



Revised Climate Zone Map and Draft Criteria for Windows

Criteria Revision Stakeholder Meeting

U.S. Department of Energy

Washington, D.C.

August 13, 2008

Stephen Bickel

D&R International, Ltd.

Topics



- Rationale for revisions to climate zone map
- Meeting DOE guiding principles and objectives in window criteria

Agenda



Climate Zone Map

Draft Window Criteria

Draft Phase 1 Criteria

Draft Phase 2 Criteria

IGU Certification Requirement

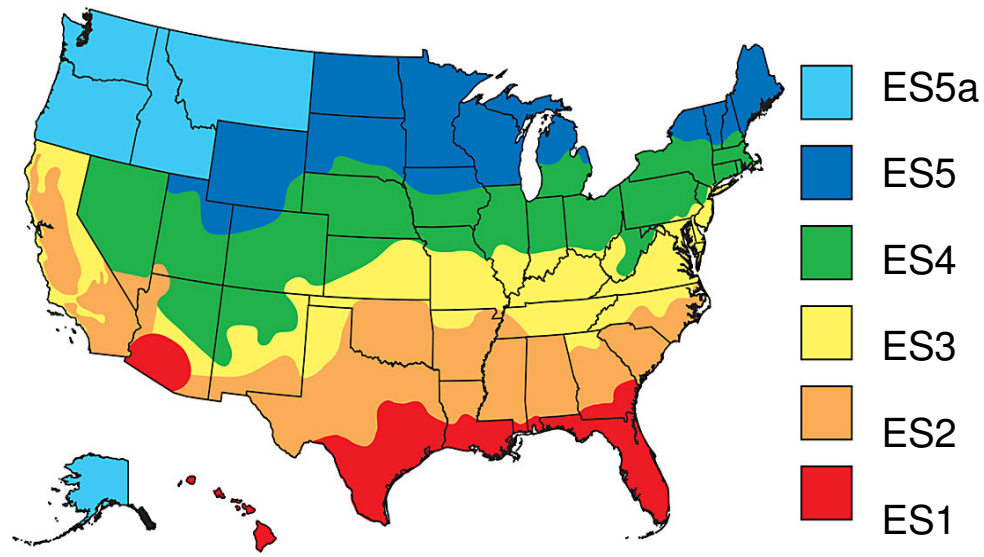
Impact Products and Dynamic
Glazings

Rationale for Revisions to Climate Zone Map

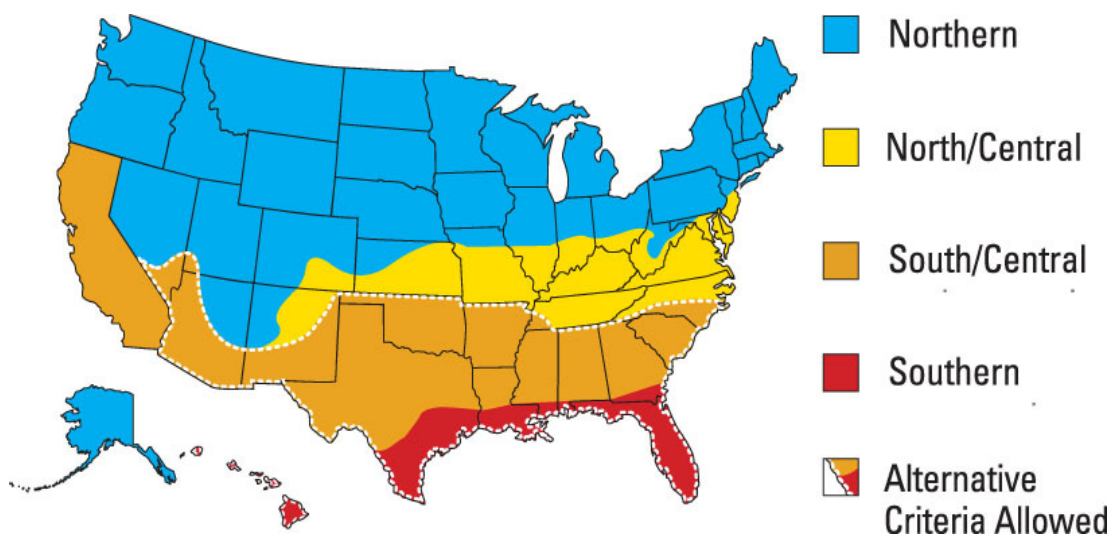


- Align more closely with dominant model energy code
 - IECC and Title 24 (CA)
- Enable criteria to meet or beat code without requiring major redesign
- Ensure zone map boundaries readable on display unit and product labels

Proposed Phase 1 Climate Zones



Current Climate Zones



Agenda



Climate Zone Map

Draft Window Criteria

Draft Phase 1 Criteria

Draft Phase 2 Criteria

IGU Certification Requirement

Impact Products and Dynamic
Glazings

Criteria Also Fulfill Additional DOE Objectives



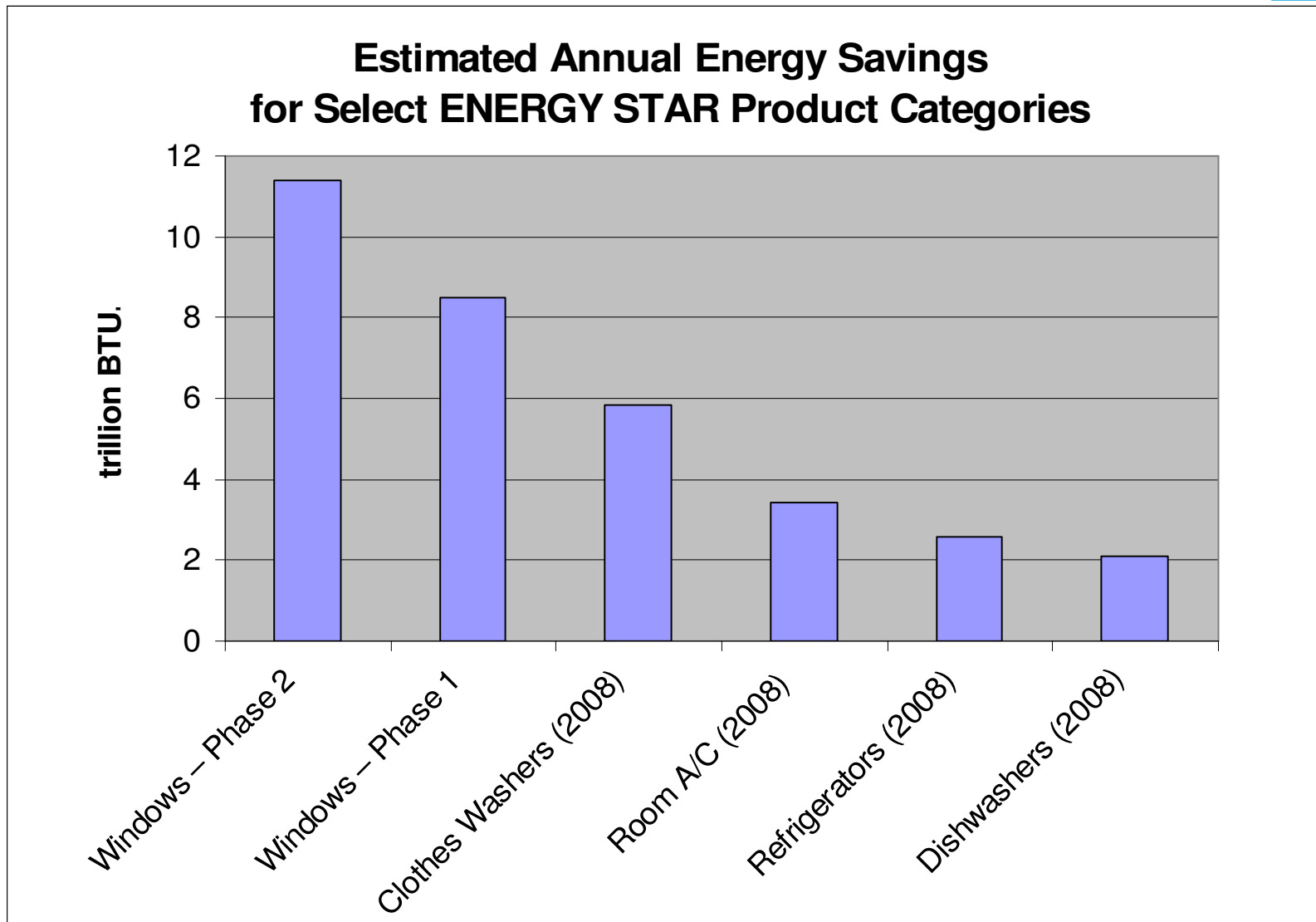
Phase 1 Objectives

- Meet or beat proposed 2009 IECC
- Majority of currently qualified products can meet without alteration or with upgraded IGU

Phase 2 Objective

- Reestablish ENERGY STAR as identifier of windows with superior energy efficiency

Phases 1 and 2 Offer Significant Energy Savings



Agenda



Climate Zone Map

Draft Window Criteria

Draft Phase 1 Criteria

Draft Phase 2 Criteria

IGU Certification Requirement

Impact Products and Dynamic
Glazings

Phase 1 Draft ENERGY STAR Criteria Windows and Sliding Glass Doors

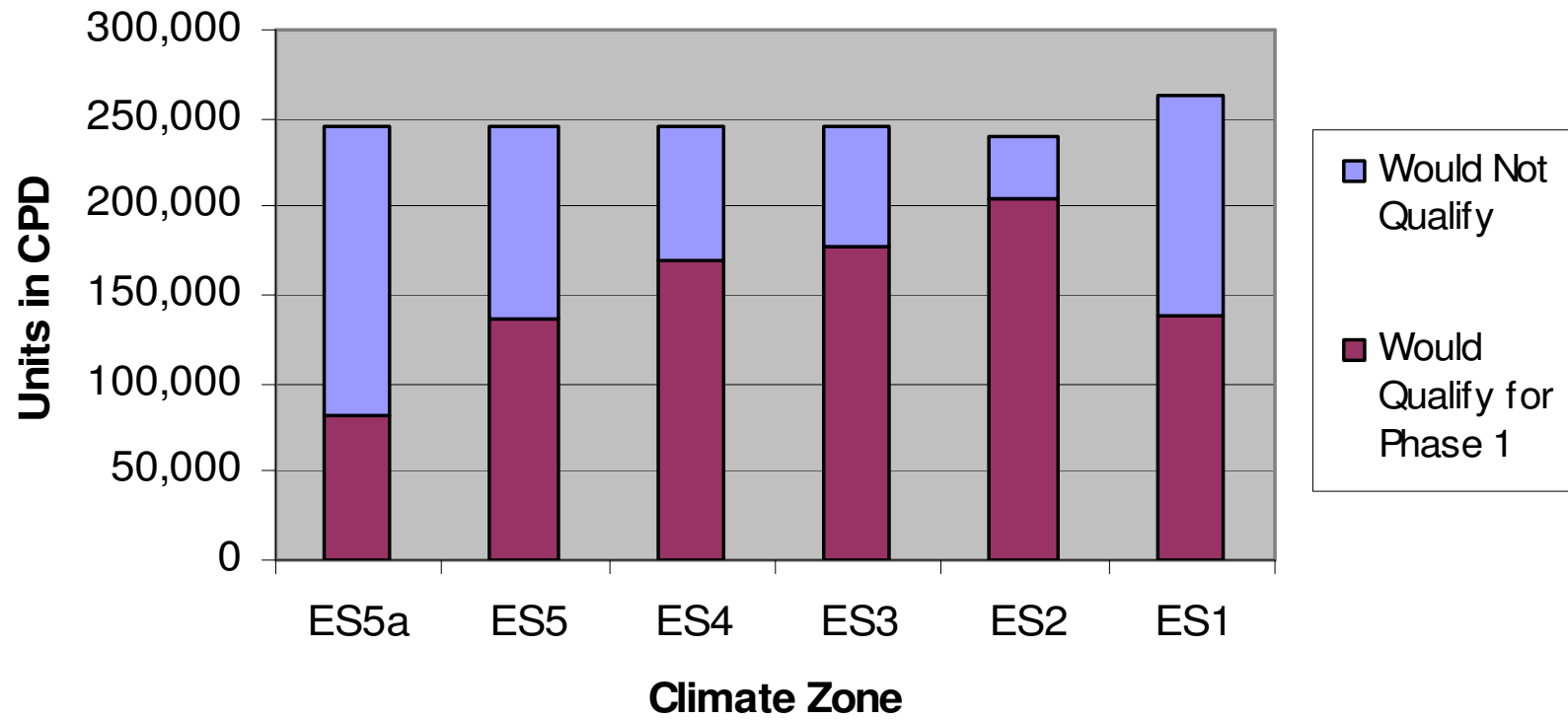


Climate Zone	Proposed 2009 IECC Levels		Draft Phase 1 Criteria		
	U-Factor	SHGC	U-Factor	SHGC	Energy Performance
ES5a	≤ 0.35	NR	≤ 0.30	≤ 0.55	-
ES5	≤ 0.35	NR	-	-	See Slide 16
ES4	≤ 0.35	NR	-	-	See Slide 17
ES3	≤ 0.35	NR	≤ 0.33	≤ 0.40	-
ES2	≤ 0.40	≤ 0.30	≤ 0.35	≤ 0.30	-

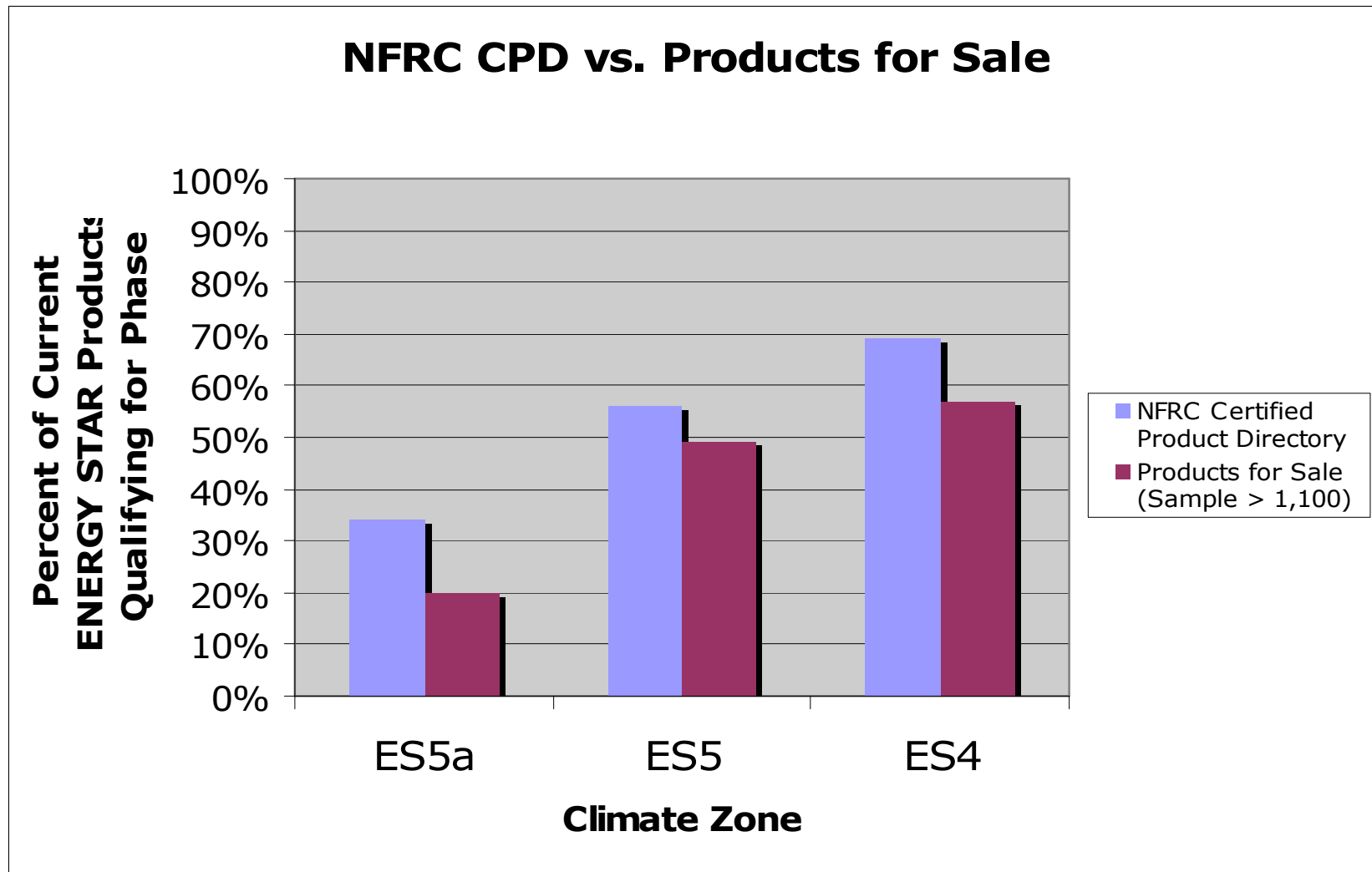
Phase 1: Technological Feasibility



Qualification Status of Current ENERGY STAR Products Under Draft Phase 1 Criteria



Does CPD Predict Accurately?



Phase 1: Cost-Effectiveness



	Marginal Cost	Payback
ES5a	0%	Immediate
	10%	Immediate or Lifetime with sufficient rebate
ES1-2, 4-5	0%	Immediate
	3%	2-5 yrs
ES3	0%	Immediate
	3%	Within lifetime

Phase 1: ES5a



- U-factor set at ≤ 0.30
 - Code in eastern Washington state
 - Request from Congressional Representatives
 - Request from Northwest Energy Efficiency Alliance
- Level is cost-effective with utility rebate
 - Energy Trust of Oregon (\$2.25/ft²)
 - Bonneville Power Administration (\$0.50), is considering increase
- Products are readily available
 - 20-35% of currently qualified products
 - Most challenging for Al-clad wood windows, but doable
- SHGC cap of 0.55 included to avoid customer discomfort and dissatisfaction

Phase 1: ES5 and ES4



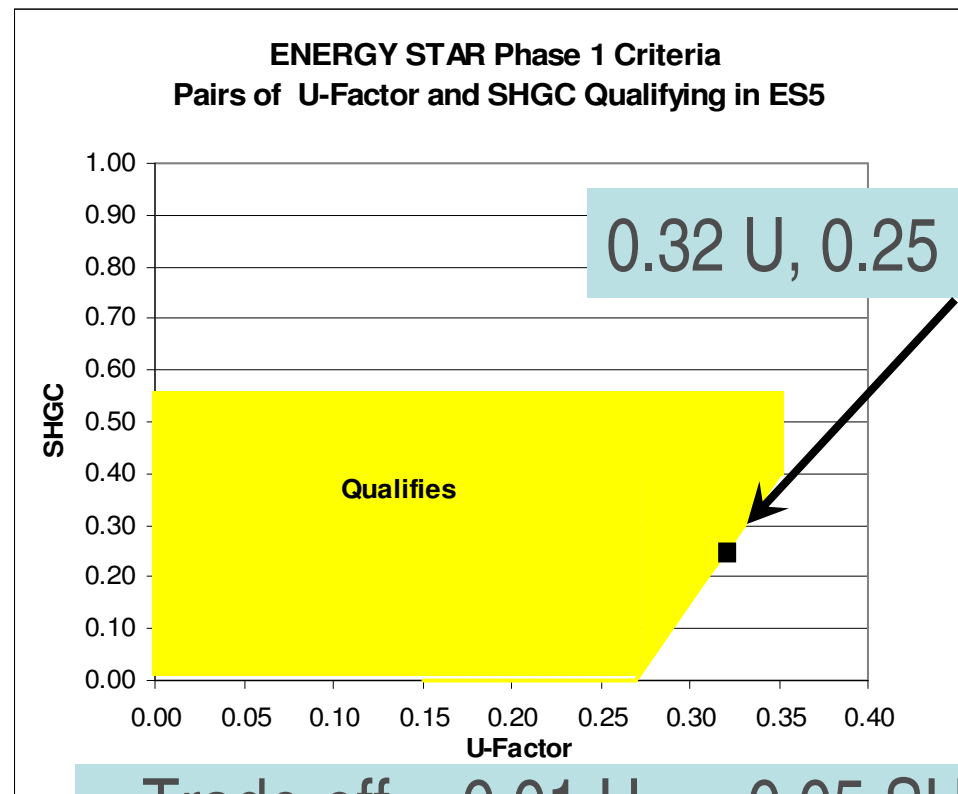
- Set criteria relative to aggregate energy performance
 - Energy savings analysis showed that various combinations of U-factor and SHGC deliver equivalent energy consumption and savings
 - 2009 IECC (≤ 0.35) allows for trade-offs
 - A majority of currently qualified products can qualify
 - Low, moderate and high SHGC can all qualify

Phase 1, ES5



Phase 1: ES5

U-factor	SHGC
($\geq X$ and ≤ 0.55)	X
0.35	0.40
0.34	0.35
0.33	0.30
0.32	0.25
0.31	0.20
0.30	0.15
0.29	0.10
0.28	0.05
0.27	0.00
0.26	0.00
0.25	0.00
0.24	0.00
0.23	0.00
0.22	0.00
0.21	0.00
0.20	0.00
0.19	0.00
0.18	0.00
0.17	0.00
0.16	0.00
0.15	0.00



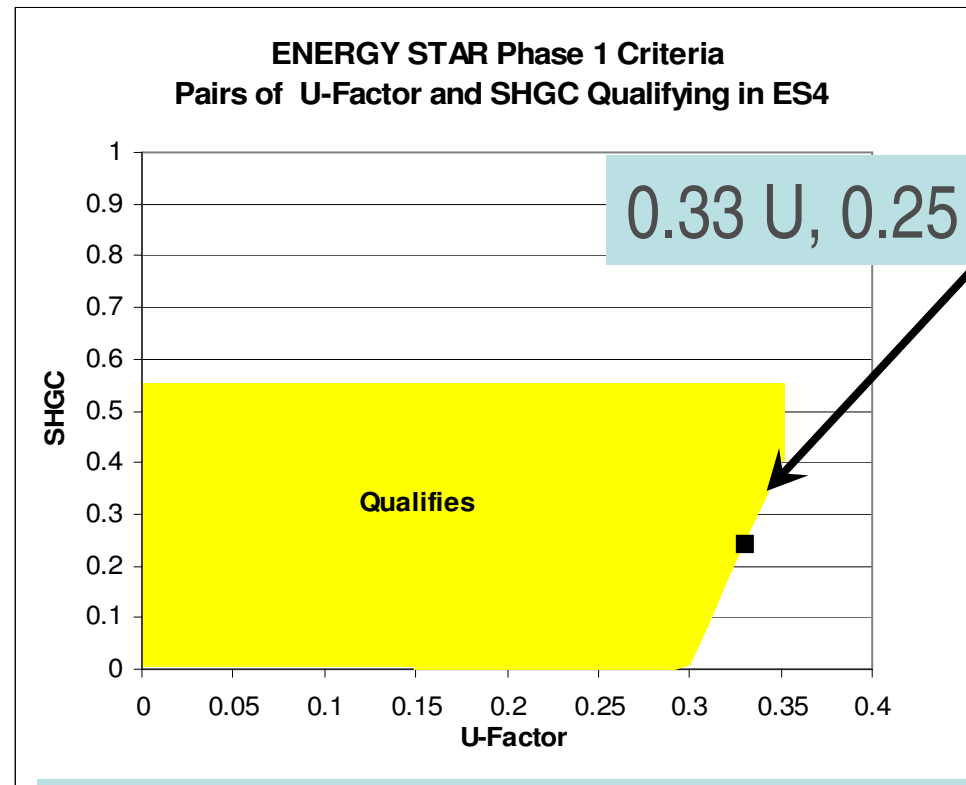
Trade-off $-0.01 U = +0.05 SHGC$

Phase 1, ES4



Phase 1: ES4

U-factor	SHGC ($\geq X$ and < 0.55)
	X
0.35	0.41
0.34	0.33
0.33	0.25
0.32	0.17
0.31	0.09
0.30	0.01
0.29	0.00
0.28	0.00
0.27	0.00
0.26	0.00
0.25	0.00
0.24	0.00
0.23	0.00
0.22	0.00
0.21	0.00
0.20	0.00
0.19	0.00
0.18	0.00
0.17	0.00
0.16	0.00
0.15	0.00



Trade-off -0.01 U = +0.08 SHGC

Phase 1: ES3 and ES2



- No trade-offs
 - ES3: SHGC impact neutral
 - ES2: wide range of climates in ES2, cannot create simple rule
- Set U-factor at ≤ 0.33 / ≤ 0.35
 - More stringent than Proposed 2009 IECC
 - A majority of currently qualified products still qualify
- Set SHGC at ≤ 0.40 / ≤ 0.30
 - ES3: to minimize peak demand and ensure solar control where beneficial but allow some solar gain for those who want it
 - ES2: lowering SHGC benefits some sub-regions harms others

Phase 1: ES1



- No trade-offs
 - Due to tightening of code U-factor
- Set U-factor ≤ 0.50
 - Proposed 2009 IECC code level
 - Will reevaluate after IECC Final Status hearings
 - Half of currently qualified products still qualify
- Set SHGC at ≤ 0.25
 - To deliver cooling energy savings

Phase 1: Major Market Impacts



- Modest decline in ENERGY STAR market share
- Greater use of argon gas
- Higher-performance glass packages
- Ready availability of moderate- and high-solar gain products
- No qualifying continuous aluminum frame windows

Agenda



Climate Zone Map

Draft Window Criteria

Draft Phase 1 Criteria

Draft Phase 2 Criteria

IGU Certification Requirement

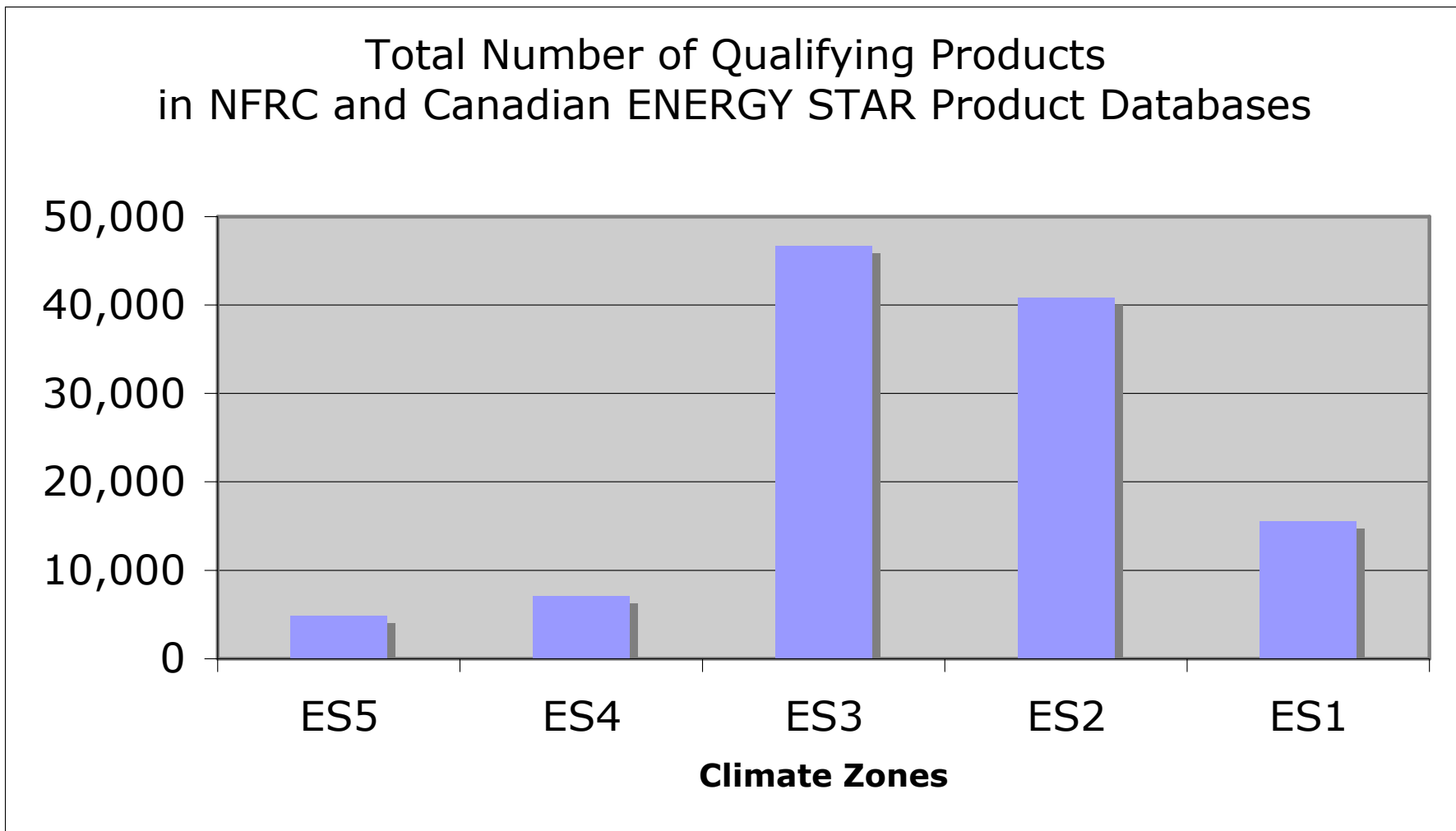
Impact Products and Dynamic
Glazings

Phase 2 Draft ENERGY STAR Criteria Windows and Sliding Glass Doors



Climate Zone	Proposed 2009 IECC Levels		Draft Phase 2 Criteria		
	U-Factor	SHGC	U-Factor	SHGC	Energy Performance
ES5	≤ 0.35	NR	-	-	See Slide 26
ES4	≤ 0.35	NR	-	-	See Slide 27
ES3	≤ 0.35	NR	≤ 0.30	≤ 0.40	-
ES2	≤ 0.40	≤ 0.30	≤ 0.30	≤ 0.30	-
ES1	≤ 0.50	≤ 0.30	≤ 0.45	≤ 0.20	-

Phase 2: Technological Feasibility



Phase 2: Cost-Effectiveness



Climate Zone	Marginal Cost	Simple Payback (years)
ES5	15%	7 to 9
ES4	15%	7 to 12
ES3	5%	9 to 12
ES2	5%	4 to 5
ES1	5%	2 to 4

Phase 2: ES5 and ES4



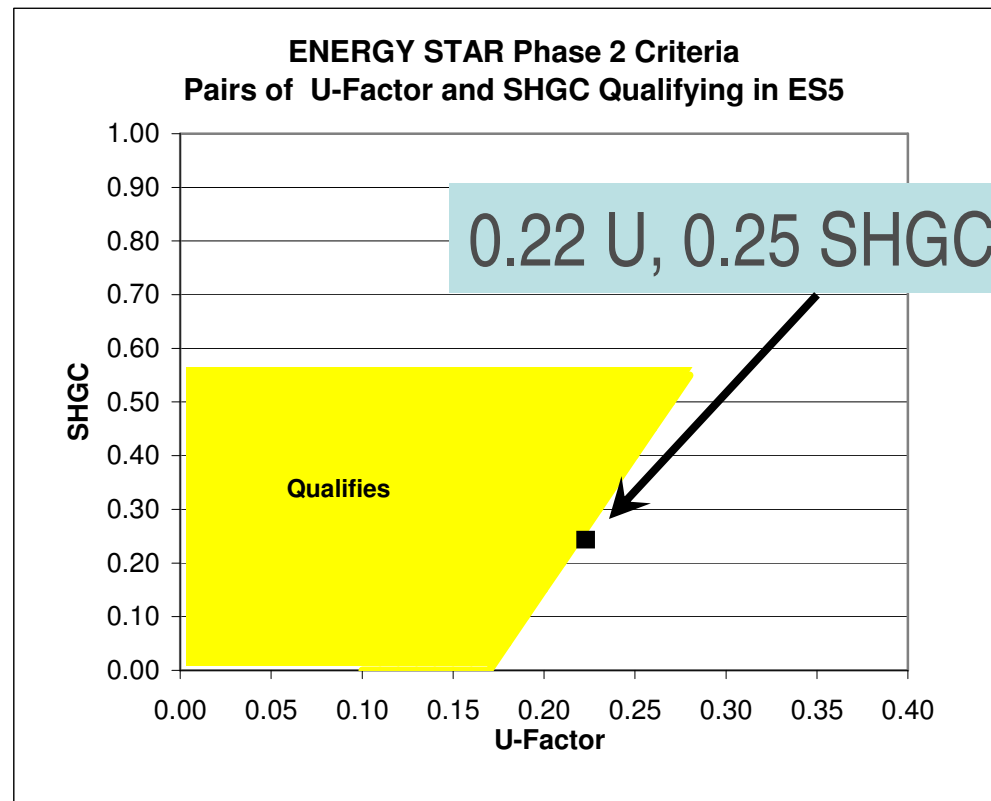
- Set criteria relative to aggregate energy performance
 - Energy savings analysis showed that various combinations of U-factor and SHGC deliver equivalent energy consumption and savings
 - 2009 IECC (≤ 0.35) allows for trade-offs, IECC 2012 likely to as well
 - Products exist that meet criteria using current technology and argon gas
 - Low, moderate and high SHGC can all qualify

Phase 2, ES5



Phase 2: ES5

U-factor	SHGC (≥X and ≤ 0.55)
	X
0.28	0.55
0.27	0.50
0.26	0.45
0.25	0.40
0.24	0.35
0.23	0.30
0.22	0.25
0.21	0.20
0.20	0.15
0.19	0.10
0.18	0.05
0.17	0.00
0.16	0.00
0.15	0.00
0.14	0.00
0.13	0.00
0.12	0.00
0.11	0.00
0.10	0.00



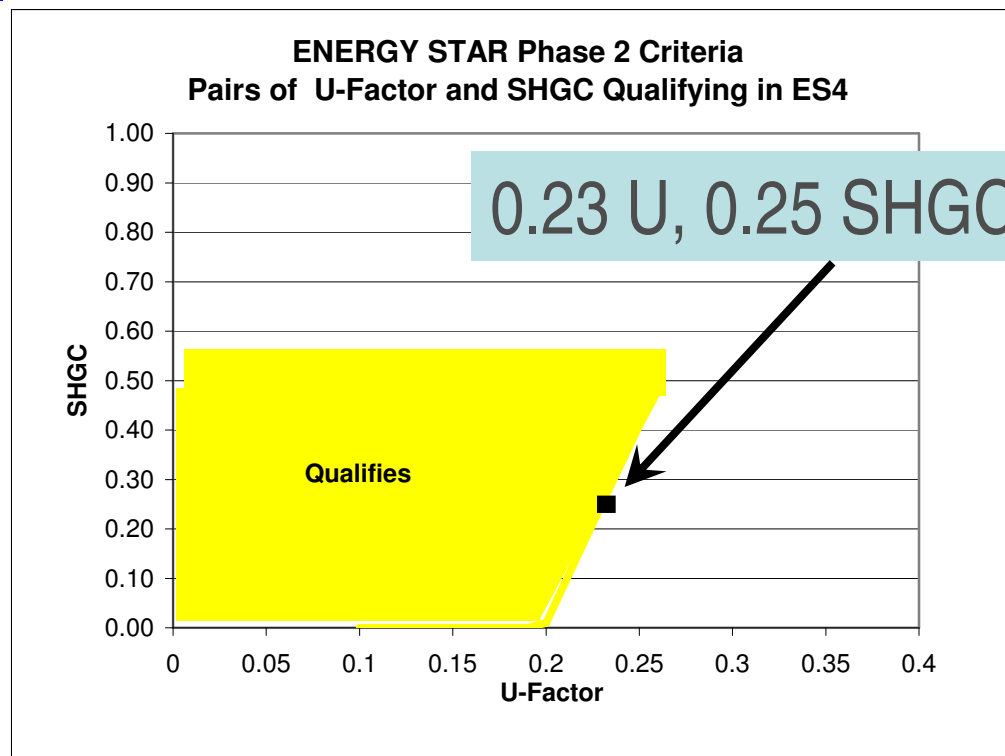
Trade-off -0.01 U = +0.05 SHGC

Phase 2, ES4



Phase 2: ES4

U-factor	SHGC $\geq X$ and ≤ 0.55
0.26	0.49
0.25	0.41
0.24	0.33
0.23	0.25
0.22	0.17
0.21	0.09
0.20	0.01
0.19	0.00
0.18	0.00
0.17	0.00
0.16	0.00
0.15	0.00
0.14	0.00
0.13	0.00
0.12	0.00
0.11	0.00
0.10	0.00



Trade-off $-0.01 U = +0.08 SHGC$

Phase 2: Technological Feasibility in ES5 and ES4



Climate Zone	ES4	ES5
Total Number of Products Qualifying	7,055	4,824
Qualifying Krypton Fills and Quad-Pane	-5,585	-4,244
Total Number of Products Qualifying	1,470	580
Total Number of Unique* Windows	57	46
Total Number of Manufacturers	37	29
*Unique windows are separate models, differentiated by more than simple glass or grid options.		

Phase 2: Technological Feasibility – ES5 and ES4



Component	Predominant Design
Frame	Vinyl /Insulated Vinyl (also Wood, Fiberglass, Other)
Lites	3
Low-e coated surfaces	1
Gas fill	Argon
Spacer	Steel/Foam/ Thermoplastic/Aluminum
Gap width	
Median	0.34 (ES4), 0.37 (ES5)
Range	0.26–0.60 (ES4) 0.25–0.60 (ES5)

Phase 2: ES3 and ES2



- No trade-offs
 - ES3: SHGC impact neutral
 - ES2: wide range of climates in ES2, cannot create simple rule
- Set U at ≤ 0.30
 - Same as Phase 1 ES5a
- SHGC kept at ≤ 0.40 / ≤ 0.30
 - ES3: to minimize peak demand and ensure solar control where beneficial but allow some solar gain for those who want it
 - ES2: lowering SHGC benefits some sub-regions harms others

Phase 2: ES1



- No trade-offs
 - Due to low minimum SHGC
- Set U-factor at 0.45
 - Thermally broken windows that can meet 0.50 can also meet 0.45
 - Will reevaluate after IECC Final Status hearings
- Set SHGC at 0.20
 - To deliver greater cooling energy savings
- Technologically feasible
 - Products exist
 - Can re-qualify by swapping in new glass

Phase 2: Major Market Impacts



- Reestablishment of ENERGY STAR as differentiator
 - Price premium for ENERGY STAR
 - Decline in ENERGY STAR market share
- Increase in aggregate window performance
- Product redesign necessary for ES5 and ES4
- Distinct products necessary for North and South
- Ready availability of moderate- and high-solar gain products

Agenda



Climate Zone Map

Draft Window Criteria

Draft Phase 1 Criteria

Draft Phase 2 Criteria

IGU Certification Requirement

Impact Products and Dynamic
Glazings

IGU Certification



- See handout

Impact Products and Dynamic Glazings



- DOE is delaying action until primary criteria are set
- DOE will evaluate:
 - The necessity of setting separate criteria for impact products. Only possible with adequate data
 - The feasibility of developing equivalent performance criteria for dynamic glazings



Next Up:

LBNL and D&R presentation of window energy savings analysis