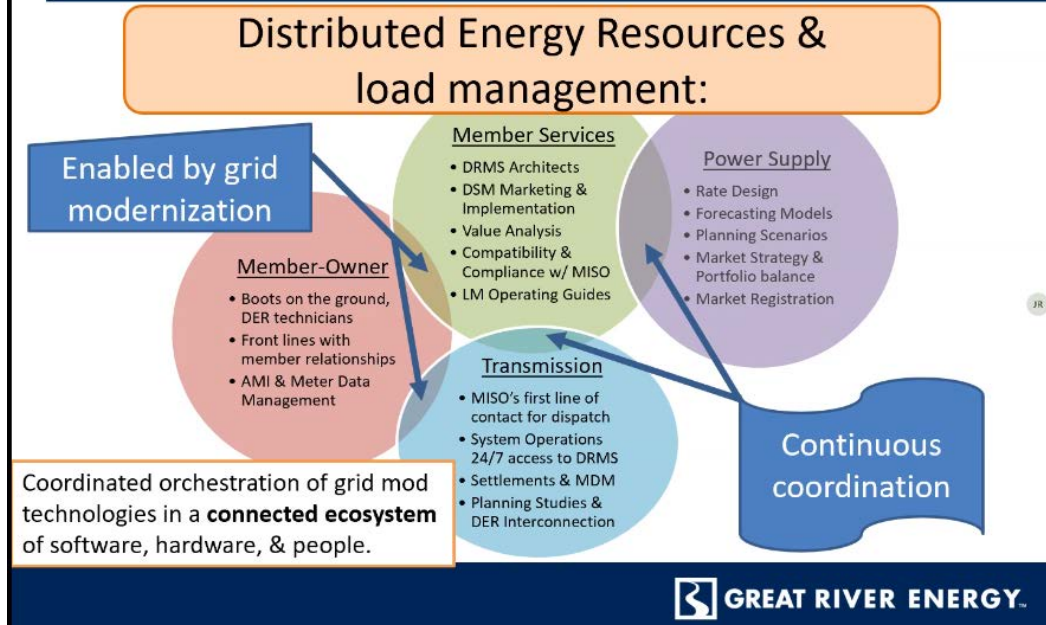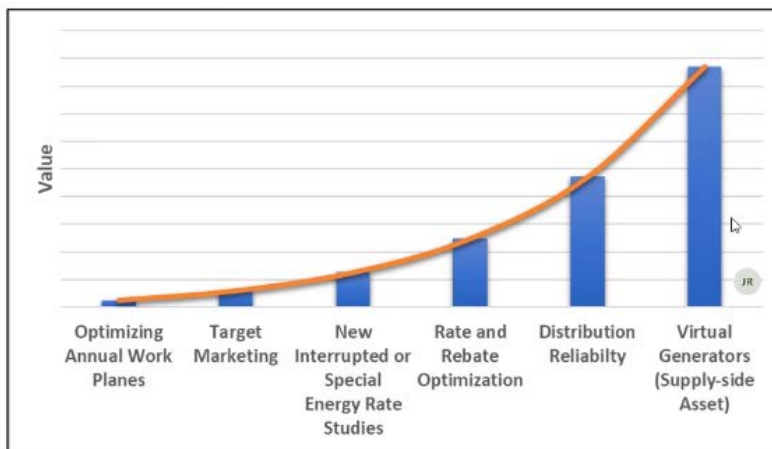
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Other data analytics projects

🚗	Remote anomaly detection	Residential PV systems EV charging detection Fuel switching
💡	Short-term and long-term energy and demand forecasting	Latest and greatest machine learning algorithms
🎯	Target marketing	Who should we market our interruptible and special energy rate programs

They are able to detect anomalies. I system connected to the grid without inspection could be a safety hazard.

Chris asked about automobile block heaters in cold climates. John said it doesn't show up really, they don't draw enough power to be significant.

MDMS for business operations

▶ Data sharing with members for effortless retail meter submissions

▶ Irrigation credits and control flexibility

▶ Dual fuel accreditation overhaul for flexibility and winter capacity benefit.

The warm water in the water heater is essentially a potential battery. The water can be heated a bit higher in advance of a planned outage to avoid running out of hot water during the outage.

How Should Electric Utility Regulators Use Grid Architecture?

GWAC F2F meeting, April 17, 2024, Minneapolis

Lorenzo Kristov, PhD, Principal Market Architect
Electric System Policy, Structure, Market Design
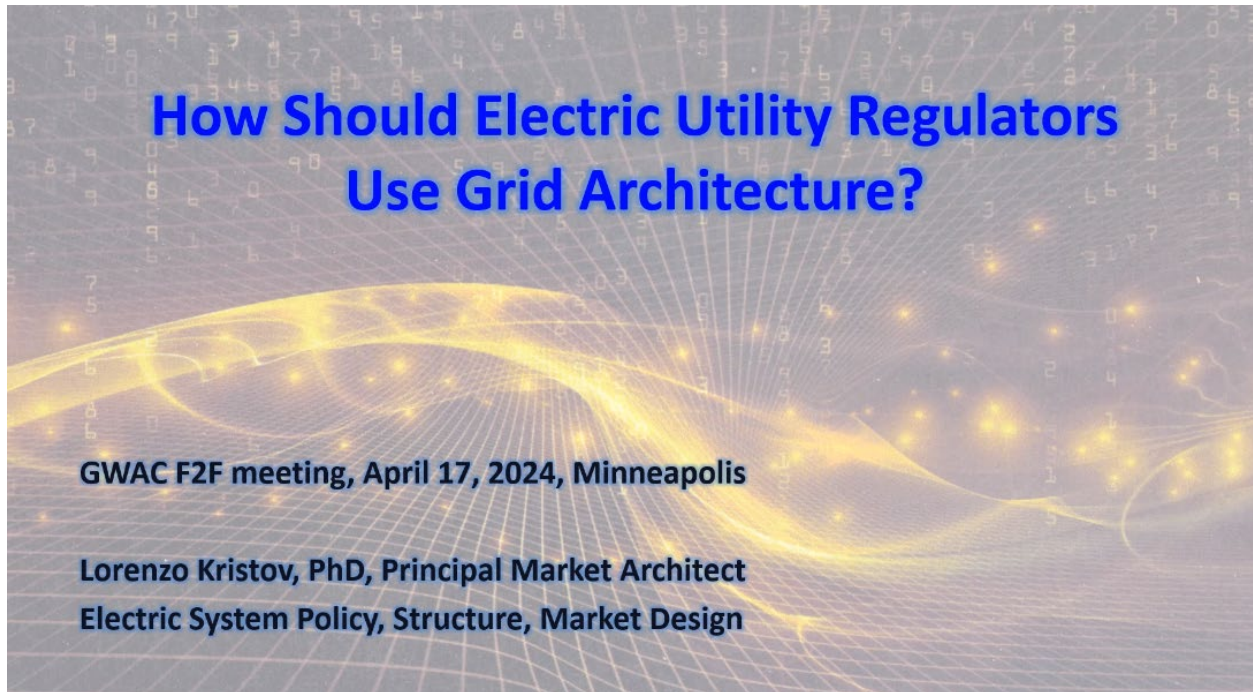
Lorenzo said that for all the conversations we've had with regulators about the value and benefits of grid architecture what he would like to do today is have a conversation about what we really want utility regulators to do with grid architecture and how they could use the tools and principles to address the things that they are struggling with.

Agenda

- Context — systemic changes disrupt 20th century architecture

- Some challenging issues for electric utility regulators

- Discussion: Identify specific ways regulators should use principles and tools of Grid Architecture

Context — the starting point

20th century architecture

- Objectives => Reliable, Safe, Affordable, Universal Access
- Supply => Bulk Power System = Fossil, Hydro, Nuke
- Demand => Consumers mostly just consume & pay bills
- Distribution utility => one-way kWh delivery
- Revenue model => based on kWh consumption & kW demand
- Profit model => ROR on capital investment
- Centralized, top-down system operation, planning, investment & asset ownership
- "The Grid" is a *de facto* monopoly

He called out new aspects of the grid:

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Context — systemic changes

20ᵗʰ century (pre-DER) architecture

1. Objectives => Reliable, Safe, Affordable, Universal Access
2. Supply => Bulk Power System = Fossil, Hydro, Nuke
3. Demand => Consumers: consume & pay bills
4. Distribution utility => one-way kWh delivery
5. Revenue model => based on kWh consumption & kW demand
6. Profit model => ROR on capital investment
7. Centralized, top-down system operation, planning, investment & asset ownership
8. "The Grid" is a *de facto* monopoly

What's new?

1. Decarbonization, Resilience, Energy Justice
2. Supply is everywhere, renewable, scalable, close to load
3. End-users become participants
4. Transactions; multi-way flows
5. Network services rather than kWh
6. Supply close to load reduces grid infrastructure needs => capital bias
7. Decentralized/layered operation & planning; local asset ownership
8. "The Grid" is contestable

Challenging Issues for Regulators

Chris Irwin's "Regulator's Dilemmas" + L. Kristov's Elaborations

1. Broader Societal Optimizations
   - Incorporating new objectives: Decarbonization, Resilience & Energy Justice
   - Valuing "non-energy benefits" and "social costs" (local externalities) in planning
   - Compensating energy exports from customer DERs (the "NEM" debates)
   - Natural monopoly and competitive arenas?
   - Should ratepayers or shareholders bear risks of new technologies?
   - Does the grid exist to serve people, or do people exist to serve the grid?
2. Proliferating Alternatives
   - Hybrid resources (PV+storage) — capacity value; interconnection & dispatch rules
   - Multi-customer microgrids (local subsystems) — 24x365 op, or backup only?
   - Locally-owned & operated DER-based electricity supply businesses

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Lorenzo incorporated Chris Irwin's perspective from yesterday into his presentation.

Utilities and PUC think customer owned assets are only good for backup.

Challenging Issues for Regulators – 2

Chris Irwin's "Regulator's Dilemmas" + L. Kristov's Elaborations

3. Sector Interdependencies
   - Integrate energy into whole-system urban planning: mobility; land use; zoning; building codes; housing development; tree canopy & habitat
   - Transport: Should regulated monopolies own EV charging stations?
4. Loss of Influence
   - Impacts of grid contestability — growing cost-effectiveness of grid defection
   - How to integrate community & local government priorities?
5. Computational Impartiality
   - Unstated common assumptions (20th century architecture; legacy utility roles)
   - Utility firepower & control of crucial data
   - Consultant oligopoly & embedded industry mindsets

4/17/24   Electric System Policy, Structure, Market Design

Lorenzo said we all know there's lots of externalities involved in energy in general. Those externalities may have impacts that are not reflected in costs.

How do they get taken into account in planning that's work in progress in some areas?

How should we compensate energy export from customer DERs?

This is the NEM debates what are the natural monopoly versus the competitive arenas? Chris brought this up yesterday in his discussion.

Lorenzo pointed out that very often when folks are talking about the benefits of DERS, it's all about grid benefits. How do they benefit the grid?

He noted that in his opinion the grid only exists to serve people so we should start with the question "why do people need energy and how should the grid help them get what they need in the best way proliferating alternatives?"

He gave some examples such as hybrid resources, for example PV storage, how do we give them capacity value?

What sort of interconnection and dispatch rules, market participation rules, for example, are things that are not well developed everywhere, multi customer, microgrids, the possibility of creating local subsystems on the grid.

Lorenzo went on to say in regard to sector dependencies that Chris had noted, how do we integrate energy into whole system urban planning?

Urban planners deal with mobility, land use, zoning, building codes, housing developments, the tree canopy, habitat, but they typically don't think about energy because they've left that to the utilities. But if we're thinking about planning as a whole system, all of these things are integrated and affect one another.

How do we bring those into the planning methods that are used at the local level and also recognize that carbon emissions are local? He said they come from somewhere and many of the carbon issues around carbon emissions are driven by the structure of the communities.

The way we've designed housing and where people live relative to where they work or the economics of where people are forced to live and commute to work.

Is it appropriate for EV charging to be a regulated monopoly or should that be a competitive business? What are the impacts of grid contestability?

He noted the growing cost effectiveness of grid defection, and DER technologies which keep getting cheaper and more powerful in their capabilities while in many places the grid keeps getting more expensive.

So, there's an economic point of inflection here where many large customers, especially energy intensive ones that want to electrify and they find the grid less friendly.

How do we integrate community and local government policies; in other words, who should have influence over regulatory decisions?

Finally, the question of computational impartation of partiality and unstated common assumptions about 20th century architecture and legacy utility roles. So many of the discussions in the industry around all of the above issues come back to an unstated assumption, for example, of top-down centralized control that is so embedded in many of the policy discussions.

The ISO is going to have to see all of these things and be able to send them signals and be able to monitor them, and so on.

This is just a survey of things that I think are questions that regulators need to deal with.

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Discussion

Brainstorm specific ways regulators should use principles and tools of Grid Architecture to navigate today's challenges and make good decisions.

Thank you.

Lorenzo Kristov
LKristov91@gmail.com

Electric System Policy, Structure, Market Design

Farrokh asked Lorenzo, "when you say regulators, are you talking about the regulators in general of the electric industry or are you specifically talking about utility regulators?

Lorenzo said he's focused on electricity. The emphasis is on the electricity system since that is mostly what GWAC is concerned with.

Ron M asked about #6 on the What's new list; "Supply close to load reduces grid infrastructure needs – capital bias." Lorenzo said this is where the architectural discussion needs to be pursued because it's not clear if it reduces the needs and then they just change the needs, and the nature of the change may be expensive.

Ron M. replied that he thinks it's a possibility that it reduces the need, but it's also possible that on a financial basis the needs stay the same or even go up because of the need to change the infrastructure to accommodate the system that you correctly pointed out needs to be based on what customers need and serving the customers.

Lorenzo said that can remain an open question. In the near term there is investment in what we call grid modernization in order to operate the system with higher numbers of these other kinds of new resources, DERs and renewables and so on. But once grid modernization investment is done and the utilities have the visibility and communications, and all of that, the thought is that with the longer run benefits we're building less grid because we've located supply closer to load.

Ron M agreed and said that may be the case.

Traditionally utilities have had to have the funds to build big infrastructure.

Chris Irwin said it allows you to prove the lines of accountability and whether the organizations are complete unto themselves and also whether they are held to account by the right entities in the system. He said we have a lot of people who are able to articulate how a grid is *engineering complete* and things like that.

He went on to say that he thinks the grid architecture's view of looking at both the technological and organizational structures allows them to say to regulators that this shuffling of responsibility creates complete organization and accountability, which was here in the system is now a shared responsibility and then the regulatory responsibility must fall to both entities to be complete both organizationally and accountability complete. So, he wonders in terms of grid architecture as a tool if it's capable of informing regulators and if so, he thinks that you are you're moving into a brave new world. Can you prove that it is organizationally complete and accountability complete?

Lorenzo said it is a great question. Grid Architecture as a set of tools and principles could do that but, in whose hands, would that tool be used? The regulatory agencies themselves typically have a very well defined, narrow, and often very siloed responsibilities. Who has that overview of the system of accountabilities that you are talking about?

Chris replied that he would let Ron M. speak about this more but the way he's heard is that the organizational diagrams completed are drafted and then vetted to deduce and uncover the responsibilities of the banks.

Ron M said the tools of grid architecture practices as we define them at PNNL are capable of documenting these things. But what you don't know, is that this question just happened to strike at an appropriate time because Ron Cunningham and he just last week reviewed a related Grid Architecture lesson in lesson 7 of *GA Bootcamp*. It speaks to how you construct industry structure diagrams and how structure diagrams are reviewed. It is a consensus building process. The rest of the lesson was a discussion by Jeff on how to use the diagrams to understand the implications of change.

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Ron explained how groups think about what they want and play them off against what needs to change.

Marc Costa noted from today's tour at OATI the slider bar for either economy or sustainability as being an either / or. How do we bring in optimization and get our priorities straight?

Lorenzo said that to keep rates low you have to externalize costs.

Ron M said the slide was the internal optimization cost to OATI.

David F gave an example of how he plans a system and keeps it simple to be discussed with the client. Showing how things support each other is a key benefit that the Grid Architecture technique brings that is not always self-evident. When you are dealing with words to represent hundreds or thousands of things it helps to draw it out in smaller chunks and discuss what the clients' objectives are.

If you pick elements of the GWAC stack and phrase it right, it should play out well. You need to get to a neutral space where people understand the implications of policies.

Stephan M. said looking at #5, argues for a more agile process for design. How do you weave in the agile process.

Jaime shared a diagram that Ron M had previously shared with him. He said that as an engineer it helps to draw it out. Focusing on where things exist and what is needed. He has software where he can drop the lines and redo. Jaime noted that Marc C and Lorenzo speak the language of the regulators.

Lorenzo said regulators would not be using Grid Architecture, but those of us with the expertise should be applying it. Like the structure diagram that Jaime showed, there are lines that show regulatory coordination and also gaps. Where things are unclear, we can see it in the diagram. Using Grid Architecture principals to guide our intervention in the procedures or our education of regulators or our education of other participants and such.

Jaime said the regulators don't need to understand the entirety of it they just need to understand their role in grid architecture. Those who do understand can basically digest it for them. The Decision Makers Checklist can help them also.

Ron mentioned the 7 habits of successful people; one is to bring the right tool to the job. People have to think about how to select and use the tools and what are the questions and problems that regulators may be trying to address. There are quality diagrams, industry structure diagrams. He mentioned a diagram that Jeff Taft had shown GWAC sometime back. We have to be driven by the problem. We need to think about what the questions/problems are that regulators are trying to address and that we may be trying to help them address. We can do an industry structure diagram or a market structure diagram. The question you are trying to answer will be the guide as too what tool to use.

Lorenzo said something he's seen often is the siloing of topics and Commission proceedings. He said with grid architecture we like to use the idea of whole systems and looking at the way things are interrelated and then when you attend a proceeding you see staff who work in their own boundaries;

they have specific proceedings to work on and won't say anything outside of those boundaries that they are doing. It might be something we can think about a bit more.

Ron M asked if that had to do with rate cases and dockets? Maybe with a rate case they have to be focused on the docket.

Lorenzo said they sometimes come up with a road map and they can be useful. They then give you a big picture view of interrelated dockets. But with actual proceedings they may not follow what is in the roadmap. Right now, there isn't a good answer for getting beyond the docket boundaries.

Ron A also commented on siloing which is said we can explain to regulatory community. We could highlight the big picture so they can understand how a set of tools might help them see the iterative effects of the siloing.

Ron A said he agreed with Ron M that we should engage more broadly with the regulatory community perhaps through NARUC. We could propose and activity and approach it through NARUC. We have the chance to understand their challenges and how grid architecture could be put into context to address the issues. Regulatory, business and technology is a 3-legged stool.

Ron A. also agreed with Ron M. that GWAC does have convening authority to call a session to go into depth on a topic. He also noted that

Stephen M. discussed using tool sets and mapping to a meeting and influencing dockets. He said California is the first state that he is aware of that is starting to have cross pollination between the state energy commission and the public utility commission. They are interested in being more agile to address these issues and processes.

Lorenzo said we could do that as a theoretical exercise but where the states draw up dockets has no visibility. It's almost too late once the scope is out to make any significant changes to the docket. Where commissions dream up dockets and decide what is in scope is not something he has knowledge of. They appear at some point and by then it's very hard to affect the defined scope once the ruling comes out.

Ron M. said that regulators don't go out too far with their dockets. To legislative policy domain, if you can get the legislators to be thinking ahead to drive processes as the system evolves that is a way to engage the regulators.

Andy has had good luck working with regulatory chairs and trying to align with their needs.

Marc C. said GWAC could create some principals to share with them. Like an internal soft version of a policy platform to help GWAC understand key talking points.

Jaime suggested the Decision Maker's Checklist and other GWAC papers . We could create a one pager with highlights geared to specific regulators and C-suite executives.

Lorenzo said some of the things that are being discussed today is what he was hoping for to add to the paper that he is finishing up. He was hoping this discussion would lead him to the next steps in this area

for the GWAC. He said he thinks we can rethink strategies to have more impact in the regulatory arena. And he would like to do as Ron suggested to think about the broader policy and legislative arena as well.

Jaime agreed with Lorenzo and said going back to what he said earlier that GWAC give guidance based on architecture and the demonstration of what is sound system design with an acknowledgement of challenges and the fact that there will be challenges due to the nature of the transitions in play and not from lack of action.

Marc said at a recent meeting where he met with California legislators and their staff, he found that 95% didn't really understand energy and how it works.

Ron M. said that Jeff Morris holds some boot camps for regulators and Ron met with some of them. They asked if he was trying to turn everyone into energy day traders.

Mark Ortiz said there's a logic progression…some regulators have to justify the benefits of what they work on. If we could explain how grid architecture could benefit and impact their problems. We could have different a list of benefits for different areas which would help them with that natural progression.

Jaime said a short roadmap of why change needs to happen at that level.

Mark agreed saying that it's kind of like Lego bits. How the grand pieces are going to fit in the right order and allow you to upgrade. Something like building back for regulators.

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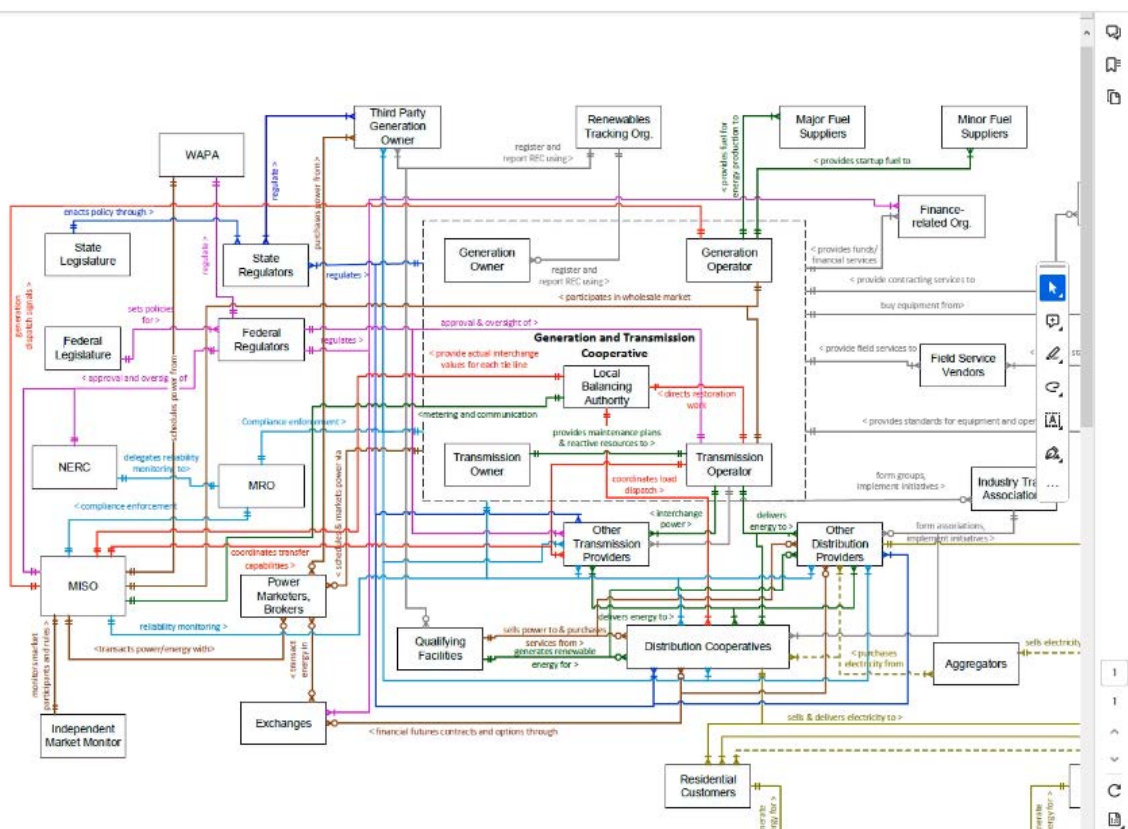
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GRIDWISE Architecture Council

Mission and Vision Refresh

Vision
The GridWise® Architecture Council supports a vision of a decarbonized, decentralized, and democratized electricity system to ensure the energy needs of today and that of future generations.

Mission
The GridWise® Architecture Council (GWAC) was formed in 2004 by the U.S. Department of Energy to propose principles for and accelerate the development and adoption of interoperability concepts and standards across all applications operating and interfacing with electric systems.

The Council's mission is to engage with stakeholders to accelerate the development and application of grid architecture concepts and principles. This leads to:

- Identification of critical paths to facilitate the effective evolution of the systems, devices, and enitities that encompass the electric systems and achieve societal objectives.

- Advancement of standards, applications, and systems interfacing with the current and future electric systems to ensure they are sustainable, reliable, resilient, efficient, extensible, and equitable.

- https://gridwiseac.org/index.php/mission-structure/

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Jaime said the mission and vision refresh was begun about a year and a half before he took on the GWAC Administrator role. He asked if anyone had any objections to the updated version shown.

The version shown is what the committee proposes to the Council for an up or down vote.

Chair Ron Bernstein asked the GWAC to confirm or deny the Mission and Vision refresh.

GWAC members (number above quorum) gave a show of hands both online and in person and voted unanimously to approve the refreshed mission and vision statement.

Action: Post the updated Mission and Vision statement to the GWAC website.

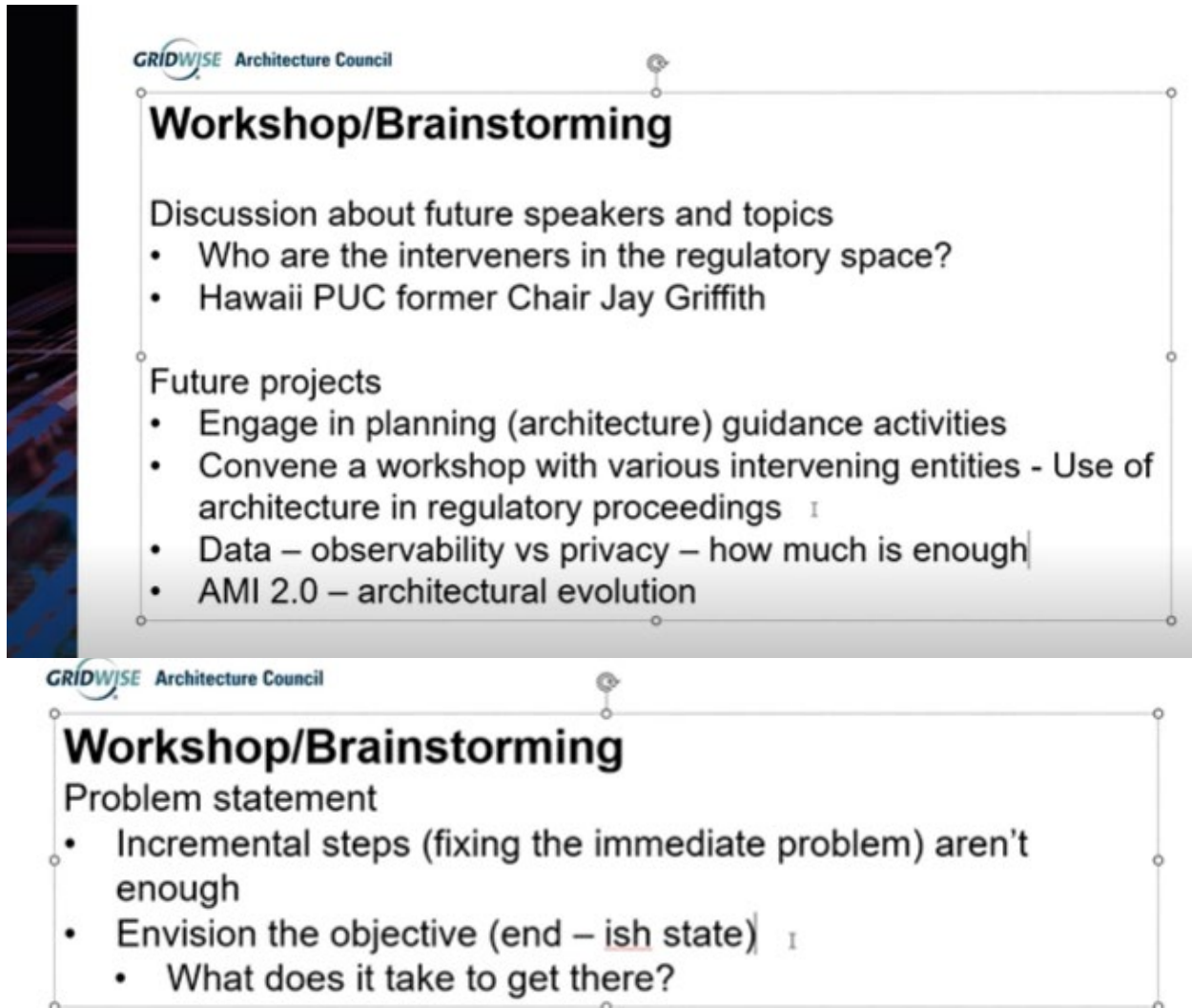David Forfia shared that Aaron Smallwood just noted to him that even though registration is not yet open for RE+ housing is open and there are very few openings.

Marc Costa suggested staying in Santa Ana or Irvine and taking the metro system which is pretty good.

Ron Bernstein suggested trying different dates such as Sunday to Thursday may increase the number of available hotel rooms in the housing block.

Workshop/Brainstorming

Discussion about future speakers and topics
- Who are the interveners in the regulatory space?
- Hawaii PUC former Chair Jay Griffith

Future projects
- Engage in planning (architecture) guidance activities
- Convene a workshop with various intervening entities - Use of architecture in regulatory proceedings
- Data – observability vs privacy – how much is enough
- AMI 2.0 – architectural evolution

Workshop/Brainstorming
Problem statement
- Incremental steps (fixing the immediate problem) aren't enough
- Envision the objective (end – ish state)
  - What does it take to get there?

The group discussed some ideas for future workshops or panels.

Ron M – Agreed with Kay and added the need for regulators not to be siloed. We should problems of interest to council members, pick a few and then then demonstrate the application of tools.

Mark O. Agreed and added the need for a use case. He noted that at this meeting Chris Irwin presented on two topics that really stood out: grid edge and data and the data perspective. He went on to say that there is an opportunity to look at reference architecture to help including interoperability. If this group could define some major problems, perhaps in those two areas, it may resonate at the state level.

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Jaime said in the second one Chris talked about home energy management systems and a reference architecture.

Mark O. said he can't say what the root cause is but if we define some of the most critical problems and work from there. We've done a lot of great automation and we have the edge, but now you can connect to the home. The ability to take advantage of local authorization and architectures such as with distributed derms and knowing which architecture can support it. He said what he has a hard time getting people to understand is how do you transition from something like Web 2.0 to move to a modern architecture. And he asked how do you continue to support legacy architecture as you move to the new one?

Jaime said that the work GWAC is doing with the white paper on transportation electrification may not be all that Mark is looking for, but it was the reason Jaime proposed it since it was one day to have a reference into this issue.

Kay A said we are applying the architecture to the transition. We are trying to facilitate transition of the system from where we are today to where the future is and what we need to get out of this is how we can apply the tools to the transitional path. And getting people to look more than three feet ahead.

Ron M. said we want to help educate and equip the industry to be able to apply sound architecture and system engineering more broadly. We need illustrations to motivate. If it's too academic and abstract, then they kind of nod their heads and go back to doing what they were going to do anyway. Having problems that are of interest to council members, we may have to pick one or two problems to demonstrate, apply tools and explore the dimensions.

Lorenzo noted that what's really changing has to a lot to do with distributed energy resource technologies that largely didn't exist ten years ago. That's the revolution that's happening in my opinion. The core element of change that we collectively need to focus on is redefining the roles and responsibilities of the distribution utility. The future needs to allow transaction with coordinating vehicle charging, HVAC systems, etc. Perhaps redesign the distributed utility. That is what is going to make it all work.

Jaime said if GWAC were to take it on alone it wouldn't make much of an impact.

Lorenzo agreed but said it does mean that's where we want to focus and help other focus because that narrows the scope in a way that really gets to the essence of where the change needs to happen.

Jaime said that is the general idea of the back from the future theme. He added that for the new GWAC white paper in development about transportation electrification he will lean on Ron Cunningham to help with this paper.

Stephan M. asked what is the right price information if you are a distributed company. Looking at resource planning and aligning to customer value to make sufficient decisions. The right price based on the use of energy and how to make the right price decision.

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Marc C said the OATI team presented on operating envelops today. We have dynamic operating envelops and price signals. He said maybe we should look more in depth at operating envelops.

Shawn suggested developing a maturity model for the grid. The idea is if you have no grid architecture understanding, then as you move up the chain to higher levels of maturity it leads to expected outcomes. How does it impact people and technology and data? I don't know that we could just say this is the way to do things. The speed at which they adopt new principals…it is an assessment tool.

Jaime said we've done some maturity models.

Shawn said if we can put something in people's hands that they can look at would help.
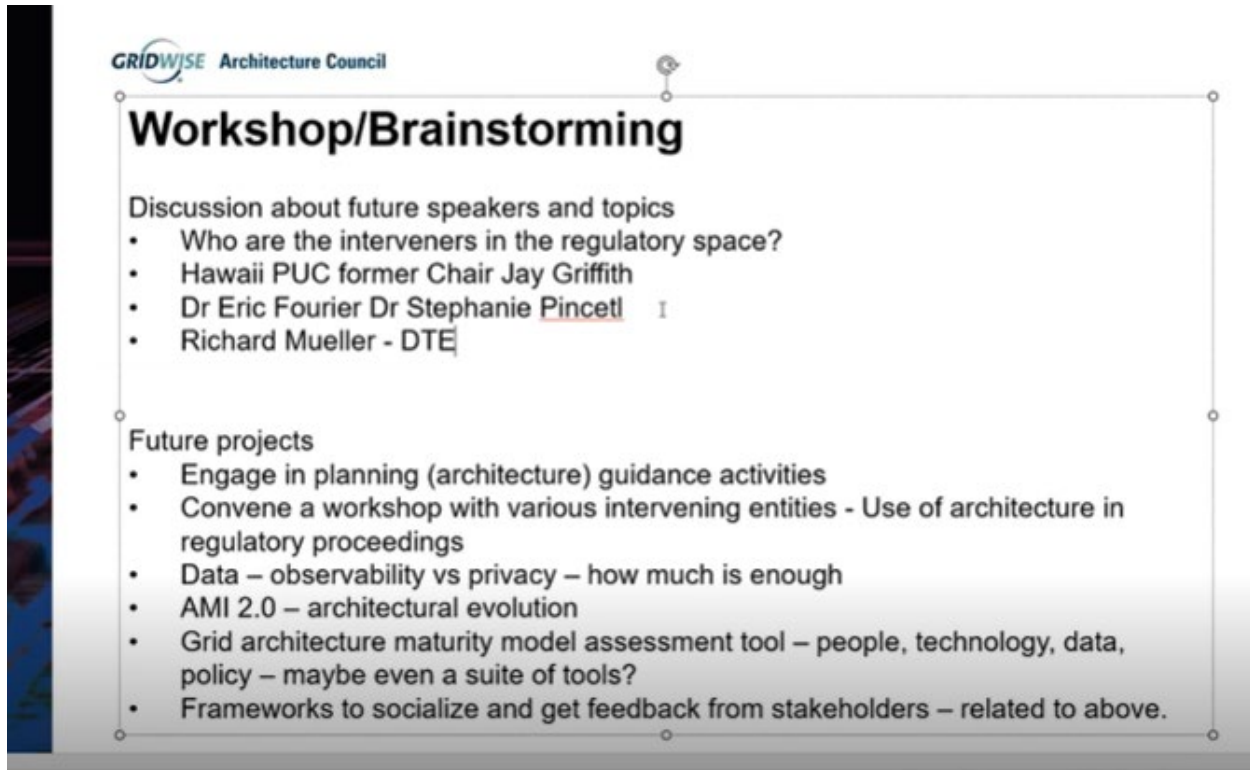
Dave LeVee said the question what the right price information even if you are a distribution company by which you make decisions about the use of energy. From his perspective of system planning and analysis and looking at what they call the avoided energy cost to buy utilities and so forth and resource planning. What is the right price signal? The energy pricing needs to align itself with giving customer value to make efficient decisions in the use of energy.

He went on to say that the cost side of things ignores the elasticity of demand. So, it doesn't include customer action, but looks at it from a cost standpoint. Basically, looks at the increment in, making economic decisions for infrastructure based on a kind of incremental costing. He asked then what satisfies customer value?

Jaime noted from the chat, it all says in the emerging electricity market, while the shift in ESO roles, responsibilities presents funding and legal challenges it's important to recognize that it functions. We will see new players in the market because of the financial aspects.

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Workshop/Brainstorming

Discussion about future speakers and topics
- Who are the interveners in the regulatory space?
- Hawaii PUC former Chair Jay Griffith
- Dr Eric Fourier Dr Stephanie Pincetl
- Richard Mueller - DTE

Future projects
- Engage in planning (architecture) guidance activities
- Convene a workshop with various intervening entities - Use of architecture in regulatory proceedings
- Data – observability vs privacy – how much is enough
- AMI 2.0 – architectural evolution
- Grid architecture maturity model assessment tool – people, technology, data, policy – maybe even a suite of tools?
- Frameworks to socialize and get feedback from stakeholders – related to above.

Jaime said he appreciated Dave's point of view today.

Ron B suggested GWAC host a speaker in the EV market to review challenges for installing charging stations for large occupant buildings. He said Chris Irwin might have some contacts.

Jaime suggested Richard Mueller at Detroit Energy (took over for Hawk). They put in a parking garage for 150 Ford F150's. Jaime also mentioned Quality Logic.

Chair Ron Bernstein asked for a Motion to adjourn. David Forfia gave the motion, Ambrosio seconded the motion.

Day 3 – Wednesday April 18, 2024

In person attendees:

Ron B, Kay, Andy B, Mark O, Dave F, Susie, Jaime, Marc C, Ron M, Farrokh R

On the phone: Ron A, Ron C, David W, Harry P, Alaa M, Dave LaV, Ken W, Anthony J

Meeting Minutes

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GWAC Symposium Planning

The group used mind map to create a detailed topical agenda for the fall GWAC Symposium.

They discussed if the tracks should be parallel.
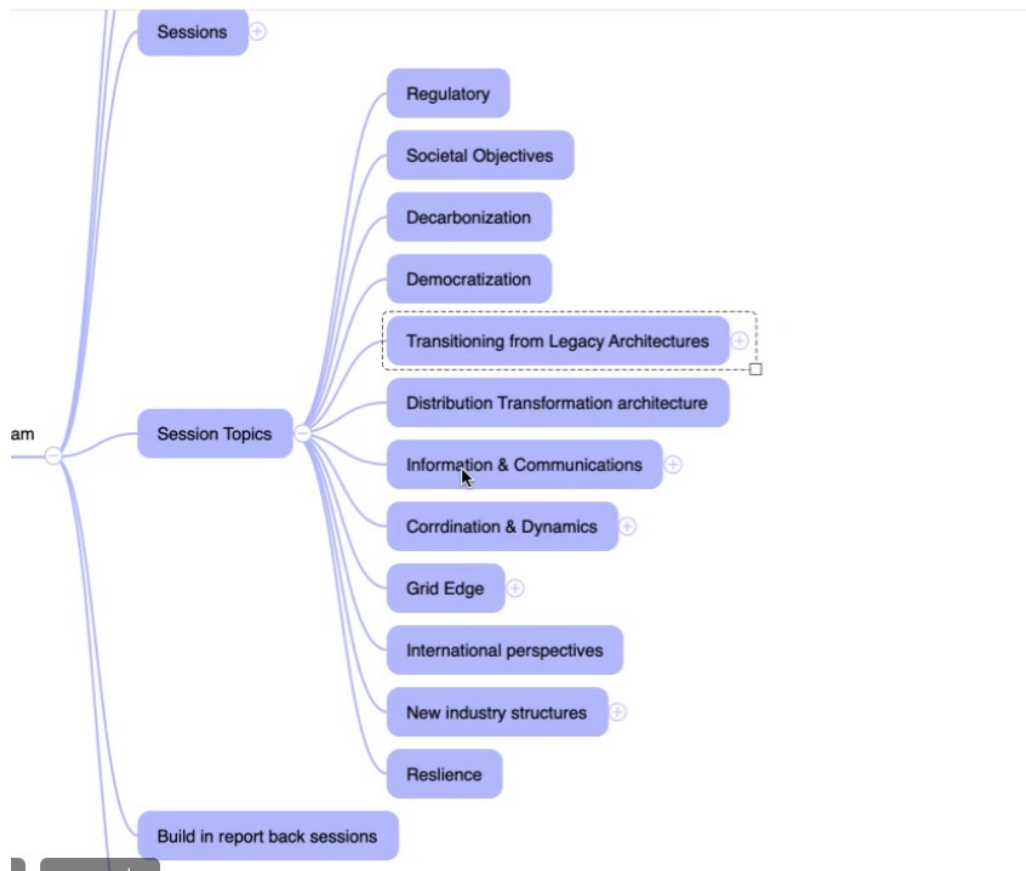
International perspectives

Aaron S. said he is currently working in three different countries with four different funding mechanisms. He is helping each with their energy transition and objectives.

Jaime noted that Aaron S, Andy B, Kay A, Dave F, and Ron B are the panel chairs. Shawn C can help with grid edge or with industry structures, and also Leonard T.

Liaison Reports –

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SEPA – David Forfia for Aaron Smallwood – David reminded everyone of the need to find a hotel for RE+/GWAC Symposium and book as soon as possible.

NIST - David Wollman – The most recent NIST smart connected systems newsletter is posted online at: https://content.govdelivery.com/accounts/USNIST/bulletins/395c264

NIST has also been wrestling with budget reduction and resulting cutbacks and project eliminations, which will affect us – NIST's research budget was effectively cut by over $40M.

IEEE – Farrokh Rahimi said with regard to the ISGT / Smart Grid Technologies conference will change its format for 2025, it will be something like the Energy Policy Conference with a new theme. There will be opportunity for GWAC to be involved with panels.

Farrokh, Ron Melton, and Jaime Kolln are planning to attend the will be at the IEEE PES General Meeting in Seattle.

Farrokh also mentioned IEEE Grid Edge Technologies to be held in January 21 – 23, 2025 in San Deigo.

AHR is talking with Ron B about GWAC participation in the AHR Expo 2025. It will be held in Orlando Feb. 10 – 12, 2025. We have no commitment yet. We could have the option of holding a F2F meeting there although it's the same time as DTech which will be Feb. 11 – 13, 2025 in Dallas, TX. Kay Aikin and David Forfia are planning to attend DistribuTech 2025. We will need to let them know sometime in June.

Jaime mentioned the RE+ tutorial. Farrokh and Mark P are interested. Jaime thought we could put a tutorial together pretty quickly.

Ron B. asked about interest in a Friday night dinner on Sept. 13 at his home for the GWAC F2F / 20th Anniversary.

For the conference Saturday morning will have some light activities and then sailing in the afternoon for those who can stick around.

Thursday will end around 4pm. Thursday night everyone will be traveling.

Ron A. said they will move from Anaheim to San Diego on Thursday night.

Jaime said in answer Alaa about interoperability as a topic, this should be addressed mostly in the foundational session. He asked if Alaa will be attending and said when you know please let Jaime Kolln and Susan McGuire know so Jaime can get you involved.

Jaime mentioned the V2G forum, this year the panels will be moderated by utilities. The utilities are seen as the closest to the customer. The next meeting is in San Diego.

Energy Storage safety will be held at PNNL in May collaboration with Sandia National Lab. Jaime is doing the standards section and the other host is doing safety. Joby Engineering will be there. Notable topics are Interconnect standards, and sodium ion batteries and flow batteries.

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GRIDWISE Architecture Council — Conferences and Events

Date	Event	Location	Attend	Speaker	Topic
March 12 – 14, 2024	EPRI Electrification 2024 International Conf & Expo	Savannah, GA	Sean Crimmins		
March 26 - 28, 2024	Energy Exchange	Pittsburgh, PN	Ron Bernstein	Ron B	Challenges of Connected and Smart Buildings
Apr. 30 – May 2, 2024	V2G 2024	San Diego, CA	James Mater, Jaime Kolln		
May 6 – 9, 2024	IEEE PES T&D Conference & Expo	Anaheim Convention Center	Jaime Kolln		Accelerate the Grid of Tomorrow
May 14 – 16, 2024	Energy Storage Safety and Reliability Forum (ESSRF)	PNNL Campus	Jaime Kolln		
June 22-26, 2024	ASHRAE Annual Conference	Indianapolis			
July 21 – 25, 2024	IEEE PES General Meeting	Seattle, WA	Jaime Kolln		
August 4 - 9, 2024	ACEEE 2024 Summer Study	Pacific Grove, CA	Marc Costa		Energy Efficiency in Buildings
Sept 9 - 12, 2024	RE+ Anaheim, CA & GWAC Conference	Anaheim, CA	GWAC		
Oct. 1 – 2, 2024	Grid FWD 2024	Banff, Canada			
Jan. 21 – 23, 2025	IEEE PES Grid Edge Tech	San Diego, CA	Jaime Kolln		

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Program
- Ron B
- Jaime
- Ron A
- Farrokh

Marketing
- Ron B - post production videos
- Need a conference logo
- Jaime and Susie
- Ahlmaz?

Committees

Tutorials
- Grid Architecture 101 - Seemita?
- Grid Edge - Grid Services - Kolln, Chandler and Ortiz
- Bridging Back from the Future - from AHR 2023
- Practical Applications Internationaly - Paterson & ?
- Operational Coordination in a High DER Grid - Rahimi

ald B

GRIDWISE Architecture Council

Thank you to Farrokh Rahimi, Danah Ortaleza, and OATI!

- GWAC Symposium - September 11th – 12th, 2024 in Anaheim

- GWAC Face-to-face Meeting September 13th, 2024, in San Diego (Casa Bernstein)
  - Followed by GWAC's 20th Anniversary Celebration!!!

- September 14th - *Optional* adventure TBD. Hosted by Chair Bernstein.

OATI speakers talks are posted online at the OATI website.

The two Great River presenters today gave permission for their talks to be posted online.

Marc Costa gave permission for his video at this F2F to be posted online.

Shawn Chandler will need to give his permission.

Chris Irwin gave permission for both his previous GWAC talk and the one from this F2F meeting to be posted online.

Action: Ron B and Jaime to discuss the Mission and Vision with the About the Council video in mind to decide if changes are needed to the video. They will discuss in their regular meeting.

Kay is planning to do a talk about her UN Coalition activities at a later date. Marc Costa may want to participate in that as well. This will be recorded.

Ron C will add Grid 3.0 into the appendix structure. There is an issue about acknowledgements (see chat), but prior decision said not to do it. Ron C is questioning the feedback on about the council. He suggested adding a reference to the GWAC website to cover "about the council."

Action: Jaime and Ron C. to discuss final steps for the Grid Future States paper and get it published.

Jaime said that he worked on Seemita's paper to get it published.

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Ron C. said that's Jaime's call for this paper. Going forward the Council can discuss.

Ron B. said About the Council can be the video.

Ron A. suggested putting the mission and vision in the white paper.

Ron C. will email the completed Future States Vision paper to Jaime with n an appendix in the next few days. Jaime will make sure that he uses that version. Ron C noted that has made some corrections.

Jaime is planning to send Ron Cs paper to Susan Tackett the PNNL editor as soon as he gets back.

Action: Jaime Kolln to send the Future States Vision paper to PNNL editors

Jaime explained the new cover with the star hexagon and the background has PV and wind which we had consensus on.

Jaime said in the future maybe the cover background could be switched out based on the topic of the paper. There will be some discussions in future meetings.

Grid Arch for Regulators – Lorenzo presented on this paper yesterday and based on discussions he will have some changes to make.

GRIDWISE Architecture Council

GWAC Future Work Products Discussion

Applying Grid Architecture Concepts to Bridge Back from the Future Grid

in concert with current work and building on the previous GridWise Architecture Council work products, this document attempts to provide a roadmap for operators, planners, developers, integrators, and policy makers as guidance to develop interoperable systems that will architect the grid of the future as described in the future states. This paper will include discussions of motivating participation of customer owned assets and opportunities for avoided costs by working toward a long-term vision rather than only short-term needs. This document will be completed in FY24.

Paper above is progressing well, Mark P is involved.

GRIDWISE Architecture Council

GWAC Future Work Products Discussion

Grid Architecture Concept Model for Transportation Electrification

Analyze various visions of the electrification of fossil fuel-based systems and identify areas where GWAC concepts could provide architectural value to bridge and coordinate between customer and grid objectives. Electrification of traditionally fossil fuel-based loads will introduce dependencies such as those seen in the transportation sector due to electrification. Grid Architecture will be used to describe the touchpoints (for example through sector coupling) that will require collaboration.

This paper is progressing, Ron C. noted that an outline is needed.

Action: Jaime and Ron C. to meet one on one to put together some ideas about an outline and materials to pull from.

GRIDWISE Architecture Council

Actions Items

- GWAC participants who have suggested topics or presenters please let Jaime Kolln and Ron Bernstein know and copy Susie.

- Look into speakers for future GWAC meetings. Possible speakers: SunSpec, Ecogy

- Website updates

  - Reorganize, check links, and add video presentation section with YouTube links

  - Create a GWAC database of presentations for future talks and a speakers bureau post on the website.

  - Create a catalog of speaker materials with links.

- Discussion of the GWAC Mission statement

Jaime said there is a need to line up some future presenters and new topics.

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Ron Ambrosio will reach out to SaLisa Berrien for as a GWAC speaker. Ron A recently heard her give a keynote. She is using technology to achieve better democratization for underserved communities.

Jaime suggested Ecogy – Philip Court, have implemented and ESI with a standard platform for solar that they repurposed the network arch for. Might be a good fit for the International Panel.

Ron B. liked the Ecogy idea, he doesn't think that Council members should be speaking, just moderating.

Jaime noted that August meeting is close to the September symposium date, we may need to move it up.

CalFuse talk by Stephan MacDonald – he volunteered. Jaime will keep him on the list of speakers.

Ron B. said he sees having a CPUC person speaking might be a draw to attract some new people to the GWAC conference.

Action: August 21 meeting may be a bit close to the GWAC Symposium.

Someone asked about holding a GWAC F2F at DistribuTech is in Dallas. Ron M noted the expense; GWAC had done one at a DTech, but the facility and AV costs were very high.

Chair Ron Bernstein asked for a motion to adjourn the meeting. Kay Aikin gave the motion and Marc Costa seconded the motion.

GRIDWISE Architecture Council

Adjourn