



Cleanup on Energy Savings on Aisle 7! Saving Energy in Supermarket Design and Operation

Better Buildings Summit

Monday, May 9, 2016

3:35-5:00 PM

Agenda

- 3:35 Welcome & Introductions
- 3:40 Mick Schwedler, ASHRAE
- 4:00 Aaron Daly, Whole Foods Market
- 4:20 Richard Heath, Southeastern Grocers
- 4:40 Group Discussion/Q&A

Today's Presenters



Mick Schwedler

American Society of Heating, Refrigerating, and Air-Conditioning Engineers (ASHRAE)



Aaron Daly

Whole Foods Market



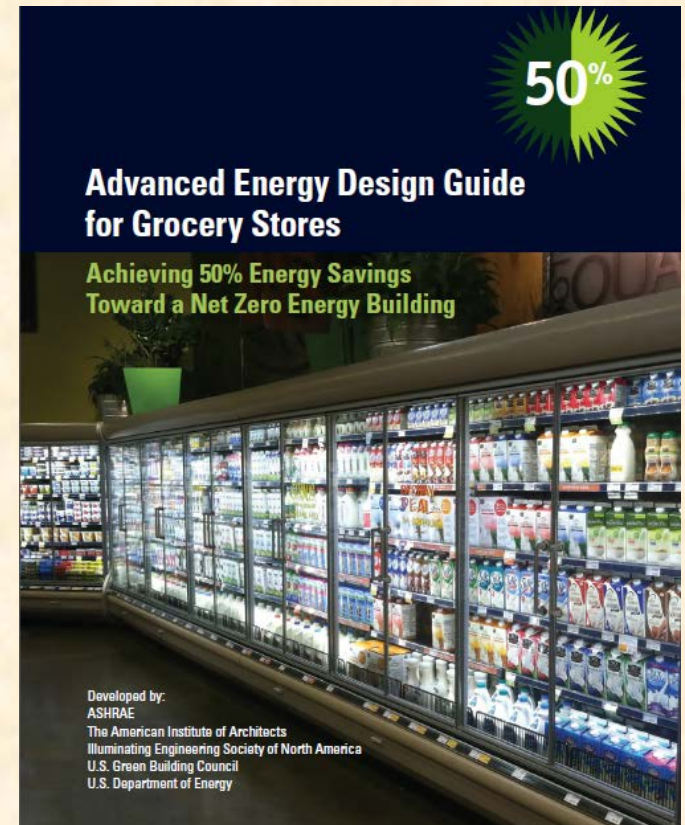
Richard Heath

Southeastern Grocers

**Recommendations for 50% Energy
Reduction in Grocery Stores
Mick Schwedler**

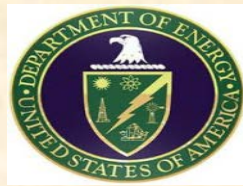
Clean up on Aisle 7: Recommendations for 50% Energy Reduction in Grocery Stores

Mick Schwedler, PE, FASHRAE, LEED AP BD+C
Trane Applications Engineering Manager
AEDG Steering Committee Chair Emeritus



Advance Energy Design Guides (AEDG) Partnership

- ▶ Collaboration of professional organizations and DOE
- ▶ Specialized Project Committee for each guide
- ▶ Oversight is provided via AEDG Steering Committee
- ▶ Backed by DOE's national laboratory leadership, energy simulation, technical analysis and support
- ▶ Open peer review and commentary process



AEDG Presents

- ▶ **“A Way Not The Only Way...”** to achieve the desired savings
- ▶ How to use **energy modeling** for design of buildings not amenable to tables
- ▶ A **prescriptive path** by climate zone to achieve desired savings
- ▶ **How-to tips and caveats** for selected energy conservation measures

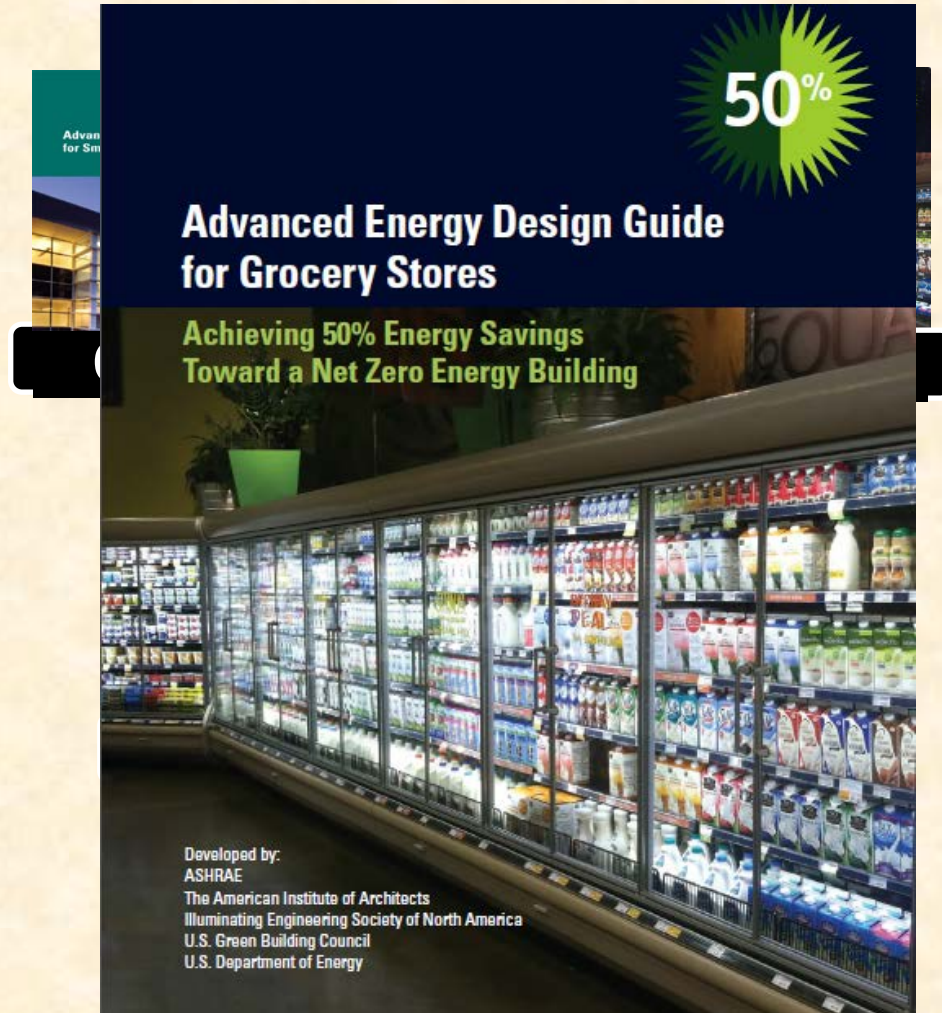
Advanced Energy Design Guides



- ▶ **Six** 50% Guides
- ▶ 100,000+ copies
- ▶ 50% energy savings over 90.1-2004
 - ▶ 50% on the way to zero net energy

Free download at:

www.ashrae.org/freeaedg



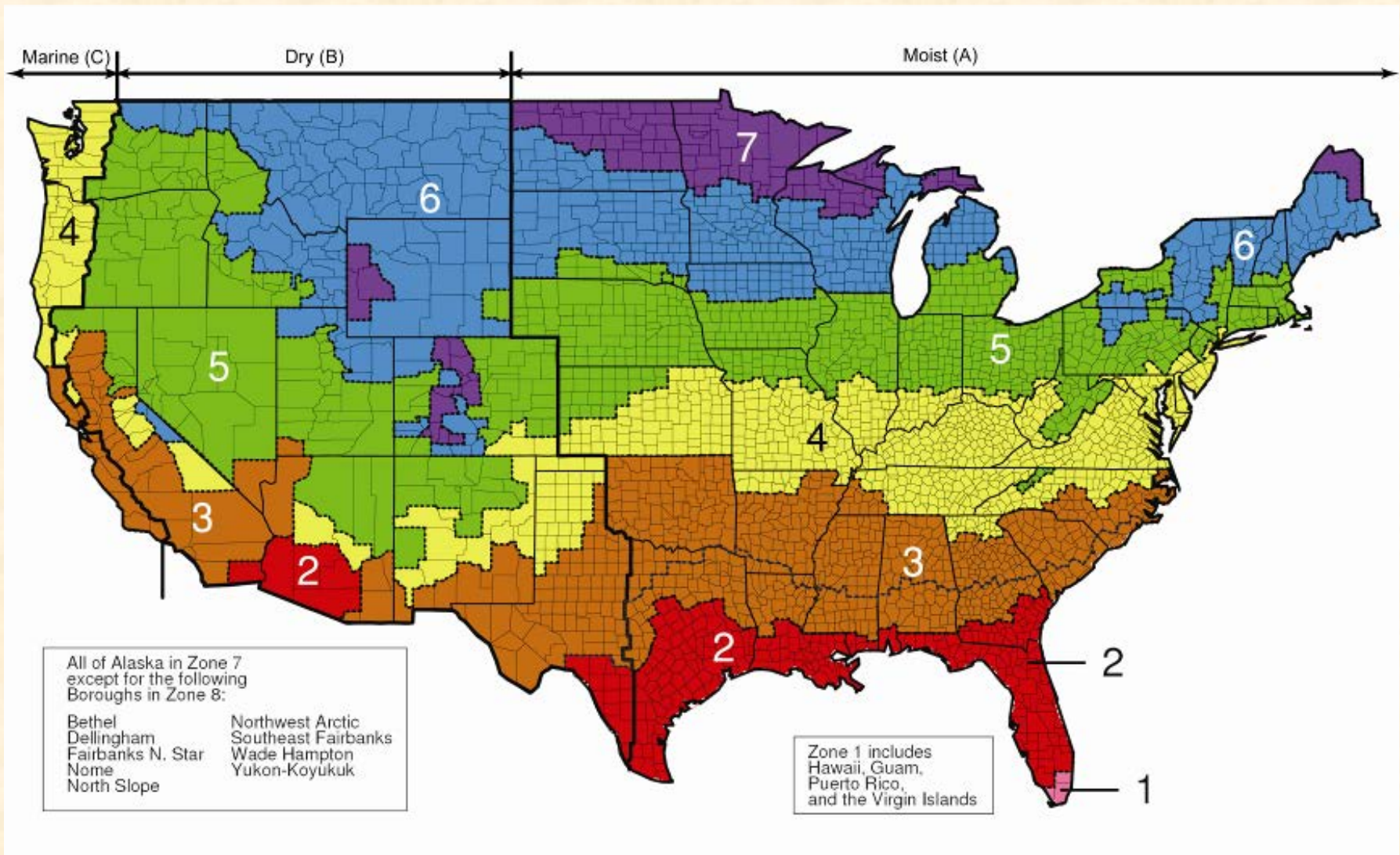
50% Grocery AEDG Project Committee

- **Paul Torcellini**, Chair, National Renewable Energy Laboratory
- **Bernie Bauer**, IES Representative, Integrated Lighting Concepts
- **Aaron Daly**, Member-at-Large, Whole Foods Market
- **Don Fisher**, Member-at-Large, PG&E Food Service Technology Center
- **Michael Lane**, IES Representative, Puget Sound Energy
- **Ken Lowney**, AIA Representative, Lowney Architecture
- **Merle McBride**, ASHRAE Representative, Owens Corning
- **Jim McClendon**, ASHRAE Representative, Walmart Stores, Inc.
- **Daniel Nall**, AIA/USGBC Representative, Syska Hennessy Group
- **Caleb Nelson**, Member-at-Large Refrigeration, CTA
- **Doug Scott**, Member-at-Large Refrigeration, VaCom Technologies
- **Eric Bonnema**, Analysis Support, National Renewable Energy Laboratory
- **Lilas Pratt**, Staff Liaison, ASHRAE

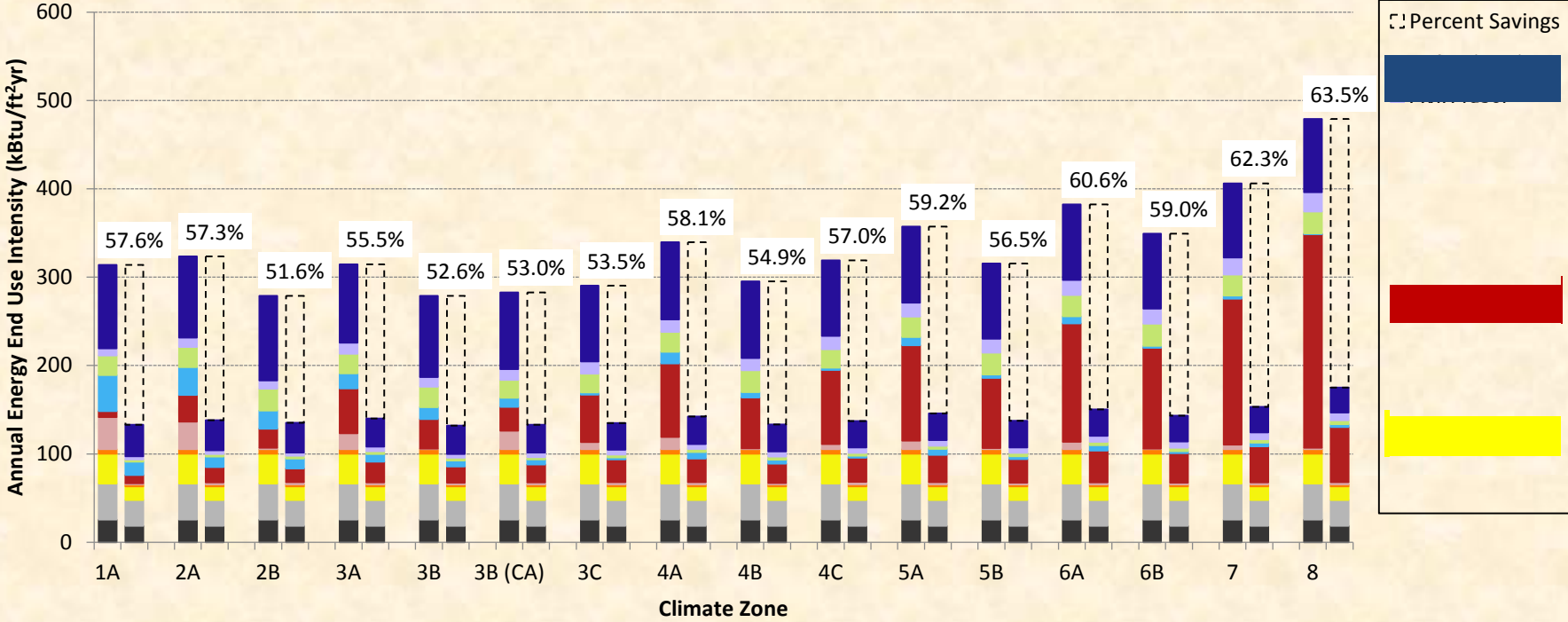
AEDG Table of Contents

- Chapter 1 – Introduction
 - How to use this document
- Chapter 2 – Integrated Design Process
 - How the design process changes in order to achieve 50% energy savings
- Chapter 3 – Design Concepts and Practices
 - Overview of the technical approaches to achieving 50% savings
 - Subsystem integration
- Chapter 4 – Design Strategies and Recommendations by Climate Zone
 - Specific technical requirements to meet the 50% goal
- Chapter 5 – How To Implement Recommendations
 - Specific technical guidance for implementation of recommendations, including technical resources and warnings

Climate Zones



AEDG Savings by Climate Zone



Recommendation Tables

Consider this a menu of energy-saving options

Building Envelope

Kitchen

Lighting/Daylighting

Refrigeration

HVAC

Quality Assurance

Plug Loads

Service Water Heating

Item	Component	Recommendation	How-to Tips
Insulation	entirely above deck	R 30.0 G.I.	1001-20-21

Item	Component	Recommendation	How-to Tips
Kitchen Equipment	Cooking equipment	ENERGY STAR or rating	1011-2-4-6
	Exhaust hoods	Include qualified equipment Topic points or exit walls, larger overheads, rear wall behind appliances, proximity hoods, DCKV	1011-2-3-2
	Condenser sizing	Low temperature = 10°F TD Medium temperature = 15°F TD	1011-2
	Fin spacing	Maximum 10 FPM (including micro channel)	1011

Item	Component	Recommendation	How-to Tips
Heating	Heating efficiency	Indirect gas heat = 80%	1001-4-12
	Cooling efficiency	See 1001-3-10	1001-3-10
	Maximum outdoor static pressure	0.7 in. w.c.	1001-2
	High-efficiency condensing boiler = 90%	Indirect gas heat = 80%	1001-3-12

Item	Component	Recommendation	How-to Tips
Doors	Swinging	U1.0-5.0	
	Nonswinging	U1.0-1.6	
Windows	Nonresidential infiltration—door closed	0.25 cfm/ft ² of door area	
	Automatic/infiltration—door open, track in place	Whether walls for dock, levels track in place	
Air Barrier	Continuous air barrier	Continuous air barrier	
	Thermal transmittance	U1.0-4.2	
View Fenestration—All Climates	SFPGC	8.40	
	VTGSFC	0.7-1.0	
Daylighting or rooftop monitors	Footcandle per Standard 90.1-4	height > 15 ft and area in 2.25	
	Daylight area	0.25% of the total floor area	

Item	Component	Recommendation	How-to Tips
Air-Cooled	Variable speed control with all fans in units	Variable speed control with all fans in units	1001-3-12
	Variable speed control using ambient dry bulb & wet bulb	Variable speed control using ambient dry bulb & wet bulb	1001-3-12
	Variable speed control using ambient wet bulb & plus design TD; additional adjustment for speed of average load	Variable speed control using ambient wet bulb & plus design TD; additional adjustment for speed of average load	1001-3-12
	Variable speed control with all fans in units	Variable speed control with all fans in units	1001-3-12

Item	Component	Recommendation	How-to Tips
Cooling	Heating efficiency	Indirect gas heat = 80%	1001-4-12
	Cooling efficiency	See 1001-3-10	1001-3-10
	Maximum outdoor static pressure	0.7 in. w.c.	1001-2
	High-efficiency condensing boiler = 90%	Indirect gas heat = 80%	1001-3-12

Item	Component	Recommendation	How-to Tips
Control setback method	Variable speed control with all fans in units	Variable speed control with all fans in units	1001-3-12
	Variable speed control using ambient dry bulb & wet bulb	Variable speed control using ambient dry bulb & wet bulb	1001-3-12
	Variable speed control using ambient wet bulb & plus design TD; additional adjustment for speed of average load	Variable speed control using ambient wet bulb & plus design TD; additional adjustment for speed of average load	1001-3-12
	Variable speed control with all fans in units	Variable speed control with all fans in units	1001-3-12

Item	Component	Recommendation	How-to Tips
Distributed MA	Heating efficiency	Indirect gas heat = 80%	1001-4-12
	Cooling efficiency	See 1001-3-10	1001-3-10
	Maximum outdoor static pressure	0.7 in. w.c.	1001-2
	High-efficiency condensing boiler = 90%	Indirect gas heat = 80%	1001-3-12

Item	Component	Recommendation	How-to Tips
Ambient and accent lighting	Stock room LFD = 0.6 W/ft ²	Average of all other LFDs = 0.6 W/ft ²	
	LFD—general = 30; accent = 1.0; interior = 7.5	10 and 15—greater than 2 ft	
Interior Lighting	Light source lamp efficacy (lumen lumens per watt)	Nonresidential = IESNA Lighting Handbook; IESNA Handbook	
	T5 ballasts	Electronic program start	
Lighting controls	Stock room, restrooms = auto sensor	Additional occupancy lighting = store open hours	
	Stock room, restrooms = auto sensor	Additional occupancy lighting = store open hours	

Item	Component	Recommendation	How-to Tips
Suction group/valves	Optimize suction groups based on load & CO2 phase change heat storage	Optimize suction groups based on load & CO2 phase change heat storage	1001-3-12
	Low temperature = low stage or cascade	Low temperature = low stage or cascade	1001-3-12
Compressor group staging and capacity control	Continuously variable capacity control on suction group	Continuously variable capacity control on suction group	1001-3-12
	Suction group "ON" SFC = staging and pressure logic	Suction group "ON" SFC = staging and pressure logic	1001-3-12

Item	Component	Recommendation	How-to Tips
Ducts and Dampers	Exhaust airflow control	Control based on occupancy using time clock or occupancy sensor	1001
	Outdoor air damper	Minimum damper	1001-21
	Duct seal class	Seal Class A	1001-21
	Insulation level	R-6	1001-21

Source: 50% AEDG Grocery Stores from ASHRAE

Recommendation Table Contents

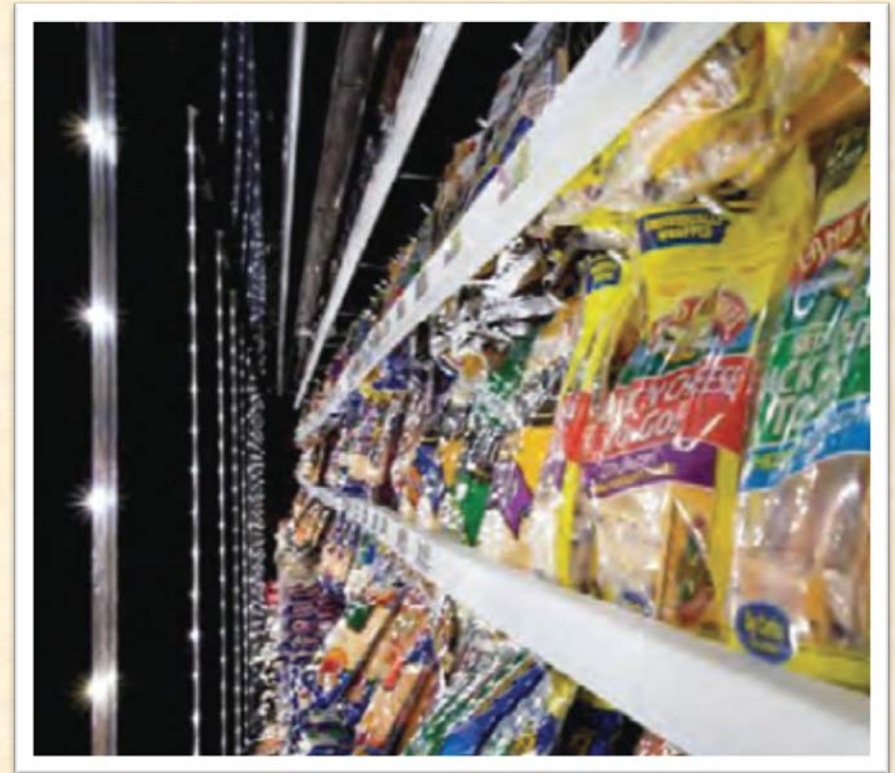
Item	Component	Recommendation	How-to Tips	✓
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- How-to Tips contain
 - Specific recommendations
 - Guidance on good practice for implementation
 - Cautions to avoid known problems

Source: 50% AEDG Grocery Stores from ASHRAE

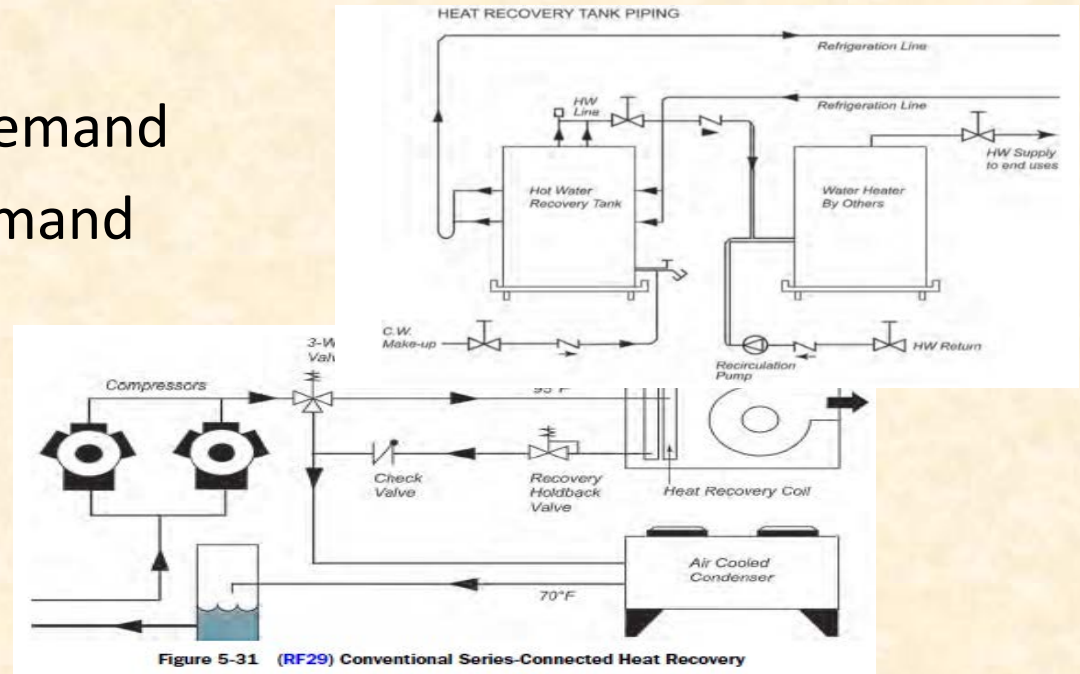
Refrigeration – Energy Reduction

- Reducing Load
 - Reduces compressor size
 - Reduces condenser size
- Examples
 - Insulation
 - Case LEDs
 - Doors on Cases



Refrigeration & HVAC Interactions

- Thermal Comfort
 - Increased heating demand
 - Reduced cooling demand
 - Cold Aisle
- Heat Reclaim
 - Water
 - Air (heat and reheat)



Source: 50% AEDG Grocery Stores from ASHRAE

Refrigeration & HVAC Interactions

- Dehumidification
 - Required store condition:
75°F/55% R.H.
 - Refrigeration COP vs. A/C COP
 - Anti-sweat heater control



Source: 50% AEDG Grocery Stores from ASHRAE

Kitchen Equipment

Climate Zone 4 Recommendation Table for Grocery Stores (Continued)

	Item	Component	Recommendation	How-to Tips	✓
Kitchen	Kitchen Equipment	Cooking equipment	ENERGY STAR or utility rebate-qualified equipment	KE1-2 , 4 , 6	
		Exhaust hoods	Side panels or end walls, larger overhangs, rear seal behind appliances, proximity hoods, DCKV	KE1 , 3 , 5 , 6	

- New technology for AEDGs
 - DCKV (Demand Controlled Kitchen Ventilation)

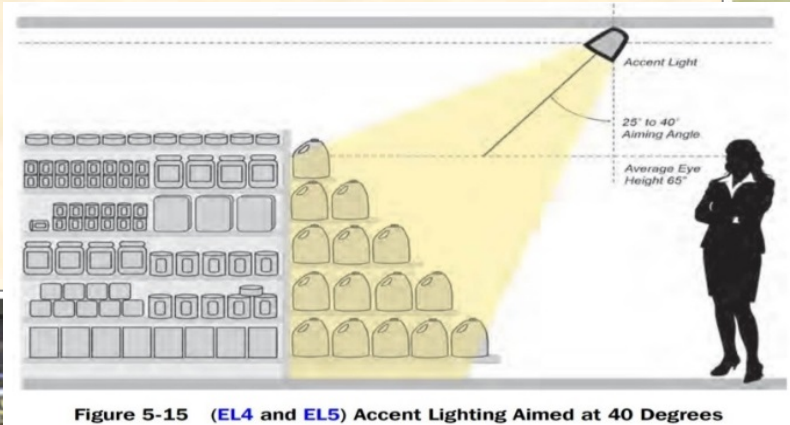


Source: 50% AEDG Grocery Stores from ASHRAE

Lighting Goals

- Support
 - Attracting customers
 - Facilitating merchandise evaluation
 - Enabling completion of the sale
- Lower Lighting Power Densities can be achieved by
 - High efficacy light sources
 - Lighting controls
 - Good design practice

Lighting Design



Use LED task and accent lighting to highlight key merchandise locations or vignettes to “feature display” light levels (three to ten times the general merchandise lighting level in the area of the display). The use of accent lighting to highlight all merchandise does not create the proper contrast ratios and should be avoided.

Source: 50% AEDG Grocery Stores from ASHRAE

Bonus Savings and Renewables How-To Tips

Not required, available for additional savings

- Natural Ventilation
- Thermal Storage
- Cogeneration
- Evaporative Cooling
- Solar Thermal
- Photovoltaics
- Wind Energy



Source: 50% AEDG Grocery Stores from ASHRAE

Case Studies

Refrigeration

- Case doors
- A.S. control
- LED
- EC motors



HVAC

- Desiccant wheel
- Heat Reclaim
- Reduced airflow / Fan savings



Kitchen

- Hood side panels
- DCKV responds to heat/smoke



Source: 50% AEDG Grocery Stores from ASHRAE

50% AEDG for Grocery Stores

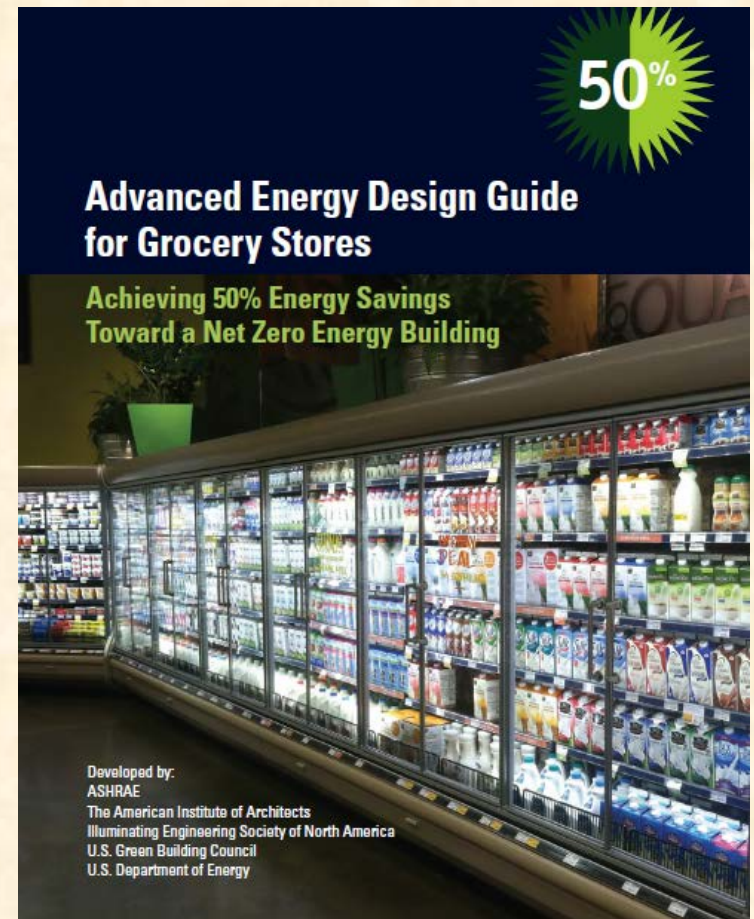
- Developed by AIA, ASHRAE, IES and USGBC and supported by the U.S. DOE
- Grocery store owners committed
- **Practitioners consider the AEDG tables a menu of vetted options for deep energy savings!**
- 50% savings are attainable
- May download for free; www.ashrae.org/freeaedg

Special Acknowledgement

- Michael Lane, Puget Sound Energy
- Daniel Nall, Syska Hennessy Group
- Caleb Nelson, CTA
- Paul Torcellini, NREL

Questions?

www.ashrae.org/freeaedg



Source: 50% AEDG Grocery Stores from ASHRAE

Aaron Daly

Cleanup on Energy Savings on Aisle 7!

Aaron Daly
Global Energy Coordinator



Who We Are

- Multi-Stakeholder Model
- Focus on Food
- Sustainability Commitment
- Distributed Decision-Making

The Whole Foods Market Conscious Business Model:
Stakeholder Interdependence



New Stores

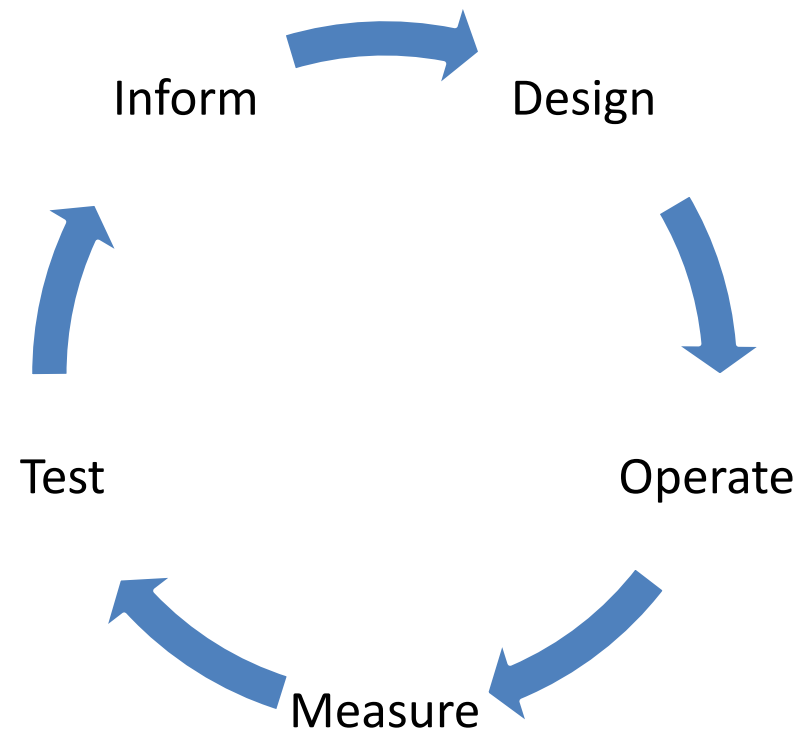
Challenges

- Multiple Stakeholders
- Competing Objectives
- Site/Shell Constraints



Continuous Learning Process

- Iterative Design Improvements Process
- Accounting for...
 - Climate
 - Building Type
 - Functional Needs
 - Technological Change



Case Study: 3rd & 3rd Brooklyn, NY

- Rooftop Power
- Rooftop Farm
- Local Recycled Materials
- Energy Efficient Systems



FROM SUPERFUND TO LEED PLATINUM

Efficient Existing Stores

Challenges

- Existing Equipment
- Maintenance
- Technology Integration



Case Study: “MarketZero”



SF Environment



ARUP



With funding from the California Energy Commission, we are collaborating to retrofit a store to scalable near-zero net energy use.

Leveraging the AEDG



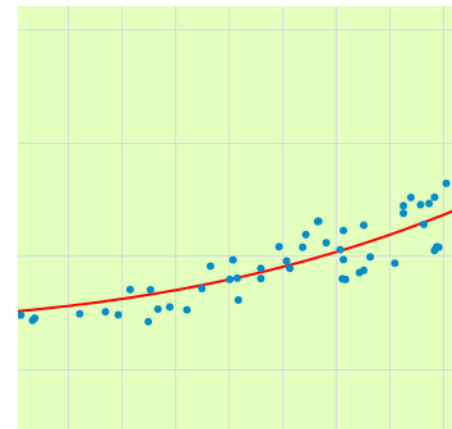
Prescriptive

- Specific Strategies Recommended
 - Included in Specs for New Buildings & Equipment



Custom

- Modeling for interactive effects
- Testing Assumptions





Thank You!

Aaron Daly, CEM

Global Energy Coordinator, Whole Foods Market

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Master the Fundamentals

Richard Heath

Saving Energy is Fundamental

Richard Heath - Director of Engineering & Energy



Home of



Fundamentals

Admiral Rickover -
Father of the Nuclear Navy



Take the Path of Least Resistance:

- Maximize the Opportunity
- Master the Fundamental Objective
- Avoid Betting on the Come
(Data Driven Picks – My Secret to Success)
- Validate Solutions
(Solution Must meet the Fundamental Objective)

Maximize the Opportunity

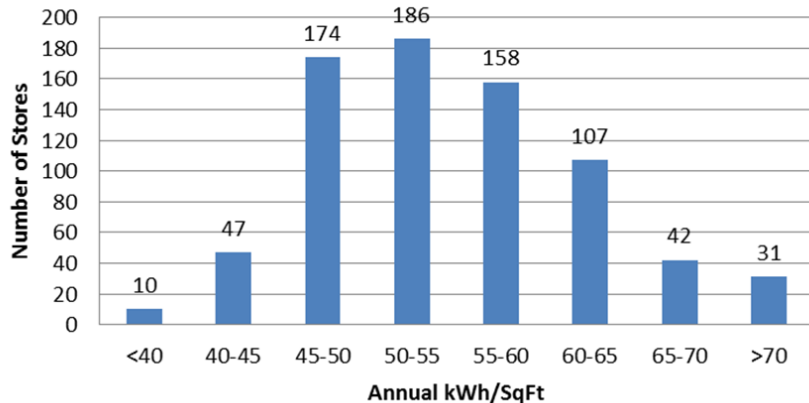


VS.



Existing Stores with Excessive Energy Use provide the biggest opportunity for Energy Reduction in Supermarkets.

Energy Use Distribution



Energy Hog Stores exceed the Average Energy use by a minimum of 20% with no limit on the high end.

- 24% of existing Stores are Energy Hogs
- 7% of Stores are New Construction

Correcting the operational issues that create Energy Hog Stores produces 3 times more energy savings opportunity than would reducing New Store Energy by 50%.

Master the Fundamental Objective

Align with the Fundamental Objective – Deliver what they require



Submarine



S = D



**Southeastern
Grocers**

Home of



Avoid Betting on the Come

Use ALL available Data to Stack the Deck in your Favor:

For Existing Stores you have all the Data that you need to ensure your investment in Energy Reduction will provide a return.

Store #	EBITDA FY.2015.P9	Store SqFt	Annualized kWh	Annual kWh/SqFt	Annual Avg Rate	Target kWh/Sq Ft	Potential Annual Energy Expense Savings	TOTAL_STR_ REPAIRS	Projected Capital Spend (based on 3 YR Simple PB)
1	\$ 100,508.81	47,718	3,812,852	79.9	\$ 0.096	52	\$ 127,802	\$ 79,062	\$ 383,406.75
2	\$ 597,127.55	45,136	3,137,600	69.5	\$ 0.127	52	\$ 100,372	\$ 184,200	\$ 301,117.12
3	\$ 1,847,691.07	48,397	3,456,294	71.4	\$ 0.105	52	\$ 98,883	\$ 118,027	\$ 296,649.77
4	\$ 14,672.34	48,150	3,486,337	72.4	\$ 0.091	52	\$ 88,980	\$ 66,387	\$ 266,940.09
5	\$ 961,295.62	48,406	3,230,101	66.7	\$ 0.113	52	\$ 80,238	\$ 101,595	\$ 240,715.16
6	\$ 251,322.14	47,918	3,301,200	68.9	\$ 0.097	52	\$ 78,803	\$ 60,054	\$ 236,410.39
7	\$ 643,430.97	45,802	3,144,800	68.7	\$ 0.099	52	\$ 75,810	\$ 51,896	\$ 227,429.71
8	\$ 1,168,600.35	48,467	3,191,143	65.8	\$ 0.109	52	\$ 73,222	\$ 129,272	\$ 219,666.70
9	\$ 274,435.93	49,004	3,366,503	68.7	\$ 0.090	52	\$ 73,954	\$ 117,518	\$ 221,861.04
10	\$ 805,769.13	49,366	3,569,507	72.3	\$ 0.074	52	\$ 74,234	\$ 140,766	\$ 222,701.93
				70.4			\$872,300		\$ 2,616,898.68

This makes Capital Planning Easy

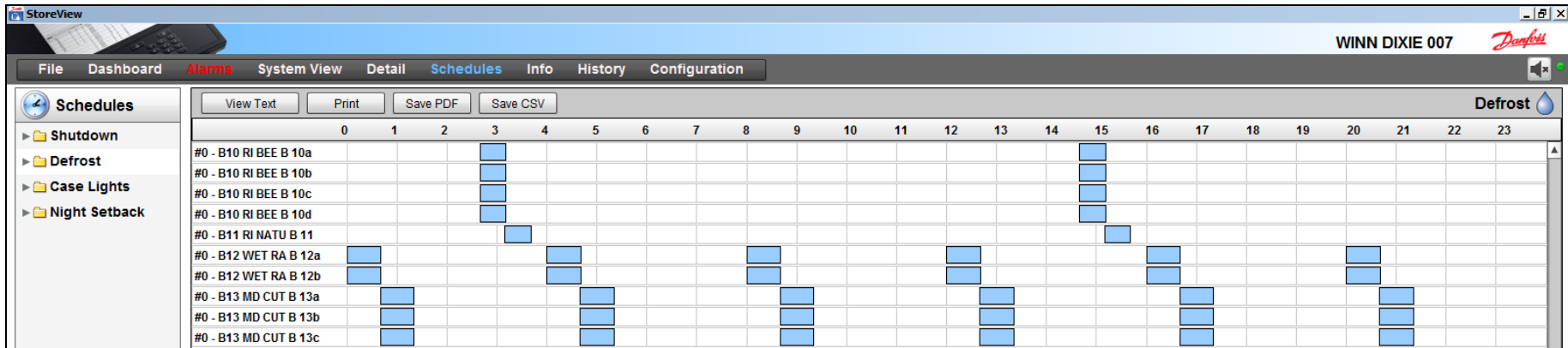
Validate Solutions

Consequences of Losing Sight of the Fundamentals



Refrigeration

What is the most Fundamental Parameter for Supermarket Refrigeration?



If our solutions violate Fundamental Principles we must re-evaluate our Path

Discussion

Thank you!

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