Non-Residential Energy Code Comparison

National and Regional Codes

David Baylon

Mike Kennedy

ECOTOPE
Consulting
Research
Design

4056 9th Avenue NE Seattle, WA 98105
PH: (206) 322-3753 FAX: (206) 325-7270

Compared Commercial Codes

- Oregon 2004
- Washington 2003
- Washington Proposed 2004
- Seattle 2002
- IECC 2003
- ASHRAE 90.1 2001 & addenda
- E-Benchmark Guidelines (NBI)

Approach

- Comparison of the State Energy Codes in the PNW
  - Oregon State Energy Code (OSEC)
  - Washington Non-Residential Energy Code (NREC)
    - 2001 (Current code)
    - 2004 (Current amendments under review)
  - Seattle Amendments to the NREC (2001)
  - IECC 2003 (Current Code in Idaho and Montana)
  - ASHRAE 90.1 2001
  - NBI Efficiency “Guideline”

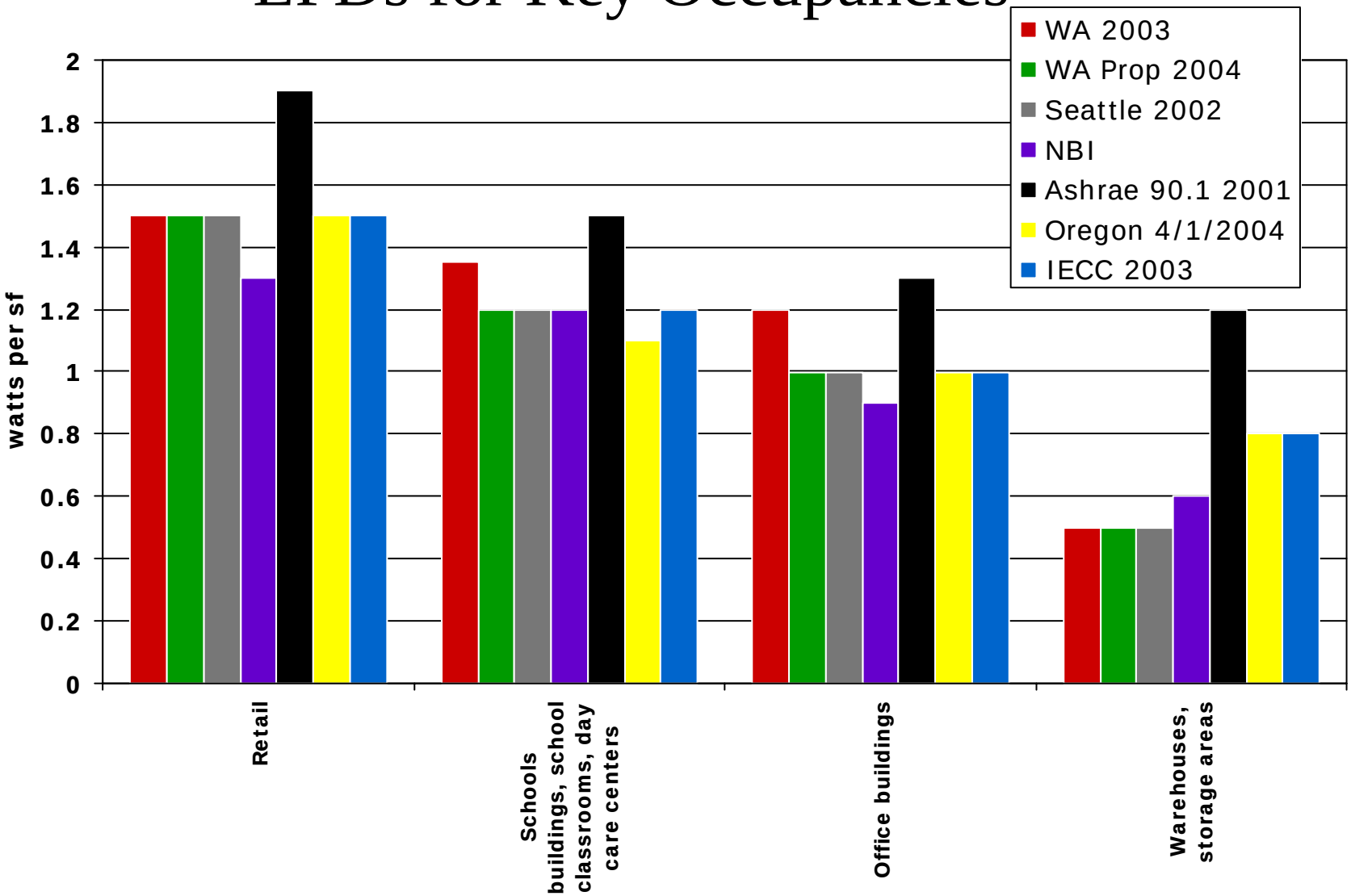
Approach (cont.)

- Provisions compared
  - Lighting power
  - Lighting controls
  - Mechanical systems
  - Building envelope
  - Window performance requirements
- Identify potential for a PNW model code
- Identify potential for utility program involvement

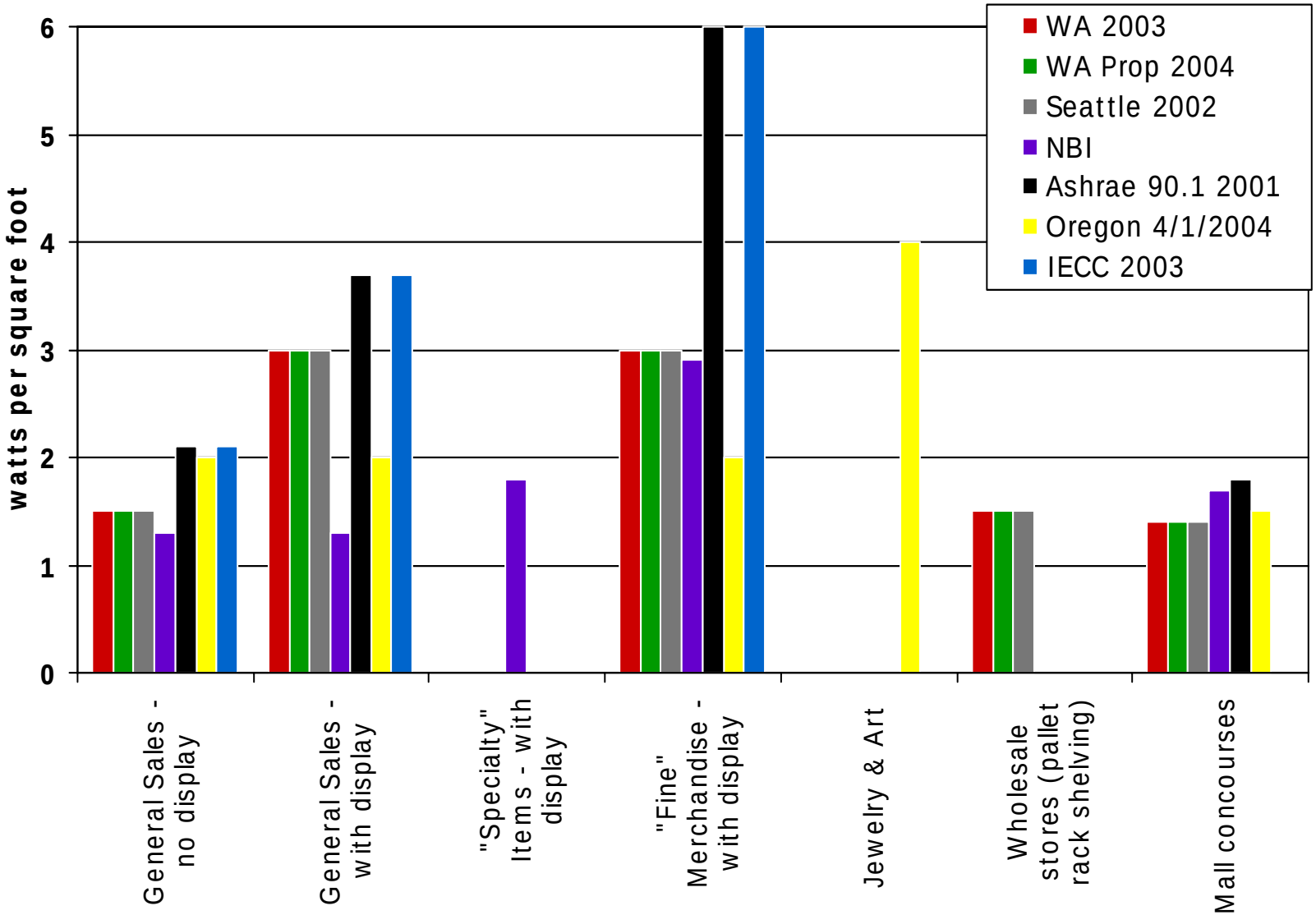
Lighting Power

- LPD requirements somewhat similar
  - Different calculation approach
    - Space or occupancy
    - Whole building
  - Difference in LPD among codes
  - Allowances can be big loop holes
- Retail and other Display Lighting exemptions
- Occupancy calculations difficult to enforce

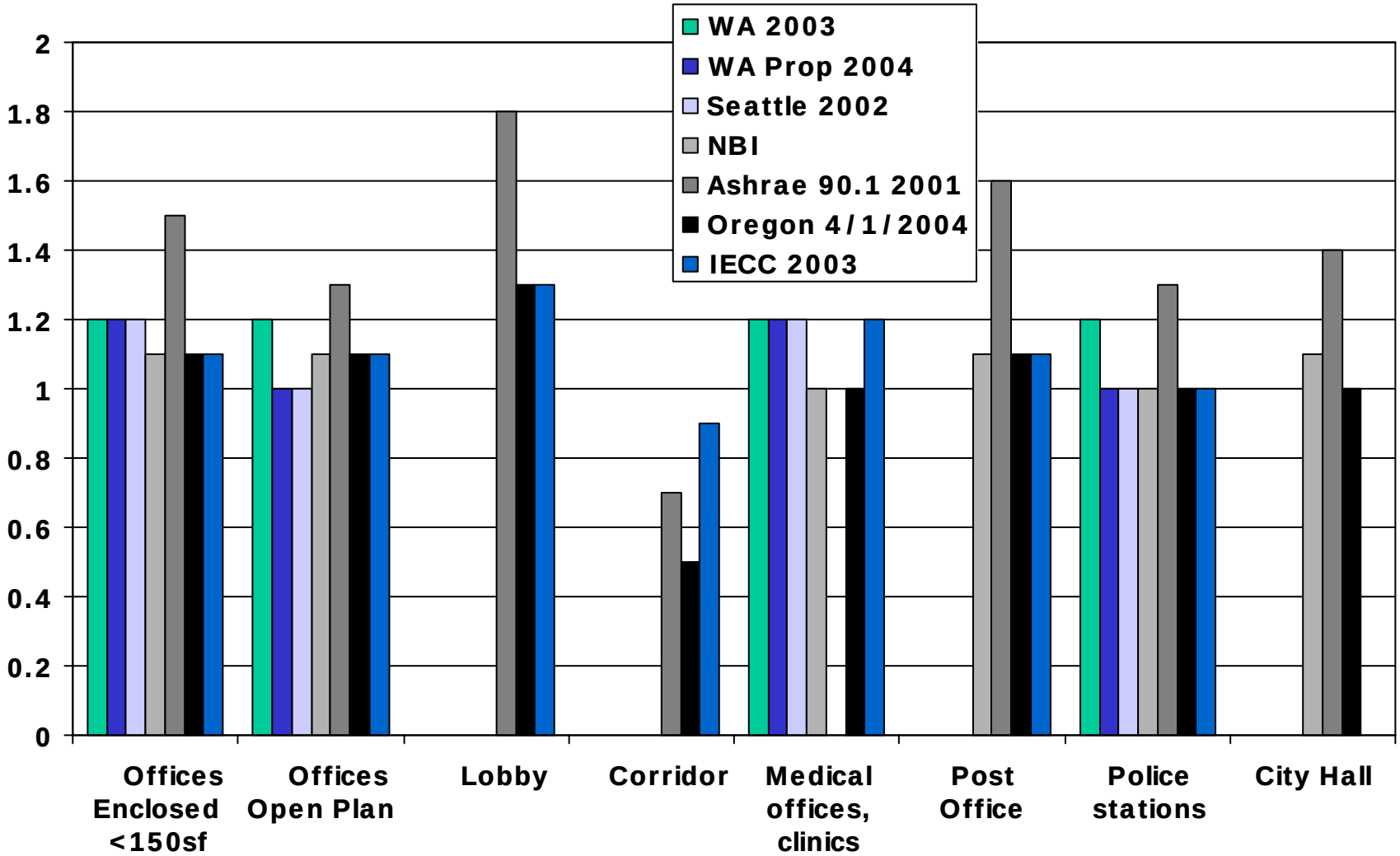
LPDs for Key Occupancies



Retail LPDs by Subtype



Office LPDs by Subtype



Lighting Controls

- Most control provisions unenforceable
- Three areas where control regulation might be helpful
  - Sweep controls (already in all codes but with varying provisions)
  - Occupancy Controls
    - Used in WA and OR but not IECC and ASHRAE
    - Application to certain spaces such as classrooms and conference rooms can be enforced
  - Bi-level switching
    - Used in California with debatable results
    - Used in early WA codes and dropped

Details: Lighting Controls

Item	WA 2003	WA Prop 2004	Sea 2002	NBI	90.1 2001	OR 2004	IECC 2003
Occupancy Sensors							
In all classrooms and conf/meeting rooms and offices/rooms <300sf				X		X	
In all classrooms and in all conf/meeting rooms and offices/rooms <300sf as long as building is >5000sf		X	X	X		X	
Automatic Shutoff							
Required in all buildings				X			
Required in all buildings >5000sf and all office occupancies>2000sf				X		X	
Required in all buildings >5000sf and all school classrooms		X	X	X		X	
Required in all buildings >5000sf		X	X	X	X	X	X
Required in office buildings >5000sf	X	X	X	X	X	X	X

Details: Lighting Controls

Item	WA 2003	WA Prop 2004	Sea 2002	NBI	90.1 2001	OR 2004	IECC 2003
Daylighting							
Perimeter Zone Circuit	X	X	X				
Step Dimming required on all perimeters			X				
Step Dimming required on perimeters with >50% window			X			X	
Step Dimming required under skylights			X	X	X	X	
Continuous dimming required in classrooms when they meet requirements above.						X	
Bi-level switching				X			X

Program Opportunities (Lighting)

- LPD standards in some cases
  - Schools in OR
  - Current WA code weakest on several items
  - LPD code weak in some IECC categories
  - Some room for utility standards
- Most LPD standards beyond code would have substantial “free-riders”

Program Opportunities (Lighting)

- Display lighting (especially Retail)
  - Loophole in code
    - Display partly exempted
    - Display often included after CO
    - Seattle uses a strict guideline for TI permits
  - High efficacy technologies could be rebate items
    - Deemed savings calculation
    - Direct fixture rebates

Mechanical Systems

- Equipment efficiency
  - Well established in all codes
  - ASHRAE has the default manufacture standard
  - Minimal savings potential beyond these standards
- Economizer
  - Higher standard in Seattle code
  - Savings depend on installation (especially smaller systems)
  - Program opportunities should focus on installation

Mechanical Systems (Distribution)

- Air distribution systems
  - Aspects are typically unregulated.
  - WA codes require ECM controls when in series
  - OR tightened ASHRAE’s Air Transport Factor
- Except IECC all codes require HRV for greater than 70% make-up air.

Mechanical Systems (cont.)

- Duct sealing
  - Prescriptive standard, not performance.
  - OR & IECC require mastic sealing.
- Commissioning
  - Washington codes & ASHRAE require commissioning plan.
  - NBI requires 3rd party commissioning.

Program Opportunities (Distribution)

- Air distribution systems
  - Air Transport Factor should be widely adopted
  - Utility opportunity exists for ECM or VSD rebates in packaged equipment
  - Adopt Seattle-type ECM motor requirements, which offer good savings in larger VAV systems

Mechanical Systems (Controls)

- Controls
  - Proper set up unenforceable
  - Only NBI has hardware requirement (DDC)
  - Heat recovery in regional codes, not IECC

Program Opportunities (Controls)

- Controls
  - Commissioning necessary for savings
  - Outside air management
  - Cooling tower and heat pump loop specifications
  - Adopt NBI guideline for ECMS trending & sensors
  - Utilities could promote DCV, for other spaces with high ventilation requirements

Program Opportunities (Commissioning)

- Commissioning
  - 3rd party requirement is a utility opportunity
  - Code-mandated controls cannot predictably achieve savings without some provision for verifying proper set up.

Program opportunities (Design)

- System design and selection
  - Underfloor distribution
  - Variable terminal flow in VAV systems
  - Water cooled and evaporatively cooled equipment
  - Natural ventilation
- Large savings can be realized from an integrated design which cannot come from a code or standard

Envelope

- Variety of building types, sizes, and process loads control the impact of the envelope on energy use
- IECC uses 6 climate zones (for Idaho alone); 2 probably are adequate
- Washington has strictest ceiling insulation requirement (R-30 or R-38). Wall requirement is R-19, but only Seattle mandates foam technology in steel frame

Envelope (cont.)

- Codes regulating nominal insulation levels do not account for dramatically differing thermal bridging issues, and insulation compression
- Codes regulating overall thermal performance can start to dictate construction technique and do not account for differing costs of achieving a given level of performance

Program Opportunities (Envelope)

- Washington’s ceiling insulation requirement should be promoted.
- In steel wall construction, better provisions for foam insulation or utility intervention to promote it are recommended.
- The IECC code and NBI code have done a good job of developing metal building requirements.

Windows

- Regional codes regulate both U-value and Solar Heat Gain Factor (SHGF), as well as glazing area (NBI allows unlimited glazing with U=.4)
- The SHGF requirement ignores the heating benefit from a higher SHGF in most regional climates.
- Default window u-value tables only distinguish between aluminum and thermally broken or improved frames with no gradation of performance.
- Achieving U-values < .4 in commercial windows is difficult, especially in curtain walls

Program Opportunities (Windows)

- Utility focus on improved frames would be beneficial
- Utilities should fund only state-of-the-art technology, such as glazing U-values less than .25 or coatings that allow natural light while minimizing heat gain
- SC and SHGC
  - Not necessarily the lower the better (energy basis)
  - Some value to passive solar gain for heating
  - Significant differences in cooling loads by building, climate, design factors