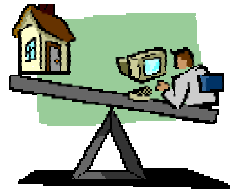




California Association of Building Energy Consultants

Proposed 2005 Residential Standards



*Ken Nittler, Enercomp, Inc. & Bill Mattinson, Sol*Data*

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Goal

- Bring you up to speed on the proposed "2005" residential standards which will likely become mandatory in 2005 or perhaps 2006



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Overview



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Process

- Began in Fall 2001 where interested parties were invited to comment
- CEC Staff workshops held during 2002 and 2003
- Series of draft standards and alternative calculation methods (ACMs – e.g. computer programs)
- Process is about to begin with 45 day language and formal rulemaking
- CEC goal is to have rulemaking and approval of Res and Non-res manuals by end of 2003

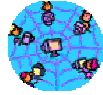
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Web Site



- Full details and drafts at www.energy.ca.gov/2005_standards
- Still time to comment and participate!!!

How can you do a presentation without at least one web site address...

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Setting the Standard

- Standards are required to be life-cycle cost effective to homeowners over 30 years
- Based on thousands of computer runs
- Significant Assumptions Needed
 - What will energy prices do in the future?
 - What energy analysis assumptions are reasonable?
 - What do the added measures cost?
 - How to calculate peak demand savings?

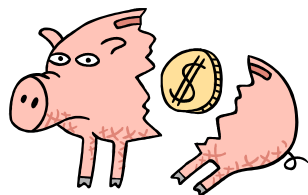
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Bottom Line



The revised standards are life cycle cost effective to homeowners over a wide range of assumptions

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Structure Unchanged

- Structure of Standards Unchanged
 - Mandatory Features
 - Prescriptive Packages
 - Computer Performance
 - Compliance Forms

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Time Dependent Valuation



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Time Dependent Valuation (TDV)

- Groundbreaking work proposed by PG&E and other investor owned utilities
- Makes standards reflect the reality that the costs of energy depends on the hour and season
- Replaces constant 3 source energy conversion for electricity used in standards since 1983
- Includes values for natural gas and propane
Propane about twice the natural gas value
- New hourly efficiency models added

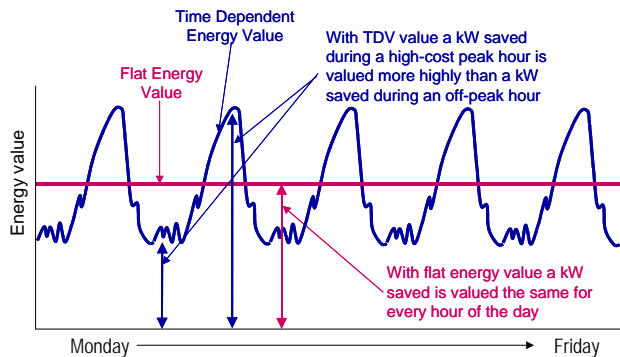
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TDV Issues



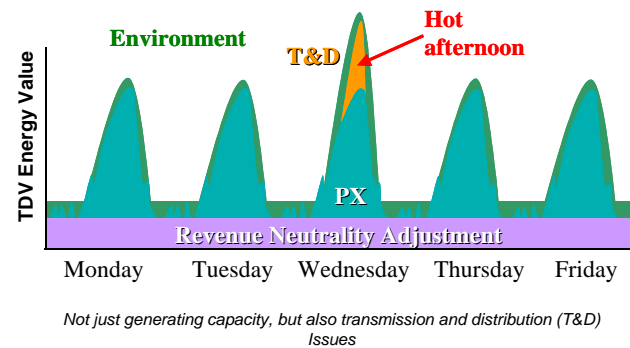
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Shape Peaks on Hot Days



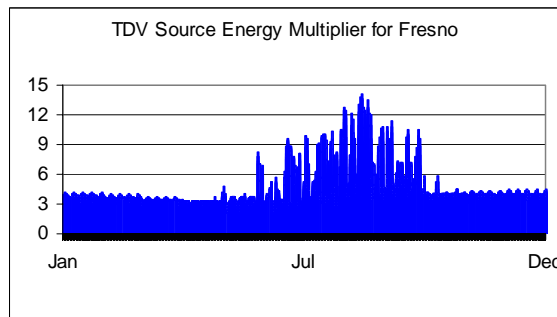
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TDV Multipliers



Standards have used a source energy multiplier of 3 for years. New TDV multipliers as much as 5 times higher in this example

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TDV Climate Zone Summary

Climate Zone	Electric Average	Electric Minimum	Month	Day	Hour	Electric Maximum	Month	Day	Hour
1	3.69	1.98	June	2	7	15.39	August	27	16
2	3.70	1.98	June	2	7	16.06	August	20	15
3	3.72	2.00	June	2	7	18.05	September	27	14
4	3.71	1.99	June	2	7	24.65	August	27	17
5	3.72	2.00	June	2	7	20.68	September	4	13
6	4.09	1.82	June	2	7	15.22	September	24	16
7	4.12	2.23	June	2	7	14.80	August	27	15
8	4.07	1.80	June	2	7	18.55	August	6	15
9	4.05	1.78	June	2	7	22.17	September	24	15
10	4.04	1.77	June	2	7	18.42	August	13	16
11	3.69	1.97	June	2	7	14.67	August	21	16
12	3.69	1.98	June	2	7	19.14	August	20	16
13	3.69	1.97	June	2	7	14.09	August	14	16
14	4.04	1.77	June	2	7	16.51	August	7	16
15	4.03	1.77	June	2	7	16.81	August	6	16
16	3.69	1.98	June	2	7	16.24	August	6	16
ave	3.86	1.92				17.59			
min	3.69	1.77				14.09			
max	4.12	2.23				24.65			

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TDV Conclusions



- Under new standards, building designs and products that cut on-peak summer time electrical energy use will be valued much higher than in current standards
- Software will handle it automatically so compliance process is unchanged

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TDV Compliance

```

MICROPAS6 v6.55  File=SCREEN  Wch=C1Z11S92  Program=MAIN

MICROPAS RUN SUMMARY

Energy Use      Standard  Source   TDU
(kBTu/sf-yr)   Design   Proposed Design
-----
Space Heating... 21.11    21.79   -0.68    20.86    21.55   -0.69
Space Cooling... 11.00    13.26   -2.26    25.99    30.37   -4.38
Water Heating... 14.18    12.57   1.61     13.45    11.91   1.54
-----
Total           46.29    47.62   -1.33    60.30    63.83   -3.53

*** Building does not comply with Computer Performance ***
*** Building does not comply with Computer Performance TDU ***
*** '2001TDUa' assumptions with TDU values for Natural Gas ***

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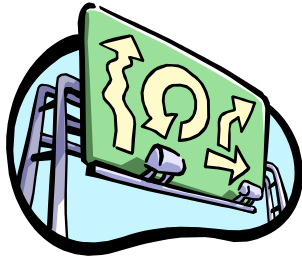
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Changes



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Tightening the Standards

- Air conditioner efficiency
- Duct insulation
- Fenestration area and modeling
- West-facing Fenestration
- Lighting
- Water Heating Efficiency and Insulation
- Multifamily Central Water Heating

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Air Conditioner Efficiency

- New federal requirements for air conditioner efficiency go into effect in January 2006
- For air conditioners with a capacity of less than 65,000 Btu/h, the minimum seasonal energy efficiency ratio (SEER) will change to 12.0

Tradeoff from 10 SEER to 12 SEER lost

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Duct Insulation

- Currently R-4.2
- Raised to R-8 in climate zones 1-5 and 9-16

Other states and IMC already have R-8 duct requirements

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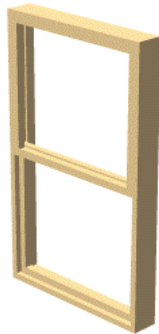


Fenestration Area



- Current standards either 16% or 20%
- Proposed 20% all climate zones

Makes it easier on homes with larger glass areas in zones that used to have 16% limit



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Fenestration Modeling



- Currently, the standard design always has the prescriptive amount of glass, either 16% or 20%
- The standard design is equal to the proposed design or 20%, whichever is less

Makes trading off glass area for buildings with lower glass areas impossible

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West-Facing Fenestration

- New prescriptive requirement for climate zones 2, 4, and 7-15 limits the west-facing glazing area to no more than 5% of the floor area
- Horizontal and west-facing skylights are defined as west-facing glazing and are included in the 5% limit

Only affects prescriptive packages—already in performance methods

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Lighting



- The proposed Standards include changes in mandatory minimum efficiency for hardwired fixtures
- Exceptions for automatic controls in some spaces

One of the biggest energy savers in the proposed standards

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Water Heating Efficiency



- The federal energy factor (EF) requirements for storage gas water heaters will change in January 2004
- For 50 gallon natural gas water heaters, the required EF is 0.575

Getting compliance with water heating tougher

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Water Heating Kitchen Pipe Insulation

- New mandatory measure
- Hot water piping to the kitchen are required to be insulated

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Multifamily Central Water Heating



- The standard design is a central system if the proposed design has a central system

Closes a huge loophole in standards that makes multifamily easy

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NFRC Changes

- New NFRC rating system. U-factors lower than in existing system
 - 0.75 goes to 0.67
 - 0.65 goes to 0.57
- Aluminum goes down 0.08. Wood/Vinyl down 0.03
- Slightly less credit for low U-factors on windows

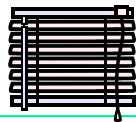
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Modeling Changes



- Wall framing factors have been increased from 15% framing to 25%
- Slab model has been improved by using a seasonal ground temperature
- Ventilation has been changed to windows always being closed from 11 p.m. to 6 a.m.
- The glazing obstruction factor, has been adjusted from 0.67 to 0.72.
- Hourly thermostat settings have changed to better match actual occupancy and residential air conditioning peak demand profile

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Additions



- All new Existing + Addition + Alteration approach
- Windows or Ducts that are altered as part of an addition must meet prescriptive levels to get credit
- Will be automated by software, possibly in a single input file where surfaces are identified as existing, removed, new or altered

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Alterations

- Replacement fenestration must meet prescriptive package requirements
- Replacement Ducts in climate zones 2 and 9-16:
 - Duct systems must be tested and sealed at the time that an air conditioner, heat pump, or furnace is replaced or installed in an existing building
 - New or replacement duct systems in existing buildings shall have an insulation level of R-8 and be tested and sealed

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HERS Verification Features



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Features Requiring HERS Verification

- Duct Sealing
- Supply Duct Location, Surface Area and R-factor
- Improved Refrigerant Charge
- Installation of Thermostatic Expansion Valve (TXV)
- Air Handler Fan Watt Draw
- High Energy Efficiency Ratio (EER)
- Building Envelope Sealing
- High Quality Insulation Installation
- Cooling Compressor Sizing

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Supply Duct Location, Surface Area and R-factor

- Verify that duct system was installed according to the design, including location, size and length of ducts, duct insulation R-value and installation of buried ducts

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Improved Refrigerant Charge

- Package D requires that split system air conditioners and heat pumps be diagnostically tested in the field to verify that they have the correct refrigerant charge
- Compliance credit also requires that adequate airflow be tested and verified

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Air Handler Fan Watt Draw

- If compliance credit is taken for reductions in fan power, the installed fan power must be diagnostically tested and verified in the field

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High Energy Efficiency Ratio (EER)



- Compliance credit may be taken for increases in EER by installation of specific air conditioner or heat pump models, but only if the installation of that high EER model is field verified
- The requirement for verification of a high EER does not apply to equipment rated only with an EER

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High Quality Insulation Installation

- The standards will include credit for Improved envelope construction
- Whole list of requirements in Appendix RQ-2005
- Walls
 - Standard U-factor increased by 19%
 - Improved increased by 5%
- Ceilings/Roofs
 - Standard add 0.02 to heating UA and 0.005 to cooling U-factor
 - Improved add 0.01 to heating UA and 0.002 to cooling U-factor

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Sample Wall Requirements #1

- Wall stud cavities shall be caulked or foamed to provide a substantially air-tight envelope to the outdoors, attic, garage and crawl space. Special attention shall be paid to plumbing and wiring penetrations through the top plates, electrical boxes that penetrate the sheathing, and the sheathing seal to the bottom plate.
- Installation shall uniformly fill the cavity side-to-side, top-to-bottom, and front-to-back.
- The batt shall be friction fitted into the cavity unless another support method is used
- And more...

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HERS Provider Notification

- When the documentation author provides a signed Certificate of Compliance (CF-1R) to the builder, which indicates that any HERS diagnostic testing and field verification measure is required for compliance, the documentation author shall notify each HERS provider by phone, FAX or email of the name of the builder, the street address...

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Impact



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New Standards are Tighter

- 14% less heating, cooling, water heating
- 24% less lighting



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Savings Statewide

Statewide Savings

	Natural Gas (therms)	Electricity (mWh)	Peak Demand (mW)	Natural Gas (%)	Electricity (%)	Peak Demand (%)
New Singlefamily	4148711	85316	125.0	46%	60%	69%
New Multifamily	1863288	15313	28.6	21%	11%	16%
Alterations	3063706	41894	27.6	34%	29%	15%
Total	9075705	142523	181.2	100%	100%	100%

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Statewide TDV Compliance Margins

1761 ft² Singlefamily Prototype Savings

Climate Zone	TDV Energy					Percent Savings (%)	Energy and Demand		
	Space Heating (kTDV/ft ²)	Space Cooling (kTDV/ft ²)	Water Heating (kTDV/ft ²)	Lighting (kTDV/ft ²)	Total (kTDV/ft ²)		Natural Gas (therms)	Electricity (kWh)	Peak Demand (kW)
1	0.69	-0.04	1.56	3.69	5.90	12%	41	0	0.0
2	0.73	1.22	1.54	3.69	7.17	11%	42	76	1.7
3	0.81	1.67	1.54	3.70	7.72	16%	43	0	0.0
4	1.27	1.62	1.53	3.69	8.11	15%	51	114	1.9
5	0.33	0.12	1.54	3.71	5.70	12%	35	0	0.0
6	0.11	1.45	1.69	4.10	7.35	17%	31	0	0.0
7	0.21	0.94	1.71	4.11	6.98	17%	32	56	2.1
8	0.25	2.83	1.69	4.07	8.84	17%	33	172	1.6
9	0.63	4.98	1.68	4.06	11.35	19%	39	334	2.5
10	0.70	7.32	1.69	4.04	13.75	19%	40	494	2.6
11	0.59	3.31	1.54	3.69	9.12	12%	39	234	1.9
12	0.52	1.98	1.53	3.69	7.71	12%	38	115	1.7
13	0.40	4.86	1.53	3.69	10.48	13%	35	366	1.8
14	0.80	5.16	1.70	4.06	11.72	13%	42	336	2.5
15	0.02	13.22	1.67	4.04	18.95	16%	29	1075	2.4
16	1.95	1.00	1.57	3.70	8.21	10%	64	0	0.0
Average	0.62	3.23	1.61	3.86	9.32	14%	40	211	1.4

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Practical Considerations

- Homes with lower glass areas much tighter
 - Sliding scale on glass area
- Homes with higher glass area in cooling climates much tougher
 - TDV impacts features that add cooling
- Multifamily way tougher
 - Central Water Heating
 - Glass Area
- Will be harder to avoid HERS Verified features

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Done!



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