

Meeting Minutes

Dec. 14, 2022

GWAC Members

Ron Bernstein, GWAC Chair and President
RBCG, LLC

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

Ron Ambrosio, Independent Energy
Transformation Professional

Andrew Bordine, VP Energy Mkts & Innovation,
Anterix

Ron Cunningham, IT Enterprise Architect,
American Electric Power

Paul DeMartini, Managing Partner, Newport
Consulting

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

Ahlmahz Negash, Sr. Power Analyst, Tacoma
Power

Farrokh Rahimi, Senior Vice President, Open
Access Technology International, Inc

Aaron Snyder, Dir. of Grid Tech. Consulting,
EnerNex

Leonard Tillman, Partner, Balch & Bingham, LLP

GWAC Associates & Emeritus

Rahul Bahadur, VMWare, Inc.

Marc Costa, the Energy Coalition

Ken Wacks, Home, Building & Utility Systems

GWAC Friends

Daniel Boff, PNNL

Toby Considine

Anthony James

David Katz

Jaime Kolln, PNNL

James Orenstein

Steve Widergren, PNNL

David Wollman, NIST

GWAC Members and Assoc. not present

David Forfia, Principal Consultant, Utilicast

Jeff Morris, Schneider Electric

Mark Paterson, Managing Director, Lead
Systems Architect, Strategen

PNNL Support

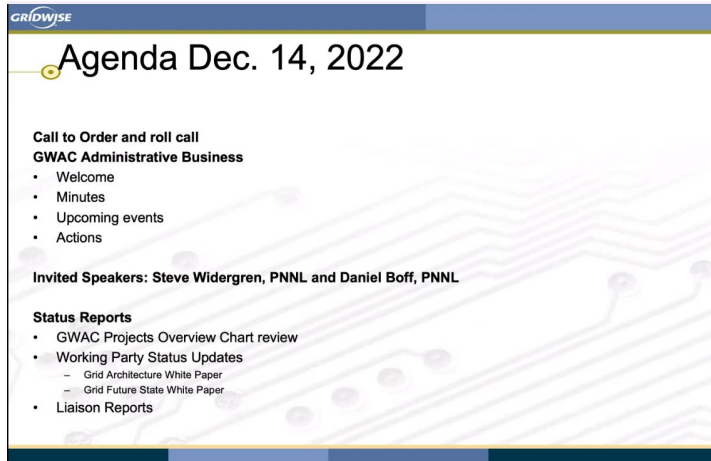
Susan McGuire, GWAC Coordinator

Ron Melton, Acting PNNL Administrator

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GWAC Administrative Business



Ron Bernstein asked for a motion to approve the meeting minutes for September and October. Susie McGuire noted that Ken Wacks has submitted grammatical changes to his liaison reports for both sets and the changes have been made. Kay Aikin gave the motion to approve, and Ron Ambrosio seconded the motion. The minutes were approved with no objections.

Ron Bernstein requested to hold off on approving the November minutes next month to allow more time for review.

Ron Melton noted that GWAC member Gerald Gray has requested to move to emeritus. All other GWAC members with expiring terms wish to continue on.

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Actions

Action: Kay and Susie to collaborate on the next blog post for Rahul Bahadur

✓ Action: Possible speaker from SEPA on future blockchain and TE related initiatives

✓ David Forfia is looking into this

Action: GWAC attendees who have suggested topics or presenters for the F2F meeting, please let Ron M. and Ron B. know and copy Susie.

Action: GWAC to send ideas for the Grid Architecture white paper cover graphic to Seemita Pal, PNNL.

Action: GWAC candidates should apply by Dec. 15, 2022

David Wollman gave a NIST update: "Interoperability is foundational to the development of more inclusive grid institutions." That was the key point made by NIST's Cheyney O'Fallon and Avi Gopstein in their article, [Reducing Barriers to Entry and Hedging Against Obsolescence With Smart Grid Interoperability](#) in *Competition Policy International*, November 2022. As the article's title indicates, increased smart grid interoperability can dissolve barriers to entry for new participants, contribute to creating value for the electric grid, and prevent obsolescence from eroding gains as technologies rapidly evolve.

Ron Melton gave an overview of the 2023 GWAC new member selection process:

GWAC Member 2023 Selection Process

- Expiring terms – Gerald Gray will transition to emeritus. All other members with expiring terms would like to continue.
- Solicitation for individuals to apply for GWAC membership posted and distributed
- Candidates should apply by mid-December
- Selection committee meets in late December or early January
 - 2 GWAC members (Cunningham and Ambrosio) whose terms are not expiring, GWAC Administrator, DOE Program Manager, outsider (Dave Wollman)

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Conferences and Events

| Date | Event | Location | Attend | Speak | Topic |
|-------------------|--|----------------|--------------------------------------|--------------------|---|
| Jan 5 – 8, 2023 | Consumer Technology Assoc.-CES 2023 | Las Vegas, NV | | | Global Stage for Innovation |
| Jan 16 -19, 2023 | IEEE ISGT | Washington, DC | | Yes | Moving to a Self Driving Grid |
| Feb 4 - 8, 2023 | ASHRAE (Co-sponsor with IEEE) / AHR Expo | Atlanta, GA | Ron Bernstein, Farrokh Rahimi (tent) | Yes | Standardized Building Datasets for Benchmarking Control Algorithms, Energy Efficiency, Modeling, and Decarbonization, Possible GWAC F2F |
| Feb 6 – 8, 2023 | AHR Expo | Atlanta, GA | GWAC | Y | Panel Presentation and F2F GWAC meeting |
| Feb 7 – 9, 2023 | DistribuTECH | San Diego, CA | | | |
| Apr 10 -13, 2023 | IEEE PES Grid Edge Technologies Conference | San Diego, CA | Jaime Kolln | Jaime Kolln, Ron B | Grid Interoperability |
| Jul 16 – 20, 2023 | IEEE PES General Meeting | Orlando, FL | | Ron M | Meeting the Energy Needs of a Dynamic World |

Jaime Kolln noted that Ron Bernstein will be presenting with Jaime at the PES Grid Edge tech meeting. Ken Wacks will attend also.

Guest Presentation

Ron Melton welcomed Steve Widergren and Daniel Boff, PNNL who will present a summary of the survey they conducted which is now concluded.

Steve Widergren said PNNL has been collaborating for some time with TNO in the Netherlands on TE issues and with the TE International Community which is a group of 25 to 30 people. They held a series of workshops. TNO also worked with a technical university in the Netherlands and with their energy ministry and produced some interviews and surveys in the EU and North America.

He said they hope to publish a paper on this work with TNO. Dan Boff, PNNL will present today.

Daniel Boff, PNNL gave a summary of the survey that was done on the Transactive Energy Systems project.

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International Transactive Energy Practices Survey

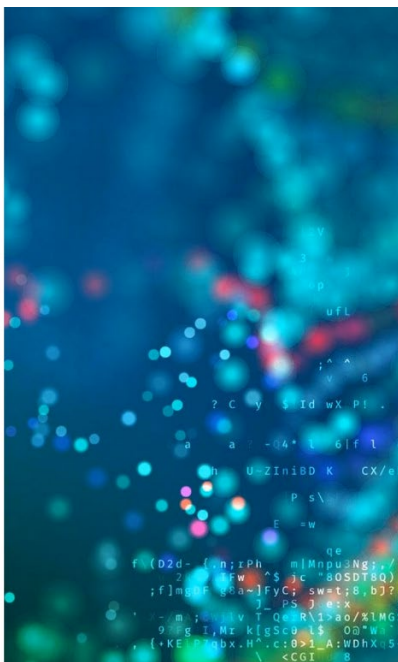
Dan Boff

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PNNL is operated by Battelle for the U.S. Department of Energy

PNNL-SA-180393



Overview

- Survey goals and process
- Characterization of field projects
- Successes and best practices from field projects
- Remaining challenges and opportunities for new research

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Survey Overview

- PNNL and TU/e created a comprehensive list of transactive energy pilots in the US and Europe
 - Through a literature review we identified 33 total projects for inclusion in the study
- A survey was designed to solicit information on 5 areas of the pilot studies: program design, technology, regulation, economics, and business
- The survey contained a mix of qualitative and quantitative questions
- Survey questions had several goals
 - Fill in project information that we were unable to find in the literature review
 - Identify successes and challenges faced by each individual program
 - Learn more about plans to scale TE programs



Organizations and projects represented in survey

| Project Name | Abbreviation | Organization | Location | Start/End |
|--|--------------|--------------------|--------------------------|-----------------|
| P2PQ | (P2PQ) | Wien Energie | Austria | Aug. 18/Aug. 20 |
| Pacific Northwest Smart Grid Demonstration Project | (PNSGDP) | PNNL | OR, WA, ID, WY & MT, USA | Dec. 09/Jun. 15 |
| Pebbles | (PEBBLES) | Pebbles Consortium | Germany | Mar. 18/Mar. 21 |
| Quartierstrom | (QS) | ETH Zurich | Switzerland | Oct. 18/Oct. 20 |
| RegHEE | (RH) | TU. Munich | Germany | Mar. 19/Feb. 22 |
| Retail Automated Energy Systems | (RATES) | TeMix | CA, USA | Jun. 16/Jun. 19 |
| Smart Neighborhood | (SN) | ORNL | GA & AL, USA | Oct. 16/Ong. |
| SoLAR | (SLAR) | | Germany | May. 18/Apr. 21 |
| SSEN Transition | (SSEN) | Opus One | Oxfordshire, UK | 2021/ong. |
| Transactive Campus | (TC) | Uni. of Toledo | OH, USA | Jan. 17/Ong. |
| Transactive Energy Service System | (TESS) | SLAC | CO, USA | Oct. 19/Ong. |
| Vermont Green | (VG) | LO3 | VT, USA | Nov. 19/ong. |
| VPP | (VPP) | Univ. Wuppertal | Germany | Mar. 17/Feb. 22 |

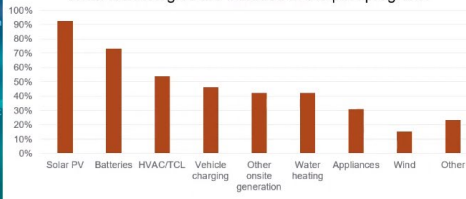
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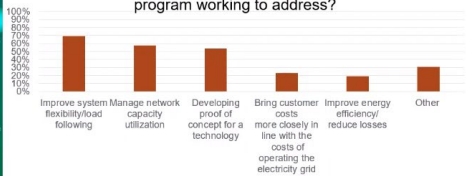
Results: Technology and Participation

What technologies are included in the pilot program?



- Implementers are using a wide array of technologies to meet a wide variety of operational challenges
 - PV is most used resource, then batteries and HVAC
 - 83% of pilots included residential customers, 44% commercial and only 17% targeted industrial
- Operators are most concerned with ascertaining system flexibility and proving out transactive systems
 - Implementers are more concerned with technical efficiency than economic efficiency
- While implementers are using a wide variety of technologies, standards and interoperability remain a key concern
- Roughly a third are using blockchain as a facilitator

What operational or market problems are your program working to address?

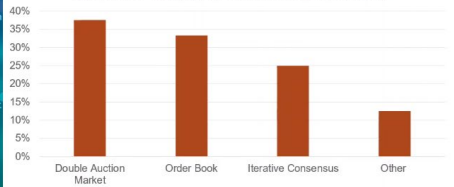


More than 50% of projects wanted



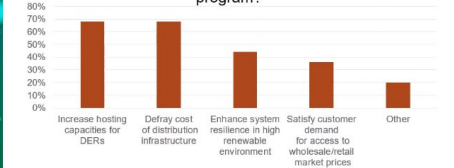
Results: Market Design

What price-forming mechanism is being used?



- There was general confusion about styles of price-forming mechanisms and options for market design.
- Some entities are also testing prices-to-devices or real-time price reaction in their transactive pilots
- Implementers are focused on providing numerous value streams, in order to unlock long term value
 - This indicates that implementers are looking at TE to address multiple objectives, rather than focusing on one specific use case
 - Relying on disparate value streams could make it difficult for TE programs to find a market toehold in the short term
 - Most projects are coordinating operation by scheduling energy to unlock value streams, but there is no common service definition for scheduled energy
- There was a greater focus on proving out transactive theory than packaging TE for effective deployment

What is the long term value proposition for this program?



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Challenge #1 Defining Value Propositions

- Despite the successes, we did not find a single “killer market” for TE.
 - Some respondents indicated it should be implemented in any building with a smart meter, others said no market is ready for transactive energy.
 - Legislation and regulation were cited as barriers, so some respondents suggested focusing on municipal and cooperative utilities
 - ✓ Regulatory barriers were perceived as less burdensome in European markets
 - Customer acquisition (regardless of market) was also cited as a barrier
- Improved communication (especially to system operators) of the benefits of TE was also cited as a clear need
- Future work could include projects directed at customer adoption of TE, addressing regulatory barriers, and broader market scoping studies



Challenge #2 Device Interoperability and System Integration

- Device interoperability and reliability were the number one challenge explicitly mentioned by respondents
- Though there have been several efforts related to standards and controls, more work is clearly needed
- Respondents also cited challenges in identifying vendors and device OEMs that can interface with each other
 - Designation/labeling could help alleviate this issue
 - There are many different vendors of technology to work with, each with non-standard communications protocols
- Though customer engagement was cited as a strength, respondents had issues with device reliability in the field
 - Network outages, connectivity issues, and data collection plagued some pilots
 - The customer enrollment process was also cited as a challenging

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Challenge #3 Education Trust and Market Transformation

- Respondents envisioned that TE programs will address multiple value streams in the long term
 - Though the ability of TE to provide benefits in multiple areas is a long-term strength, the lack of valuable niche application could limit its growth in the short term.
- Likewise, few implementers had a strong vision of how to scale these programs gradually
- Identifying high-value use cases for TE (even if they are limited overall) could provide a pathway for more immediate deployment.
- Having a supportive regulatory environment is important.
 - Respondents said cooperatives and areas with independent DSOs were easier to work with. IOUs and areas with substantial state regulation can be more complex.
- Internal buy-in could also be challenging. Many said they had a strong project team but had difficulty getting buy-in from key decision makers. This made demos short lived.



Future Questions and Opportunities

- How can the transactive community make TE scale?
 - Identify growth pathways for programs to become profitable at scale
 - Improve education for regulators, owner/operator, and other decision makers
 - Improve interoperability and standardization
 - ✓ Make it easy to enroll customers
 - ✓ Accommodate multiple tech providers' devices
- How can programs articulate their operational objectives (value streams) separate from the service transacted to achieve those objectives?
- What role will blockchain play?
- How to address regulatory issues of fairness, reliability, cost effectiveness?
 - No respondents mentioned equity as a concern or objective
 - Regulatory acceptance of dynamic rates and common services remains low

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Ron Melton asked about the architectures used in the systems that they studied.

Dan Boff replied that LO3 or OPUS One platforms were the main platforms being used. This information came up in the interview process.

Ron M. said he was really interested in the structure of their approach such as centralized or distributed. He asked if it was distributed what is the structure of the distributed functionality and what interactions take place?

Dan said that it is a market design question such as is the device communicating and how is the market clearing? Also, who is participating?

Steve Widergren added that there is a lot of dimensions to Ron's question. They had some technologists that they interviewed who really understood the platforms and how they are organized.

He said automation could be located in the cloud or back at central processors, but the architecture could be pushed to devices and things like that. He said a designer needs to have flexibility as to how they think the business can run. He said he thought most projects did meet some level of distributed decision making that are fundamental to a transactive approach.

Ron M. also asked to what extent was there alignment and direct involvement using the transactive system to achieve utility operational objectives versus some other system? Where the purpose was independent of the utility?

Steve replied that the answer is very project specific. Some were aligned around specific use case and the Netherlands is a good example. But we have an issue with congestion. Some large customers are somewhat prepared to move load around because of the congestion and they are going to design the program with that in mind and actually are doing a very good job of solving those system utility system problems.

But others were just trying transactive to see if it works and then find a use for it. So, the answer is it varied based on how the groups were positioning themselves in the market. Steve felt that more of them were in the "let's try it and find a use for it" group.

Ron Ambrosio asked of the projects that were surveyed, how much of a split was there between those that viewed transactive as a method of creating a distributed energy market versus those that really see it as an interoperability and loosely coupled architecture approach, regardless of whether there are markets like explicit markets that transactive bids are going into, such as what we did with the Northwest demo project where there weren't any real markets per se. It was more peer-to-peer negotiation.

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Dan said they were expecting more representation of the sort of bilateral arrangements that they ultimately got. The most common set up was a more centralized double auction type approach. He felt that was largely because that is what most in the utility sector are familiar with.

Ron A. asked if they are mapping transactive to that?

Daniel replied that yes, it's likely the mode but then not necessarily. Many framed their projects as being a bit more of peer-to-peer than they actually ended up being.

He continued that on the utility side there were many people negotiating directly with each other and then when follow up questions were asked, and the answer is no they are submitting bids and doing some matching there, but it's not a true peer-to-peer system.

Marc Costa put links in the chat that are relevant to today's GWAC presentation topic

[Publication by Renewable Energy – Science Direct:](https://www.sciencedirect.com/science/article/pii/S0960148122005055?via%3Dihub)
<https://www.sciencedirect.com/science/article/pii/S0960148122005055?via%3Dihub>

IEEE Explore article:
<https://ieeexplore.ieee.org/document/9535547>

MDPI article:
<https://www.mdpi.com/1996-1073/12/24/4708>

Marc also said that Powerledger has a couple dozen publications that he will forward if anyone is interested which focuses on a few EU countries and Australia.

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PowerPoint Slide Show - [2022 DEC DRAFT GWAC Meeting slides]

| Project | Grid Arch for Regulators | Grid Architecture White Paper | TESC 2022 Conference | Grid Future States | GWAC Blog Content and Review Committee | THE NEXT BIG THING |
|------------|---|--|---|--------------------------------------|---|--|
| Scope | Applying Grid Architecture in the Policy & Regulatory arenas | An introduction to Grid Architecture -- including best practices and real-world examples | Annual GWAC sponsored conference focused on Transactive Energy and related topics | Update Grid 3.0 Future States | Decarbonization, GA for Policy | Council's primary focus for the next year -- results of F2F meeting. |
| Audience | Policy Makers | Geared to stakeholders who aren't familiar with grid architecture | Decision makers, solution providers, labs, academics, policy, solution providers | Industry Stakeholders | Industry stakeholders, public facing website | Council, Friends, All Stakeholders |
| Status | Case studies | Collected inputs and comments from working party members | Complete | First full initial draft is complete | 5 blogs released, 2 in queue | Concept phase |
| Actions | Group: Lorenzo Kristov, Larisa Dobriansky, Kay Aikin, Farrokh Rahimi, Chris Villarreal, Mark Paterson | Finalize draft, polish graphics | Conference Closeout (final accounting, reporting in process RB) | Target: EOY 22 for a candidate draft | Group: Kay Aikin, Ahlmahz Negash, Larisa Dobriansky, Ron Bernstein, Tonya Barham, Rahul Bahadur, Leonard Tillman, David Katz, Tim Schoeche, Heather Donaldson | Potential focus of seminar at AHR Expo in Atlanta in Feb. 23 |
| Leadership | Lorenzo Kristov | Seemita Pal, PNNL | GWAC members on the OC | Ron Cunningham | Kay Aikin | Council |

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GWAC Work Products Matrix

Matrix Action: Ron Bernstein asked Susie to remove the TESC2022 column for next month. (done)

Kay Aikin reported on the GWAC Blog committee that they just met yesterday. Attendance was a bit light but productive. They are planning connect to the work to Next Big Thing for the F2F meeting. They are thinking about titles and ways to contribute.

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WINTER FACE TO FACE GWAC WORKSHOP MEETING FEB 7 & 8, 2023 AHR EXPO ATLANTA, GA

GWAC EVENTS

2/7/23 TUESDAY – 4:00PM – 6:00PM

GWAC PRESENTATION: WORKING BACK FROM THE FUTURE

2/8/23 WEDNESDAY – 8:00AM – 5:00PM – GWAC MEETING/PRESENTATIONS/WORKSHOP.

Ron Bernstein mentioned the recent email announcements that have gone out about the next GWAC Face to Face. Tuesday, Feb. 7 will be a GWAC seminar/workshop that AHR attendees can participate in, and he recalled that when GWAC presented at the AHR in Orlando in Feb. 2020 the attendance was very good.

On Wednesday, Feb. 8 GWAC will have a full day Face-to-Face meeting, and we are expecting to have a quorum of seven in spite of some schedule conflicts. AHR attendees will be invited to participate in that as well.

On GWAC history slide – the latest blog post has been added

Seemita Pal, PNNL, is in India right now and couldn't update the grid architecture white paper slide. If there are any suggestions for the cover graphic, please email Seemita your ideas.

Lorenzo Kristov, Chair of the Grid Architecture for Regulators work group said he is drafting an outline of the final paper and adding material to the purpose statement and the case studies outline. Each team member will add a case study, and all of those will have a comparable format. He will get the outline out before the end of the year and then the team will meet to discuss.

Lorenzo and the group are interested in feedback on this task from GWAC, please send your ideas to Lorenzo.

Lorenzo noted that he will not be at the Atlanta GWAC Face to Face so the work group will not be presenting at that meeting.



“Next Big Thing” / “Back from the Future”

Working party met last week and will meet again tomorrow

Several threads:

- The future is fundamentally different from today
- Strategic gaps (ULS from CMU)
- Role of the “anti-story” in setting up the story / message



Ron Melton noted that the Next Big Thing group met last week to discuss how to approach this topic and how to create an outline for this work. We know that the future is fundamentally different from today. The problem is getting people to realize this. Paul had noted today how some regional groups are not really recognizing this in their long-term planning. We will also look at strategic gaps and how to identify them and to communicate the gaps in our communications. Mark Paterson has presented an interesting narrative about this by telling the anti-story which is his approach.

Ron B. suggested GWAC think in incremental steps – 5 years, 10 years, 50 years. He suggested an assessment phase and then look at the next steps. He sees it as being more than one bridge needed to the future and added that we can't take on everything in one shot, we have to break it into increments.

Ron M. replied to Ken Wacks that we are framing the challenge so we can put the material together for the seminar at AHR. We want to engage participants in a discussion as a starting point. Ron said fundamental changes are required, it won't be business as usual.

Ron M. asked Paul DeMartini about the three S curves for capability.

Paul said originally there was one curve and then as we thought about a more distributed system more curves came along. Two years ago, we realized the current platform won't get us there. We need to think in terms of a technology S curve and then business and regulatory – similar to the GWAC stack. We need to rethink all of it – there is a 2nd platform that gets developed. He added that we are now looking to 2040 and beyond, the thinking has evolved since 2010.

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He said there is something called “pre-mortem” where you look at a future state – such as domestically or globally and you look at where the failure points were. And you ask if there are things that you could have done to mitigate these. If we help people understand things will likely fail to shape design and planning.

Lorenzo said he had been talking with Mark Paterson and said when you look at the bridge construction meeting, you know what the other side looks like. But with this – how do we know what we are aiming for and what we want to build back from?

Ron B. added that there is what we know today and what we think we need. It will be a moving target. We have to start from what we know and then identify the puzzle pieces and gaps.

Kay A. said that does lead to incrementalism. For certain performance and equipment aspects – if we don’t plan for it the premortem is that the lights aren’t on – like a dystopian movie of everyone being back in the dark ages cooking over an open fire because the system falls apart.

Paul DeMartini cautioned that it may not be that bad. He noted intermediate goal of 2030 with a 70% reduction of decarbonization of the electric structure in Hawaii. He asked in the current plans what will it take to achieve that, and do we have the land resources, and do we have the community support. If not, what are the other options? What are the alternatives? What can we do instead of an incremental approach?

Ron M. said that GWAC won’t say what the future will look like other than broad brush strokes. With Power Systems Architecture – what does the system need to be to meet decarbonization goals? The community can work back from set goals.

Lorenzo Kristov agreed and said we need to think about goals, and we should include energy equity. He added that he has a real concern that many people will be left out of the DER revolution.

Chat comment:

Anthony James 11:58 AM Edited

The assumption is that the average energy cost per customer for all energy will decrease by a 1/3 (our investor business update). However, does this apply to DACs, and non EV owners. ditto Lorenzo

US DOE EERE [link](#) to EAS-E Prize for Home Electrification

Commented [MSG(1):

Liaison Reports

David Wollman with NIST has already presented his update at the beginning of the meeting since he had to leave early.

ISO/IEC - Ken Wacks said that mid-December is the period of time between meetings and group members are busy writing standards. Ken noted a standard that he is leading called the Energy

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Management Agent, which provides energy management for consumers using equipment in homes and buildings. It is a base level standard that forms the foundation for all the work we're doing in energy management.

IREC – Ken Wacks noted that the next Customer Grid Edge meeting has been rescheduled for Thursday, December 22. The guest speaker will be someone who has been a program director for microgrids and Puerto Rico recovery from the effects of the recent major hurricane. The meeting is open to the public. Anyone interested in attending can contact Ken Wacks for more information.

Chat information about Registering for the 2023 AHR Expo:

11:37 AM

REGISTER: GWAC attendees can register for the 2023 AHR Expo at no cost. You will get an AHR Expo badge for access to the conference venue.

All advanced registration is free online: <https://registration.experientevent.com/ShowAHR231/>

Venue: Georgia World Congress Center, 285 Andrew Young International Blvd, NW, Atlanta, GA 30313

Ron Bernstein thanked today's speakers for their presentation to the GWAC and he adjourned the meeting.