Goal 3: Field Detection & Diagnostics (FDD) Committee
Monday, May 15, 2017, Meeting Notes

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Call to Order

Co-Chair Sean Gouw (SCE) called the May 15, 2017, meeting of the FDD Committee to order at 10:06 a.m. PDT.

Agenda

TOPIC	FACILITATOR
Roll Call Agenda Review Approval of April 24, 2017, Meeting Minutes	Bonnie Gustavson Sean Gouw Elsia Galawish
Discuss FDD Roadmap	Joe Schmutzler
Discuss FDD-CQM Activities	Sean Gouw Elsia Galawish
Next Steps and Adjourn	Joe Schmutzler Sean Gouw

Roll Call

Organization	First Name	Last Name	WHPA Category	P=Present
Voting Members				
ACCA (Air Conditioning Contractors of America)	Glenn	Hourahan	Contractor Association	
Carrier Corporation	Dick	Lord	HVAC Manufacturer	
Daikin Applied	Skip	Ernst	HVAC Manufacturer	P
Ezenics, Inc.	Benjamin	Kelderman	Other Stakeholder	
FDSI (Field Diagnostic Services, Inc.)	Dale	Rossi	Third Party Quality Assurance Providers	P
Goodman Manufacturing	Aniruddh	Roy	HVAC Manufacturer	P
JCI (Johnson Controls, Inc.) (YORK)	Wayne	Guelfo	HVAC Manufacturer	
NBI (New Buildings Institute)	Alexi	Miller	Energy Efficiency Organization	
Proctor Engineering	Abram	Conant	Other Stakeholder	P
Purdue University	Andy (Andrew)	Hjortland	Research Organization	
SCE (Southern California Edison)	Sean	Gouw (Co-Chair)	California IOU	P
Trane-Ingersoll Rand, Inc.	Caleb	Joiner	HVAC Manufacturer	P
Transformative Wave	Joe	Schmutzler (Co-Chair)	Controls (Manufacturer or Distributor)	P
TRC, Inc.	Farhad	Farhamad	Other Stakeholder	P
Verified, Inc.	Robert	Mowris	Third Party Quality Assurance Providers	

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Organization	First Name	Last Name	WHPA Category	P=Present
XCSPec	Janet Jeff	Peterson Aalfs	Controls (Manufacturer or Distributor)	
Guests				
Bes-Tech Inc.	Jeff	Gamble	Controls (Manufacturer or Distributor)	P
Energy Solutions	Jim	Hanna	Energy Efficiency Program Consultant	P
Staff				
BJGustavson Consulting (WebEx)	Bonnie	Gustavson	Other Stakeholder	P
Galawish Consulting Associates (Staff Support)	Elsia	Galawish	Energy Efficiency Program Consultant	P

Agenda Review

Sean Gouw (SCE) reviewed the agenda:

1. FDD Roadmap Update: He reported that there were no additional comments on the FDD Roadmap but requested continued input from members. All updates to be incorporated by 6/12/17.
2. FDD-CQM Update: Update CA CQM Considerations & Recommendations Document, advise on structure of CQM measures, role of FDD, and incorporate all updates by 6/12/17.
    i. Formal Link with WHPA CQM Committee?
3. Complete – 2019 California T-24 Codes & Standards FDD Activities: FDD Committee's discussions on this topic for both the residential and non-residential sectors were enough to feed into the ongoing T24 update process. This item is considered complete unless the Committee hears from either Farhad Farahmand (TRC) or Davis Energy for any needed follow up discussions or required information.

Approval of April 24, 2017, Meeting Minutes

Sean Gouw (SCE) motioned to have the April 24 FDD Committee Meeting Minutes approved, and Skip Ernst (Daikin Applied) seconded the motion. Since there was not a voting quorum at the meeting, roll call and email votes were tallied, and the motion passed.

A roll-call vote was called, and the following seven "aye" votes were cast:

1. Daikin Applied, Skip Ernst;
2. FDSI, Dale Rossi;
3. Goodman, Anriuddh Roy;
4. SCE, Sean Gouw;
5. Trane, Caleb Joiner;
6. Transformative Wave, Joe Schmutzler;
7. TRC, Farhad Farahmand.

An email vote was taken, and the following six "aye" votes were cast:

1. Bes-Tech, Jeff Gamble;
2. Carrier, Dick Lord;
3. Energy Solutions, Jim Hanna;
4. JCI, Wayne Guelfo;
5. NBI, Alexi Miller;
6. Proctor, Abram Conant; and
7. Verified, Robert Mowris.

Discuss FDD Roadmap

Joe Schmutzler (Transformative Wave) continued the Roadmap Update discussions focused on comments received to date, discussions on removal of parts of the roadmap that have been completed, and determination of those areas that still need to be tracked or worked on.

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- ***CLTEESP HVAC Goal 4:*** *New climate--appropriate HVAC technologies (equipment and controls, including system diagnostics) are developed with accelerated market penetration.* ***Goal Results:*** *At least 15 percent of equipment shipments are optimized for California's climate by 2015 and 70 percent by 2020.*
  1. *Is there any data on % of units sold with Title 24 approved FDD systems?*

Joe Schmutzler (Transformative Wave) posited the need to track the 15% of shipments optimized for California climate, see where it stands, and whether the goal can be met by 2020. He noted that one potential impediment to accomplishing this is the low percentage of permits pulled for equipment actually installed in California. As a result, to verify what is installed versus what is sold becomes a difficult task.

Dale Rossi (FDSI) – However, over the past several years, manufacturers have been adamant that any product developed must be universally available across the country. They will not develop a product just for the California market. Because of that, these kinds of regional standards have been fought *tooth and nail* by the manufacturers.

Sean Gouw (SCE) – Currently the Federal standards do incorporate additional EER requirements for specific regions.

Roy Aniruddh (Goodman Manufacturing) – I agree that there are EER requirements for residential A/C that varies by capacity (11.7, 12.2 EER for 5 tons or less).

Dale Rossi (FDSI) – FDD requires a microprocessor. Manufacturers have a line of value-priced products that do not contain microprocessors, and they do not want to lose that line of products or any sales in a particular jurisdiction because of that.

Sean Gouw (SCE) – How does FDD fit into this goal? Is there any connection?

ACTION ITEM: Joe Schmutzler (Transformative Wave) – The Committee may seek to remove this particular Roadmap Goal given that the nature of FDD is not relevant just to California.

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- ***CLTEESP HVAC Strategy 4-5****: Develop nationwide standards and/or guidelines for onboard diagnostic functionality and specification for designated sensor mount locations.*
  1. ***Short Term Milestones****:*
     a. *Establish an industry--wide task force to develop national standard diagnostic protocols.*
        - *2015 IECC has economizer FDD requirement. At least WA has this code*
     b. *Begin implementation.*
     c. *Incorporate into HVAC industry and utility programs.*
        - *Service programs in CA have incentives for FDD*

Joe Schmutzler (Transformative Wave) – The development of nationwide standards and/or guidelines are slowly moving forward in some states. In addition, service programs in California provide incentives for FDD. The Committee may want to review what is being installed and the quality of those installations to see what is going on in the field.

Dale Rossi (FDSI) – The process of getting FDD into code was backwards. The FDD product existed prior to the discussion to include it into code; code was then written around the specifications of the existing product. For refrigeration cycle FDD, this issue does not exist.

Sean Gouw (SCE) – The strategy does not specify diagnostic functionality.

Dale Rossi (FDSI) – For economizers, a self-certification process was developed; however, the requirements are vague, open to lots of interpretations, and there are no enforcement requirements. In addition, included in the code is the idea that a customer should be able to see what the economizer is doing – the process must be enunciated. The utilities' incentive programs do not enforce this. In my research, I have seen no instance where it was installed and enunciated.

Sean Gouw (SCE) – It looks like there may be enforcement activities that can be pursued.

Skip Ernst (Daikin Applied) – It was a very vague code requirement. The committee involved in including this into T24 came up with a testing procedure that provided a method for manufacturers to take the vagueness out of it. Whether it is enforced or not, there is a list of all manufacturers on website.

Sean Gouw (SCE) – There are activities trying to put a little more substance behind some of that vagueness; i.e., ASHRAE SPC 207 is trying to establish test methodology for it.

Dale Rossi (FDSI) – Those test methodologies are only to test claims, and there is nothing there to say that those claims are of interest to those concerned.

Sean Gouw (SCE) – I emphasize that we do have something on the table to support the strategy. We need to list all questions that should be answered. For example:

2. What can be done to reduce the vagueness?
3. What can be done to address which types of claims should be emphasized?
4. What is the role of this Committee to help push this strategy forward?

Skip Ernst (Daikin Applied) – To advance FDD, the importance of working with industry to resolve the vagueness should be stressed; it cannot be done in a vacuum within a committee.

Dale Rossi (FDSI) – Both ASHRAE 207 Committee and the past FDD Committee discussed this, and there were a lot of concerns during this first attempt to put a standard around FDD, but the language appeared in T24 because no one knew what they wanted and they preferred the vagueness.

Sean Gouw (SCE) – How do we extend the reach of conversation on this topic to others? Are there other partners and venues to engage?

Dale Rossi (FDSI) – The important thing is to address the vagueness. Have a standard or some guidelines so that data that comes out of the FDD can be standardized, can be integrated with other systems, and can be used. Currently, everything is very proprietary, and there is no thought about how the data could be used. The critical question here is, "How is the data going to be used?"

Sean Gouw (SCE) – I agree that *putting more meat* behind what is done with the data is a worthwhile activity to be pursued. We have discussed the vagueness, but there is still the question of other partners and venues to engage and share info. Examples include this Committee, ASHRAE 207 Committee, T24 Stakeholder Meetings, and AHRI. Can we partner with them?

Aniruddh Roy (Goodman) – There has been no public review of ASHRAE 207, given the work done for seven years, so what is the timeline for public review of ASHRAE 207?

Sean Gouw (SCE) – I am not sure of a timeline, although one needs to be established, and there needs to be more confidence in the usability of the language before public review. Committee members were hesitant to release the current draft.

Dale Rossi (FDSI) – It boils down to this—the title/scope/purpose of the 207 Committee has three different FDD aspects: (1) Economizers, (2) Airflow, and (3) Refrigeration Cycle. Due to the development around T24 codes (discussed here), economizer FDD is much better defined than airflow or refrigeration FDD. The ASHRAE 207 Committee cannot currently release an economizer-only testing scope without the other two aspects. Problems are in the institutional process-related issues with releasing part of a standard while working on other components.

Sean Gouw (SCE) noted that the Committee agreed to tackle the economizer FDD first.

Aniruddh Roy (Goodman) raised this issue because he wants to see how we can tie in the ASHRAE 207 efforts fully into the FDD Committee efforts. There is a lot of cross-pollination.

ACTION ITEM: Sean Gouw (SCE) will ask the ASHRAE 207 Committee for a targeted review of their draft standard by the FDD Committee before public release for comments.

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- ***CLTEESP Strategy 4-6:*** *Prioritize in--field diagnostic and maintenance approaches based on the anticipated size of savings, cost of repairs and the frequency of faults occurring.*
  - ***Short Term Milestones****:*
    a. *Benchmark existing diagnostic, repairs and maintenance protocols and develop appropriate products.*
  - ***Mid Term Milestones****:*
    a. *Commercialize On--0board Diagnostic systems*
  - ***Long Term Milestones****:*
    a. *Incorporate mandatory Onboard Diagnostic Systems in California Building Codes*
- ***Economizer FDD part of CA code, moving to faults being listed at/near Tstat***

Joe Schmutzler (Transformative Wave) – We have made progress on the economizer side.

Dale Rossi (FDSI) – In order to accomplish this idea, there needs to be an agreement within industry. A manufacturers' agreement on standard for thermostats relating to how to do this is not there. It is currently being ignored.

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- ***Lack of Availability.*** *Existing residential and commercial HVAC systems have limited ability to detect operating faults. There are third--party FDD tools, but most are not readily available or understood by consumers. Few embedded, automated residential FDD tools are available. There are no tools that can detect multiple faults, which are much more common than individual faults.*
  - *FDD is common in commercial systems*
- ***Research into FDD on Thermostat.***
  - *Being implement in Title 24*

Joe Schmutzler (Transformative Wave) – Infield implementation is an issue, and we are far from that capability.

Dale Rossi (FDSI) – Currently there is AMI data that is physically available but no one is using it. We have the data analytics to parse the data.

Sean Gouw (SCE) – Some legislation (AB 802) is pushing California to use metered data.

Dale Rossi (FDSI) – However, there is a difference between what a Bill can do (make data available) and what can be done with the data. It is not just how you process the data but how it is presented if you want people to act on it.

Farhad Farahmand (TRC) – In talking to manufacturers regarding ECMS data, that FDD vendors do look at building-level ECMS data like power input outside air temperatures.

Dale Rossi (FDSI) – However, 90% of units are not attached to ECMS, but 100% are connected to the grid in California where there is AMI data available.

Joe Schmutzler (Transformative Wave) – AMI data availability may be an item to look into.

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- ***Lack of Standards*** *Currently, there is no established method to prove that an FDD tool works properly and will not generate excessive false alarms.*
  - *Standards good enough to implement in state codes, but no simple comparison tool, similar to LEDs on DLC*
  - *Need to re-engage with other standard setting groups, or would this just slow things down with little benefit?*
- ***ASHRAE*** *Standard Method of Test for RTU FDD*
  - *ASHRAE Standard 207 – currently on hold, WAS THIS INCORPORATED into 90.1/90.2?*

Joe Schmutzler (Transformative Wave) – Standards for testing FDD tools—implementing in state codes but how do customers compare like-to-like systems?

Dale Rossi (FDSI) – It will be very useful if this Committee can create some form of clearinghouse that contains knowledge about (a) what is learned about these technologies as we progress, (b) what is used, and (c) what produces value—basically, capturing lessons learned. For example, there are those who define the effectiveness of an FDD system as being able to detect a problem at smaller and smaller intensities. If you can detect at these smaller intensities, you have a better system. However, from my experience and work done at Purdue, this is not the case. You need to look at the cost of having this problem. The cost of the energy is the issue. To reach market acceptance, you need to have some kind of evaluation that takes into consideration what it is really worth.

Sean Gouw (SCE) – The evaluation aspect has been incorporated into the FDD evaluator.

Dale Rossi (FDSI) – Lots of industry folklore is accepted as true. This Committee may take up the task of explaining, documenting, and communicating this information because the info is valuable but not obvious.

ACTION ITEM: Dale Rossi (FDSI) will provide his chapter from a book containing many essays on fault detection and diagnostics in buildings (edited by Mike Brambley-PNNL). *This Action Item has been completed.*

Sean Gouw (SCE) – As part of our deliverables from last year, this Committee developed a literature list, which will be added to that list. This Committee can look into (a) an FDD lessons-learned segment and extend an invite to others to present, and (b) lack of information dissemination.

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- **Lack of Customer Pull**
  - ***High Performance RTU Challenge***
    - DOE has ongoing annual awards and promotion
  - ***Program Pilot Test***
    - IOUs have implemented programs that incorporate promoting FDD
  - ***Research into Market Acceptability***
    - Currently implemented by all OEMs. Limited research shows little or no communication to customers and no setup of faults notice to customer or contractor.
  - ***Design IOU FDD Program***
    - IOUs have implemented programs that incorporate promoting FDD
  - ***Launch IOU FDD Program***
    - IOUs have implemented programs that incorporate promoting FDD

Sean Gouw (SCE) – The last two bullets are basically what we are trying to feed into with our deliverable on CQM activities; trying to make those connections.

ACTION ITEM: Co-Chairs Sean Gouw (SCE) and Joe Schmutzler (Transformative Wave) will coordinate revision of Roadmap and send to the Committee. Joe Schmutzler (Transformative Wave) to present changes at June 12 FDD Committee Meeting.

Discuss FDD-CQM Activities

Sean Gouw (SCE) – There are two paths/strategies for CQM activities.

Strategy 1: Create a stand-alone HVAC CQM Statewide FDD measures, in addition to the current measures:

- **Pros**: Directly recognize FDD's value in achieving kW/kWh savings, empower CQM offering to a measurement-based approach rather than checklist, establish a feedback loop for field data to inform forecasting and verification activities.
- **Cons**: Lots of upfront work, much uncertainty, rigid approach is not easily adaptable with changing technology landscape, and risk of bias towards certain offerings.

Dale Rossi (FDSI) – There is technology currently available in San Diego and for other utilities in California. They are giving incentives for Wi-Fi thermostats. As soon as you have that, you now have data flow, and that data flow can be used to measure baseline. You can do FDD on data that comes off these thermostats and can also tie into CQM via performance monitoring—space temperature, looking at how long it takes to reduce temperature in run time 1 degree, compare to the ambient temperature, and find out when there is a change in the unit's performance. These are completely useful in a high performance maintenance program. Standard 180 has specific language that allows for these types of measurements to be used.

Sean Gouw (SCE) – We can add to the current CQM list of offerings measures like what Dale just mentioned, but we should set expectations about the high level of upfront work and uncertainty and inflexible approach given the changing technology landscape.

Dale Rossi (FDSI) – We simply have to design a proposal, and then it is up the implementers to run with it. CLEAResult has a Wi-Fi thermostat program at SDG&E and PG&E has a program, so there is enough to kick-start the proposal. One does not need to develop any algorithms – already available.

Sean Gouw (SCE) – Under the "deemed approach" to implementing programs within California, there is an uphill battle at getting measures incorporated into the DEER database. It takes a lot of upfront work during the IOU/CPUC Energy Division process for developing measures. It is a slow-moving rigid process, so let's feed into that as much as possible and recommend measures. Some questions may include: How do you build in the FDD savings? What studies can be used as justification? How do we develop the measure?

Strategy 2: Maintain a qualified FDD product list; let FDD enhance the realization rates of current CQM measures by acting as a "validation tool" for CQM implementers and evaluators.

- **Pros**: Allows more flexibility to learn/adapt to landscape of FDD technologies, choice for CQM implementers to explore/choose solutions.
- **Cons**: FDD plays a passive role in CQM; may not be fully utilized.

Sean Gouw (SCE) – Keep an eye on the product list and try to establish what types of things they do – be informative and allow customers to make informed choices.

- **FDD Qualification Criteria**
  - "Performance" criteria = each FDD technology is subjected to test runs (lab, simulation), and outputs have to meet an established performance metric.
  - "Prescriptive" criteria = each FDD technology should provide documentation of capabilities that meets the "checklist" of established target capabilities.

- **FDD Offering Mechanisms**
  - In-field tools that help techs during visit.
  - Onboard, remote monitoring tools that leverage historical data from one or more of a variety of sources.
    - Factory-installed devices
    - 3rd party/long-term/field installed
    - Thermostat
    - Building energy management systems
    - Advanced metering infrastructure (AMI) smart meter data

Sean Gouw (SCE) – The criteria for evaluating the performance metrics needs a little more work. The methodology has not been fully established.

Next Steps and Adjourn

ACTION ITEMS

- **Page 3**: Joe Schmutzler (Transformative Wave) – The Committee may seek to remove this particular Roadmap Goal given that the nature of FDD is not relevant just to California.
- **Page 5**: Sean Gouw (SCE) will ask the ASHRAE 207 Committee for a targeted review of their draft standard by the FDD Committee before public release for comments.
- **Page 6**: Dale Rossi (FDSI) will provide his chapter from a book containing many essays on fault detection and diagnostics in buildings (edited by Mike Brambley). *This Action Item has been completed.*
- **Page 7**: Co-Chairs Sean Gouw (SCE) and Joe Schmutzler (Transformative Wave) will coordinate revision to Roadmap and send to the Committee. Joe Schmutzler (Transformative Wave) to present on changes at June 12 FDD Committee Meeting.

Next scheduled Meeting is Monday, June 12, 2017, 10:00-11:00 a.m. PDT. *(This meeting was cancelled.)*

The remainder of 2017 FDD Committee Meetings (July-December) will be scheduled soon.

The meeting adjourned at 11:10 a.m. PDT.

Submitted by Elsia Galawish, WHPA Staff
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