POOL EFFICIENCY SUBCOMMITTEE TO THE FLORIDA ENERGY CODE WORKGROUP REPORT TO THE FLORIDA BUILDING COMMISSION

August 12, 2009

Melbourne, Florida

Facilitation, Meeting and Process Design By

CONSENSUS SOLUTIONS

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FLORIDA BUILDING COMMISSION

POOL EFFICIENCY SUBCOMMITTEE TO THE FLORIDA ENERGY CODE WORKGROUP REPORT

Pool Efficiency Subcommittee to Florida Energy Code Workgroup
The Energy act of 2008 (HB 7135) directs adoption of pool pump efficiencies in the 2010 Code. During discussions with the Florida Spa and Pool Association regarding energy efficiency requirements for pool pumps members suggested improved efficiency could be achieved through criteria for pool hydronic system design. This initiative is being conducted in coordination with the national industry and other state's initiatives currently underway.

The Commission convened a Pool Efficiency Subcommittee to the Florida Energy Code Workgroup to provide recommendations to the Florida Energy Code Workgroup regarding the pool equipment efficiencies subtask for pool pumps and heaters efficiencies and hydronic systems standards. The Chair indicted that subcommittees will be facilitated using the Commission's workgroup process.

The Subcommittee Members are as Follows:
Steve Bassett, Tony Caruso, Kevin Fennel, Ken Gregory, Dale Greiner, Dan Johnson, Bill Kent, Dino Muggeo, Gordon Shepardson, Jeff Sonne, and Rob Vieira.

Florida Energy Code Workgroup Subtask Regarding Energy Efficient Pools

Issues

- *Pool pump standards.*
- *Pool plumbing system design.*
- *Performance and prescriptive compliance paths for pools.*
- *Credits for alternative energy sources for pool heating, lighting and pumping.*

Subtask 29 Develop Criteria for Energy Efficient Pool and Spa Systems

Schedule:

Workgroup appointed	4/8/09
Workgroup meetings	6/8/09
	8/12/09
	TBD
Recommendations to Commission	12/09
Proposals for 2010 FBC submitted for adoption	3/10
(See 2010 FBC development schedule)	

Status: *Pending*

% Complete

10%

Origination: Energy act of 2008 (HB 7135) directs adoption of pool pump efficiencies in the 2010 FBC.

553.909 Setting requirements for appliances; exceptions.--

1) The Florida Energy Efficiency Code for Building Construction shall set the minimum requirements for commercial or residential swimming pool pumps, swimming pool water heaters, and heat traps and thermostat settings for water heaters used to heat potable water sold for residential use. The code shall further establish the minimum acceptable standby loss for electric water heaters and the minimum recovery efficiency and standby loss for water heaters fueled by natural gas or liquefied petroleum gas.

(3) Commercial or residential swimming pool pumps or water heaters sold after July 1, 2011, shall comply with the requirements of this subsection.

Natural gas pool heaters shall not be equipped with constantly burning pilots.

Heat pump pool heaters shall have a coefficient of performance at low temperature of not less than 4.0.

The thermal efficiency of gas fired pool heaters and oil-fired pool heaters shall not be less than 78 percent.

All pool heaters shall have a readily accessible on-off switch that is mounted outside the heater and that allows shutting off the heater without adjusting the thermostat setting.

(4) Pool pump motors shall not be split-phase, shaded pole, or capacitor start-induction run types.

Residential pool pumps and pool pumps motors with a total horsepower of 1 HP or more shall have the capability of operating at two or more speeds with a low speed having a rotation rate that is no more than one-half of the motor's maximum rotation rate.

Residential pool pump motor controls shall have the capability of operating the pool pump at a minimum of two speeds. The default circulation speed shall be the residential filtration speed, with a higher speed override capability being for a temporary period not to exceed one normal cycle or 120 minutes, whichever is less. Except that circulation speed for solar pool heating systems shall be permitted to run at higher speeds during periods of usable solar heat gain.

(5) Portable electric spas standby power shall not be greater than 5(V2/3) watts where V = the total volume, in gallons, when spas are measured in accordance with the spa industry test protocol.

REPORT OF THE AUGUST 12, 2009 MEETING

Opening and Meeting Attendance
The meeting started at 8:30 AM, and the following Subcommittee members were present:
Tony Caruso, Kevin Fennel, Ken Gregory, Dale Greiner, Dan Johnson, Jeff Farlow for Bill Kent, Dino Muggeo, Terry Futrell for Gordon Shepardson, Jeff Sonne, and Rob Vieira.

Members Absent
Steve Bassett.

DCA Staff Present
Rick Dixon, Bruce Ketcham, Mo Madani, Jim Richmond, and Ann Stanton.

Meeting Facilitation
The meeting was facilitated by Jeff Blair from the FCRC Consensus Center at Florida State University. Information at: http://consensus.fsu.edu/

Project Webpage
Information on the project, including agenda packets, meeting reports, and related documents may be found in downloadable formats at the project webpage below:
http://consensus.fsu.edu/FBC/Pool-Efficiency.html

Agenda Review and Approval
The Workgroup voted unanimously, 9 - 0 in favor, to approve the agenda as presented including the following objectives:

- ✓ To Approve Regular Procedural Topics (Agenda and Summary Report)
- ✓ To Hear a Summary Report Regarding California Title 24
- ✓ To Identify and Evaluate Code Amendment Options Regarding Pool Energy Efficiency
- ✓ To Consider Public Comment
- ✓ To Identify Needed Next Steps and Agenda Items for Next Meeting

June 8, 2009 Facilitator's Summary Report Review and Approval
Jeff Blair, Commission Facilitator, asked if any members had corrections or revisions to the June 8, 2009 Report, and none were offered.
The Workgroup voted unanimously, 9 - 0 in favor, to approve the June 8, 2009 Facilitator's Summary Report as presented.

California Title 24 Presentation
Jeff Sonne, FSEC, presented a PowerPoint Presentation on a summary of CEC Title 24 Pool and Spa Equipment Revision and answered members questions.
(Attachment 3—CEC Title 24 Summary)

Identification and Evaluation in Turn of Code Amendment Options Regarding Pool Energy Efficiency
Members were asked to identify and evaluate options regarding proposed code amendments for each of the key topical issue areas as follows:
pool pump standards; pool plumbing system design; performance and prescriptive compliance paths for pools; and, credits for alternative energy sources for pool heating, lighting and pumping.

Following are proposed code amendments that achieved a consensus level for support from the Workgroup:

1. POOL PUMP STANDARDS

403.9 Swimming Pools (Mandatory). Pools shall be provided with energy-conserving measures in accordance with Sections 403.9.1 through 403.9.3.

403.9.1 Swimming Pool and spa heaters. All pool heaters shall be equipped with a readily *accessible* on-off switch to allow shutting off the heater without adjusting the thermostat setting. ~~Pool heaters fired by natural gas shall not have continuously burning pilot lights.~~

403.9.1.1 [13-612.AB.2.3.4] Swimming Pool heater efficiency.

403.9.1.1.1 All gas- and oil-fired pool heaters, when tested in accordance with ANSI Z 21.56, shall have a minimum thermal efficiency of 78 percent. Pool heaters fired by natural gas shall not have continuously burning pilot lights.

403.9.1.1.1.2 Heat pump pool heaters, when tested in accordance with ARI 1160, Table 2, Standard Rating Conditions-Low Air Temperature, shall have a minimum COP of 4.0. Test reports from independent laboratories are required to verify procedure compliance.

403.9.1.2 Swimming Pool/Spa pool filtration pump motors. Split-phase, shaded-pole or capacitor start-induction run filtration pool pump motors shall not be permitted ~~installed~~. Residential filtration pool pumps and pool pump motors that total ~~are~~ ≥ 1 hp shall be capable of operating at two or more speeds and shall meet the following criteria:

1. The low speed shall have a rotation rate of no more than one-half the motor's maximum rotation rate.

2. Pool f**iltration** pump motor controls shall be capable of operating the pool pump on at least two speeds with the default speed at the filtration speed. A temporary override is required on the higher speeds for a period not to exceed one normal cycle or 120 minutes, whichever is less.

Exception: Solar pool heating systems may circulate at higher speeds during periods of usable solar heat gain.

403.9.1.3 Portable electric spas. Standby power for portable electric spas shall not exceed 5 (V2/3) watts when tested to the spa industry protocol" where V= the total volume of the spa, in gallons,

403.9.2 Time switches. Time switches that can automatically turn off and on heaters and pumps according to a preset schedule shall be installed on swimming pool heaters and pumps.

2. POOL PLUMBING SYSTEM DESIGN

Title 24, Section 150, p. 144

2. **System piping.**

A. A length of straight pipe that is greater than or equal to at least 4 pipe diameters shall be installed before the pump; and

B. Pool piping shall be sized so that the velocity of the water at maximum flow for auxiliary pool loads does not exceed 8 feet per second in the return line and 6 feet per second in the suction line; and

C. All elbows shall be sweep elbows or elbow-type that have a pressure drop of less than the pressure drop of straight pipe with a length of 30 pipe diameters.

Title 24, Section 150, p. 144

4. **Valves.** Minimum diameter of backwash valves shall be 2 inches or the diameter of the return pipe, whichever is greater.

Title 24, Section 5.2.9: p. 5-14 – 5-18

5.2.8.3 Pool Pump Requirements

For maximum energy efficiency, pool filtration should be operated at the lowest possible flow rate for a time period that provides sufficient water turnover for clarity and sanitation. Auxiliary pool loads that require high flow rates such as spas, pool cleaners, and water features, should be operated separately from the filtration to allow the filtration flow rate to be kept to a minimum.

§150.p.1

All pumps and pump motors shall comply with the specifications of the Appliance Efficiency Regulations. The pool filtration flow rate may not be greater than the rate needed to turn over the pool water volume in six hours or 36 gpm, whichever is greater. This means that for pools of less than 13,000 gallons the pump must be sized to have a flow rate of less than 36 gpm and for pools of greater than 13,000 gallons, the pump
must be sized using the following equation:

Max Flow Rate (gpm) = Pool Volume (gallons) / 360

These are maximum flow rates. Lower flow rates and longer filtration times are encouraged and will result in added energy savings. Pools with auxiliary pool loads must use either a multi-speed pump or a separate pump for each auxiliary pool load. For example, if a spa shares the pool filtration system, either a multi-speed pump must be used or a separate pump must be provided to operate the spa. If the pool system can be served by one pump of less than 1 total-hp in capacity, the pump may be single speed. Filtration pump motors with a capacity of 1 total-hp or more must be multi-speed. All pool pumps sold in California must be tested and listed with the CEC according to the Appliance Efficiency Regulations. Pump manufacturers must list flow rate, power, and energy factor at each of three system curves (see Figure xx). For pools equal to or less than 17,000 gallons, a pump must be chosen such that the flow rate listed for Curve A is less than the six-hour turnover rate. For pools greater than 17,000 gallons, a pump must be chosen such that the listed flow rate at Curve C is less than the six-hour turnover rate.

[insert Figure 5-3: System Test Curves]

Title 24, Section 5.2.9: p. 5-14 – 5-18

5.2.8.5 Pool Pipe, Filter, and Valve Requirements

System design for residential pools is new for 2008. Correct sizing of piping, filters, and valves reduces overall system head, reduces noise and wear, and increases energy efficiency. Other mandatory requirements include leading straight pipe into the pump, directional inlets for mixing, and piping to allow for future solar installations.

§114.b and §150.p.2

Pool piping must be sized according to the maximum flow rate needed for all auxiliary loads. The maximum velocity allowed is 8 fps in the return line and 6 fps in the suction line. Table 5-3 shows the minimum pipe sizes required by pool volume based on a six-hour turnover filtration flow rate. These pipe sizes would need to be increased if there are auxiliary loads that operate at greater than the filtration flow rate. Conversely, they could be reduced if the pump is sized for greater than a six-hour turnover filtration flow rate.

[insert Table 5-3: Six-Hour Turnover Pipe Sizing]

There must be a length of straight pipe that is greater than or equal to at least 4 pipe diameters installed before the pump. That is, for a 2 inch suction pump, there must be at least 8 inches of straight pipe before the pump's strainer basket.

Traditional hard 90 elbows are not allowed. All elbows must be sweep elbows or a type of elbow that has a pressure drop less than the pressure drop of straight pipe with a length of 30 pipe diameters. For example, a 2-inch elbow must have a pressure drop less than a 5-foot length of 2-inch straight pipe. Field verification of sweep elbows may be performed by checking that the distance "w" of the installed sweep elbow is greater than that for a hard 90 elbow (refer to Figure 5-4). The difference in measurement between the radial edge of one sleeve to the perpendicular side of the elbow is found to be distinct between sweep elbows and hard 90's. There is sufficient difference in distance "w" such that all sweep elbows exceed the minimum values listed in Table 5-4. Figure 5-4 below illustrates "w" the dimension between the elbow sleeves and Table 5-4 shows the minimum distances "w" for an acceptable sweep elbow.

[insert Figure 5-4: Measuring w at the pool site].

[insert Table 5-4: Pool site measurement for sweep elbows]

Title 24, Section 5.2.9: p. 5-14 – 5-18

Backwash valves must me sized to the diameter of the return pipe or two inches, whichever is greater. Multiport backwash valves have a high pressure drop and are discouraged. Low-loss slide and multiple three-way valves can provide significant savings.

Title 24, Section 5.2.9: p. 5-14 – 5-18

The pool must have directional inlets to adequately mix the pool water. If a pool does not currently use solar water heating, piping must be installed to accommodate any future installation. Contractors can choose three options to allow for the future addition of solar heating equipment:

- Provide at least 36 inches of pipe between the filter and the heater to allow for the future addition of solar heating equipment
- Plumb separate suction and return lines to the pool dedicated to future solar heating.
- Install built-up or built-in connections for future piping to solar water heating. An example of this would be a capped off tee fitting.

Pipe Size:
6-hour turn and max 6 fps on suction and 8fps on return.

Filter

Title 24, Section 150, p. 144

3. **Filters.** Filters shall be at least the size specified in NSF/ANSI 50 for public pool intended applications.

4. **Valves.** Minimum diameter of backwash valves shall be 2 inches or the diameter of the return pipe, whichever is greater.

Title 24, Section 5.2.9: p. 5-14 – 5-18

Filters shall be sized using NSF/ANSI 50 based on the maximum flow rate through the filter. The filter factors that must be used are (in ft2/gpm):
Cartridge 0.375
Sand 15
Diatomaceous Earth 2

Backwash valves must me sized to the diameter of the return pipe or two inches, whichever is greater. Multiport backwash valves have a high pressure drop and are discouraged. Low-loss slide and multiple three-way valves can provide significant savings.

Portable Electric Spas

NOTE: The following is the work product of the APSP-14 committee, as completed 7-9-2009. This constitutes the complete model code by the ASPS-14 and it is fully consistent with CEC Title 20-2008, which is the amended 2006 version of Title 20.

Draft APSP 14 7-9-09 Work Product

1. Scope:

1.1 These requirements apply to residential portable (self-contained) spas that are used for bathing and are operated by an owner.

1.2 This standard is meant to establish minimum energy efficiency requirements for spas. This standard shall be met notwithstanding certain variations in equipment, materials, and design.

1.3 These requirements do not apply to public spas, permanently installed residential spas or other spas, such as those operated for medical treatment, physical therapy or other purposes. Swim-spas and portions of combination spas/swim-spas not intended to be heated over 100°F are also not subject to the requirements of this standard.

1.4 Other standards are referenced in this standard for items not covered.

2. Test Method:

2.1 **Purpose.** To measure the energy consumption of a portable electric spa in standby mode, using a repeatable and reproducible test procedure. The results will be used to calculate the standby power demand.

2.2 **Test Equipment:**
Note: All equipment shall be calibrated and traceable to the National Institute of Standards and Technology (NIST).
2.2.1 Recording Watt Hour meter – Accuracy: Class-2 or better.
2.2.2 Temperature measurement system - Accuracy: +/- 1°F
2.2.3 Water meter to measure fill water in gallons – Accuracy: +/- 1.5%

2.3 **Test Conditions.** The test method for portable electric spas is as follows:

2.3.1 Minimum continuous testing time shall be 72 hours.
2.3.2 The spa shall be filled with water to the halfway point between the bottom of the skimmer basket opening and the top of the spa. If there is no skimmer basket, the spa shall be filled with water to six inches below the top of the spa.
2.3.2.1 Measure and record fill volume (V) while filling according to 2.3.2.
2.3.3 The water temperature shall be 102°F, ± 2°F for the duration of the test.
2.3.4 The ambient air temperature shall be 60°F, ± 3°F for the duration of the test.
2.3.5 The standard cover that comes with the unit shall be used during the test.

2.4 Test Procedure.

2.4.1 The test shall start when the water temperature has been at 102°F, ± 2°F for at least a four hour stabilizing period.
2.3.2 Record water temperature at two points.
2.3.2.1 Primary thermocouple shall be located three to five inches below the water level and centrally located relative to the shape of the vessel.
2.3.2.2 Redundant thermocouple shall be located within three to six inches of the primary thermocouple, on the same horizontal plane relative to water depth.
2.3.3 Record ambient air temperature at one point located a maximum of one to one and a half feet above spa cover level and six to eight inches from the chamber wall and out of direct airflow from the chamber temperature control system and/or circulation fan.

2.3.4 **Data Recording.**
2.3.4.1 Record temperatures at a maximum interval of 4 minutes.
2.3.4.2 Record voltage, current, and power factor at a maximum interval of 4 minutes.
2.3.4.3 Record watt-hours used during entire Test Period.
2.3.4.4 Record elapsed time during Test Record.

2.3.5 Record the total energy use for the period of test, starting at the end of the first heating cycle after the stabilization period and finishing at the end of the first heating cycle after 72 hours has elapsed.
Exception: For spas without heaters, substitute heating cycle with filter or purge cycle.
2.3.6 The unit shall remain covered and in the default operation mode during the test. Energy-conserving circulation functions, if present, must not be enabled if not appropriate for continuous, long-term use. Ancillary equipment including, but not limited to lights, audio systems, and water treatment devices, shall remain connected to the mains but may be turned off during the test if their controls are user accessible.

3. Formulas

3.1 The measured standby power (Pmeas) shall be determined by E/t:

Pmeas = E/t

Where:

E = total energy use during the test (Wh)
t = length of test (hr)

3.2 The measured standby power (Pmeas) shall be normalized (P_{norm}) to a temperature difference of 37°F using the equation:

P_{norm} = Pmeas (ΔTideal / ΔTmeas)

Where:

ΔTideal = 37°F
ΔTmeas = Twater avg – Tair avg
Twater avg = Average water temperature during test
Tair avg = Average air temperature during test.

3.3 The normalized standby power (Pnorm) shall not be greater than maximum standby power (Pmax):

Pmax = $5(V^{2/3})$

Where:

V = fill volume in gallons

4. Labeling

5. Glossary:

HEATING CYCLE –

Stand-by mode – All settings at default as shipped by the manufacturer, except water temperature which may be adjusted to meet the test conditions.
Spa Volume – The advertised and marketed water fill capacity of the tub in gallons. This measurement is generally found on the tub specification label on the tub, in the owner's manual or within advertising of the tub.
Total Spa Capacity – The total fill capacity of the tub in gallons (this measurement is greater than the Spa Volume). This is measured by filling the tub to the point where the entire vessel is full, at the threshold of spilling out of the tub.

Other
Title 24, Section 114: p. 62-63

2. **Covers**. A cover for outdoor pools or outdoor spas that have a heat pump or gas heater.

Pipe Size: Require 6-hour turn over rate and max 6 fps on suction and 8fps on return. No hard 90s allowed, sweeps required. Copy prescriptive language from Title 24. Allow the chart referenced.(velocity of ANSI std will come out)

4. ALTERNATIVE ENERGY SOURCES CREDITS FOR POOL HEATING/LIGHTING/PUMPING

Add from Title 24, 5.2.9:

Provide one of the following for later solar installation:

1) *install at least 18 ~~36~~ inches of pipe after the filter between the filter and the heater to allow for the future addition of solar heating equipment.*
2) *plumb separate suction and return lines to the pool dedicated to future solar heating.*
3) *Install built-up or built-in connections for future piping to solar water heating. An example of this would be a capped-off tee fitting.*

Eliminate requirement for pool covers but retain requirement for spas.

6. OTHER

PV POOL PUMPS

Provide an energy code credit for powering pool pumps by PV or alternative technologies that reduce power needed by pool pump.

The results of the ranking exercise and a summary of the discussions are included as Attachment 4 of this Report.
(Attachment ~~4~~—Worksheet Results)

General Public Comment
Members of the public were invited to provide the Subcommittee with general comments. In addition, members of the public spoke on each of the substantive discussion issues before the Subcommittee throughout the meeting.

Public Comment:
No additional public comments were offered.

Review of Subcommittee Delivery and Meeting Schedule
The Subcommittee's delivery and meeting schedule is as follows:

Workgroup appointed	4/8/09
Workgroup meetings	6/8/09
	8/12/09
	TBD
Recommendations to Commission	12/09
Proposals for 2010 FBC submitted for adoption	3/10

(See 2010 FBC development schedule: 2010 Code Effective date is 12/31/2011)

Next Steps
Once additional information is available from the APSP Energy Standard writing committees and the California Title 24 process, members will evaluate the results for possible inclusion in the Florida Building Code.

The APSP Energy Standard writing committees (one for pools, one for spas) have set out their objectives into three phases with the timeline as follows:

Phase One: complete a model code, APSP Energy Standard committees noted that this is being done in cooperation with the FBC Pool Efficiency Subcommittee, and they will continue to provide all their language/documentation. Jennifer Hatfield will continue to keep Subcommittee up to date from APSP's end so the language put into the 2010 Florida Building Code is as consistent as possible.

Phase two: complete the APSP 14 and 15 pool and spa energy standards, goal is to have language ready for canvas by the end of 2010.

Phase Three: an equipment scoring system (a rating system based on the national Energy Star Program that would score equipment categories such as pumps), probably completed by 2011.

Adjourn
The Subcommittee voted unanimously, 10 - 0 in favor, to adjourn at 12:00 PM.

ATTACHMENT 1

MEETING EVALUATION RESULTS

August 12, 2009—Melbourne, Florida

Average rank using a 0 to *10* scale, where *0* means totally disagree and *10* means totally agree.

1. Please assess the overall meeting.

9.83 The background information was very useful.
9.50 The agenda packet was very useful.
9.83 The objectives for the meeting were stated at the outset.
9.33 Overall, the objectives of the meeting were fully achieved.

2. Do you agree that each of the following meeting objectives was achieved?

9.17 Evaluation of Code Amendment Options Regarding Pool Energy Efficiency.
9.20 Identification of Next Steps.

3. Please tell us how well the Facilitator helped the participants engage in the meeting.

10.00 The members followed the direction of the Facilitator.
10.00 The Facilitator made sure the concerns of all members were heard.
10.00 The Facilitator helped us arrange our time well.
10.00 Participant input was documented accurately.

4. Please tell us your level of satisfaction with the meeting?

9.83 Overall, I am very satisfied with the meeting.
10.00 I was very satisfied with the services provided by the Facilitator.
9.50 I am satisfied with the outcome of the meeting.

5. Please tell us how well the next steps were communicated?

9.00 I know what the next steps following this meeting will be.
9.00 I know who is responsible for the next steps.

6. What did you like best about the meeting?

- The diversity of the knowledge about each topic.
- Information I obtained.
- The professionalism.

7. How could the meeting have been improved?

None provided.

8. Do you have any other comments?

- Jeff did and outstanding job in conducting the discussion and keeping the meeting moving.

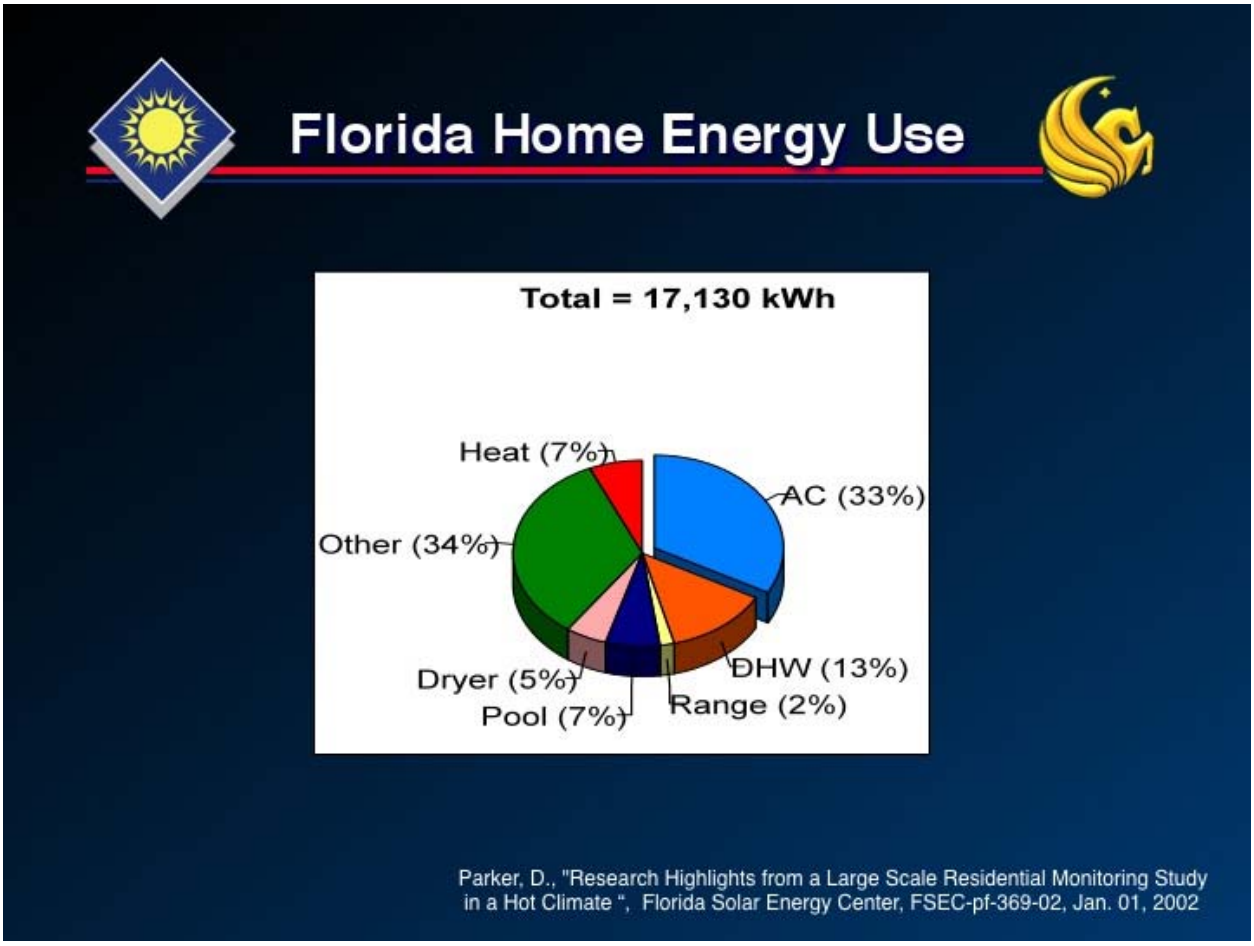
ATTACHMENT 2

MEETING ATTENDANCE—PUBLIC

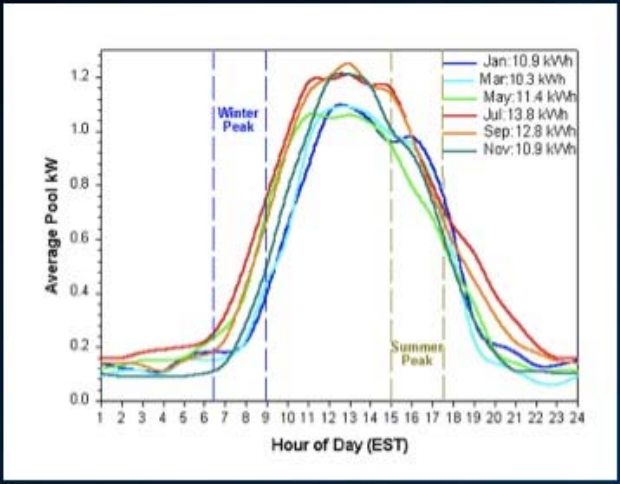
Public Meeting Attendance
Name
Jim Manning
Jennifer Hatfield
Pete Zaharah
Dan Welsh
Conna Christensen
Fred Horowitz
Bill Dumbaugh
Carl Moody

ATTACHMENT 3

FSEC CEC TITLE 24 SUMMARY

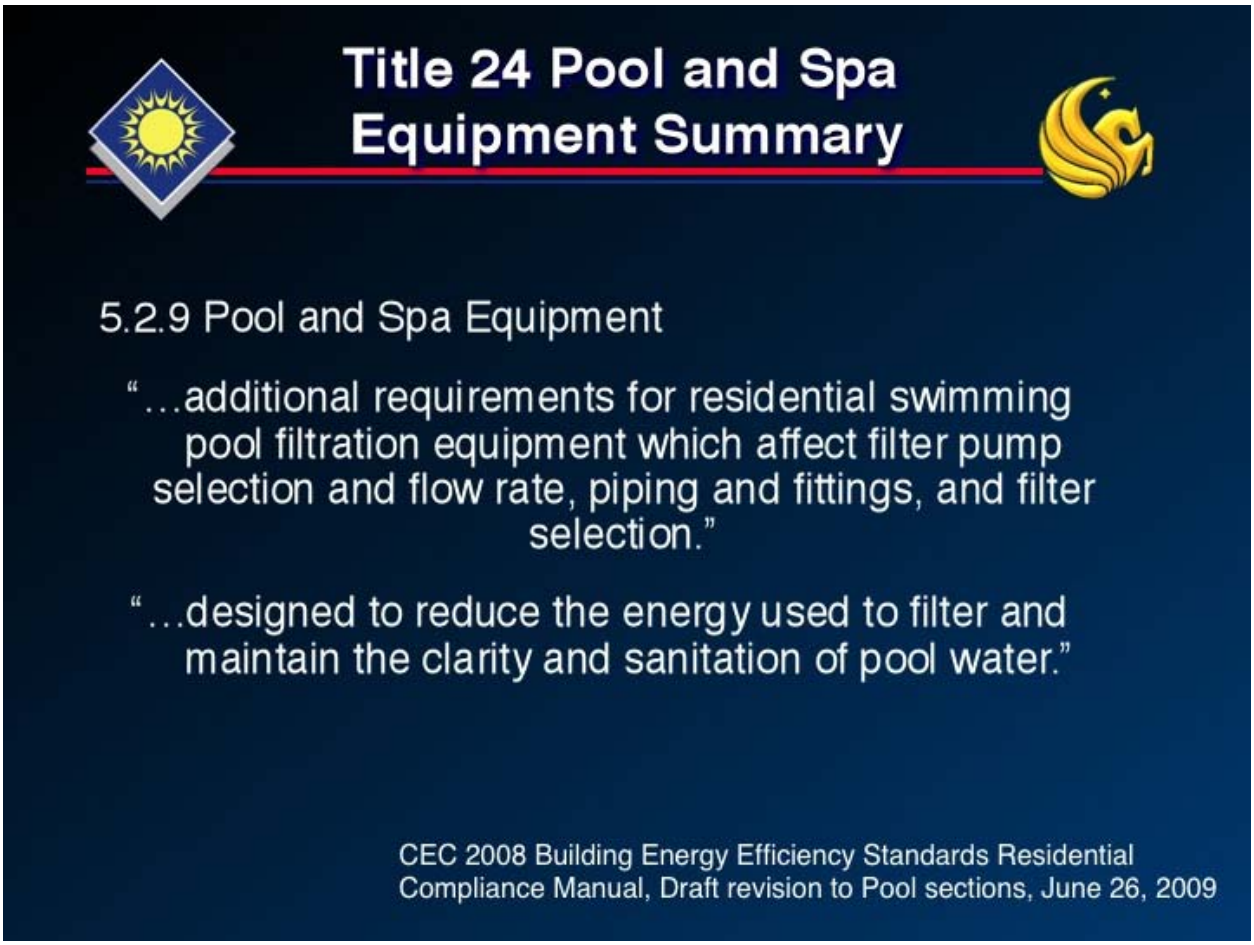


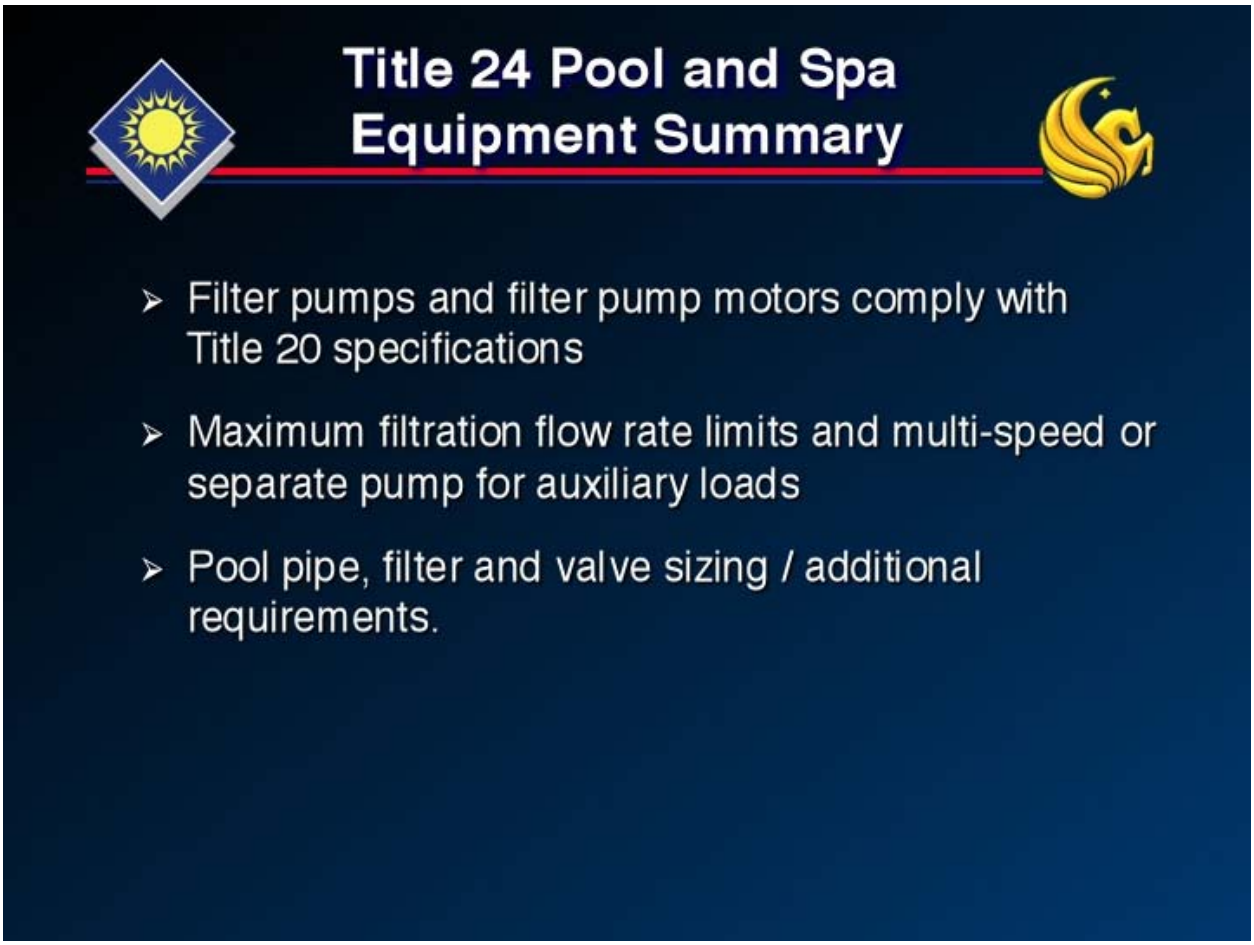
Florida Residential Pool Energy Use



1999 utility study results showing pool pump electrical demand – 24% had pools with avg. use of 4,200 kWh/yr; 7% had electrically heated hot tubs with avg. use of 2,150 kWh/yr.

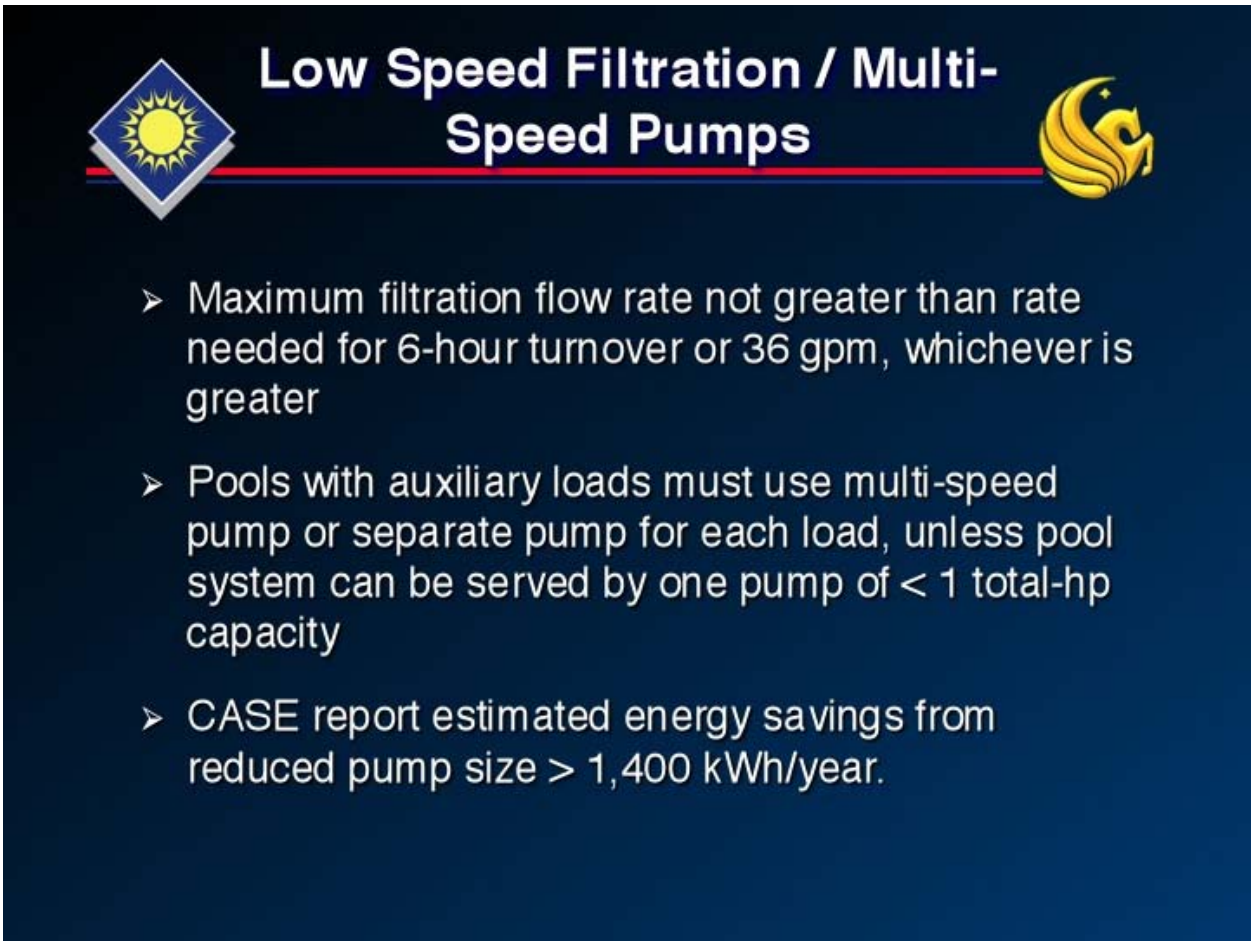
Parker, D., "Research Highlights from a Large Scale Residential Monitoring Study in a Hot Climate ", Florida Solar Energy Center, FSEC-pf-369-02, Jan. 01, 2002


Title 24 Pool and Spa Equipment Summary
5.2.9 Pool and Spa Equipment
"…additional requirements for residential swimming pool filtration equipment which affect filter pump selection and flow rate, piping and fittings, and filter selection."
"…designed to reduce the energy used to filter and maintain the clarity and sanitation of pool water."
CEC 2008 Building Energy Efficiency Standards Residential Compliance Manual, Draft revision to Pool sections, June 26, 2009


Title 24 Pool and Spa Equipment Summary
Filter pumps and filter pump motors comply with Title 20 specifications
Maximum filtration flow rate limits and multi-speed or separate pump for auxiliary loads
Pool pipe, filter and valve sizing / additional requirements.

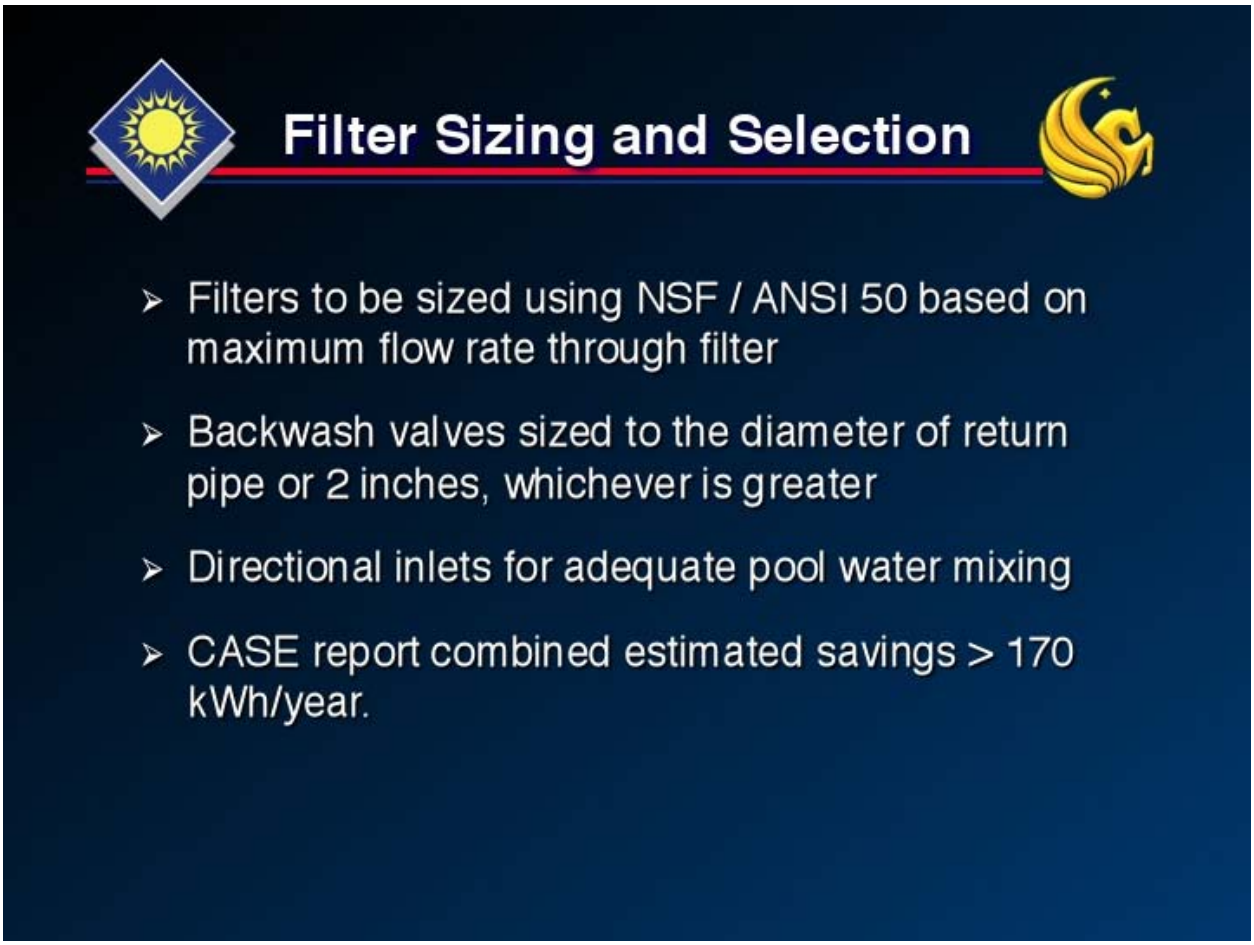
Title 20 Compliance

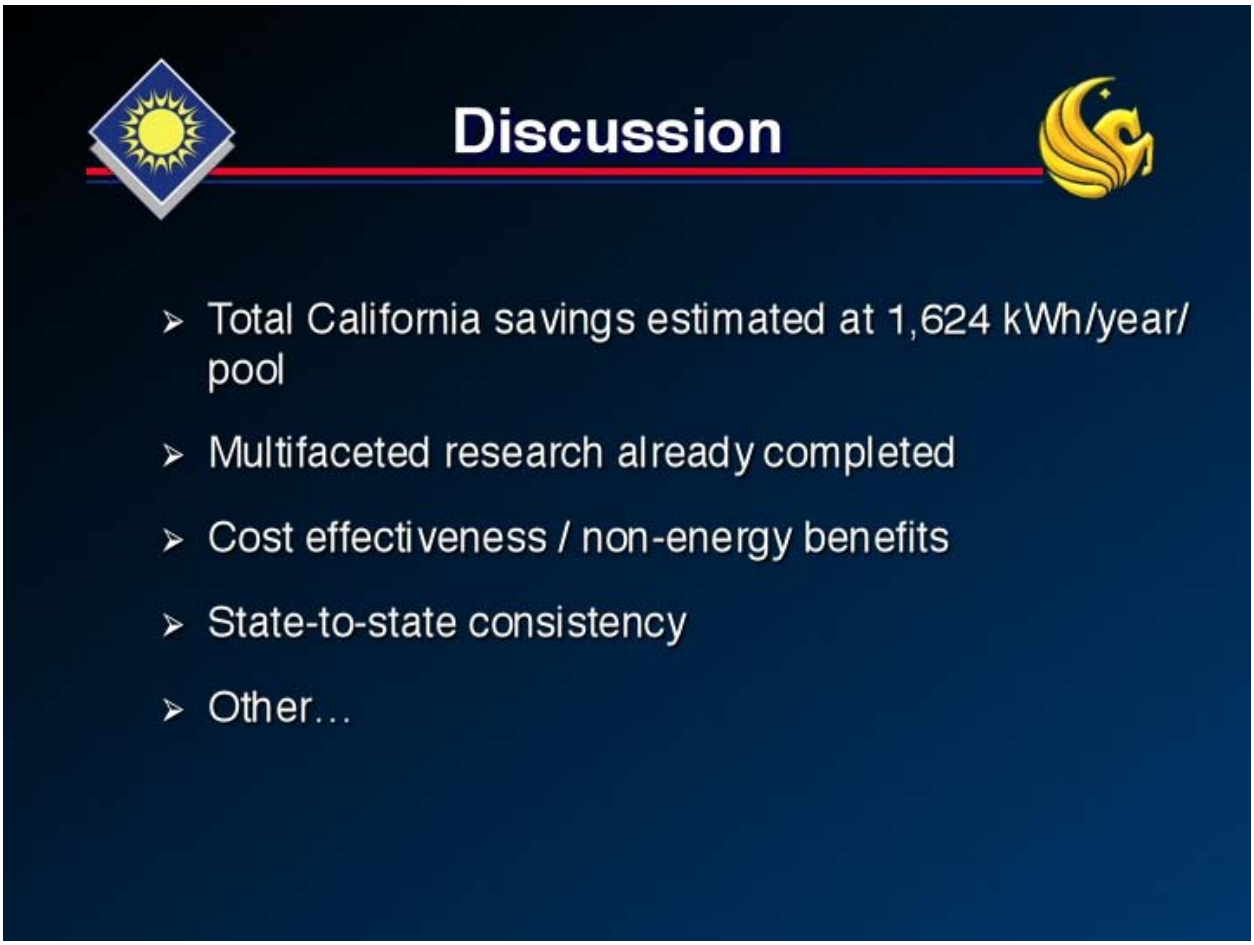
- Enable enforcement of Title 20 standards
- No split-phase and capacitor start – induction run pump motors
- Minimum two-speed capability for pump motors w/ capacity of 1 total-hp or more and pump controls
- Energy savings estimated in the CASE Title 20 study from elimination of low effic. motors and use of two speed pumps is 10% and 40%, respectively.


Low Speed Filtration / Multi-Speed Pumps
Maximum filtration flow rate not greater than rate needed for 6-hour turnover or 36 gpm, whichever is greater
Pools with auxiliary loads must use multi-speed pump or separate pump for each load, unless pool system can be served by one pump of < 1 total-hp capacity
CASE report estimated energy savings from reduced pump size > 1,400 kWh/year.

Pipe Design and Efficient Pipe Fittings

- Sets maximum filtration system suction and return velocities of 6 and 8 fps, respectively
- Minimum straight length of at least four pipe diameters on suction side
- Sweep / low pressure drop elbows for filter system
- Provide for future solar heating
- CASE report combined estimated savings > 500 kWh/year.

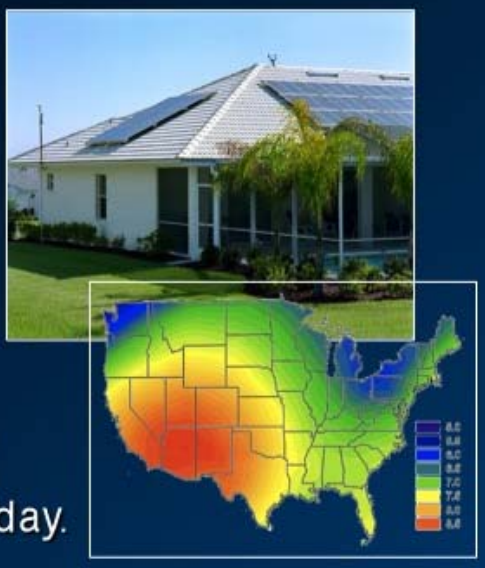

Filter Sizing and Selection
Filters to be sized using NSF / ANSI 50 based on maximum flow rate through filter
Backwash valves sized to the diameter of return pipe or 2 inches, whichever is greater
Directional inlets for adequate pool water mixing
CASE report combined estimated savings > 170 kWh/year.


Discussion
Total California savings estimated at 1,624 kWh/year/ pool
Multifaceted research already completed
Cost effectiveness / non-energy benefits
State-to-state consistency
Other…

PV Pool Pumping

(FSEC)

- ½ to ¾ hp pump with 600-900 Watts of PV
- Direct DC power
- Completely removes pool pumping load from grid
- Reduces avg. household electricity use by 11 kWh/day.



ATTACHMENT 4

OPTIONS EVALUATION RESULTS

ACCEPTABILITY RANKING EXERCISE

This list of options is a preliminary list and is not meant to be an exhaustive or all inclusive list. The options were provided by members. During the meeting(s) members will be asked to propose any additional option(s) they would like the Subcommittee to evaluate, and to develop and rank options, and following discussions and refinements, may be asked to do additional rankings of the options if requested by a Subcommittee member. Members should be prepared to offer specific refinements to address their reservations. The following scale will be utilized for the ranking exercises:

Acceptability Ranking Scale	***4 = acceptable,*** *I agree*	***3 = acceptable,*** *I agree with* ***minor reservations***	***2 = not acceptable, I*** *don't agree unless* ***major reservations*** *addressed*	***1 = not acceptable***

SUBCOMMITTEE'S OPTIONS EVALUATION PROCESS OVERVIEW

For each key topical issue area the following format will be used:

* Research/data presentation(s) will be given (if any on the topic),
* Questions and answers on the presentation(s),
* General discussion with Subcommittee members on the topic/issue,
* Identification of new options (if any),
* Refinements proposed to existing options (to enhance option's acceptability, if possible),
* Acceptability ranking of options (new, those with some level of support from previous meeting(s), and those a Subcommittee member proposes to be re-evaluated),
* Additional data/research needs identified, as needed.

During Subcommittee Meetings:

For each of the key topical issue areas, members will be asked to review existing options and invited to propose additional options for Subcommittee consideration. The worksheet is organized, by key topical issue areas with relevant options for each, to address key issues regarding proposed pool efficiency code amendments for the 2010 Florida Building Code. A preliminary list of options was drafted, and the Subcommittee may add any additional options they deem appropriate. When available, staff will provide relevant information from data collections, research studies, and other pertinent sources. Members should request any information they feel necessary for evaluating an issue, option or range of options. Once ranked by the Subcommittee, options will be listed within relevant key topical issue areas, in descending order of initial support as indicated by the initial acceptability ranking. Options with 75% or greater number of 4's and 3's in proportion to 2's and 1's shall be considered consensus draft recommendations.

The Worksheet is organized as follows: pool pump standards; pool plumbing system design; performance and prescriptive compliance paths for pools; and, credits for alternative energy sources for pool heating, lighting and pumping.

The Energy Act of 2008 (HB 7135) directs adoption of pool pump efficiencies in the 2010 FBC. During discussions with the Florida Spa and Pool Association regarding energy efficiency requirements for pool pumps members suggested improved efficiency could be achieved through criteria for pool hydronic system design.

1. POOL PUMP STANDARDS

403.9 Swimming Pools (Mandatory). Pools shall be provided with energy-conserving measures in accordance with Sections 403.9.1 through 403.9.3.

403.9.1 Swimming Pool and spa heaters. All pool heaters shall be equipped with a readily *accessible* on-off switch to allow shutting off the heater without adjusting the thermostat setting. ~~Pool heaters fired by natural gas shall not have continuously burning pilot lights.~~

403.9.1.1 [13-612.AB.2.3.4] Swimming Pool heater efficiency.

403.9.1.1.1 All gas- and oil-fired pool heaters, when tested in accordance with ANSI Z 21.56, shall have a minimum thermal efficiency of 78 percent. Pool heaters fired by natural gas shall not have continuously burning pilot lights.

403.9.1.1.1.2 Heat pump pool heaters, when tested in accordance with ARI 1160, Table 2, Standard Rating Conditions-Low Air Temperature, shall have a minimum COP of 4.0. Test reports from independent laboratories are required to verify procedure compliance.

403.9.1.2 Swimming Pool/Spa pool filtration pump motors. Split-phase, shaded-pole or capacitor start-induction run filtration pool pump motors shall not be permitted ~~installed~~. Residential filtration pool pumps and pool pump motors that total ~~are~~ ≥ 1 hp shall be capable of operating at two or more speeds and shall meet the following criteria:

1. The low speed shall have a rotation rate of no more than one-half the motor's maximum rotation rate.

2. Pool f**iltration** pump motor controls shall be capable of operating the pool pump on at least two speeds with the default speed at the filtration speed. A temporary override is required on the higher speeds for a period not to exceed one normal cycle or 120 minutes, whichever is less.

Exception: Solar pool heating systems may circulate at higher speeds during periods of usable solar heat gain.

403.9.1.3 Portable electric spas. Standby power for portable electric spas shall not exceed 5 (V2/3) watts when tested to the spa industry protocol" where V= the total volume of the spa, in gallons,

403.9.2 Time switches. Time switches that can automatically turn off and on heaters and pumps according to a preset schedule shall be installed on swimming pool heaters and pumps.

Regarding proposed language above,

	4=acceptable	*3= minor reservations*	*2=major reservations*	*1= not acceptable*
Initial Ranking 8/12/09	**7**	**2**	**0**	**0**

Member's Comments and Reservations (August 12, 2009):

TC: Question about 120 or less, don't think can change here.
JF: Not sure which document considering here. Reference to pipe size. Clarify that it doesn't apply to fittings.
JF: Does this cover above ground pools.
KG: Definition of swimming pool covers the issue.
RD: There is an issue: law says "for sale".
MM: For replacement pumps & motors, rely on FBC-Existing Building.

2. POOL PLUMBING SYSTEM DESIGN

JF: Clarify that pipe sizing is relevant only to the pipe, not the fittings.
Title 24 has a prescriptive measure for suction and discharge pipe size.
DJ: Title 24 is very clear.
KG: Pipe sizing determines fps.
MM: Can reference national standard if complete.
JM: 6 hour turnover, with velocities on flow rate
KG: 5.2.9 p. 14-18 on piping from Title 24

KG: Recommend we approve the following:
Title 24, Section 150, p. 144
2. **System piping.**
A. A length of straight pipe that is greater than or equal to at least 4 pipe diameters shall be installed before the pump; and
B. Pool piping shall be sized so that the velocity of the water at maximum flow for auxiliary pool loads does not exceed 8 feet per second in the return line and 6 feet per second in the suction line; and
C. All elbows shall be sweep elbows or elbow-type that have a pressure drop of less than the pressure drop of straight pipe with a length of 30 pipe diameters.

Title 24, Section 150, p. 144
4. **Valves.** Minimum diameter of backwash valves shall be 2 inches or the diameter of the return pipe, whichever is greater.

Title 24, Section 5.2.9: p. 5-14 – 5-18
5.2.8.3 Pool Pump Requirements
For maximum energy efficiency, pool filtration should be operated at the lowest possible flow rate for a time period that provides sufficient water turnover for clarity and sanitation. Auxiliary pool loads that require high flow rates such as spas, pool cleaners, and water features, should be operated separately from the filtration to allow the filtration flow rate to be kept to a minimum.
§150.p.1
All pumps and pump motors shall comply with the specifications of the Appliance Efficiency Regulations. The pool filtration flow rate may not be greater than the rate needed to turn over the pool water volume in six hours or 36 gpm, whichever is greater. This means that for pools of less than 13,000 gallons the pump must be sized to have a flow rate of less than 36 gpm and for pools of greater than 13,000 gallons, the pump

must be sized using the following equation:
Max Flow Rate (gpm) = Pool Volume (gallons) / 360
These are maximum flow rates. Lower flow rates and longer filtration times are encouraged and will result in added energy savings. Pools with auxiliary pool loads must use either a multi-speed pump or a separate pump for each auxiliary pool load. For example, if a spa shares the pool filtration system, either a multi-speed pump must be used or a separate pump must be provided to operate the spa. If the pool system can be served by one pump of less than 1 total-hp in capacity, the pump may be single speed. Filtration pump motors with a capacity of 1 total-hp or more must be multi-speed. All pool pumps sold in California must be tested and listed with the CEC according to the Appliance Efficiency Regulations. Pump manufacturers must list flow rate, power, and energy factor at each of three system curves (see Figure xx). For pools equal to or less than 17,000 gallons, a pump must be chosen such that the flow rate listed for Curve A is less than the six-hour turnover rate. For pools greater than 17,000 gallons, a pump must be chosen such that the listed flow rate at Curve C is less than the six-hour turnover rate.
[insert Figure 5-3: System Test Curves]

Title 24, Section 5.2.9: p. 5-14 – 5-18

5.2.8.5 Pool Pipe, Filter, and Valve Requirements

System design for residential pools is new for 2008. Correct sizing of piping, filters, and valves reduces overall system head, reduces noise and wear, and increases energy efficiency. Other mandatory requirements include leading straight pipe into the pump, directional inlets for mixing, and piping to allow for future solar installations.
§114.b and §150.p.2
Pool piping must be sized according to the maximum flow rate needed for all auxiliary loads. The maximum velocity allowed is 8 fps in the return line and 6 fps in the suction line. Table 5-3 shows the minimum pipe sizes required by pool volume based on a six-hour turnover filtration flow rate. These pipe sizes would need to be increased if there are auxiliary loads that operate at greater than the filtration flow rate. Conversely, they could be reduced if the pump is sized for greater than a six-hour turnover filtration flow rate.
[insert Table 5-3: Six-Hour Turnover Pipe Sizing]

There must be a length of straight pipe that is greater than or equal to at least 4 pipe diameters installed before the pump. That is, for a 2 inch suction pump, there must be at least 8 inches of straight pipe before the pump's strainer basket.

Traditional hard 90 elbows are not allowed. All elbows must be sweep elbows or a type of elbow that has a pressure drop less than the pressure drop of straight pipe with a length of 30 pipe diameters. For example, a 2-inch elbow must have a pressure drop less than a 5-foot length of 2-inch straight pipe. Field verification of sweep elbows may be performed by checking that the distance "w" of the installed sweep elbow is greater than that for a hard 90 elbow (refer to Figure 5-4). The difference in measurement between the radial edge of one sleeve to the perpendicular side of the elbow is found to be distinct between sweep elbows and hard 90's. There is sufficient difference in distance "w" such that all sweep elbows exceed the minimum values listed in Table 5-4. Figure 5-4 below illustrates "w" the dimension between the elbow sleeves and Table 5-4 shows the minimum distances "w" for an acceptable sweep elbow.
[insert Figure 5-4: Measuring w at the pool site].
[insert Table 5-4: Pool site measurement for sweep elbows]

Title 24, Section 5.2.9: p. 5-14 – 5-18
Backwash valves must me sized to the diameter of the return pipe or two inches, whichever is greater. Multiport backwash valves have a high pressure drop and are discouraged. Low-loss slide and multiple three-way valves can provide significant savings.

Title 24, Section 5.2.9: p. 5-14 – 5-18
The pool must have directional inlets to adequately mix the pool water. If a pool does not currently use solar water heating, piping must be installed to accommodate any future installation. Contractors can choose three options to allow for the future addition of solar heating equipment:
- Provide at least 36 inches of pipe between the filter and the heater to allow for the future addition of solar heating equipment
- Plumb separate suction and return lines to the pool dedicated to future solar heating.
- Install built-up or built-in connections for future piping to solar water heating. An example of this would be a capped off tee fitting.

Pipe Size:
6-hour turn and max 6 fps on suction and 8fps on return.

Filter
Title 24, Section 150, p. 144
3. **Filters.** Filters shall be at least the size specified in NSF/ANSI 50 for public pool intended applications.
4. **Valves.** Minimum diameter of backwash valves shall be 2 inches or the diameter of the return pipe, whichever is greater.

Title 24, Section 5.2.9: p. 5-14 – 5-18
Filters shall be sized using NSF/ANSI 50 based on the maximum flow rate through the filter. The filter factors that must be used are (in ft2/gpm):
Cartridge 0.375
Sand 15
Diatomaceous Earth 2

Backwash valves must me sized to the diameter of the return pipe or two inches, whichever is greater. Multiport backwash valves have a high pressure drop and are discouraged. Low-loss slide and multiple three-way valves can provide significant savings.

Portable Electric Spas
NOTE: The following is the work product of the APSP-14 committee, as completed 7-9-2009. This constitutes the complete model code by the ASPS-14 and it is fully consistent with CEC Title 20-2008, which is the amended 2006 version of Title 20.

Draft APSP 14 7-9-09 Work Product

1. Scope:

1.1 These requirements apply to residential portable (self-contained) spas that are used for bathing and are operated by an owner.

1.2 This standard is meant to establish minimum energy efficiency requirements for spas. This standard shall be met notwithstanding certain variations in equipment, materials, and design.

1.3 These requirements do not apply to public spas, permanently installed residential spas or other spas, such as those operated for medical treatment, physical therapy or other purposes. Swim-spas and portions of combination spas/swim-spas not intended to be heated over 100°F are also not subject to the requirements of this standard. [To be reviewed with Gary F.]

1.4 Other standards are referenced in this standard for items not covered.

2. Test Method:

2.1 **Purpose.** To measure the energy consumption of a portable electric spa in standby mode, using a repeatable and reproducible test procedure. The results will be used to calculate the standby power demand.

2.2 **Test Equipment:**

Note: All equipment shall be calibrated and traceable to the National Institute of Standards and Technology (NIST).

2.2.1 Recording Watt Hour meter – Accuracy: Class-2 or better.

2.2.2 Temperature measurement system - Accuracy: +/- 1°F

2.2.3 Water meter to measure fill water in gallons – Accuracy: +/- 1.5%

2.3 **Test Conditions.** The test method for portable electric spas is as follows:

2.3.1 Minimum continuous testing time shall be 72 hours.

2.3.2 The spa shall be filled with water to the halfway point between the bottom of the skimmer basket opening and the top of the spa. If there is no skimmer basket, the spa shall be filled with water to six inches below the top of the spa.

2.3.2.1 Measure and record fill volume (V) while filling according to 2.3.2.

2.3.3 The water temperature shall be 102°F, ± 2°F for the duration of the test.

2.3.4 The ambient air temperature shall be 60°F, ± 3°F for the duration of the test. [Review issue of low ambient temp with Gary F.]

2.3.5 The standard cover that comes with the unit shall be used during the test.

2.4 Test Procedure.

2.4.1 The test shall start when the water temperature has been at 102°F, ± 2°F for at least a four hour stabilizing period.

2.3.2 Record water temperature at two points.

2.3.2.1 Primary thermocouple shall be located three to five inches below the water level and centrally located relative to the shape of the vessel.

2.3.2.2 Redundant thermocouple shall be located within three to six inches of the primary thermocouple, on the same horizontal plane relative to water depth.

2.3.3 Record ambient air temperature at one point located a maximum of one to one and a half feet above spa cover level and six to eight inches from the chamber wall and out of direct airflow from the chamber temperature control system and/or circulation fan.

2.3.4 **Data Recording.**

2.3.4.1 Record temperatures at a maximum interval of 4 minutes.
2.3.4.2 Record voltage, current, and power factor at a maximum interval of 4 minutes.
2.3.4.3 Record watt-hours used during entire Test Period.
2.3.4.4 Record elapsed time during Test Record.

2.3.5 Record the total energy use for the period of test, starting at the end of the first heating cycle after the stabilization period and finishing at the end of the first heating cycle after 72 hours has elapsed.

Exception: For spas without heaters, substitute heating cycle with filter or purge cycle.

2.3.6 The unit shall remain covered and in the default operation mode during the test. Energy-conserving circulation functions, if present, must not be enabled if not appropriate for continuous, long-term use. Ancillary equipment including, but not limited to lights, audio systems, and water treatment devices, shall remain connected to the mains but may be turned off during the test if their controls are user accessible.

3. Formulas

3.1 The measured standby power (Pmeas) shall be determined by E/t:

$Pmeas = E/t$

Where:

E = total energy use during the test (Wh)
t = length of test (hr)

3.2 The measured standby power (Pmeas) shall be normalized (P_{norm}) to a temperature difference of 37°F using the equation:

$P_{norm} = Pmeas (\Delta Tideal / \Delta Tmeas)$

Where:

ΔTideal = 37°F
ΔTmeas = Twater avg – Tair avg
Twater avg = Average water temperature during test
Tair avg = Average air temperature during test.

3.3 The normalized standby power (Pnorm) shall not be greater than maximum standby power (Pmax):

$Pmax = 5(V^{2/3})$

Where:

V = fill volume in gallons

4. Labeling

5. Glossary:

HEATING CYCLE –

Stand-by mode – All settings at default as shipped by the manufacturer, except water temperature which may be adjusted to meet the test conditions.
Spa Volume – The advertised and marketed water fill capacity of the tub in gallons. This measurement is generally found on the tub specification label on the tub, in the owner's manual or within advertising of the tub.
Total Spa Capacity – The total fill capacity of the tub in gallons (this measurement is greater than the Spa Volume). This is measured by filling the tub to the point where the entire vessel is full, at the threshold of spilling out of the tub.

Other
Title 24, Section 114: p. 62-63
2. **Covers**. A cover for outdoor pools or outdoor spas that have a heat pump or gas heater.

Pipe Size: Require 6-hour turn over rate and max 6 fps on suction and 8fps on return. No hard 90s allowed, sweeps required. Copy prescriptive language from Title 24. Allow the chart referenced.(velocity of ANSI std will come out)

	4=acceptable	***3= minor reservations***	***2=major reservations***	***1= not acceptable***
Initial Ranking 8/12/09	**9**	**1**	**0**	**0**

Member's Comments and Reservations (August 12, 2009):
DJ: Final standard is still in the works.
MM: We can work with the draft document, and reference when final.
KG: Size of pipe determines performance. It is easy to understand.
RV: Performance method can achieve the same thing.
KG: Can put in solar accommodation. Eliminate hard elbows.
DJ: Is this going to lead us back to open pipe inspections. Or can we document installation so it won't be required.
DG: Currently can do a performance test.
Dixon: Provide the performance alternative.
KG: Right now, telling BO have X dynamic head in system. If using sweep 90s, will have total dynamic head (6 hr turnover, max suction/return), way to achieve will be sweep elbows, BD can check dynamic head.
Trying to lower the resistance in the pipe without exceeding flow rates & also prevent entrapment.
DJ: What happens if tested at different pressure, what should factor be?
MM: May end up requiring an engineer.
KG: Engineer won't get closer to real number. Accepted hydraulic charts achieve close to same effect. Question 6 gallons per pipe?
DJ: Maybe restrict residential.
RD: If reducing friction, pushing higher flow rate, where is the harm? Possibly downsize the pump and push fpm.
DJ: Agree. Currently 6 fph used, safety may get there soon.
RV: Would multispeed pump help?
DJ: Have used multi-speeds for years, homeowner can kick into high speed. No locks.

KG: ANSI 7 requires 6fps remains in case suction is blocked. Safety is in maintaining the 6 fps.

3. PERFORMANCE/PRESCRIPTIVE COMPLIANCE PATHS FOR POOLS

JF: There are ways to limit use of multispeed pumps.
KG: Multispeed pump, can we limit through software?
DG: Currently have design to maximum speed. Would consider software. Haven't seen it.

4. ALTERNATIVE ENERGY SOURCES CREDITS FOR POOL HEATING/LIGHTING/PUMPING

Pool Heating:
KG: APSP document, energy efficiency of gas-fired heaters, electrical heaters. Require cover. 60% site solar exempt.
Pete Saharak, Pool Pak Heaters. High end can meet 98%, most about 82% efficient.
Presently 90% electronic ignition. Some gas heater manufacturers demand millivolt ignition (always burning). Industry happy when millivolt gas heaters not allowed. Much happier with electronic.
AS: Why is minimum standard 78% when higher efficiency units are available? Federal law preempts states from requiring higher efficiencies.

RV: Question, 36" to retrofit a solar system. Seems reasonable on new pool. Did we incorporate that language. Put in alternative language as credit.

Recommend add from Title 24, 5.2.9:
Provide one of the following for later solar installation:

4) *install at least 18 ~~36~~ inches of pipe after the filter between the filter and the heater to allow for the future addition of solar heating equipment.*
5) *plumb separate suction and return lines to the pool dedicated to future solar heating.*
6) *Install built-up or bulilt-in connections for future piping to solar water heating. An example of this would be a capped-off tee fitting.*

	4=acceptable	***3= minor reservations***	***2=major reservations***	***1= not acceptable***
Initial Ranking 8/12/09	**10**	**0**	**0**	**0**

Member's Comments and Reservations (August 12, 2009):
DJ: Can retrofit solar without 36 inches. Sometimes not enough room on equipment pad.
Garland William (GW): 36 inches is a lot. Recommend 20-26 inches. Concern that have to cut a lot out. At least 18".
KG: Alternatives should be allowed.

ISSUE OF POOL COVERS:
Eliminate requirement for pool covers but retain requirement for spas.

Initial Ranking 8/12/09	**1**	**8**	**1**	**0**

Member's Comments and Reservations (August 12, 2009):

DJ: Not many BDs enforcing pool covers until recently, although in code for years. Can be counter productive to pool chemistry. Can be deadly for pets and children. Requiring them doesn't serve any real purpose.
TM: There are options available, to do same thing.
RV: Bigger issue is spas, lot of heat loss.
DJ: Customers don't use them.
KG: Spa covers for portable spas are hard covers. Efficiency numbers achieved by using covers. Used small heaters, stay hot all time. If not heated all the time, question
JH: 13-412 of FBC energy requires pool covers.
DJ: Temperature wise, Florida temperatures don't justify having a cover.
TM: People don't use them because they are inconvenient.
GW: Central Florida, most of customers use covers. With water falls, can get pretty difficult. Blankets 40 % as efficient.
KG: Part of the national mandate, would lower it. Also agree that hardly ever used and can be a hazard to pets & children. Can we require solar cover or an alternative.
JF: Bill Kent feel strongly against requiring pool covers.

5. RESEARCH INITIATIVES

Pump efficiency vs. motor efficiency.

6. OTHER

PV POOL PUMPS

Provide an energy code credit for powering pool pumps by PV or alternative technologies that reduce power needed by pool pump.

	4=acceptable	***3= minor reservations***	***2=major reservations***	***1= not acceptable***
Initial Ranking 8/12/09	**7**	**3**	**0**	**0**

Member's Comments and Reservations (August 12, 2009):
JF: Tech that can take outlet from pole, use DC power to pump so that it never exceeds power from pump.
TM: Would like to expand power required by house due to PV.
RB: Advantage of having PV system on the house, will be used all the time. If stand-alone application, doesn't apply to house. Simpler. Limited in application.
MM: Will go into energy code. Incorporate into code compliance calculation as an alternative.
RD: Historically, credits have been provided for ceiling fans, etc that reduce energy use of a house.
RV: If electric resistance pool heaters are still allowed, the issue should be addressed.
KG: Title 24, Sec. 114, #4: Electric resistance heating. No electric resistance heating; and
Exception: Listed package units with fully insulated enclosures, and with tight-fitting coverers that are insulated to at least R-6.
Exception 2: Pools or spas deriving at least 60 percent of the annual heating energy from site solar energy recovered energy.