Progress Report
2007 IECC 2006 Energy Codes Training
Utah State Energy Program
November 2007

Background

This report provides year-to-date (November 2007) results of training on the 2006 International Energy Conservation Code administered by the Utah State Energy Program (USEP). The 2006 IECC sets baseline energy conservation and energy efficiency standards for residential and commercial buildings. The code covers both new buildings and renovations. Utah adopted the 2006 IECC effective on January 1, 2007. However, a wide variety of stakeholders have indicated that, 1) The adoption of the new IECC was not well known among builders and code officials, and 2) Even the earlier 2003 IECC was not being enforced in many jurisdictions. The free training administered by USEP is intended to improve both knowledge and enforcement of energy codes in order to ensure energy efficiency in Utah's buildings. Potential energy savings from training activities are significant and long lasting. Assuming that one half of the @ 20,000 new homes that are built each year in Utah can be brought from the current "standard practice" to 2006 IECC compliance through codes training, the resulting annual savings is estimated to be 2.7 million kWh of electricity per year and 5 million therms of natural gas per year. This represents an annual total energy savings of 17% for each home or 502,000 MMbtu for all homes built in typical recent year. Because most energy saving features are built into the home, they will continue to realize savings throughout the expected life of the structure.

The training program was funded primarily by $50,000 provided by Questar Gas and $40,000 by Rocky Mountain Power as part of each company's demand-side management programs. (USEP's administration of the program was an in-kind contribution.) Local sponsorship (providing meeting space and refreshments) were also provided by the City of St. George Energy Services Department and Moon Lake Electric Coop.

USEP issued an RFP for a professional energy codes trainer on February 21, 2007. The RFP requested proposals for a codes training programs with up to $80,000 in contractor costs (personnel, travel, and printed materials) for 10 to 20 days of training and technical assistance for one year. Responses were received from one local and four national building codes education organizations. The winning bid was submitted by the Britt Makela Group (codes trainer Eric Makela) and proposed 22 days of training for $74,720.

Training Schedule, Marketing, and Attendance

After consultations between USEP, RMP, QGC, and our trainer, it was decided to offer four courses:

1. Seventeen half-day (morning) sessions providing the basics of the IECC residential code and intended for those with little to no familiarity with prior IECC codes.
2. Seventeen half day (afternoon) sessions providing an update of both the residential and commercial portions of the 2006 IECC and intended for those who were familiar with the 2003 edition of the IECC.
3. Two full-day sessions providing in-depth information on the commercial code and intended for those with little to no familiarity with prior IECC versions.

4. Four on-site residential sessions intended to help those who had attended the classroom residential session transfer their knowledge to "real world" construction sites.

Training sessions were offered at a wide variety of locations across the state. The schedule was intended to provide geographic diversity while also providing offerings in areas where building activity is currently the greatest. Site selection was also limited by a desire to provide training in RMP service territory unless the local utility was also a sponsor. Efforts were also made to select sites where no-cost meeting rooms could be used in order to optimize program funds. The complete schedule, locations, and course descriptions are attached to this report.

Prior to the start of the training schedule, USEP created a training program information flier and registration system. A mailing of over 7,000 pieces was conducted. Information was sent to all licensed general, HVAC, and insulation contractors, engineers, architects, code inspectors, and plan reviewers. Two supplemental mailings have also been done for areas of southern Utah. USEP also contacted local branches of AIA, ASHRAE, and home builders associations to request that they also publicize training events. RMP and QGC also marketed training opportunities through their DSM program representatives and trade partners.

Attendance generally met expectations. Sessions in Salt Lake and Utah counties were especially well-attended. Turnout in Weber County was below expectation, although the initial session at Brigham City surpassed initial estimates. Attendance in areas away from the Wasatch Front was mixed. Moab, Price, and St. George have not met expectations (though two sessions are planned in St. George in December and a supplemental mailing has been done to improve turnout). Commercial sessions have been very well attended.

CODES TRAINING, 2007 YTD ATTENDEES BY SITE AND SESSION

June 19	Brigham City	Residential (a.m.)	42	2006 Update (p.m.)	13
June 20	Ogden	Residential (a.m.)	22	2006 Update (p.m.)	8
June 21	Layton	Residential (a.m.)	30	2006 Update (p.m.)	12
July 10	Davis County	On-Site (a.m.)	12	On-Site (p.m.)	8
July 11	Salt Lake City	Residential (a.m.)	41	2006 Update (p.m.)	24
July 12	Lehi	Residential (a.m.)	47	2006 Update (p.m.)	31
August 7	Roosevelt	Residential (a.m.)	10	2006 Update (p.m.)	8
August 8	Park City	Residential (a.m.)	26	2006 Update (p.m.)	15
August 9	Salt Lake City	Commercial	54		
August 14	Moab	Residential (a.m.)	8	2006 Update (p.m.)	7
August 15	Price	Residential (a.m.)	9	2006 Update (p.m.)	9
Sept 19	St. George	Residential (a.m.)	16	2006 Update (p.m.)	15
Sept 20	Richfield	Residential (a.m.)	16	2006 Update (p.m.)	9
Sept 21	Lehi	Residential (a.m.)	28	2006 Update (p.m.)	16
Oct 2	Salt Lake City	Residential (a.m.)	22	2006 Update (p.m.)	12
Oct 3	Utah County	On-Site (a.m.)	21	On-Site (p.m.)	12
Oct 4	Salt Lake County	On-Site (a.m.)	22	On-Site (p.m.)	8
Nov 7	Ogden	Residential (a.m.)	26	2006 Update (p.m.)	17
Nov 8	Lehi	Commercial	60		

TOTAL ATTENDEES BY SESSION TYPE		AVERAGE PER SESSION
Residential overview (1/2 day, 14 sessions)	**343**	**24.5**
2006 update (1/2 day, 14 sessions)	**196**	**14.0**
Commercial (full day, 2 sessions)	**114**	**57.0**
On-Site (1/2 day, 6 sessions)	**84**	**14.0**

At residential overview sessions, over one-third of attendees were local code enforcement officials and about one-quarter were general contractors. The remainder were a mix of other contractor trades, architects, and others. At afternoon sessions, over one-half of attendees were building inspectors or local plan reviewers, with general contractors comprising just under a quarter. Commercial sessions had a very different population, with less than 10% representing contractors of any kind. Roughly one-third were architects, another third local officials, and 15% engineers. Profession data were not collected at on-site sessions but a majority of attendees were local codes officials. The high turnout among codes enforcement officials was a good beginning for improving code enforcement in the state. It is hoped that in future training turnout among contractors will increase when enforcement by newly-trained code officials increases.

Training Evaluation

In an effort to assess training results and collect feedback from participants, questionnaires were administered at all classroom sessions (i.e. all but on-site training). Pre-training questionnaires asked knowledge-based questions to assess prior code knowledge. Post-training questionnaires repeated the knowledge-based questions in order to assess learning from the session. Post-training questionnaires also included qualitative ratings of the training sessions, the trainer himself, and the value of the training. Open-ended questions also solicited input regarding most and least valuable aspects of the training and suggestions for improvement and future sessions.

Open-ended comments on the “most valuable” aspect of the training frequently reflected approval of the use of example scenarios in the teaching. Many, rather than just single out one aspect of the training, simply wrote “it was all valuable.” Very few commented on the “least valuable” question, except for some from specific professions who cited information that was not applicable to their trade (e.g. HVAC contractors commenting on shell information). The question soliciting suggestions for improvement overwhelmingly reflected two themes – A desire for more time for training sessions and a desire to go into more detail. Some of the detail suggestions were trade specific. Open-ended comments suggest that the attendees were eager to learn more and would participate in future sessions providing more in-depth instruction.

The results of pre- and post-training knowledge based questions are provided below, as are the closed-ended qualitative ratings of the training.

Further discussion of evaluation results appears in the “Evaluation Discussion and Lessons Learned” section that follows the results presented below.

Utah Energy Codes Training, 2007
Post-Training Questionnaire
Morning Residential Codes Sessions
Results YTD June - November

	POOR				EXCELLENT
1. Your overall satisfaction with this training session	**1**	**2**	**3**	**4**	**5**
n = 243					
# responding with rating	0	0	12	106	125
% responding with rating	0%	0%	4.9%	43.6%	51.4%
Mean = 4.48					
2. Your rating of the presenter's knowledge of the topic	**1**	**2**	**3**	**4**	**5**
n = 243					
# responding with rating	0	1	2	53	186
% responding with rating	0%	0.4%	0.8%	21.8%	76.5%
Mean = 4.77					
3. Your rating of the presenter's teaching abilities	**1**	**2**	**3**	**4**	**5**
n = 243					
# responding with rating	0	0	7	68	168
% responding with rating	0%	0%	2.9%	28.0%	69.1%
Mean = 4.68					

	NOT AT ALL			VERY MUCH	
4. How relevant was the session to your work?	**1**	**2**	**3**	**4**	**5**
n = 243					
# responding with rating	1	9	32	83	118
% responding with rating	0.4%	3.7%	13.2%	34.1%	48.6%
Mean = 4.29					
5. Do you expect to apply what you learned to your work?	**1**	**2**	**3**	**4**	**5**
n = 243					
# responding with rating	1	3	20	94	125
% responding with rating	0.4%	1.2%	8.2%	38.7%	51.4%
Mean = 4.41					
6. Did the training meet your goals for attending?	**1**	**2**	**3**	**4**	**5**
n = 243					
# responding	0	8	22	99	114
% responding with rating	0%	3.3%	9.1%	40.7%	46.9%
Mean = 4.33					

Pre-Training and Post-Training Knowledge Tests, Morning Residential Sessions

Trainees were asked to answer knowledge questions both before and after training. Results below show changes in number of correct answers. (Note that n's are smaller for post-training tests. Nearly all participants answered qualitative post-training questions but several skipped the second page of the questionnaire.) Correct answers are highlighted below. All questions except #2 are multiple choice. Question #2 requires that respondents fill in several correct responses. Results for number 2 are shown as number of correct answers provided (maximum of 4).

1. What three Climate Zones make up the state of Utah?

[ ] A. Climate Zones 1, 2, and 3
[ ] B. Climate Zones 4, 5 and 6
[ ] C. Climate Zones 3, 5 and 6
[ ] D. Climate Zones 5, 6 and 7
[ ] E. Don't Know

Pre-Training		Post-Training	
n =	255	n =	194
# correct	96	# correct	148
% correct	37.6%	% correct	76.3%
# "Don't Know"	86	# "Don't Know"	0
% "Don't' Know"	33.7%	% "Don't' Know"	0.0%

2. What four compliance approaches are available to demonstrate compliance with the residential provisions of the IECC?

A. _____
B. _____
C. _____
D. _____
[ ] E. Don't Know

Correct responses are: Prescriptive Approach, Total UA, Simulated Performance, and ResCheck.

Pre-Training		Post-Training	
n =	242	n =	166
Don't Know	134	Don't Know	21
zero correct	5	zero correct	2
1 correct	12	1 correct	3
2 correct	15	2 correct	5
3 correct	11	3 correct	47
4 correct	65	4 correct	88
% zero correct or DK	53.1%	% zero correct or DK	13.9%
% 1 or 2 correct	17.9%	% 1 or 2 correct	4.8%
% 3 or 4 correct	29.0%	% 3 or 4 correct	81.3%

3. Which of the following compliance options provide the greatest flexibility for trading-off the energy efficient features of a building?

[ ] A. Prescriptive Package approach
[ ] B. Total UA Alternative
[ ] C. RES*check*
[ ] D. Simulated Performance Alternative (Performance)
[ ] E. Don't Know

Pre-Training		Post-Training	
n =	247	n =	174
# correct	59	# correct	73
% correct	23.9%	% correct	42.0%
# "Don't Know"	134	# "Don't Know"	3
% "Don't' Know"	54.3%	% "Don't' Know"	1.5%

4. What is the minimum duct insulation R-value for supply ducts located in conditioned space?

[ ] A. No insulation is required
[ ] B. R-2
[ ] C. R-4.2
[ ] D. R-8
[ ] E. Don't Know

Pre-Training		Post-Training	
n =	254	n =	192
# correct	67	# correct	55
% correct	26.4%	% correct	28.6%
# "Don't Know"	57	# "Don't Know"	1
% "Don't' Know"	22.4%	% "Don't' Know"	0.5%

5. What spaces are considered conditioned under the residential provisions of the IECC?

[ ] A. An unfinished basement that includes supply registers from a heating system
[ ] B. A garage with a separate heater
[ ] C. A furnace closet located inside a house with combustion air ducts leading into the closet area from the outside
[ ] D. A and B only
[ ] E. Don't Know

Pre-Training		Post-Training	
n =	246	n =	181
# correct	116	# correct	127
% correct	47.2%	% correct	70.2
# "Don't Know"	67	# "Don't Know"	2
% "Don't' Know"	27.2%	% "Don't' Know"	1.0%

6. How must floor insulation be installed in a raised floor over a vented crawlspace?

[ ] A. The insulation is allowed to be supported by wires or netting with an air space between the insulation and the subfloor
[ ] B. The insulation is allowed to be friction fit into the floor joist with no support as long as it is in contact with the subfloor
[ ] C. The insulation must be installed to maintain permanent contact with the underside of the subfloor
[ ] D. There are no requirements for floor insulation installation in the IECC
[ ] E. Don't Know

Pre-Training		Post-Training	
n =	255	n =	187
# correct	113	# correct	161
% correct	44.3%	% correct	86.1%
# "Don't Know"	57	# "Don't Know"	3
% "Don't' Know"	22.4%	% "Don't' Know"	1.5%

SUMMARY – Total Correct Answers, Questions 1, 3, 4, 5, and 6

Pre-Training		Post-Training	
n =	1,257	n =	928
# correct	451	# correct	564
% correct	35.9%	% correct	60.8%
# "Don't Know"	401	# "Don't Know"	9
% "Don't' Know"	31.9%	% "Don't' Know"	1.0%

Attendees Profile, Morning Residential Sessions

Attendees who self-identify as not attending previous SEP training sessions
Pre-Training Questionnaire = 95.0%
Post-Training Questionnaire = 93.6%

	Pre-Training		Post-Training	
Profession	Number	Percent	Number	Percent
General Contractor	61	25.1%	70	28.9%
HVAC Contractor	19	7.8%	20	8.3%
Insulation Contractor	3	1.2%	3	1.2%
Other Contractor	12	4.9%	10	4.1%
Architect	21	8.6%	18	7.4%
Engineer	8	3.3%	8	3.3%
Building Inspector	82	33.7%	80	33.1%
Plans Reviewer	13	5.3%	8	3.3%
Other	24	9.9%	25	10.3%
Total	243		242	

Note: Some respondents listed two professions. Where this occurred, the following rules were used for coding:
If Building Inspector was listed along with any other profession, Building Inspector was entered. (Several listed both Inspector and Plan Reviewer.)
If General Contractor was listed along with any other profession, General Contractor was entered except where listed with Code Inspector.

Commentary: The results above confirm what we know already – Contractors arrive late.

Utah Energy Codes Training, 2007
Post-Training Questionnaire
Afternoon Codes Update Sessions
Results YTD June - October

	POOR				**EXCELLENT**
1. Your overall satisfaction with this training session	1	2	3	4	5
n = 119					
# responding with rating	0	0	4	47	68
% responding with rating	0.0%	0.0%	3.4%	39.5%	57.1%
Mean = 4.54					
2. Your rating of the presenter's knowledge of the topic	1	2	3	4	5
n = 119					
# responding with rating	0	0	2	26	91
% responding with rating	0.0%	0.0%	1.7%	21.8%	76.5%
Mean = 4.75					
3. Your rating of the presenter's teaching abilities	1	2	3	4	5
n = 119					
# responding with rating	0	0	3	28	88
% responding with rating	0.0%	0.0%	2.5%	23.6%	73.9%
Mean = 4.71					

	NOT AT ALL			**VERY MUCH**	
4. How relevant was the session to your work?	1	2	3	4	5
n = 119					
# responding with rating	2	10	14	38	55
% responding with rating	1.7%	8.4%	11.8%	31.9%	46.2%
Mean = 4.13					
5. Do you expect to apply what you learned to your work?	1	2	3	4	5
n = 119					
# responding with rating	2	6	14	39	58
% responding with rating	1.7%	5.0%	11.8%	32.8%	48.7%
Mean = 4.22					
6. Did the training meet your goals for attending?	1	2	3	4	5
n = 119					
# responding with rating	0	6	9	40	64
% responding with rating	0.0%	5.0%	7.6%	33.6%	53.8%
Mean = 4.39					

Pre-Training and Post-Training Knowledge Tests, Afternoon Update Sessions

Trainees were asked to answer knowledge questions both before and after training. Results below show changes in number of correct answers. (Note that n's are smaller for post-training tests. Nearly all participants answered qualitative post-training questions but several skipped the second page of the questionnaire.) Correct answers are highlighted below. All questions are multiple choice.
NOTE: Morning and afternoon sessions were originally intended to cater to different audiences. However, experience has shown that most trainees attended both the morning and afternoon sessions. Thus, several pre-training questions have very high rates of correct answers that would not be expected if all attendees attending their first training.

1. What types of commercial buildings must comply with the envelope requirements of the IECC?
   - [ ] A. Buildings with space conditioning systems designed for freeze protection of sprinkler systems
   - [ ] B. Office and retail buildings that are conditioned for human comfort
   - [ ] C. Commercial buildings with space conditioning systems where the peak design rate of energy use is less than 3.4 Btu/h-ft^2
   - [ ] D. A and B
   - [ ] E. Don't know

Pre-Training		Post-Training	
n =	123	n =	108
# correct	58	# correct	69
% correct	47.2%	% correct	63.9%
# "Don't Know"	44	# "Don't Know"	1
% "Don't' Know"	35.8%	% "Don't' Know"	0.9%

2. What three Climate Zones make up the state of Utah?
   - [ ] A. Climate Zones 1, 2, and 3
   - [ ] B. Climate Zones 4, 5 and 6
   - [ ] C. Climate Zones 3, 5 and 6
   - [ ] D. Climate Zones 5, 6 and 7
   - [ ] E. Don't Know

Pre-Training		Post-Training	
n =	129	n =	111
# correct	99	# correct	98
% correct	76.7%	% correct	88.3%
# "Don't Know"	9	# "Don't Know"	1
% "Don't' Know"	7.0%	% "Don't' Know"	0.9%

3. Which of the compliance options provide the greatest flexibility for trading-off the energy efficient features of a building?
   - [ ] A. Prescriptive Package approach
   - [ ] B. RES*check*
   - [ ] C. Simulated Performance Alternative (Performance)
   - [ ] D. Total UA Alternative
   - [ ] E. Don't Know

Pre-Training		Post-Training	
n =	123	n =	105
# correct	66	# correct	49
% correct	53.7%	% correct	46.7%
# "Don't Know"	20	# "Don't Know"	2
% "Don't' Know"	16.3%	% "Don't' Know"	1.8%

4. When can ASHRAE 90.1-2004 be used to show compliance with the commercial provisions of the IECC?
   - [ ] A. Only for buildings with greater than 40% of the above grade wall area in glazing
   - [ ] B. Only when the building energy system falls out of the scope of Section 502, 503, 504 and 505 of the IECC
   - [ ] C. For any building
   - [ ] D. Only when demonstrating compliance for LEED commercial projects
   - [ ] E. Don't Know

Pre-Training		Post-Training	
n =	122	n =	109
# correct	28	# correct	68
% correct	23.0%	% correct	62.4%
# "Don't Know"	72	# "Don't Know"	7
% "Don't' Know"	59.0%	% "Don't' Know"	6.4%

5. When can the building envelope requirements be used in Section 502?
   - [ ] A. For buildings with less than or equal to 50% glass to above-grade wall area
   - [ ] B. For buildings with less than or equal to 40% glass to above-grade wall area
   - [ ] C. For any building regardless of the glass to above-grade wall percentage
   - [ ] D. For buildings with less than or equal to 10% of the roof area in skylight
   - [ ] E. Don't Know

Pre-Training		Post-Training	
n =	123	n =	107
# correct	24	# correct	69
% correct	19.5%	% correct	64.5%
# "Don't Know"	72	# "Don't Know"	9
% "Don't' Know"	58.5%	% "Don't' Know"	8.4%

6. Which of the following interior lighting systems are exempt from the provisions of the IECC?
   - [ ] A. Interior lighting installed in an unconditioned warehouse
   - [ ] B. Interior lighting installed in a dwelling units in a building greater than 3 stories
   - [ ] C. Interior lighting installed in an office building
   - [ ] D. Interior lighting installed in an underground parking garage
   - [ ] E. Don't Know

Pre-Training		Post-Training	
n =	124	n =	107
# correct	12	# correct	39
% correct	9.7%	% correct	36.4%
# "Don't Know"	53	# "Don't Know"	13
% "Don't' Know"	42.7%	% "Don't' Know"	12.1%

SUMMARY – Total Correct Answers, Questions 1, 2, 3, 4, 5, and 6

Pre-Training		Post-Training	
n =	744	n =	647
# correct	284	# correct	392
% correct	38.2%	% correct	60.6%
# "Don't Know"	271	# "Don't Know"	33
% "Don't' Know"	36.4%	% "Don't' Know"	5.1%

Attendees Profile, Afternoon Update Sessions

Attendees who self-identify as not attending previous SEP training sessions
Pre-Training Questionnaire = 78.8%
Post-Training Questionnaire = 73.9%
Commentary: Analysis shows this question was flawed. Most respondents interpreted it to include all of the training received on a given day. Thus, those who attended morning sessions indicated that they had not received training before, contrary to the intent of the question. The majority of those attending afternoon sessions had already participated in a morning residential training session.

	Pre-Training		Post-Training	
Profession	Number	Percent	Number	Percent
General Contractor	30	23.3%	26	22.0%
HVAC Contractor	5	3.9%	6	5.1%
Insulation Contractor	1	0.8%	1	0.8%
Other Contractor	6	4.7%	6	5.1%
Architect	7	5.4%	8	6.8%
Engineer	3	2.3%	3	2.5%
Building Inspector	65	50.4%	58	49.2%
Plans Reviewer	6	4.7%	7	5.9%
Other	6	4.7%	3	2.5%
Total	129		118	

Note: Some respondents listed two professions. Where this occurred, the following rules were used for coding:
If Building Inspector was listed along with any other profession, Building Inspector was entered. (Several listed both Inspector and Plan Reviewer.)
If General Contractor was listed along with any other profession, General Contractor was entered except where listed with Code Inspector.

Utah Energy Codes Training, 2007
Post-Training Questionnaire
Commercial Session
August 2007

	POOR				EXCELLENT
1. Your overall satisfaction with this training session	1	2	3	4	5
n = 77					
# responding with rating	0	1	4	45	25
% responding with rating	0.0%	2.3%	5.2%	58.4%	32.5%
Mean = 4.14					
2. Your rating of the presenter's knowledge of the topic	1	2	3	4	5
n = 78					
# responding with rating	0	0	1	27	50
% responding with rating	0.0%	0.0%	1.3%	34.6%	64.1%
Mean = 4.63					
3. Your rating of the presenter's teaching abilities	1	2	3	4	5
n = 78					
# responding with rating	0	1	5	33	39
% responding with rating	0.0%	1.3%	6.4%	42.3%	50.0%
Mean = 4.41					

	NOT AT ALL			VERY MUCH	
4. How relevant was the session to your work?	1	2	3	4	5
n = 77					
# responding with rating	0	0	20	35	21
% responding with rating	0.0%	0.0%	26.0%	45.5%	27.3%
Mean = 3.96					
5. Do you expect to apply what you learned to your work?	1	2	3	4	5
n = 77					
# responding with rating	0	0	8	36	32
% responding with rating	0.0%	0.0%	10.4%	46.8%	41.6%
Mean = 4.26					
6. Did the training meet your goals for attending?	1	2	3	4	5
n = 77					
# responding with rating	0	0	7	41	28
% responding with rating	0.0%	0.0%	9.1%	53.2%	36.4%
Mean = 4.22					

Pre-Training and Post-Training Knowledge Tests, Commercial Session

Trainees were asked to answer knowledge questions both before and after training. Results below show changes in number of correct answers. (Note that n's are smaller for post-training tests. Nearly all participants answered qualitative post-training questions but several skipped the second page of the questionnaire.) Correct answers are highlighted below. All questions are multiple choice.

1. What types of commercial buildings must comply with the envelope requirements of the IECC?
   - [ ] A. Buildings with space conditioning systems designed for freeze protection of sprinkler systems
   - [ ] B. Office and retail buildings that are conditioned for human comfort
   - [ ] C. Commercial buildings with space conditioning systems where the peak design rate of energy use is less than 3.4 Btu/h-ft^2
   - [ ] D. A and B
   - [ ] E. Don't know

Pre-Training		Post-Training	
n =	92	n =	82
# correct	41	# correct	65
% correct	44.6%	% correct	79.3%
# "Don't Know"	29	# "Don't Know"	0
% "Don't' Know"	31.5%	% "Don't' Know"	0.0%

2. Which of the following interior lighting systems are exempt from the provisions of the IECC?
   - [ ] A. Interior lighting installed in an unconditioned warehouse
   - [ ] B. Interior lighting installed in a dwelling units in a building greater than 3 stories
   - [ ] C. Interior lighting installed in an office building
   - [ ] D. Interior lighting installed in an underground parking garage
   - [ ] E. Don't Know

Pre-Training		Post-Training	
n =	93	n =	78
# correct	4	# correct	40
% correct	4.3%	% correct	51.3%
# "Don't Know"	41	# "Don't Know"	4
% "Don't' Know"	44.1%	% "Don't' Know"	5.1%

3. When can the building envelope requirements be used in Section 502?
   - [ ] A. For buildings with less than or equal to 50% glass to above-grade wall area
   - [ ] B. For buildings with less than or equal to 40% glass to above-grade wall area
   - [ ] C. For any building regardless of the glass to above-grade wall percentage
   - [ ] D. For buildings with less than or equal to 10% of the roof area in skylight
   - [ ] E. Don't Know

Pre-Training		Post-Training	
n =	92	n =	79
# correct	6	# correct	56
% correct	6.5%	% correct	70.9%
# "Don't Know"	64	# "Don't Know"	2
% "Don't' Know"	69.6%	% "Don't' Know"	2.5%

4. When can ASHRAE 90.1-2004 be used to show compliance with the commercial provisions of the IECC?

[ ] A. Only for buildings with greater than 40% of the above grade wall area in glazing
[ ] B. Only when the building energy system falls out of the scope of Section 502, 503, 504 and 505 of the IECC
[ ] C. For any building
[ ] D. Only when demonstrating compliance for LEED commercial projects
[ ] E. Don't Know

Pre-Training		Post-Training	
n =	91	n =	82
# correct	22	# correct	59
% correct	24.2%	% correct	72.0%
# "Don't Know"	53	# "Don't Know"	1
% "Don't' Know"	58.2%	% "Don't' Know"	1.2%

5. Economizers are required on all cooling systems with greater than or equal to _____ Btu/hour in Climate Zone 5.

[ ] A. 48,000
[ ] B. 54,000
[ ] C. 65,000
[ ] D. 135,000
[ ] E. Don't Know

Pre-Training		Post-Training	
n =	91	n =	82
# correct	11	# correct	64
% correct	12.1%	% correct	78.0%
# "Don't Know"	60	# "Don't Know"	3
% "Don't' Know"	65.9%	% "Don't' Know"	3.7%

6. Which of the following lighting control requirements will an occupancy sensor satisfy?

[ ] A. Interior lighting controls
[ ] B. Lighting reduction controls
[ ] C. Automatic lighting shut-off
[ ] D. All of the above (A, B, and C)
[ ] E. Don't Know

Pre-Training		Post-Training	
n =	92	n =	81
# correct	50	# correct	70
% correct	54.3%	% correct	86.4%
# "Don't Know"	32	# "Don't Know"	0
% "Don't' Know"	34.8%	% "Don't' Know"	0.0%

SUMMARY – Total Correct Answers, Questions 1, 2, 3, 4, 5, and 6

Pre-Training		Post-Training	
n =	551	n =	484
# correct	134	# correct	354
% correct	24.3%	% correct	73.1%
# "Don't Know"	279	# "Don't Know"	10
% "Don't' Know"	50.6%	% "Don't' Know"	2.1%

Attendees Profile, Commercial Session

Attendees who self-identify as not attending previous SEP training sessions
Pre-Training Questionnaire = 71.1%
Post-Training Questionnaire = 69.8%

	Pre-Training		Post-Training	
Profession	Number	Percent	Number	Percent
General Contractor	3	3.3%	2	2.6%
HVAC Contractor	5	5.4%	5	6.5%
Insulation Contractor	0	0.0%	0	0.0%
Other Contractor	1	1.1%	2	2.6%
Architect	24	26.4%	29	37.7%
Engineer	13	14.3%	12	15.6%
Building Inspector	33	36.3%	16	20.6%
Plans Reviewer	4	4.4%	4	5.2%
Other	8	8.8%	7	9.4%
Total	91		77	

Note: Some respondents listed two professions. Where this occurred, the following rules were used for coding:
If Building Inspector was listed along with any other profession, Building Inspector was entered. (Several listed both Inspector and Plan Reviewer.)
If General Contractor was listed along with any other profession, General Contractor was entered except where listed with Code Inspector.

Evaluation Discussion and Lessons Learned

Closed-ended qualitative ratings of the training sessions have been very good. Overall sessions rating averages have been 4.48 (scale of 1 to 5) for residential sessions, 4.54 for update sessions and, 4.14 for commercial. (Interestingly, while the commercial session students gave lower qualitative ratings, knowledge-based testing suggests that these students absorbed more information than did those in other sessions.) Students were also very complimentary of the trainer's personal abilities and knowledge. While Scores on the relevance of the training have generally been high, it is worth noting that some trainees suggested that training was less relevant for them than for others. Some of this was due to the fact that, during a half- or full-day training session, a specific trade contractor might only have his specialty covered for 30-60 minutes. Indeed, some attendees suggested that trade or topic-specific sessions be offered in the future. As a result, planned 2008 training includes two half-day sessions for detailed HVAC/mechanical systems training for the residential code, 2 half days for HVAC/mechanical in commercial buildings, and 2 half days for commercial lighting systems.

Knowledge based tests for the residential sessions generally showed significant improvement across four of the six questions. The relatively small knowledge increase in Question #3 is likely attributable to the time constraints in the sessions. Alternative compliance methods were discussed at the end of each session. As indicated in the qualitative data and by reports from the trainer, many sessions became short on time. That this occurred was generally a good thing. Students wanted to examine in-depth examples and present hypothetical situations for discussion throughout training sessions. While this showed interest in the topic and no-doubt contributed to learning in the areas examined, it did result in the end-of-session topics being shorted on time. The results of Question #4 show ongoing student confusion, even after training, about duct insulation requirements. This confusion is due to a lack of code clarity on defining conditioned versus unconditioned space and the insulation requirements under each condition. A clear lesson learned is therefore to devote more time to this topic. Overall, totaling answers to the five multiple choice questions shows an improvement from 35.9% correct pre-training answers to 60.8% in post-training.

The afternoon update sessions did not work as anticipated. The intent of these sessions was to bring in those with a good knowledge of the 2003 IECC and to provide an update on changes in both the commercial and residential section of the 2006 IECC. As it turned out, a substantial majority of those attending the afternoon sessions were holdovers from the morning residential sessions who wanted to stay for the afternoon sessions to get some knowledge of the commercial sections of the code. Only a small number of afternoon attendees had the prior knowledge anticipated. As a result, afternoon sessions changed to respond to the audience in the room; less residential coverage than planned and more commercial. Some attendees - some of the few who attended for the anticipated reasons and with the expected prior knowledge - were disappointed with the scant coverage of residential code. On the other hand, the fact that most morning attendees remained for further afternoon training suggests an eagerness to learn more. Open-ended questions for both morning and afternoon sessions showed a strong desire for more time for training and more in-depth coverage.

Because afternoon sessions were not conducted as originally anticipated, knowledge based test results for these sessions are complex. For instance, Question #2 shows little improvement from pre-to post-training, primarily because most of respondents knew the answer from having attended the morning session. Results for Question #3 are a mystery, showing a slight decline in

correct answers on alternative compliance methods. This suggests confusion on how to use alternative compliance methods. This may be because compliance methods generally were addressed at the end of each session. Because of the number of questions from students, the final segments of both morning and afternoon sessions were generally rushed, meaning superficial coverage of compliance methods. This experience is translated in the lesson learned (below) into longer residential sessions that will leave more time to address this topic.

Though afternoon sessions showed more nuanced results than the morning sessions, substantial improvement in responses occurred on three of the six questions with moderate improvement on two. Combining results of the six questions shows correct pre-training answers at 38.2% and correct post-training answers at 60.6%.

Full-day commercial sessions were generally well-received, though the very different demographics of the audience led to slightly more critical evaluations. Nevertheless, overall satisfaction registered an average score of 4.14, with rating of the instructor averaging 4.63. Relevance scored a 3.96, again perhaps because of the different mix of professions. (For commercial sessions, an architect would get less out of the lighting discussion than an engineer, and a mechanical engineer likely would be less interested than an architect in building shell issues.) All told, however, the qualitative scores were again good.

Knowledge based testing showed very substantial knowledge increases compared with the other half-day sessions. The only question that raises some concern if the post-training result of 51.3% correct on lighting (#2). However, the fact that only 4.3% correctly answered the question before training suggests more a difficult subject matter than lack of improvement.

Overall, commercial sessions showed an increase from 24.3% correct pre-training answers to 73.1%. These are very positive results.

Taken together, observation of individual sessions, open- and closed-ended feedback, and knowledge based test results point to the following “lessons learned” that will be applied in 2008 training:

Lesson 1 - Move to Full-Day Residential Sessions
Those attending residential sessions showed an unanticipated desire to probe and understand the 2006 IECC. Students asked many questions and posed frequent hypotheticals. They also wanted to explore interactive effects of building codes (e.g. the effect of a tighter envelope on mold prevention). As a result of frequent student queries, topics at the end of the sessions tended to be rushed (e.g. RESCheck and other alternative compliance methods). As a result, 2008 will see full-day residential sessions to allow time for more-full coverage of topics and allow students time for in-depth queries.

Lesson 2: Drop Afternoon Update Sessions
Despite the original intention of the program partners, afternoon sessions turned into “commercial lite” sessions. One-half day is not sufficient to effectively introduce commercial code to those without experience in the area. While evaluation scores for these sessions were generally positive, the students that were expected (those looking for updates) by-and-large did not materialize. This could suggest that there were very few who already had a working knowledge of energy codes or that they did not feel that an update was necessary. In either case, the partners and trainer together feel that increasing the number of commercial sessions and

moving to full-day residential will provide better training results in these two areas than did the afternoon update sessions offered in 2007.

Lesson 3: Introduce Half-Day Topics Sessions
Several open-ended questions suggested that more-detailed instruction be offered for mechanical and HVAC systems. Informal feedback from other sessions suggested that code officials desired sessions specifically aimed at reviewing building plans for code compliance and that commercial sessions (populated largely by architects and engineers) were not the best setting for lighting sessions. Thus, in 2007 we plan to offer two of each of the following half-day topic sessions:

HVAC and Mechanical Systems, Commercial Buildings
HVAC and Mechanical Systems, Residential Systems
Commercial Code Compliance, Lighting Systems
Plan Review, Residential

Lesson 4: Drop On-Site Sessions
On-site sessions were not as well-attended as expected. The purpose of such sessions was to allow students to apply and discuss the new code requirements learned in the classroom in homes that were under construction. For whatever reason, the demand was simply not as-anticipated. The logistics of these sessions were difficult. Arranging sites was very time-consuming, many prospective attendees had difficulties finding the right houses and got lost, and some attendees came and left mid-session. While we did not administer evaluations for this sessions (very difficult given the setting), the program partners feel that time and dollars could better be spent on other training opportunities.

Lesson 5: Provide Sessions Targeted at Inspectors & Plan Reviewers
Local enforcement officials have turned out in large numbers for training sessions and indicate a desire to not only learn more but also to translate classroom learning into application. Code officials have also taken advantage of the technical assistance that is part of our contract with Eric Makela. Jurisdictions have called with detailed questions on several occasions. Because improving codes compliance is the central purpose of this training, assisting local governments with improved enforcement is a priority. Thus, we plan to offer plan review classroom sessions solely for inspectors and plan reviewers. In addition, we are planning on three days of at-jurisdiction training where the trainer visits the offices of a local government's code officials for a full day of in-depth plans review focused on both residential and commercial buildings. Selected jurisdictions for this training would be those that have shown an interest in better understanding of the applicable codes and that are also in areas of significant growth.

Lesson 6: Continue and Increase Commercial Offerings
The large number of attendees and favorable test scores for the commercial sessions suggests a large and receptive audience exists to improve energy efficiency in commercial buildings. We intend to offer four full day commercial sessions in the coming year. Target areas will be those with the greatest commercial building activity with at least one session to be offered in southern Utah.

<u>Energy Savings</u>
It is difficult to estimate directly the energy saved by codes training. We are aware of only one credible study that has done so. As part of a study assessing the national State Energy Program (of which USEP is a participant), the Oak Ridge National Laboratory examined a variety of

common state energy office programs and activities, assigning each an assumed energy savings metric. (See Schweitzer, Jones, Berry, and Tonn, "Estimating Energy and Cost Savings and Emission Reductions for the State Energy Program Based on Enumeration Indicators Data," ORNL/CON-487, (2003).) One of the activities examined in the report was codes training for commercial building codes. The Oak Ridge researchers estimated that for each participant in commercial codes training, four new buildings per year were affected, resulting in annual energy savings of 324.4 million source Btu's per participant. By this metric, the 2007 Utah codes training for commercial buildings would save 36, 981 MMBtu per year. However, the Oak Ridge study does not break electricity out from gas savings in their reported metrics, nor do they disaggregate source from end-use Btu's.

Based upon residential codes modeling software, Eric Makela has made an estimate of the energy savings that can be realized for upgrading the "typical" newly built house in Utah to IECC 2006 compliance. ("Typical" practice is based upon feedback and discussions with builders and inspectors during codes training sessions. It assumes no basement insulation, R-13 walls and U-0.50 windows.) Eric estimates that meeting IECC 2006 standards results in annual savings per house of 272kWh of electricity (13% of household cooling load) and 499 therms of natural gas. Conservatively assuming that codes training will affect (i.e. result in upgrading to 2006 IECC) ten homes per year per participant, we get the following:

343 residential session attendees x 10 houses x 272kWh per year = 932,960 kWh / year saved

343 residential session attendees x 10 houses x 499 therms per year = 1,711,570 therms / year saved

As former trainees continue to build or inspect houses, presumably they continue to influence the energy consumption of new homes. After five years, and maintaining the assumptions above, annual electricity savings from codes training in 2007 would be estimated at 46,664 MWh per year in savings. Given that this electricity saving is entirely cooling load, the peak demand savings are also significant. Annual natural gas savings after ten years would be expected to be 8,557,850 therms per year.

Financial Summary

In preliminary planning for 2007 training, cash expenses were budgeted as follows:

Full-Day Training Sessions (Assumes @ 30 participants per session)	
Trainer (includes travel & fee)	$ 1,500
Course Materials	900
Refreshments & lunch	600
Room Fee	400
Total per session	$ 3,400
Course Development Fee	$ 8,000
Advertising / Marketing	10,000
Post-Training Consultation	7,000
Contractor Administrative	5,000
20 Full Days (40 Half Days) Training Sessions	68,000
Miscellaneous	2,000

Total Cash Expenses	$ 100,000

Of the cash expenses, $50,000 was to be funded by Questar, $40,000 by Rocky Mountain Power, and remaining cash expenses would be assumed by an undetermined mix of additional sponsorship and USEP. In addition USEP estimated that its in-kind contributions (personnel, mailing, copies, materials) would equal @ $25,000 for the 2007 program.

Significant cost savings from the preliminary budget have been realized. Eric Makela's proposal and resulting contract was finalized at $74,720 for training, course development, post-training consultation, travel, and other contractor expenses. A significant cash savings was realized by USEP assuming most marketing costs. (USEP printing and mailing costs were not tracked separately for this program. A reasonable estimate of these mailing and printing costs is @ $4,000.) While the original budget assumed $1,000 per classroom session (food and room fees), USEP was able to reduce these expenses by finding many low- or no-cost rooms. Local sponsorship by utilities in St. George and Duchesne resulted in additional food and room cost savings. Final site costs will thus be less than half of originally budgeted. As a result, final cash expenses at this date (late-November, with three training sessions remaining) for the 2007 codes training program are estimated as follows:

Eric Makela contract	$ 74,720
Room and food expenses	9,300
Total cash expenditure, 2007 program	$ 84,020

Plans for 2008

USEP, QGC, and RMP plan to offer continued training in 2008, with each utility donating the same amount as in 2007. USEP has solicited participation by UAMPS, UMPA, and the Rural Electric Association; no responses have been received from these organizations to-date. The partners are in the process of evaluating Eric Makela's proposal for extending his existing contract to cover 2008 training and an additional year of technical support. Currently planned training sessions total 22 full days, as follows:

Residential Code Basics, full day	8
Commercial Code Basics, full day	4
Commercial Plan Review, full day	3
On-Site Jurisdiction Plans Review, full day	3
HVAC/Mechanical Commercial In-Depth, half day	2
HVAC/Mechanical Residential In-Depth, half day	2
Commercial Lighting In-Depth, half day	2
Residential Plans Review, half day	2

Additional sessions can still be planned if new sponsors or funding sources are identified.

No final budget has yet been prepared, however, with the sessions outlined above, spending is preliminarily estimated to be roughly comparable to 2007 cash expenses.