Show Me the Savings: TRMs, Big Data, and EM&V 2.0 as Catalysts for Energy Efficiency Savings

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Vermont Energy Investment Corporation

ACEEE Energy Efficiency as a Resource Conference

September 21, 2015

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Agenda

1. The Need for Savings Documentation

2. What is a Technical Reference Manual?

2. Best Practices in TRMs

3. The Evolution of TRMs: Integrating Data from Submetering and AMI

About VEIC

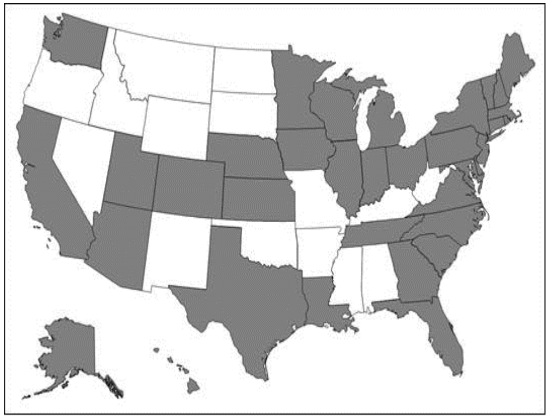
- Mission-driven nonprofit
- 30 years reducing economic & environmental costs of energy
- Electric & thermal; buildings & transportation
- Services:

  Policy, planning, regulatory support

  Program design, review, evaluation

  Program implementation
- Clients: Regulators, utilities, government, foundations

VEIC Experience



Technical Reference Manuals

- DC
- Illinois
- Iowa
- Mid-Atlantic (NEEP)
- Ohio
- Vermont

Electronic TRM and Tools

- Launched in 2015

VEIC's Experience with TRMs and EM&V

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DC SUSTAINABLE ENERGY UTILITY

EFFICIENCY$MART

Comprehensive Energy Efficiency Program Administration

- Implement in highly regulated markets
- Compensated based on independently verified savings
- Realization rates averaging 97-98%
- In part due to development and use of Technical Reference Manuals

The Need for Savings Documentation

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The Need for Savings Documentation

- Essential to calculate and justify savings in a way that integrates with EE program operations and reporting

- Savings calculations are critical for:
  - Program planning and goal setting
  - Cost-effectiveness screening
  - Tracking and reporting
  - Program evaluation
  - PA performance review

- Plus, exciting new uses are emerging for:
  - Market valuation (Forward Capacity Markets)
  - Environmental compliance (Clean Power Plan)

Types of Savings Documentation

- Information exists in many forms:
  - Stand-alone spreadsheets
  - Databases – DEER (California); MEMD (Michigan)
  - Downloadable programs
  - Web-based applications
  - Statewide and regional TRMs – used in many jurisdictions
  - Many combinations of these
- Each has its advantages and drawbacks

What is a TRM?

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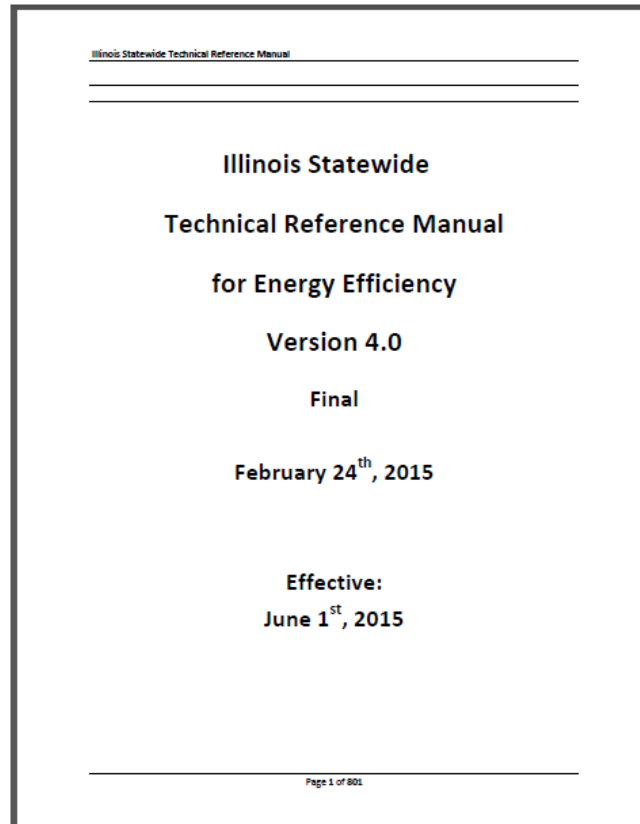
What is a TRM?

- A manual with a standard methodology for estimating savings for many common, mass marketed EE measures

- **Advantages**
  - Provides a full narrative of the measures and how calculations should be applied
  - Documents all details of the calculations and assumptions
- **Disadvantages**
  - Traditional approach can be laborious to update
  - Integration with program operations may not be seamless


Illinois Statewide Technical Reference Manual

Illinois Statewide

Technical Reference Manual

for Energy Efficiency

Version 4.0

Final

February 24th, 2015

Effective:
June 1st, 2015

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TRM Components #1

Description of Measure

- Name and Description
- Eligibility Criteria
- Definition of Baseline Case
- Definition of Efficient Case
- Measure ID
- Effective Dates

TRM Components #2

Description of Measure

Name and Descrip

Definiti Baseline

Measu

Savings Calculations

Electric Savings: kW, kWh

Gas Savings: Therms, peak therms

Algorithms

Assumptions

Examples / Supporting Documentation

Net to Gross Adjustment

TRM Components #3

Description of Measure

Name and Descriptic

Definition Baseline Ca

Measure

Savi

Electric Sav kW, kWh

Algorithr

Example

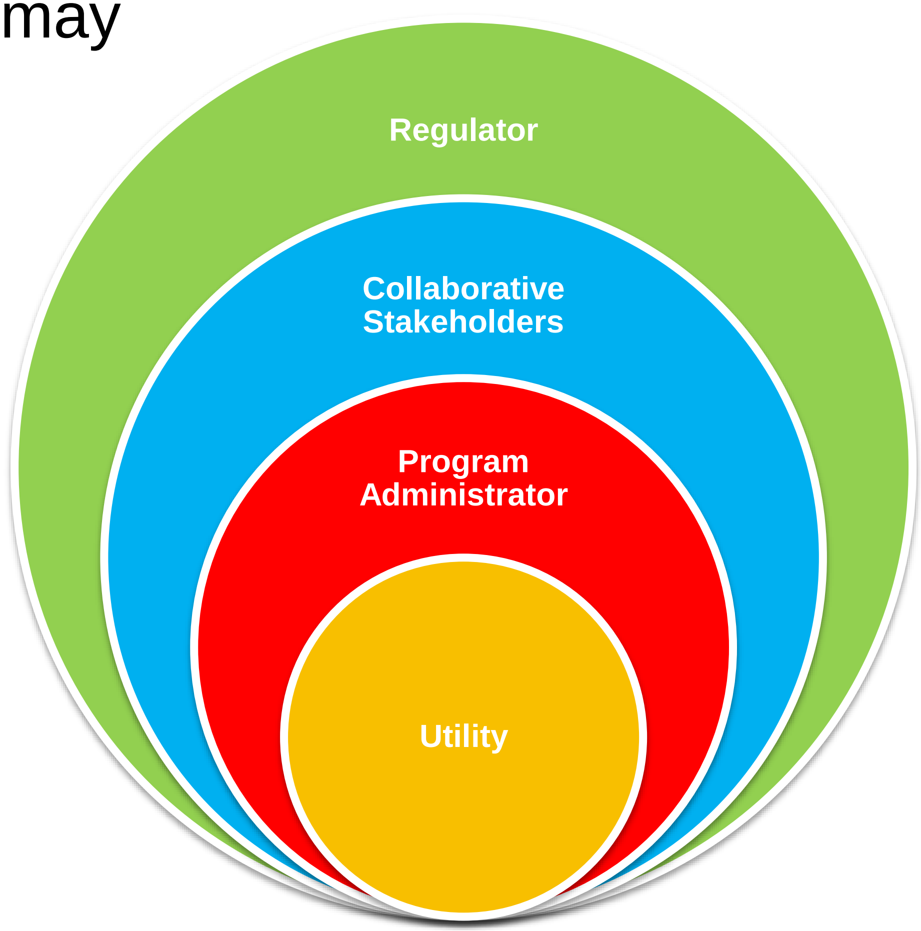
Additional Inputs for Cost-effectiveness

- Measure Life
- Persistence
- Loadshape
- Measure cost
- Coincidence Factor
- Interactive Effects
- O&M Cost and Schedule
- Water and Other Non-Energy Benefits
- Retrofit Baseline Adjustment

TRM Components #4

Policy and regulatory section may include:

- Enabling legislation
- Cross-cutting assumptions
- Process updates
- Guidelines for use to meet stakeholder needs:
  - ✓ Planning
  - ✓ Screening
  - ✓ Tracking
  - ✓ Reporting
  - ✓ Review
  - ✓ Evaluation
  - ✓ Compliance



Geographic Scope and Need for TRMs Varies

- Can serve a single provider/utility or multiple parties
- Trend is toward statewide or regional TRMs
  - Captures information for savings calculations by multiple PAs
  - Provides ready-made tool that can reduce transaction costs
  - Can support participation in FCM or CPP compliance
- Can be complex
  - Being comprehensive can mean hundreds of measures
  - Developing local program and market information can be costly
  - For statewide or regional TRMs, costs can be shared

TRM Best Practices

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Desired Attributes for Successful TRMs

Desired Attributes:

- Credible
- Accurate
- Transparent
- Comprehensive
- Standardized
- Easy to use
- Accepted by Stakeholders

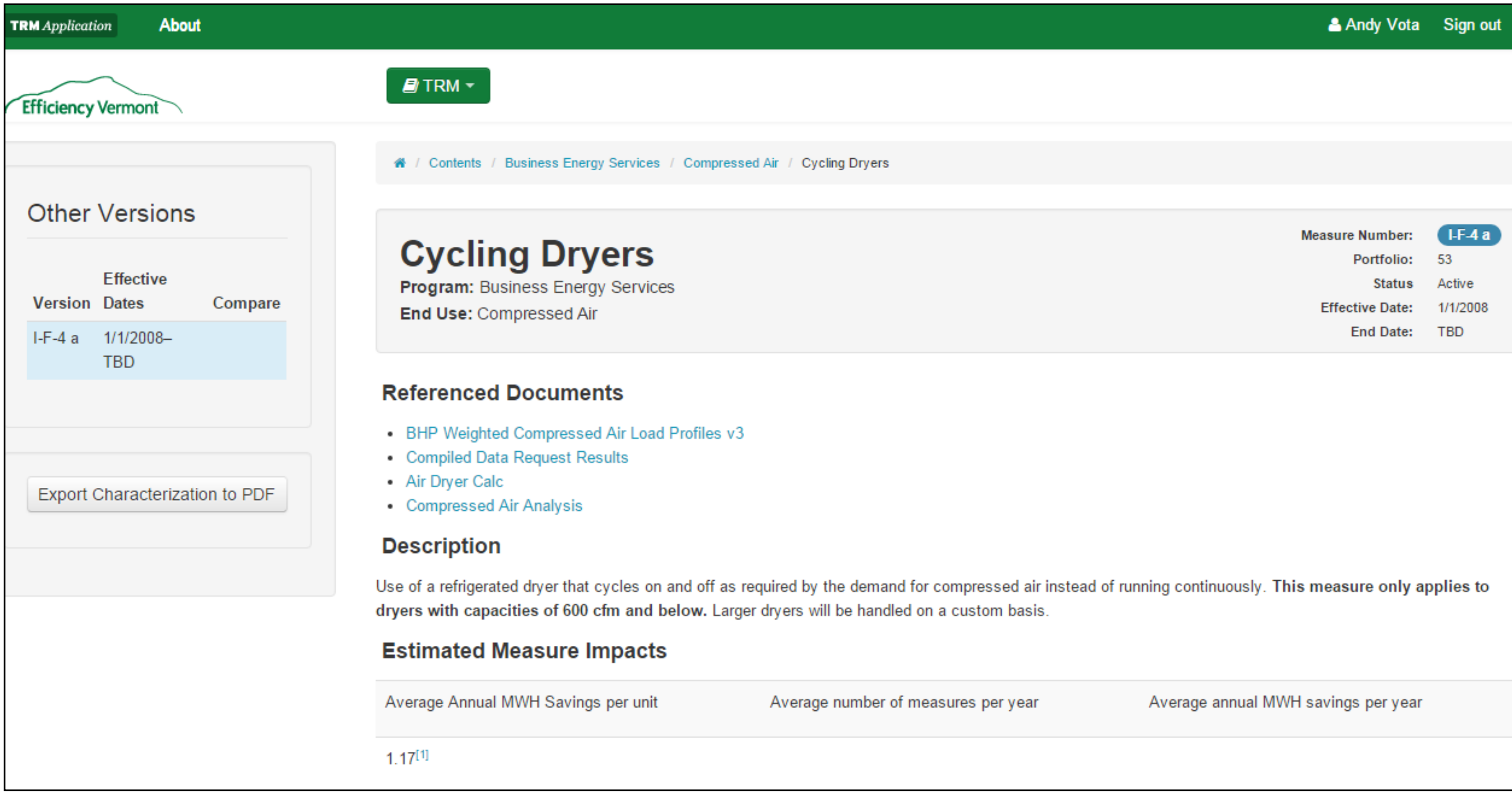
Achieving Success Requires:

- ✓ Using Best Data
- ✓ Following Best Practices
- ✓ Engaging Stakeholders Early and Often

Best Practices for TRMs

- **More standardization**
  - TRM developers are learning and sharing
  - Uniform Methods Project and other standardized protocol approaches are informing characterizations
- **Increased accuracy and improved realization rates**
  - Data from sub metering and / or AMI can enhance savings calculations, inform goals, and improve realization rates
- **Broader scope**
  - Non-energy benefits are increasingly being addressed, e.g. water savings, health impacts, and more

Best Practices in User Interface



Best Practices in User Interface

TRM Application | About | Andy Vota | Sign out

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TRM

Other Versions

Version	Effective Dates	Compare
I-F-4 a	1/1/2008–TBD	

Export Characterization to PDF

Algorithms

Electric Demand Savings

ΔkW = ΔkWh / HOURS

Symbol Table

Electric Energy Savings

ΔkWh = ((4 × $hp_{compressor}$) × 0.0087 × HOURS × (1 − APC)) × RTD

Where:

ΔkW	=	gross customer kW savings for the measure
ΔkWh	=	gross customer annual kWh savings for the measure
0.0087	=	compressor CFM to baseline dryer kW conversion factor[2]
4	=	approximate compressor output CFM per compressor motor nominal hp[3]
APC	=	Average % Capacity; average operating capacity of compressor (65%)[4]
HOURS	=	compressor total hours of operation (see Operating Hours section)
$hp_{compressor}$	=	compressor motor nominal hp
RTD	=	Chilled Coil Response Time Derate (0.925) (from "Air Dryer Calc.xls")

See "Compressed Air Analysis.xls" for algorithm details.

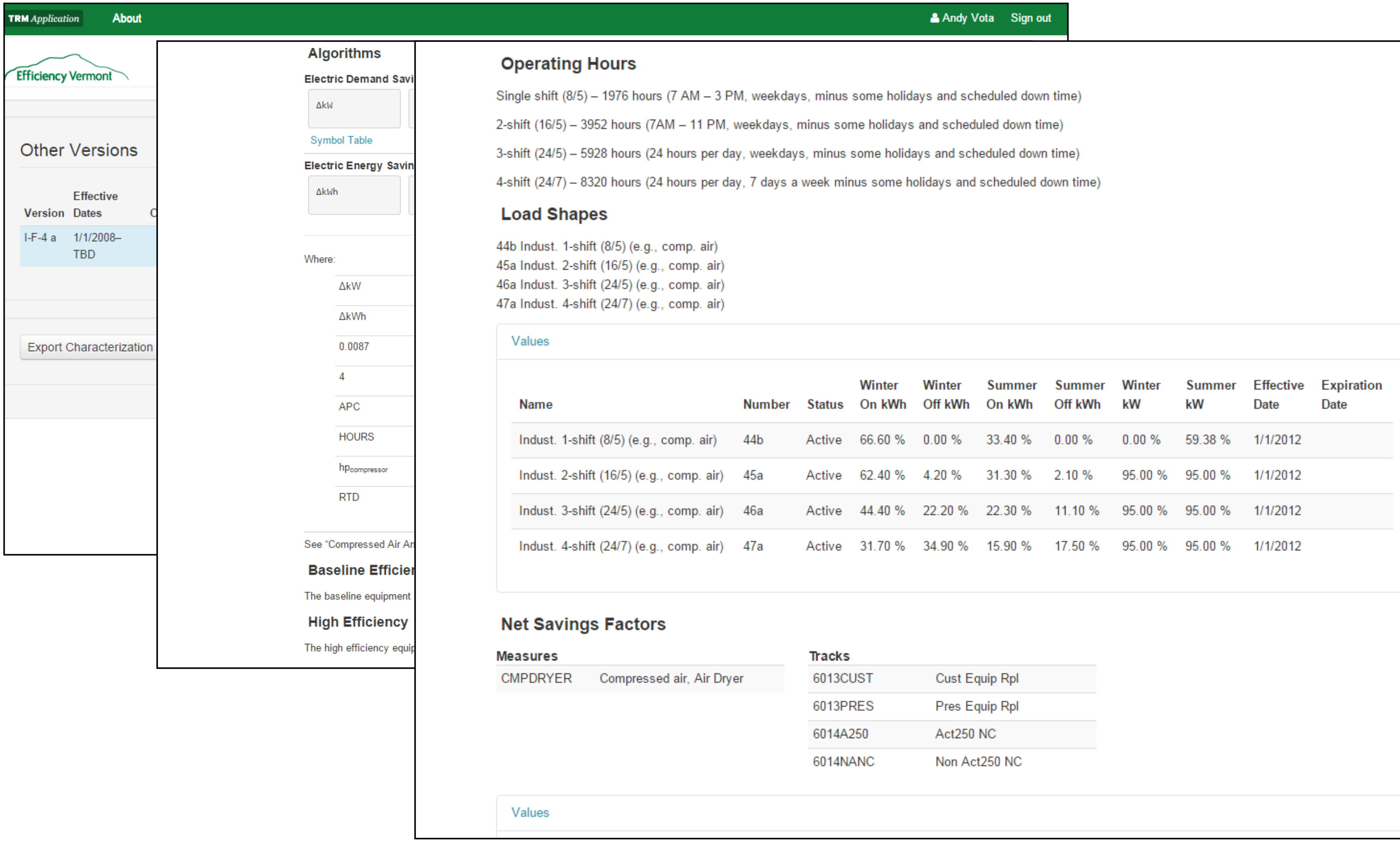
Baseline Efficiencies

The baseline equipment is a non-cycling refrigerated air dryer with a capacity of 600 cfm or below.

High Efficiency

The high efficiency equipment is a cycling refrigerated air dryer with a capacity of 600 cfm or below.

Best Practices in User Interface



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ΔkW

Symbol Table

Electric Energy Savin

ΔkWh

Where:

ΔkW

ΔkWh

0.0087

4

APC

HOURS

$hp_{compressor}$

RTD

See "Compressed Air Ar

Baseline Efficier

The baseline equipment

High Efficiency

The high efficiency equip

Operating Hours

Single shift (8/5) – 1976 hours (7 AM – 3 PM, weekdays, minus some holidays and scheduled down time)

2-shift (16/5) – 3952 hours (7AM – 11 PM, weekdays, minus some holidays and scheduled down time)

3-shift (24/5) – 5928 hours (24 hours per day, weekdays, minus some holidays and scheduled down time)

4-shift (24/7) – 8320 hours (24 hours per day, 7 days a week minus some holidays and scheduled down time)

Load Shapes

44b Indust. 1-shift (8/5) (e.g., comp. air)
45a Indust. 2-shift (16/5) (e.g., comp. air)
46a Indust. 3-shift (24/5) (e.g., comp. air)
47a Indust. 4-shift (24/7) (e.g., comp. air)

Values

Name	Number	Status	Winter On kWh	Winter Off kWh	Summer On kWh	Summer Off kWh	Winter kW	Summer kW	Effective Date	Expiration Date
Indust. 1-shift (8/5) (e.g., comp. air)	44b	Active	66.60 %	0.00 %	33.40 %	0.00 %	0.00 %	59.38 %	1/1/2012	
Indust. 2-shift (16/5) (e.g., comp. air)	45a	Active	62.40 %	4.20 %	31.30 %	2.10 %	95.00 %	95.00 %	1/1/2012	
Indust. 3-shift (24/5) (e.g., comp. air)	46a	Active	44.40 %	22.20 %	22.30 %	11.10 %	95.00 %	95.00 %	1/1/2012	
Indust. 4-shift (24/7) (e.g., comp. air)	47a	Active	31.70 %	34.90 %	15.90 %	17.50 %	95.00 %	95.00 %	1/1/2012	

Net Savings Factors

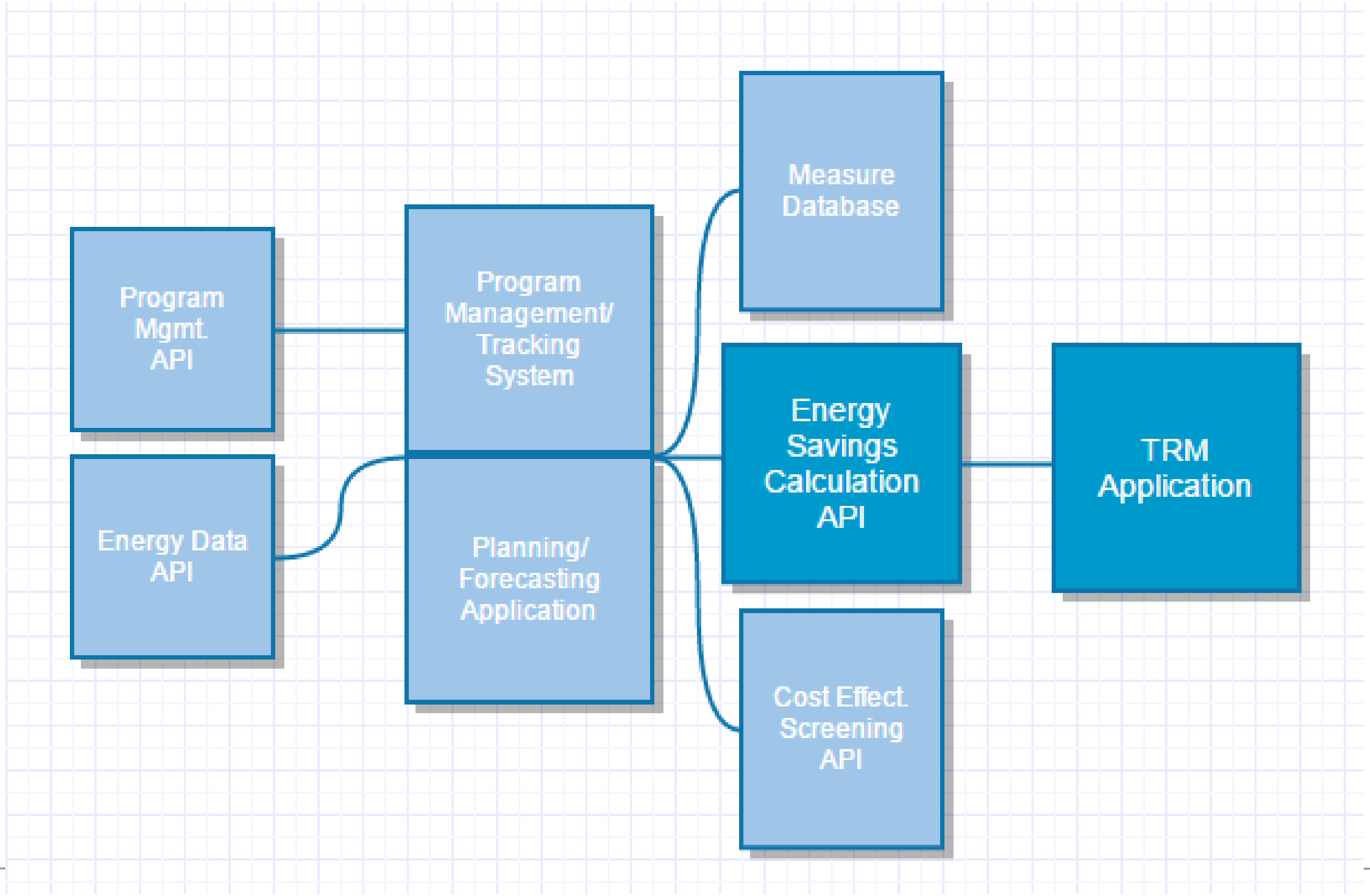
Measures	
CMPDRYER	Compressed air, Air Dryer

Tracks	
6013CUST	Cust Equip Rpl
6013PRES	Pres Equip Rpl
6014A250	Act250 NC
6014NANC	Non Act250 NC

Values

Best Practices in Data Management

Electronic platforms allow the TRM to become a more automated component of data management and reporting systems



The Evolution of TRMs: Moving Toward EM&V 2.0

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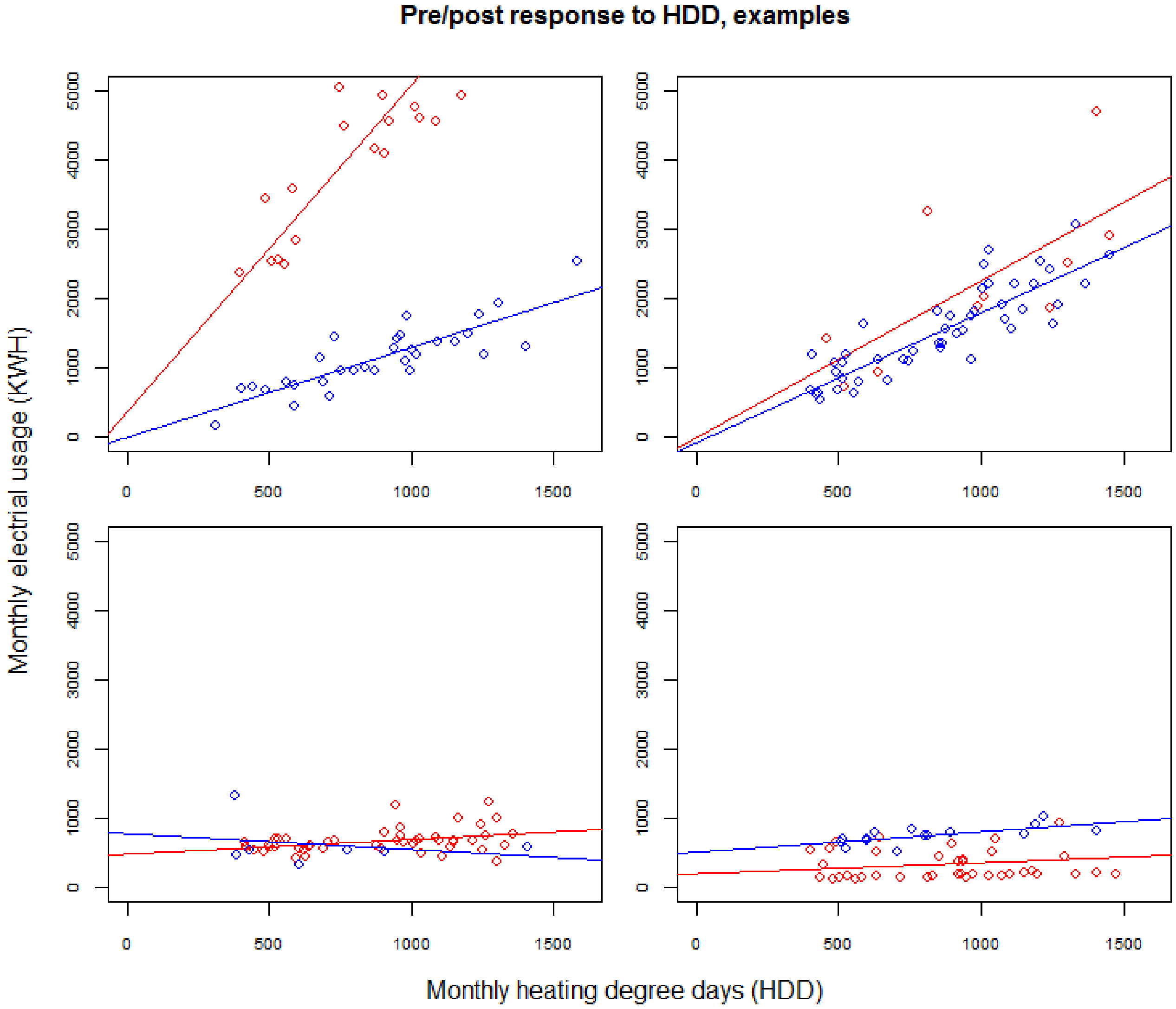
TRMs and EM&V 2.0

- Development of electronic, database platforms for TRMs:
  - Enables integration of submetering and AMI data
  - Supports the move toward 8,760 hrs / year load shapes rather than just on- and off- peak information
  - Simplifies the ability to adjust calculations informed by new data
  - Reduces data analysis time and therefore labor costs
  - Expedites the ability to modify program designs
  - Helps catalyze savings and improve program performance

Example: Electric Resistance Heat

- **Goal**
  - Serve 5-10% of homes in VT with electric resistance heat
    - Difficult to identify; previously dropped the program
- **Action**
  - Recently tried a new approach to target customers
    - Used data to correlate heating degree days and usage
    - Identified likely candidates with electric resistance heat
    - Ran a targeted promotion
- **Next steps**
  - Leverage this as an early stage example of what lies ahead with more, better AMI data
  - Replacing average values currently in TRM with metrics calculated from AMI data

Example: Electric Resistance Heat



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Example: Light Logger Analysis

- **Goal**
  - Determine lighting hours of use across applications using light logger submetering
- **Action**
  - Created tool to calculate key outputs
    - Annual hours and on-peak / off-peak hours
    - These fed directly into the TRM
- **Result**
  - Labor savings for EM&V, therefore reduced program cost
- **Next steps**
  - Internet connected light loggers will enable more frequent updates to the TRM

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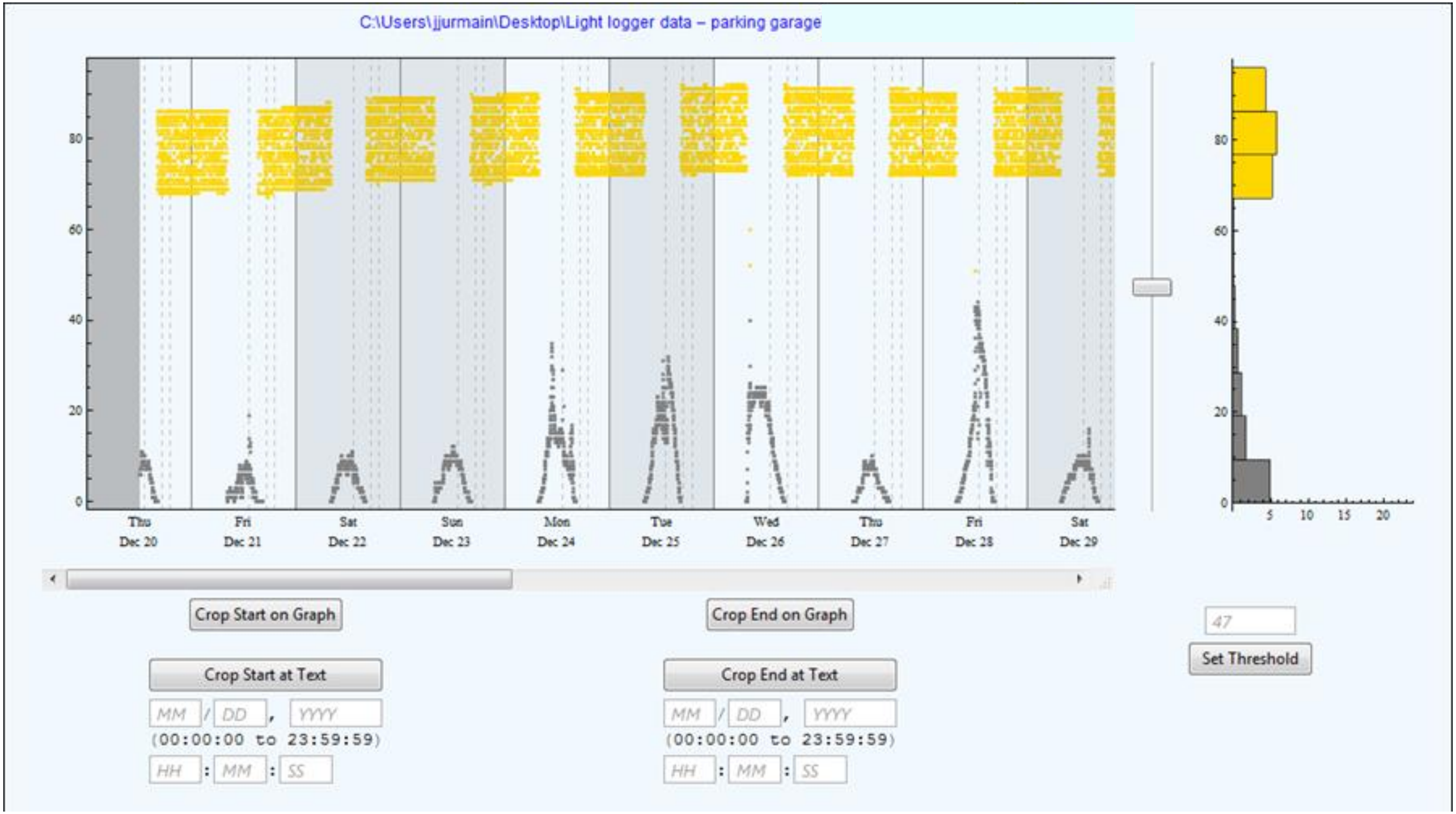
Example: Light Logger Analysis



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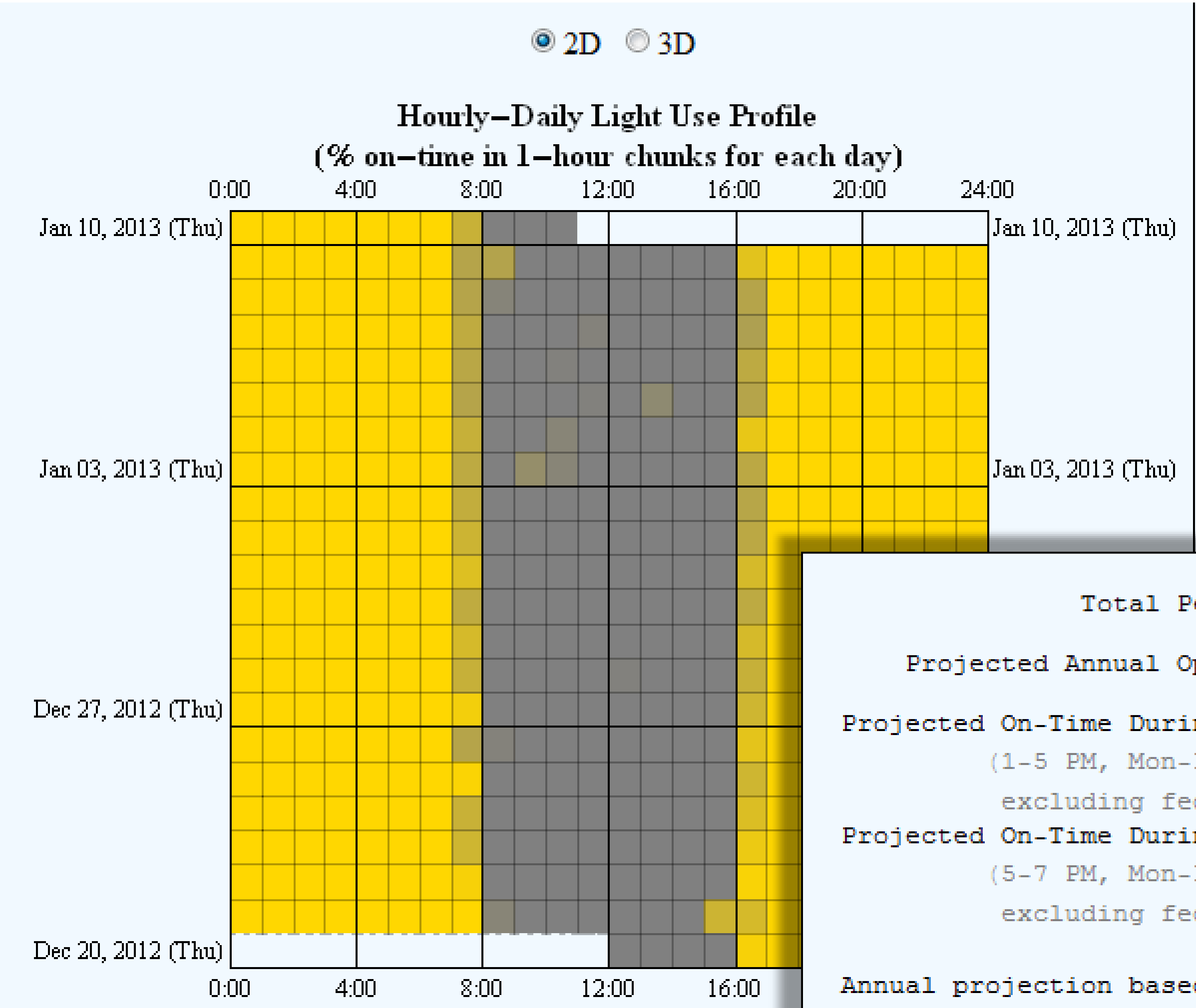
Example: Light Logger Analysis



Total Percent On-Time: 63.93 %

Projected Annual Operating Hours: 5600.00 Hrs

Projected On-Time During Summer Peak: 16.92 %
(1-5 PM, Mon-Fri, Jun - Aug, excluding federal holidays)

Projected On-Time During Winter Peak: 100.00 %
(5-7 PM, Mon-Fri, Dec & Jan, excluding federal holidays)

Annual projection based on 20.96 metered days
FCM projection based on 13 metered business days

TRMs and EM&V 2.0: Opportunities and Challenges

- Integrating more real world data into TRMs through sub-metering and/or AMI can:
  - Increase accuracy in savings calculations
  - Lead to program changes that result in increased savings
  - Enhance realization rates
  - Thereby, continue the move towards “EM&V 2.0”

- Utilities / program administrators will need:
  - A data collection infrastructure
  - Database and analytics skills
  - The ability and capacity to monitor and address opportunities shown through the data

TRMs and EM&V 2.0: Tips for Success

- Invest in TRMs and savings calculation databases and tools with consideration of the full data collection, management, and reporting system
- Avoid adding data integration and tools as patches on top of the current way of doing things
- Engage key stakeholders early and often
- Create and build partnerships among utilities, PAs, and other key stakeholders to ensure buy-in and acceptance

Contact Information

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