

Final Results: Modeling of Energy Efficiency Recommendations for the West

David Von Hippel

David Nichols

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Purpose

- To quantify the potential of achieving energy and demand savings by accelerating the market penetration of available efficiency technologies
- Demand-side measures reduce energy users' need for electricity from "grid" through efficiency (on-site CHP removed from package)

Overall Approach

- **Identification of energy efficiency measures**, by Forum/Tellus team
- **Measure evaluation**: Determination of basic cost-effectiveness of individual measure installations.
- **Program evaluation**: Assembly of illustrative energy efficiency programs (application of measures to markets) and estimation of program impacts and costs

Approach by Region

- Savings, costs for energy-efficiency in WSCR (Interior West), and WSCP (OR/W. ID) built up from estimates for 20+ program types per region
- Savings and costs for energy efficiency in CNV (CA/Las Vegas) estimated based on parameterization of a national (ACEEE) study

Characterizing Measures

- Measure cost information: capital cost (incremental/total)/unit, annual O&M
- Energy use impacts: annual energy and peak power savings, gas use
- Discount rate (4.88%/yr a real basis)
- Levelized avoided capacity and energy costs for rough screening purposes only
- Gas avoided costs
- Result: “incremental” measure costs and savings

Program Evaluation

- **Grouping** of measures into "programs"
- Program **market** estimation
- Estimating **program penetration rates**: based on rates historically achieved, program targets
- Estimating **expenditures for administering** programs

Residential Measures Assessed (WSCR/WSCP)

- Efficient cooling systems
 - Room and central AC efficiency impr.
 - Evaporative AC (Direct and IDDEC)
- Residential Appliance Recycling
- Efficient lighting
 - CFL bulbs, fixtures, and torchieres
- Heating system performance measures--duct testing and sealing

Residential Measures Assessed (WSCR/WSCP)

- Appliance Efficiency/Standards
 - Clothes washers
 - Reduced electronics standby losses
- Building thermal performance
 - Weatherization
 - Building envelope - new construction

“Commercial” Measures Assessed (WSCR/WSCP)

- Efficient lighting--Mix of widely applicable and advanced tech.
- Efficient refrigeration--mix of tech.
- Efficient cooling systems
 - High-efficiency package AC, chillers
 - Residential-type room, central, HP AC
 - Evaporative cooling (IDDEC) and GSHP
 - Gas-fired AC
 - Cooling tower improvements (VSD)

“Commercial” Measures Assessed (WSCR/WSCP)

- Combined heat and power
 - CHP - 30 kW to 800 kW systems, mix of microturbines and IC (diesel) types
- Space Heating--GSHP, fuel switching
- Miscellaneous devices--LED traffic lights and signs, clothes washers
- Retrocommissioning
- Water heating--heat pump, gas WH
- Building envelope improvements
- Electrical transformers

Industrial Measures Assessed (WSCR/WSCP)

- Transformer efficiency improvements
- Motors--Premium motors (new and replace vs. rewind), motor downsizing
- Motor drive systems--upgrades of fan, air compressor, pump systems
- Combined heat and power--800 kW to 40 MW units, mix of IC (diesel), CT systems
- Aluminum Process Improvements--
Retrofit options to improve efficiency of cells, and reduce heat loss (WSCP only)

Grouped Efficiency Options Assessed (CNV)

- System Benefit Fund
 - Efficiency improvements for lighting, appliances, AC, motor systems, others
- Equipment efficiency standards--
 - Transformers, C/I refrig., exit signs, traffic lights, torchieres, commercial heaters/AC, residential refrig./DW, standby loss reduction
- Tax incentives for efficiency
 - Clothes washers, refrig., AC, gas heat pumps, HPWH, furnaces, efficient new construction
- CHP--Mix of C/I, industrial technologies

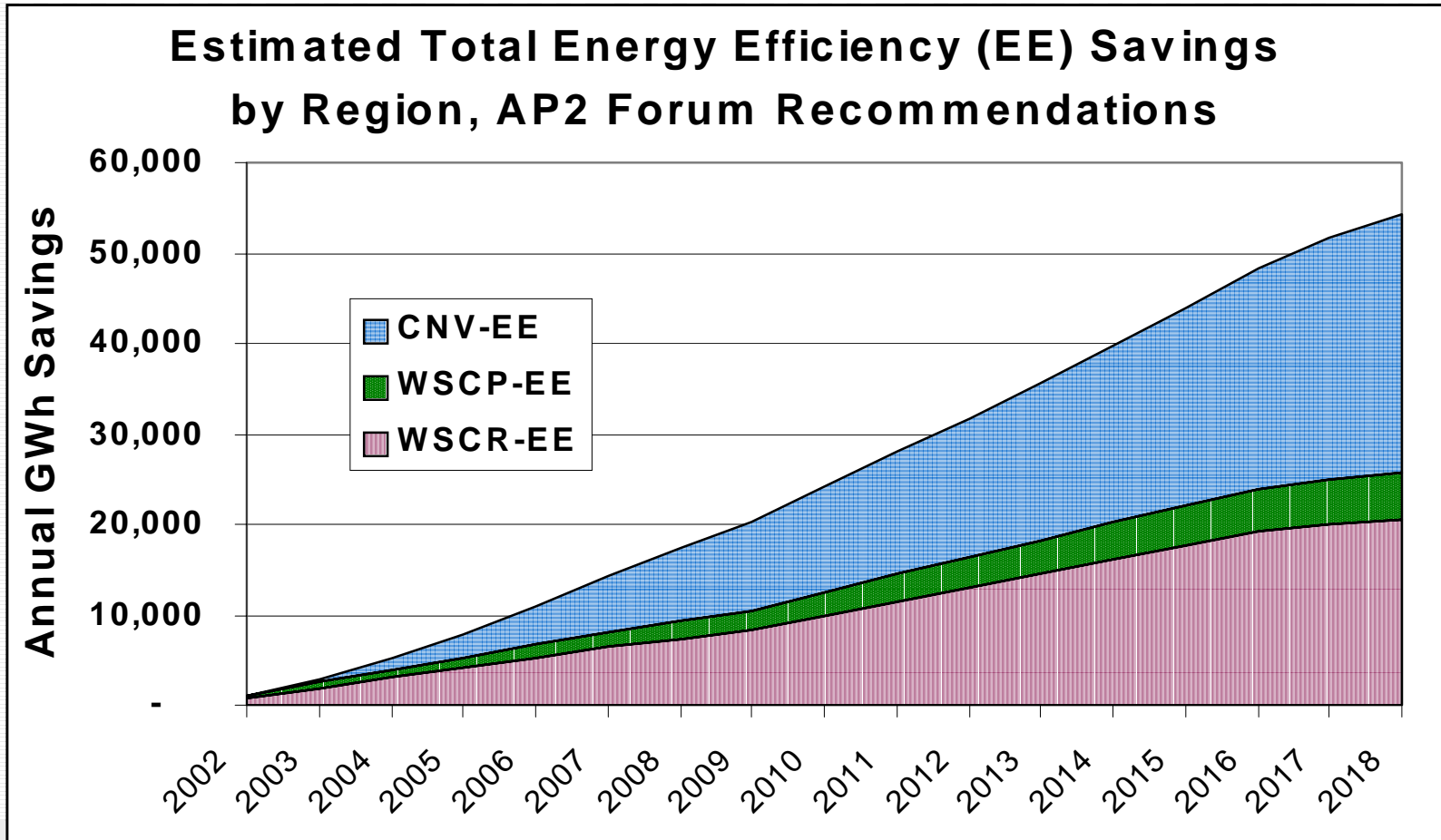
Measures Not Assessed

- Load response and load management programs
- Distributed generation without CHP
- Renewable energy technologies
- Gas energy efficiency measures
- Transportation sector measures

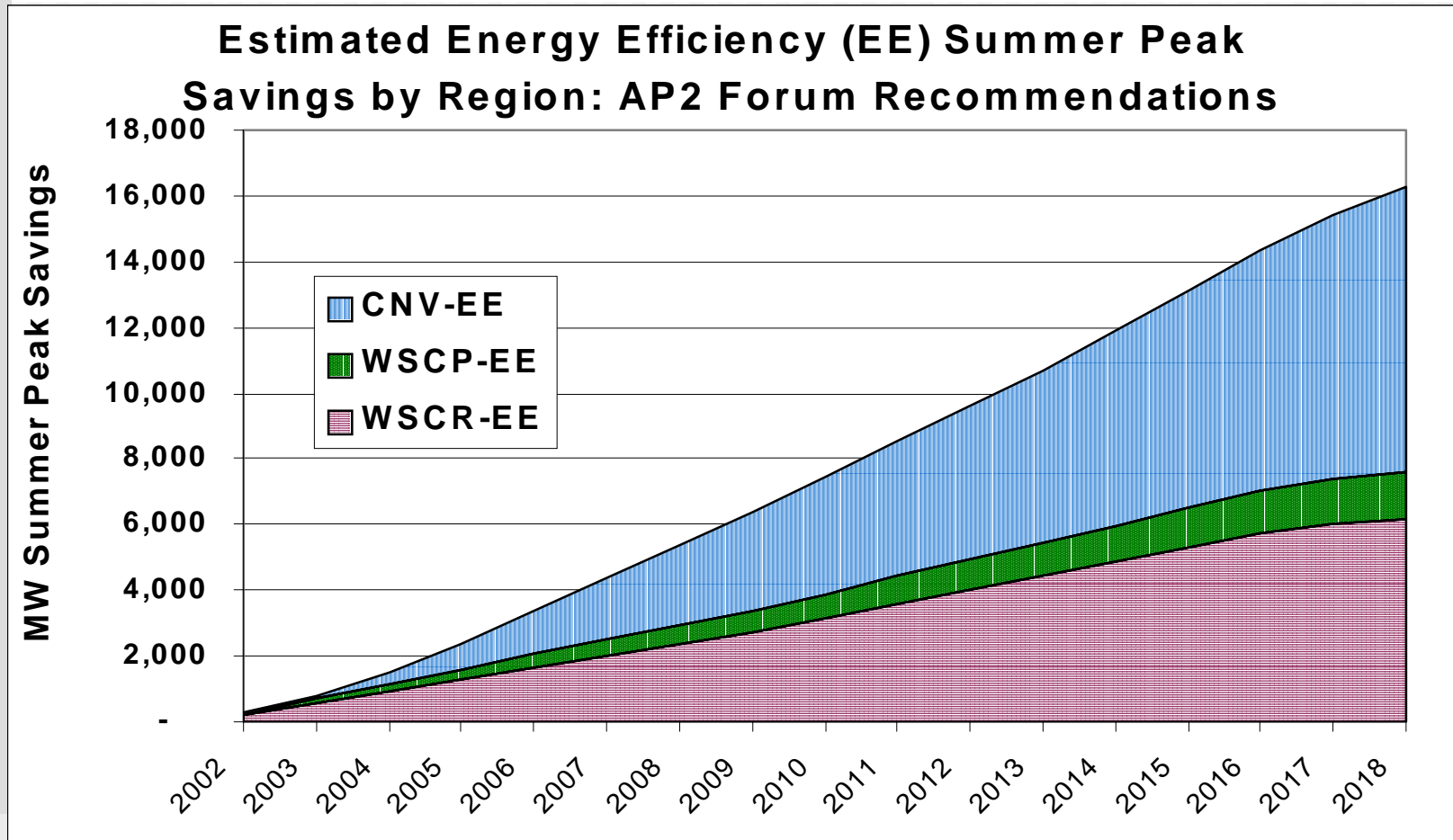
Measures/Programs for Use in IPM Emissions Modeling

- Results of CHP Modeling excluded due to concerns over local air pollution impacts
- Threshold of 5.1 cents/kWh levelized cost set for measures included

Results, Energy Savings, All Regions

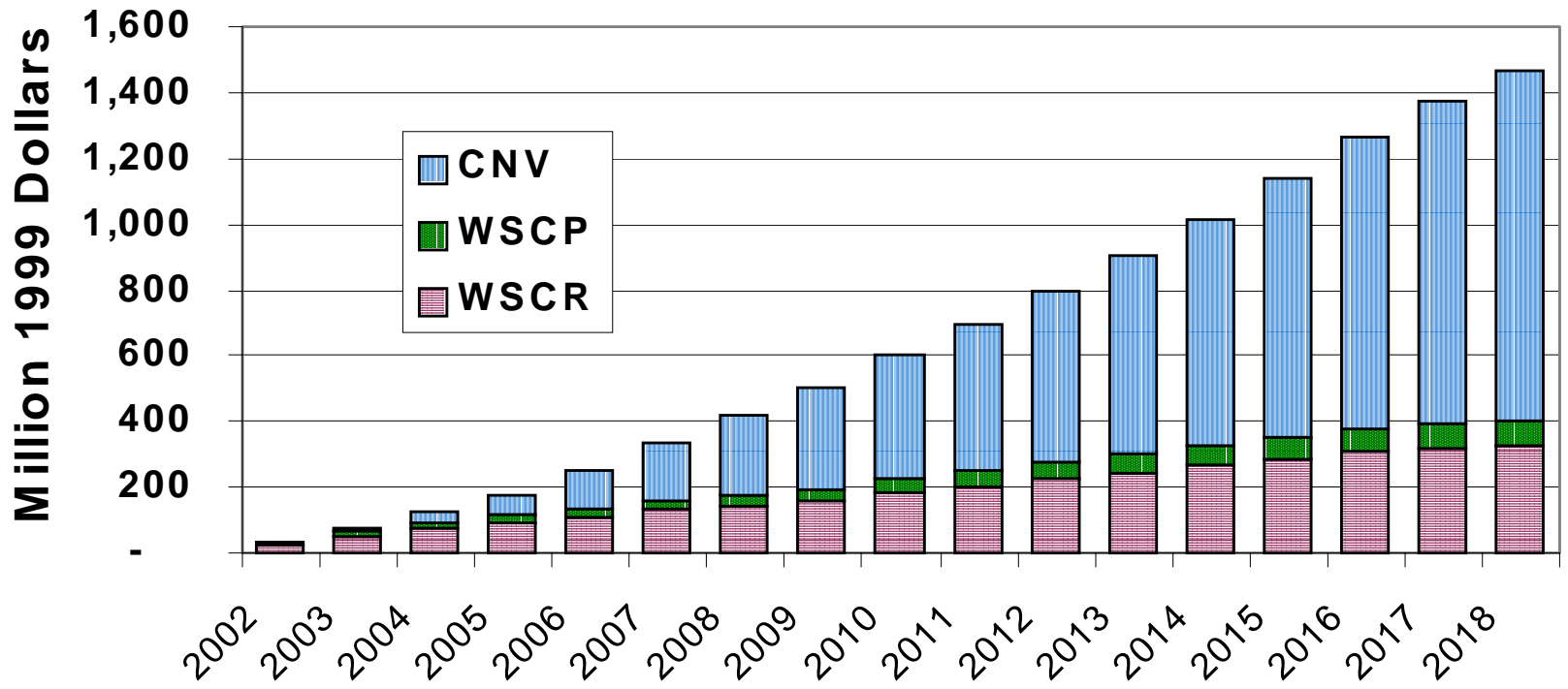


Results, Summer Peak Savings, All Regions

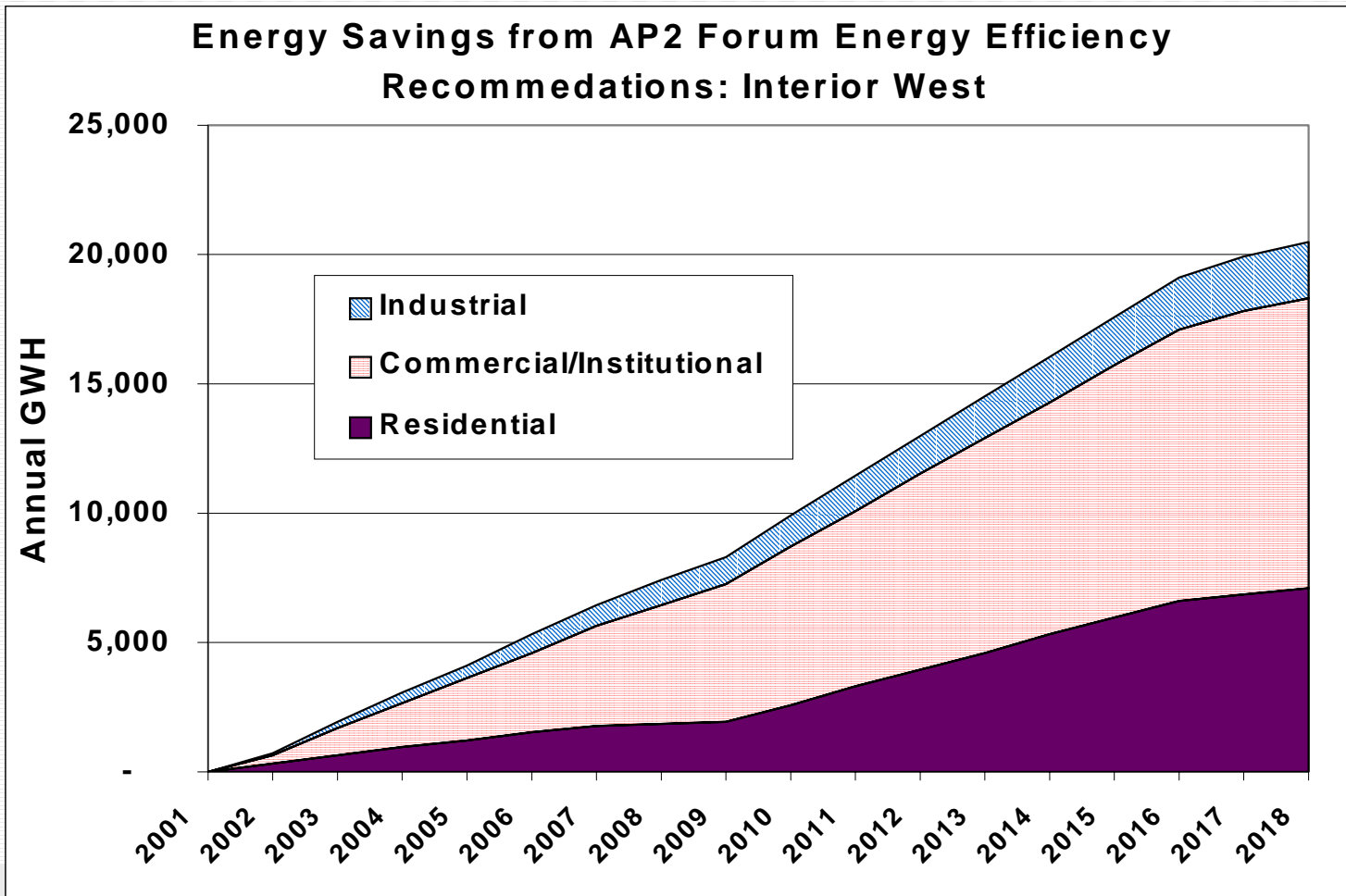


Results, Costs, All Regions

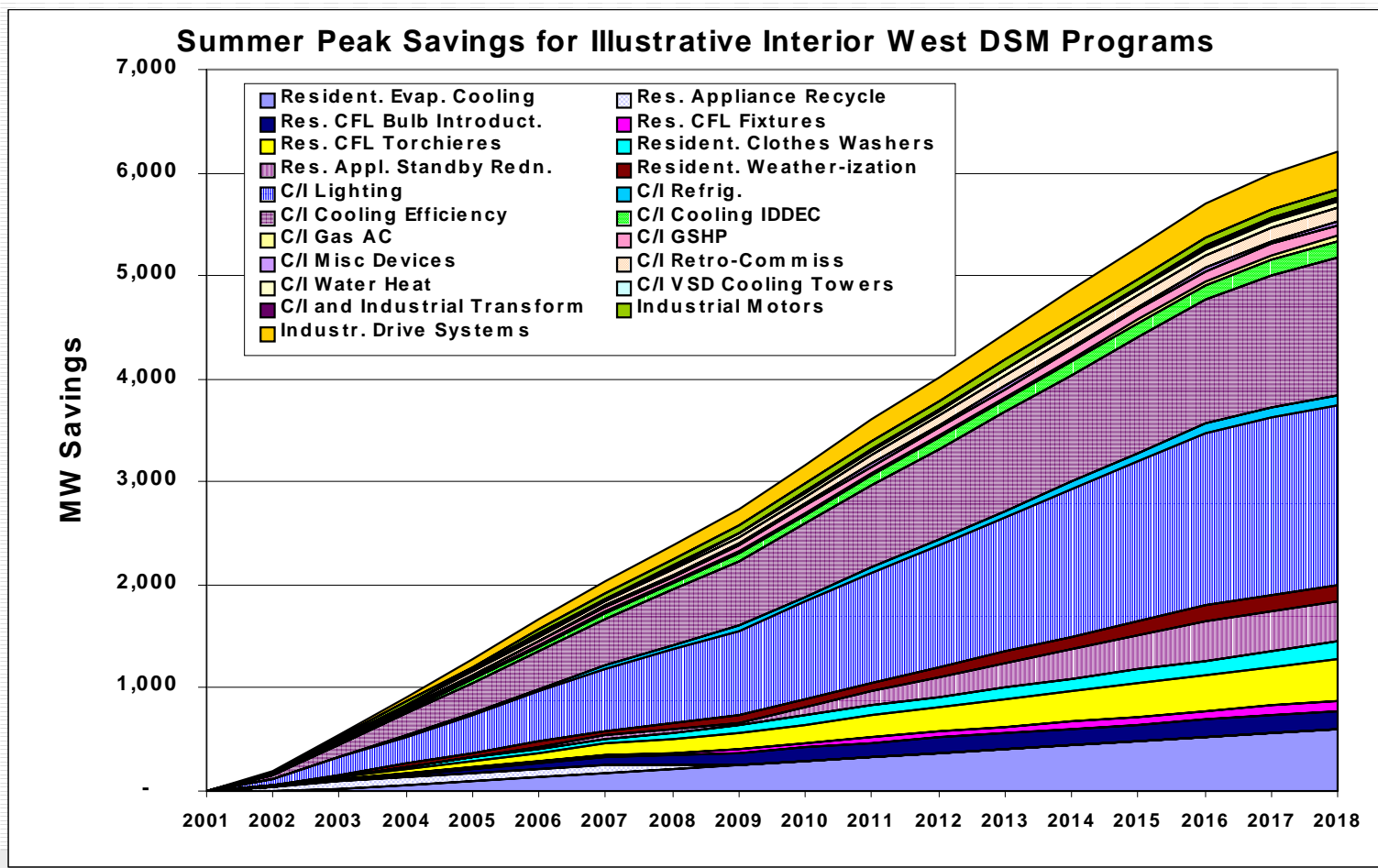
Estimated Annualized Incremental Costs of Energy Efficiency Programs by Region



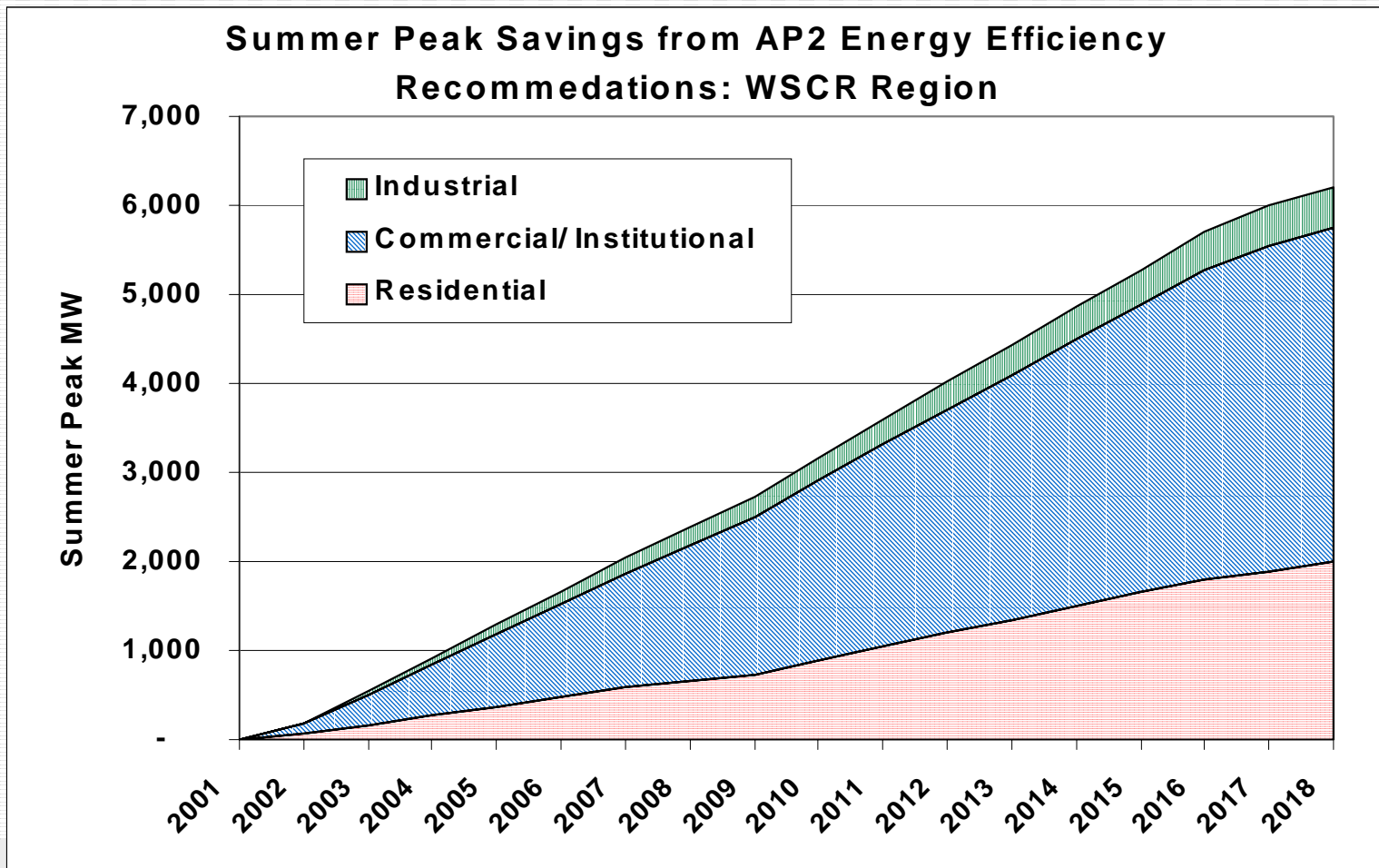
Results, Energy Savings, WSCR



Results, Energy Savings, WSCR: By Program

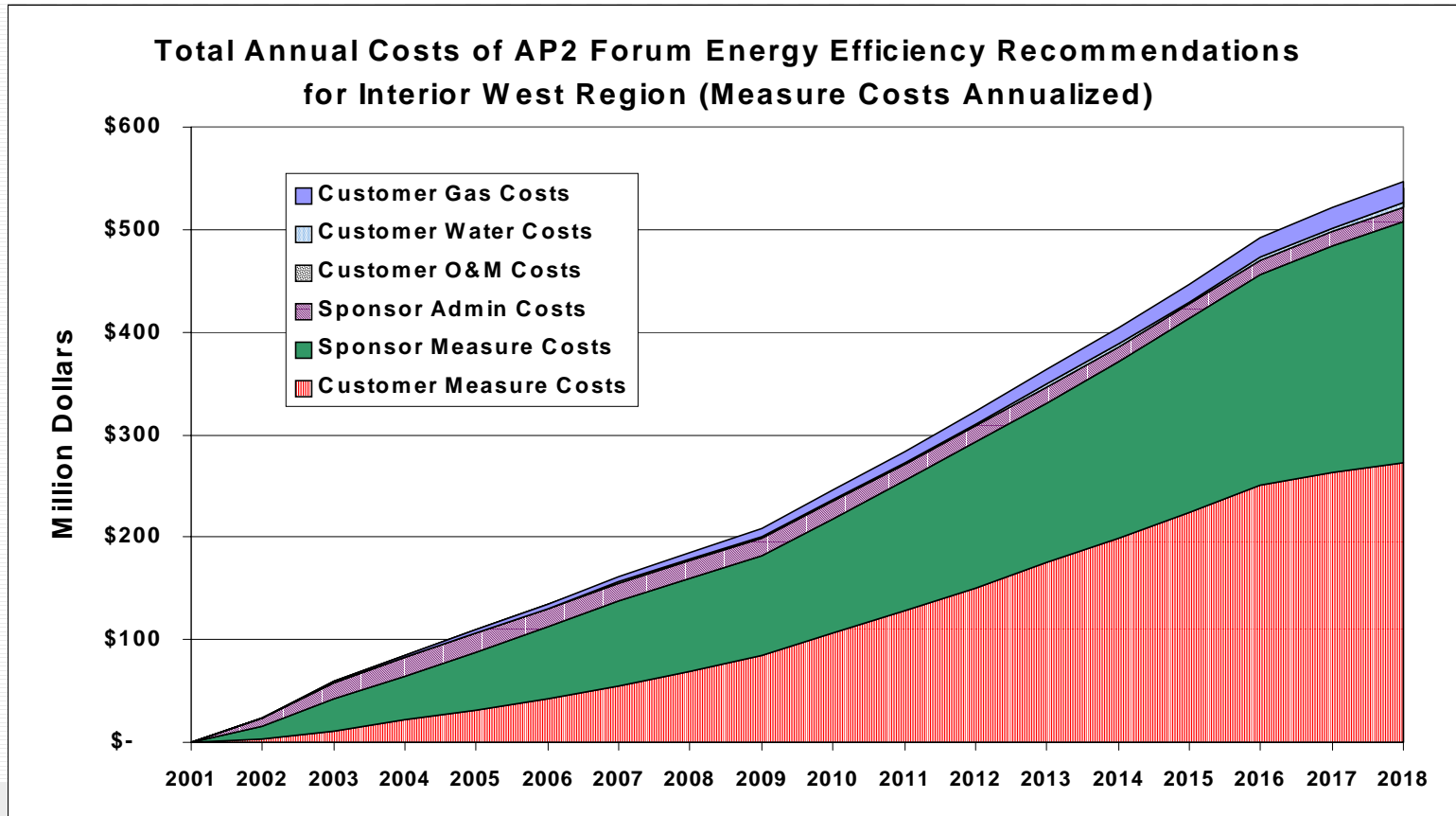


Results, Summer Peak Savings, WSCR

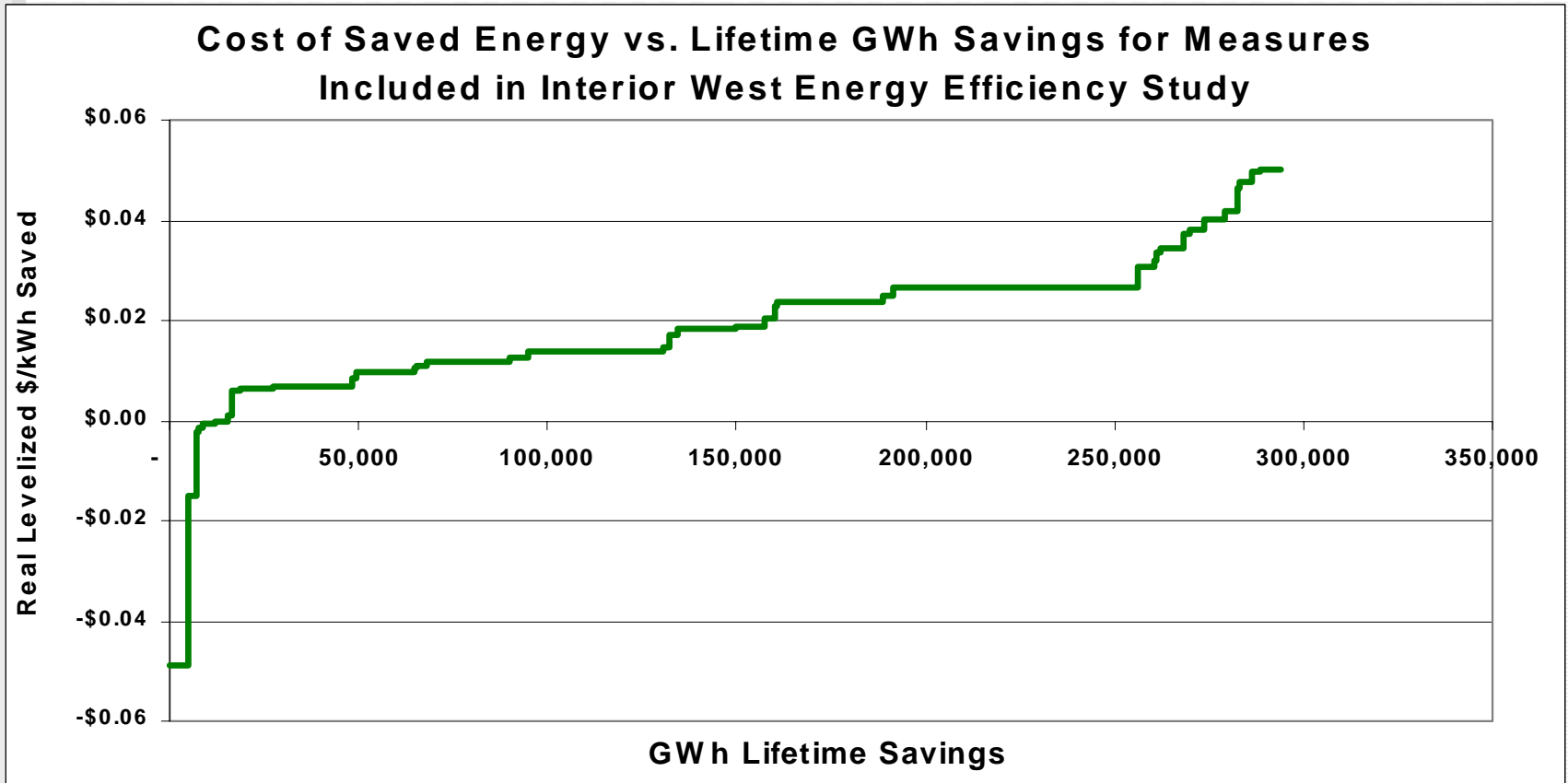


Results, Costs, WSCR

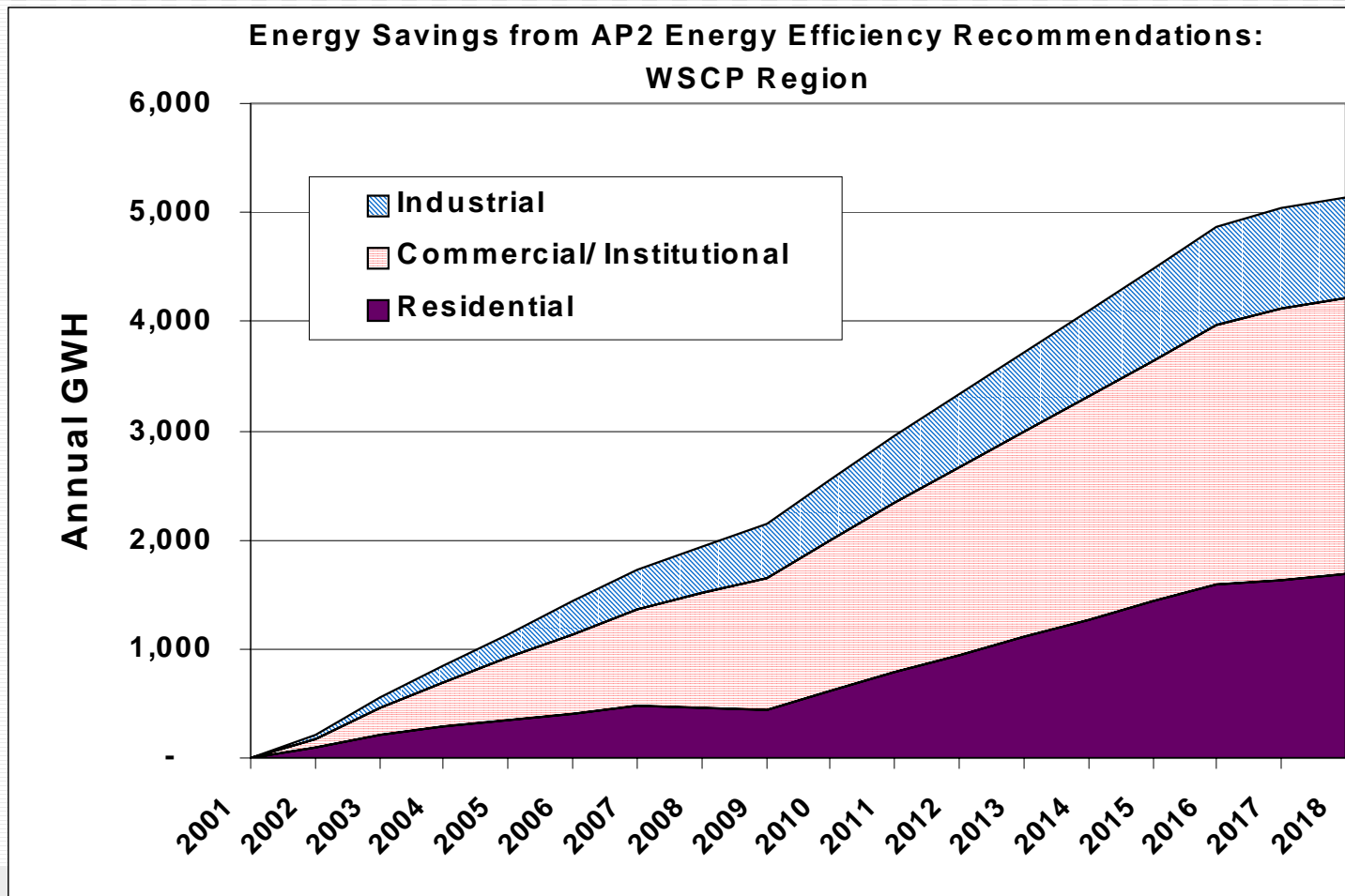
■ Nominal Annualized Costs



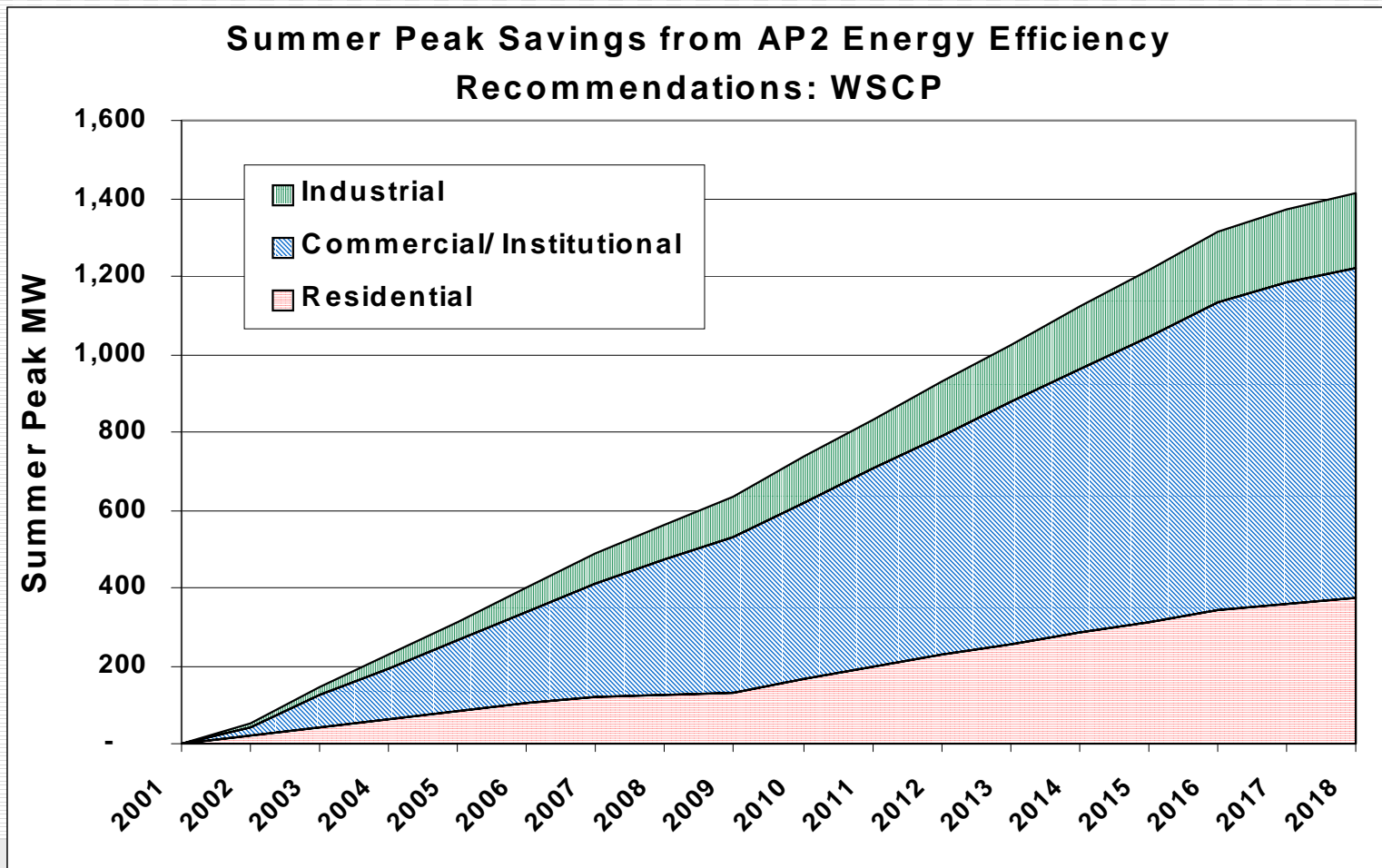
Measure Cost Curve, WSCR



Energy Savings, WSCP

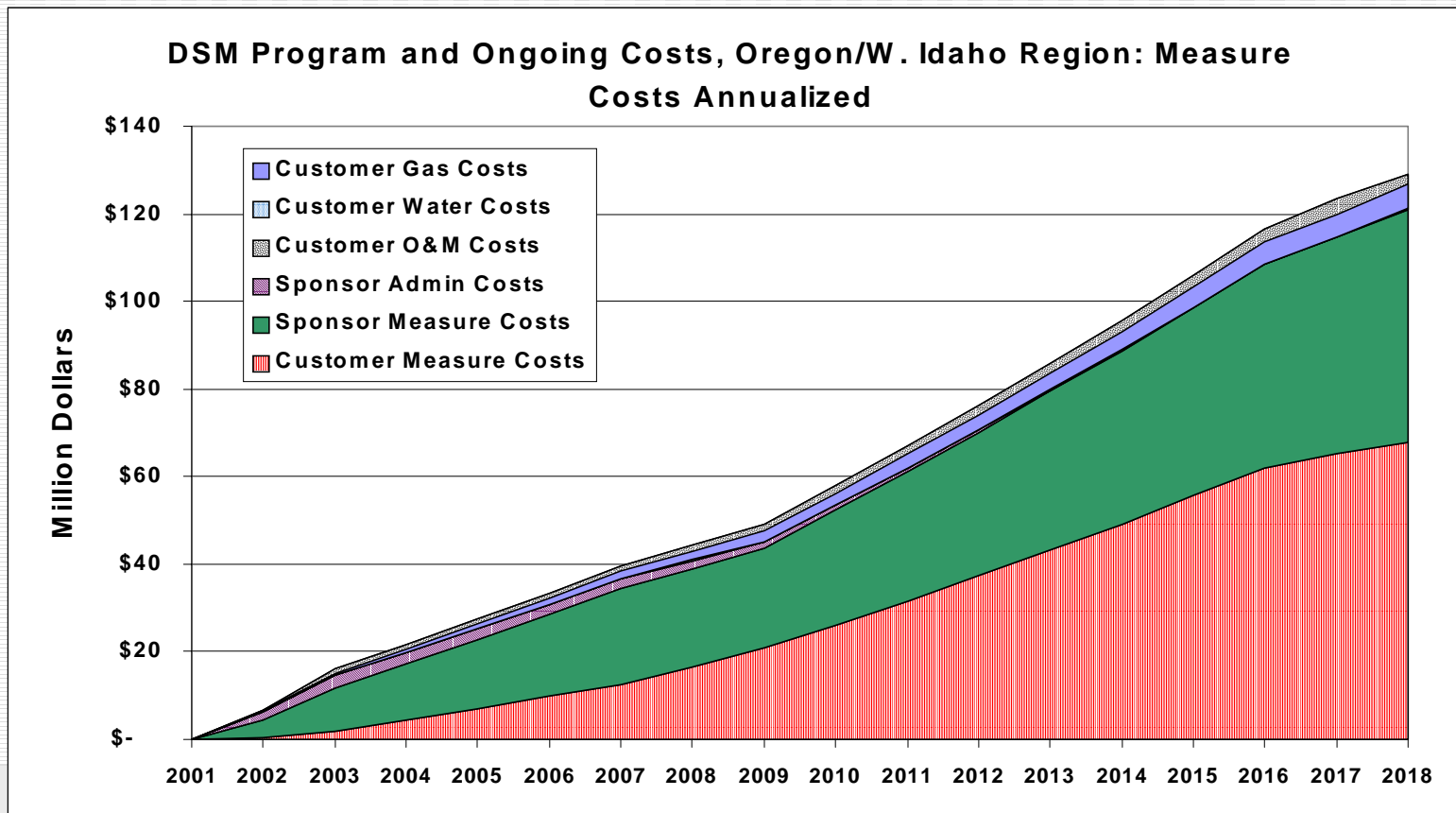


Summer Peak Savings, WSCP

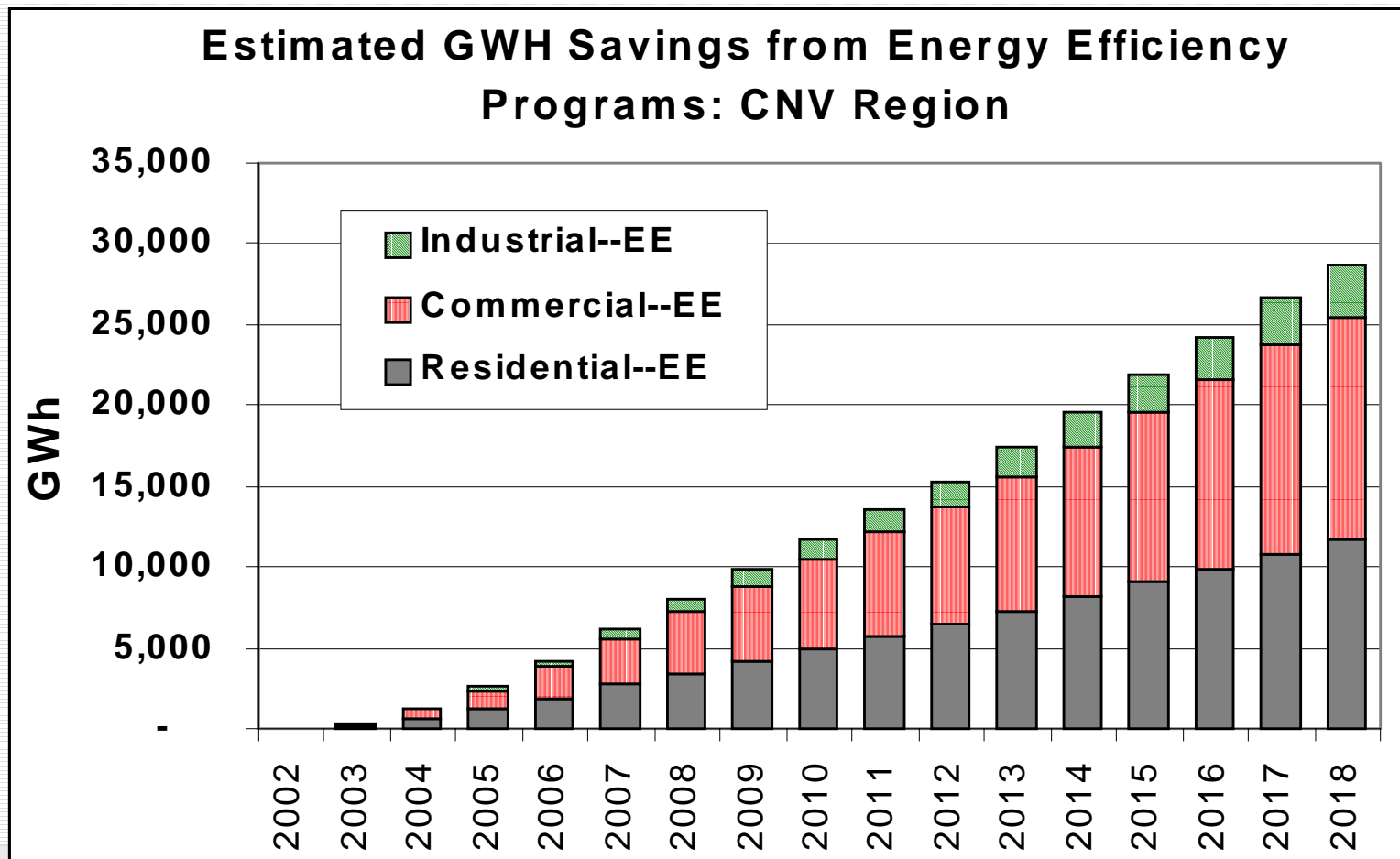


Results, Costs, WSCP

■ Nominal Annualized Costs



Results, Energy Savings, CNV

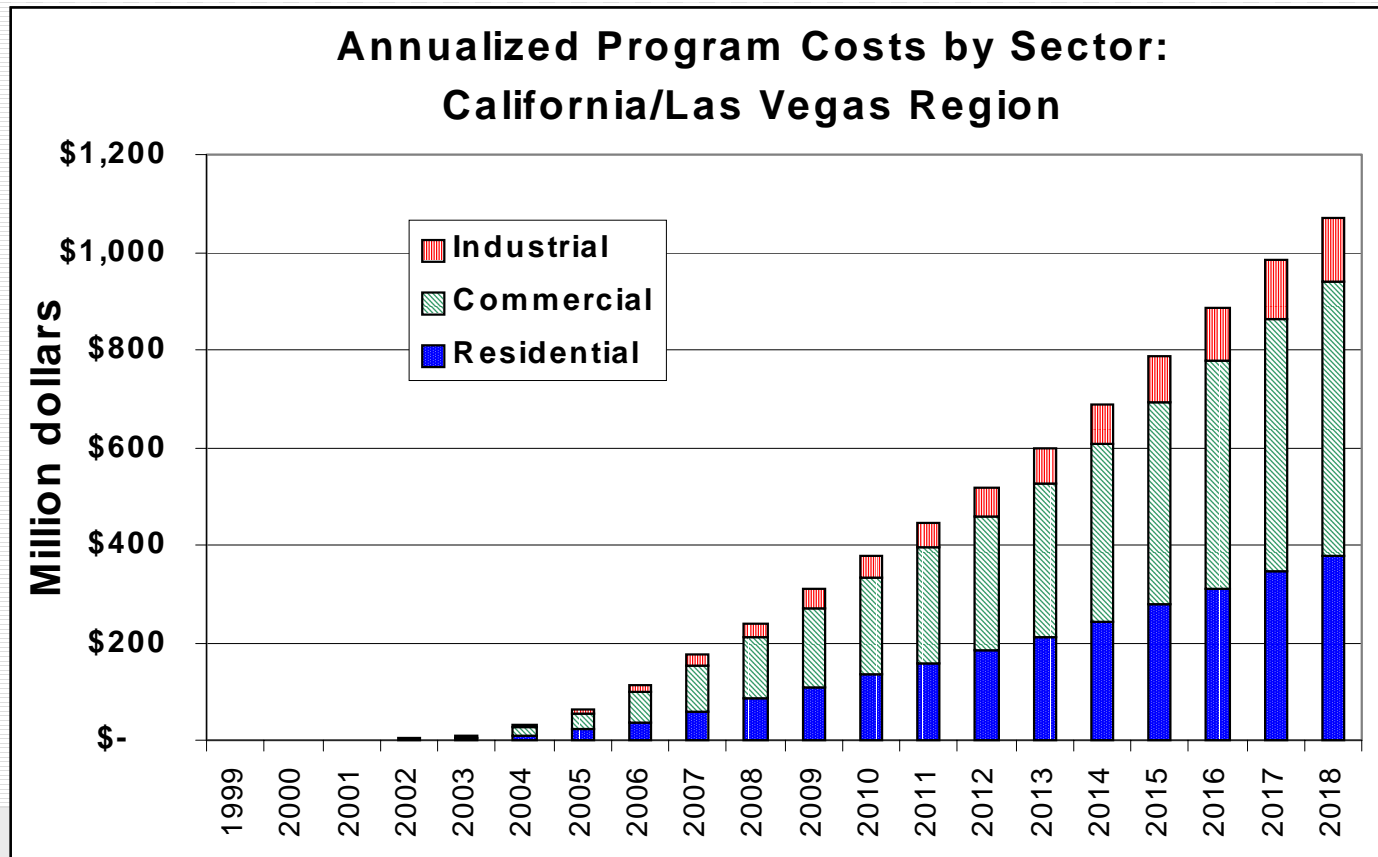


Results, Summer Peak Savings, CNV

- 780 MW in 2005
- 3,500 MW in 2010
- 6,600 MW in 2015
- 8,700 MW in 2018

Results, Costs, CNV

■ Annualized Costs: 1999 Dollars



Potential Follow-on?

- Additional expert review?
- Prepare by-measure estimate for CNV?
- Closer look at air pollution (NO_x) impacts of CHP?
- Deepen the overall analysis with additional measures, incorporation of more region-, state-, tribal- and utility-area-specific information?

Potential Follow-on?

- Energy-efficiency analysis on a state-by-state and tribal level, and/or transfer energy-efficiency estimation capabilities to states and tribes?
- Identify and tailor approaches for implementation of energy-efficiency programs on regional, statewide, and/or tribal bases?
- Other???