

M e m o r a n d u m

To: Commissioners

Date: August 29, 2019

Telephone: (916) 654-6560

From: **Dee Anne Ross**
Efficiency Division
California Energy Commission
1516 Ninth Street
Sacramento CA 95814-5512

Subject: **ENERGYPRO 8.0 SUMMARY OF RESIDENTIAL ACM TESTS**

EnergyPro 8.0 is a residential alternative calculation method (ACM) for complying with the 2019 Building Energy Efficiency Standards.

The 2019 Residential ACM Approval Manual CEC-400-2018-023-CMF (December 2018), specifies the requirements for approving vendor software. Section 3.3 is a checklist for compliance submittals. The vendor provided all required items to staff.

Appendix A of the Approval Manual includes the details of the certification tests required. The purpose of ACM testing is to demonstrate that software successfully integrates the compliance manager into the software. A test data set with specific description and details of the tests, inputs, and a spreadsheet of compliance results is provided as back-up materials for this business meeting agenda item.

Staff evaluated the input files and compared the test results as documented in the test data set to ensure compliance with all applicable requirements.

Staff reviewed and tested EnergyPro 8.0 to ensure it meets the requirements, specifications, and criteria for building energy models set forth in the 2019 ACM Approval Manual.

Summary of Residential ACM Tests (EDR total)

Comparison Date: 5/31/2019
 Comparison Author: Martyn Dodd
 Candidate Software: EnergyPro V8
 Reference Software: CBECC-Res 2019 1431
 Type of Software: Candidate
 Single Family: Yes
 Multi Family: Yes
 Newly Constructed: Yes
 Additions Alterations: Yes
 Units for Summary: **EDR total**
 Tolerance: 0.04

Test	Pass/ Fail	Average Proposed EDR total	Average Standard EDR total	Description
V01	n/a	25.21	25.21	Standard Design in All Zones for Prototype S2100ft2
V02	n/a	24.18	24.18	Standard Design in All Zones for Prototype S2700ft2
V03	n/a	26.12	26.12	Standard Design in All Zones for Prototype S6960ft2
V04	Pass	23.70	25.21	Proposed Design in All Zones for Prototype P2100ft2
V05	Pass	22.33	24.18	Proposed Design in All Zones for Prototype P2700ft2
V06	Pass	24.79	26.12	Proposed Design in All Zones for Prototype P6960ft2
V07	Pass	24.80	25.90	Common Measures in Zone 12 for Prototype P2100ft2
V08	Pass	25.48	26.18	Water Heating in Zone 12 for Prototype P2100ft2
V09	Pass	26.03	25.90	Multiple Orientation in Zone 12 for Prototype S2100ft2/P2100ft2
V10	Pass	26.87	26.94	Multi Family Water Heating in Zone 12 for Prototype P6960ft2
V11	Pass	28.56	28.64	Source Energy in Zone 12 for Prototype P2100ft2
V12	Pass	n/a	n/a	E+A+A Base & Windows in Zone 12 for Prototype P1665ft2
V13	Pass	n/a	n/a	E+A+A Walls & HVAC in Zone 12 for Prototype P1665ft2
V14	n/a	32.98	32.98	Standard Design All Electric in All Zones for Prototype S2100ft2
V15	n/a	31.28	31.29	Standard Design All Electric in All Zones for Prototype S2700ft2
V16	n/a	32.97	33.10	Standard Design All Electric in All Zones for Prototype S6960ft2
V17	Pass	31.57	32.98	Proposed Design All Electric in All Zones for Prototype P2100ft2
V18	Pass	29.61	31.29	Proposed Design All Electric in All Zones for Prototype P2700ft2
V19	Pass	31.84	33.10	Proposed Design All Electric in All Zones for Prototype P6960ft2
V20	Pass	22.29	25.90	PV in Zone 12 for Prototype P2100ft2
V21	Pass	17.20	27.87	PV, Battery and Target EDR in Zone 12 for Prototype P2100ft2
V22	Pass	23.25	25.90	Verified and Buried Ducts in Zone 12 for Prototype P2100ft2

Comparison between Reference & Candidate Software (EDR total)

Comparison Date: 5/31/2019 Comparison Author: Martyn Dodd Candidate Software: EnergyPro V8													33	34	35	0	36	37	46	12	191	192	207	
				Reference	Candidate	Percent	Within	Standard	Reference	Candidate	Percent		Candidate	Candidate	Candidate	Candidate	Candidate	Candidate	Candidate	Candidate	Candidate	Candidate	Candidate	
Test	Run	Description	Pass/Fail	Proposed	Proposed	Difference	Tolerance	Equals	Standard	Standard	Difference		Within	Proposed	Proposed	Proposed	Proposed	Proposed	Proposed	Proposed	Proposed	Proposed	Proposed	
													Tolerance	SpcHeat	SpcCool	IAQVent	OtherHVAl	WtrHeat	SelfUtilizat	Total	EDRtot	EDReff	EDRflex	PVSize
V01	Standard Design in All Zones for Prototype S2100ft2												Standard = Proposed for this test											
V01	R01	Zone 01	n/a	34.50	34.50	0.00%	Yes	34.50	34.50	34.50	0.00%	Yes		44.29	0	2.6	0	13.72	0	60.61	34.5	56.2	21.7	3.05
V01	R02	Zone 02	n/a	25.80	25.80	0.00%	Yes	25.80	25.80	25.80	0.00%	Yes		26.88	0.64	2.61	0	12.67	0	42.8	25.8	47.3	21.5	2.56
V01	R03	Zone 03	n/a	25.10	25.10	0.00%	Yes	25.10	25.10	25.10	0.00%	Yes		20	0	2.63	0	12.67	0	35.3	25.1	48.2	23.1	2.51
V01	R04	Zone 04	n/a	22.80	22.80	0.00%	Yes	22.80	22.80	22.80	0.00%	Yes		19.09	0.49	2.62	0	12.24	0	34.44	22.8	45.2	22.4	2.47
V01	R05	Zone 05	n/a	23.50	23.50	0.00%	Yes	23.50	23.50	23.50	0.00%	Yes		18.1	0	2.61	0	12.9	0	33.61	23.5	45.8	22.3	2.34
V01	R06	Zone 06	n/a	23.50	23.50	0.00%	Yes	23.50	23.50	23.50	0.00%	Yes		9.04	2.63	2.58	0	11.83	0	26.08	23.5	50.3	26.8	2.50
V01	R07	Zone 07	n/a	20.50	20.50	0.00%	Yes	20.50	20.50	20.50	0.00%	Yes		3.41	0.26	2.62	0	11.52	0	17.81	20.5	49.5	29	2.38
V01	R08	Zone 08	n/a	21.00	21.00	0.00%	Yes	21.00	21.00	21.00	0.00%	Yes		4.73	9.57	2.55	0	11.43	0	28.28	21	47	26	2.60
V01	R09	Zone 09	n/a	24.30	24.30	0.00%	Yes	24.30	24.30	24.30	0.00%	Yes		6.99	20.66	2.53	0	11.43	0	41.61	24.3	48	23.7	2.65
V01	R10	Zone 10	n/a	24.40	24.40	0.00%	Yes	24.40	24.40	24.40	0.00%	Yes		8.15	21.37	2.52	0	11.4	0	43.44	24.4	46.8	22.4	2.73
V01	R11	Zone 11	n/a	25.30	25.30	0.00%	Yes	25.30	25.30	25.30	0.00%	Yes		22.32	36.96	2.61	0	11.67	0	73.56	25.3	45.9	20.6	3.23
V01	R12	Zone 12	n/a	25.90	25.90	0.00%	Yes	25.90	25.90	25.90	0.00%	Yes		23.53	17.91	2.61	0	12.05	0	56.1	25.9	45.6	19.7	2.70
V01	R13	Zone 13	n/a	26.50	26.50	0.00%	Yes	26.50	26.50	26.50	0.00%	Yes		19.66	41.02	2.64	0	11.47	0	74.79	26.5	47.7	21.2	3.42
V01	R14	Zone 14	n/a	26.00	26.00	0.00%	Yes	26.00	26.00	26.00	0.00%	Yes		21.68	33.35	2.51	0	11.75	0	69.29	26	47.3	21.3	2.83
V01	R15	Zone 15	n/a	23.00	23.00	0.00%	Yes	23.00	23.00	23.00	0.00%	Yes		0.68	89.58	2.54	0	9.38	0	102.18	23	50.6	27.6	4.91
V01	R16	Zone 16	n/a	31.30	31.30	0.00%	Yes	31.30	31.30	31.30	0.00%	Yes		44.39	2.03	2.63	0	13.8	0	62.85	31.3	50	18.7	2.46
Result V01			n/a	25.21	25.21	0.00%		25.21	25.21	25.21	0.00%		Min	18.31	17.28	2.59	0.00	12.00		50.17	25.21	48.21	23.00	2.83
												Ave		0.00%	0.00%	0.00%		0.00%		0.00%				
V02	Standard Design in All Zones for Prototype S2700ft2												Standard = Proposed for this test											
V02	R01	Zone 01	n/a	30.90	30.90	0.00%	Yes	30.90	30.90	30.90	0.00%	Yes		32.49	0	2.48	0	11.78	0	46.75	30.9	52.6	21.7	3.52
V02	R02	Zone 02	n/a	24.30	24.30	0.00%	Yes	24.30	24.30	24.30	0.00%	Yes		21.99	3.25	2.52	0	10.84	0	38.6	24.3	44.9	20.6	3.00
V02	R03	Zone 03	n/a	23.00	23.00	0.00%	Yes	23.00	23.00	23.00	0.00%	Yes		14.93	0	2.54	0	10.85	0	28.32	23	45.9	22.9	2.92
V02	R04	Zone 04	n/a	23.30	23.30	0.00%	Yes	23.30	23.30	23.30	0.00%	Yes		16.09	5.08	2.53	0	10.46	0	34.16	23.3	44.7	21.4	2.91
V02	R05	Zone 05	n/a	21.10	21.10	0.00%	Yes	21.10	21.10	21.10	0.00%	Yes		12.62	0	2.51	0	11.06	0	26.19	21.1	43.2	22.1	2.73
V02	R06	Zone 06	n/a	23.20	23.20	0.00%	Yes	23.20	23.20	23.20	0.00%	Yes		7.73	4.03	2.52	0	10.1	0	24.38	23.2	49.5	26.3	2.95
V02	R07	Zone 07	n/a	20.10	20.10	0.00%	Yes	20.10	20.10	20.10	0.00%	Yes		2.81	0.83	2.55	0	9.85	0	16.04	20.1	48.7	28.6	2.79
V02	R08	Zone 08	n/a	21.50	21.50	0.00%	Yes	21.50	21.50	21.50	0.00%	Yes		4.33	12.07	2.5	0	9.78	0	28.68	21.5	46.9	25.4	3.10
V02	R09	Zone 09	n/a	24.60	24.60	0.00%	Yes	24.60	24.60	24.60	0.00%	Yes		6.51	23.17	2.46	0	9.77	0	41.91	24.6	47.5	22.9	3.18
V02	R10	Zone 10	n/a	24.10	24.10	0.00%	Yes	24.10	24.10	24.10	0.00%	Yes		7.49	23.46	2.45	0	9.72	0	43.12	24.1	45.8	21.7	3.29
V02	R11	Zone 11	n/a	24.10	24.10	0.00%	Yes	24.10	24.10	24.10	0.00%	Yes		20.33	38.4	2.53	0	9.91	0	71.17	24.1	44.1	20	3.94
V02	R12	Zone 12	n/a	25.20	25.20	0.00%	Yes	25.20	25.20	25.20	0.00%	Yes		20.72	21.06	2.52	0	10.27	0	54.57	25.2	44.2	19	3.25
V02	R13	Zone 13	n/a	25.10	25.10	0.00%	Yes	25.10	25.10	25.10	0.00%	Yes		18.35	40.58	2.56	0	9.77	0	71.26	25.1	45.5	20.4	4.16
V02	R14	Zone 14	n/a	24.80	24.80	0.00%	Yes	24.80	24.80	24.80	0.00%	Yes		19.51	35.1	2.42	0	9.99	0	67.02	24.8	45.4	20.6	3.46
V02	R15	Zone 15	n/a	21.90	21.90	0.00%	Yes	21.90	21.90	21.90	0.00%	Yes		1.6	84.07	2.45	0	7.91	0	96.03	21.9	47.9	26	5.84
V02	R16	Zone 16	n/a	29.70	29.70	0.00%	Yes	29.70	29.70	29.70	0.00%	Yes		38.54	4.4	2.55	0	11.81	0	57.3	29.7	48	18.3	2.94
Result V02			n/a	24.18	24.18	0.00%		24.18	24.18	24.18	0.00%		Min	15.38	18.47	2.51	0.00	10.24		46.59	24.18	46.55	22.37	3.37
												Ave		0.00%	0.00%	0.00%		0.00%		0.00%				

Page 2 of 11

Comparison between Reference & Candidate Software (EDR total)

Comparison Date: 5/31/2019 Comparison Author: Martyn Dodd Candidate Software: EnergyPro V8																									
													33	34	35	0	36	37	46	12	191	192	207		
				Reference	Candidate	Percent	Within	Standard	Reference	Candidate	Percent		Candidate	Candidate	Candidate	Candidate	Candidate	Candidate	Candidate	Candidate	Candidate	Candidate	Candidate		
Test	Run	Description	Pass/Fail	Proposed	Proposed	Difference	Tolerance	Equals	Standard	Standard	Difference		Within	Proposed	Proposed	Proposed	Proposed	Proposed	Proposed	Proposed	Proposed	Proposed	Proposed		
												Tolerance	SpCHeat	SpCCool	IAQVent	OtherHVAl	WtrHeat	SelfUtilizat	Total	EDRTot	EDReff	EDRflex	PVSize		
V03	Standard Design in All Zones for Prototype S6960ft2			Standard = Proposed for this test																					
V03	R01	Zone 01	n/a	28.60	28.60	0.00%	Yes	28.60	28.60	28.60	0.00%	Yes	14.97	0	3.16	0	22.55	0	40.68	28.6	60.7	32.1	15.93		
V03	R02	Zone 02	n/a	25.70	25.70	0.00%	Yes	25.70	25.70	25.70	0.00%	Yes	9.22	9.3	3.13	0	20.91	0	42.56	25.7	56.5	30.8	13.93		
V03	R03	Zone 03	n/a	24.70	24.70	0.00%	Yes	24.70	24.70	24.70	0.00%	Yes	4.5	1.59	3.15	0	20.96	0	30.2	24.7	57.8	33.1	13.47		
V03	R04	Zone 04	n/a	25.50	25.50	0.00%	Yes	25.50	25.50	25.50	0.00%	Yes	5.6	11.81	3.13	0	20.29	0	40.83	25.5	56.8	31.3	13.58		
V03	R05	Zone 05	n/a	24.20	24.20	0.00%	Yes	24.20	24.20	24.20	0.00%	Yes	3.55	1.46	3.15	0	21.29	0	29.45	24.2	57.4	33.2	12.64		
V03	R06	Zone 06	n/a	26.80	26.80	0.00%	Yes	26.80	26.80	26.80	0.00%	Yes	0.92	9.81	3.05	0	19.63	0	33.41	26.8	63.2	36.4	13.86		
V03	R07	Zone 07	n/a	26.80	26.80	0.00%	Yes	26.80	26.80	26.80	0.00%	Yes	0.06	7.39	3.11	0	19.18	0	29.74	26.8	64.5	37.7	13.19		
V03	R08	Zone 08	n/a	25.70	25.70	0.00%	Yes	25.70	25.70	25.70	0.00%	Yes	0.31	19.37	3.02	0	19.04	0	41.74	25.7	61.8	36.1	14.62		
V03	R09	Zone 09	n/a	26.40	26.40	0.00%	Yes	26.40	26.40	26.40	0.00%	Yes	0.87	27.66	3.01	0	19.03	0	50.57	26.4	59.7	33.3	14.65		
V03	R10	Zone 10	n/a	27.00	27.00	0.00%	Yes	27.00	27.00	27.00	0.00%	Yes	1.17	30.36	3.01	0	18.98	0	53.52	27	58.7	31.7	15.07		
V03	R11	Zone 11	n/a	24.50	24.50	0.00%	Yes	24.50	24.50	24.50	0.00%	Yes	8.84	41.47	3.13	0	19.33	0	72.77	24.5	54.5	30	16.64		
V03	R12	Zone 12	n/a	25.90	25.90	0.00%	Yes	25.90	25.90	25.90	0.00%	Yes	8.76	27.26	3.13	0	19.94	0	59.09	25.9	55.3	29.4	14.95		
V03	R13	Zone 13	n/a	26.10	26.10	0.00%	Yes	26.10	26.10	26.10	0.00%	Yes	7.62	46.39	3.15	0	19.08	0	76.24	26.1	55.9	29.8	17.51		
V03	R14	Zone 14	n/a	25.60	25.60	0.00%	Yes	25.60	25.60	25.60	0.00%	Yes	8.62	39.33	3.02	0	19.51	0	70.48	25.6	55.9	30.3	14.62		
V03	R15	Zone 15	n/a	25.00	25.00	0.00%	Yes	25.00	25.00	25.00	0.00%	Yes	0.01	89.5	3.03	0	15.87	0	108.41	25	59.2	34.2	21.64		
V03	R16	Zone 16	n/a	29.40	29.40	0.00%	Yes	29.40	29.40	29.40	0.00%	Yes	22.68	8.22	3.14	0	22.69	0	56.73	29.4	57.3	27.9	13.43		
Result V03			n/a	26.12	26.12	0.00%		26.12	26.12	26.12	0.00%		Min Max	6.11 0.00%	23.18 0.00%	3.10 0.00%	0.00	19.89		52.28	26.12	58.45	32.3	14.98	
													Ave												
V04	Proposed Design in All Zones for Prototype P2100ft2			Standard = V01 Standard for this test																					
V04	R01	Zone 01	Pass	33.90	33.90	0.00%	Yes	34.50	34.50	34.50	0.00%	Yes	43.15	0	2.6	0	13.72	0	59.47	33.9	55.6	21.7	3.05		
V04	R02	Zone 02	Pass	24.80	24.80	0.00%	Yes	25.80	25.80	25.80	0.00%	Yes	25.52	0	2.61	0	12.67	0	40.8	24.8	46.3	21.5	2.56		
V04	R03	Zone 03	Pass	24.10	24.10	0.00%	Yes	25.10	25.10	25.10	0.00%	Yes	18.14	0	2.63	0	12.67	0	33.44	24.1	47.1	23	2.51		
V04	R04	Zone 04	Pass	22.00	22.00	0.00%	Yes	22.80	22.80	22.80	0.00%	Yes	17.58	0.4	2.62	0	12.24	0	32.84	22	44.3	22.3	2.47		
V04	R05	Zone 05	Pass	22.50	22.50	0.00%	Yes	23.50	23.50	23.50	0.00%	Yes	16.15	0	2.61	0	12.9	0	31.66	22.5	44.7	22.2	2.34		
V04	R06	Zone 06	Pass	22.10	22.10	0.00%	Yes	23.50	23.50	23.50	0.00%	Yes	7.85	1.77	2.58	0	11.83	0	24.03	22.1	48.9	26.8	2.50		
V04	R07	Zone 07	Pass	19.90	19.90	0.00%	Yes	20.50	20.50	20.50	0.00%	Yes	2.68	0.09	2.62	0	11.52	0	16.91	19.9	48.9	29	2.38		
V04	R08	Zone 08	Pass	19.40	19.40	0.00%	Yes	21.00	21.00	21.00	0.00%	Yes	3.88	7.82	2.55	0	11.43	0	25.68	19.4	45.4	26	2.60		
V04	R09	Zone 09	Pass	22.30	22.30	0.00%	Yes	24.30	24.30	24.30	0.00%	Yes	6.02	17.78	2.53	0	11.43	0	37.76	22.3	46	23.7	2.65		
V04	R10	Zone 10	Pass	22.60	22.60	0.00%	Yes	24.40	24.40	24.40	0.00%	Yes	7	18.83	2.52	0	11.4	0	39.75	22.6	45	22.4	2.73		
V04	R11	Zone 11	Pass	23.10	23.10	0.00%	Yes	25.30	25.30	25.30	0.00%	Yes	20.64	32.64	2.61	0	11.67	0	67.56	23.1	43.7	20.6	3.23		
V04	R12	Zone 12	Pass	23.90	23.90	0.00%	Yes	25.90	25.90	25.90	0.00%	Yes	22.32	14.33	2.61	0	12.05	0	51.31	23.9	43.6	19.7	2.70		
V04	R13	Zone 13	Pass	24.60	24.60	0.00%	Yes	26.50	26.50	26.50	0.00%	Yes	18.65	36.81	2.64	0	11.47	0	69.57	24.6	45.8	21.2	3.42		
V04	R14	Zone 14	Pass	23.40	23.40	0.00%	Yes	26.00	26.00	26.00	0.00%	Yes	19.61	28.66	2.51	0	11.75	0	62.53	23.4	44.6	21.2	2.83		
V04	R15	Zone 15	Pass	21.20	21.20	0.00%	Yes	23.00	23.00	23.00	0.00%	Yes	0.42	84.21	2.54	0	9.38	0	96.55	21.2	48.8	27.6	4.91		
V04	R16	Zone 16	Pass	29.40	29.40	0.00%	Yes	31.30	31.30	31.30	0.00%	Yes	41.35	0.55	2.63	0	13.8	0	58.33	29.4	48	18.6	2.46		
Result V04			Pass	23.70	23.70	0.00%		25.21	25.21	25.21	0.00%		Min Max	16.94 0.00%	15.24 0.00%	2.59 0.00%	0.00	12.00		46.76	23.70	46.67	22.97	2.83	
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Page 3 of 11

Comparison between Reference & Candidate Software (EDR total)

Comparison Date: 5/31/2019																									
Comparison Author: Martyn Dodd																									
Candidate Software: EnergyPro V8																									
Test	Run	Description	Pass/Fail	Reference Proposed	Candidate Proposed	Percent Difference	Within Tolerance	Standard Equals	Reference Standard	Candidate Standard	Percent Difference	Within Tolerance	Candidate Proposed SpcHeat	Candidate Proposed SpcCool	Candidate Proposed IAQVent	Candidate Proposed OtherHVAl	Candidate Proposed WtrHeat	Candidate Proposed SelfUtilizat	Candidate Proposed Total	Candidate Proposed EDRTot	Candidate Proposed EDReff	Candidate Proposed EDRflex	Candidate Proposed PVSize		
V05	Proposed Design in All Zones for Prototype P2700ft2												Standard = V02 Standard for this test												
V05	R01	Zone 01	Pass	30.20	30.20	0.00%	Yes	30.90	30.90	30.90	0.00% Yes		31.26	0	2.48	0	11.78	0	45.52	30.2	51.9	21.7	3.52		
V05	R02	Zone 02	Pass	22.40	22.40	0.00%	Yes	24.30	24.30	24.30	0.00% Yes		20.68	0.92	2.52	0	10.84	0	34.96	22.4	43	20.6	3.00		
V05	R03	Zone 03	Pass	21.90	21.90	0.00%	Yes	23.00	23.00	23.00	0.00% Yes		13.15	0	2.54	0	10.85	0	26.54	21.9	44.8	22.9	2.92		
V05	R04	Zone 04	Pass	20.10	20.10	0.00%	Yes	23.30	23.30	23.30	0.00% Yes		14.67	0.55	2.53	0	10.46	0	28.21	20.1	41.4	21.3	2.91		
V05	R05	Zone 05	Pass	20.00	20.00	0.00%	Yes	21.10	21.10	21.10	0.00% Yes		10.71	0	2.51	0	11.06	0	24.28	20	42.1	22.1	2.73		
V05	R06	Zone 06	Pass	21.80	21.80	0.00%	Yes	23.20	23.20	23.20	0.00% Yes		6.65	3.13	2.52	0	10.1	0	22.4	21.8	48.1	26.3	2.95		
V05	R07	Zone 07	Pass	19.30	19.30	0.00%	Yes	20.10	20.10	20.10	0.00% Yes		2.2	0.43	2.55	0	9.85	0	15.03	19.3	47.9	28.6	2.79		
V05	R08	Zone 08	Pass	20.00	20.00	0.00%	Yes	21.50	21.50	21.50	0.00% Yes		3.58	10.39	2.5	0	9.78	0	26.25	20	45.3	25.3	3.10		
V05	R09	Zone 09	Pass	22.50	22.50	0.00%	Yes	24.60	24.60	24.60	0.00% Yes		5.65	20.01	2.46	0	9.77	0	37.89	22.5	45.3	22.8	3.18		
V05	R10	Zone 10	Pass	22.10	22.10	0.00%	Yes	24.10	24.10	24.10	0.00% Yes		6.44	20.42	2.45	0	9.72	0	39.03	22.1	43.7	21.6	3.29		
V05	R11	Zone 11	Pass	21.80	21.80	0.00%	Yes	24.10	24.10	24.10	0.00% Yes		18.71	33.89	2.53	0	9.91	0	65.04	21.8	41.8	20	3.94		
V05	R12	Zone 12	Pass	23.20	23.20	0.00%	Yes	25.20	25.20	25.20	0.00% Yes		19.59	17.4	2.52	0	10.27	0	49.78	23.2	42.1	18.9	3.25		
V05	R13	Zone 13	Pass	22.80	22.80	0.00%	Yes	25.10	25.10	25.10	0.00% Yes		17.37	35.47	2.56	0	9.77	0	65.17	22.8	43.2	20.4	4.16		
V05	R14	Zone 14	Pass	22.00	22.00	0.00%	Yes	24.80	24.80	24.80	0.00% Yes		17.51	30.01	2.42	0	9.99	0	59.93	22	42.6	20.6	3.46		
V05	R15	Zone 15	Pass	19.70	19.70	0.00%	Yes	21.90	21.90	21.90	0.00% Yes		1.16	77.87	2.45	0	7.91	0	89.39	19.7	45.7	26	5.84		
V05	R16	Zone 16	Pass	27.50	27.50	0.00%	Yes	29.70	29.70	29.70	0.00% Yes		35.69	2.27	2.55	0	11.81	0	52.32	27.5	45.7	18.2	2.94		
Result V05			Pass	22.33	22.33	0.00%		24.18	24.18	24.18	0.00%	Ave	Min Max	15.51	0	3.16	0	22.55		42.61	22.33	44.66	22.33	3.37	
V06	Proposed Design in All Zones for Prototype P6960ft2												Standard = V03 Standard for this test												
V06	R01	Zone 01	Pass	28.80	28.80	0.00%	Yes	28.60	28.60	28.60	0.00% Yes		15.51	0	3.16	0	22.55	0	41.22	28.8	60.9	32.1	15.93		
V06	R02	Zone 02	Pass	24.90	24.90	0.00%	Yes	25.70	25.70	25.70	0.00% Yes		9.21	7.36	3.13	0	20.91	0	40.61	24.9	55.6	30.7	13.93		
V06	R03	Zone 03	Pass	24.10	24.10	0.00%	Yes	24.70	24.70	24.70	0.00% Yes		4.36	0.65	3.15	0	20.96	0	29.12	24.1	57.3	33.2	13.47		
V06	R04	Zone 04	Pass	23.80	23.80	0.00%	Yes	25.50	25.50	25.50	0.00% Yes		5.51	7.94	3.13	0	20.29	0	36.87	23.8	55.1	31.3	13.58		
V06	R05	Zone 05	Pass	23.70	23.70	0.00%	Yes	24.20	24.20	24.20	0.00% Yes		3.66	0.44	3.15	0	21.29	0	28.54	23.7	56.9	33.2	12.64		
V06	R06	Zone 06	Pass	25.60	25.60	0.00%	Yes	26.80	26.80	26.80	0.00% Yes		0.88	7.57	3.05	0	19.63	0	31.13	25.6	62	36.4	13.86		
V06	R07	Zone 07	Pass	25.60	25.60	0.00%	Yes	26.80	26.80	26.80	0.00% Yes		0.09	5.22	3.11	0	19.18	0	27.6	25.6	63.3	37.7	13.19		
V06	R08	Zone 08	Pass	24.40	24.40	0.00%	Yes	25.70	25.70	25.70	0.00% Yes		0.29	16.66	3.02	0	19.04	0	39.01	24.4	60.5	36.1	14.62		
V06	R09	Zone 09	Pass	24.50	24.50	0.00%	Yes	26.40	26.40	26.40	0.00% Yes		0.88	23.45	3.01	0	19.03	0	46.37	24.5	57.9	33.4	14.65		
V06	R10	Zone 10	Pass	25.20	25.20	0.00%	Yes	27.00	27.00	27.00	0.00% Yes		1.19	26.22	3.01	0	18.98	0	49.4	25.2	57	31.8	15.07		
V06	R11	Zone 11	Pass	22.80	22.80	0.00%	Yes	24.50	24.50	24.50	0.00% Yes		8.71	36.49	3.13	0	19.33	0	67.66	22.8	52.8	30	16.64		
V06	R12	Zone 12	Pass	24.30	24.30	0.00%	Yes	25.90	25.90	25.90	0.00% Yes		8.7	22.92	3.13	0	19.94	0	54.69	24.3	53.6	29.3	14.95		
V06	R13	Zone 13	Pass	24.10	24.10	0.00%	Yes	26.10	26.10	26.10	0.00% Yes		7.54	40.62	3.15	0	19.08	0	70.39	24.1	53.9	29.8	17.51		
V06	R14	Zone 14	Pass	23.70	23.70	0.00%	Yes	25.60	25.60	25.60	0.00% Yes		8.55	33.93	3.02	0	19.51	0	65.01	23.7	54	30.3	14.62		
V06	R15	Zone 15	Pass	22.90	22.90	0.00%	Yes	25.00	25.00	25.00	0.00% Yes		0.01	82.13	3.03	0	15.87	0	101.04	22.9	57	34.1	21.64		
V06	R16	Zone 16	Pass	28.30	28.30	0.00%	Yes	29.40	29.40	29.40	0.00% Yes		22.84	5.23	3.14	0	22.69	0	53.9	28.3	56.2	27.9	13.43		
Result V06			Pass	24.79	24.79	0.00%		26.12	26.12	26.12	0.00%	Ave	Min Max	6.12	19.80	3.10	0.00	19.89		48.91	24.79	57.13	32.33	14.98	
Page 4 of 11																									

Comparison Date: 5/31/2019
Comparison Author: Martyn Dodd
Candidate Software: **EnergyPro V8**

33	34	35	0	36	37	46	12	191	192	207
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Page 5 of 11

Comparison Date: 5/31/2019
Comparison Author: Martyn Dodd
Candidate Software: **EnergyPro V8**

Page 6 of 11

Comparison between Reference & Candidate Software (EDR total)

Comparison Date: 5/31/2019													Candidate 'Candidate 'Candidate 'Candidate 'Candidate 'Candidate 'Candidate 'Candidate 'Candidate 'Candidate 'Candidate 'Candidate												
Comparison Author: Martyn Dodd													33	34	35	0	36	37	46	12	191	192	207		
Candidate Software: EnergyPro V8													Candidate	Candidate	Candidate	Candidate	Candidate	Candidate	Candidate	Candidate	Candidate	Candidate	Candidate	Candidate	
Test	Run	Description	Pass/Fail	Reference Proposed	Candidate Proposed	Percent Difference	Within Tolerance	Standard Equals	Reference Standard	Candidate Standard	Percent Difference	Within Tolerance	Proposed SpcHeat	Proposed SpcCool	Proposed IAQVent	Proposed OtherHVAl	Proposed WtrHeat	Proposed SelfUtilizat	Proposed Total	Proposed EDRtot	Proposed EDReff	Proposed EDRflex	Proposed PVSize		
V13	E+A+A Walls & HVAC in Zone 12 for Prototype P1665ft2												Standard = Varies for this test												
V13	R01	EAA Ceiling R38 Verified Wall R	Pass	0.00	0.00	0.00%	Yes	0.00	0.00	0.00	0.00%	Yes	44.41	115.02	0	0	19.45	0	178.88	0	0	0	0		
V13	R02	EAA Ceiling R38 Verified Wall R	Pass	0.00	0.00	0.00%	Yes	0.00	0.00	0.00	0.00%	Yes	44.41	115.02	0	0	19.45	0	178.88	0	0	0	0		
V13	R03	EAA Ceiling R38 Verified Wall R	Pass	0.00	0.00	0.00%	Yes	0.00	0.00	0.00	0.00%	Yes	43.35	114.17	0	0	19.45	0	176.97	0	0	0	0		
V13	R04	EAA Ceiling R38 Verified Wall R	Pass	0.00	0.00	0.00%	Yes	0.00	0.00	0.00	0.00%	Yes	43.35	114.17	0	0	19.45	0	176.97	0	0	0	0		
V13	R05	EAA Ceiling R38 Verified HVAC	Pass	0.00	0.00	0.00%	Yes	0.00	0.00	0.00	0.00%	Yes	55.89	100.12	0	0	19.45	0	175.46	0	0	0	0		
V13	R06	EAA Ceiling R38 Verified HVAC	Pass	0.00	0.00	0.00%	Yes	0.00	0.00	0.00	0.00%	Yes	55.89	100.12	0	0	19.45	0	175.46	0	0	0	0		
V13	R07	EAA Ceiling R38 Verified HVAC	Pass	0.00	0.00	0.00%	Yes	0.00	0.00	0.00	0.00%	Yes	52.62	65.93	0	0	19.45	0	138	0	0	0	0		
V13	R08	EAA Ceiling R38 Verified HVAC	Pass	0.00	0.00	0.00%	Yes	0.00	0.00	0.00	0.00%	Yes	52.62	65.93	0	0	19.45	0	138	0	0	0	0		
V13	R09	EAA Ceiling R38 Verified HVAC	Pass	0.00	0.00	0.00%	Yes	0.00	0.00	0.00	0.00%	Yes	45.79	55.26	0	0	19.45	0	120.5	0	0	0	0		
V13	R10	EAA Ceiling R38 Verified HVAC	Pass	0.00	0.00	0.00%	Yes	0.00	0.00	0.00	0.00%	Yes	45.79	55.26	0	0	19.45	0	120.5	0	0	0	0		
Result V13		Pass	n/a	n/a	n/a		n/a	n/a	n/a	n/a	#VALUE!	Min	48.41	90.10	0.00	0.00	19.45		157.96	1.21	1.59	0.39	0.07		
											Ave	Max	0.00%	0.00%	#DIV/0!		0.00%		0.00%						

Page 7 of 11

Comparison between Reference & Candidate Software (EDR total)

Comparison Date: 5/31/2019																									
Comparison Author: Martyn Dodd																									
Candidate Software: EnergyPro V8																									
													33	34	35	0	36	37	46	12	191	192	207		
													Candidate	Candidate	Candidate	Candidate	Candidate	Candidate	Candidate	Candidate	Candidate	Candidate	Candidate		
Test	Run	Description	Pass/Fail	Reference	Candidate	Percent	Within	Standard	Reference	Candidate	Percent		Within	Proposed	Proposed	Proposed	Proposed	Proposed	Proposed	Proposed	Proposed	Proposed	Proposed		
				Proposed	Proposed	Difference	Tolerance	Equals	Standard	Standard	Difference		Tolerance	SpcHeat	SpcCool	IAQVent	OtherHVAl	WtrHeat	SelfUtilizat	Total	EDRtot	EDReff	EDRflex	PVSize	
V14	Standard Design All Electric in All Zones for Prototype S2100ft2												Standard = Proposed for this test												
V14	R01	Zone 01	n/a	49.90	49.90	0.00%	Yes	49.90	49.90	49.90	0.00%	Yes	63.81	0	2.6	0	19.83	0	86.24	49.9	71.3	21.4	3.05		
V14	R02	Zone 02	n/a	34.20	34.20	0.00%	Yes	34.20	34.20	34.20	0.00%	Yes	31.92	0.58	2.61	0	17.4	0	52.51	34.2	55.7	21.5	2.56		
V14	R03	Zone 03	n/a	34.60	34.60	0.00%	Yes	34.60	34.60	34.60	0.00%	Yes	25.99	0	2.63	0	17.44	0	46.06	34.6	57.4	22.8	2.51		
V14	R04	Zone 04	n/a	31.80	31.80	0.00%	Yes	31.80	31.80	31.80	0.00%	Yes	24.39	1.75	2.62	0	15.99	0	44.75	31.8	53.9	22.1	2.47		
V14	R05	Zone 05	n/a	34.20	34.20	0.00%	Yes	34.20	34.20	34.20	0.00%	Yes	26.2	0	2.61	0	18.43	0	47.24	34.2	56.2	22	2.34		
V14	R06	Zone 06	n/a	29.80	29.80	0.00%	Yes	29.80	29.80	29.80	0.00%	Yes	10.29	2.61	2.58	0	13.77	0	29.25	29.8	56.3	26.5	2.50		
V14	R07	Zone 07	n/a	27.40	27.40	0.00%	Yes	27.40	27.40	27.40	0.00%	Yes	3.96	0.23	2.62	0	13.58	0	20.39	27.4	55.8	28.4	2.38		
V14	R08	Zone 08	n/a	25.90	25.90	0.00%	Yes	25.90	25.90	25.90	0.00%	Yes	5.25	9.69	2.55	0	12.14	0	29.63	25.9	51.9	26	2.60		
V14	R09	Zone 09	n/a	28.90	28.90	0.00%	Yes	28.90	28.90	28.90	0.00%	Yes	7.72	21.42	2.53	0	11.96	0	43.63	28.9	52.5	23.6	2.65		
V14	R10	Zone 10	n/a	29.20	29.20	0.00%	Yes	29.20	29.20	29.20	0.00%	Yes	9.55	22.06	2.52	0	12	0	46.13	29.2	51.7	22.5	2.73		
V14	R11	Zone 11	n/a	30.70	30.70	0.00%	Yes	30.70	30.70	30.70	0.00%	Yes	26.52	38.26	2.61	0	14.59	0	81.98	30.7	51.3	20.6	3.23		
V14	R12	Zone 12	n/a	31.60	31.60	0.00%	Yes	31.60	31.60	31.60	0.00%	Yes	25.98	18.46	2.61	0	15.9	0	62.95	31.6	51.2	19.6	2.70		
V14	R13	Zone 13	n/a	31.80	31.80	0.00%	Yes	31.80	31.80	31.80	0.00%	Yes	22.41	42.83	2.64	0	13.66	0	81.54	31.8	53	21.2	3.42		
V14	R14	Zone 14	n/a	32.20	32.20	0.00%	Yes	32.20	32.20	32.20	0.00%	Yes	26.58	34.69	2.51	0	14.52	0	78.3	32.2	53.4	21.2	2.83		
V14	R15	Zone 15	n/a	27.00	27.00	0.00%	Yes	27.00	27.00	27.00	0.00%	Yes	1.09	94.33	2.54	0	8.48	0	106.44	27	54.6	27.6	4.91		
V14	R16	Zone 16	n/a	48.40	48.40	0.00%	Yes	48.40	48.40	48.40	0.00%	Yes	72.36	2.01	2.63	0	21.49	0	98.49	48.4	66.8	18.4	2.46		
Result V14			n/a	32.98	32.98	0.00%		32.98	32.98	32.98	0.00%	Ave	Min	24.00	18.06	2.59	0.00	15.07		59.72	32.98	55.81	22.84	2.83	
													Max	0.00%	0.00%	0.00%		0.00%		0.00%					
V15	Standard Design All Electric in All Zones for Prototype S2700ft2												Standard = Proposed for this test												
V15	R01	Zone 01	n/a	44.30	44.30	0.00%	Yes	44.30	44.30	44.30	0.00%	Yes	46.32	0	2.48	0	17.37	0	66.17	44.3	65.6	21.3	3.52		
V15	R02	Zone 02	n/a	31.70	31.70	0.00%	Yes	31.70	31.70	31.70	0.00%	Yes	25.99	3.2	2.52	0	14.99	0	46.7	31.7	52	20.3	3.00		
V15	R03	Zone 03	n/a	31.80	31.80	0.00%	Yes	31.80	31.80	31.80	0.00%	Yes	19.11	0	2.54	0	15.37	0	37.02	31.8	54.1	22.3	2.92		
V15	R04	Zone 04	n/a	30.90	30.90	0.00%	Yes	30.90	30.90	30.90	0.00%	Yes	20.7	5.06	2.53	0	12.99	0	41.28	30.9	51.9	21	2.91		
V15	R05	Zone 05	n/a	31.10	31.00	-0.32%	No	31.10	31.10	31.10	0.00%	Yes	18.34	0	2.51	0	16.5	0	37.35	31	52.6	21.6	2.73		
V15	R06	Zone 06	n/a	29.70	29.70	0.00%	Yes	29.70	29.70	29.70	0.00%	Yes	8.92	4.05	2.52	0	12.22	0	27.71	29.7	55.4	25.7	2.95		
V15	R07	Zone 07	n/a	26.90	26.90	0.00%	Yes	26.90	26.90	26.90	0.00%	Yes	3.22	0.79	2.55	0	11.75	0	18.31	26.9	54.8	27.9	2.79		
V15	R08	Zone 08	n/a	26.20	26.20	0.00%	Yes	26.20	26.20	26.20	0.00%	Yes	4.72	12.31	2.5	0	10.87	0	30.4	26.2	51.1	24.9	3.10		
V15	R09	Zone 09	n/a	28.80	28.80	0.00%	Yes	28.80	28.80	28.80	0.00%	Yes	7.07	24.09	2.46	0	10.07	0	43.69	28.8	51.4	22.6	3.18		
V15	R10	Zone 10	n/a	28.50	28.50	0.00%	Yes	28.50	28.50	28.50	0.00%	Yes	8.61	24.4	2.45	0	10.19	0	45.65	28.5	49.8	21.3	3.29		
V15	R11	Zone 11	n/a	29.40	29.40	0.00%	Yes	29.40	29.40	29.40	0.00%	Yes	24.06	40.13	2.53	0	12.51	0	79.23	29.4	49.3	19.9	3.94		
V15	R12	Zone 12	n/a	30.40	30.40	0.00%	Yes	30.40	30.40	30.40	0.00%	Yes	22.89	21.79	2.52	0	13.23	0	60.43	30.4	49.2	18.8	3.25		
V15	R13	Zone 13	n/a	29.80	29.80	0.00%	Yes	29.80	29.80	29.80	0.00%	Yes	20.89	42.45	2.56	0	11.73	0	77.63	29.8	50.2	20.4	4.16		
V15	R14	Zone 14	n/a	30.60	30.60	0.00%	Yes	30.60	30.60	30.60	0.00%	Yes	23.98	36.72	2.42	0	12.35	0	75.47	30.6	51.2	20.6	3.46		
V15	R15	Zone 15	n/a	25.50	25.50	0.00%	Yes	25.50	25.50	25.50	0.00%	Yes	1.99	88.5	2.45	0	7.03	0	99.97	25.5	51.3	25.8	5.84		
V15	R16	Zone 16	n/a	45.00	45.00	0.00%	Yes	45.00	45.00	45.00	0.00%	Yes	61.95	4.52	2.55	0	18.1	0	87.12	45	62.8	17.8	2.94		
Result V15			n/a	31.29	31.28	-0.02%		31.29	31.29	31.29	0.00%	Min	19.92	19.25	2.51	0.00	12.95		54.63	31.28	53.29	22.01	3.37		
												Ave		0.00%	0.00%	0.00%		0.00%		0.00%					

Page 8 of 11

Comparison between Reference & Candidate Software (EDR total)

Comparison Date: 5/31/2019 Comparison Author: Martyn Dodd Candidate Software: EnergyPro V8													33	34	35	0	36	37	46	12	191	192	207		
				Reference Proposed	Candidate Proposed	Percent Difference	Within Tolerance	Standard Equals	Reference Standard	Candidate Standard	Percent Difference	Within Tolerance	Candidate Proposed SpCHeat	Candidate Proposed SpCCool	Candidate Proposed IAQVent	Candidate Proposed OtherHVAl	Candidate Proposed WtrHeat	Candidate Proposed SelfUtilizat	Candidate Proposed Total	Candidate Proposed EDRtot	Candidate Proposed EDReff	Candidate Proposed EDRflex	Candidate Proposed PVSize		
Test	Run	Description	Pass/Fail																						
V16	Standard Design All Electric in All Zones for Prototype S6960ft2												Standard = Proposed for this test												
V16	R01	Zone 01	n/a	41.10	41.10	0.00%	Yes	42.10	42.10	42.10	0.00%	Yes	22.94	0	3.16	0	37.22	0	63.32	41.1	70.6	29.5	15.93		
V16	R02	Zone 02	n/a	34.30	34.30	0.00%	Yes	34.30	34.30	34.30	0.00%	Yes	19.15	8.43	3.13	0	23.22	0	53.93	34.3	63.4	29.1	13.93		
V16	R03	Zone 03	n/a	33.50	33.50	0.00%	Yes	34.00	34.00	34.00	0.00%	Yes	6.95	1.62	3.15	0	29.56	0	41.28	33.5	64.2	30.7	13.46		
V16	R04	Zone 04	n/a	32.00	32.00	0.00%	Yes	32.00	32.00	32.00	0.00%	Yes	13.36	8.67	3.13	0	21.3	0	46.46	32	61.4	29.4	13.58		
V16	R05	Zone 05	n/a	34.70	34.70	0.00%	Yes	35.30	35.30	35.30	0.00%	Yes	7.24	1.45	3.15	0	32.32	0	44.16	34.7	65.4	30.7	12.64		
V16	R06	Zone 06	n/a	31.90	31.90	0.00%	Yes	31.90	31.90	31.90	0.00%	Yes	4.71	7.65	3.05	0	19.26	0	34.67	31.9	65.9	34	13.86		
V16	R07	Zone 07	n/a	31.70	31.70	0.00%	Yes	31.70	31.70	31.70	0.00%	Yes	1.47	5.65	3.11	0	19.38	0	29.61	31.7	66.6	34.9	13.19		
V16	R08	Zone 08	n/a	29.80	29.80	0.00%	Yes	29.80	29.80	29.80	0.00%	Yes	2.51	17.04	3.02	0	18.07	0	40.64	29.8	63.6	33.8	14.62		
V16	R09	Zone 09	n/a	30.40	30.40	0.00%	Yes	30.40	30.40	30.40	0.00%	Yes	4.28	26.28	3.01	0	17.59	0	51.16	30.4	61.9	31.5	14.65		
V16	R10	Zone 10	n/a	31.20	31.20	0.00%	Yes	31.20	31.20	31.20	0.00%	Yes	5.57	29.09	3.01	0	17.76	0	55.43	31.2	61.3	30.1	15.07		
V16	R11	Zone 11	n/a	31.90	31.90	0.00%	Yes	31.90	31.90	31.90	0.00%	Yes	17.98	44.14	3.13	0	20.27	0	85.52	31.9	60.6	28.7	16.64		
V16	R12	Zone 12	n/a	32.00	32.00	0.00%	Yes	32.00	32.00	32.00	0.00%	Yes	16.97	25.37	3.13	0	20.84	0	66.31	32	59.9	27.9	14.95		
V16	R13	Zone 13	n/a	32.10	32.10	0.00%	Yes	32.10	32.10	32.10	0.00%	Yes	15.37	45.5	3.15	0	20.34	0	84.36	32.1	60.5	28.4	17.51		
V16	R14	Zone 14	n/a	32.50	32.50	0.00%	Yes	32.50	32.50	32.50	0.00%	Yes	18.2	39.88	3.02	0	20.03	0	81.13	32.5	61.6	29.1	14.62		
V16	R15	Zone 15	n/a	28.20	28.20	0.00%	Yes	28.20	28.20	28.20	0.00%	Yes	0.82	91.1	3.03	0	14.18	0	109.13	28.2	61	32.8	21.64		
V16	R16	Zone 16	n/a	40.20	40.20	0.00%	Yes	40.20	40.20	40.20	0.00%	Yes	48.33	6.84	3.14	0	20.23	0	78.54	40.2	66.6	26.4	13.43		
Result V16			n/a	32.97	32.97	0.00%		33.10	33.10	33.10	0.00%	Min Ave	12.87 0.00%	22.42 0.00%	3.10 0.00%	0.00	21.97 0.00%		60.35 0.00%	32.97	63.41	30.44	14.98		
V17	Proposed Design All Electric in All Zones for Prototype P2100ft2												Standard = V14 Standard for this test												
V17	R01	Zone 01	Pass	48.90	48.90	0.00%	Yes	49.90	49.90	49.90	0.00%	Yes	61.45	0	2.6	0	20.14	0	84.19	48.9	70.3	21.4	3.05		
V17	R02	Zone 02	Pass	33.80	33.80	0.00%	Yes	34.20	34.20	34.20	0.00%	Yes	31.2	0	2.61	0	17.87	0	51.68	33.8	55.2	21.4	2.56		
V17	R03	Zone 03	Pass	33.70	33.70	0.00%	Yes	34.60	34.60	34.60	0.00%	Yes	23.95	0	2.63	0	17.69	0	44.27	33.7	56.4	22.7	2.51		
V17	R04	Zone 04	Pass	30.60	30.60	0.00%	Yes	31.80	31.80	31.80	0.00%	Yes	22.94	0.44	2.62	0	16.39	0	42.39	30.6	52.7	22.1	2.47		
V17	R05	Zone 05	Pass	33.10	33.10	0.00%	Yes	34.20	34.20	34.20	0.00%	Yes	23.62	0	2.61	0	18.79	0	45.02	33.1	55	21.9	2.34		
V17	R06	Zone 06	Pass	28.80	28.80	0.00%	Yes	29.80	29.80	29.80	0.00%	Yes	9.33	1.73	2.58	0	13.98	0	27.62	28.8	55.3	26.5	2.50		
V17	R07	Zone 07	Pass	26.90	26.90	0.00%	Yes	27.40	27.40	27.40	0.00%	Yes	3.34	0.06	2.62	0	13.76	0	19.78	26.9	55.4	28.5	2.38		
V17	R08	Zone 08	Pass	24.40	24.40	0.00%	Yes	25.90	25.90	25.90	0.00%	Yes	4.42	7.81	2.55	0	12.22	0	27	24.4	50.3	25.9	2.60		
V17	R09	Zone 09	Pass	27.10	27.10	0.00%	Yes	28.90	28.90	28.90	0.00%	Yes	6.89	18.53	2.53	0	12.07	0	40.02	27.1	50.7	23.6	2.65		
V17	R10	Zone 10	Pass	27.50	27.50	0.00%	Yes	29.20	29.20	29.20	0.00%	Yes	8.51	19.41	2.52	0	12.21	0	42.65	27.5	50	22.5	2.73		
V17	R11	Zone 11	Pass	28.80	28.80	0.00%	Yes	30.70	30.70	30.70	0.00%	Yes	25.17	34.01	2.61	0	14.76	0	76.55	28.8	49.4	20.6	3.23		
V17	R12	Zone 12	Pass	29.90	29.90	0.00%	Yes	31.60	31.60	31.60	0.00%	Yes	25.11	14.68	2.61	0	16.35	0	58.75	29.9	49.5	19.6	2.70		
V17	R13	Zone 13	Pass	30.00	30.00	0.00%	Yes	31.80	31.80	31.80	0.00%	Yes	21.57	38.36	2.64	0	13.93	0	76.5	30	51.1	21.1	3.42		
V17	R14	Zone 14	Pass	29.90	29.90	0.00%	Yes	32.20	32.20	32.20	0.00%	Yes	24.92	29.93	2.51	0	15.1	0	72.46	29.9	51.2	21.3	2.83		
V17	R15	Zone 15	Pass	25.00	25.00	0.00%	Yes	27.00	27.00	27.00	0.00%	Yes	0.81	88.42	2.54	0	8.45	0	100.22	25	52.6	27.6	4.91		
V17	R16	Zone 16	Pass	46.70	46.70	0.00%	Yes	48.40	48.40	48.40	0.00%	Yes	68.75	0.46	2.63	0	22.33	0	94.17	46.7	65	18.3	2.46		
Result V17			Pass	31.57	31.57	0.00%		32.98	32.98	32.98	0.00%	Min Ave	22.62 0.00%	15.87 0.00%	2.59 0.00%	0.00	15.38 0.00%		56.45 0.00%	31.57	54.38	22.81	2.83		
	Page 9 of 11																								

Comparison between Reference & Candidate Software (EDR total)

Comparison Date: 5/31/2019													'Candidate 'Candidate 'Candidate 'Candidate 'Candidate 'Candidate 'Candidate 'Candidate 'Candidate 'Candidate 'Candidate 'Candidate												
Comparison Author: Martyn Dodd													Candidate Candidate Candidate Candidate Candidate Candidate Candidate Candidate Candidate Candidate Candidate Candidate Candidate												
Candidate Software: EnergyPro V8													33 34 35 0 36 37 46 12 191 192 207												
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Test	Run	Description	Pass/Fail	Reference Proposed	Candidate Proposed	Percent Difference	Within Tolerance	Standard Equals	Reference Standard	Candidate Standard	Percent Difference	Within Tolerance	Proposed SpcHeat	Proposed SpcCool	Proposed IAQVent	Proposed OtherHVAl	Proposed WtrHeat	Proposed SelfUtilizat	Proposed Total	Proposed EDRtot	Proposed EDReff	Proposed EDRflex	Proposed PVSize		
V18	Proposed Design All Electric in All Zones for Prototype P2700ft2												Standard = V15 Standard for this test												
V18	R01	Zone 01	Pass	43.20	43.20	0.00%	Yes	44.30	44.30	44.30	0.00% Yes		43.93	0	2.48	0	17.84	0	64.25	43.2	64.5	21.3	3.52		
V18	R02	Zone 02	Pass	30.30	30.30	0.00%	Yes	31.70	31.70	31.70	0.00% Yes		25.02	0.84	2.52	0	15.55	0	43.93	30.3	50.6	20.3	3.00		
V18	R03	Zone 03	Pass	30.70	30.70	0.00%	Yes	31.80	31.80	31.80	0.00% Yes		17.03	0	2.54	0	15.62	0	35.19	30.7	53	22.3	2.92		
V18	R04	Zone 04	Pass	29.90	29.90	0.00%	Yes	30.90	30.90	30.90	0.00% Yes		19.18	4.37	2.53	0	13.32	0	39.4	29.9	50.9	21	2.91		
V18	R05	Zone 05	Pass	29.80	29.80	0.00%	Yes	31.10	31.10	31.10	0.00% Yes		15.79	0	2.51	0	16.95	0	35.25	29.8	51.4	21.6	2.73		
V18	R06	Zone 06	Pass	28.50	28.50	0.00%	Yes	29.70	29.70	29.70	0.00% Yes		7.98	3.08	2.52	0	12.31	0	25.89	28.5	54.2	25.7	2.95		
V18	R07	Zone 07	Pass	26.30	26.30	0.00%	Yes	26.90	26.90	26.90	0.00% Yes		2.67	0.38	2.55	0	11.91	0	17.51	26.3	54.2	27.9	2.79		
V18	R08	Zone 08	Pass	24.70	24.70	0.00%	Yes	26.20	26.20	26.20	0.00% Yes		4	10.49	2.5	0	10.88	0	27.87	24.7	49.5	24.8	3.10		
V18	R09	Zone 09	Pass	26.70	26.70	0.00%	Yes	28.80	28.80	28.80	0.00% Yes		6.3	20.63	2.46	0	10.27	0	39.66	26.7	49.3	22.6	3.18		
V18	R10	Zone 10	Pass	26.40	26.40	0.00%	Yes	28.50	28.50	28.50	0.00% Yes		7.61	21.22	2.45	0	10.26	0	41.54	26.4	47.8	21.4	3.29		
V18	R11	Zone 11	Pass	27.20	27.20	0.00%	Yes	29.40	29.40	29.40	0.00% Yes		22.62	35.2	2.53	0	12.56	0	72.91	27.2	47	19.8	3.94		
V18	R12	Zone 12	Pass	28.50	28.50	0.00%	Yes	30.40	30.40	30.40	0.00% Yes		21.95	17.87	2.52	0	13.45	0	55.79	28.5	47.3	18.8	3.25		
V18	R13	Zone 13	Pass	27.60	27.60	0.00%	Yes	29.80	29.80	29.80	0.00% Yes		20.02	36.98	2.56	0	11.92	0	71.48	27.6	47.9	20.3	4.16		
V18	R14	Zone 14	Pass	27.90	27.90	0.00%	Yes	30.60	30.60	30.60	0.00% Yes		22.14	31.23	2.42	0	12.65	0	68.44	27.9	48.5	20.6	3.46		
V18	R15	Zone 15	Pass	23.10	23.10	0.00%	Yes	25.50	25.50	25.50	0.00% Yes		1.53	81.69	2.45	0	7.06	0	92.73	23.1	49	25.9	5.84		
V18	R16	Zone 16	Pass	43.00	43.00	0.00%	Yes	45.00	45.00	45.00	0.00% Yes		58.62	2.29	2.55	0	19.16	0	82.62	43	60.8	17.8	2.94		
Result V18			Pass	29.61	29.61	0.00%		31.29	31.29	31.29	0.00%	Min Max	18.52	16.64	2.51	0.00	13.23		50.90	29.61	51.62	22.01	3.37		
													Ave												
V19	Proposed Design All Electric in All Zones for Prototype P6960ft2												Standard = V16 Standard for this test												
V19	R01	Zone 01	Pass	41.30	41.30	0.00%	Yes	42.10	42.10	42.10	0.00% Yes		23.42	0	3.16	0	37.22	0	63.8	41.3	70.7	29.4	15.93		
V19	R02	Zone 02	Pass	33.70	33.70	0.00%	Yes	34.30	34.30	34.30	0.00% Yes		19.35	6.53	3.13	0	23.33	0	52.34	33.7	62.8	29.1	13.93		
V19	R03	Zone 03	Pass	33.00	33.00	0.00%	Yes	34.00	34.00	34.00	0.00% Yes		6.79	0.63	3.15	0	29.56	0	40.13	33	63.7	30.7	13.46		
V19	R04	Zone 04	Pass	30.70	30.70	0.00%	Yes	32.00	32.00	32.00	0.00% Yes		13.37	5.37	3.13	0	21.52	0	43.39	30.7	60.2	29.5	13.58		
V19	R05	Zone 05	Pass	34.20	34.20	0.00%	Yes	35.30	35.30	35.30	0.00% Yes		7.36	0.4	3.15	0	32.32	0	43.23	34.2	64.9	30.7	12.64		
V19	R06	Zone 06	Pass	31.10	31.10	0.00%	Yes	31.90	31.90	31.90	0.00% Yes		4.74	5.88	3.05	0	19.29	0	32.96	31.1	65	33.9	13.86		
V19	R07	Zone 07	Pass	31.10	31.10	0.00%	Yes	31.70	31.70	31.70	0.00% Yes		1.58	4.14	3.11	0	19.54	0	28.37	31.1	66	34.9	13.19		
V19	R08	Zone 08	Pass	28.50	28.50	0.00%	Yes	29.80	29.80	29.80	0.00% Yes		2.5	13.99	3.02	0	18.14	0	37.65	28.5	62.3	33.8	14.62		
V19	R09	Zone 09	Pass	29.00	29.00	0.00%	Yes	30.40	30.40	30.40	0.00% Yes		4.32	22.58	3.01	0	17.78	0	47.69	29	60.5	31.5	14.65		
V19	R10	Zone 10	Pass	29.80	29.80	0.00%	Yes	31.20	31.20	31.20	0.00% Yes		5.6	25.46	3.01	0	17.8	0	51.87	29.8	60	30.2	15.07		
V19	R11	Zone 11	Pass	30.20	30.20	0.00%	Yes	31.90	31.90	31.90	0.00% Yes		17.93	38.65	3.13	0	20.27	0	79.98	30.2	58.9	28.7	16.64		
V19	R12	Zone 12	Pass	30.10	30.10	0.00%	Yes	32.00	32.00	32.00	0.00% Yes		17.02	19.97	3.13	0	20.82	0	60.94	30.1	58.1	28	14.95		
V19	R13	Zone 13	Pass	30.40	30.40	0.00%	Yes	32.10	32.10	32.10	0.00% Yes		15.38	39.98	3.15	0	20.43	0	78.94	30.4	58.8	28.4	17.51		
V19	R14	Zone 14	Pass	30.70	30.70	0.00%	Yes	32.50	32.50	32.50	0.00% Yes		18.3	34.05	3.02	0	20.06	0	75.43	30.7	59.7	29	14.62		
V19	R15	Zone 15	Pass	26.10	26.10	0.00%	Yes	28.20	28.20	28.20	0.00% Yes		0.81	83.46	3.03	0	14.18	0	101.48	26.1	58.8	32.7	21.64		
V19	R16	Zone 16	Pass	39.50	39.50	0.00%	Yes	40.20	40.20	40.20	0.00% Yes		48.63	4.26	3.14	0	20.4	0	76.43	39.5	65.8	26.3	13.43		
Result V19			Pass	31.84	31.84	0.00%		33.10	33.10	33.10	0.00%	Min Max	12.94	19.08	3.10	0.00	22.04		57.16	31.84	62.26	30.43	14.98		
													Ave												
													0.00%												
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Comparison between Reference & Candidate Software (EDR total)

Comparison Date: 5/31/2019 Comparison Author: Martyn Dodd Candidate Software: EnergyPro V8													33	34	35	0	36	37	46	12	191	192	207
Test	Run	Description	Pass/Fail	Reference Proposed	Candidate Proposed	Percent Difference	Within Tolerance	Standard Equals	Reference Standard	Candidate Standard	Percent Difference	Within Tolerance	Candidate	Candidate	Candidate	Candidate	Candidate	Candidate	Candidate	Candidate	Candidate	Candidate	
													Proposed SpcHeat	Proposed SpcCool	Proposed IAQVent	Proposed OtherHVAC	Proposed WtrHeat	Proposed SelfUtilizat	Proposed Total	Proposed EDRtot	Proposed EDReff	Proposed EDRflex	Proposed PVSize
V20	PV in zone 12 for Prototype P2100ft2												Standard = V04R12										
V20	R01	Package	Pass	23.90	23.90	0.00%	Yes	25.90	25.90	25.90	0.00%	Yes	22.32	14.33	2.61	0	12.05	0	51.31	23.9	43.6	19.7	2.70
V20	R02	Maximum PV	Pass	24.20	24.20	0.00%	Yes	25.90	25.90	25.90	0.00%	Yes	22.32	14.33	2.61	0	12.05	0	51.31	24.2	43.6	19.4	2.66
V20	R03	2 kWdc PV	Pass	28.80	28.80	0.00%	Yes	25.90	25.90	25.90	0.00%	Yes	22.32	14.33	2.61	0	12.05	0	51.31	28.8	43.6	14.8	2.66
V20	R04	Premium Module	Pass	23.50	23.50	0.00%	Yes	25.90	25.90	25.90	0.00%	Yes	22.32	14.33	2.61	0	12.05	0	51.31	23.5	43.6	20.1	2.70
V20	R05	Tracking (one axis) Array	Pass	15.40	15.40	0.00%	Yes	25.90	25.90	25.90	0.00%	Yes	22.32	14.33	2.61	0	12.05	0	51.31	15.4	43.6	28.2	2.70
V20	R06	Tracking (two axis) Array	Pass	12.90	12.90	0.00%	Yes	25.90	25.90	25.90	0.00%	Yes	22.32	14.33	2.61	0	12.05	0	51.31	12.9	43.6	30.7	2.70
V20	R07	Microinverters	Pass	23.90	23.90	0.00%	Yes	25.90	25.90	25.90	0.00%	Yes	22.32	14.33	2.61	0	12.05	0	51.31	23.9	43.6	19.7	2.70
V20	R08	DC Power Optimizers	Pass	24.10	24.10	0.00%	Yes	25.90	25.90	25.90	0.00%	Yes	22.32	14.33	2.61	0	12.05	0	51.31	24.1	43.6	19.5	2.70
V20	R09	Maxium PV Preimum Fixed Mic	Pass	24.10	24.10	0.00%	Yes	25.90	25.90	25.90	0.00%	Yes	22.32	14.33	2.61	0	12.05	0	51.31	24.1	43.6	19.5	2.61
V20	R10	Maximum PV Preimum Trackin	Pass	22.10	22.10	0.00%	Yes	25.90	25.90	25.90	0.00%	Yes	22.32	14.33	2.61	0	12.05	0	51.31	22.1	43.6	21.5	1.84
Result V20			Pass	22.29	22.29	0.00%		25.90	25.90	25.90	0.00%	Ave	Min	22.32	14.33	2.61	0.00	12.05	51.31	25.07	48.75	23.68	6.48
													Max	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%				
V21	PV, Battery and Target EDR in Zone 12 for Prototype P2100ft2												Standard = V04R12										
V21	R01	Package	Pass	23.90	23.90	0.00%	Yes	25.90	25.90	25.90	0.00%	Yes	22.32	14.33	2.61	0	12.05	0	51.31	23.9	43.6	19.7	2.70
V21	R02	Two 1 kWdc PV	Pass	28.80	28.80	0.00%	Yes	25.90	25.90	25.90	0.00%	Yes	22.32	14.33	2.61	0	12.05	0	51.31	28.8	43.6	14.8	2.66
V21	R03	Two 1 kWdc PV 90/270 Azm/11t	Pass	30.00	30.00	0.00%	Yes	25.90	25.90	25.90	0.00%	Yes	22.32	14.33	2.61	0	12.05	0	51.31	30	43.6	13.6	3.06
V21	R04	Reduced PV 0 kWdc < 80 ft2 ar	Pass	43.60	43.60	0.00%	Yes	45.60	45.60	45.60	0.00%	Yes	22.32	14.33	2.61	0	12.05	0	51.31	43.6	43.6	0	0.00
V21	R05	14 kWh Battery Basic	Pass	5.40	5.40	0.00%	Yes	25.90	25.90	25.90	0.00%	Yes	22.32	14.33	2.61	0	12.05	0	51.31	5.4	43.6	38.2	4.30
V21	R06	14 kWh Battery TOU	Pass	0.00	0.00	0.00%	Yes	25.90	25.90	25.90	0.00%	Yes	22.32	14.33	2.61	0	12.05	0	51.31	0	43.6	43.6	4.30
V21	R07	14 kWh Battery Advanced	Pass	0.00	0.00	0.00%	Yes	25.90	25.90	25.90	0.00%	Yes	22.32	14.33	2.61	0	12.05	0	51.31	0	43.6	43.6	4.31
V21	R08	Self Utilization Credit	Pass	5.40	5.40	0.00%	Yes	25.90	25.90	25.90	0.00%	Yes	22.32	14.33	2.61	0	12.05	-7.85	43.46	5.4	40.3	34.9	4.30
V21	R09	Self Utilization Credit Allow Exc	Pass	34.90	34.90	0.00%	Yes	25.90	25.90	25.90	0.00%	Yes	22.32	14.33	2.61	0	12.05	-1.8	49.51	34.9	42.8	7.9	1.00
V21	R10	Self Utilization Credit Allow Exc	Pass	0.00	0.00	0.00%	Yes	25.90	25.90	25.90	0.00%	Yes	22.32	14.33	2.61	0	12.05	-7.85	43.46	0	40.3	40.3	5.13
Result V21			Pass	17.20	17.20	0.00%		27.87	27.87	27.87	0.00%	Ave	Min	22.32	14.33	2.61	0.00	12.05	49.56	19.10	43.44	24.34	3.24
													Max	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%				
V22	Verified and Buried Ducts in Zone 12 for Prototype P2100ft2												Standard = V04R12										
V22	R01	Package	Pass	23.90	23.90	0.00%	Yes	25.90	25.90	25.90	0.00%	Yes	22.32	14.33	2.61	0	12.05	0	51.31	23.9	43.6	19.7	2.70
V22	R02	Verified equal to default ducts	Pass	23.90	23.90	0.00%	Yes	25.90	25.90	25.90	0.00%	Yes	22.32	14.33	2.61	0	12.05	0	51.31	23.9	43.6	19.7	2.70
V22	R03	Buried R-60	Pass	23.20	23.20	0.00%	Yes	25.90	25.90	25.90	0.00%	Yes	21.63	13.47	2.61	0	12.05	0	49.76	23.2	42.9	19.7	2.70
V22	R04	Buried R-60/Ducts Half Length	Pass	22.70	22.70	0.00%	Yes	25.90	25.90	25.90	0.00%	Yes	20.99	12.78	2.61	0	12.05	0	48.43	22.7	42.4	19.7	2.70
V22	R05	Buried R-60/Ducts R-6	Pass	23.20	23.20	0.00%	Yes	25.90	25.90	25.90	0.00%	Yes	21.64	13.48	2.61	0	12.05	0	49.78	23.2	42.9	19.7	2.70
V22	R06	Buried R-60/Duct Diameters 8,	Pass	22.50	22.50	0.00%	Yes	25.90	25.90	25.90	0.00%	Yes	20.77	12.58	2.61	0	12.05	0	48.01	22.5	42.2	19.7	2.70
V22	R07	Buried R-60/Duct Diameters 8,	Pass	22.50	22.50	0.00%	Yes	25.90	25.90	25.90	0.00%	Yes	20.8	12.6	2.61	0	12.05	0	48.06	22.5	42.2	19.7	2.70
V22	R08	Buried R-60/Duct Diameters 8,	Pass	22.50	22.50	0.00%	Yes	25.90	25.90	25.90	0.00%	Yes	20.76	12.57	2.61	0	12.05	0	47.99	22.5	42.2	19.7	2.70
V22	R09	Buried R-60/Ducts Half Length	Pass	22.40	22.40	0.00%	Yes	25.90	25.90	25.90	0.00%	Yes	20.66	12.32	2.61	0	12.05	0	47.64	22.4	42	19.6	2.70
V22	R10	Buried R-60/Ducts Half Length	Pass	25.70	25.70	0.00%	Yes	25.90	25.90	25.90	0.00%	Yes	22	19.01	2.61	0	12.05	0	55.67	25.7	45.4	19.7	2.70
Result V22			Pass	23.25	23.25	0.00%		25.90	25.90	25.90	0.00%	Min	21.39	13.75	2.61	0.00	12.05	49.80	22.04	42.76	20.73	2.80	

STATE OF CALIFORNIA

**STATE ENERGY RESOURCES
CONSERVATION AND DEVELOPMENT COMMISSION**

**2019 Building Energy Efficiency Standards,
California Code of Regulations, Title 24,
Parts 1 and 6**

Docket No. 19-BSTD02

**[PROPOSED] RESOLUTION OF THE ENERGY COMMISSION
APPROVING 2019 RESIDENTIAL COMPLIANCE SOFTWARE
ENERGYPRO VERSION 8.0**

WHEREAS, the Warren-Alquist State Energy Resources Conservation and Development Act,¹ requires the California Energy Commission to, among other things, establish a process for certifying calculation methods for demonstrating compliance with its building energy efficiency standards; and

WHEREAS, as allowed by the 2019 Building Energy Efficiency Standards (Standards),² sections 10-109 and 10-110, an application was submitted to approve EnergyPro 8.0 as an alternative calculation method; and

WHEREAS, as described in the EnergyPro Summary of Residential Alternative Calculation Method (ACM) Tests presented to the Energy Commission along with this proposed resolution, staff of the Energy Commission reviewed and tested EnergyPro 8.0 to ensure it meets the requirements, specifications, and criteria for building energy models set forth in the 2019 ACM Approval Manual, CEC-400-2018-023-CMF (December 2018); and

THEREFORE, the Energy Commission approves EnergyPro 8.0, pursuant to Standards section 10-109, for estimating energy consumed by residential buildings as specified in Public Resources Code section 25402.1, subdivision (a), and for demonstrating compliance with the performance-based residential provisions of the

¹ Public Resources Code section 25402.1, subd. (b).

² California Code of Regulations, Title 24, Part 1, Chapter 10.

2019 Building Energy Efficiency Standards, California Code of Regulations, Title 24, Parts 1 and 6; and

THEREFORE, the Energy Commission directs the Executive Director to take, on behalf of the Energy Commission, all actions reasonably necessary to implement this resolution, as follows:

- To post information on the Energy Commission's public website as to how to obtain EnergyPro 8.0;
- To ensure that EnergyPro 8.0, a Residential Alternative Calculation Method (ACM), is maintained and revised to accurately estimate the energy use of residential buildings,
- To review and approve updates to vender software, consistent with Section 1 of the 2019 ACM Approval Manual.

CERTIFICATION

The undersigned Secretariat to the Commission does hereby certify that the foregoing is a full, true, and correct copy of a Resolution duly and regularly adopted at a meeting of the California Energy Commission held on September 11, 2019.

AYE:

NAY:

ABSENT:

ABSTAIN:

Cody Goldthrite
Secretariat