IRP Contemporary Issues Technical Conference - WORKSHOP 2
Development and Utilization of Market Potential Studies

12:00 -12:15 p.m.	IURC Chairman Huston
1:15 - 1:30 p.m.	Questions and Comments
12:15 - 1:15 p.m.	Natalie Mims Frick and Tom Eckman (Lawrence Berkeley National Laboratory) will present on the development of Market Potential Studies. This includes data requirements, integration of the load forecasts, and development of energy efficiency programs.
1:30 – 2:45 p.m.	Jeffery Huber (GDS) Pat Augustine (CRA) & Rush Childs (NEXTANT)discuss approaches to MPS. Utilities will discuss their utilization of the MPS.
2:45-3:00 p.m.	Questions and Comments
3:00 - 3:45 p.m.	Dan Mellinger, EFG and Jennifer Washburn representing Citizens Action Coalition and utility experts to discuss Energy Efficiency Oversight Board.
3:45 -4:00 p.m.	Questions and Comment

IRP Contemporary Issues Technical Conference

Workshop 2: Development and Utilization of Market Potential Studies

Natalie Mims Frick, Berkeley Lab

Tom Eckman, Berkeley Lab subcontractor

July 15, 2021

This work was funded by the U.S. Department of Energy's Office of Energy Efficiency and Renewable Energy's Building Technologies Office, under Contract No. DE-AC02-05CH11231.

Housekeeping

- We are recording this session.
- Please remain on mute during the presentations.
- We will monitor questions in the chat box. IURC staff will read your questions or ask you to unmute yourself and pose the question yourself.
- Please use your camera if possible when speaking.

Berkeley Lab Presenters

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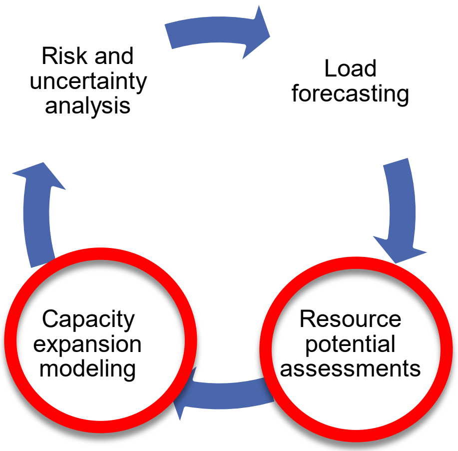
How to Model Efficiency or Other DERs as Resources

- Using energy efficiency (EE) or other DERs as a selectable resource requires a *different process* than using these resources as a decrement to the load forecast.
- Allowing a capacity expansion model to select EE or other DERs permits optimization between *all resources* (e.g., supply and demand side).
- Over three workshops, we will discuss changes that may need to be made to four components of planning: load forecasting, resource potential assessments, capacity expansion modeling and risk and uncertainty analysis.
- Today we focus on resource potential assessments (market potential studies).



Slides and recording from the first workshop are here.

Topics and Concepts in First Presentation (June)

- Topics
  - Load forecast basics
  - Load forecast models
  - Load and resource risk
- Concepts

1. *Frozen Efficiency Forecast - When efficiency or other DERs are considered as selectable resources, the potential impact of efficiency or other DERs is not included in the load forecast.* Only efficiency impacts from known codes and standards are included in the load forecast.
2. *Load Forecast Consistency with Potential Assessments* – The load forecast and efficiency potential assessment should use consistent assumptions regarding baseline use and forecast "units" (e.g., number of appliances, buildings). While this calibration is a more straightforward process when end-use/econometric load forecasting models are used, it can also be done, although with much less certainty, when econometric load forecasting models are used.
3. *Range Forecast – Load uncertainty is a source of risk that should be reflected by the use of range load forecast, preferably without specifying a "reference" case.* Use of a range forecast permits resource planners to evaluate the relative risk of efficiency compared to other resources in mitigating the impacts of load uncertainty.

Topics in Today's Presentation

- Benefits of using direct competition to evaluate energy efficiency
- Five steps to estimate the technical achievable potential of energy efficiency and other DERs
  - Step 1 - Estimate *Technical Potential* on a *per application* basis (i.e. savings per unit)
  - Step 2 - Estimate *number of applicable units* (account for physical limits, retirements, new construction, etc.)
  - Step 3 – Estimate *Technical Potential* for *all applicab*le units
  - Step 4 – Estimate *Achievable* Potential for *all realistically achievable* units
  - Step 5 – Estimate *Economic Potential* for *all realistically achievable* units

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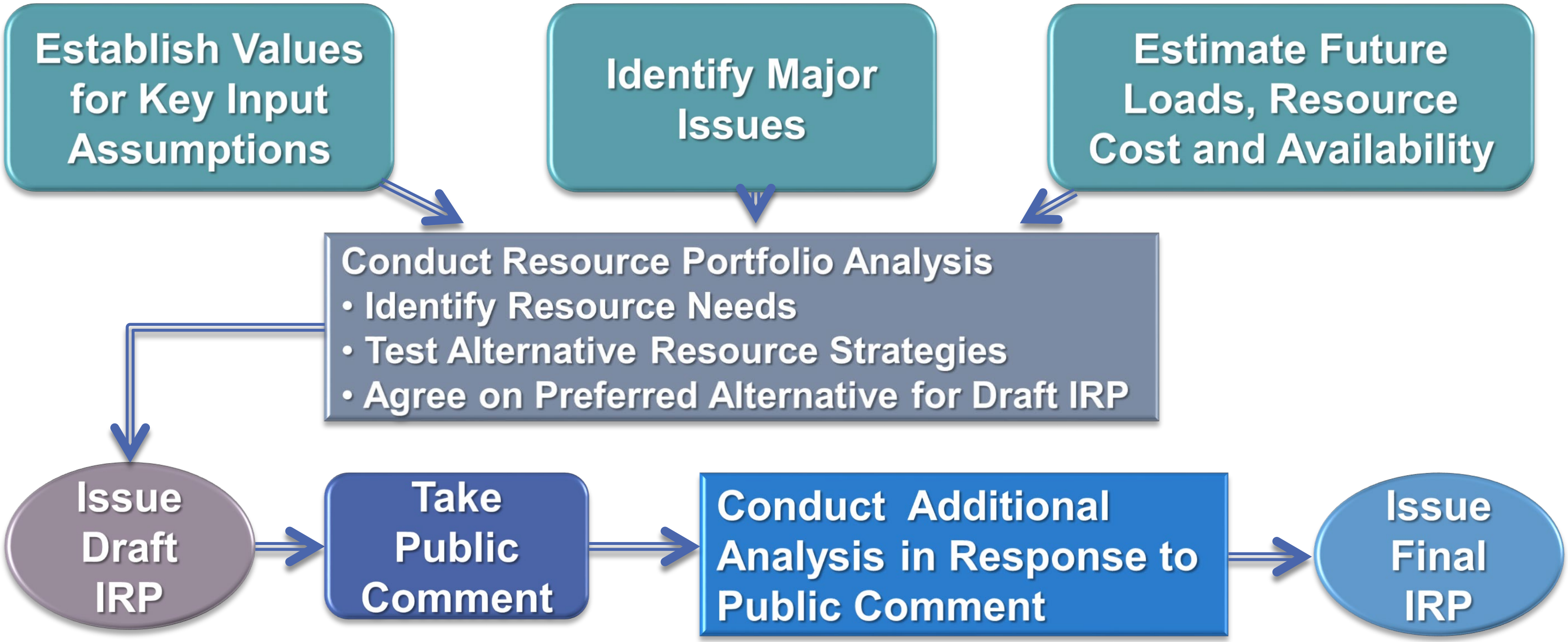
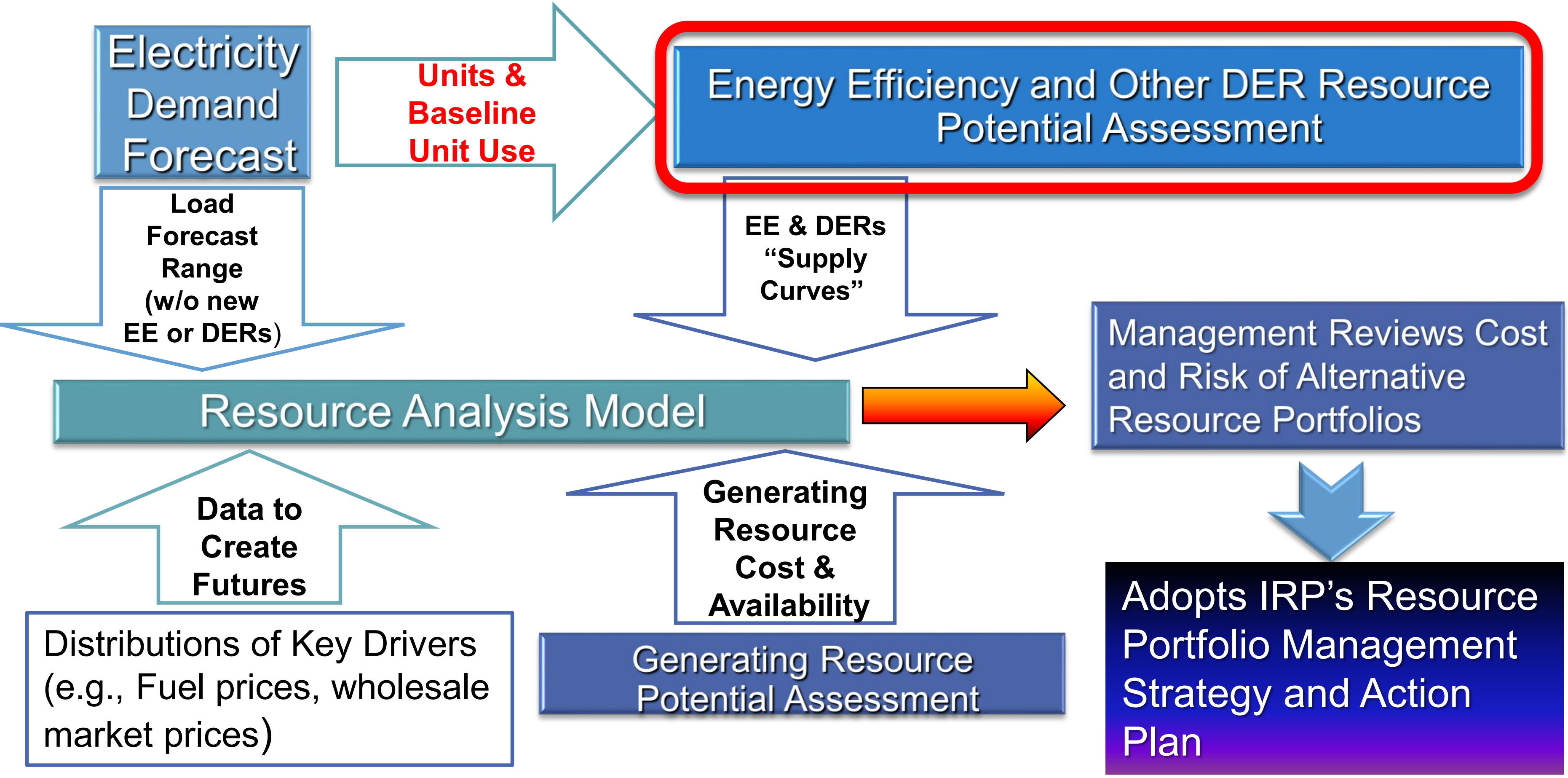
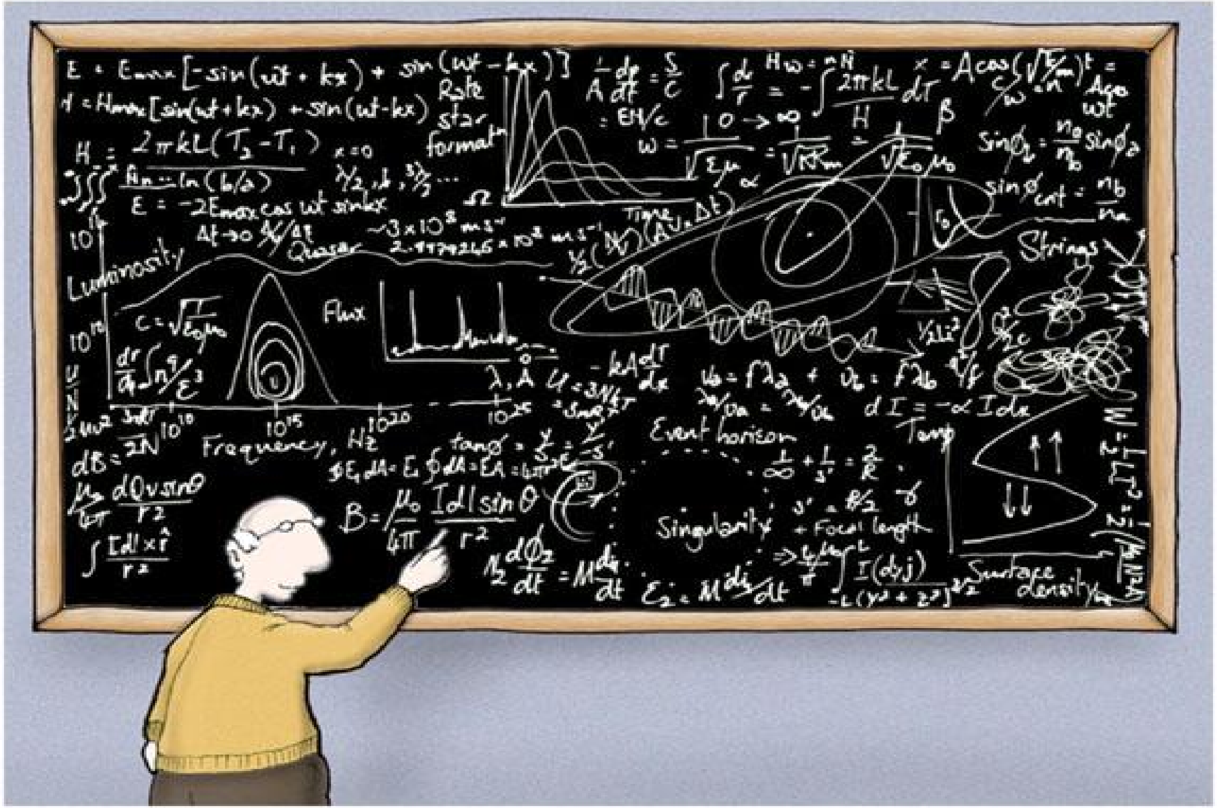
Overview of IRP Development Process



Best Practice IRP Development - Analytical Process Flow





How Do We Know How Much is Left To Do?

Alexa, How Do I Find Out How Much Energy Efficiency Potential Remains in Indiana?

The Amount of EE and Other DERs Are Now Determined in a *Five* Step Process (But the Core Elements Have Not Changed)

- *Step 1* - Estimate *Technical Potential* on a *per application* basis (i.e. savings per unit)
- Step 2 - Estimate *number of applicable units* (account for physical limits, retirements, new construction, etc.)
- Step 3 – Estimate *Technical Potential* for *all applicable* units
- Step 4 – Estimate *Achievable* Potential for *all realistically achievable* units
- Step 5 – Estimate *Economic Potential* for *all realistically achievable* units **by competing EE (and other DERs) against supply side resources in capacity expansion modeling***

*Where EERS or RPS requirements which include distributed renewable resources exist they are modeled as "must build" resources and only additional increments above the minimum EERS/RPS "compete" against generating resources in capacity expansion modeling.

In Many IRPs the Amount of EE Determined in Six Step Process – And the O[...]er Is Different

- *Step 1* - Es[...]*l Potential* on a *per application* b[...]gs per unit)
- Step 2 – Estimate[...]*ntial* on a *per appl*[...]., levelized cost per unit) based on "avoided cost" of "pr[...] capacity ex[...] marginal resource analysis
- Step 3 - Estimate *number o*[...] physical limits, retirements, new construction, etc.)
- Step 4 – Estimate *Economic Po*[...]e units
- Step 5 – Estimate *Econo*[...]*ble* [...] *realistically achievable* units
- Step 6 - **Reduce t[...]st provided to th[...]ansion model** by the amount of *economically a*[...]gs resulting from Step 5[...]del is used to "optimize" the supply side resour[...]

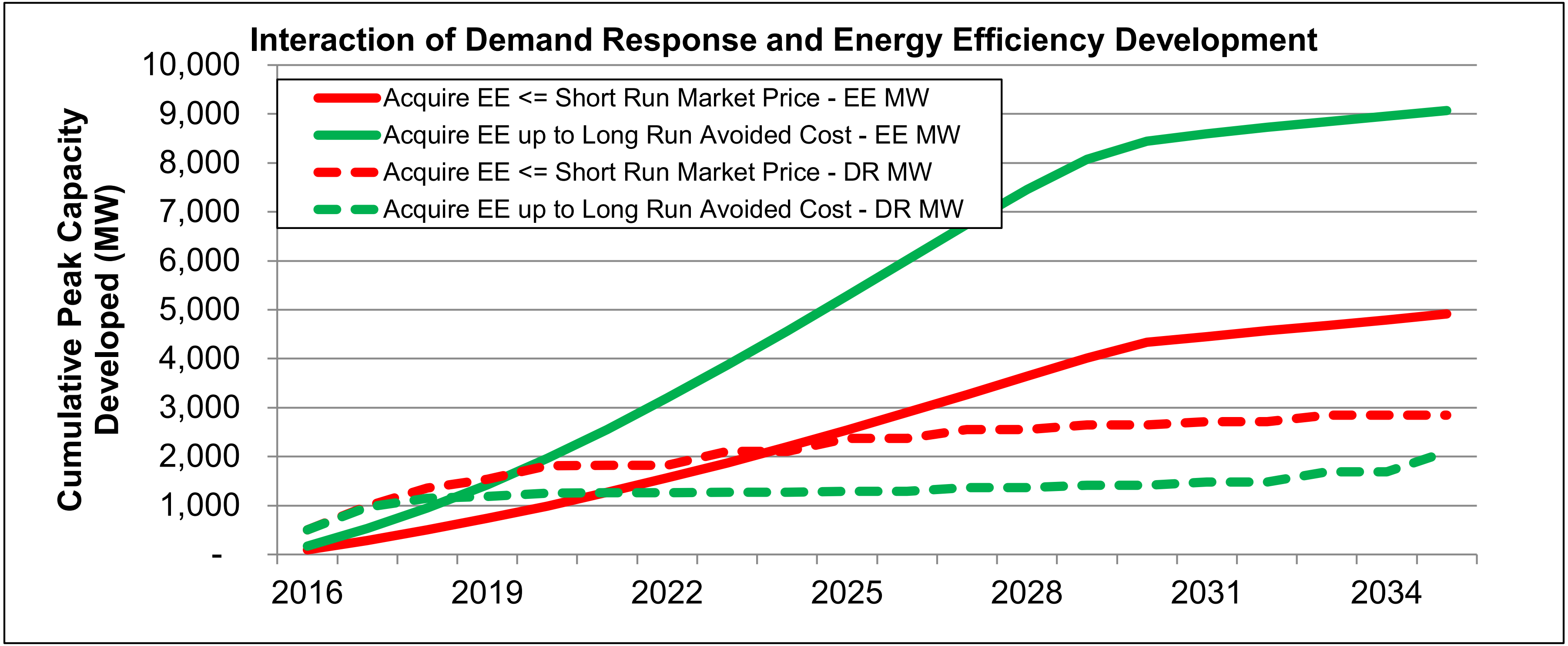
Not Consistent with Treating EE as a Resource

Not Consistent with Treating EE as a Resource

Establishing the Amount and Timing of EE and DR Development Through Direct Competition

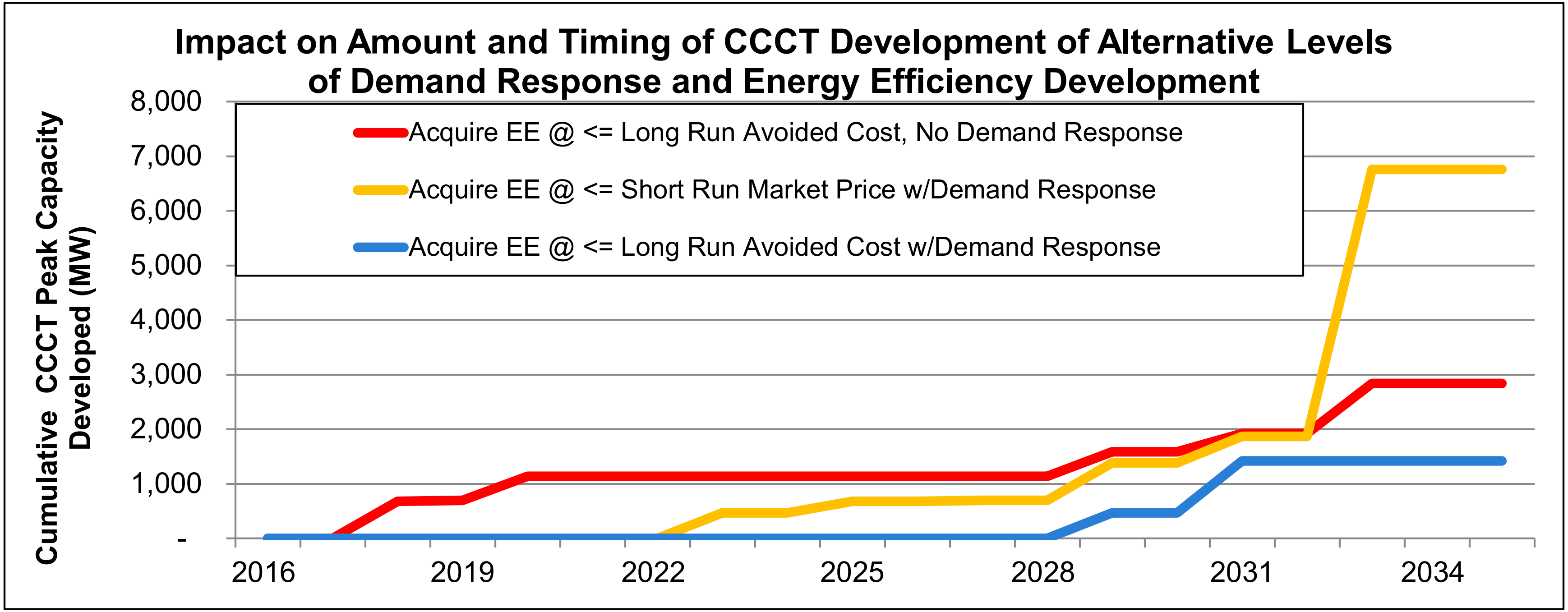
- Allows *optimization* across all resources based on their cost, load shape/load following characteristics and risk
- Requires capacity expansion models that are capable of accepting "acquisition decision and development rules" for EE and other DERs (specifics later on this)
- Is less useful when deterministic (versus probabilistic) capacity expansion models are used
  - Because there's *no uncertainty* regarding the "optimum" type, timing and amount of resources to develop, so the risk mitigation value of EE and other DERs relative to competing resources is not tested

Failing To Analyze the Potential Interactions *Between Distributed Energy Resources* Through Direct Comparison May Result In Selecting Less Than Optimal Resource Strategies



Source: Northwest Power and Conservation Council, 7th Power Plan

Failing To Analyze The Potential Interaction Between *All Resources* Through Direct Comparison May Result In Less Than Optimal Resource Strategies



Source: Northwest Power and Conservation Council, 7th Power Plan

We're Now Heading In To the Weeds . . .

The Details of the *Five* Step Process

- Step 1 - Estimate *Technical Potential* on a *per application* basis (i.e. savings per unit)
- Step 2 - Estimate *number of applicable units* (account for physical limits, retirements, new construction, etc.)
- Step 3 – Estimate *Technical Potential* for *all applicab*le units
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The Basic Formula For Estimating Savings Potential

***Potential* =**

Number Units * Savings per Unit * Market Penetration

Examples:
- Number Homes
- Floor Area of Office Buildings
- Number of TVs
- Acres Irrigated
- Pounds of Paper

Use per Unit at Current Efficiency – Use per at Improved Efficiency) = Savings (kWh/yr)

Current Efficiency is adjusted for adopted codes & standards and stock turnover (Frozen Efficiency)

Fraction of units ***technically*** or ***realistically*** achievable *annually* and *over entire planning period*

Step 1 - Identification of “Baselines” and Technically Feasible Efficiency Improvements

- Baseline Measure Characteristics & Consumption
  - Identify measures that improve the efficiency of electricity “production, distribution or use”
  - Establish measure’s “baseline” consumption
- Estimate Cost and Savings per Unit (more about “defining units” later)
- Identify “*similarly available and reliable*” (per EIA) efficiency technology improvements
  - Estimate per unit incremental energy and capacity savings from each technology improvement measure
  - Estimate per unit incremental cost, including capital, O&M, periodic capital replacement and associated non-energy resource benefits “directly attributable to the measure
  - Estimate measure life

Assessments Identify A Comprehensive List of EE and Other DER Measures

- Northwest Power and Conservation Council's Seventh Power Plan considered nearly 100 EE measure categories (e.g., Air Source Heat Pumps), multiple DR measures and distributed generation (PV)
  - Buildings (insulation, windows, HVAC, lighting)
  - Appliances (refrigerators, dishwashers, ovens, steamers)
  - Processes (energy management, pump optimization)
- Measure Categories included all sectors
  - Residential
  - Commercial
  - Industrial
  - Utility System
- Over 1600 EE measure unique permutations of cost and savings considered
  - Accounting for variations by heating and cooling zone, system types, building types and vintages

Assessment Baselines Require Consistency with Load Forecast

- Internal consistency between load forecast and energy efficiency assessment is necessary to avoid potential for *over* or *under* estimating remaining EE potential
  - Existing and Forecast "Unit Counts" should match for each "load growth path" used in capacity expansion model (i.e. the number of single houses, multifamily units, commercial floor space, appliance counts, etc.) should be identical
  - Baseline and Forecast "Use per Unit" and "Temporal pattern of use" (i.e., kWh/yr. and load shapes) should match
- Internal consistency is most readily achieved when *end-use* load forecasting models are used
  - When *econometric* load forecasting models are used "calibration" between load forecast and EE potential assessments is best done at the sector (i.e., residential, commercial) level.
  - This is typically done by translating measure level EE savings in kWh derived from the potential assessment to percent improvements off a baseline and reducing the load forecast by these percentages.
    - Unfortunately, this requires either an *a priori* determination of each measure's cost-effectiveness or an iterative process between the capacity expansion model, potential assessment and load forecast
- *Editorial Comment* - Major consulting firms that provide potential assessments services have developed the "unit level" models that permit varying levels of transparency into their "calibration" process.

Baseline Consistency with Load Forecast – Frozen Efficiency Isn't Completely Frozen

- "Frozen Efficiency Forecast" is used in capacity expansion model, but "frozen" doesn't mean all efficiency improvements are excluded
  - Load forecast reflects improvements in efficiency due to "stock turnover" (i.e., new appliances replacing existing appliances as replacement occurs
  - Load forecast reflects mandated improvements in efficiency due to *known* (i.e., adopted in final form) codes and federal standards, including those which have an effective date in the future

Important Sidebar Note: When "econometric" load forecasts models are used, specific analytical techniques should be employed to ensure that historical energy efficiency impacts from programs and codes and standards (if statistically significant) are captured and removed from a "frozen efficiency forecast to avoid double counting remaining potential.

Baseline Efficiency – Timing Matters for Determining Cost & Savings

New
- Homes & Commercial Buildings
- Equipment
- Appliances

Improvement decisions made when item is built or purchased

Baseline efficiency & cost = "best of minimum code, federal standard, or common practice"

Natural Replacement
- Burn-out
- Remodel
- Market Shifts

Improvement decisions made when item burns out or reaches obsolescence

Baseline efficiency & cost = "best of minimum code, federal standard, or common practice"

Retrofit
- Remove & Replace
- Remodel/Add-on (insulate existing home)

Improvement decision is not "time constrained" (i.e., when improvement occurs is discretionary)

Baseline efficiency & cost = "as found, unless subject to code or standard"

"Lost-Opportunity" Resources

Baseline Cost and Savings Per Unit – Input Data

Energy Savings (kWh)
- Savings/unit at site (annual)
- Line losses from source to site
- Seasonal and daily shape of savings
- *Measure interactions*
- Measure "Take Back"

Capacity Savings (kWh)
- Coincident peak savings/unit at site (annual)
- Line losses from source to site at system peak

Measure Life
- Expected Useful Life of Measure

Costs*
- Capital
- Financing (if any)
- Installation Labor
- Operation and maintenance
- Periodic capital replacement
- Reinstallation cost (for measures with lifetimes less than planning period)
- Deferred distribution and transmission costs
- Quantifiable Environmental Benefits (e.g., water, natural gas, health)

**Costs are "net" of the value of all benefits not captured in the capacity expansion model (e.g., deferred T&D)*

Technical Potential Assessments Account for Interaction with Load Forecast and Resource Cost

When "direct competition" method is used to determine EE and other DER development

- All potential EE and other DER improvements are treated as resource options that compete against generating resources in supply expansion model and characterization includes both energy and capacity impacts
- Load forecast are not decremented with assumed level of EE and DERs
- Baseline load forecast used in capacity expansion/resource optimization model assume "frozen efficiency" (i.e., no price responsive improvements occur) only efficiency improvements from stock turnover and known codes and standards
- EE and other DER costs should reflect all utility system impacts not accounted for in capacity expansion resource optimization process
  - Example – Capacity expansion model does not estimate value of deferred transmission and distribution, therefore EE levelized cost input into model should be "net" of deferred T&D.
  - Example – If non-energy benefits, such as the value of water savings, are to be included in the valuation of energy efficiency, the levelized cost input into the model should be "net" of the value of such benefits

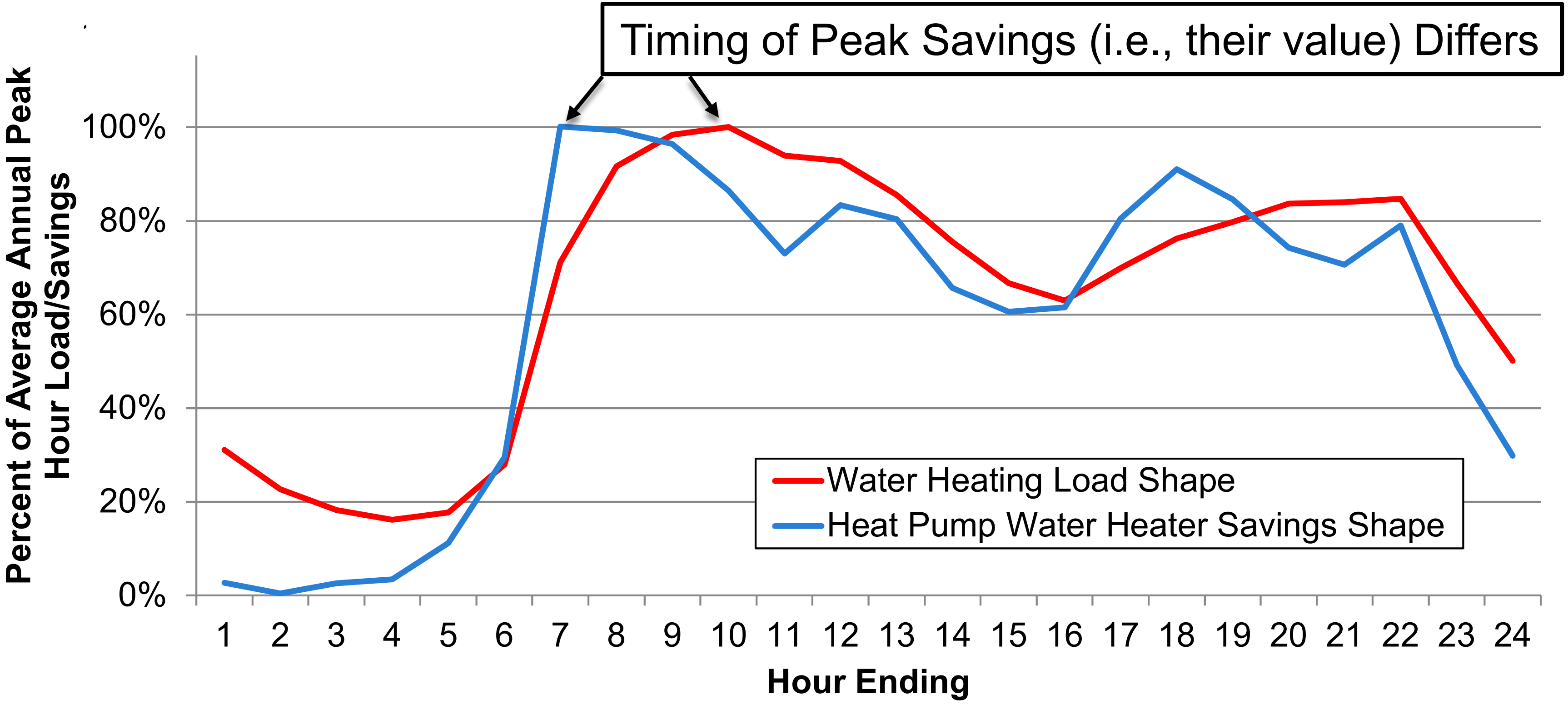
Technical Potential Assessments Account for Temporal Patterns By Assigning End-use Load Shapes and Energy Savings Shapes

Definitions:

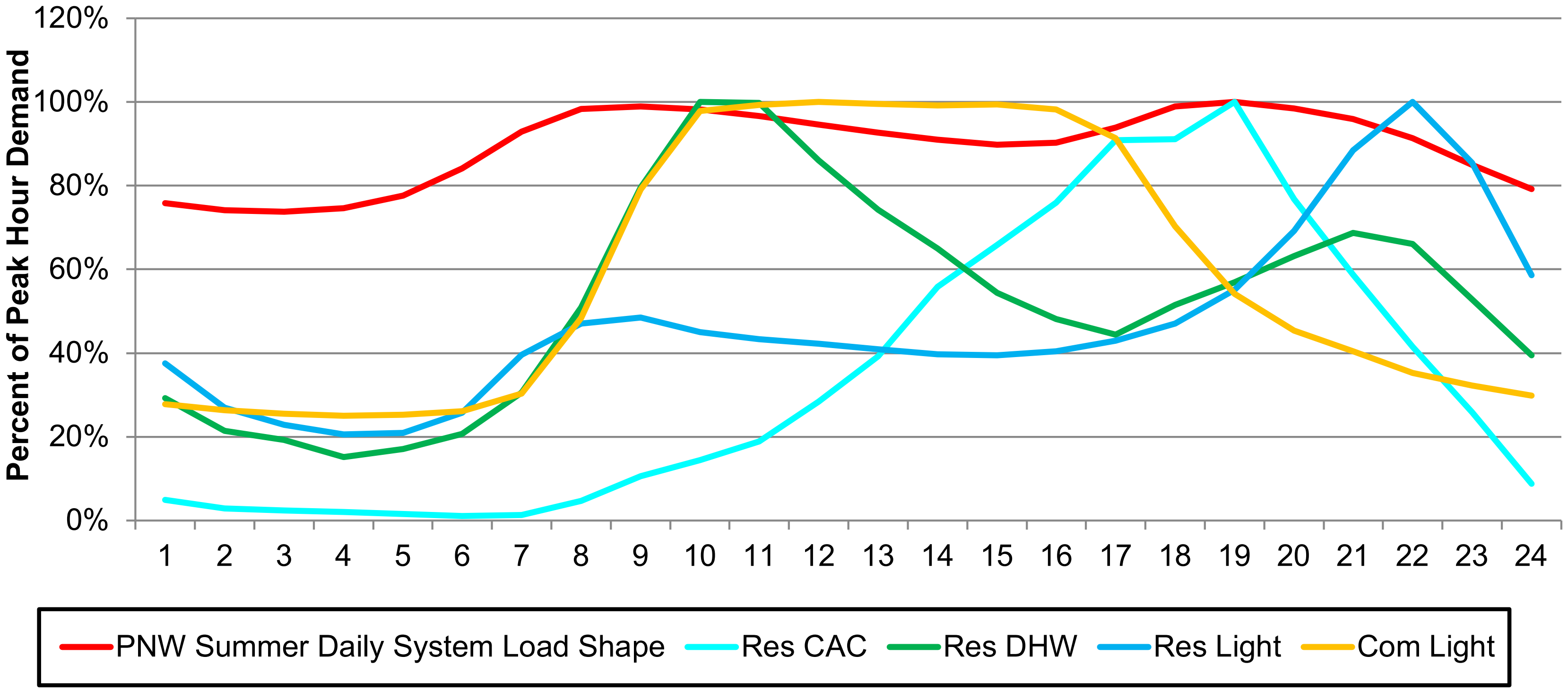
- **End-use load shape:** Hourly consumption of an end-use (e.g., residential lighting, commercial HVAC) over the course of one year.
- **Energy savings shape:** The difference between the hourly use of electricity in the baseline condition and the hourly use post-installation of the energy efficiency measure (e.g., the difference between the hourly consumption of an electric resistance water heater and a heat pump water heater) over the course of one year.

- The time pattern of savings from the substitution of a more efficient technology does not always mimic the underlying end-use.
- Examples:
  - Controls can reduce hours of operation (e.g., occupancy sensor or changing duty cycle), resulting in the shape of savings being different than the underlying end-use.
  - Improved end-use technology and controls (daylighting controls, sensors and software to power down computers when not in use)

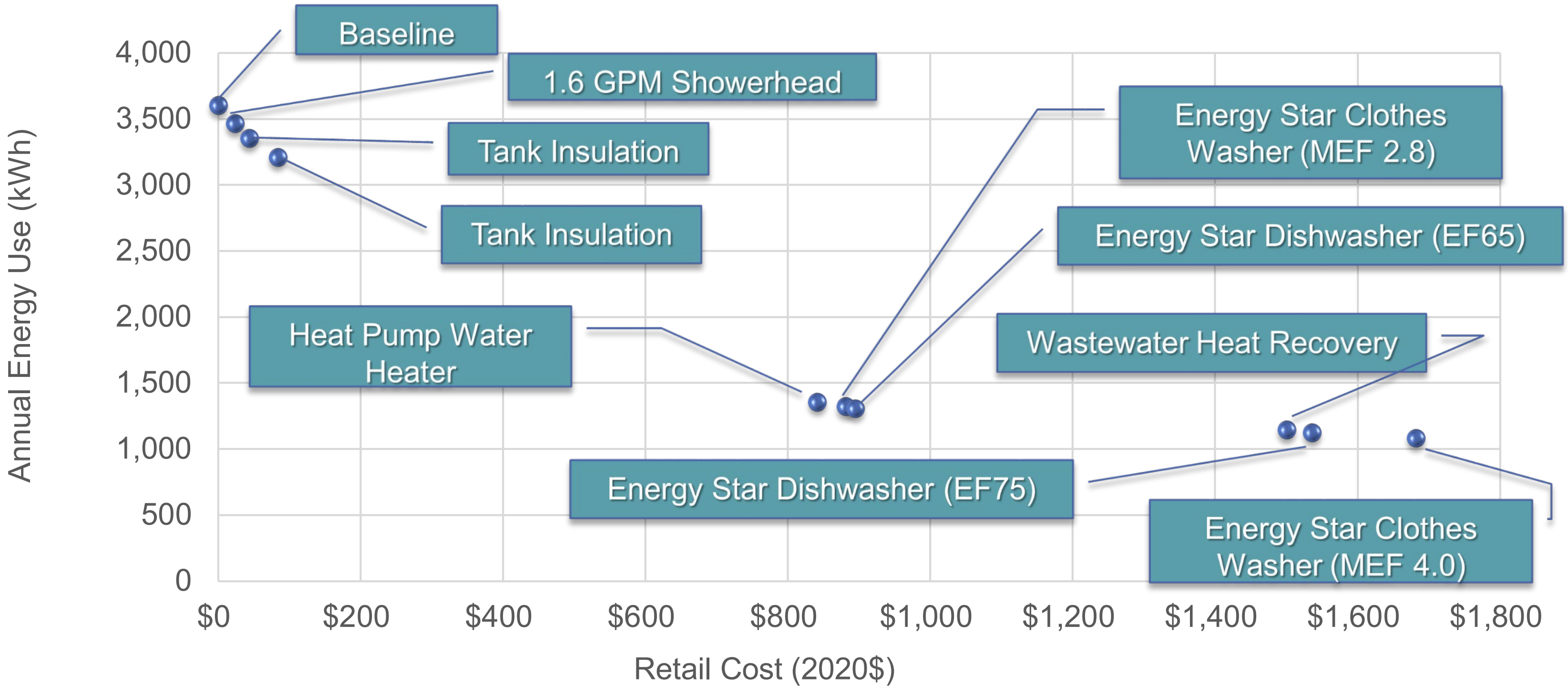
Each Measure Assigned the Applicable Energy Savings Load Shape or End Use Load Shape



Coincidence Matters When Determining Capacity Benefits (But Other Loads Also Contribute To the Peak)

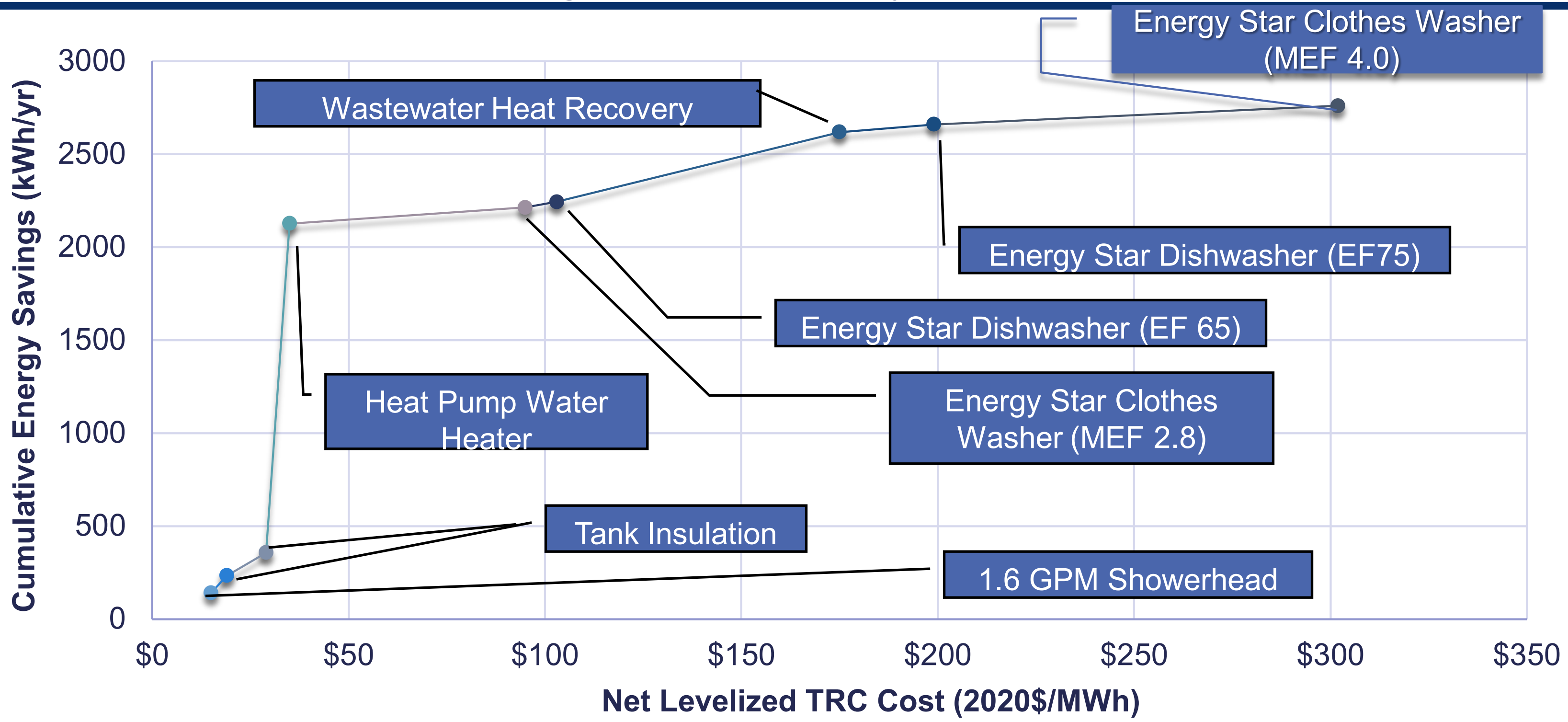


Technical Potential Assessments Account for Measure Interactions -
Illustrative Electric Water Heating Unit Level Cost and Savings



Step 1 Output – After Accounting for Measure Interaction Measures Are Rank Ordered Based on "Net Levelized TRC Cost"

Illustrative Electric Water Heating Unit Level Supply Curve



Step 2 – Estimate the Number of Units

Examples of "Units"
- Number of replacement clothes washers per year
- Number of new single family homes per year
- Floor Area of existing "Mini-Mart" groceries
- Sq. Ft. of attics with no insulation in existing homes
    - with electric baseboard heat
    - with heat pumps
    - with electric forced-air furnaces

Data Sources:
- Sector Specific Stock Assessments
- End Use Forecast Model
- DOE Standards Rulemakings
- Product Sales Data
- Census Data

Annual Estimates
- Year-by-Year unit counts over 20-year :forecast period
- Existing stock, minus demolitions and conversions
- New Stock Added
- New appliances added
- Appliance & equipment turnover (consistent with lifetime assumptions)

Step 2 - Estimate the Number of Units Where Measure Is Applicable – Annually and Cumulatively

New
- Homes & Commercial Buildings
- Equipment
- Appliances

Number of Units Determined by Population and Employment Growth

Natural Replacement
- Burn-out
- Remodel
- Market Shifts

Number of Units Determined by Equipment Life, Stock Turnover Rates, Consumer Preferences and Obsolescence

Retrofit
- Remove & Replace
- Remodel/Add-on (insulate existing home)

Number of Units Determined By Portion of Remaining Stock Adopting Efficiency Measure

Savings/Unit x Number of Applicable Units = Technical Potential

Step 3 – Estimate *Annual* and *Cumulative* Achievable Potential Considerations

- Maximum Achievability Over Planning Period
  - Reflect gross savings from all mechanism (e.g., programs, codes, standards, market transformation, etc.).
    - Free-ridership (i.e., the share of the population that is already adopting measure, since "common practice" baselines are used) should be captured in load forecast model
  - Treating EE is a resource means that acquisition payments to consumers up to the value of avoided utility system cost can be legitimately (i.e. are cost-effective) assumed so that economic barriers to participation are not a constraint
  - Limits to achievability should reflect continuous program operation across the entire planning period (10 - 20 years)
  - Limits on lost opportunity resource achievability should reflect potential adoption of codes and standards as well as other market transformation activities
- Maximum Annual Achievability for Lost-Opportunity Measures
  - Limits are based on the fraction of annual new or replacement units subject to program/codes/standards influence
  - Typically assume increasing penetration over time up to maximum, which for measures subject to codes and standards can be 90-100%.

Estimates Achievable Potential Are Subjective . . . but should reflect experience

- Even assuming no customer cost-sharing is required, not all customers are expected to adopt all efficiency measures
  - Achievable potential is, therefore, always *less than or equal to technical* potential
    - How much less is determined by multiple factors, some of which are outside the control of utilities
- Estimates of Annual and Cumulative Achievable Potential, while subjective, should rely on historical experience from successful programs.
  - PNW historical experience implies that 85% of retrofit and approximately 65% of loss opportunity efficiency resources can be acquired over 20-year planning period. (See: *Achievable Savings: A Retrospective Look at the Northwest Power and Conservation Council's Conservation Planning Assumptions*. Available at: https://www.nwcouncil.org/sites/default/files/2007_13_2.pdf)
  - Reliable forecast of the pace at which efficiency programs can be "ramped up" and maintained over the near-term is more critical than forecasts of achievable potential 20 years into the future.

Why the Long Term "Achievable Potential" Forecast Used to Be Much More Critical

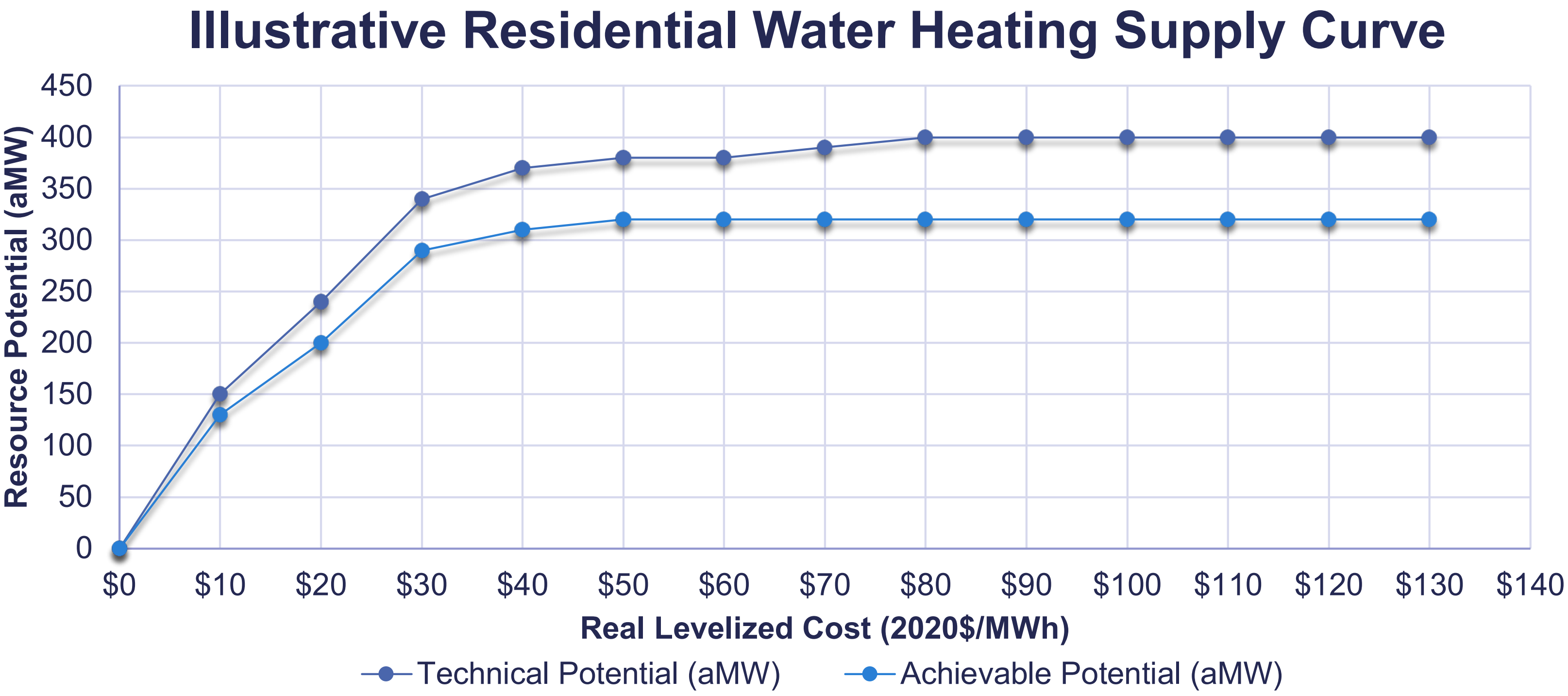
- In 1980's and through much of the 1990's *lead times* for construction of new generation (coal & nuclear) were 12-15 years
- Average resource size ~ 1000 MW
- Therefore, if energy efficiency resources were to offset the construction of new generation, forecast "achievable savings" needed to be highly reliable 12-15 years into the future

Why Long Term Achievable Potential is Less Critical Today

- Lead times for new generating resources are 2-5 years*
- Average resource size ~ 250 – 350 MW
- Ability to expedite (or delay) construction is now greater
- Current Critical Question: Are the near-term “ramp rates” achievable?

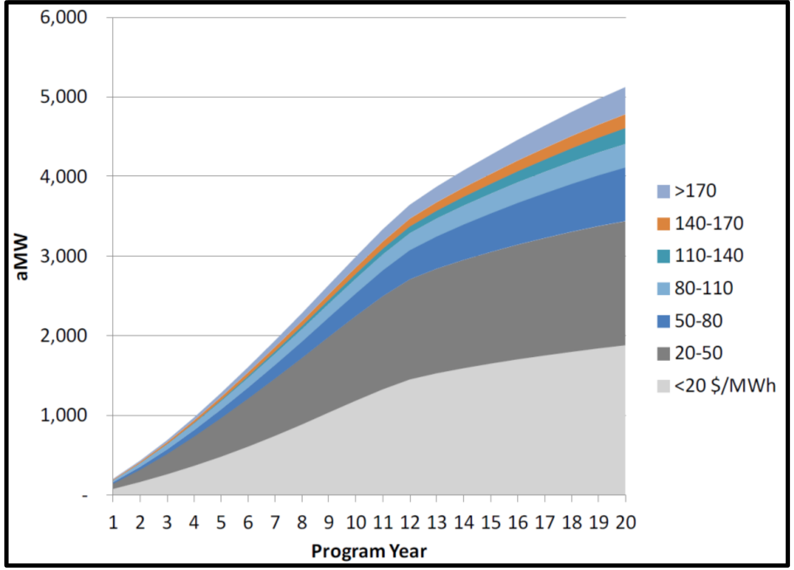
That said, since major transmission infrastructure projects can sometimes take 7-10 years to develop, reliable long term forecast of achievable potential are still important.

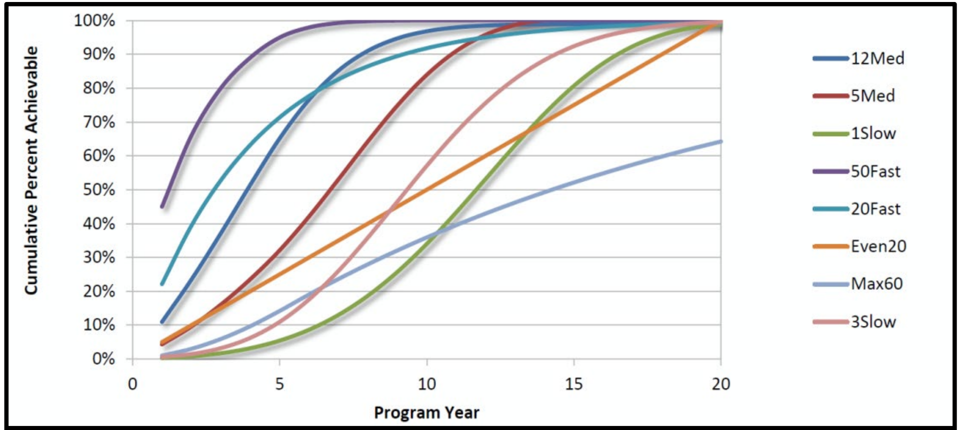
Step 4 – Estimate Total Technical and Achievable Potential



Step 5 – Estimate the Economically Achievable Potential of All Units - Develop Inputs to Capacity Expansion Model (CEM)

Maximum Annual and Cumulative Achievable Potential





Maximum Ramp Rates

Modeling EE and other DERs in Capacity Expansion Model - "Acquisition Logic"

- Capacity expansion models require decision rules that determine when a resource is acquired
  - Resources are always developed to meet reliability standards
  - Resources are considered for development if they meet specific economic conditions (i.e., are "in the money")
  - The conditions that determine what "in the money" is for EE and other DERs should be comparable to generating resources.

Modeling EE and other DERs in Capacity Expansion Model - "Acquisition Logic"

- Capacity expansion models must be able to compare the cost and load impacts of EE and other DERs with the cost and load following capability of supply side generation to determine which resource meets forecast needs for energy and capacity at the lowest reasonable cost with acceptable risk
  - This may (likely will) require modification to the capacity expansion model's acquisition logic.
  - Unlike supply side resources EE and other DERs can be acquired across a wide range of costs (i.e., EE has a nearly continuous supply curve)
  - EE and other DERs supply curves are usually represented as "discrete cost bin"
    - When "cost bins" are used, care should be taken to avoid the "binning game"
    - When "cost bins" are used, each bin should have a load shape representative of the measures within that bin

Modeling EE and other DERs in Capacity Expansion Model - "Acquisition Logic"

- Modeling supply curve in cost "bins" can result in acquisition lowest to highest cost measures through time
  - Real world programs don't acquire <u>only</u> the lowest cost measures first
  - EE cost bins may be created so that resources are selected across entire supply curve by creating "program" bins or individual supply curves that reflect programs which meld low and higher cost measures with load shape specific to each bin.

Modeling EE and other DERs in Capacity Expansion Model – the Pace of Acquisition

- Maximum Retrofit Pace Constraint:
  - Resource optimization models will "build" (i.e., replace all existing lamps in a single year) all retrofit EE and other DERs with cost below the marginal dispatch of existing generating resources at first opportunity – unless constrained
  - Real-world infrastructure limits maximum annual retrofit development constraints on the annual acquisition of retrofit EE and DERs must be set in the model. Limits may be grow through time or fixed for 20-yrs (i.e., assumes delivery infrastructure never expands)
- Lost Opportunity "Found Again" Acquisition Logic
  - Some lost-opportunity resources present more than one acquisition "opportunity" (e.g. water heaters are replaced on average every 12 years)
  - Due either to their high cost or, more likely constraints on their maximum achievable ramp rate these resource might not be selected when they first occur
  - Acquisition logic should permit savings that is not "acquired" at the first opportunity, be considered for acquisition at next opportunity, if it occurs within planning period.

We’re Now Out of the Weeds . . .

It’s Time For Questions About Where We’ve Been

Issues You May Want to Discuss

- Measure interaction (and measure ordering)
- Treatment of free-ridership
- Achievable potential modeling (logit functions in consultant models)
- Translating CPA results into supply curves
- Measure bundling
  - How large is the “increment”
  - What characteristics are important to capture in “bundle” (besides cost)
- Translating IRP results into program/measure cost-effectiveness

Questions

Backup Slides

This work was funded by the U.S. Department of Energy's Office of Energy Efficiency and Renewable Energy's Building Technologies Office, under Contract No. DE-AC02-05CH11231.

Retrofit Resources and Lost-Opportunity Resources Have Different Maximum Acquisition Rates

Achievable Potential - What Evidence Do We Have?

- Residential Weatherization
  - Hood River Conservation Project
- Multiple Sectors and Measures
  - Actual Achievements Relative to 1983 Plan Assumptions
- Ramp Rates
  - Planned vs. Actual Annual Changes in Program Achievements

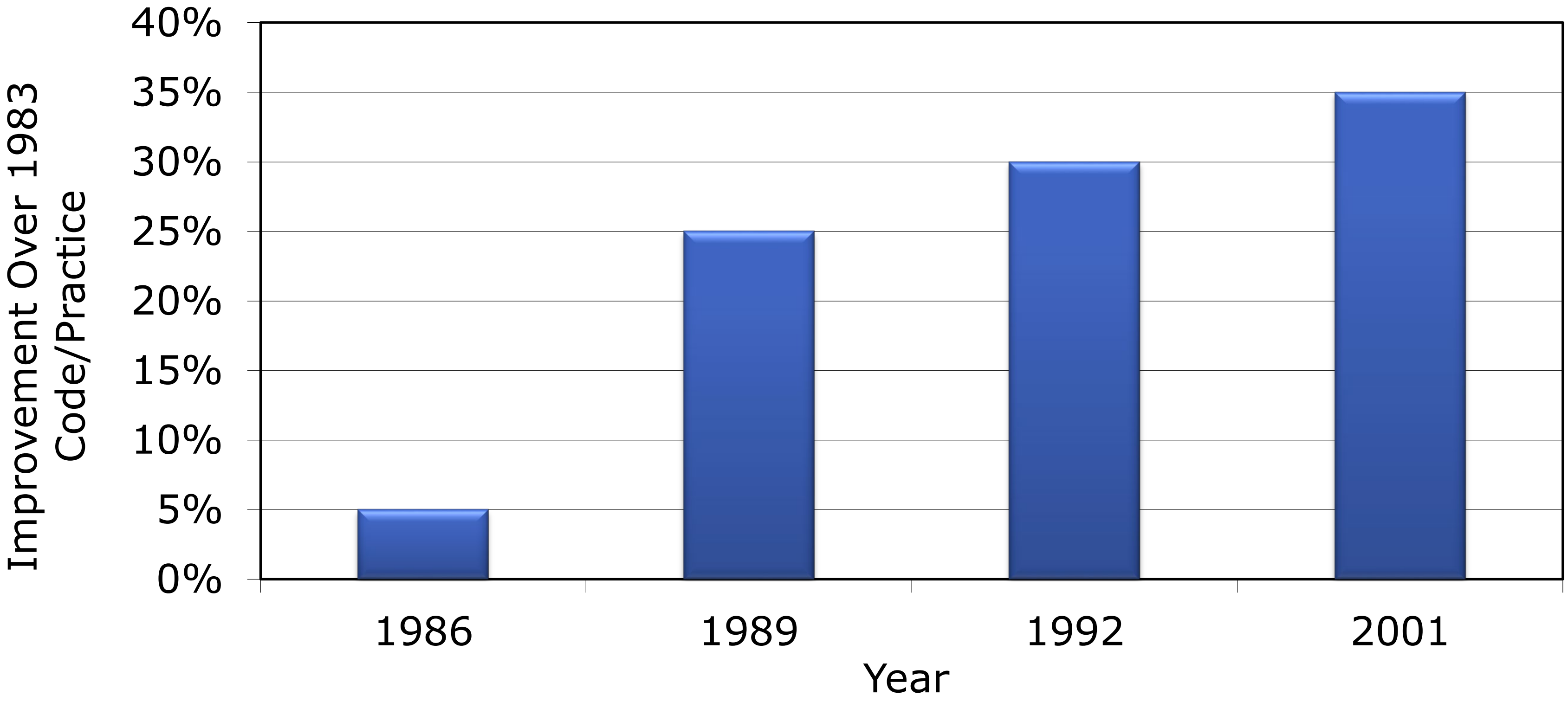
Evidence: Hood River

- Hood River Conservation Project
- 1982-84 experiment in Hood River County
- Try to weatherize all electric-heated homes
- Measures installed at no cost to participants
- Result: 85% Achieved
  - 85% of Technically Feasible Residential Weatherization Savings Achieved **Over 2 years**

Evidence: Actual Achievements Relative to 1983 Plan Assumptions

- New Residential and Commercial Construction (Model Conservation Standards)
- Residential Appliances
- Residential Water Heating
- Commercial Lighting
- Commercial HVAC Equipment
- Irrigation (kWh/acre)
- Industrial

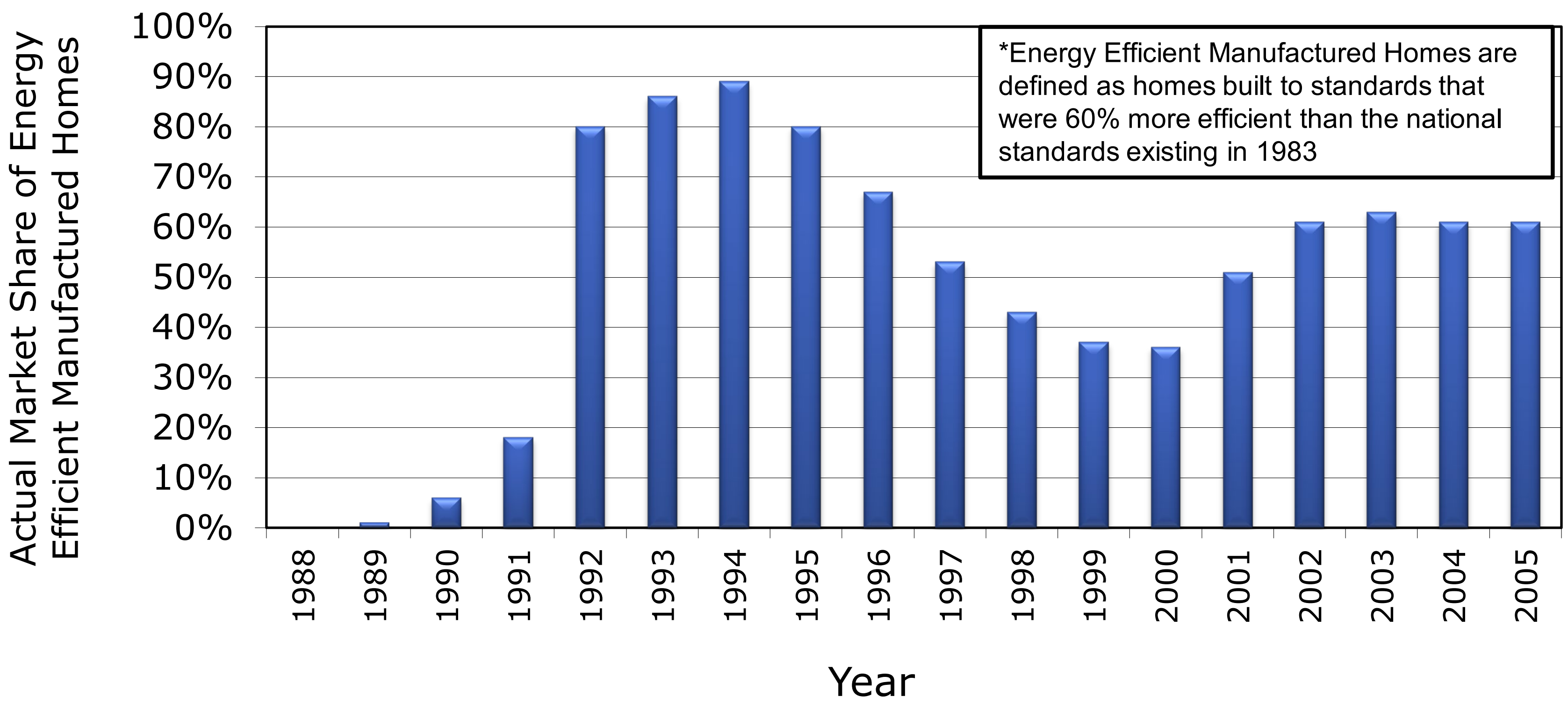
Residential New Construction Council Goal - 40% Improvement in Building Envelop by 2002 (Planning Assumption = 85% of 40% = 34%)



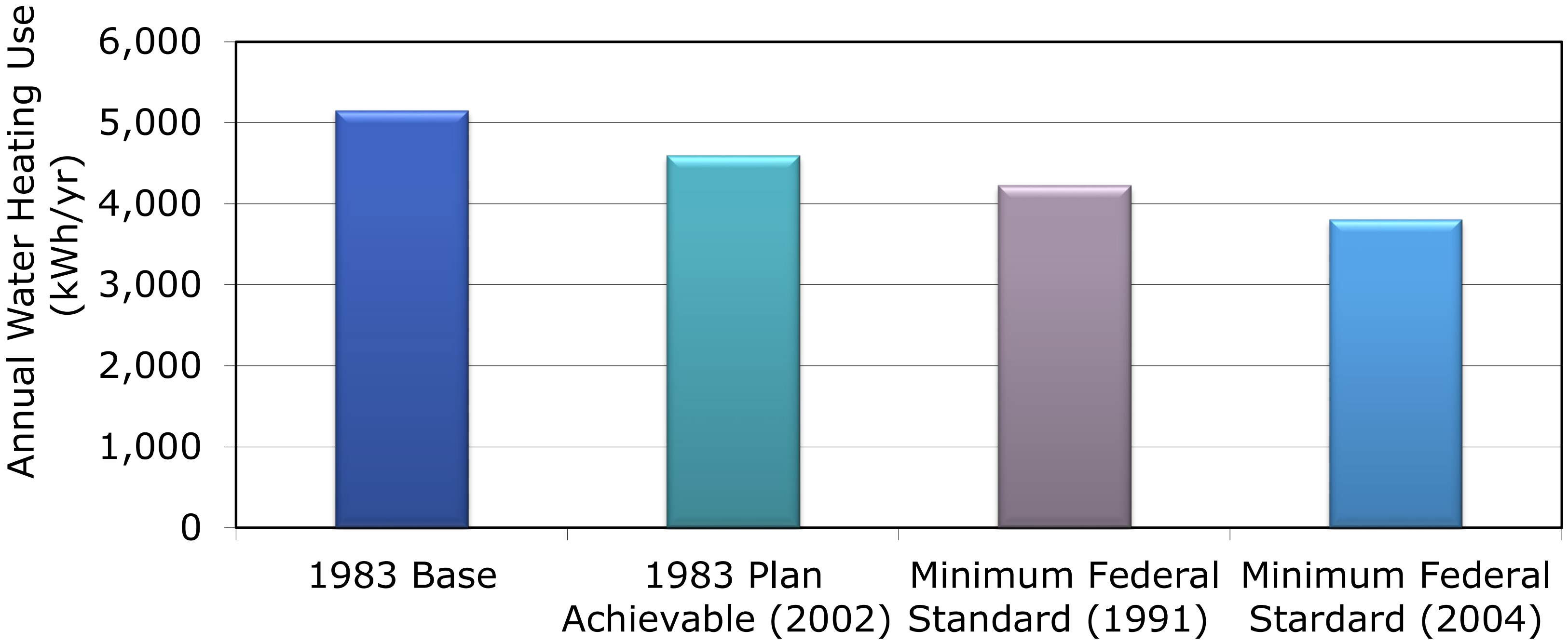
Residential New Construction Council Goal
40% Improvement in Building Envelope by 2002

Regional Average Annual Space Heating Use New Single Family Homes Constructed Between 1983 and 2002			
Vintage	Annual Use (kWh/sq.ft./yr)	Percent of 1983 Use	Improvement over 1983
1983	6.3	100%	0%
1986	5.5	88%	12%
1989	5.4	86%	14%
1992	4.0	64%	36%
2001 (MCS)	3.7	59%	41%

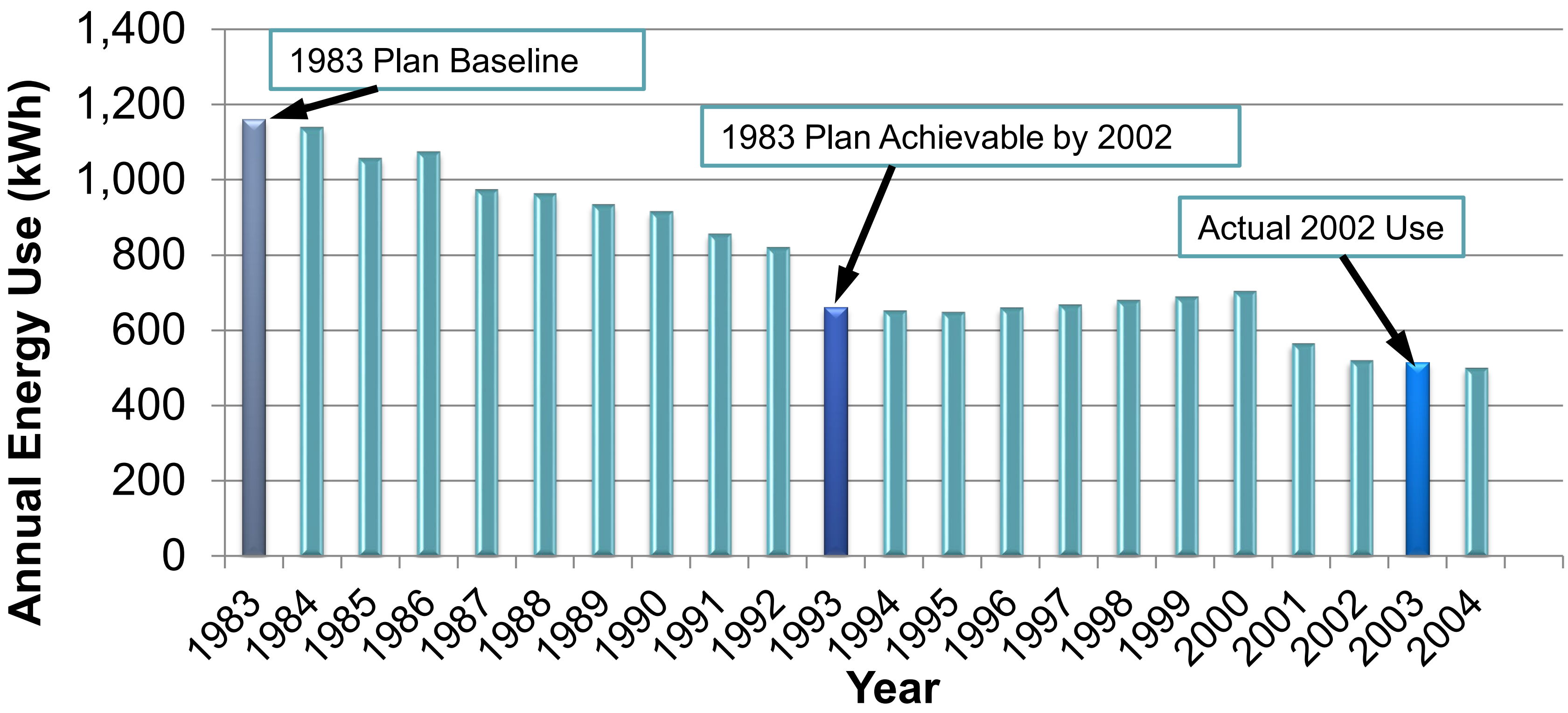
1983 Plan Forecast “0%” Market Share of Energy Efficient Manufactured Housing*



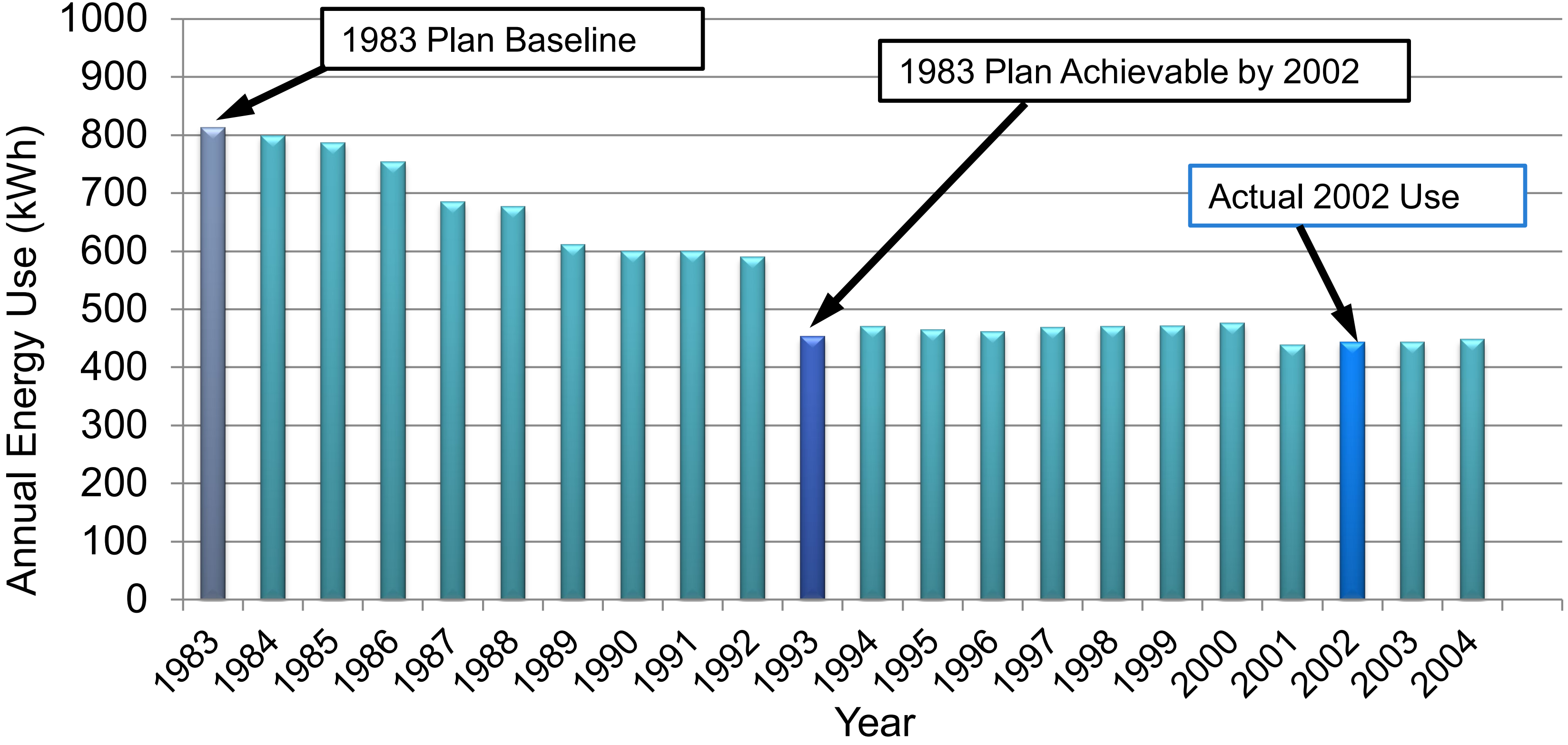
Residential Water Heating Use



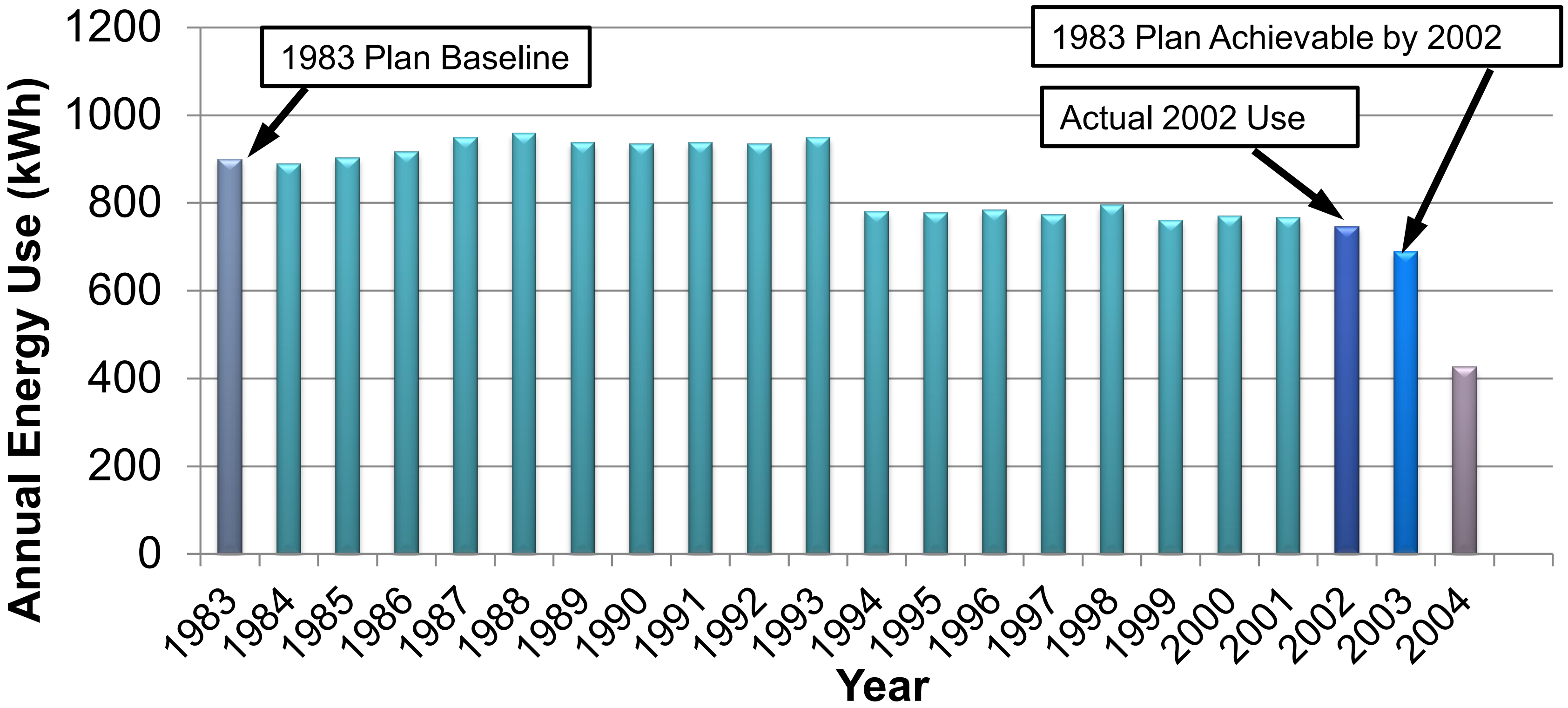
Average Energy Use of New Refrigerators



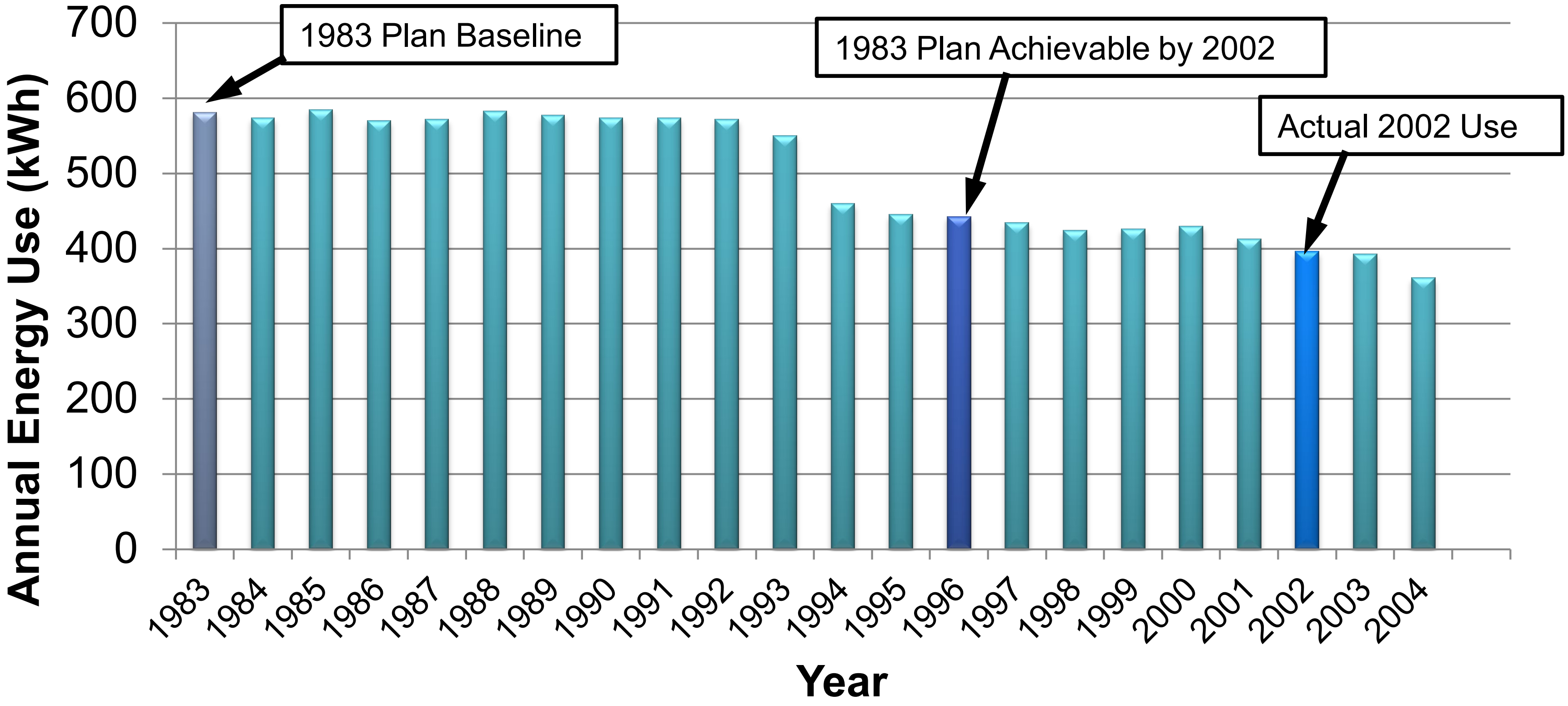
Average Energy Use of New Freezers



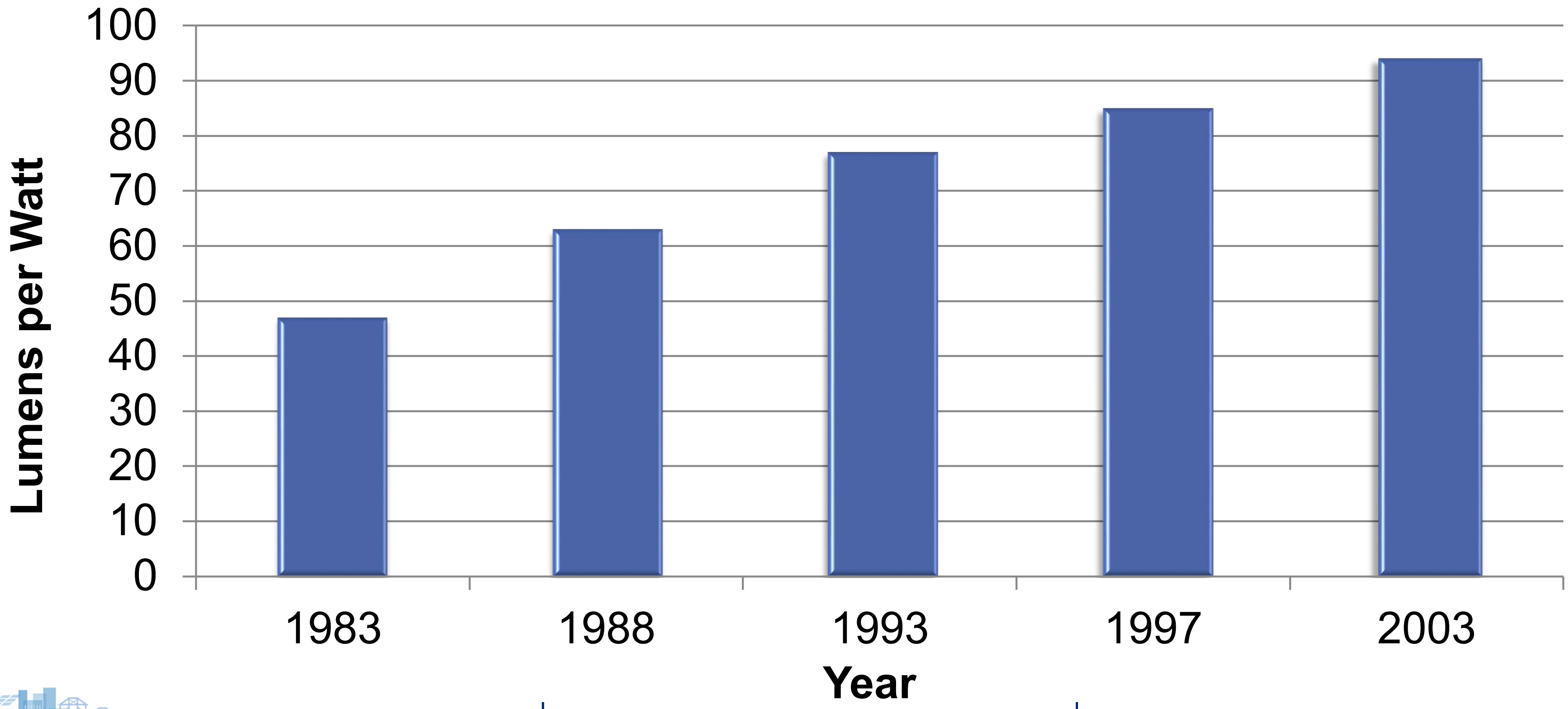
Average Energy Use of New Clothes Washers



Average Energy Use of New Dishwashers



Change in Fluorescent Lighting Efficacy 1983 - 2003



Commercial Lighting Power Density

Codes Surpass 1983 MCS

Building Type	Lighting Power Density (Watts/sq.ft.)				
	1983 Plan Target (MCS)	Oregon 2004	Washington 2004	Idaho and Montana	Seattle 2004
Office	1.5	1.0	1.0	1.0	1.0
Retail Stores	1.5	Varies 1.5+	Varies 1.5+	Varies 1.5+	Varies 1.5+
Schools	2.0	1.1	1.35	1.2	1.2
Warehouses	0.7	0.5	0.8	0.8	0.5

Change in Lighting Power Density of Existing Buildings

Audit Date	Lighting Power Density (Watts/sq.ft.)			Reduction in Lighting Power Density (%)		
	All Buildings	Offices	Retail	All Buildings	Office	Retail
As found in 1987	1.5	1.6	1.9			
As found in 2001	1.2	1.4	1.5	20%	13%	21%

Commercial HVAC Equipment Efficiency Requirements

System Type	Capacity Under 65,000 Btu/hr		Capacity 65,000 Btu/hr and Larger	
	1983 Achievable SEER	Current Code Minimum SEER	1983 Achievable EER	Current Code Minimum EER
Air Cooled	7.8	13	8.2	11.0
Evaporative or Water cooled	8.8	14	9.2	14.0

Industrial Sector Achievable Potential

- 1983 Council's forecast of achievable conservation potential was equivalent to about 6 percent of non-DSI industrial electric loads
- Motors comprise approximately 60 percent of industrial energy use
  - Federal minimum efficiency standards required 3 - 10 % improvement over 1983 efficiency levels for covered sizes

Other Documented Industrial Sector Efficiency Improvements

- 20 to 30 % improvement in multiple cold-storage facilities
- 15 to 30 percent improvements in compressed air systems for many plants across different industries
- 50 percent in improvement in lighting in manufacturing spaces with high ceilings; and,
- industry-specific process changes in the range of 20 percent improvement.

Irrigation Sector Achievable Potential