

Part 1: Overview of ASHRAE Standard 90.1

Don Brundage
Southern Company Services

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Part 1: Overview of Standard 90.1

- ❑ What is Standard 90.1?
 - ❑ Different versions (2001, 2004, 2007)
 - ❑ Mandatory v. Prescriptive
 - ❑ Energy Cost Budget Method (ECB)
 - ❑ Appendix G – savings versus 90.1
 - ❑ 30% savings goal
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What is Standard 90.1?

- ❑ Cumbersome title – “Energy Standard for Buildings Except Low-Rise Residential Buildings”
 - ❑ Everything except 3-floor or fewer residential buildings.
 - ❑ Reference building code standard for commercial construction – residential standard is IECC
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Reference Code?

- ❑ Federal legislation “requires” states to have standards at least as stringent as reference standard.
 - ❑ Current reference is 90.1 -2004.
 - ❑ DOE has not finished analyzing 2007 edition.
 - ❑ Traditionally, no “teeth” in requirement. Stimulus bill in 2009 tied funding to adopting and enforcing energy codes.
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Different versions

- ❑ 2001 edition – not DOE reference, but some tax credits are based on % savings compared to this edition.
 - ❑ 2004 edition – current reference. Substantial lighting efficiency improvements versus 2001. Added Appendix G, to measure savings versus minimum code.
 - ❑ 2007 edition – some equipment efficiency improvements. Improved version of G.
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Mandatory v. Prescriptive

- Mandatory – “X.4” sections of standard. (Section 6.4, 7.4, etc.) Measurement and controls, some specific requirements.
 - Prescriptive – If you want to NOT do these (such as less insulation, different windows, etc.) can “trade off” using Energy Cost Budget (ECB), by making another part of the building more efficient to make up for what you are doing differently. Most of standard 90.1 is prescriptive.
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Scope of the Standard

- Buildings and systems in them to provide for human comfort.
 - Excludes buildings, such as computer centers, where the climate controls are based on the needs of equipment rather than occupants.
 - Most plug loads are excluded, whether computers or supermarket freezers.
 - Proposed addenda for 2010 edition (aq) would allow selective broadening of scope to require improvements in process loads in buildings, where appropriate.
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Energy Cost Budget (Chapt. 9)

- ❑ Do an energy simulation model of the building, based on type of heating system and condenser (11 possibilities). Compare to minimal code building.
 - ❑ Must model with same heating fuel. (electric resistance, HP, or fossil.)
 - ❑ Uses a cost budget, not an energy budget. So thermal storage can gain credit under ECB, even though more energy used.
 - ❑ “Budget” building is a minimum code version of the proposed building that meets all prescriptive requirements of Standard 90.1
 - ❑ “Proposed” building is what you want to build. Proposed energy cost must be same or less than budget to pass ECB.
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Pros and Cons of ECB

- Pros: Allows design freedom, can do architectural feature that uses more energy, just make it up elsewhere. Can specify more efficient equipment or lighting to trade off envelope, for example.
 - Cons: Time and cost. Energy simulation is expensive, especially if it would not otherwise be done for the building.
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What ECB can't do well:

- ❑ Measure energy savings versus minimum code building. To prevent “gaming” that reduces efficiency, very limited on tradeoffs allowed. ECB is essentially a pass/fail measure.
 - ❑ Appendix G written to allow measurement of savings versus minimum code building, for use with green building programs such as LEED.
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Appendix G

- ❑ Similar to ECB, but more detailed.
 - ❑ More tradeoffs allowed.
 - ❑ As with ECB, cost based rather than energy based.
 - ❑ Instead of heating type, does baseline building systems based on square footage, floors, and heating type. DX systems for small buildings, chillers for large ones.
 - ❑ Unlike ECB, baseline building may have little resemblance to the actual building.
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Comments on Appendix G

- Measuring savings is a harder job than ECB tradeoffs.
 - 2004, 2007 editions unfairly penalize:
 - purchased heating and cooling
 - laboratories
 - both will be fixed in the 2010 edition.
 - 2007 edition too lenient for data centers, (too easy to get LEED points) working on possible fixes.
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30% Savings Goal

- ❑ ASHRAE and DOE have a goal to have the 2010 edition be 30% more efficient than the 2004 edition.
 - ❑ Not mandated by laws or regulations.
 - ❑ In progress, but 2004 is already a tough standard.
 - ❑ Easier to save energy in cold or dry climates than hot or wet ones.
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PART 2: Update on Energy Legislation, Potential Changes

Various topics of interest, mostly dealing with climate change legislation.

Outline

- Background/Disclaimer
 - Current bills/status
 - Renewables/Efficiency Requirements
 - Global Warming Cap/Trade
 - Refrigerants "phasedown"
 - R-22 Issues
 - Summary
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Background

- ❑ Various bills currently in Congress would, if passed, have a major impact on commercial construction and energy prices for all fuels.
 - ❑ Attempting to be nonpolitical – discuss the bills and their potential impact. Not official position of Southern Company or Alabama Power.
 - ❑ **Climatology is a forbidden topic of discussion today.** Wastes time. Whether real or not, it appears likely that some sort of climate change legislation will be passed in the next year or two.
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Two approaches to carbon limits: cap and trade versus tax

- ❑ Most current proposals are cap and trade.
 - ❑ Cap and trade saves a known amount of greenhouse gas emissions – cost is unknown.
 - ❑ A carbon tax has a known cost, but the emission savings is not known.
 - ❑ Easier to judge economics of capital-intensive decisions with tax than cap and trade.
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Cap and trade v. tax - revenue

- ❑ Revenue from tax goes to govt., can (in theory) be directed to mitigate financial hardships.
 - ❑ Revenue from cap and trade goes part to govt., part to brokers/3rd parties, part to polluters who can most easily reduce emissions.
 - ❑ Tax is less costly to administer
 - ❑ Easier to give credits for offsets with cap and trade.
 - ❑ Cap and trade does not look like a tax.
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Current Bills/Status

- ❑ Markey-Waxman (HR 2454)– passed by House, sent to Senate in July.
 - ❑ S 1462 – Republican alternative. No carbon cap and trade, does include technology incentives, requirement for renewables.
 - ❑ Action on either bill deferred until after health care bill decided.
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Why do utilities, oil companies, etc. say they want a climate change bill passed?

- ❑ Lesser of two evils – EPA required to regulate CO₂ as a pollutant under CAA Title V (Supreme Ct. decision 2007)
 - ❑ EPA forbidden to consider compliance costs, only health and environmental impacts. Regulations poorly suited for this issue.
 - ❑ Can change required control technology at any time, no protection for past investments.
 - ❑ Consensus (not unanimous) view – a cap and trade bill is better than EPA regulation of CO₂.
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Meanwhile, EPA slogs forward

- August 31 – EPA makes first steps towards CO₂ regulation – proposed reporting requirements for Title V regulations.
 - Required under CAA to regulate pollutants any sources GT 250 tons/year carbon-equivalent with “best available control technologies.”
 - EPA proposal is to only regulate 25,000 tons per year or greater.
 - 25,000 tons – 13,000 sites.
 - 250 tons – 1.2 million sites. Schools, churches, fast food restaurants, farms, irrigation pumps, etc.
 - EPA chief *“we will not regulate Dunkin Donuts.”*
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Markey Waxman Bill

- Much more than just carbon cap and trade
 - Require minimum renewables generation percentage
 - Big improvements in building code efficiency levels, not limited by cost-effectiveness.
 - “Phase-down” of standard HFC refrigerants with no ozone depletion (134a, 407, etc.)
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Impact of Markey-Waxman bill

- Unlikely to pass in exactly the current form, but here is what version passed by House in July would require.
 - Final version not necessarily weaker:
 - environmental groups say has been watered down too much
 - European govts. say it does not save enough carbon in the early years – not consistent with European proposals.
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Carbon cap and trade: basics

- ❑ Utilities and oil companies must acquire allowances for the energy they sell.
 - ❑ Passed through in energy costs to consumers.
 - ❑ Only entities that directly emit greenhouse gases as part of an industrial process have to get allowances (steelmaking, cement, ammonia, hydrogen, etc.)
 - ❑ **No carbon credits gained by energy efficiency measures.** Already received benefit via reduced energy costs.
 - ❑ Appliance recycling, pig farm methane control, other non-combustion sources can generate offset credits.
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Allowances (oversimplified)

- ❑ Allowances are right to emit 1 ton CO₂ equivalent of greenhouse gases
 - ❑ Carbon dioxide is just one of many regulated gases. Reduce emissions of another chemical by one ton, you may gain credit for many tons of emission credits.
 - ❑ Eventually (2030) all must be purchased from federal government
 - ❑ Price based on auction/open market
 - ❑ Initially (2012), 90% of 2005 level given for free (about 75-80% of needs, given growth 2005-2012)
 - ❑ Can generate some offsets by reducing emerging market emissions, protecting rain forests, etc. *(Makes emission allowance pricing even harder to predict.)*
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Carbon dioxide “equivalent:”

□ Global warming potential of various substances – carbon dioxide is 1 by definition.

■ Methane –	21
■ CFC-11	3800
■ HCFC-22-	1500
■ HFC-134a-	1430
■ Halon 1301	5400 (fire extinguishers)

What will allowances cost?

- Currently no limit, high or low.
 - Proposals in Congress for price “collar”
 - Floor price can’t go below, allow price security for low carbon investments
 - Ceiling price can’t go above, prevent price spike such as the year 2000 California electricity market, with dollars per kWh summer prices.
 - Some concern on initial 2012 prices, little time to change to low carbon alternatives.
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Who gets allowances? Complicated

- (All % are initial year, 2012)
 - Electric distributors, for use by customers, 43.75% of total
 - Low income residential, 15%
 - Energy conservation programs & renewable energy (state or state-authorized utility programs), 9.5%
 - Note: States have no need for allowances, will sell them. Higher electricity rates, subsidy for energy efficiency programs.
 - Revenue dependent on allowance prices, but will be in the billions for EE programs.
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Rate impacts & cost shifting

- ❑ If all went to utilities on behalf of customers, effects would be spread evenly.
 - ❑ Subsidies for low income residential means lower prices for them, higher for others
 - ❑ EE program funding from allowances means higher energy prices, subsidies for those who participate in EE projects.
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Energy Efficiency will be mostly Renovation Instead of New Construction

- ❑ Other parts of the bill require very strong building code standards.
 - ❑ Minimum equipment efficiencies will be high, little room for improvement.
 - ❑ Envelope improvements in existing buildings, such as better windows, duct sealing, and early replacement of inefficient equipment, will likely be the focus of EE programs.
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Renewables/EE Requirement

- ❑ Starting with 6% of fossil generation in 2012, 20% by 2020.
 - ❑ 25% can be energy efficiency
 - ❑ Existing hydro does not count, nuclear does not count.
 - ❑ If fail to acquire renewables, pay 2.5 cents per kWh of shortage, directed to states for renewables and EE programs.
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Renewables in Southeast

- ❑ Local wind and solar not cost effective
 - ❑ Limited biomass generation potential, avoid impact on pulp/paper industries
 - ❑ Purchasing out of region wind would require enormous power line investment and right of way purchase.
 - ❑ Mostly pay the 2.5 cents/kWh.
 - ❑ **Next slide** – actual utility study on power lines needed to supply wind from midwest to eastern power markets.
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NERC study, 20% wind in the east

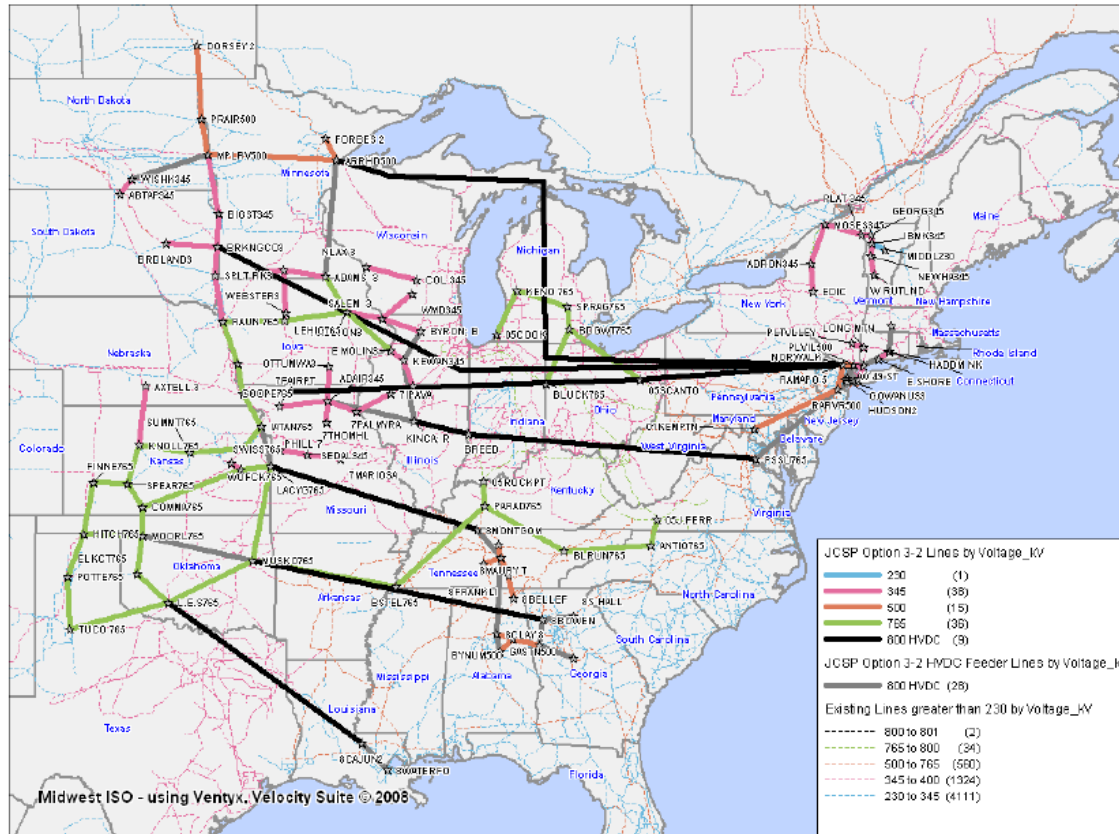


Figure 1-3: 20% Wind Energy Scenario Conceptual Transmission Overlay

Does not include Florida, additional lines needed if included.

Energy Efficiency Codes (ASHRAE 90.1 and IECC)

- ❑ Next version of IECC must be 30% more efficient than 2003 IECC.
 - ❑ 2010 (2013?) version of 90.1 must be 30% more efficient than 2004 90.1.
 - ❑ Next version after bill passage.
 - ❑ Similar goals in DOE programs, if cost-effective, but this is mandatory, with no cost-effectiveness “escape clause”.
 - ❑ 50% improvement 2014-2015 stds.
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In conflict: High mandatory codes and high EE savings

- ❑ Energy efficiency programs measure savings from legal minimum. High mandatory codes reduces energy saving that can be claimed.
 - ❑ Many energy saving practices at consumer level (cut off lights, change thermostat settings) not countable.
 - ❑ All code setting (DOE, ASHRAE, etc.) set codes based on life cycle costs.
 - ❑ Hard to get savings on new buildings – best opportunities in existing building renovation.
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HFC “Phasedown”

- No global warming impact if not leaked, will hurt energy efficiency efforts to restrict their use.
 - 10% reduction from 2005 base in 2012, 75% reduction from 2005 in 2030.
 - Force conversion to CO₂, ammonia, propane, and new non-HFC refrigerants such as HFO-1234yf (possible replacement for HFC-134a.)
 - HFO-1234yf – GWP=4, atmospheric life 11 days.
 - Compare this to:
 - HFC-134a – GWP=1430, atmospheric life 14 years.
 - R-410a – GWP=2100.
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R-22 Phaseout

- ❑ **Not proposed, this one is real.**
 - ❑ No use of R-22 in new equipment manufactured after 12/31/2009.
 - ❑ EPA's proposed rule defined manufacture as date fully charged, which would make installation date the manufacture date for split systems.
 - ❑ Would make any R-22 split systems in inventory illegal to install after 12/31/09.
 - ❑ Informal communications from EPA suggesting they will not do this, but nothing official yet.
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Future availability of R-22

Year	% relative reduction from previous level (total reduction)	Action
2000	Base amount	
2004	35%	Ban on HCFC foams, used in water heaters and refrigerators
2010	62% (75%)	Ban on R-22 and HCFC-142b in new equipment, other HCFC's such as HCFC-123 still OK
2015	60% (90%)	Reduced quota for servicing and non R-22 new equipment
2020	95% (99.5%)	Ban on all new HCFC equipment, all types of refrigerant
2030	100%	Ban on new refrigerant, only reclaimed/recycled available

Outlook for future – my opinion

- ❑ 2010 - Ban on new R-22 units should leave plenty of R-22 for servicing.
 - ❑ 2015 – reduced quota could cause shortages. Retirements a factor. Rate that manufacturers phase out of HCFC-123 equipment will be a factor.
 - ❑ 2020 – huge reduction in quota. With all R-22 machines GT 10 years old, repair likely means replace.
 - ❑ post 2030 – probably have to replace any remaining R-22 units when they break – no refrigerant except salvaged/reclaimed/stockpiled.
 - ❑ Smuggling will become an issue (this is not a joke)
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Questions?

Summary

- Some variation on cap and trade seems likely to be passed in next couple of years
 - Some proposed laws are very specific on how to reduce global warming emissions.
 - Cost and timing of cost increases highly uncertain.
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