

**AMERICAN SOCIETY OF HEATING, REFRIGERATING AND AIR-CONDITIONING  
ENGINEERS, INC.  
1791 Tullie Circle, N.E./Atlanta, GA 30329  
404-636-8400**

**TC/TG/MTG/TRG MINUTES COVER SHEET**

(Minutes of all Meetings are to be distributed to all persons listed below within 60 days following the meeting.)

TC/TG/MTG/TRG No. 6.1 DATE August 12, 2014

TC/TG/MTG/TRG TITLE Hydronic and Steam Equipment and Systems  
DATE OF MEETING July 1, 2014 LOCATION Seattle, WA

MEMBERS PRESENT	YEAR APPTD	MEMBERS ABSENT	YEAR APPTD	EX-OFFICIO MEMBERS AND ADDITIONAL ATTENDANCE
Ramez Afify	2011	Tricia Bruenn	2009	
Jason Atkisson	2011	Trevor Houck	2010	
Michael McDermott	2011	Ken Luther	2011	
Frank Myers	2013			
Don Prather	2013			
Rex Scare	2011			
Greg Towsley	2013			
Edward Tsui (non-quorum)	2011			

**DISTRIBUTION**

<i>All Members of TC/TG/MTG/TRG plus the following:</i>	
TAC Section Head:	Mark C. Hegberg
TAC Chair:	Walter T. Grondzik
All Committee Liaisons As Shown On TC/TG/MTG/TRG Rosters:	ALI/PDC – Hugh D. McMillan Chapter Tech. Transfer – Maggie Moninski Research - Stephen S. Hancock Special Pubs - Standard – Cyrus H. Nasser 2016 HB Systems - Forrest S. Yount 2017 HB Fundamentals – Van D. Baxter
Manager Of Standards Manager Of Research & Technical Services	Stephanie Reiniche Mike Vaughn

## **1. Call to Order:**

Vice Chair Scare called the meeting to order at 1:03pm. The Vice Chair welcomed all in attendance, and self-introductions were made. An attendance sheet was passed and signed by those in attendance. A roll call of voting members was conducted and a quorum was present with attendance with 6 of 11 voting members at the start of the meeting. 2 additional voting members (1 non-quorum voting member, included) joined the meeting while in progress.

Technical Committee 6.1 is concerned with all aspects of hydronic and steam systems. This includes the application of boilers, chillers, terminal units, and all accessories and controls making up the total system as well as the design of the integrated system. In addition to comfort applications of both heating and cooling, snow melting systems are included. Cooperation with other TCs is recognized in areas such as control, noise and vibration, refrigeration, pumps and hydronic and service water piping.

## **2. Setting of the Agenda:**

The Chair passed out an updated Agenda. Motion by Don Prather, seconded by Jason Atkisson to approve the agenda. Motion passed 5-0-1 (with the Vice Chair abstaining).

## **3. Approval of New York Meeting Minutes:**

Motion by Jason Atkisson, seconded by Frank Myers to approve the past meeting minutes. Motion passed 5-0-1 (with the Vice Chair abstaining).

## **4. Recognition of Liaisons:**

Mark Hegberg, Section Head, advised the TC that he was attending the meeting as a Corresponding Member, not as the Section Head.

Cyrus Nasser, Standards, asked the TC to reaffirm, revise or withdraw Standard 125. The committee last reaffirmed this standard in 2011. Vice Chair Scare appointed a subcommittee to look into this issue and report back to the full committee. Jason Atkisson and Edward Tsui were appointed as members. TC 6.8 has also been asked to review Standard 125 and will return their comments to TC 6.1.

## **5. Chair's Report**

Vice Chair Scare summarized the key items from the Section 6 Breakfast.

- (a) Explained the Outstanding TC Award.
- (b) 2014/15 Hightower Award Nominations are open.
- (c) Members are encouraged to update their 'employment discipline' on their respective ASHRAE bio (on-line).
- (d) ASHRAE will be sending attendees an e-mail offering the issuance of a letter to the member's employer thanking the employer for their TC service.
- (e) TC Subcommittees are now permitted and encouraged to utilize a conference call or a web meeting to encourage more participation. Mike Vaughn is the ASHRAE contact for scheduling these.
- (f) A new TAC Presentation Template is available for members to present at their local chapter.

- (g) ASHRAE is looking for input on developing topics of interest for 'how to' training modules (e.g. How to Use Social Media for ASHRAE).
- (h) Members are encouraged to post on the ASHRAE Exchange, [www.ashraexchange.com](http://www.ashraexchange.com).
- (i) Professional development is a key element of the current ASHRAE Strategic Plan with an emphasis on e-learning and learning tools for operation and maintenance.

## 6. Sub-Committee Reports

- A. Research: Tom Cappellin (Chair). Subcommittee meeting minutes of June 30, 2014 are attached.
- B. Chilled Water Sub Committee : Steve Tredinnick (Chair). Chair Tredinnick reported little activity from the last meeting in New York. The load profile, chapter summary, outline and volunteers remain the same. Anyone else interested in volunteering should contact him to be added to the list.
- C. Programs: Mike McDermott (Chair). Subcommittee meeting minutes of June 30, 2014, are attached. Spreadsheets with a look ahead to proposed programs in Chicago, Atlanta, and Orlando are also attached.

The TC sponsored in Seattle, Workshop 8 – Variable Air Volume Reheat vs. Active Chilled Beams and Dedicated Outdoor Air Systems Workshop.

Chair McDermott reviewed the upcoming programs for Chicago, Atlanta, and Orlando.

Ideas for future programs are always welcome to Mike McDermott.

- D. Handbook: Jason Atkisson (Chair). Subcommittee meeting minutes of June 29, 2014, are attached.
- E. Membership: Larry Konopacz (Chair). John Glunt has resigned as Chair of the Subcommittee. The TC thanks John Glunt for his service to the Committee.

Larry Konopacz has accepted the Chair position.

- F. Standards: Mike O'Rourke (Chair). Chair O'Rourke reported Standard 55 has had a series of updates and reads much better. Funding has been approved for a user's manual and the outline is completed.

Frank Myers reported on Standard 155P. The group is continuing to meet and is making progress. The decision has been made to go away from the Calometric Testing and replace it with a jacket loss test. Modeling is being conducted to provide default values for those who wish to use it in lieu of running the full test. The next step is to develop the information into the Standard language.

Robert Bean reported on the Solar Hydronic Codes stating the first review is completed. The comment period for the second review is over and the group is preparing to review those comments.

Greg Towsley reported on the activities of 90.1

- Presentations at full 90.1 committee meeting
  - Interesting one about the success of Vancouver, BC using 90.1-2010
  - PNNL presentation on energy end use costs in commercial buildings
    - \$110 billion total/\$11 billion new annual energy costs in 83 billion sq. ft.
    - Includes analysis on HVAC by climate zone and by building type
    - Opportunity still exists with service water heating and cooling, a little with heating, but most still with lighting and “other” equipment.
    - Pumps have been broken out in more detail and included in “Fan Aux.” category
    - Pumps – 0.5% - “not as much as they thought”
    - A lot of savings is shown with pumps, due to changes over the years requiring variable speed driven pumps, but more is possible.
    - Large office buildings and hospitals have the greatest pump energy consumption, as expected
- Reported to the Mechanical Subcommittee the status of the DOE Pump Rulemaking ASRAC Work Group
- Mostly “quiet” in 90.1 work with Hydraulics
- AES Hydraulics Work Group
  - Goals of Work Group:
    - Prescriptive requirements in 90.1 (chapter 6)
    - Appendix G or Chapter 11 for engineers who do not plan to do their own chiller plant optimization studies.
    - Fill gaps in the modeling of Appendix G (or maybe Chapter 11).
    - Addendum BM may require recommended good practices to be put into the User’s Guide or the upcoming Handbook chapter.
  - Pumping energy (Chapter 6) is being looked at
    - Modification of pipe table
    - Condenser pump energy budget
    - Cooling tower approach

Frank Myers asked for 90.1 to consider things that could affect the energy efficiency of the hydronic system (such as pipe efficiency, the effect elbows have on flow in regards to pump power, etc.) that can be effective measures of reducing pump energy. Mr. Towsley asked for any suggestions to be sent to him and these will be forwarded to 90.1 for consideration.

Attached to these minutes is Mr. Towsley’s presentation to the Hydronic Institute updating the energy conservation standards for commercial and industrial pumps.



G. Professional Development (ALI). Greg Towsley (Chair):

- New ASHRAE Strategic Plan – with the approval of the ASHRAE’s new strategic plan, professional development will be a key element of the plan. They have identified a focus on the method of e-learning. In addition, there will be a new effort related to operation and maintenance.
- SDL 7 – Water System Designs (Mark Hegberg) – Again, the SDL is nearing completion. Mr. Hegberg has received the I-P ‘staff draft’ and is in the process of reviewing the staff’s comments. No decision has been made on how to produce the SI version.
- SDL 12 – Heating Systems (Mark Hegberg) - No work received by ASHRAE staff on this SDL. Mr. Hegberg reports Bill Pascal is working on this with him. He feels this will be finished by the end of summer/early September.

H. Web: Jason Atkisson (Chair) David Lee is the new Webmaster. He will be handling future updates to the website. All is updated for the website. The Vice Chair thanked Jason Atkisson for his service to the TC in this position.

**7. Liaison Reports from other TC’s and Organizations.**

Aykut Yilmaz reported AHRI is working on revising its Residential Baseboard and Commercial Finned Tube Standard. Any members interested in participating in the revisions should contact Aykut Yilmaz from AHRI ([ayilmaz@ahrinet.org](mailto:ayilmaz@ahrinet.org)). AHRI is specifically seeking to expand the method of test to include instructions and diagrams on steam fittings and piping for commercial finned tube enclosures and multi-tier bare elements. Specifically, information on header design, series and parallel fittings, purging excess air from the multi-tier bare elements is requested.

Greg Towsley reported on the work being conducted by the seven pump manufacturers of the Hydraulic Institute to develop new test procedures for circulators with the Department of Energy.

Robert Bean reported the ISO 205 Working Group 8 has completed the first design standard related to embedded pipe radiant systems and radiant panels with air gaps. This work is continuing.

**8. Old Business:**

- (a) Due to the absence of Ken Luther, no update was provided regarding the IAPMO proposal to make major revisions to the hydronic requirements in the UMC (Uniform Mechanical Code).

**9. New Business:**

- (a) TC 7.3 has proposed a MTG (Multi-Discipline Task Group) to address the operations and maintenance activities that impact energy efficiency. TC 7.3 is asking for our involvement as either a co-sponsor or to join the MTG. Don Prather volunteered to participate in this MTG as a representative of TC 6.1 and will report back at the next meeting.

**10. Meeting Adjournment:**

Motion by Greg Towsley, seconded by Jason Atkisson, to adjourn the meeting. Meeting adjourned at 2:58pm.

Submitted by,  
Bob Walker.  
TC 6.1 Secretary

Research Subcommittee Report For:

ASHRAE TC 6.1 Hydronic and Steam Heating Equipment and Systems Technical Committee

Submitted By Thomas E. Cappellin, Chair of TC 6.1 Research Subcommittee

Meeting held Monday, June 30, 2014 – 3:16 PM – 4:15 PM – Seattle

Items discussed:

1. Reviewed Research Subcommittee Chair's Breakfast:

- a. ASHRAE currently has 63 active research projects having a total value of \$10.8 million.
- b. Since June, 2013, 16 projects were completed; 20 new projects were approved for funding; 19 projects are now under contract; 12 Tentative Research Projects (TRPs) have been released for bid.
- c. At Seattle, RAC evaluated 9 RTARS; 5 were accepted with comments; 4 were rejected with comments.
- d. 4 TRP bid packages were to be evaluated within the week.
- e. 2 URPS were under review by RAC and TCs.
- f. This Chair was advised that TC 6.1's RTAR-1736 was rejected by RAC, with comments. The comments will be reviewed by this Chair to determine how this committee will respond to the comments. See below for a brief report on these comments.

2. Consideration for possible future RTARs:

- a. Establishing good practice design for minimum and maximum copper tube flow velocity in open and closed hydronic systems.
- b. Evaluating automatic fluid control valves for flow limiting and flow regulating characteristics to determine if they perform with accuracy and dependability.
- c. Several RTAR topic possibilities were discussed but considered to be better covered if presented as programs. These topics were given to Programs Subcommittee for their consideration.
- d. Chair will work with the subcommittee members to develop additional topics for development into RTARs during the months prior to the Chicago meeting.

3. TC 6.1's RTAR 1196:

- a. An older RTAR submitted by TC 6.1 has been under contract by the University of Iowa. The person leading the research on this RTAR is retiring but his office has reported that they plan to complete the project and submit their results to ASHRAE in a timely manner. This Chair will contact the University to secure their schedule for completion.

4. Rejection of RTAR 1736:

- a. It was reported that our current RTAR may be in conflict with similar RTARS being considered by TC 1.4 "Control Theory and Application" and TC 4.7 "Energy Calculations". Thus, the reason for its rejection. This Chair will contact these TCs and determine if our RTAR's subject matter, and intent, is parallel with theirs or if we are addressing a hydronic balancing solution that does not infringe upon their process.

End of Report

Attachments: ASHRAE letter rejecting RTAR 1736  
Attendance Sign-in Sheet



Shaping Tomorrow's  
Built Environment Today

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Michael R. Vaughn, P.E.  
Manager Research & Technical Services

[mvaughn@ashrae.org](mailto:mvaughn@ashrae.org)

TO: Tricia Bruenn, Chair TC 6.1, [tricia16@msn.com](mailto:tricia16@msn.com)  
Thomas Cappellin, Research Subcommittee Chair TC 6.1, [tcappellin@msn.com](mailto:tcappellin@msn.com)  
Stephen Hancock, Research Liaison Section 6.0, [steve.hancock@trane.com](mailto:steve.hancock@trane.com)

FROM: Michael Vaughn, MORTS, [mvaughn@ashrae.org](mailto:mvaughn@ashrae.org)

DATE: July 24, 2014

SUBJECT: Research Topic Acceptance Request (1736-RTAR), "A novel approach for modeling of hydronic systems in Building Performance Simulation (BPS) tools "

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During their recent Annual meeting, the Research Administration Committee (RAC) reviewed the subject Research Topic Acceptance Request (RTAR) and voted 5-0-0 to reject it. The following is the consensus reason for rejecting this RTAR:

1. Project needs more justification before acceptance.
2. Coordinate with other TC's, especially TC1.4 and TC 4.7.
3. Need is not well established.
4. How would this study improve what is currently available in the market.

By rejecting this RTAR, RAC is strongly suggesting to the TC that this particular topic be dropped from the TC research plan based on the information that has been provided.

An RTAR evaluation sheet is attached as additional information and it provides a breakdown of comments and questions from individual RAC members based on specific review criteria. This should give you an idea of how your RTAR is being interpreted and understood by others.

If the TC wishes to pursue this topic further, please address the above issues noted by RAC in a revised version of the RTAR with the help of your Research Liaison, Arthur Giesler, [RL1@ashrae.net](mailto:RL1@ashrae.net), prior to submitting it to the Manager of Research and Technical Services for further consideration by RAC. In addition, a separate document providing a point by point response to each of these comments and questions must be submitted with the RTAR. The response to each item should explain how the RTAR has been revised to address the comment, or a justification for why the Technical Committee feels a revision is unnecessary or inappropriate. The RTAR and response to these comments and questions must be approved by the Research Liaison prior to submitting it to RAC.

The next submission deadline for RTARs and WSs is **August 15, 2014** for consideration at the Society's 2014 fall meeting. The submission deadline after that is December 15, 2014.



Project ID	1736
Project Title	A novel approach for modeling of hydronic systems in Building Performance Simulation (BPS) tools
Sponsoring TC	TC 6.1 Hydronic & Steam Equipment & Systems
Chair/Deputy Chair	387.650.124
Submission History	RTAR 1st Submission
Classification	Research or Technology Transfer
RAC 2014 Annual Meeting Review	Basic/Applied Research
Check List Criteria	NOTED NO
Comments & Suggestions	
Is there a well-established need? The RTAR should include some level of literature review that documents the importance/magnitude of a problem. If not, then the RTAR should be returned for revision.	#10 - Need is not well established. It is not well stated the inaccuracies due to current approach in the calculations and resulting impact on the prediction of energy performance. #14 - Maybe, but the case isn't clearly presented here. #7 - Would like to know how this study would improve what is currently available in the market. How accurate are the commercially available software packages? #2 - Improvement in the simulation of the hydronic systems will provide better results and better understanding of the effect of different designs on a buildings performance. #13 - Component models and a control system evaluation framework were developed in BPS-EP. There is an existing RTAR from TC4.7 and TC1.4 that addresses substantial parts of the proposed work. (Need for TC coordination). DOE is developing an implementation of this approach using Modelica for incorporation in Energy Plus for supervisory control. There is a need for a controls design tool shell for a Modelica/Energy Plus implementation. #8 - The definition and performance requirements of "a novel approach" seem vague. The contractor could define based on his/her own understanding or preference, leading to the quality of research potentially difficult to evaluate.
Is this appropriate for ASHRAE funding? If not, then the RTAR should be rejected. Examples of projects that are not appropriate for ASHRAE funding would include: 1) research that is more appropriately performed by industry, 2) topics outside the scope of ASHRAE activities.	#8 - The project requires contractor to integrate the hydraulic model into an existing energy simulation tool such as Energy Plus or TRNSYS. This may be difficult for contractors who does not have prior experience developing those BPS tools.
Is there an adequate description of the approach in order for RAC to be able to evaluate the appropriateness of the budget? If not, then the RTAR should be returned for revision.	#10 - There are several flow network analysis software both in public and commercial domain which can perform this analysis. It should be noted the key component in these analyses is pressure loss data of each element in the flow network. #7 - Would like to see more elaboration on how this study would vary from current methodology. #13 - A bigger challenge than developing component models is the development of a platform with robust numerics and an effective user interface. #8 - The objectives need to be clear. Otherwise the level of efforts in both modeling and experimental validation are difficult to evaluate.
Is the budget reasonable for the project scope? If not, then RTAR could be returned for revision or conditionally accepted with a note that the budget should be revised for the WS.	#14 - Seems like a very odd budget, is this an RTAR estimate or a price quote? #7 - Hydronic component manufacturers should provide co-funding. #13 - Already done for TRNSYS, implementation in Energy Plus would require > \$100k. #8 - The budget should be an estimate and leave to the contractor to give an accurate number. #4 - As a non-specialist, I think there might be some key missing links. The RTAR refers to issues of non-linearity, particularly in valves (of different types), but I just don't know if there is enough documentation to guide designers of different types of variable flow hydronic systems about specifications they need for their systems. Tied to this is another area where I'm ignorant sort of an "extended products" question. Should engineers design tools include modules that assure that branch controls are optimizing (valves and pumping)? How does this tie to some of the newer VSD centrifugal pumps for zone control, and how they do or don't interact with boilers (or other heat/cold sources)? I'd like to know how this RTAR fits into the TC's overall research plan, which I think should drive toward making good, robust designs easier for the consultant.
Have the proper administrative procedures been followed? This includes recording of the TC vote, coordination with other TCs, proper editing of the Research Strategic Plan, etc. If not, then the RTAR could be returned for revision or possibly conditionally accepted based on adequately resolving these issues.	#4 - seems ok
Decision Options	Initial Decision
ACCEPT	
COND. ACCEPT	
RETURN	
REJECT	
Approval Conditions	
#7 - Project needs more justification before acceptance. #13 - Coordinate with other TCs, esp. TC1.4 and TC4.7. #4 - I need a briefing to help me understand why this is the critical path, why my concerns are unfounded, and how this fits on the path to better designs and implementation. I'd also like to see more emphasis on tech transfer to the working designers, for example with an ASHRAE Journal article (gratis) and how to avoid them?	

ACCEPT Vote - Topic is ready for development into a work statement (WS).  
 COND. ACCEPT Vote - Minor Revision Required - RAC approve RTAR for development into WS without going back to RAC once TC satisfies RAC's approval condition(s).  
 RETURN Vote - Topic is probably acceptable for ASHRAE research, but RTAR is not quite ready.  
 REJECT Vote - Topic is not acceptable for the ASHRAE Research Program

# ATTENDANCE LIST

## ASHRAE TC 6.1 HYDRONIC & STEAM HEATING EQUIPMENT & SYSTEMS - "RESEARCH" SUBCOMMITTEE

3:15 - 4:15pm - Monday, June 30, 2014 - Room 204 (WSCC)

Name	Company and Address	Committee Position	Preferred Phone or E-mail Address
Thomas E. Cappellin	Horne & Shiffin, Inc. Engineers 5200 Oakland Avenue St. Louis, MO 63110-1490	Subcommittee Chair	tcappellin@msn.com
Jesse Atkisson	Affiliated Engineers	Hardbook Chair VM	jatkisson@aceng.com
Scott Fisher	State Farm Mutual	CM	Scott.Fisher.AGTS@StateFarm.com
David Lee	Armstrong Fluid Technology	CM	dlee@armstrongfluidtechnology.com
Rex Seave	Armstrong International	VM Vice-Chair	RexSeave@armstronginternational.com
Bob Walker	Belimo	CM	robert.walker@us.belimo.com
Mike McKechnie	GRONMANBUTBUS	PROGRANS SUB-COM CHAIR	mikec@gronmanbutbus.com
Nick Biedstrup	Grundfos	CM	nbiedstrup@grundfos.com



# ATTENDANCE LIST

## ASHRAE TC 6.1 HYDRONIC & STEAM HEATING EQUIPMENT & SYSTEMS - "RESEARCH" SUBCOMMITTEE

3:15 - 4:15pm - Monday, June 30, 2014 - Room 204 (WSCC)

Name	Company and Address	Committee Position	Preferred Phone or E-mail Address
HANS BRINK HANSEN	BRUNDFOS	C. M.	hbhansen@grundfos.com
Larry Konopacz	Xylem - Bell & Gossett	C. M.	larry.konopacz@xyleminc.com
Stan Sween	Upson apple valley, mn	C. M.	stan.sween@upson.com
Steve Mawcock	Success Land	Sec. 6 Ed Chairman	Steve.Mawcock@eco.com
Forest Reider	Belimo AG	Guest	forest.reider@belimo.ch
Edward Tsui	Intelligent	VM	edward.tsui@intelligent-hvac.com



## SEATTLE MEETING MINUTES

### PROGRAMS SUBCOMMITTEE

#### ASHRAE TC 6.1 "HYDRONICS AND STEAM HEATING EQUIPMENT AND SYSTEMS"

A. Meeting was called to order at 2:15 pm, June 30, 2014 at Seattle Conference Center by Mike McDermott

B. Members and Visitors projected attendance

Name - Position

Mike McDermott – Prog Chair

Rex Scare – Chair

Scott Fisher – CM

Bob Walker - Secretary

Niels Bidstrup – CM

Jason Atkisson - Handbook

Edward Tsui – VM

Hans Brink Hanson - CM

John Bade - Guest

David Lee - CM

Xudang Wang –Guest

Tom Cappellin – CM

Larry Konopacz – CM

Stan Sveen – CM

C. Current and future programs will be discussed.

1. We had one programs in Seattle: VAV Reheat vs. Active Chilled Beams/DOAS Workshop
2. Feedback from CEC on rejected programs – Lower Rank.
3. See attachment 1 look ahead spread sheet for future programs.
4. For detailed information on how the above programs as to be assembled and submitted visit ASHRAE's web site for information and direction.

D. Adjournment of subcommittee at 4:15 pm.

# TC-6.1 Programs Look Ahead - Denver 2013 Meeting

Year		2014	2015
Date		June 28-July 2	Jan 24-28
City		Seattle	Chicago
Tracks		<a href="http://www.ashare.org/seattle/">www.ashare.org/seattle/</a>	<a href="http://www.ashare.org/chicago/">www.ashare.org/chicago/</a>
1	HVAC & R Systems and Equipment	HVAC & R Systems and Equipment	HVAC & R Systems and Equipment
2	HVAC & R Fundamentals and Applications	HVAC & R Fundamentals and Applications	HVAC & R Fundamentals and Applications
3	Research Summit - High Performance Buildings	Research Summit - High Performance Buildings	Industrial Facilities
4	Environmental Health Through Indoor Environmental Quality	Environmental Health Through Indoor Environmental Quality	Large Buildings: Mission Critical Facilities and Applications
5	Geothermal Applications	Geothermal Applications	Energy Efficiency
6	Standards	Standards	Life Safety
7	Facility Management: Operations, Technology and Energy Improvements	Facility Management: Operations, Technology and Energy Improvements	Design of Energy and Water Efficient Systems
8	Refrigeration	Refrigeration	Hospital Design and Codes
9	Professional Skills	Professional Skills	
Technical Paper		Paper: September 23, 2013	Paper: April 14, 2014
Conference Paper		Abstract: Sept. 23, 2013; Paper: Jan. 9, 2014	Abstract: March 24, 2014; Paper: July 9, 2014
Seminar		Proposal: January 6, 2014 to February 14, 2014	Proposal: June 1 to August 11, 2014
VAVR and Active Chilled Beams Workshop - Mike McDermott			Std 90 Update for Hydronic Seminar - Greg T, Jeff B, John Bade, Jason
			Industrial Steam System Design Fundamentals and Applications- Rex Scare
			Chiller Plant Control Fundamentals and Optimization Workshop- Ed T
Forum		Proposal: January 6, 2014	Proposal: June 1 to August 11, 2014
			Effects of pipe aging on pump head - Scott Fisher

## TC-6.1 Programs Look Ahead - Seattle 2014 Meeting

Year

2015

Date

June 27 to 31

City

Atlanta

Tracks

[www.ashare.org/atlanta/](http://www.ashare.org/atlanta/)

- 1 HVAC & R Systems and Equipment
- 2 HVAC & R Fundamentals and Applications
- 3 Research Summit
- 4 Refrigeration
- 5 Building Operation, Maintenance and Optimization/Commissioning
- 6 Indoor Air Quality
- 7 Modeling Throughout The Building Life Cycle
- 8 High Performance Building
- 9 Moving Advanced Energy Design Guidance to the Mainstream

Technical Paper

Paper: September 22, 2014

Conference Paper

Abstract: September 22, 2014; Paper: January 5, 2015

Seminar

Proposal: February 9, 2015

Pressure Independent Control Valves vs Distributed Pumps - Robert Walker, Hans  
Design of Energy Efficient Hydronic Systems - Tricia B, David

Forum

Proposal: February 9, 2015

## TC -6.1 Programs Look Ahead - Seattle 2014 Meeting

Year  
Date  
City

2016  
Jan 18-22  
Orlando

Tracks [www.ashare.org/orlando/](http://www.ashare.org/orlando/)

- 1 HVAC & R Systems and Equipment
- 2 HVAC & R Fundamentals and Applications
- 3
- 4
- 5
- 6
- 7
- 8

Technical Paper Paper: April 19, 2015

Conference Paper Abstract: March 19, 2015; Paper: July 2, 2016

Seminar Proposal: August 13, 2015  
ECM Motors for Distributed Pumps - Neils Bidstrup

Forum Proposal: August 13, 2015



## TC 6.1 Handbook Subcommittee Minutes

June 29, 2014

2014 Annual Meeting – Seattle

### Attendees:

Jason Atkisson

Bob Walker

David Lee

Larry Konopacz

Hans Brink Hansen

Thomas Neill

Rex Scare

Robert Bean

Scott Fisher

Steve Severini

Steve Tredinnick

Ramez Afify

Stan Sveen

Niels Bidstrup

Aaron Stotko

Van Baxter – Hndbk Liason

1. Introductions of Attendees
2. Reviewed New York Meeting Minutes
3. Reviewed Handbook Volume Meeting
4. Reviewed Committee Assigned Handbook Chapters & Status

### 2016 Systems and Equipment

Chapter	Title	Lead Author	Status
11	Steam Systems	Ramez Afify	Initial Review Complete – Sent to Reviewers
13	Hydronic Heating & Cooling System Design	Mick Schwedler	Approved – Ready to Send to Handbook
14	Condenser Water Systems	Steve Tredinnick	Reviewed & Approved by Subcommittee – To Be Voted on By TC in Chicago
15	Medium and High Temperature Water Heating Systems	N/A	Submit without edits for 2016. TC 6.2 to take over following.
28	Unit Ventilators, Unit Heaters and Makeup Air Units	Scott Fisher	Reviewed & Approved by Subcommittee – To Be Voted on By TC in Chicago
32	Boilers	Evans Lizardos	Need to Contact Evans to Determine if he is reviewing
36	Hydronic Heat Distribution Units and Radiators	Scott Fisher	In Need of Updating
44	Centrifugal Pumps	Neils Bidstrup	Reviewed by Subcommittee – Additional Edits Needed – Intermediate Approval by Subcommittee anticipated in November

46	Pipes, Tubes, & Fittings	N/A	Not Being Edited this Cycle / Being Combined with Ch. 22 (F – 2017)
47	Valves	Bob Walker	In Progress / Additional Reviewers Requested
48	Heat Exchangers	Scott Fisher	Approved – Ready to Send to Handbook

#### 2017 Fundamentals

Chapter	Title	Lead Author	Status
22	Pipe Sizing	Scott Fisher	In Progress, Initial Review Complete / Awaiting Review by Others

5. Chapter 14 was reviewed by the Subcommittee. Motion to accept by Scott Fisher with 2<sup>nd</sup> by Rex Scare. Chapter to be sent to the full TC for a vote in Chicago.
6. Chapter 28 was reviewed by Subcommittee, including comments provided by TC 5.8. Motion to accept by Scott Fisher with 2<sup>nd</sup> by Steve Tredinnick. Chapter to be sent to the full TC for a vote in Chicago.
7. Chapter 44 was reviewed by Subcommittee. There are several figures that need to be corrected as well as some verbiage that appears to be a repeat of text included in Chapter 13. Chapter committee to revise figures and edit text accordingly to complement Chapter 13. Intermediate review by subcommittee will be required. Jason to set up a Doodle poll and WebEx for future discussion. Goal is to have edited chapter ready for Subcommittee vote by December so a vote by the full TC can be provided in Chicago.
8. Chapter 47 was not discussed. Bob Walker is in need of additional assistance, particularly with steam valves and SI units. Rex Scare volunteered to assist with steam valves.
9. Jason Atkisson discussed potentially using Google Docs for tracking/editing of Chapters in Review. He will upload all chapters in review to Google Docs and send invitations to Authors/Reviewers to access. Steve Tredinnick noted he has had issues with this platform in the past. Jason will review. If the same issues are experienced, Google Docs will be used at a minimum for transferring of documents.
10. Jason also reviewed the history of chapter reviews, as provided by Society. Several chapters have not been edited in some time; however, these are the chapters that have been targeted for update in 2016.
11. Three (3) questions from the General Membership were discussed:
  - a. High Altitudes – Where is this addressed in the Handbooks? This is a global question that affects numerous chapters throughout all handbooks. Subcommittee response is to ensure our applicable chapters include language instructing the user when to consider high altitudes in design.

- b. Expansion requirements of copper at 400 deg F. Scott Fisher received a response from the Copper Development Association which will be passed on to the member.
- c. Should Liquefied Natural Gas (LNG) be included in the Pipe Materials and/or Pipe Design Chapters? Subcommittee response was no as this is not a typical piping system used in HVAC.

12. Adjourn

# UPDATE: Energy Conservation Standards for Commercial & Industrial Pumps



27 June, 2014  
Greg Towsley

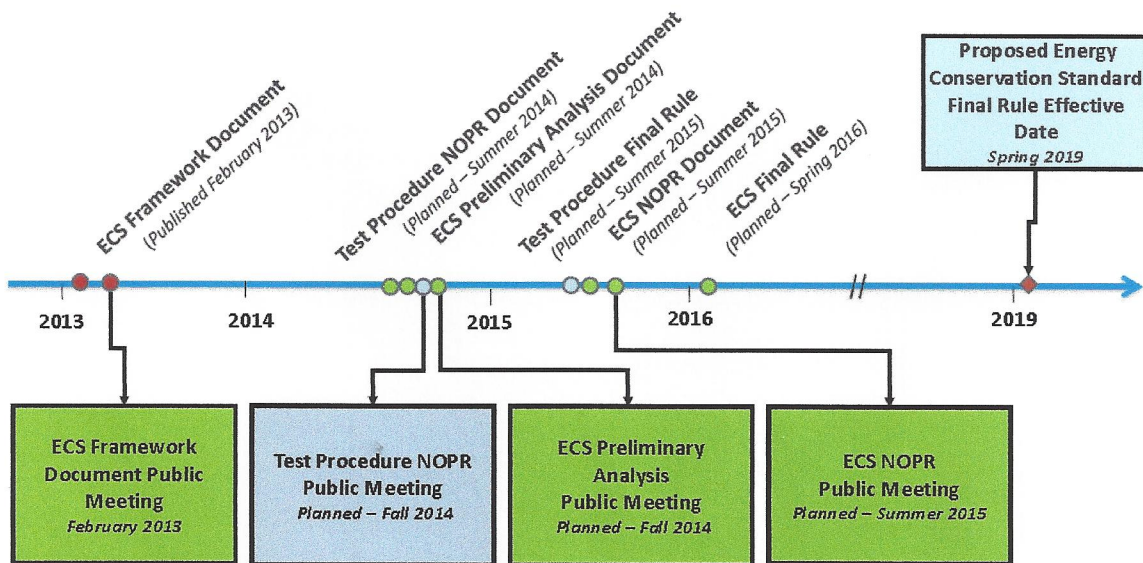
## Legislative History and Coverage

### Authority and Background

- Currently **no energy conservation standards for commercial and industrial pumps**
- The **Energy Policy and Conservation Act (EPCA) of 1975** (Public Law 94-163) established an energy conservation program for certain commercial and industrial equipment.
  - This program, set forth in Part C of Title III of EPCA, **includes pumps as covered equipment and authorizes DOE to issue standards, test procedures and labeling requirements for them.** (42 U.S.C. 6311(1)(A)).
- **DOE issued a Request for Information (RFI) on June 13, 2011** (76 FR 34192) and received comments from stakeholders.



## Commercial & Industrial Pumps Rulemaking Schedule



## Negotiated Rulemaking Process Overview

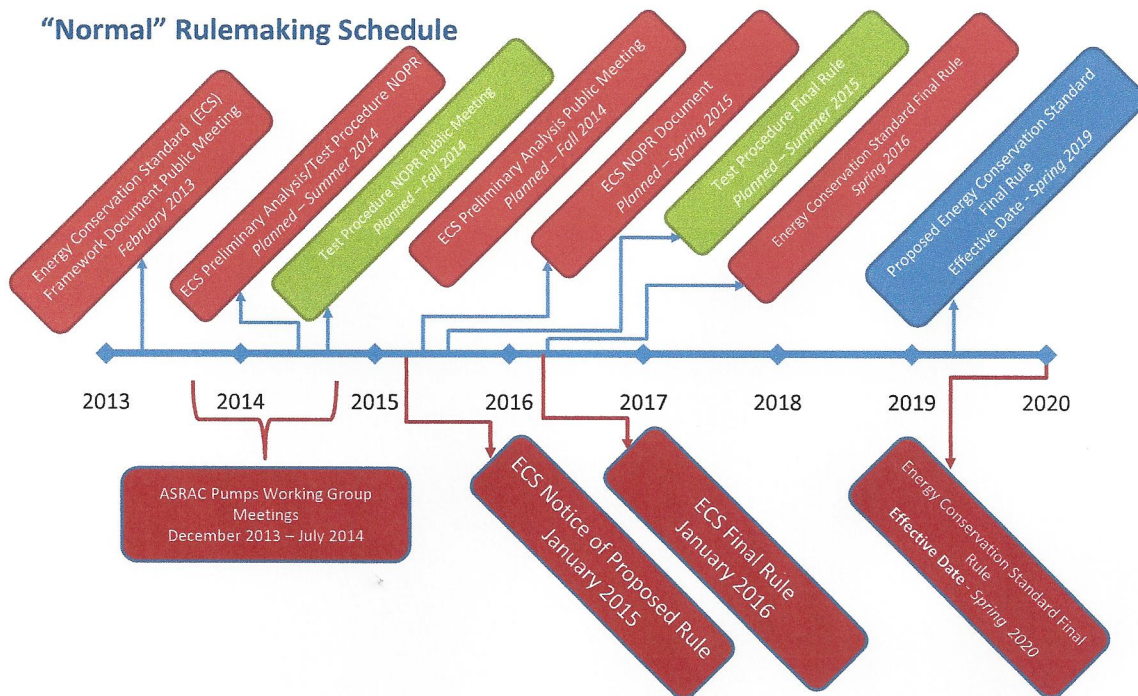
- On **July 16, 2013** DOE announced that it intended to establish a **negotiated rulemaking working group** under Appliance Standards and Rulemaking Federal Advisory Committee (ASRAC) .
- Negotiated rulemaking is a process by which a federal agency and interested stakeholders **attempt to develop a consensus proposal for a regulation**.
- DOE believes this process, when done correctly, yields both **better and faster decisions**.

# Working Group Members

- **(1) Trade Associations:** Hydraulic Institute
- **(1) Pump User:** American Water
- **(1) Motor Manufacturer:** Regal Beloit
- **(1) DOE**
- **(6) Energy Efficiency Advocates:** (next slide)
- **(6) Pump Manufacturers:** Flowserve, Grundfos, ITT, Patterson , Taco & Xylem

## EE NGOs Caucus

- Energy Efficiency Advocates
  - California Investor Owned Utilities
  - Appliance Standards Awareness Project
  - Natural Resources Defense Council
  - Northwest Power and Conservation Council
  - Northwest Energy Efficiency Alliance
  - Edison Electric Institute
- Common Platforms
  - Conserve energy
  - Make sure that there are no exceptions that can be exploited
  - Prevent states from being pre-empted in creating their own legislation



## NEGOTIATED Rulemaking Schedule

## Recommendations #1 and #2: Definition of Covered Product

- **'Pump'** is a device that moves liquids (which may include entrained gases, free solids, and totally dissolved solids) by physical or mechanical action and includes a bare pump and, if included by the manufacturer, the mechanical equipment, driver, and controls.
- **'Bare pump'** is a 'pump' excluding mechanical equipment, driver, and controls.
- **'Mechanical equipment'** is any component that transfers energy from the driver to the bare pump.
- **'Driver'** is the machine providing mechanical input to drive the bare pump directly or through the mechanical equipment, and may include an electric motor, internal combustion engine, or gas/steam turbine.
- **'Controls'** means any device that can be used to control the driver.

## Additional Recommendations

- Recommendation #3: Driver
  - Metric will not cover non-electric drivers.
  - Pump test procedure will also apply to pumps with non-electric drivers
- Recommendation #4: Pump type
  - End suction frame mounted/own bearings (ESFM/OH0, OH1)
  - End suction close coupled (ESCC/OH7)
  - Inline (IL/OH3, OH4, OH5)
  - Radial split (multistage) vertical (RS-V/VS8)
  - Vertical turbine submersible (VT-S/VS0)

*Items in parentheses represent DOE and ANSI/HI nomenclature*

## Additional Recommendations

- Recommendation #5 – Circulators and swimming pool pumps to follow
- Recommendation #6 – Excluded
  - Positive displacement pumps
  - Axial/mixed flow pumps
  - Double suction (DS) pumps
  - Multistage axially split (AS) pumps
  - Multistage radial split-horizontal (RS-H) pumps
  - Multistage radial split vertical immersible pumps
  - Vertical turbine (non-submersible) (VT) pumps



## Additional Recommendations

- Recommendation #7: Characteristics
  - 1-200 Horsepower (shaft power at BEP at full impeller diameter)
  - 25 gallons/minute and greater (at BEP at full impeller diameter)
  - 459 feet of head maximum (at BEP at full impeller diameter)
  - Design temperature range from -10 to 120 degrees C
  - Pumps designed for nominal 3600 or 1800 rpm driver speeds
  - 6 inch or smaller bowl diameter (VT-S/HI VS0)

## Additional Recommendations

- Recommendation #8: Pumps designed for “clean water”
  - Exclude:
    - Wastewater, sump, slurry, solids handling
    - API 610 pumps
    - ASME/ISO chemical pumps
    - Fire pumps - compliant with NFPA 20 and UL listed or FM approved
    - Self-priming pumps
    - Prime-assisted pumps
    - Nuclear pumps
    - Navy pumps
    - Sanitary pumps

# Additional Recommendations

- Recommendation #9: Energy Conservation Standards
  - **PEI25** – ESCC, ESFM, IL, VTS
  - RSV – harmonized with EU levels
  - Compliance: 4 years from the publication of the Final Rule
  - National Full-Fuel Cycle Energy Savings (30 years of shipments): 0.35 quads
- Recommendation #10: Pump test procedure should be in accordance with HI 40.6 for determining bare pump performance

## Pump Energy Rating (PER) and Index (PEI) Nomenclature A

**Pump Energy Rating (PER) CL and VL:** equally weighted average electric input power to the ‘pump’ measured (or calculated) at the driver input or, when present, controls input, over a specified load profile, over the weighted average electric input power to the pump for a minimally compliant, uncontrolled pump:

$$PER_{CL/VL} = \left[ \frac{\sum_i \omega_i (P^{in}_i)}{\sum_i \omega_i (P^{in}_{i,max})} \right]$$

Where:

- $w_i$  = weight at each load point  $i$
- $P^{in}_i$  = power input to the “pump” at the driver, inclusive of the controls if present, (hp)
- $i$  = Percentage of flow at the best efficiency point (BEP) of the pump
  - $i = 110\%, 100\%, 75\%$  of Best Efficiency Point (BEP) flow at nominal speed for uncontrolled pumps
  - $i = 25\%, 50\%, 75\%, \text{ and } 100\%$  of BEP flow at nominal speed for pumps sold with motors and controls

## Recommendation #11

## Pump Energy Rating (PER) and Index (PEI) Nomenclature B

**Pump Energy Rating (PER) CL and VL:** equally weighted average electric input power to the 'pump' measured (or calculated) at the driver input or, when present, controls input, over a specified load profile:

$$PER_{CL/VL} = \sum_i \omega_i (P_i^{in})$$

Where:

- $w_i$  = weight at each load point  $i$
- $P_i^{in}$  = power input to the "pump" at the driver, inclusive of the controls if present, (hp)
- $i$  = Percentage of flow at the best efficiency point (BEP) of the pump
  - $i = 110\%, 100\%, 75\%$  of Best Efficiency Point (BEP) flow at nominal speed for uncontrolled pumps
  - $i = 25\%, 50\%, 75\%$ , and  $100\%$  of BEP flow at nominal speed for pumps sold with motors and controls

**Pump Energy Index (PEI) CL and VL:** PER CL and VL, for a given pump model, over the  $PER_{CL}$  for a minimally compliant pump ( $PER_{max}$ ):

$$PEI_{CL/VL} = \left[ \frac{PER_{CL/VL}}{PER_{max}} \right]$$

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## Minimally Compliant Pump

- PER for a minimally compliant pump
  - Based on PER Standard set through Standards analysis
  - Assumes a pump curve shape for the minimally compliant pump and always assumes no controls
  - Motor losses are that of a minimally compliant enclosed motor for the appropriate pump type
  - The minimally compliant pump efficiency is calculated for each pump type based on a function of flow and speed

$$PER_{max} = \omega_{0.75} \left( \frac{P_{Hydro,0.75}}{0.95 * \eta_{pump,min}} + L_{0.75} \right) + \omega_{BEP} \left( \frac{P_{Hydro,BEP}}{\eta_{pump}} + L_{BEP} \right) + \omega_{1.1} \left( \frac{P_{Hydro,1.1}}{0.985 * \eta_{pump}} + L_{1.1} \right)$$

$$\eta_{pump} = 88.59 * \ln(Ns) + 13.46 * \ln(Q_{metric}) - 11.48 * \ln(Ns)^2 - 0.85 * \ln(Q)^2 - 0.38 * \ln(Ns) * \ln(Q) - C$$

- Where:
  - $Ns$  is the specific speed of the pump in metric units,
  - $Q$  is the flow rate of the pump at BEP in  $m^3/hr$ ,
  - $C$  is the C-value of the surface, which is set based on the speed of rotation of the pump, and
  - All values are for the pump at 50 Hz

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## Determining $PEI_{CL}$ for an Uncontrolled Pump

- **Pump Performance**
  - $P_i$  values are the tested shaft input power to the pump (speed x torque) at each load point  $i$ 
    - $i = 75\%$ ,  $100\%$ , and  $110\%$  of flow rate at BEP of the pump
    - Equal weighting
- **Motor Performance (Losses)**
  - $L_{rated}$  is the full load losses of a motor that is paired with the pump for pumps sold with motors
  - $L_{rated}$  is the full load losses of an enclosed motor that is minimally compliant with DOE's motor regulations (10 CFR 431.25) for general purpose motors (subtype I) for all pumps except ESCC and general purpose motors (subtype II) for ESCC pumps

$$PEI_{CL} = \frac{\omega_{0.75}(P_{0.75}^{in}) + \omega_{BEP}(P_{BEP}^{in}) + \omega_{1.1}(P_{1.1}^{in})}{PER_{max}}$$

$$= \frac{\omega_{0.75}(P_{0.75}^{in}) + \omega_{BEP}(P_{BEP}^{in}) + \omega_{1.1}(P_{1.1}^{in})}{\omega_{0.75} \left( \frac{P_{Hydro,0.75}}{0.95 * \eta_{pump}} + L_{0.75} \right) + \omega_{BEP} \left( \frac{P_{Hydro,BEP}}{\eta_{pump}} + L_{BEP} \right) + \omega_{1.1} \left( \frac{P_{Hydro,1.1}}{0.985 * \eta_{pump}} + L_{1.1} \right)}$$

$$= \frac{\frac{1}{3}(P_{0.75} + L_{0.75}) + \frac{1}{3}(P_{BEP} + L_{BEP}) + \frac{1}{3}(P_{1.1} + L_{1.1})}{\frac{1}{3} \left( \frac{P_{Hydro,0.75}}{0.95 * \eta_{pump}} + L_{0.75} \right) + \frac{1}{3} \left( \frac{P_{Hydro,BEP}}{\eta_{pump}} + L_{BEP} \right) + \frac{1}{3} \left( \frac{P_{Hydro,1.1}}{0.985 * \eta_{pump}} + L_{1.1} \right)}$$

17 • **No Controls Performance**

## Determining $PEI_{VL}$ for a Controlled Pump

- **Pump Performance**
  - $P_i$  values are the tested shaft input power to the pump (speed x torque) at each load point  $i$ 
    - $i = 25\%$ ,  $50\%$ ,  $75\%$ , and  $100\%$  of flow rate at BEP of the pump
    - Equal weighting
- **Motor Performance (Losses)**
  - $L_{rated}$  is the full load losses of a motor that is paired with the pump for pumps sold with motors
- **Controls Performance**
  - Benefit is captured in calculation of bare shaft input power
  - Could still account for drive efficiency

$$PEI_{VL} = \frac{1}{\eta_{ctrl}} \left[ \frac{\omega_{0.25}(P_{0.25}^{in}) + \omega_{0.50}(P_{0.50}^{in}) + \omega_{0.75}(P_{0.75}^{in}) + \omega_{BEP}(P_{BEP}^{in})}{\omega_{0.75} \left( \frac{P_{Hydro,0.75}}{0.95 * \eta_{pump}} + L_{0.75} \right) + \omega_{BEP} \left( \frac{P_{Hydro,BEP}}{\eta_{pump}} + L_{BEP} \right) + \omega_{1.1} \left( \frac{P_{Hydro,1.1}}{0.985 * \eta_{pump}} + L_{1.1} \right)} \right]$$

$$= \frac{1}{\eta_{ctrl}} \left[ \frac{\frac{1}{4}(P_{0.25}^{in}) + \frac{1}{4}(P_{0.50}^{in}) + \frac{1}{4}(P_{0.75}^{in}) + \frac{1}{4}(P_{BEP}^{in})}{\omega_{0.75} \left( \frac{P_{Hydro,0.75}}{0.95 * \eta_{pump}} + L_{0.75} \right) + \omega_{BEP} \left( \frac{P_{Hydro,BEP}}{\eta_{pump}} + L_{BEP} \right) + \omega_{1.1} \left( \frac{P_{Hydro,1.1}}{0.985 * \eta_{pump}} + L_{1.1} \right)} \right]$$

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## Additional Recommendations

- Recommendation #12: Labeling requirements
  - Pumps are labeled based on the configuration in which they are sold.
  - The following information would be required to be included on a pump nameplate:

Bare Pump	Bare Pump + Motor	Bare Pump + Motor + Controls
<ul style="list-style-type: none"><li>• <math>PEI_{CL}</math></li><li>• Model number</li><li>• Impeller diameter for each unit</li></ul>	<ul style="list-style-type: none"><li>• <math>PEI_{CL}</math></li><li>• Model number</li><li>• Impeller diameter for each unit</li></ul>	<ul style="list-style-type: none"><li>• <math>PEI_{VL}</math></li><li>• Model number</li><li>• Impeller diameter for each unit</li></ul>

## Additional Recommendations

- Recommendation #13: Certification Reporting Requirements
  - Manufacturer name
  - Model number(s)
  - Equipment class
  - $PEI_{CL}$  or  $PEI_{VL}$  as applicable
  - BEP flow rate and head
  - Rated speed
  - Number of stages tested
  - Full impeller diameter (in.)
  - Whether the  $PEI_{CL}$  or  $PEI_{VL}$  is calculated or tested
  - Input power to the pump at each load point  $i$  ( $P^{in}_i$ )

# DOE Rulemaking: What's Next

- The DOE ASRAC Pump Working Group has now completed their assigned tasks. The scheduled July meeting is cancelled.
- The Term Sheet summarizing the results will be presented at the next meeting of the Appliance Standards and Rulemaking Federal Advisory Committee (ASRAC) meeting. Date: tbd
  - Expect to approve and forward recommendations to DOE
- DOE will spend the rest of the year doing further in depth studies of the recommendation, vetting the impacts with other federal departments who have to approve and developing the Notice of Proposed Rulemaking (NOPR)
  - NOPR targeted for January 2015
  - Expect all recommendations to be adopted into NOPR

## What else?

### Extended Motor Product Label Initiative Pump WG

- Goals for initiative:
  - **Develop Voluntary Labels** that establish component and/or extended product identification scheme that **meets utility sector energy efficiency program requirements for incentives**
  - **Each trade organization** to develop a label(s)
  - Describe products in a manner that can be **readily understood** in the respective markets
  - **Use** trade association **existing or proposed product testing and metrics**
  - **Define** necessary **measurement and verification** protocols

# DOE Regulation vs. EMPLI Labeling

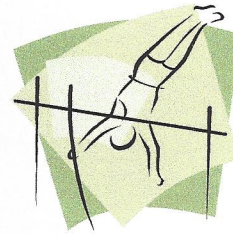


## DOE Regulation:

- Sets minimum bar (level)
  - PEI: <1.0
    - Pump with motor: 0.99 to 0.80-ish range
    - Pump with VFD: <0.50
  - Label requirements: PEI, Model, Imp. Dia.
- 

## Extended Motor Product Labeling Initiative:

- Raises the bar (level)
- PER **Example**:
  - Pump with motor: <0.75?
  - Pump with VFD: <0.30?
- Label requirements: ?



# EMPLI Joint Marketing Working Group

- Trade associations - create the labels/marks for their products
- Trade associations - will be responsible for any registration or trade mark of their label
  - Co-branding with NEMA Premium may be an option
  - Trade association may elect to include an MOU and license agreement for their respective labels
- Efficiency Program - create new programs that serve the needs of their customers
  - These programs may utilize one or more labels
- Marketing message – same/similar across pumps, fans, compressors with motors
- EMPLI Working Group established – take feedback to/from HI committee