# TEN PITFALLS OF POTENTIAL STUDIES: AN OVERVIEW

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# Introduction and Context



- Potential studies fulfill important purposes, such as:
  - Evaluating potential of energy efficiency as an alternative to supply-side resources
  - Planning a portfolio of energy efficiency programs
- But they require significant investments, including:
  - Time
  - Money
  - Staffing
- Less costly to avoid mistakes up front
- Sometimes may need to reinterpret results

# Introduction and Context (Cont.)



- Too often, study results imbued with false sense of precision
- Important to be as accurate as possible
- But also acknowledge uncertainties
- Engage stakeholders early
- Identify potential pitfalls up front
- Be transparent about approach to them

# Value of The RAP Report

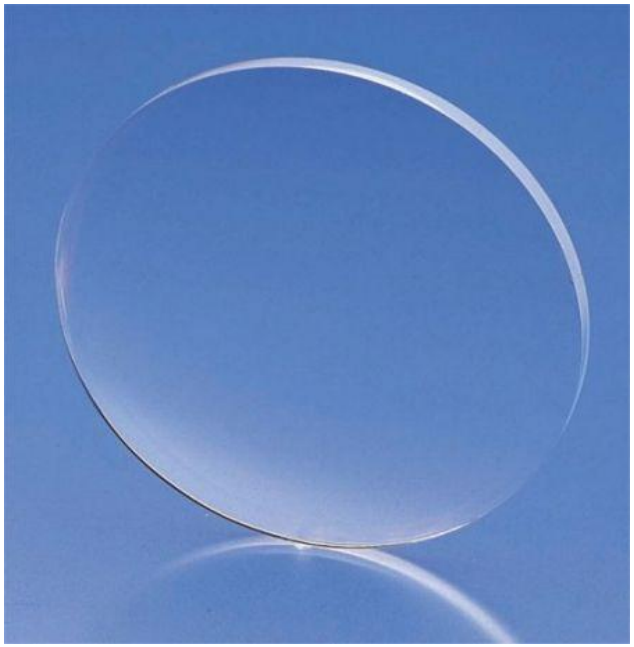


- Identifies 10 Key Potential Study Pitfalls
- Chosen by Project Team from list of about 40
- Describes them along six dimensions:
  1. Why is it an issue?
  2. Impact on savings and cost-effectiveness (direction)
  3. Impact on savings and cost-effectiveness (magnitude)
  4. How to determine whether it is an issue in a given potential study
  5. How to avoid the issue in the first place or correct it
  6. How to reinterpret potential study findings when issue is already embedded

# Key Themes



- Identify potential pitfalls *early* in the process
- Spell out *in writing* (RFP, Scope of Work) methods used to address them
- Ensure *transparency* with respect to inputs, methods, and uncertainties



# Ten Pitfalls



1. Defining "Achievable" Savings
2. Policy Considerations and Constraints
3. Modeling Program Participation
4. Excluding Measures and Savings Opportunities
5. Incorporating Codes and Standards into Technology Baselines

# Ten Pitfalls, Continued

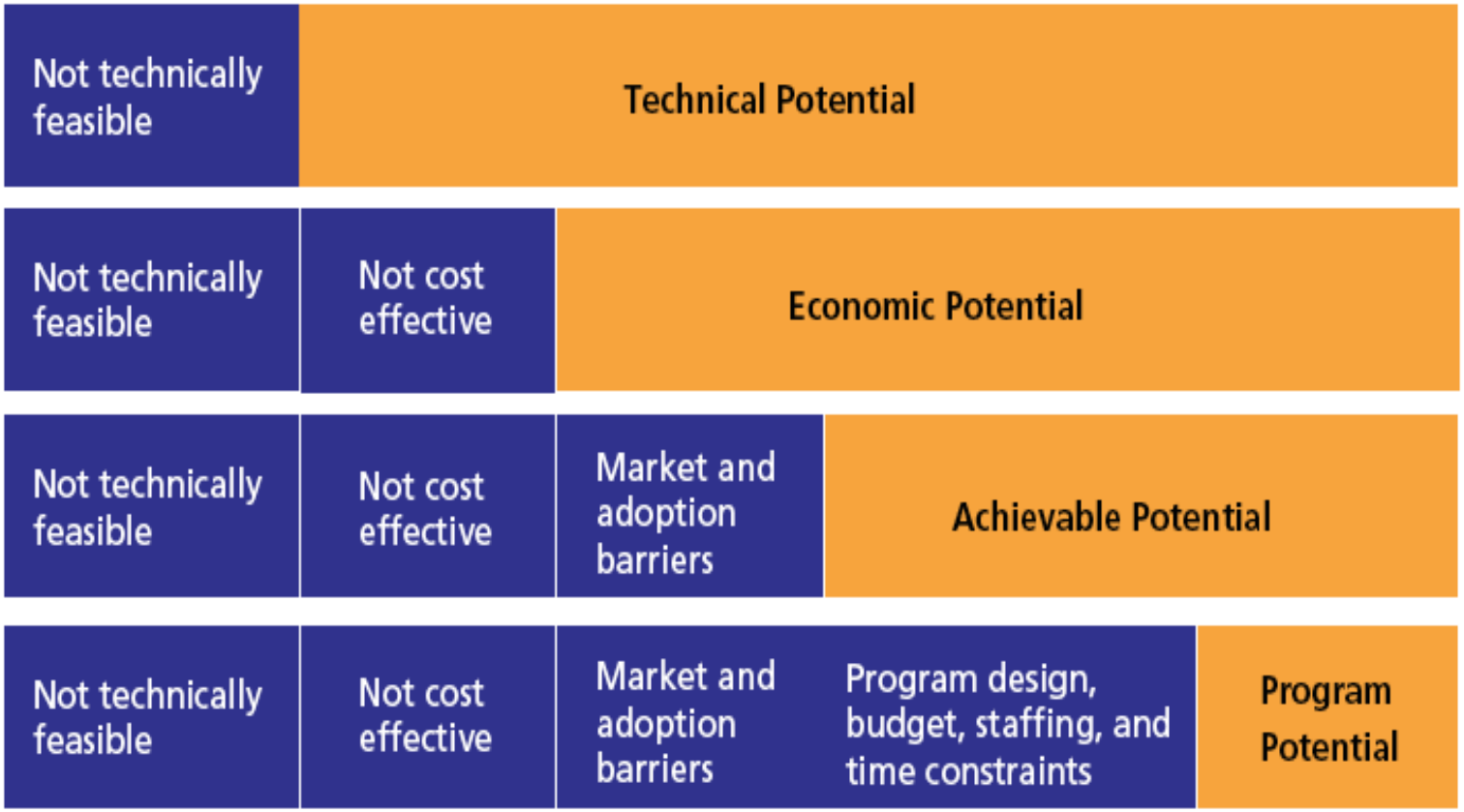


6. Issues with Utility Sales Forecasts
7. Consistency with the Integrated Resources Plan
8. Cost-Effectiveness Screening with the Total Resource Cost and Societal Cost Tests
9. Inclusion of Non-Energy Impacts
10. Forecasting Net Savings

# 1. Defining "Achievable" Savings



- Technical vs. Economic vs. Achievable



# 1. Defining Achievable Savings



- Achievable is *not* necessarily an upper limit
- Multiple "flavors" of achievable:
  - "Maximum Achievable"
  - "Program Achievable"
  - Specific budget limits
  - Incentive limits

# 1. Defining Achievable Savings (Cont.)



- Interpreting "Achievable"
  - Within one set of budget/incentive limits, "achievable" often carries false connotation of maximum possible under those constraints
  - But non-monetary factors can influence what is possible (e.g., program design, implementation)
  - Study results may be modeled based on past results in which these factors were not optimized

*Key Takeaways*: Decide and spell out meaning of "achievable." Beware of comparing different studies with different definitions. When reading a completed study, don't assume it's really a maximum, even under one set of constraints.

# 2. Policy Considerations



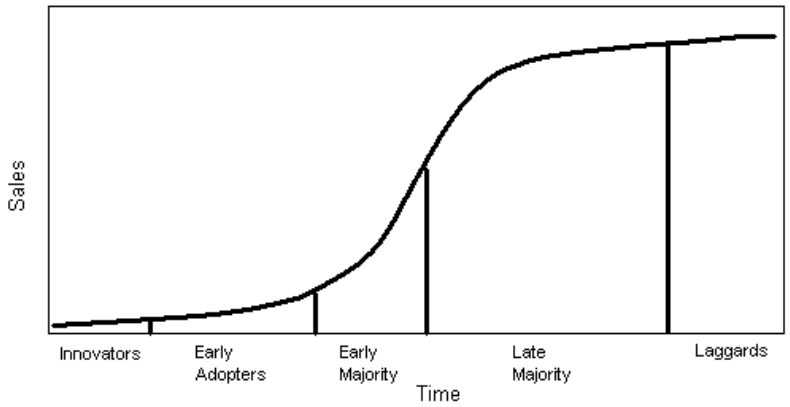
- Many up-front policy decisions will impact savings projections
  - Sector Equity
  - Low Income Programs
  - Screening Test and Methodology
  - Measure vs. Portfolio-Level Screening
  - Fuel Switching
  - Combined Heat and Power
  - Joint promotion of programs saving multiple fuel types

*Key Takeaway: Many types of policies may impact savings projections. Identify them up front and look for policy differences when comparing study results from different jurisdictions.*

# 3. Modeling Participation



- Two typical methods: technology adoption curves and direct estimates
- Technology adoption curves
  - Often take on a false air of precision
  - But only as good as their inputs and methods
  - These are often not adequately described
  - Frequently presented as a “black box”



# 3. Modeling Participation (Cont.)



- Technology adoption curves (cont.):
  - Tend to focus heavily on payback periods
  - May not account for other key factors (marketing, stocking practices, etc.)
  - Backward-looking, often based on contexts in which goal was not maximum achievable
  - Should be calibrated against experience, especially of aggressive programs
  - Maximum achievable from such programs has been higher than what curves typically predict

# 3. Modeling Participation (Cont.)



- Direct estimates
  - "Informed projections"
  - May be subjective
  - But impossible to eliminate subjectivity
- For either method, important to gather expert/stakeholder input up front
- Provide intermediate projections

*Key Takeaway*: Projecting participation is a forward-looking, subjective process. Adoption curves are just as subjective as direct estimates, but too often treated as more accurate, despite range of possible problems with them.

# 4. Excluding Savings Opportunities



- Emerging Technologies
- System-Wide Savings
  - E.g., improvements in an entire set of industrial processes
- Interactive Effects
  - E.g., lighting retrofit at time of commercial chiller replacement may reduce both lighting power density and necessary size of replacement chiller
- Retrofit/Early Replacement
  - Important to quantify shift in replacement cycle correctly (see report for methodology)

# 4. Excluding Savings Opportunities (Cont.)



- Behavior/Operational Improvements
- Market Segments
- Combined Heat and Power
- Fuel Switching
- Demand Response
- Screening under Average Conditions
- Promoting Codes and Standards


*Key Takeaway: Decide up front what types of savings opportunities will be assessed. Leaving out important opportunities may lead savings potential to be substantially understated.*

# Excluding Savings Opportunities (Cont.)

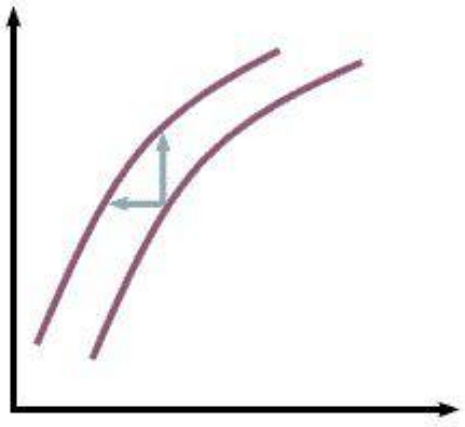


| Indicator | (Column 1) - Replace on Burnout Base Case | (Column 2) - Early Replacement Scenario | (Column 3) Difference of Column 2 and Column 1 (Column 2 - Column 1) | (Column 4) - Percent Difference |
|---|---|---|---|---|
| | | | | |
| Total Incentives Paid for 2006 to 2015 (Present Value) | $214,251,884 | $290,457,037 | $ 76,205,153 | 35.57% |
| Total Administrative Costs Paid from 2006 to 2015 (Present Value) | $133,800,997 | $ 97,443,174 | $ (36,357,824) | -27.17% |
| Present Value of Total Utility Energy Efficiency Program Budget 2006 to 2015 | $348,052,882 | $387,900,211 | $ 39,847,329 | 11.4% |
| Average Annual Budget (2006-2015) | $34,805,288 | $38,790,021 | $3,984,733 | 11% |
| Cumulative Annual mWh Savings by 2015 | 1,286,823 | 1,166,144 | (120,679) | -9.4% |
| Cumulative Annual Winter Peak MW Savings by 2015 | 379 | 389 | 10 | 2.6% |
| Cumulative Annual Summer Peak MW Savings by 2015 | 225 | 244 | 19 | 8.5% |
| NPV Benefits ( Vermont Societal Test) | $ 1,358,463,742 | $ 1,675,495,161 | $ 317,031,419 | 23.3% |
| NPV Costs (Vermont Societal Test) | $ 393,994,396 | $ 526,653,726 | $ 132,659,330 | 33.7% |
| NPV Savings | $ 964,469,346 | $ 1,148,841,435 | $ 184,372,089 | 19.1% |
| B/C Ratio | 3.45 | 3.18 | (0.27) | -7.7% |

# 5. Codes, Standards, & Baselines



- Codes and standards set the minimum requirements for buildings and measures
- Savings may represent the delta between these minimums and efficient alternatives
- Not always 100% enforced
- Sometimes measured using actual observed baseline



# 5. Codes, Standards, & Baselines (Cont.)



- All else equal, savings delta shrinks as baselines increase
- But efficiency of advanced technologies typically increases, too
- Incorporate known future changes in codes and standards
- Be transparent about how more uncertain changes are factored in

*Key Takeaway: Account for future codes and standards and future increases in efficiency of advanced technologies to project savings potential.*

# 6. Utility Sales Forecasts



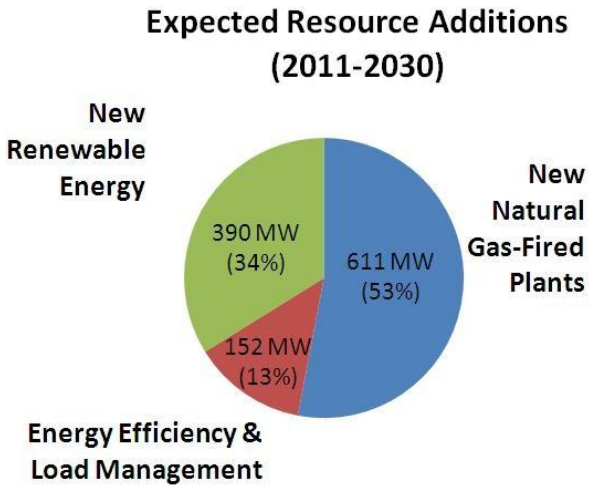

- Typical Use of Forecasts by Sector
  - "Top Down" use for C&I
  - Calibration in Residential
- "Embedded Efficiency" from past DSM
  - Failure to adjust the forecast upward may cause the forecast to be understated
- Future Codes and Standards
  - Failure to account for them may cause program-related savings potential to be overstated

*Key Takeaway: Examine what factors may be left in or left out of utility sales forecasts and make appropriate adjustments for study purposes.*

# 7. Consistency with the IRP



- Many inputs/assumptions overlap between potential studies and other resource planning
  - Energy and peak demand forecasts
  - Future codes and standards
  - Fuel prices/avoided costs
  - Inflation rates
  - Discount rates
- Consider conducting potential study as integral part of IRP process.
- Otherwise, make adjustments where practical or explicitly highlight discrepancies and relevant impacts.




Source: PNM Electric IRP

*Key Takeaway: As much as possible, IRP and potential study inputs should be consistent to ensure EE is considered on an equal footing.*

# 8. TRC and Societal Tests



- Measures and/or programs screened based on costs vs. benefits
- More measures and programs = higher savings potential
- But which benefits are included?
- Societal vs. Utility Discount Rate
- Methodological issues in calculating all of these avoided costs

| Avoided Costs & Other Benefits | TRC | SCT |
|---|---|---|
| Avoided energy of subject fuel | ✓ | ✓ |
| Avoided capacity of subject fuel | ✓ | ✓ |
| Avoided line losses *(marginal vs. avg.) | ? | ? |
| Avoided transmission and distribution | ? | ? |
| Demand-reduction-induced price effects (DRIPE) | ? | ? |
| Avoided costs of other fuels | ? | ? |
| Avoided water costs | ? | ? |
| Avoided environmental compliance costs | ? | ? |
| Non-energy benefits | ? | ? |
| Other environmental externalities | | ? |

*Key Takeaway: Benefits included vary widely, with important implications for total savings potential. Decide up-front which to include, state them clearly, and be wary of cross-study comparisons using different types of screens.*

# TRC and Societal Tests (Cont.)

## Conservative Case

| | Avoided kWh | Avoided kW | Avoided Therms | Avoided H2O gal | Avoided T&D | Env. Adder | Total Bens | Cost | Net Bens | BCR |
|---|---|---|---|---|---|---|---|---|---|---|
| Clothes Washer | $69.22 | $5.13 | $0.00 | $0.00 | $0.00 | $0.00 | $74.35 | $250 | ($175.65) | 0.30 |
| Central A/C | $93.16 | $75.84 | $0.00 | $0.00 | $0.00 | $0.00 | $169.00 | $550 | ($381.00) | 0.31 |
| CFL | $15.88 | $1.28 | $0.00 | $0.00 | $0.00 | $0.00 | $17.16 | $3 | $14.16 | 5.72 |

## Comprehensive Case

| | Avoided kWh | Avoided kW | Avoided Therms | Avoided H2O gal | Avoided T&D | Env. Adder | Total Bens | Cost | Net Bens | BCR |
|---|---|---|---|---|---|---|---|---|---|---|
| Clothes Washer | $98.93 | $7.34 | $34.63 | $496.35 | $13.79 | $9.89 | $660.93 | $250 | $410.93 | 2.64 |
| Central A/C | $143.65 | $116.94 | $0.00 | $0.00 | $219.76 | $14.37 | $494.72 | $550 | ($55.28) | 0.90 |
| CFL | $19.96 | $1.61 | $0.00 | $0.00 | $3.02 | $2.00 | $26.58 | $3 | $23.58 | 8.86 |

# 9. Non-Energy Impacts



- Many types:

| Customer | Utility | Society |
|---|---|---|
| • Reduced operations & maintenance<br>• Increased comfort<br>• Aesthetics<br>• Convenience (+/-)<br>• Air quality<br>• Health | • Reduced collection costs<br>• Fewer shut-offs<br>• Fewer write-offs<br>• Fewer customer complaints | • Increased energy independence<br>• Community aesthetics<br>• Reduced health costs |

- Many are difficult to quantify, but evidence suggests they are substantial. Quantified in MA. Other states (e.g., VT) use adders.
- Improvements often sold more on basis of NEBs than on energy savings, yet rarely counted in screening.

*Key takeaway: As with other costs and benefits, leaving out NEIs will affect screening and therefore total savings potential.*

# 10. Forecasting Net Savings



- "Net savings" = Gross Savings – Free Ridership + Spillover
- Important when potential study is intended to inform energy efficiency program planning
  - Key question: what level of savings potential is attributable to programs
- May be less critical in resource planning
  - Key question: what level of total demand can be met through efficiency (program-driven or naturally occurring)?
- Or where gross savings goals are pre-established

# 10. Forecasting Net Savings



- Net-to-gross ratio (1 – Free Ridership + Spillover) can be estimated for purposes of potential study in several ways
  - Applying past experience
  - Market share analysis
  - Sales data analysis


- Not an exact science
- But important to apply best estimate, if looking at potential impact of programs

*Key takeaway: Apply NTG ratio when purpose is program planning. Be transparent about uncertainty, and consider offering range or error margin.*

# Cross-Cutting Themes



## Transparency Is Key

- Too often, inputs and methods not fully explained in study narrative
- This makes it very difficult to interpret how projections were reached
- Denies the reader the ability to reinterpret results based on alternative assumptions or scenarios
- No shame in acknowledging that projections may or may not bear out
- Better to give enough information to allow readers to draw their own conclusions

# Cross-Cutting Themes (Cont.)



Don't Fall Prey to False Sense of Precision

- Overall Savings Projections
- Technology Adoption Curves
- Econometric Modeling in Net Savings Analysis
- Sales Forecasting
- Avoided Cost Projections

- All of these modeling exercises can seem impressive
- But they are only as good as the inputs and equations they are based on
- Better to acknowledge uncertainties
  - Explain methods
  - Provide scenario analyses, range of outcomes, or error bars
  - Provide intermediate projections where relevant

# Cross-Cutting Themes (Cont.)



## Identify Pitfalls Early

- Much harder to go back and re-do analysis once work is too far along or complete
- May be no budget left for the project
- Engage range of stakeholders early to agree on the study scope, identify pitfalls, and agree on approaches/methodologies
- Lay out approaches in writing as early as possible
  - Can describe them in the RFP
  - At a minimum, should be discussed in scope of work

# Cross-Cutting Themes (Cont.)



Identify Issues with Outside Sources

- Utility Sales Forecasts
- Integrated Resource Plans
- Avoided Cost Assumptions
- Other Potential Studies (Inputs/Calibration)

- Examine whether any issues may be embedded in these sources
- Where possible, make appropriate adjustments
- If not possible, be clear about possible impacts on potential study results

# Cross-Cutting Themes (Cont.)



Be Wary of Comparing Study Results

- Different definitions of "achievable"
- Different inputs and assumptions
- Different contexts
- Past results may not reflect future conditions

- Study results from other jurisdictions can provide helpful data points
- But be sure to apply them with the proper caveats

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