

# Energy Efficiency Evaluation, Measurement and Verification (EM&V) Resources

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# Resources

- There are a significant number of resources available that cover efficiency EM&V planning and implementation, as well as reports of results
- Select resources are summarized in the next few slides:
  - Measurement and verification documents
  - Evaluation documents
  - Websites
  - Training

# Definitions – EM&V

- **Evaluation** - The performance of studies and activities aimed at determining the effects of a **program**
- **Measurement and Verification** – Data collection, monitoring, and analysis associated with the calculation of gross energy and demand savings from **individual sites or projects**. M&V can be a subset of program evaluation.
- **EM&V** - The term “evaluation, measurement, and verification” is frequently seen in efficiency evaluation literature. EM&V is a catchall acronym for determining both program and project impacts.

# **MEASUREMENT AND VERIFICATION RESOURCES**




# IPMVP



- IPMVP is the leading international energy efficiency M&V protocol:
  - IPMVP has been translated into 10 languages and is used in more than 40 countries
  - Since going online, there have been more than 20,000 downloads of the IPMVP
- More information can be found at [www.evo-world.org](http://www.evo-world.org)

# Measurement and Verification Guides

ASHRAE Guideline 14-2002



## ASHRAE GUIDELINE

### Measurement of Energy and Demand Savings

Approved by the ASHRAE Standards Committee June 22, 2002, and by the ASHRAE Board of Directors June 27, 2002.

ASHRAE Guidelines are updated on a five-year cycle; the date following the Guideline is the year of approval. The latest edition of an ASHRAE Guideline may be purchased from ASHRAE Customer Service, 1791 Tullie Circle, NE, Atlanta, GA 30329-2305. E-mail: [orders@ashrae.org](mailto:orders@ashrae.org). Fax: 404-321-5478. Telephone: 404-636-8400 (worldwide) or toll free 1-800-627-4723 (for orders in U.S. and Canada).

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ISSN 1049-894X

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### M&V Guidelines: Measurement and Verification for Federal Energy Projects

### Version 3.0



[www.eere.energy.gov/femp](http://www.eere.energy.gov/femp)



U.S. Department of Energy  
**Energy Efficiency  
and Renewable Energy**  
Bringing you a prosperous future where energy  
is clean, abundant, reliable, and affordable

# *Key References*

## *M&V Guidelines/ Protocols*

- 2007 International Performance Measurement and Verification Protocol (IPMVP): ([www.evo-world.org](http://www.evo-world.org))
- 2008 Federal Energy Management Program M&V Guidelines and related documents: <http://ateam.lbl.gov/mv/>
- 2002 ASHRAE Guideline 14 Measurement of Energy and Demand Savings: [www.ashrae.org](http://www.ashrae.org)

# EVALUATION RESOURCES



# Model Energy Efficiency Program Impact Evaluation Guide

**National Action Plan for Energy Efficiency**  
[www.epa.gov/eeactionplan](http://www.epa.gov/eeactionplan)

# NAPEE Guide Program & Evaluation Types Covered

- Program types addressed:
  - Primary focus is resource acquisition, downstream energy efficiency programs
    - Includes detailed guidance
  - Secondary focus is other demand-side programs and several supply-side programs
    - Guide addresses, no detailed guidance
- Evaluation types addressed:
  - Primary focus is impact evaluation
  - “Very” secondary focus on other evaluation types

# NAPEE Guide Audience

- Program evaluation managers and policy makers looking for guidance on process and key issues relating to:
  - Documenting energy and/or demand savings
  - Documenting avoided emissions
  - Comparison of demand and supply side resources
- Program designers looking to understand how their programs will be evaluated
- Energy efficiency community looking for:
  - Common terminology definitions
  - A central reference document that provides guidance, but also references publicly available best practices resources
  - An understanding of the mechanisms for determining the potential value of energy efficiency as an emissions avoidance strategy

# NAPEE Guide Table of Contents

|               |  |
|---------------|--|
| <i>Part 1</i> | <b>Executive Summary</b>   |
| <i>Part 2</i> | <b>Chapter 1: Introduction</b><br><b>Chapter 2: Energy Efficiency Program Evaluation</b><br><b>Chapter 3: Impact Evaluation Basics</b>   |
| <i>Part 3</i> | <b>Chapter 4: Calculating Gross Energy and Demand Savings</b><br><b>Chapter 5: Calculating Net Energy and Demand Savings</b><br><b>Chapter 6: Calculating Avoided Air Emissions</b>  |
| <i>Part 4</i> | <b>Chapter 7: Planning An Impact Evaluation</b>  |
| <i>Part 5</i> | <b>Appendix A: Leadership Group List</b><br><b>Appendix B: Glossary</b><br><b>Appendix C: Other Evaluation Types</b><br><b>Appendix D: Uncertainty</b><br><b>Appendix E: Resources and References</b><br><b>Appendix F: Renewables and Combined Heat and Power Program Evaluation</b><br><b>Appendix G: References</b> |

**Also includes about  
40 "sidebars" and 25  
figures and tables**

# Resources: Technical Reference Manuals and Evaluation Protocols

## Technical Reference Manuals (TRMs)

- In the simplest form 'TRMs' are databases of deemed savings values with applicability conditions
- Examples of database contents:
  - kWh, kW, therm savings values
  - Measure effective lifetimes
  - Net to gross ratios
  - Measure cost information
  - Local/regional utility cost information for TRC calculations
  - Work papers that document basis for values

## Evaluation Protocols

- Documents with varying level of detail that define how the evaluations (and M&V) are to be conducted with a particular jurisdiction.
- Contents might include:
  - Which approaches to use
  - Sample size requirements
  - Evaluation timing
  - Reporting requirements

# States With Evaluation Protocols and/or TRMs

## Examples of the usual suspects....

- California
- Connecticut
- Maine
- New York
- Texas
- Vermont
- Wisconsin

## But others are under development:

- Illinois
- Missouri
- Ohio
- Pennsylvania

# Select References

## Program Evaluation

- 2007 NAPEE Model Energy Efficiency Program Impact Evaluation Guide:  
[www.epa.gov/cleanrgy/documents/evaluation\\_guide.pdf](http://www.epa.gov/cleanrgy/documents/evaluation_guide.pdf)
- 2006 California Energy Efficiency Evaluation Protocols:  
[http://www.calmac.org/publications/EvaluatorsProtocols\\_Final\\_AdoptedviaRuling\\_06-19-2006ES.pdf](http://www.calmac.org/publications/EvaluatorsProtocols_Final_AdoptedviaRuling_06-19-2006ES.pdf)
- 2004 The California Evaluation Framework:  
[http://www.calmac.org/publications/California\\_Evaluation\\_Framework\\_June\\_2004.pdf](http://www.calmac.org/publications/California_Evaluation_Framework_June_2004.pdf)
- 2007 US DOE Impact Evaluation Framework for Technology Deployment Programs:  
[http://www.eere.energy.gov/ba/pba/km\\_portal/docs/pdf/2007/impact\\_framework\\_tech\\_deploy\\_2007\\_main.pdf](http://www.eere.energy.gov/ba/pba/km_portal/docs/pdf/2007/impact_framework_tech_deploy_2007_main.pdf)
- 2006 US DOE Guide for Managing General Program Evaluation Studies:  
[http://www1.eere.energy.gov/ba/pba/pdfs/evl\\_mg\\_app.pdf](http://www1.eere.energy.gov/ba/pba/pdfs/evl_mg_app.pdf)
- ISO New England Manual for Measurement and Verification of Demand Reduction Value from Demand Resources: [http://www.iso-ne.com/rules\\_proceeds/isone\\_mnls/m\\_mvdr\\_measurement\\_and\\_verification\\_demand\\_reduction\\_revision\\_1\\_10\\_01\\_07.doc](http://www.iso-ne.com/rules_proceeds/isone_mnls/m_mvdr_measurement_and_verification_demand_reduction_revision_1_10_01_07.doc)

# WEBSITES

# Key References

## EM&V Websites

- Evaluation reports and guidance/plans document websites:
  - CALifornia Measurement Advisory Council (CALMAC): <http://www.calmac.org>
  - The Consortium for Energy Efficiency's Market Assessment and Program Evaluation (MAPE) Clearinghouse: <http://www.cee1.org/eval/eval-res.php3>
  - Northwest Energy Efficiency Alliance: <http://www.nwalliance.org/research/evaluationreports.aspx>
  - California PUC 2006-08 Evaluation Contracts: <http://www.energydataweb.com/cpuc/default.aspx>
  - US EPA Evaluation, Monitoring and Verification Resources: [http://www.epa.gov/RDEE/documents/stateforum/11\\_13\\_08/background\\_info\\_emv\\_11-13-2008.pdf](http://www.epa.gov/RDEE/documents/stateforum/11_13_08/background_info_emv_11-13-2008.pdf)
  - University of California (CIEE) Evaluation Resources : <http://uc-ciee.org/energyeff/energyeff.html>
- "TRM"s:
  - California DEER Database: <http://eega.cpuc.ca.gov/deer/>
  - Northwest Regional Technical Forum: <http://www.nwcouncil.org/energy/rtf/Default.htm>
- Other Sites:
  - Proceedings of the IEPEC Conference: [www.iepec.org](http://www.iepec.org)
  - ACEEE Summer Studies [www.aceee.org](http://www.aceee.org)
  - NEEP Regional EM&V Forum: [www.neep.org/emv-forum](http://www.neep.org/emv-forum)

# TRAINING

# Training on EM&V

- **Energy Efficiency Evaluation Training Opportunities, Prepared by Edward Vine, California Institute for Energy and Environment**
- [http://uc-ciee.org/energyeff/documents/Evaluation\\_Training\\_Opportunities.pdf](http://uc-ciee.org/energyeff/documents/Evaluation_Training_Opportunities.pdf)

# Select Evaluation Training Opportunities

- Efficiency Valuation Organization
  - Fundamentals of Measurement & Verification: Applying the New IPMVP and Certified Measurement and Verification Professional (CMVP) Certification
- American Society of Heating, Refrigerating and Air Conditioning Engineers (ASHRAE)
- International Energy Program Evaluation Conference (IEPEC)
- Consortium for Energy Efficiency
- Association of Energy Services Professionals
- American Council for an Energy-Efficient Economy (ACEEE)