Conservation Resource Potential in the 5th Power Plan

Economically Achievable Potential

And

Total Resource Costs

April 8, 2004

Northwest Power and Conservation Council

Focus of Today's Presentation

- Size of the conservation resource
- Cost of the conservation resource
- Major sources of resource potential
- Implications for resource portfolio
- Implications for Action Plan

Size of Conservation Resources

- Cost effective & achievable potential = 2800 MWa by 2025
- Remaining Potential Equivalent to Regional Accomplishments 1980 - 2001
- Annual Acquisitions = 150 MWa per year could meet half of "medium" forecast load growth

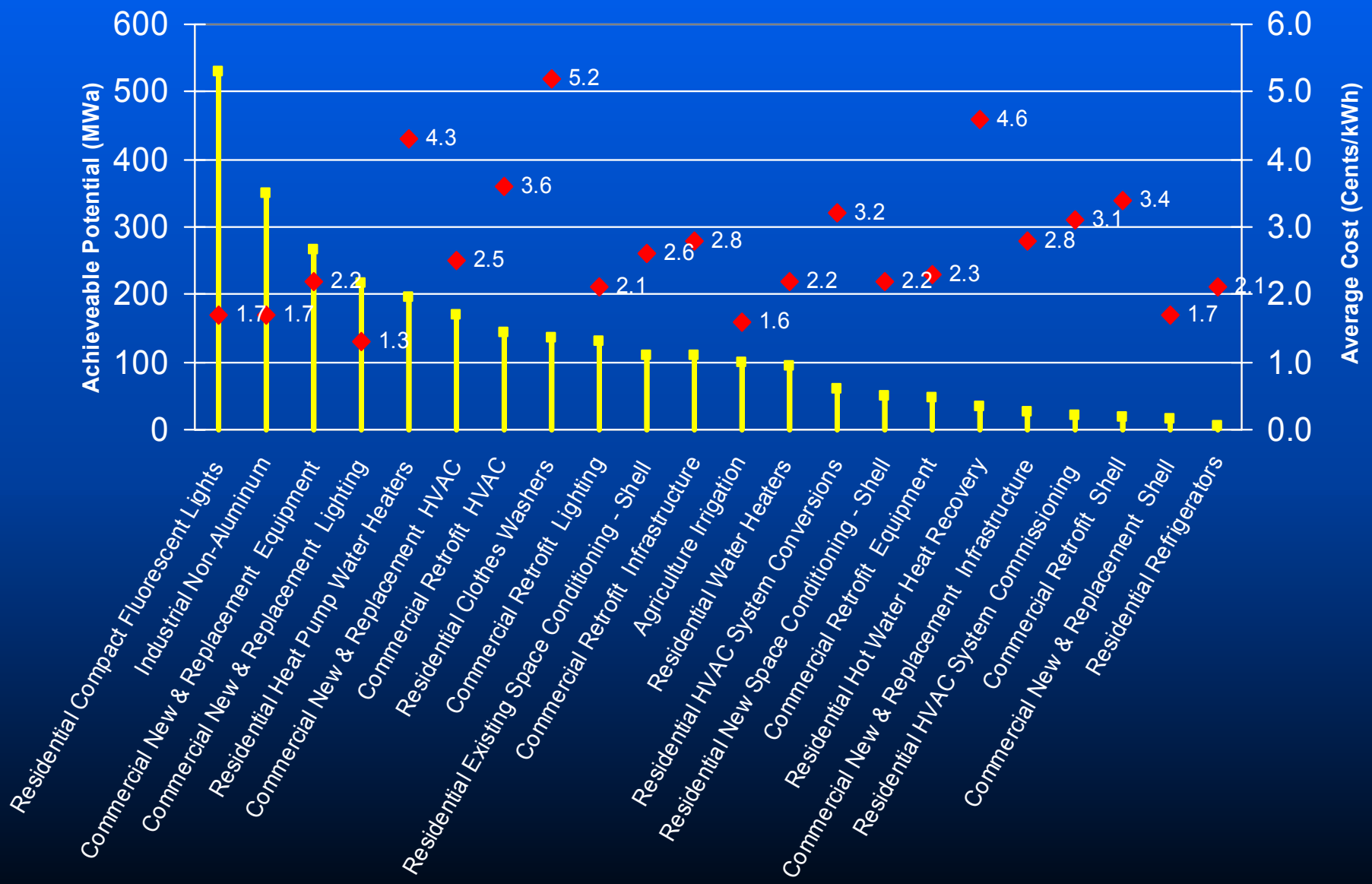
Caveat:

- These findings represent a point estimate for cost-effectiveness based on a single forecast of future market prices
- The Plan's Conservation Resource acquisition targets will be based on the results of the portfolio analysis which considers a wide array of future market prices and risks

Cost of Conservation

- About 2.4 cents per kWh levelized on average
- Up to 8.9 cents per kWh cost-effective depending on shape
- Mostly capital cost, about $350-400 million per year on a Total Resource Cost basis (TRC)
- Includes non-energy benefits and costs

Cost and Achievable Potential by Sector and End Use



New and Improved Technologies

- New technology and/or lower cost of existing technologies
  - High performance T8 lighting, control optimization, compact fluorescent lighting
- New applications
  - Sewage treatment, LED traffic signals
- New end uses evaluated
  - Network PC control
  - AC/DC power converters
  - Commercial refrigerators, freezers, ice-makers

Revised Existing Measures

- Changing costs
  - CFLs lower, Commissioning higher
- Higher avoided costs for some measures
  - Air conditioning measures now 8.9 cents/kWh
- Many previous measures removed due to new codes & standards
  - Refrigerators, freezers, clothes washers, AC
- Technology improvements
  - Residential heat pumps for space & water

Process for Estimating Conservation Resource Potential

- About 150 measures considered in 100's of applications (T-8 lighting in schools, offices, retail, etc.)
- Estimate costs, applicability, baseline penetration
- Estimate savings: energy, T&D impacts, measure interaction and non-energy benefits
- Benefit/Cost ratio > 1.0 means cost-effective
- De-rate technical potential by 15% to reflect what is "Realistically Achievable" through programs, codes & standards, market transformation and other mechanisms

Estimating the Resource: Costs

- Measure capital
- Labor and profit
- Net ongoing O&M (positive or negative)
- Incremental over base case
- Program administration costs added
- Total Resource Cost Perspective =
  - All costs regardless of who pays

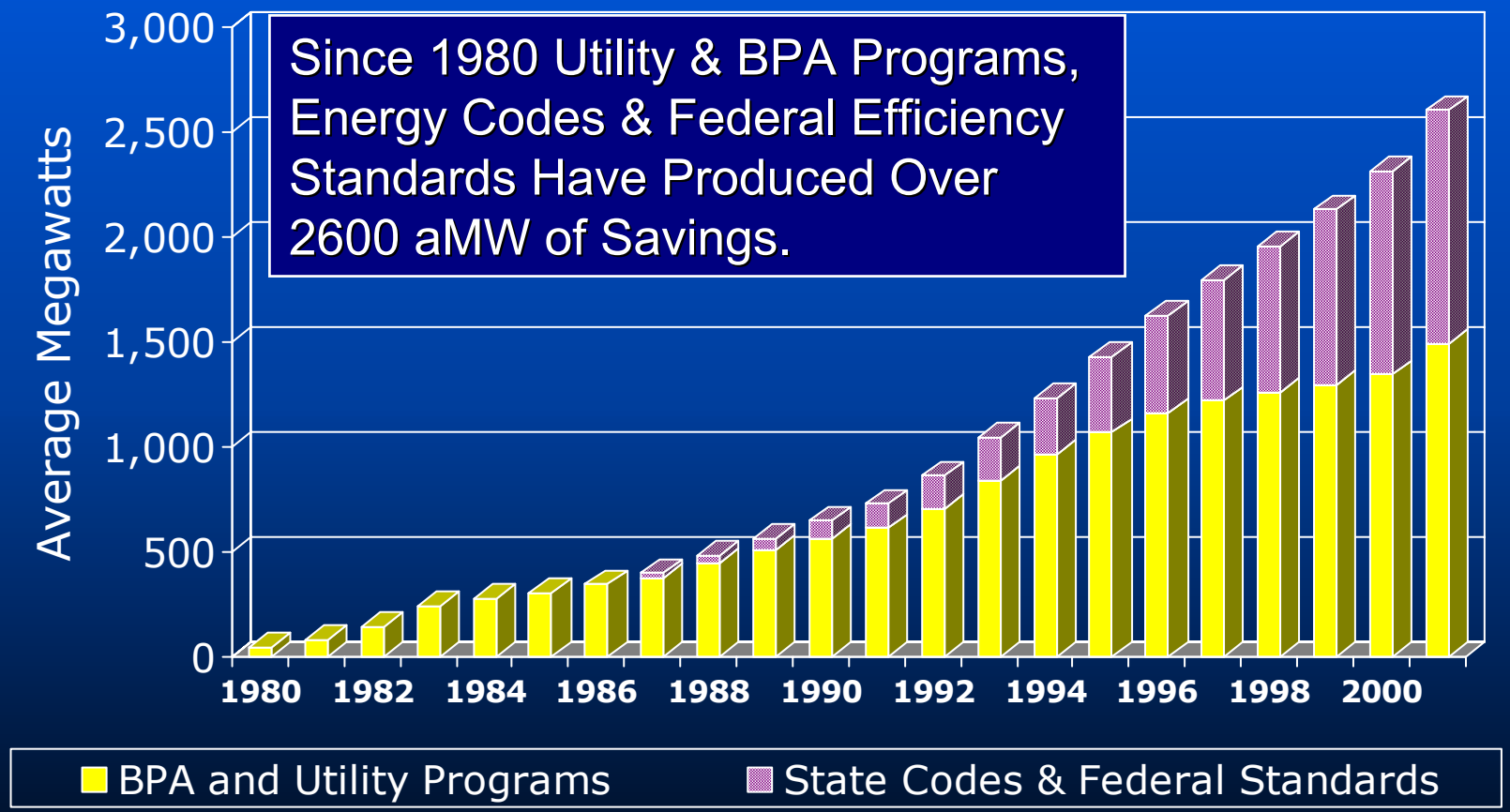
Estimating the Resource: Savings

- Energy (kWh) by time of day and month
  - Based on AURORA™ base case Mid-C prices
- Capacity (kW) for T&D deferral
  - Based on coincidence with PNW peak kW (January)
- Based on forecast of applicable "stock"
  - Number of widgets, floor area, population
- Account for interaction between end uses
  - Lighting measures influence heating and cooling needs
- Account for overlap between measures
  - Day lighting applied after lighting power density

Adjustments Since Last Plan

- Reflect new codes & standards
- Reflect conservation achieved
- Incorporate new base line data
  - Commercial Building Stock Assessment
  - Penetration of existing programs (E-Star)
  - Census data, utility data, economic data
- Higher Avoided Costs
- New Technology

Historical Conservation Savings



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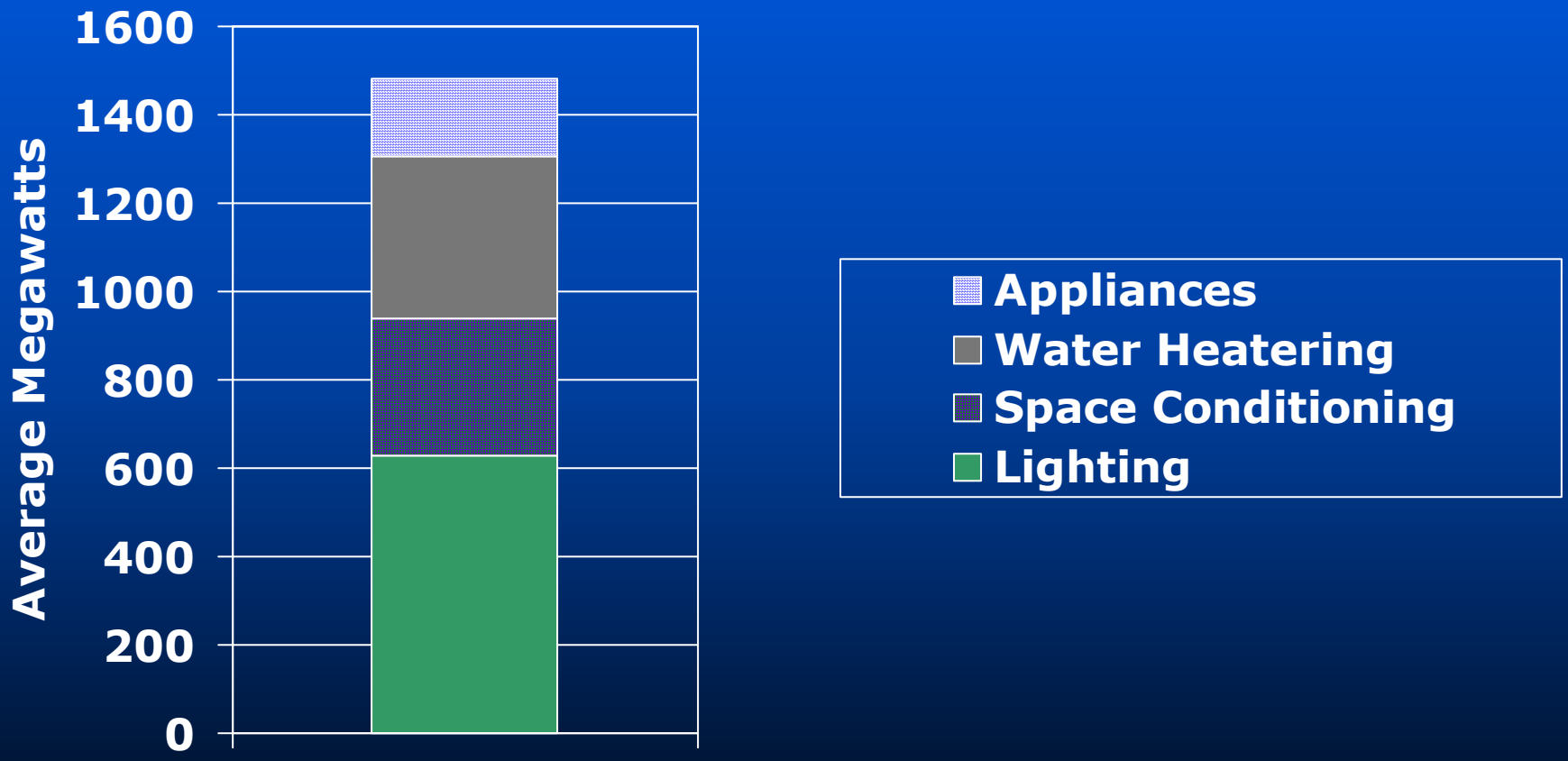
Summary of Major Changes Effecting Regional Conservation Potential

Factor	Decrease MWa	Increase MWa
Utility Program Acquisitions	600	0
Regional Market Transformation Actions	170	0
New/Revised Federal Standards	730	0
Higher Avoided Cost	0	767
Technology Improvements	0	1240

Total Residential Sector Cost-Effective Potential – 1475 aMW



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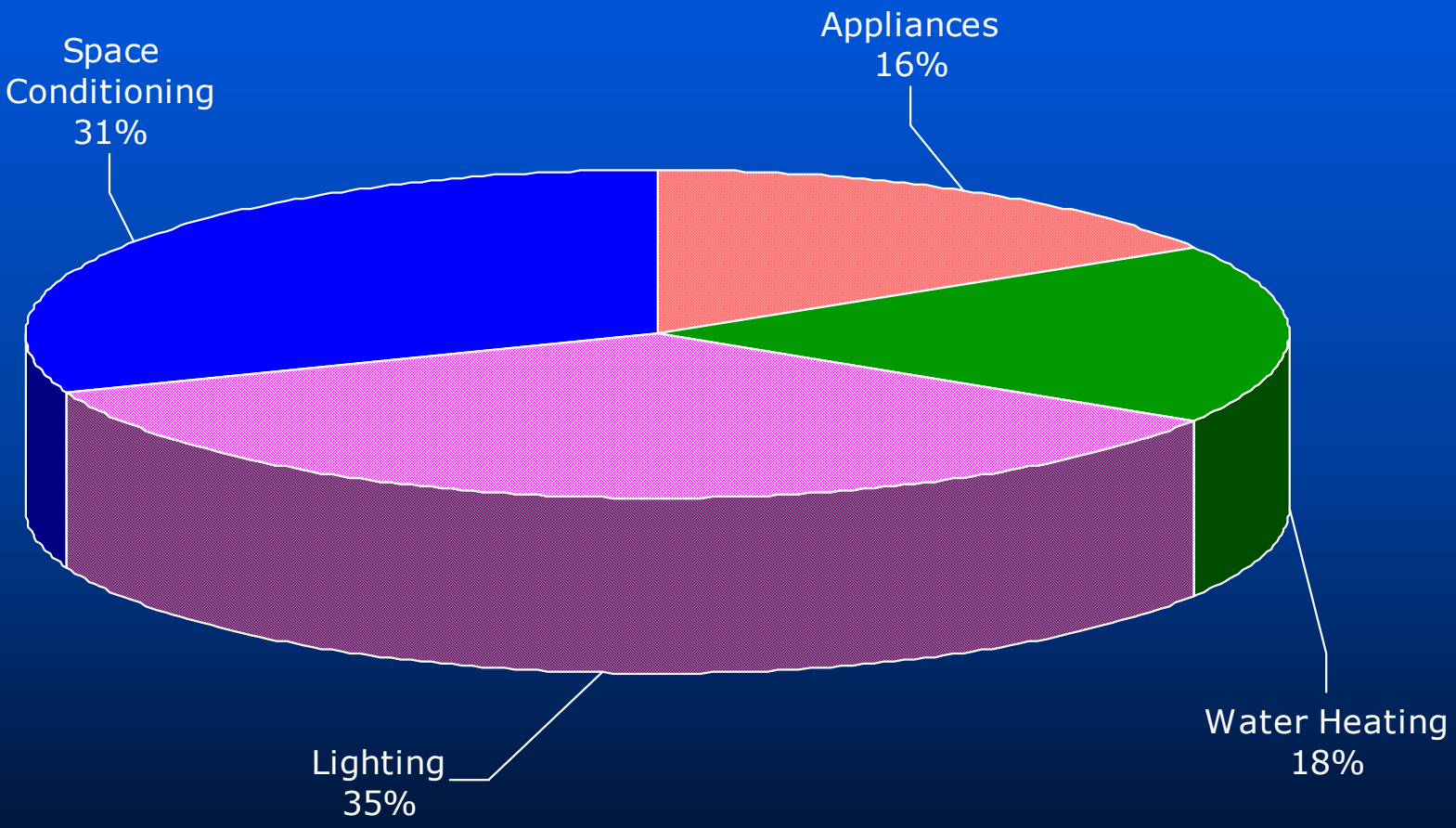
Residential Sector Conservation Achievable Resource Potential by Major End Use



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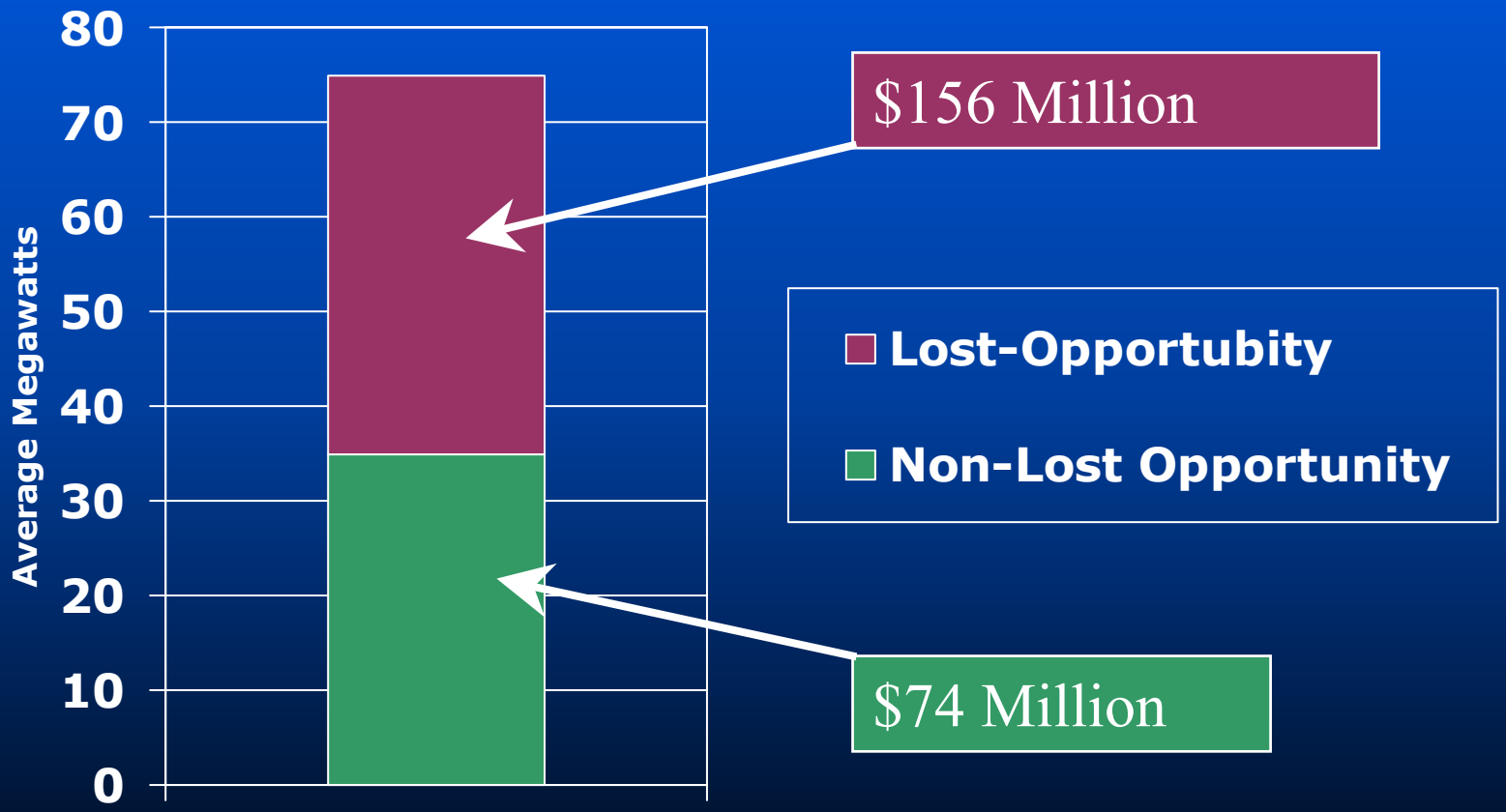
Annual Residential Sector Acquisitions 2005 to 2010



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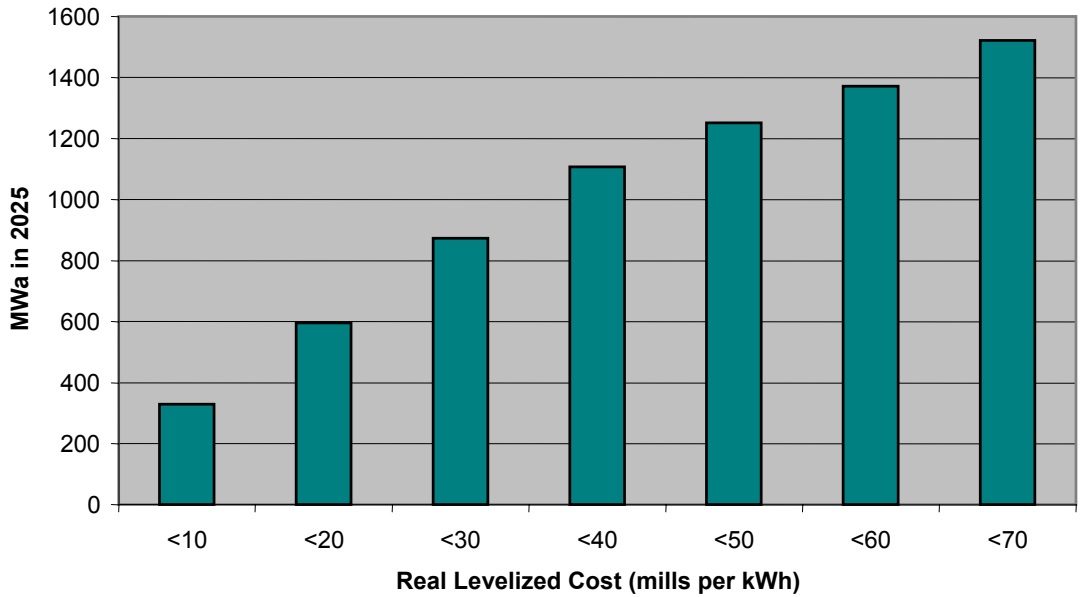
Commercial Sector Technical, Economic and Realistically Achievable Potential (Medium Forecast - 2025)



Technical Potential is 1539 MWa

Cost-Effective Amount is 1346 MWa

Cost-Effective & Achievable Potential is 1144 MWa

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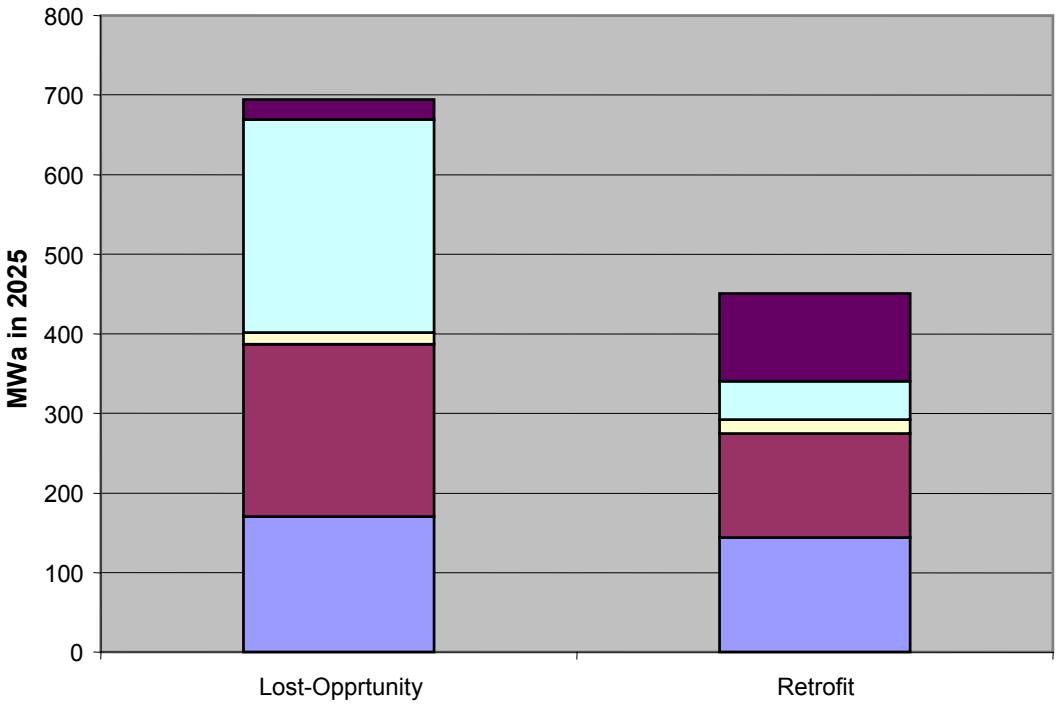
Commercial Sector Realistically Achievable Potential by Major End Use (Medium Forecast – 2025)



- Infrastructure
- Equipment
- Envelope
- Lighting
- HVAC

Total Cost-Effective Achievable Potential is 1145 MWa

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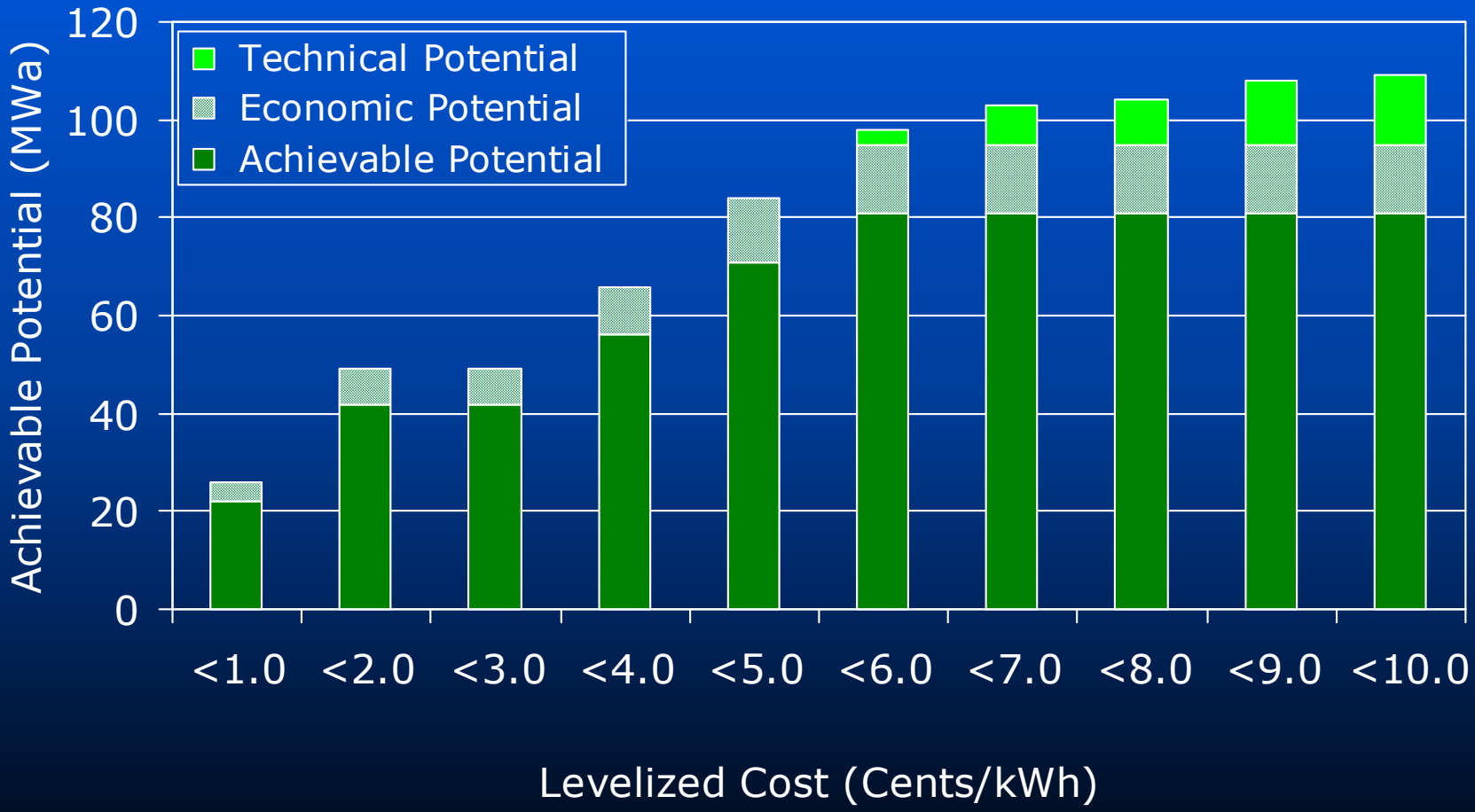
Industrial Conservation

- Still a placeholder estimate
- Estimate of 5% of forecast loads
- 350 MWa at 1.7 cents per kWh
- Process controls, drive systems, lighting, refrigeration

Irrigated Agriculture Sector Technical, Economic and Realistically Achievable Potential (Medium Forecast - 2025)



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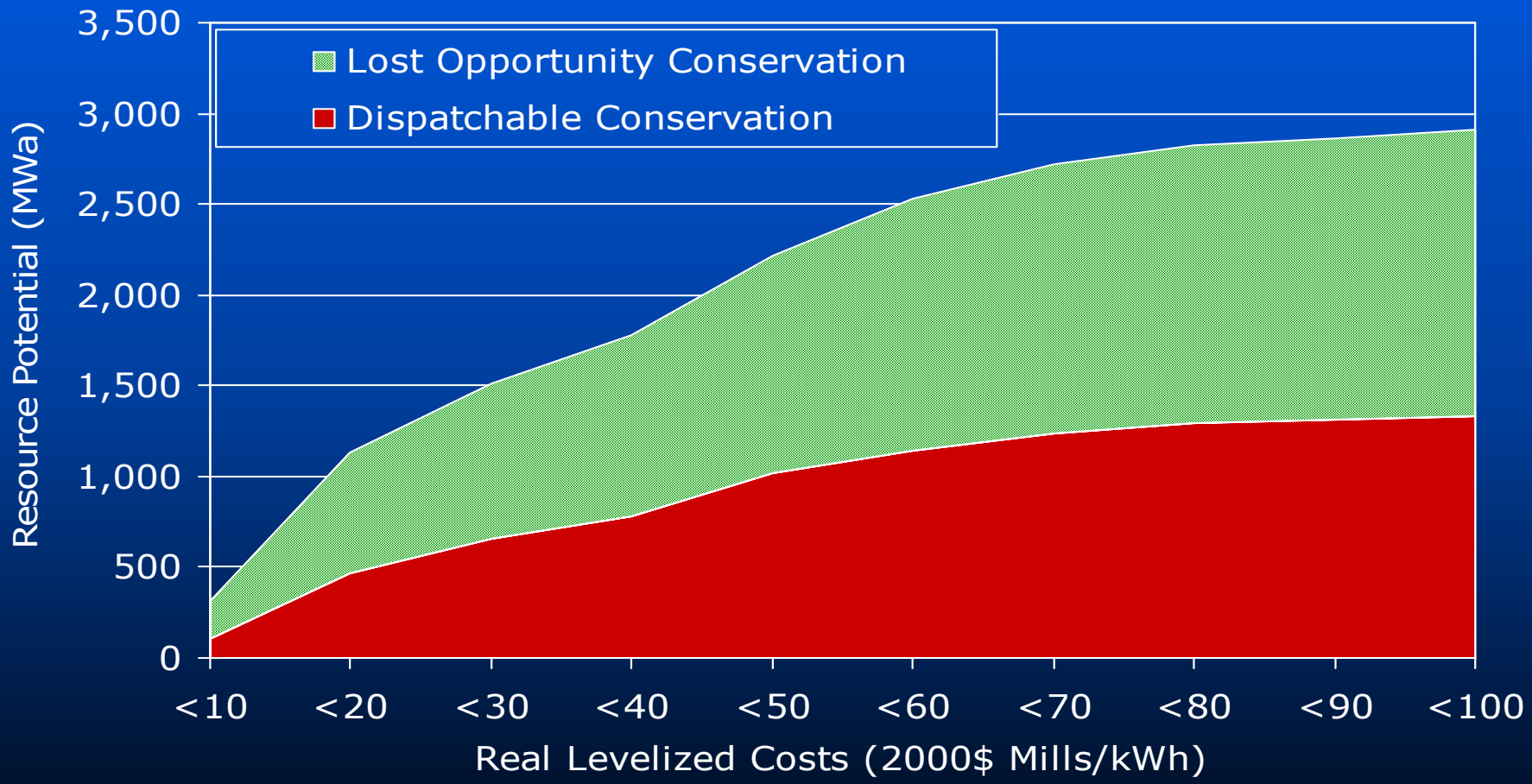
Regional Conservation Resource Potential "Supply Curve"



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Cost-Effective and Achievable Conservation Could Meet Over 10% of "Medium" Forecast PNW Loads in 2025

- Agricultural Sector - 80 aMW
- Non-DSI Industrial Sector - 350 aMW
- Commercial Sector Non-Building Measures - 430 aMW
- HVAC, Envelope & Refrigeration - 375 aMW
- New Commercial Building Lighting - 220 aMW
- Existing Commercial Buildings Lighting - 130 aMW
- Residential Space Conditioning - 240 aMW
- Residential Lighting - 530 aMW
- Residential Water Heating - 325 aMW
- Residential Appliances - 140 aMW

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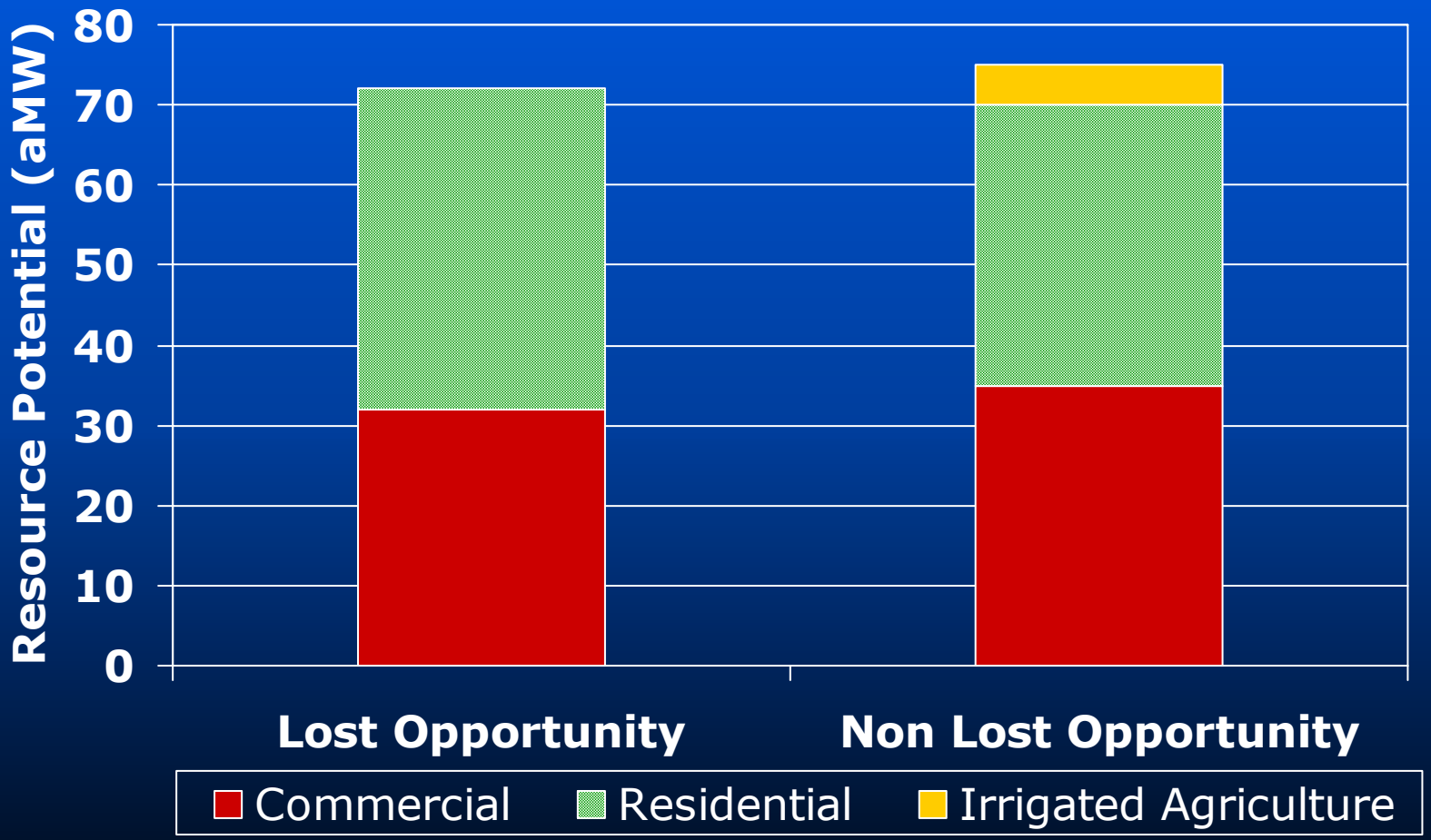
Annual Total Economic Resource Potential



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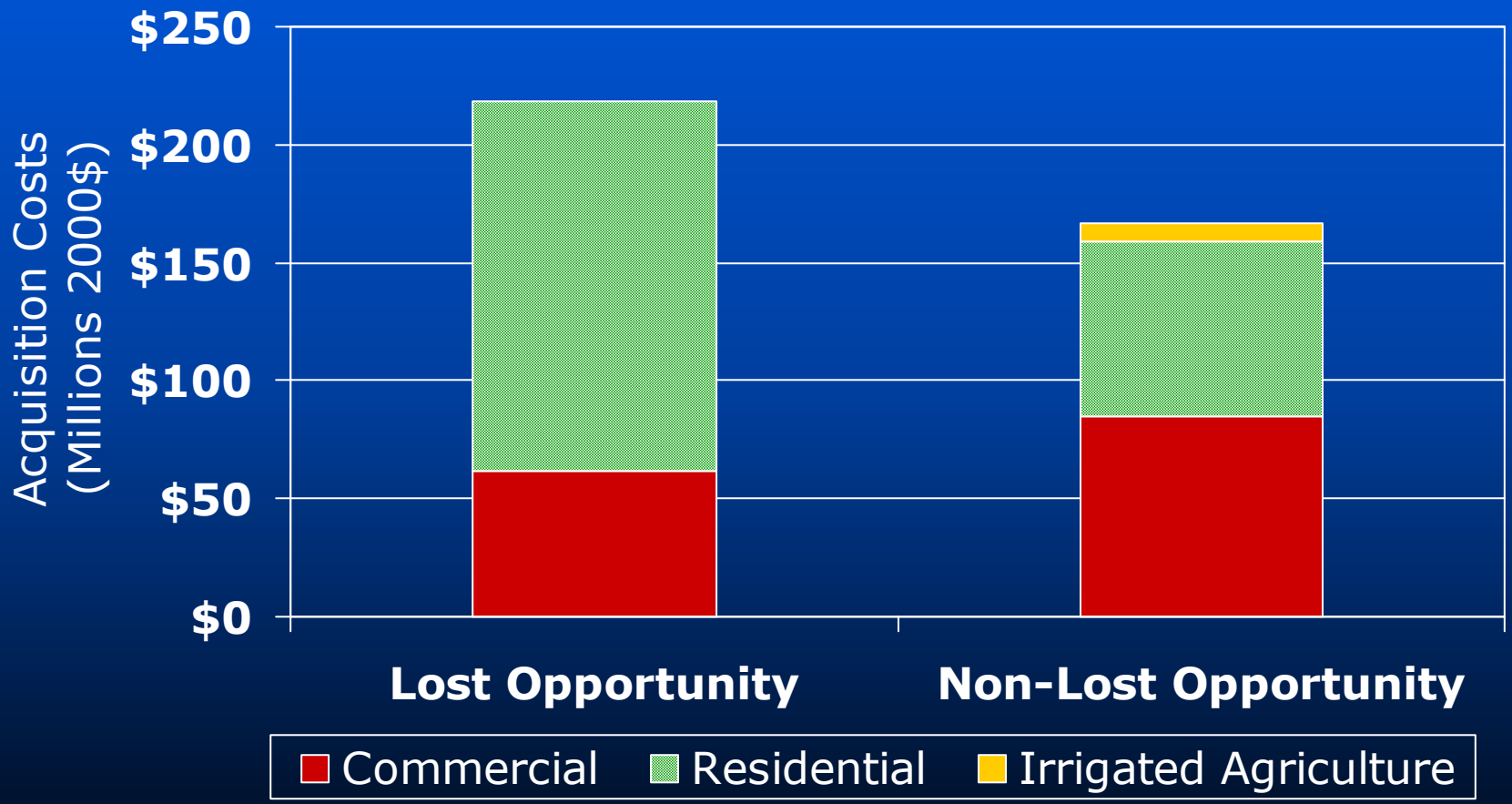
Annual Total Resource Acquisition Cost



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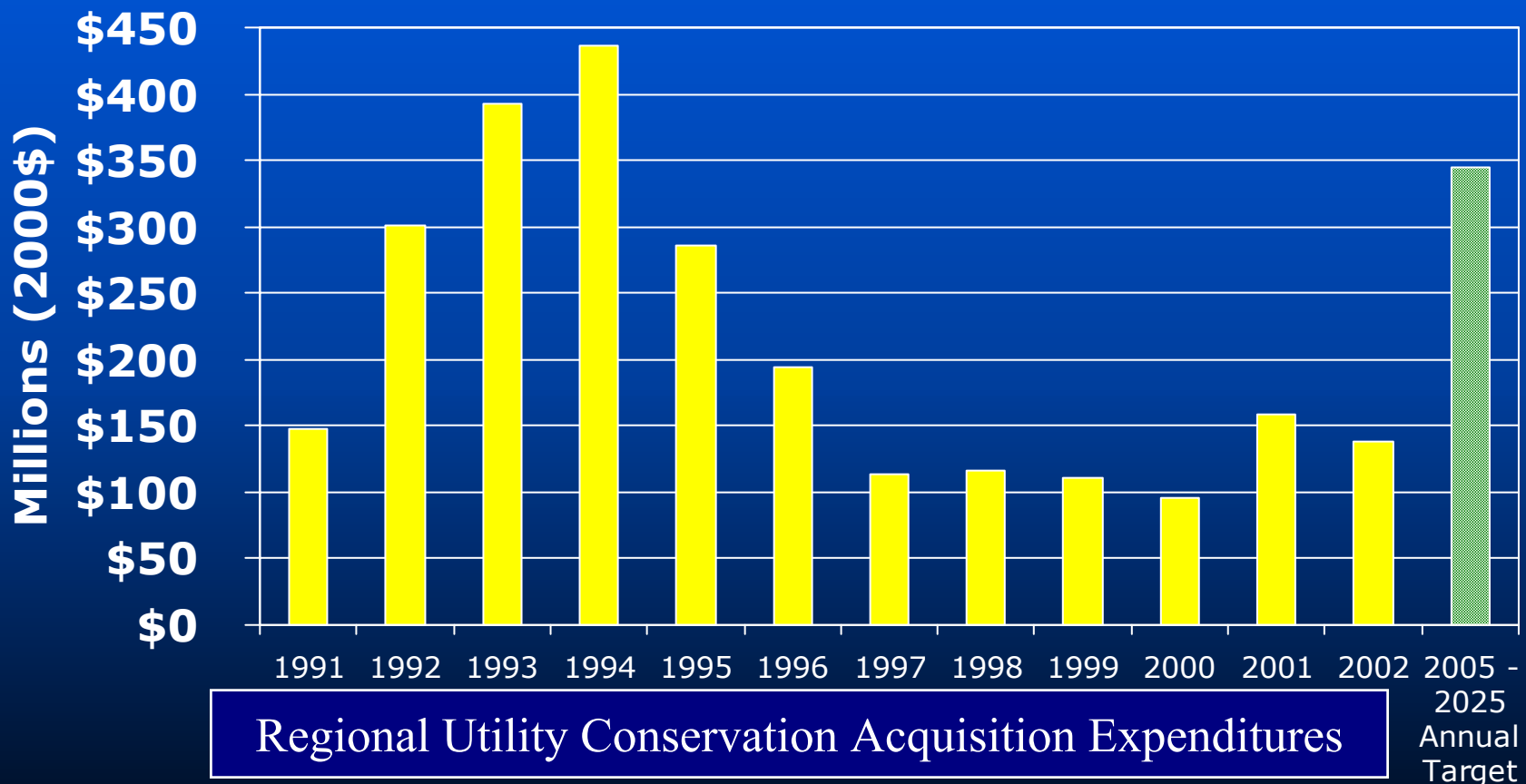
To Meet Council Plan Targets Regional Conservation Investments Will Have to Increase Significantly or Be More Efficient



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Summary

- It's big – Over 2800 MWa
- It's cheap ~ 2.4 cents/kWh
- It's new "stuff" and improved "old stuff"
- It's half lost opportunity
- It's nearly all capital
- It's going to require more money at a time when utilities are faced with the bad politics of rate increases
- It's a "point estimate"
- Olivia is using this supply curve to test the value of developing more or less conservation resources

Backup slides

Figure 5
Hour Load Profile for Residential Central Air Conditioning
Water Heating and Space Heating Conservation Savings

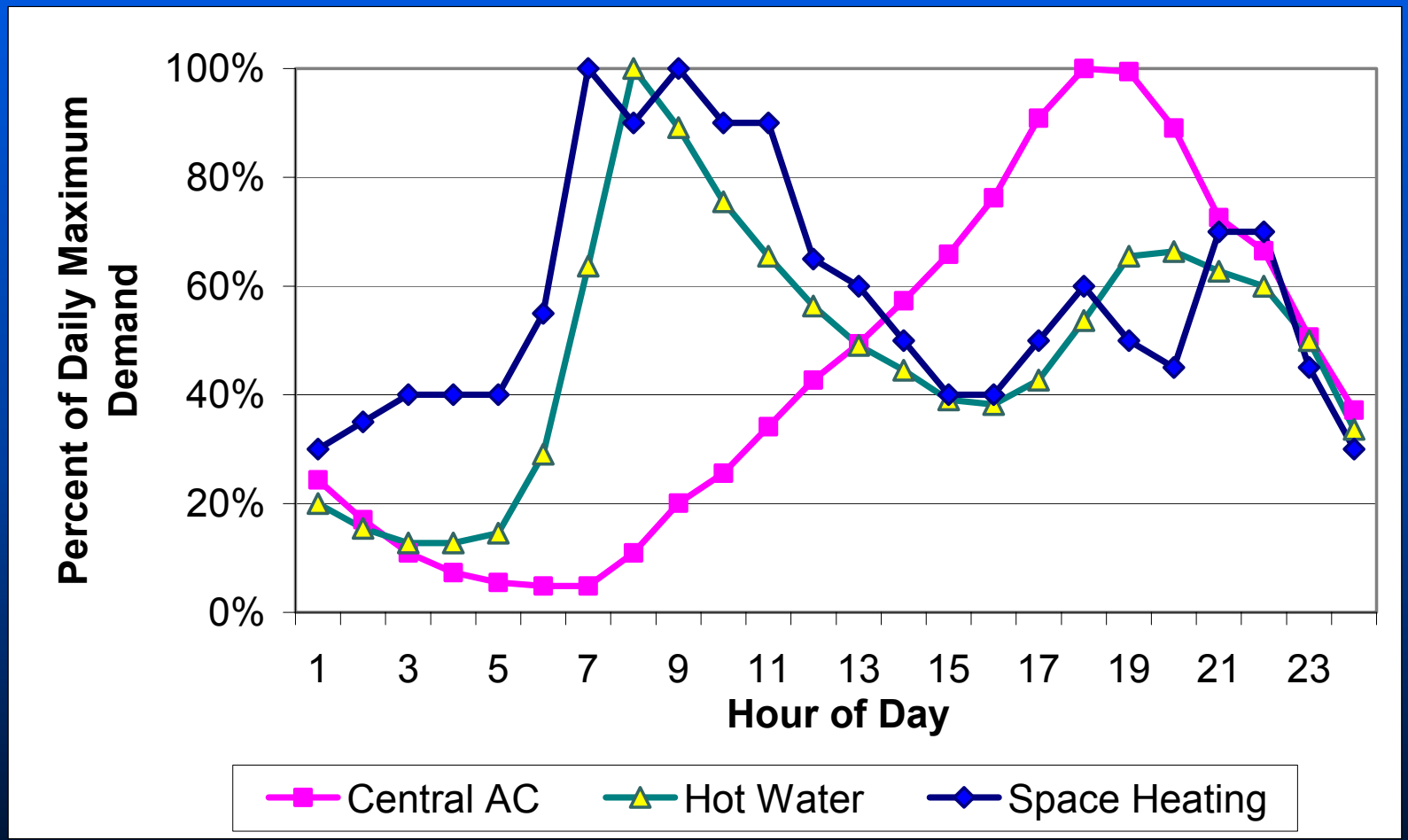

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Figure - 6
Forecast Levelized "On" and "Off-Peak" Wholesale Power Market Prices for

January and August at Mid C

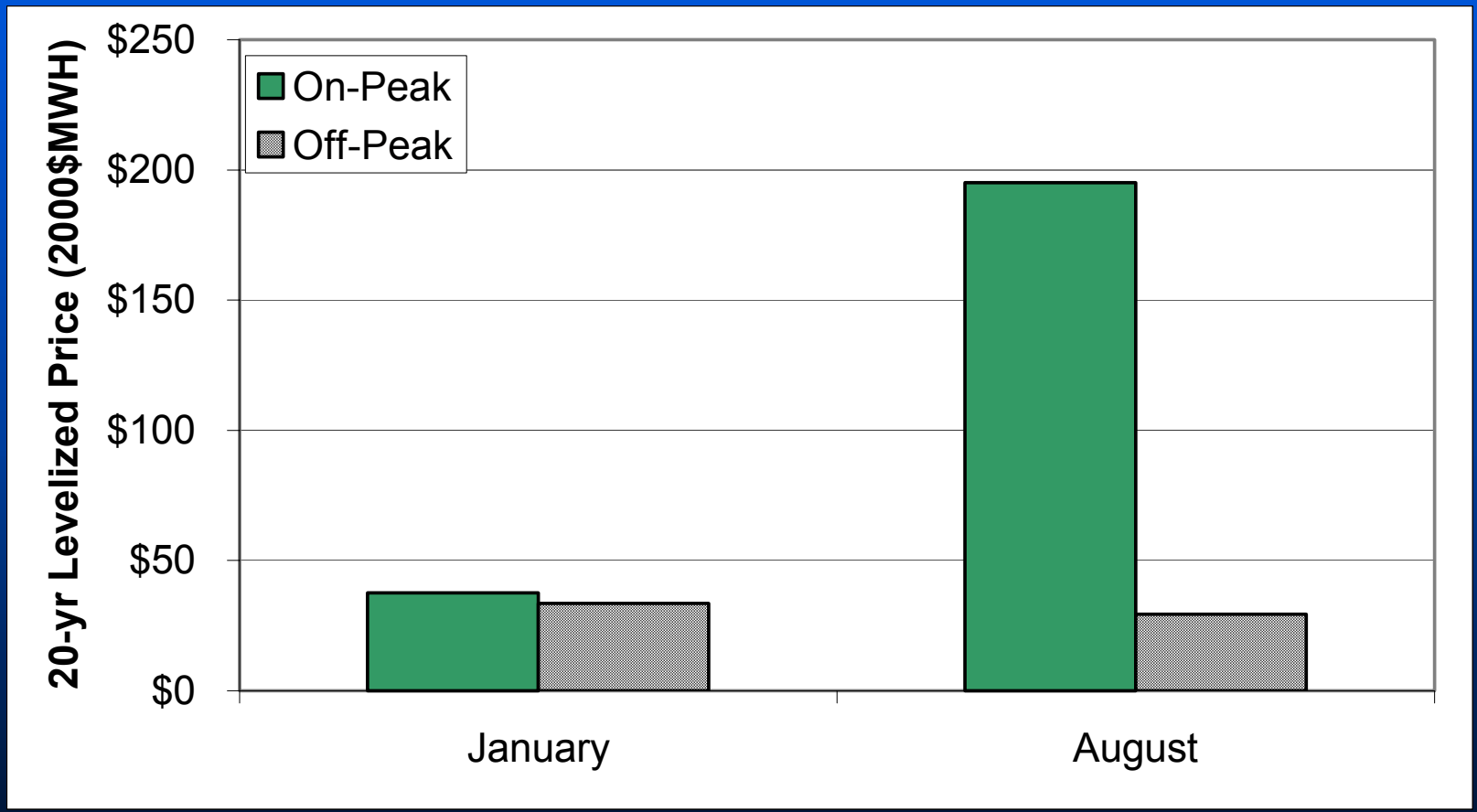

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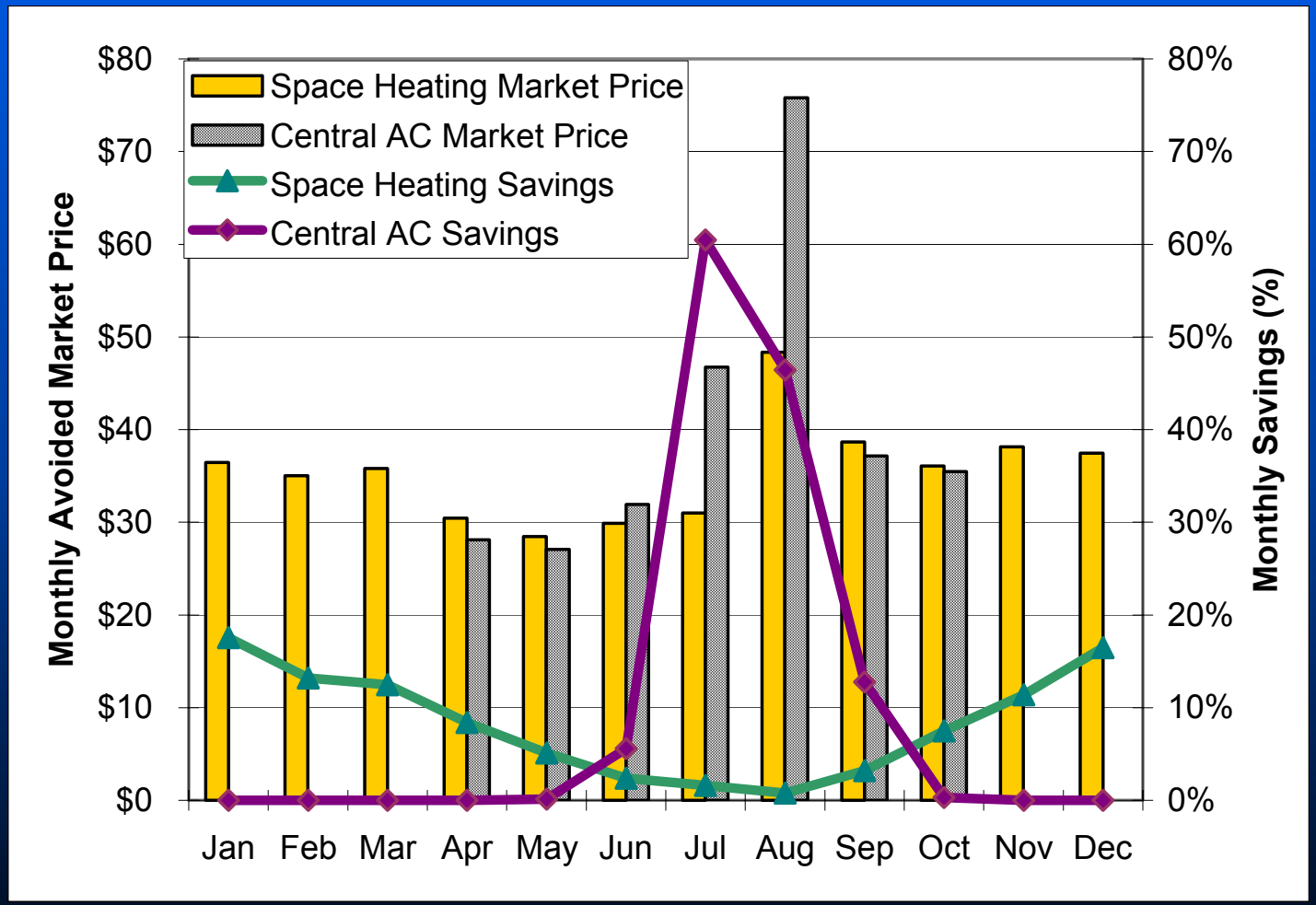
Figure 7
Market Price and Savings for Residential Space Heating and Central Air Conditioning Conservation Saving



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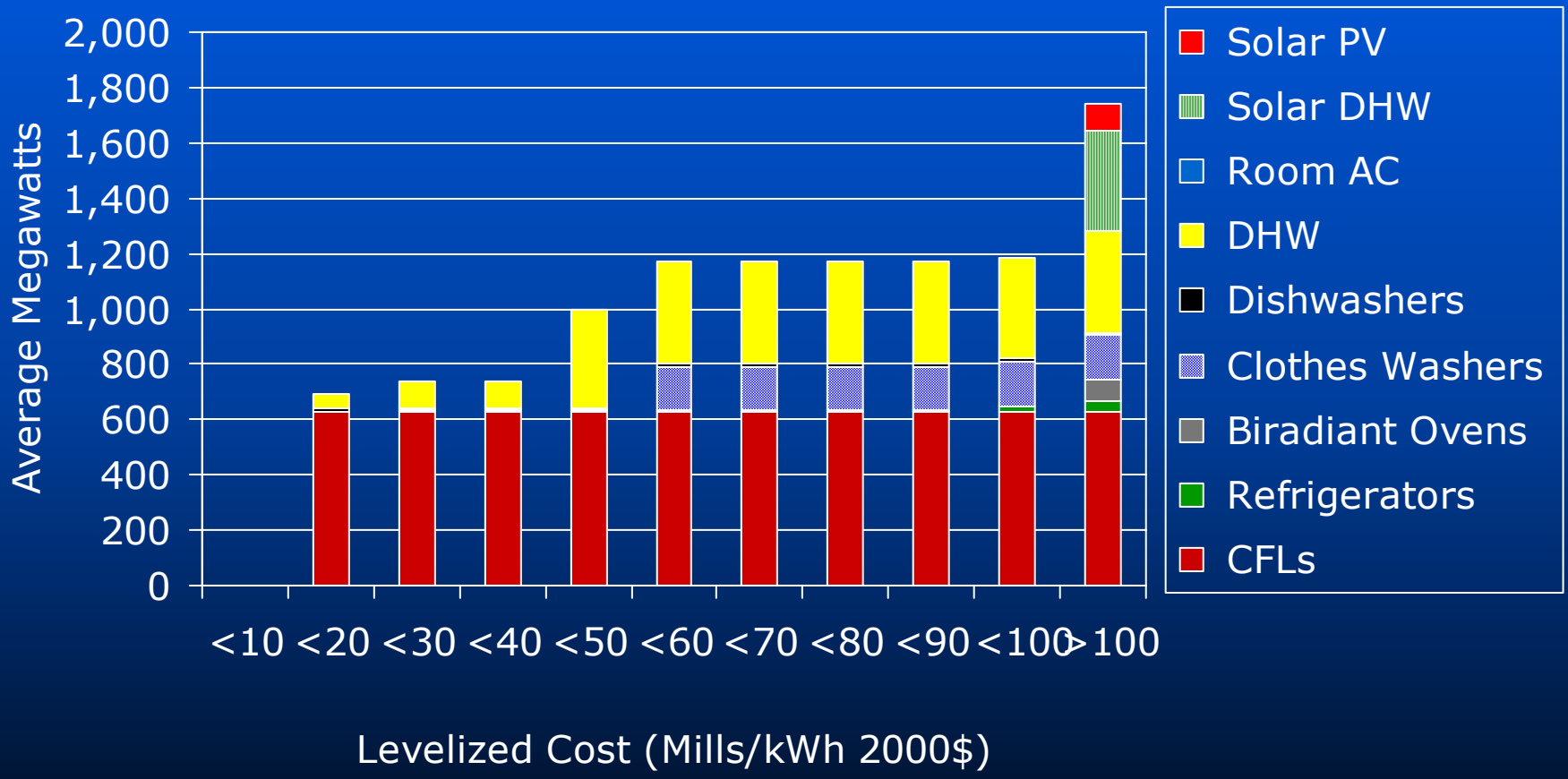
Estimating the Resource: Sources of Measures

- Last Council Plan
- National Labs, USDOE, ACEEE, E-Source
- BPA, utilities, NEEA, Energy Trust
- Regional Technical Forum
- Other regional & national assessments

Estimating the Resource: Analytical Conservatisms

- Currently Available technologies & practices
  - i.e., No savings from technologies "from the future"
- Measure applicability screening
  - e.g., heat pump water heaters excluded from Multifamily buildings
- Interactions between measures
  - e.g., more efficient lighting, less air condition, but more heating
- Code or better base case
  - e.g., accounts for 2006 federal standards, Energy Star market share, etc.
- All non-energy costs and benefits, to the extent quantifiable
- Multiple data sources considered, conservative values chosen

Residential Lighting, Appliance and Water Heating Technical Potential



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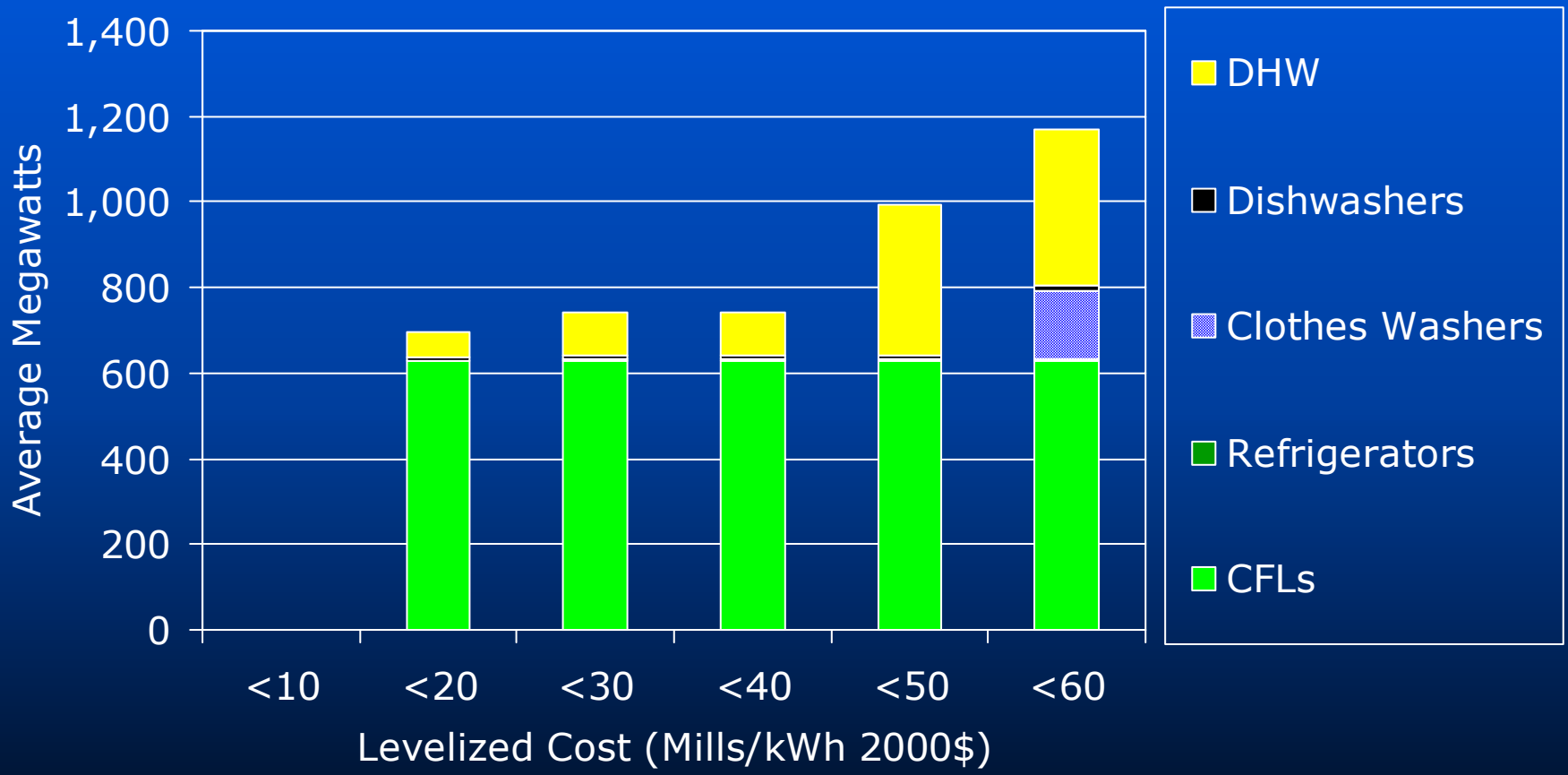
Residential Lighting, Appliance and Water Heating Economic Potential



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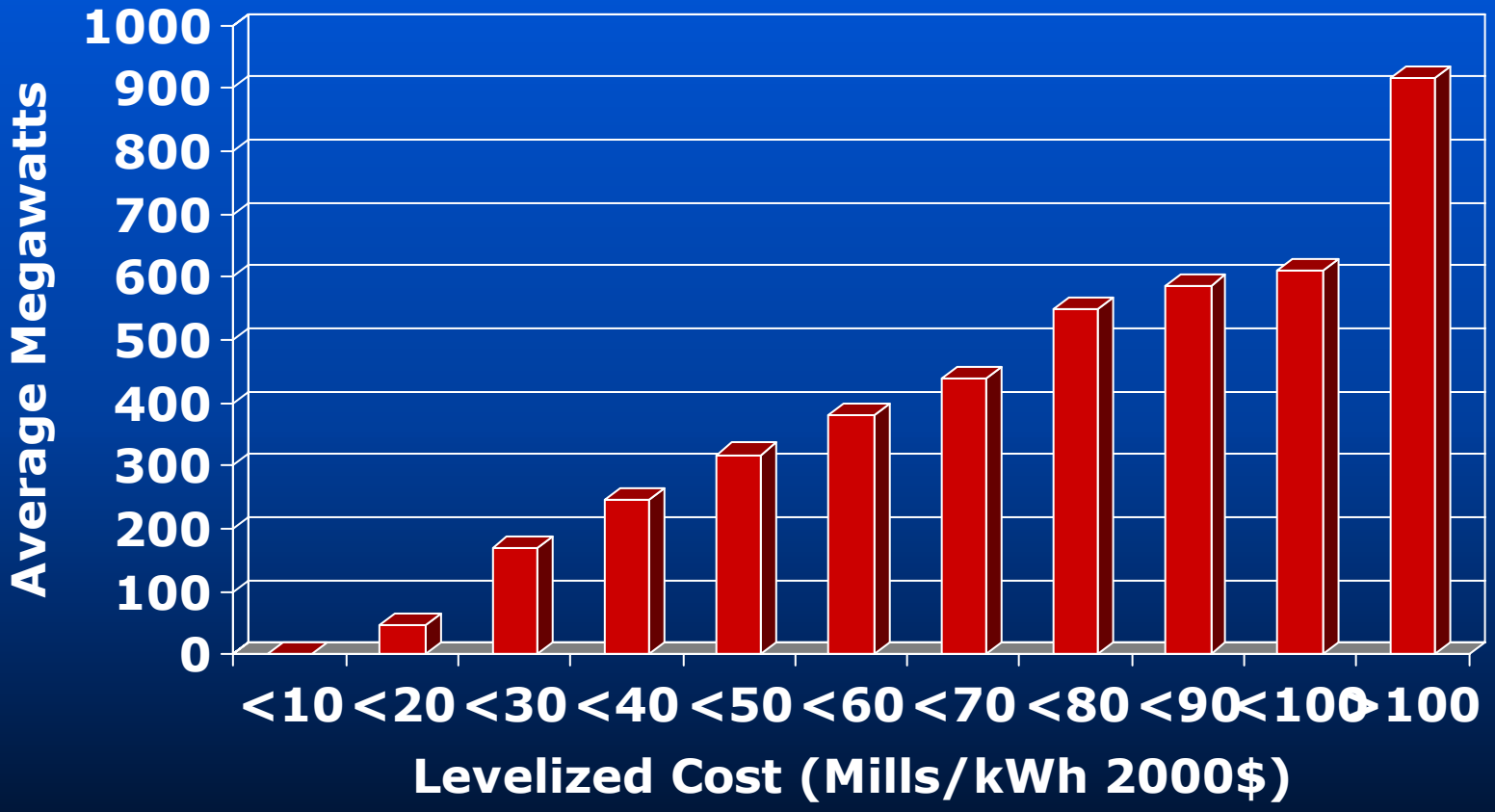
Residential Space Conditioning Technical Potential



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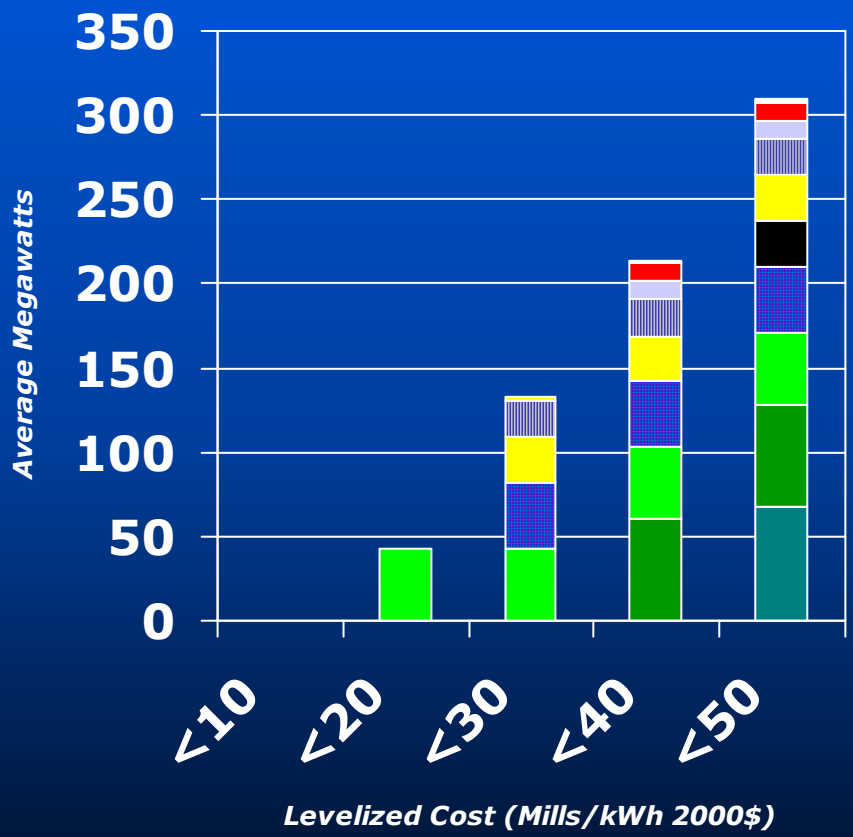
Residential Space Conditioning Economic Potential



- *PTCS Duct Sealing, Commissioning and Controls*
- *SGC - Multifamily Homes*
- *PTCS Duct Sealing*
- *PTCS Duct Sealing and System Commissioning*
- *SGC - Single Family Homes*
- *SGC - Manufactured Homes*
- *Weatherization - Manufactured Home*
- *Weatherization - Multifamily*
- *Weatherization - Single Family*
- *Heat Pump Upgrades*
- *Heat Pump Conversions*

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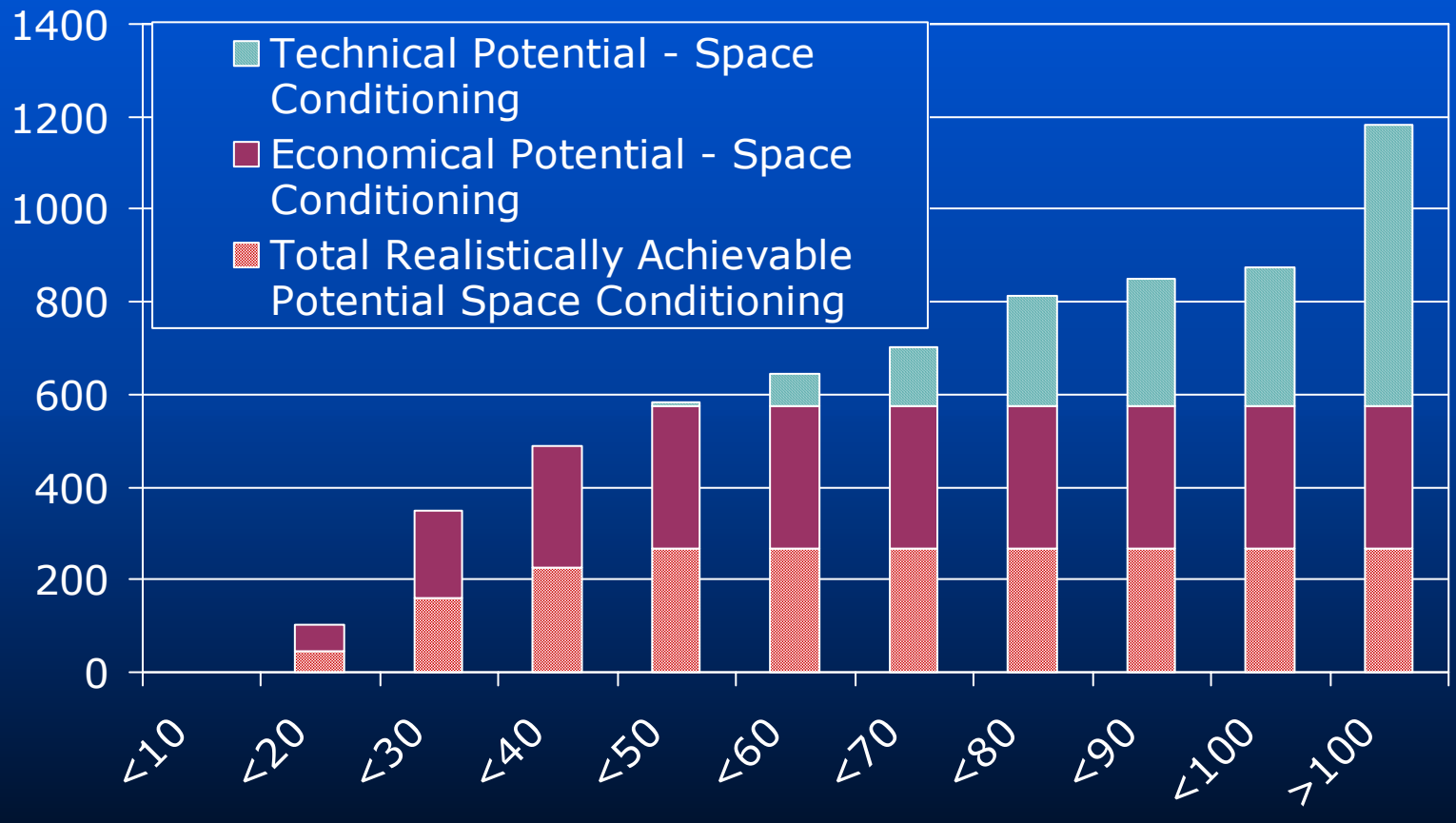
Residential Sector Technical, Economic and Realistically Achievable Space Conditioning Conservation Potential
(Medium Forecast - 2025)



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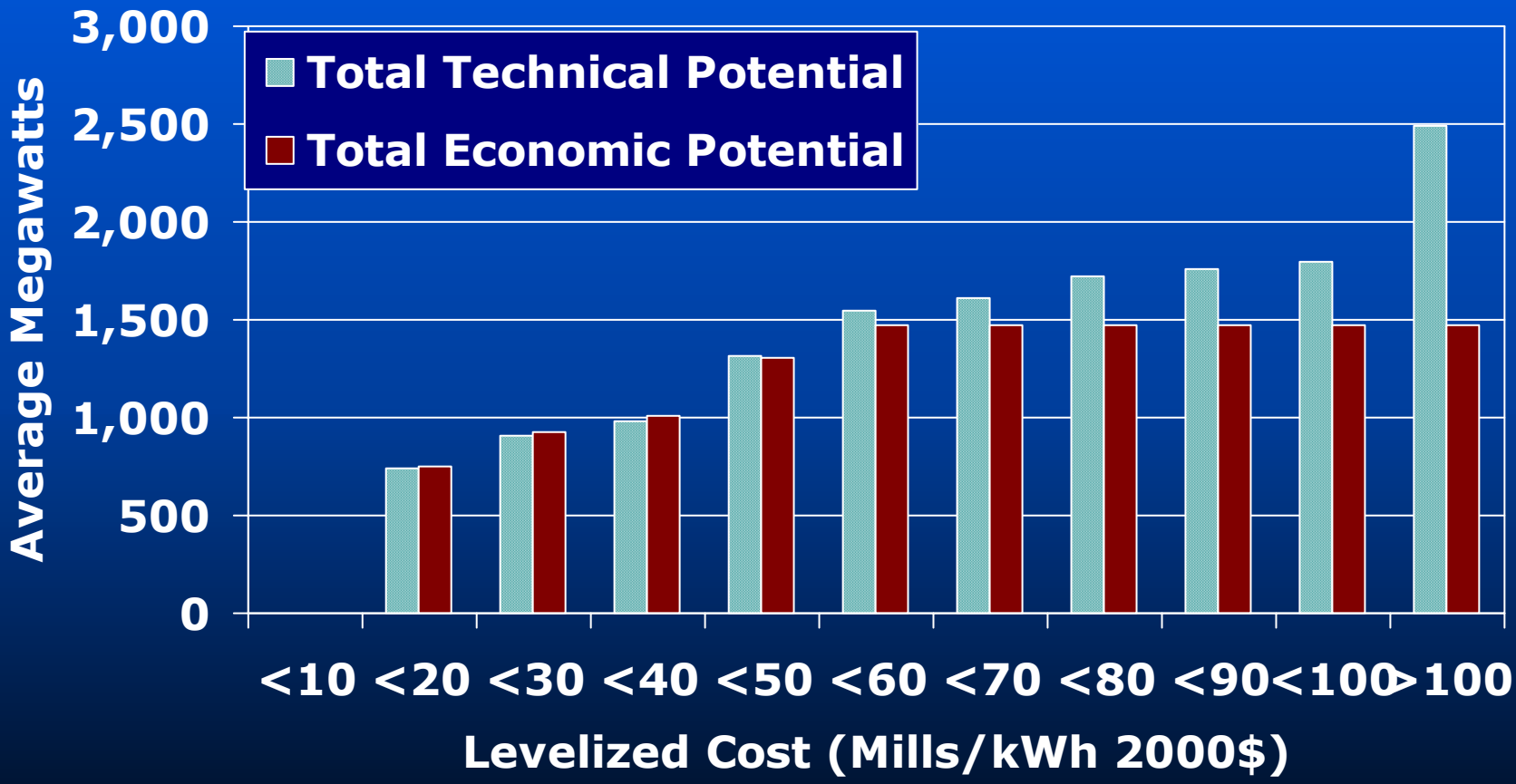
Residential Sector Conservation Potential



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Residential Sector Technical, Economic and Realistically Achievable Conservation Potential
(Medium Forecast - 2025)

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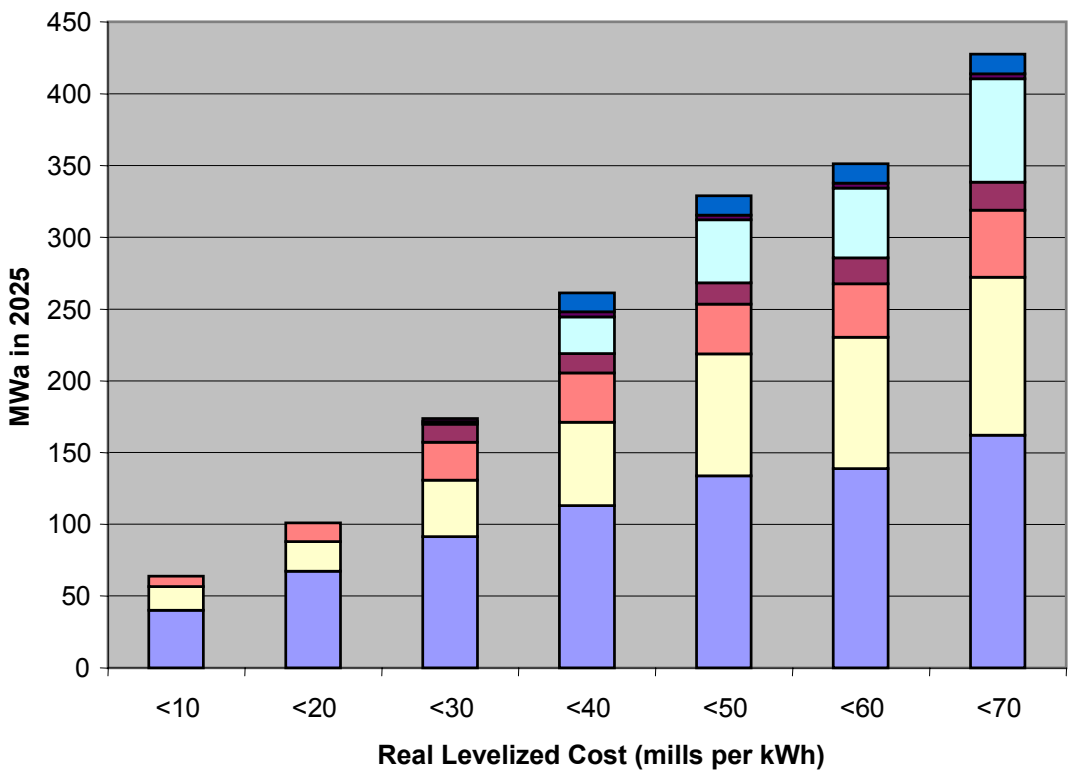
Commercial Sector Realistically Achievable Retrofit Potential (Medium Forecast – 2025)



- Plug Load Sensor
- Variable Drive Power
- Built-Up HVAC Controls Optimization
- Glass
- Grocery Refrigeration
- Package Roof Top Optimization
- Lighting Measures

Cost-Effective Amount is 340 MWa

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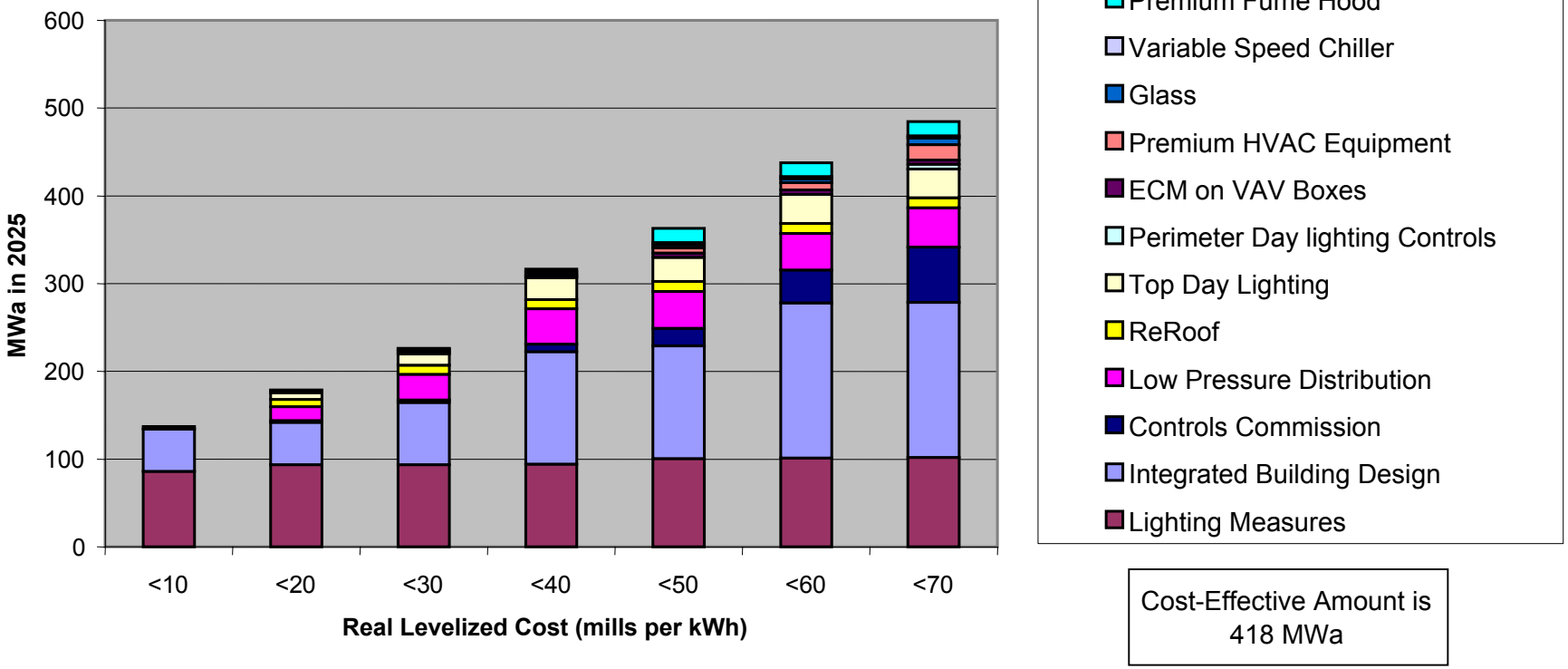
Commercial Sector
Realistically Achievable Lost Opportunity Potential
(Medium Forecast – 2025)



Cost-Effective Amount is 418 MWa

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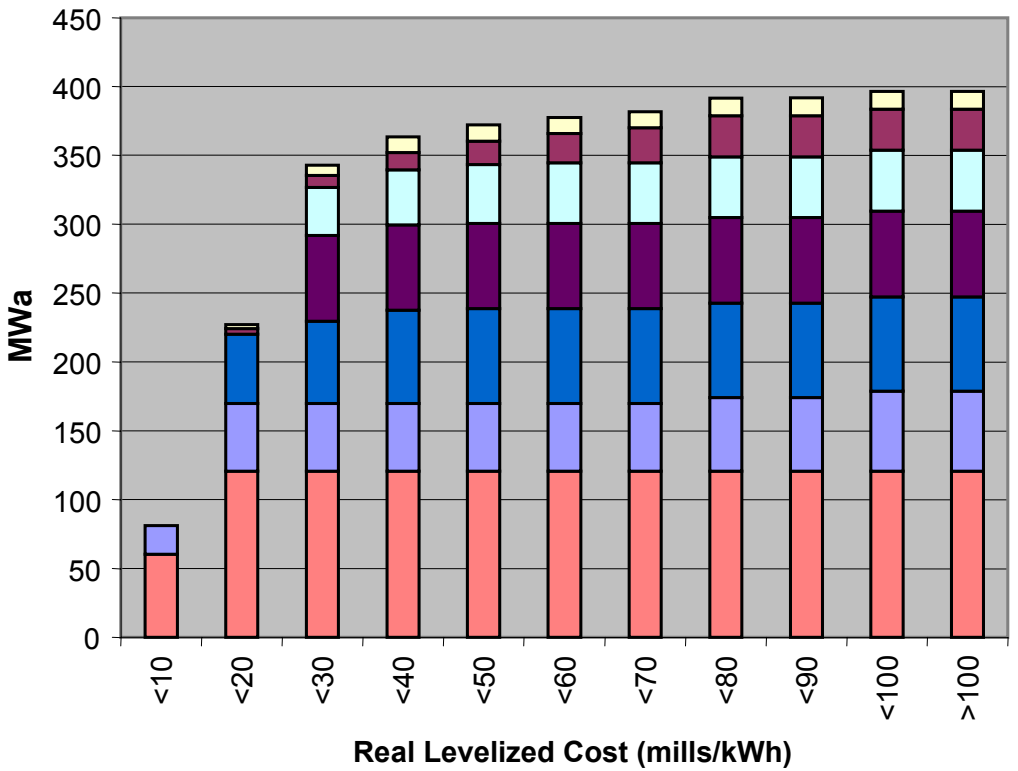
Commercial Sector
Realistically Achievable Non-Building Potential
(Medium Forecast – 2025)



- LED Traffic Lights
- Municipal Water Supply
- LED Exit Signs
- Network PC Power Management
- Packaged Refrigeration Equipment
- Municipal Sewage Treatment
- Efficient Power Supplies

Cost-Effective Amount is
386 MWa

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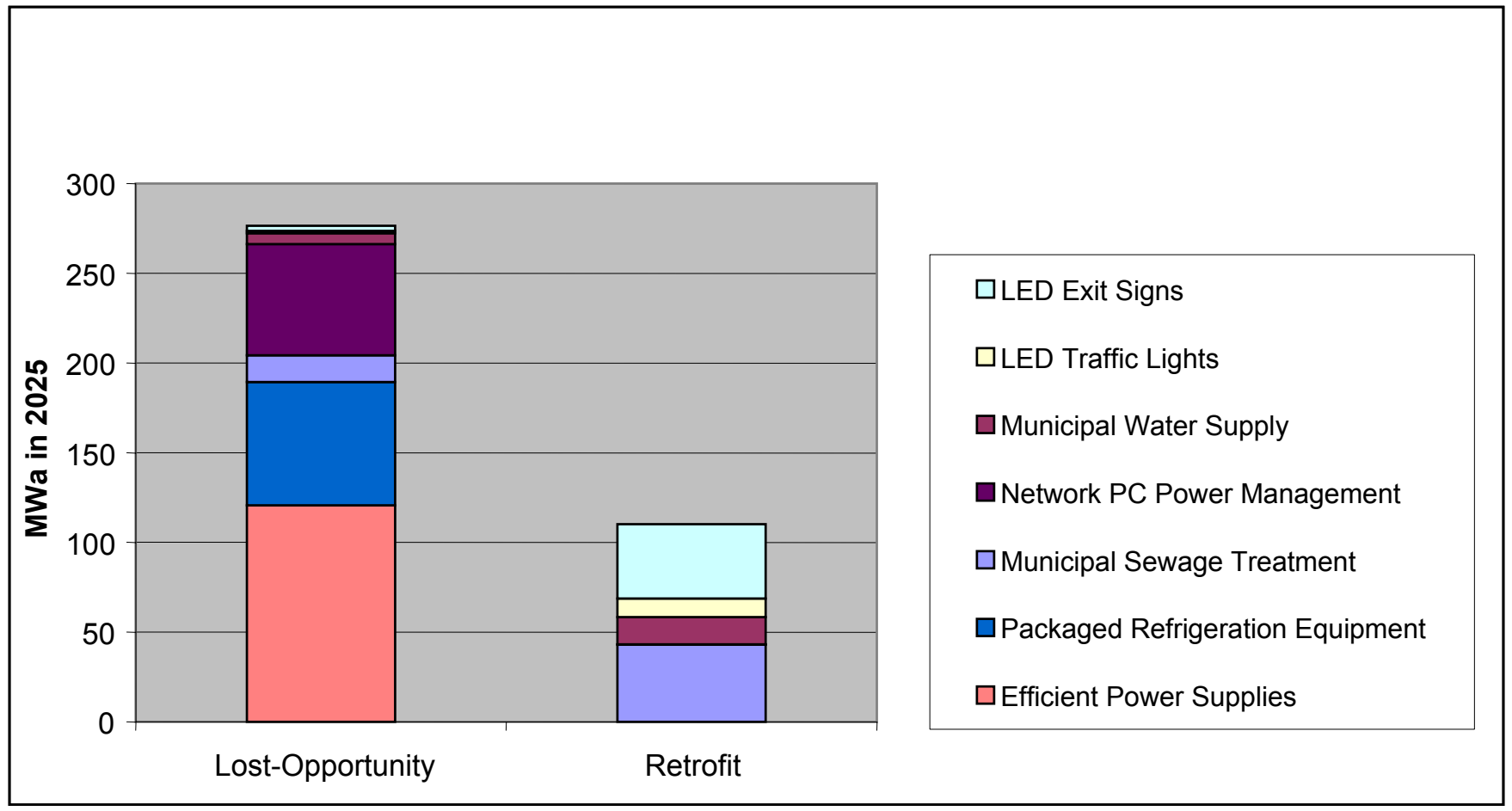
Commercial Sector
Non-Building Resources Total Realistically Achievable Potential
(Medium Forecast – 2025)



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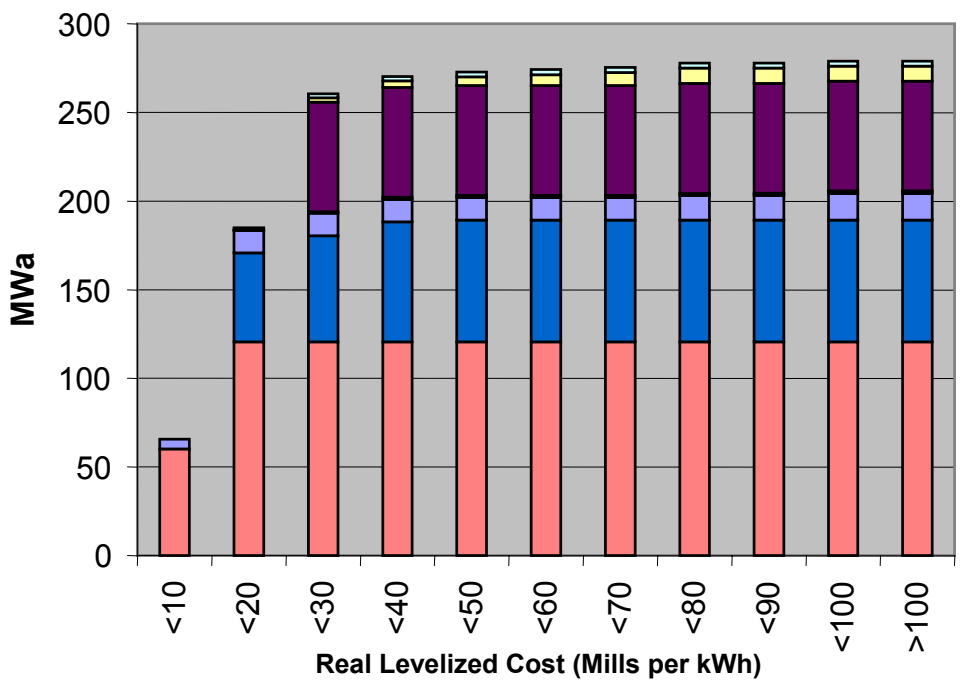
Commercial Sector Lost Opportunity Resources Realistically Achievable Potential (Medium Forecast – 2025)



Cost-Effective Amount is 276 MWa

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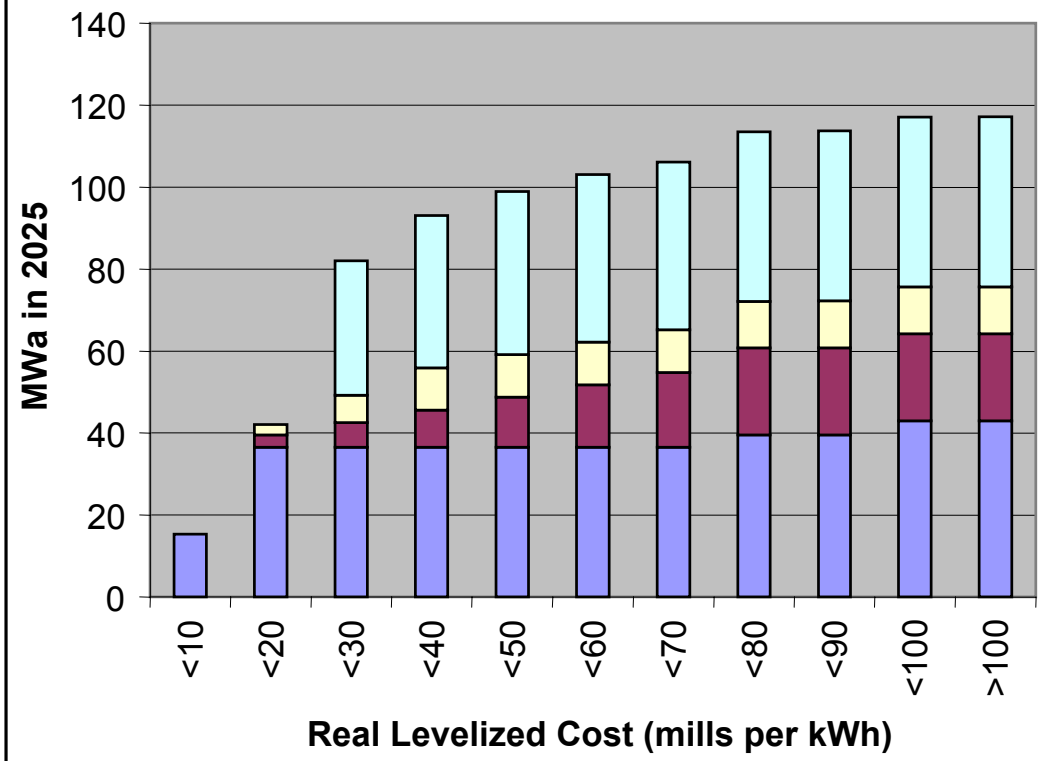
Lost Opportunity Potential C



LED Exit Signs

LED Traffic Lights

Municipal Water Supply

Municipal Sewage Treatment

Cost-Effective Amount is 110 MWa

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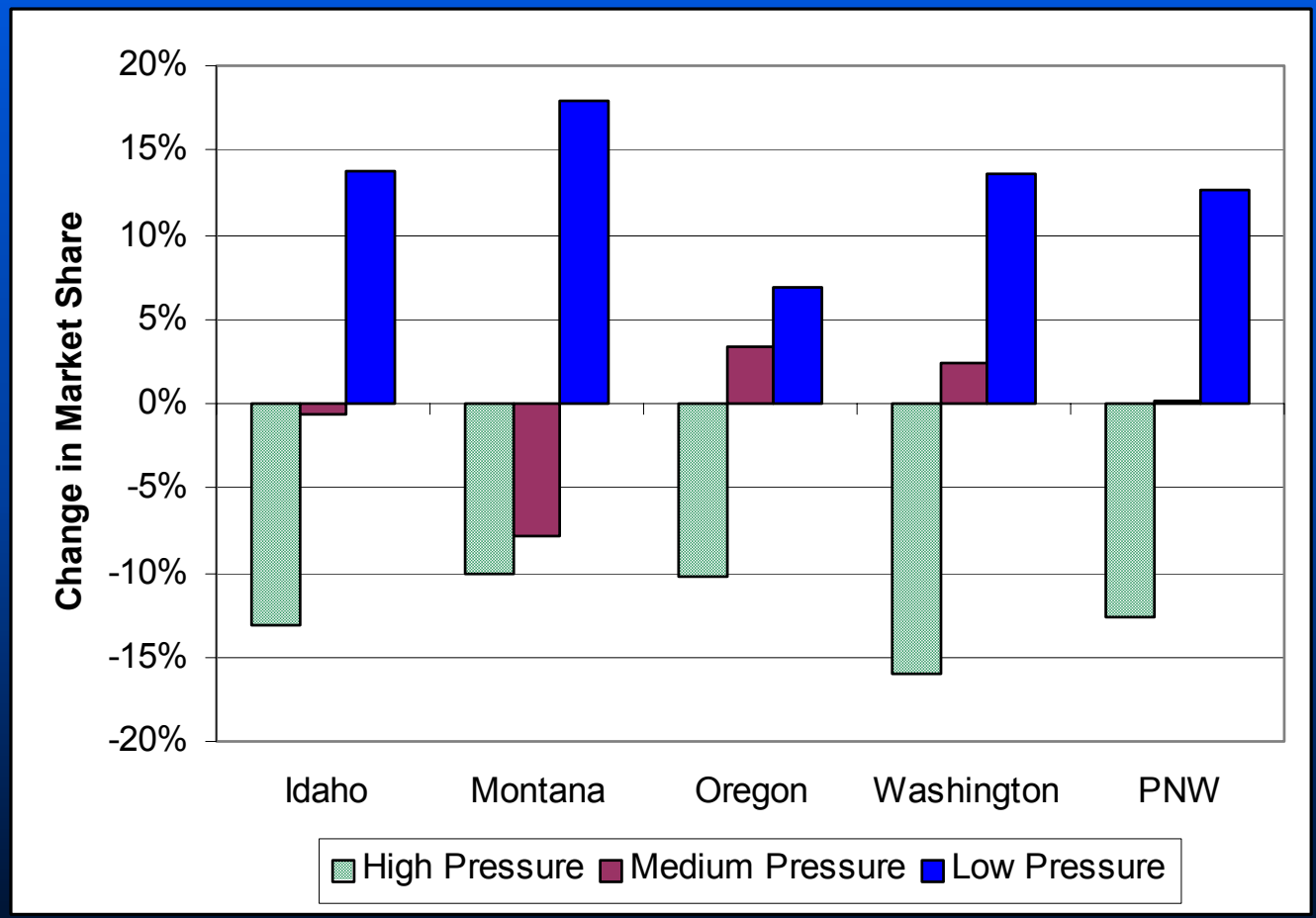
Change in Market Share of High, Medium and Low Pressure Center Pivot Irrigation Systems 1994 to 1997



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Realistically Achievable Conservation Resource Potential in Irrigated Agriculture