“SUPER T8’s”

So Many Lights:Too Many Options

Transforming the Market

“Sardo”

ROBERT SARDINSKY, LC

Rising Sun

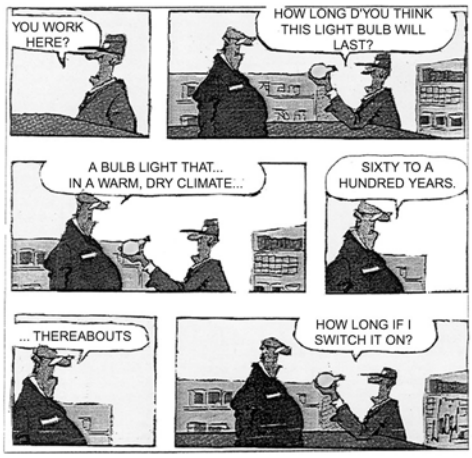
Basalt, Colorado

Technology is Relatively Simple

Black Box - White Tube

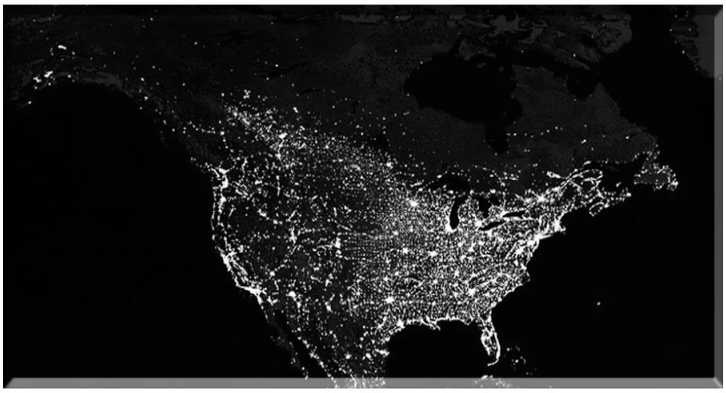
The Marketplace is Not!

Be Clear What You Are Asking For…



NIGHT TIME VIEW U.S. LIGHTING FLEET

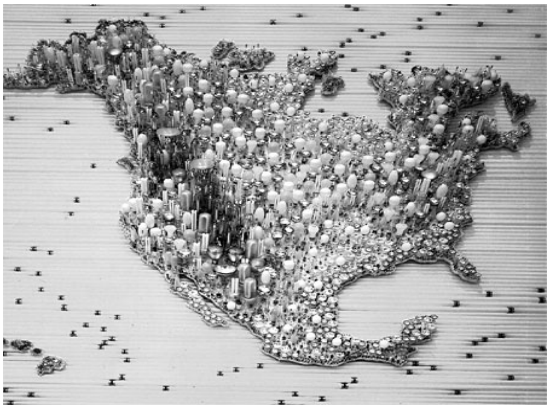
Who Is Paying To Power All Those Lights:



Commercial 51%, Industrial 14%, Residential 27%, and Outdoor 8%

PS. If you can see it from outer space, it's wasted energy!

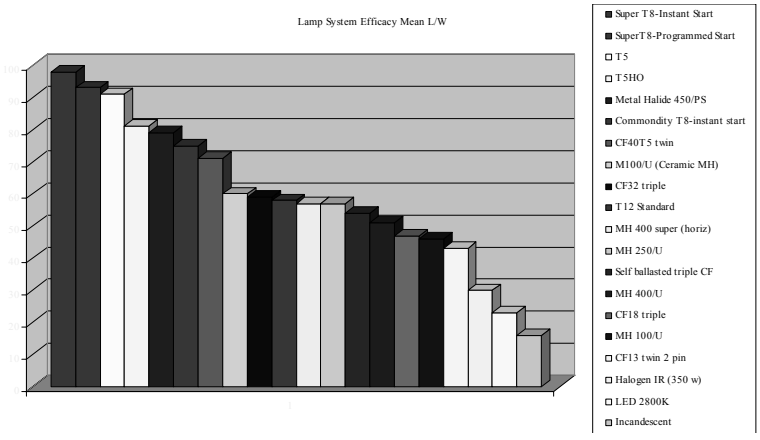
DAYTIME VIEW U.S LIGHTING FLEET
Sea of 2.5 Billion Fluorescents
Amidst 4.4 B Incandescents + 105 M HID



Average Light Source only delivers 18 L/W Residential, 55 L/W Commercial and 75L/W Industrial

With Super T8 Fluorescents Can Leapfrog:
T12 ES @ 54 L/W >Commodity T8 @ 75 L/W >

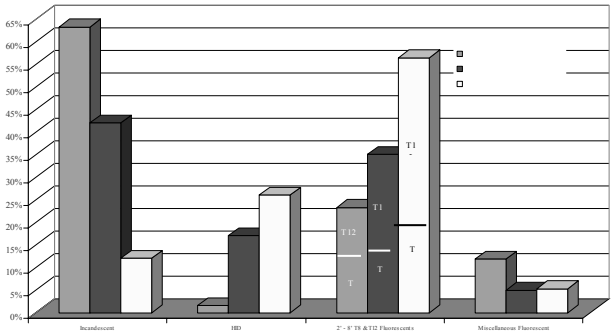
Super T8 @ 98 L/W



` ~1.6 Billion Fluorescent candidates plus ~25 Million HID Low Bay prospects (100W – 250W MH @45-57 L/W)

What's The Big Deal?

Full size fluorescents (2' – 8') = 1:4 US light sockets
Consume 35% total US lighting Energy
Generate > 50% total light



Source: Rising Sun Enterprises, Inc.; Lighting Market Characterization Study

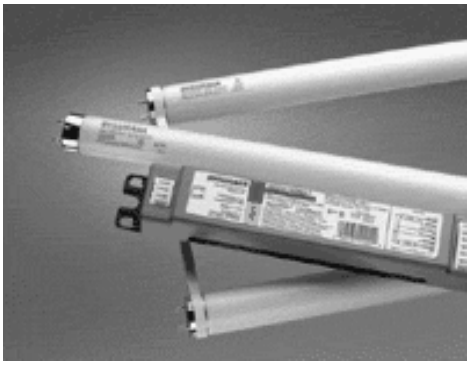
Most common lamp found in C&I sectors = 77% and 93% respectively

Super T8's Represent The Greatest Energy Saving Lighting Opportunity for C&I!

Technical Potential Exists to Save
~15% of all US lighting electricity
= ~3% of total US electricity use, plus indirect cooling savings

WHAT'S A"SUPER T8"?

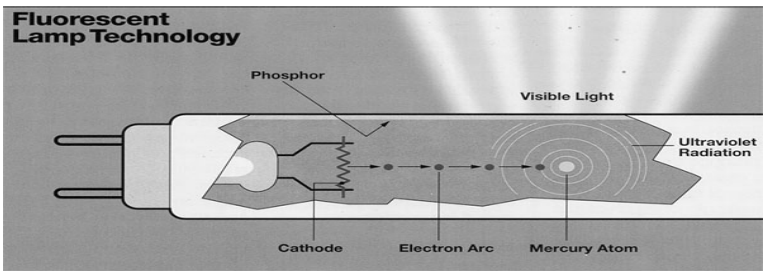
Evolving Family of High Performance Fluorescent Lamps AND Electronic Ballasts > L/W Than All Other Light Sources



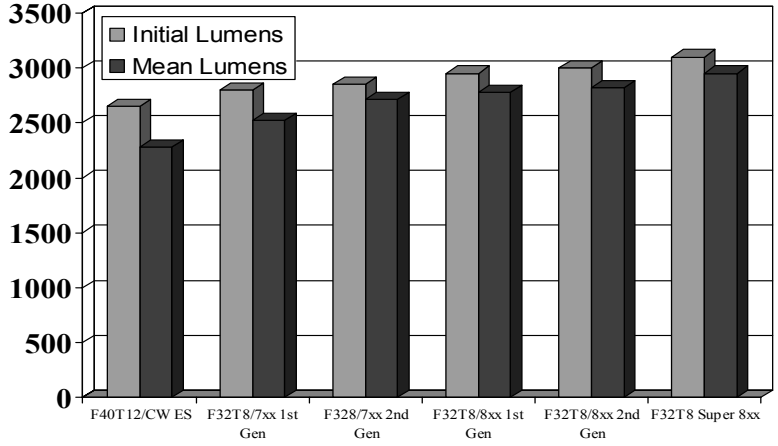
Look the same on the outside as Standard T8's, but……

Inside Super T8 Lamps:

- ⊕ Enhanced Rare Earth Phosphors > light output and maint.
- ⊕ Improved Gas Fill compositions >light output and lamp life
- ⊕ More robust cathodes >lamp life
- ⊕ Barrier Coatings Reflect more U.V. photons back into the phosphors and keep Mercury from being bound up

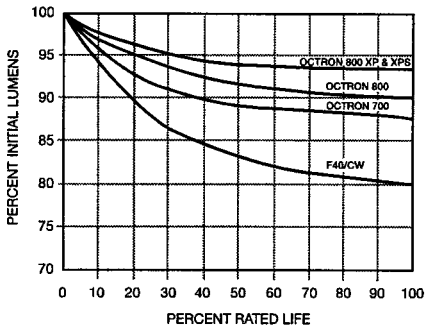


WHAT'S SO SUPER: 5 Generations of 4' 32-Watt Lamps Available Today >Light + > Lumen Maintenance ~same Watts



WHY MEAN LUMENS ARE SO IMPORTANT

Lumen Maintenance
OCTRON XP, OCTRON XPS, OCTRON & F40/CW



Its All Downhill After the First Day

Working Definition For 4' "Super T8" Lamp (1:5 U.S. light sockets)

32 watt lamp
3,100+ initial lumens,
95% lumen maint. at 8,000 hrs
82+ CRI
Extended lamp life
0 degree starting
Will operate on any ballast –I,S., R.S., P.S., Dimming

Note: 2', 3', U Bent Super T8's now available,
8' in the works

Super T8 Lamp Offerings

> Mean Lumens + Longer Life

Brand/trade name	Mean lumens @ 8000	CRI	Rated lamp life (hours)			
			3 Hrs/Start Instant-Start Ballast	3 Hrs/Start Programmed Start Ballast	12 Hr/Start Instant Start Ballast	12 Hr/Start Programmed Start Ballast
GE Extra-Life, Starcoat Phosphor, High Lumen ECO F32T8/XL/SPX835/HL/ECO	2,915	82	24,000	24,000	29,000	29,000
Philips Advantage High-Vision ALTO F32T8/ADV/835/ALTO	2,950	86	24,000	30,000	30,000	36,000
Sylvania Xtreme XPS EcoLogic FO32/835/XPS/ECO	2,945	85	15,000	30,000 (On PSX ballast)	24,000	34000 (On PSX ballast)

Where do "Energy Saver" T8's Fit In? The Good, Bad, and Confusing

- ⊕ Two families of "Energy Saver" 4' F30T8 (30 watt) and F28T8 (28 watt) lamps on the market!
- ⊕ Fit in same socket as F32T8
- ⊕ Shave ~ proportionately more watts than 32 watt T8
- ⊕ Lamps operate almost as efficient as Super T8 -- delivering 89-92 Mean L/W on Super T8 ballast
- ⊕ Offered in 70 and 80 CRI series options.

But Energy Saver T8 Lamps…..

- ⊕ Finicky: Min 60F Starting, no drafts, iffy on some low B.F. ballasts, some require I.S. ballasts, others require brand/series specific ballast, no dimming
- ⊕ Strategic issue: use the lamp or ballast factor to fine tune light levels and energy savings (ave. lamp service life 5 yrs Vs. ballast life 15+)?
- ⊕ Practical issue: how do you minimize snap back? (from 30 watt and 28 watt back to 32 watt)
- ⊕ ES lamps confuse the marketplace, but may represent best energy saving strategy in some applications. With ES additions, now have 3 families of 4' T8's w/9 iterations between them…….

GE Lighting

ULTRAMAX ELECTRONIC BALLAST

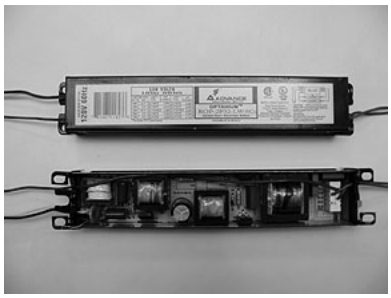
System Wattage Comparison

Starting	Power	# Lamps	GE UltraMax Ballasts			UltraMax T8 Systems: Input Watts			T8 System Watts	T12 System Watts
			Product Code	Description	Input Voltage	F32T8	F32T8/WM	F28T8	Std. Elec. Ballast & F32T8	Magnetic Ballast & F34T12
Instant Start	Low Power	1	49706	GE-132-MAX-L/Ultra	Multi- 120	25	24	22	31	39
					Multi- 277	25	24	22	31	39
		2	49707	GE-232-MAX-L/Ultra	Multi- 120	48	46	44	51	74
					Multi- 277	48	46	44	51	74
		3	49708	GE-332-MAX-L/Ultra	Multi- 120	73	69	65	77	117
					Multi- 277	72	68	65	77	117
		4	49709	GE-432-MAX-L/Ultra	Multi- 120	97	92	87	100	148
					Multi- 277	96	91	86	100	148
	Standard	1	49771	GE-132-MAX-N/Ultra	Multi- 120	28	27	25	30	39
					Multi- 277	28	27	25	32	39
		2	49772	GE-232-MAX-N/Ultra	Multi- 120	54	53	49	58	74
					Multi- 277	53	52	48	58	74
		3	49773	GE-332-MAX-N/Ultra	Multi- 120	82	78	72	87	117
					Multi- 277	80	77	71	87	117
		4	49774	GE-432-MAX-N/Ultra	Multi- 120	109	105	98	114	148
					Multi- 277	107	103	96	114	148
	High	2	49775	GE-232-MAX-H/Ultra	Multi- 120	74	71	66	76	74
					Multi- 277	73	70	65	76	74
		3	49776	GE-332-MAX-H/Ultra	Multi- 120	111	106	97	113	117
					Multi- 277	109	104	96	113	117
		4	49777	GE-432-MAX-H/Ultra	Multi- 120	150	145	133	N/A	148
					Multi- 277	147	141	131	N/A	148

Rising Sun Enterprises, Inc.

Inside Super T8 Ballasts:

Improved Magnetic Components > efficiecy
Smarter Circuitry > efficiency
Better Topology > efficiency
Optional Soft Starting Mode > lamp life



Rising Sun Enterprises, Inc.

Super T8 Ballasts

Two Families: Instant Start and Programmed Rapid Start

INSTANT START

Highest Efficiency

Up to 98 L/W

Parallel lamp operation

Simplest Wiring

85+% Market Share

Least expensive

Industry Workhorse

Super T8 Ballasts

Programmed Rapid Start

Extend lamp life, esp. in shorter duty cycle

Next gen. R.S. + Program Start

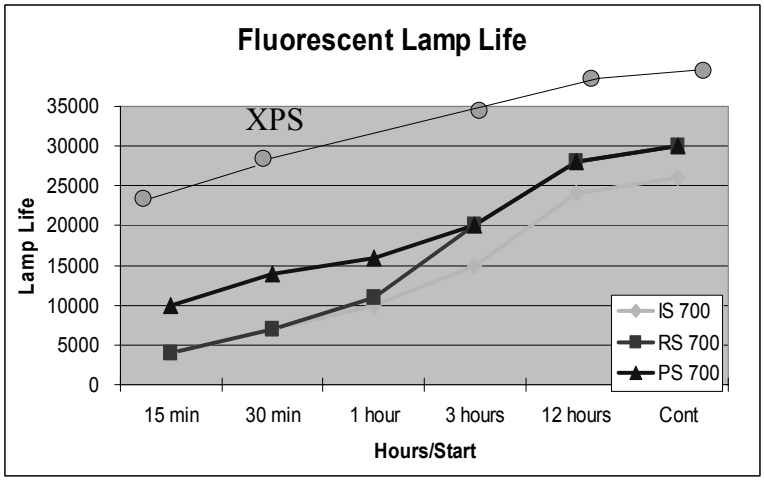
Soft Starting reduces filament sputtering

Cathode Heating and Series Wiring draws ~2W/Lamp

High 80-low 90's L/W w/Super T8 L

10 – 15% Market Potential?

Impact of I.S. Vs. P.S. Ballast Circuitry On Lamp Life:
Extended lamp life –100,000 starting cycles– Vs. energy costs up to 2-W/lamp



SUPER T8 ELECTRONIC BALLAST GAINS

(Independent of Super T8 Lamp Gains)

	Lamp + Ballast System Watts @ .88 Ballast Factor				% Improvement Over Standard Electronic IS
Qty 32 Watt Lamps / Ballast	Energy Saver T12 Magnetic Ballast	Standard Rapid Start / Super T8 Programmed Rapid Start Electronic	Standard T8 Instant Start Electronic	Super T8 Instant Start Electronic	Super T8 Instant Start Electronic
2	72	62/60	**58**	**55**	**5.45%**
3	108	91/88	**85**	**82.5**	**3%**
4	144	118/116	**112**	**107.5**	**4.2%**

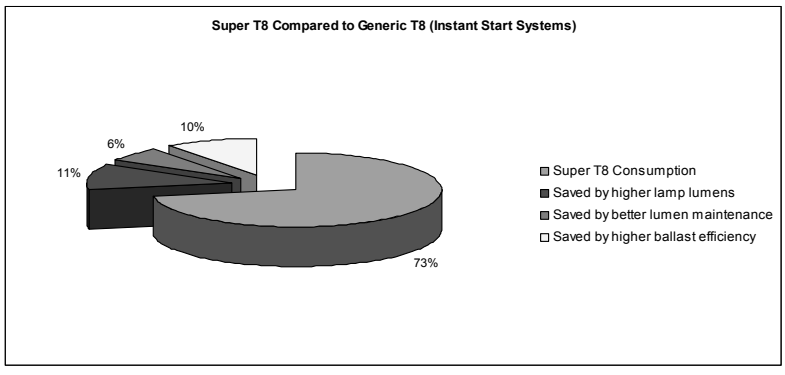
Raises ballast efficiency from mid 80's to low 90's –academic, won't find this published and doesn't account for real world performance given differences in ballast factor.

SUPER T8 4' 2 Lamp/Ballast System Comparison

Mean Lumens / Watt

Lamp / Ballast	Mean Lumens / Watt	% System L/W Gain Over T12 Prehistoric System	% System L/W Gain Over 700 Series Base System	% System L/W Gain Over Spec 800 Series Base System
"Prehistoric" ES T12/ MB	54			
Commodity T8 7xx / ST EB	75	39%		
Spec T8 8xx / ST EB	85	57%	13%	
Premium T8 8xx /ST EB	87	61%	15%	2%
Super T8 / High Efficiency Programmed Rapid Start EB	92	70%	23%	8%
Super T8 / IS High Efficiency EB	**98**	**81%**	**31%**	**15%**

Where's The Savings Over Standard T8's?



Key To Levering Super T8 Lamp and Ballast Efficiency Gains: Optimize "Ballast Factor"

(Super T8 Lamps > Light Output, So Either Under Drive Them or Reduce Lamp Count)

"L -Low, N-Normal, H-High" B.F. or Light Output

Use to Fine Tune Lighting Levels

Use Minimize Lamp, Ballast, and Fixture Counts

Use to Tweak Power Density

How does it work?

"Ballast Factor" for any given ballast = ratio of lamp lumens produced by lamp(s) operated on that ballast to the rated lamp lumens on a reference ballast

2 Lamp Electronic Ballast	Ballast Factor (% Lt. Output)	Mean Lumens 2 Lamps	System Lumens
Super T8 Programmed Start Low Light Output	0.71	5890	**4182**
Super T8 Instant Start Low Light Output	0.78	5890	**4594**
Super Instant T8 Start Normal Light Output	0.88	5890	**5183**
Super T8 Instant Start High Light Output	1.15	5890	**6774**

@2945 Mean Lumen/Lamp

To Compare The Relative Efficiency of Different Ballasts (Indep. Of Lamps): BEF

- **"BALLAST EFFICACY FACTOR"**
  BEF =(Ballast Factor / Ballast Input Watts) X 100
- **Can Only Compare Ballasts Driving The Same Number of Lamps and Same Lamp Type; normalizes for differences in ballast factor.**
- **BEF also affected by starting circuitry (RS, IS., PS), operating voltage 120V or 277V, and whether dedicated input voltage or universal input**

BALLAST EFFICACY FACTOR EX.

> Number the Better, But Only Relative To Same Lamp Type + Count

LAMP	SUPER BALLAST	BALLAST FACTOR/	INPUT WATTS @120V	X100	**BEF**
(1) F32T8	Instant Start Univ. Volt	0.87	28	100	**3.11**
(2) F32T8	Instant Start Univ. Volt	0.87	54	100	**1.61**
(3) F32T8	Instant Start Univ. Volt	0.87	82	100	**1.06**
(4) F32T8	Instant Start Univ. Volt	0.87	109	100	**0.80**

Not Intuitive

What BEF Qualifies As "Super T8" In Debate. It Depends On How High You Raise The Efficiency Bar

Ballast Type	1 Lamp	2 Lamp	3 Lamp	4 Lamp
Instant Start	3.11	1.60	1.06	0.80
Instant Start LP	3.08	1.63	1.07	0.82
Programmed Start LP	2.84	1.48	0.99	0.76

National Grid "High Road" BEF Criteria
(REV 11)

CURRENT SUPER T8 ELECTRONIC BALLAST OFFERINGS
5 Main Players

Brand/trade name	I.S.	P.S.	Number of lamps	Low ballast factor	Normal ballast factor	High ballast factor	Input Voltage
Advance /Optanium	X		2, 3, 4	0.78	0.88		120V, 277V
Advance /Optanium		X	2		0.88		108V - 305V
GE /Ultramax	X		1, 2, 3, 4	0.77	0.87	1.15	108V - 305V
Howard Industries/HEX	X		1, 2, 3, 4	0.75	0.87		120V, 277V
Sylvania/ ProStart PSX (.71 B.F.), PSN (.88 B.F.)		X	1, 2, 3, 4	0.71	0.88		108V-305V
Sylvania Quicktronic High Efficiency	X						
Universal / ULTim8 EL (.77 B.F.), HE (.87 B.F.)	X		2, 3, 4	0.77	0.87	1.18 4L-277V	120V, 277V, 108V-305V

To Maximize Ballast Savings:

⊕ Use Instant Start Ballast

<Programmed Start 6 Mean L/W>

⊕ Use Dedicated Voltage Input Ballast (Universal input Reduces inventory req. + simplifies implementation but)

<Universal Input .5 – 1 W per lamp>

⊕ Operate at 277 V Where Possible

<120V 1 – 3 watt per ballast>

⊕ Optimize Ballast Factor Given High Lumen Super T8 Lamps and The Desired Light Levels

.71 –1.15 BF Options

PUTTING IT ALL TOGETHER

LAMP	MEAN LUMENS	2 LAMP BALLAST	B.F. %	SYSTEM MEAN LUMENS	INPUT WATTS @ 277V	L/W
34W F40T12 CW ES	**2279**	**RS Energy Saver Magnetic**	**0.87**	**3950**	**72**	**55**
F32/700 2ND Gen	**2710**	**IS Commodity Electronic NBF**	**0.87**	**4700**	**58**	**81**
F32/800 1ST Gen	2774	IS Commodity Electronic NBF	0.87	4800	58	83
F32T8/800 Super	2945	IS Super T8 Electronic NBF	0.87	5100	53	97
F32T8/800 Super	**2945**	**IS Super T8 Electronic LBF**	**0.77**	**4550**	**47**	**96**
F28T8/800	2585	IS Super T8 Electronic LBF	0.77	4000	44	90

What Do Super T8's Cost?

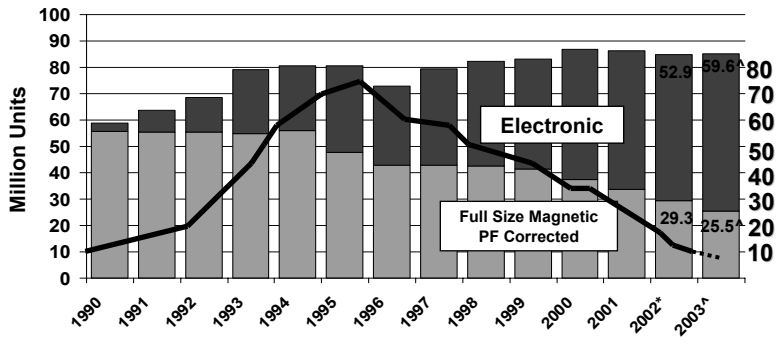
Aggressive Pricing In a Competitive Marketplace (National Grid's Buyer's Alliance Pricing)

T8 Lamp	End User Cost	% Premium
Commod F32T8/7xx gen 2	~$1.30	Base
Spec F32T8/8xx gen 3	~$1.70	31%
Prem F32T8/8xx/XP gen 4	~$2.10	62%
Super F32T8/8xx/XPS gen 5	~$2.70	108%

Ballast	End User Cost	% Premium
2-Lamp Commodity Instant Start Electronic	~$10.25	Base
2-Lamp Super T8 Instant Start and Programmed Start	~$11.00 / $15.00	7%-46% G.E. I.S. 0%

What's The Market For Super T8 Ballasts?

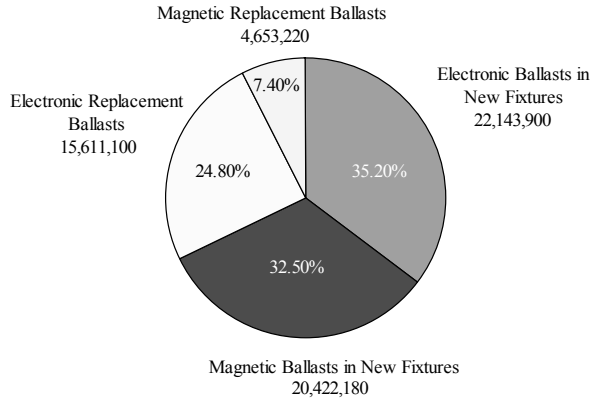
Gross Annual Ballast Sales 85 M



Source: Bureau of Census

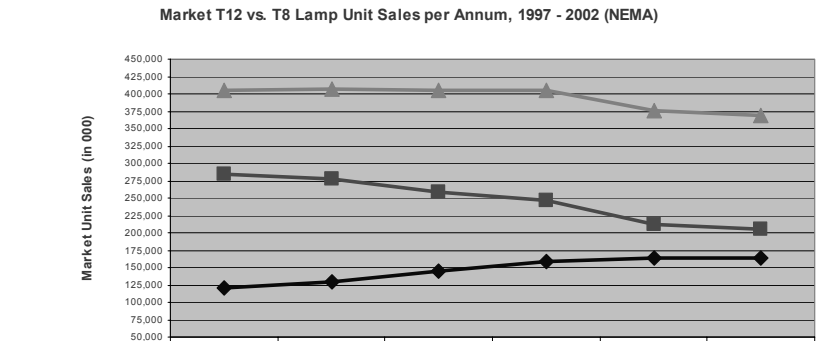
Where are those ballasts going now?

~ Mostly Into New Fixtures



What's The Market for Super T8 Lamps?

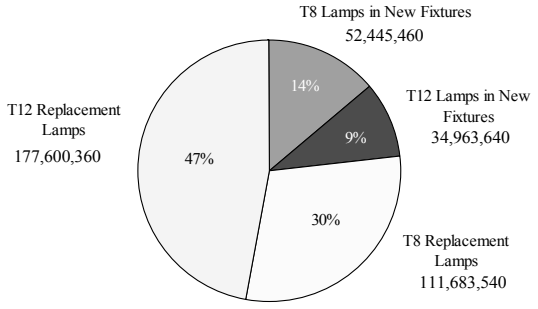
Gross annual lamp sales 375 M



	1997	1998	1999	2000	2001	2002
Bi-pin linear T8 rapid start	120,270	128,933	145,630	158,475	164,129	163,632
Others 4 foot & above (T12)	285,162	277,280	259,159	247,067	212,564	205,998
Total	405,432	406,213	404,789	405,542	376,693	369,630

Where Are Those Lamps Going Now?

Mostly Refills + Retrofits, some New Fixtures



Transforming the Market!

- **Challenge: So Many Lights, Too Many Choices**
- Goal: Leapfrog Technology -- Skip Over Five Generations of "obsolete" fluorescent technology; we are still stuck on 2nd gen T8
- **Is Super T8 Technology Up To It?**
  - **Product offered by all mainstream manufacturers.**
  - **Building on proven technology**
  - **75% of full product family build out in production now**
  - **Most Super T8 lamps and ballasts are special order though; little sitting on distributors or fixture manufacturers shelves**
  - **Still need lower BF ballasts + universally long life lamps**
  - **No incremental labor costs for new fixtures or retrofit**

Transforming the Market!

- **Amongst other things, its going to take:**
- **Education: Most Specifiers, Fixture Manufacturers, Distributors, ESP's, or Contractors are not familiar with "Super T8"**
- **How are we going to get them to understand ML/W + BEF in our lifetime when most still can't distinguish between PF and BF, CRI and K, or I.L. and M.L.?**
- **Need consensus on performance criteria to qualify as Super T8.**
- **Need to be specific about what products qualify as Super T8.**

Transforming the Market!

- **Need to consolidate product offerings, purge at least half of what is on the market; Legislate Vs. Market Forces**
- **The "price is right" now if we consolidate buying power and only support the best products.**
- **Why incentivize anything less than Super T8's; remember we are talking about ave. lamp service lives of 4 years and ballasts at 15 years.**
- **Don't rebate away watts unless they are justified, , ie., use of universal input voltage ballasts and programmed start ballasts**

SUPER T8 Incentive Programs:
Energy Service Providers' First Wave

- ⊕National Grid USA
- ⊕Eugene Water and Electric Board - EWEB
- ⊕Energy Trust of Oregon : PacifiCorp, Portland General Electric
- ⊕Bonneville Power Administration
- ⊕Others?

EWEB
Program

- ⊕ Only Incentivize LBF Super T8
- ⊕ Worked to get local Specifiers On Board
- ⊕ Lever State Purchasing Contract for Municipal Projects
- ⊕ 25% of T8 rebates are for Super T8 projects; offer $5 premium per ballast over $15 standard T8 rebate
- ⊕ Hands-on Involvement with Performance Based Projects

For more information:

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