

# BC Hydro To Deliver M&V 2.0 to Customers and Program Administrators

Traditionally, savings measurement and verification (M&V) costs can range from 1% to 5% of total project costs. Currently, more than \$7 billion is spent on utility demand side management programs each year, representing tens to hundreds of millions of dollars in expenditures on savings estimation. “M&V 2.0” methods promise to reduce these costs significantly.

## M&V 2.0 Overview

### *M&V 2.0 Defined*

M&V 2.0 refers to the energy savings estimation that uses high-granularity or high-volume data, e.g. from smart meters and smart devices or from large numbers of buildings, in combination with automated computation and analytical tools. These meter- and software-based approaches are the subject of surging industry interest, particularly in the context of energy efficiency program delivery, implementation, and evaluation.

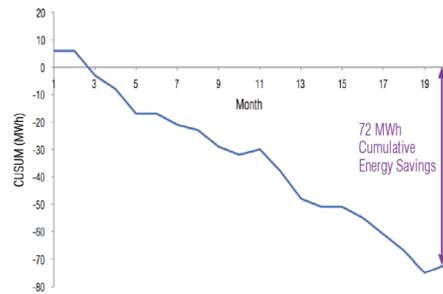
### *Potential Benefits of M&V 2.0 for Program Administrators and Customers*

M&V 2.0 methods offer a number of potential benefits for customers as well as program administrators.

#### **BC Hydro’s Vision for Use of M&V 2.0**

For program evaluation purposes, BC Hydro has employed large-scale comparison group analyses that provide a net program-level savings result. This approach permits determination of program-wide savings directly attributable to the program, however cannot be used to determine overall gross savings for any specific customer, or to provide customer level feedback on their success in achieving savings.

Recognizing the value of customer-specific savings insights, BC Hydro is incorporating cumulative gross savings analyses into their customer-facing analysis tools. With M&V 2.0 techniques, this can be provided to customers without the need to send an M&V agent to evaluate each site.



Today’s M&V 2.0 tools provide the ability to track savings as they accrue throughout the performance period, at both the customer or site level, as well as at the aggregated portfolio level. This visibility can enable early identification and correction of measures that may be underperforming. In addition, it can provide verification to the customer of specifically how much they are saving based on their own metered energy consumption. This is in contrast to more common approaches that offer a pre-calculated average savings estimate. By leveraging automated data acquisition and savings calculations, M&V 2.0 also holds promise to reduce the time and cost necessary to quantify savings with associated potential for increasing the scale of program delivery.

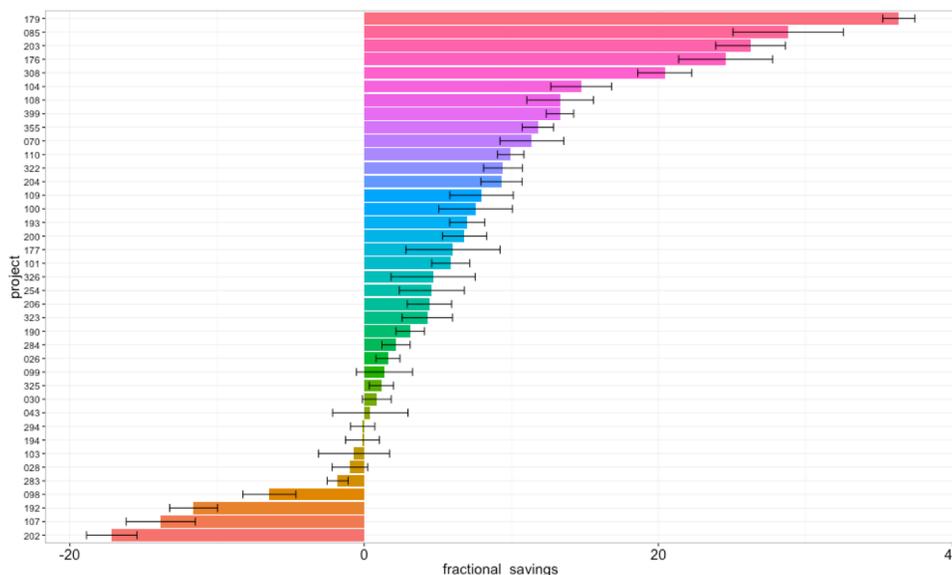
### **Working toward the Vision**

Recently, BC Hydro began testing and developing M&V 2.0 software functionality in partnership with contracted M&V experts and software developers. Targeting its commercial customers, BC Hydro is focusing on a representation of gross savings referred to as the ‘cumulative sum.’ The cumulative sum represents total accumulated savings with respect to a baseline period, as a timer series plot. Periods of increasing or decreasing consumption relative to the baseline are reflected in a positive or negative slope, while periods where consumption is equivalent to the baseline are reflected in a flat line. In addition to its contracted software development team, BC Hydro worked with researchers at the Lawrence Berkeley National Laboratory to run open-source M&V 2.0 algorithms against a set of historic program data, and to incorporate uncertainty quantification into gross savings calculations.

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## Exploratory Findings

Of the set of buildings and projects that were analyzed with M&V 2.0 methods, gross savings of up to 37% were quantified. Good model fit was observed for three quarters of the buildings, using a limited set of explanatory variables including time of day, day of week, and outside air temperature. The normalized mean bias error and CV(RMSE) for these buildings were found to meet ASHRAE Guideline 14 recommendations of less than 0.5% and less than 25%, respectively. In addition, for the majority of cases the savings were estimated with a level of uncertainty that met or surpassed the ASHRAE recommendations, i.e., fractional savings uncertainty less than 50% of the estimated savings at a 68% confidence level. Analyzed as an aggregated portfolio, gross savings were quantified as 3.96% within a 95% confidence interval of [3.66%, 4.26%].



Savings uncertainty ranges for each of 39 buildings, at 95% confidence

Since savings cannot be directly metered, uncertainty analysis is used to express the doubt surrounding the savings estimate. No estimate is 100% perfect, and some buildings can be more accurately analyzed than others. Therefore, BC Hydro's customer facing tool includes customer-understandable explanations of the statistical concepts of uncertainty and confidence so that M&V 2.0 results can be appropriately interpreted.

## Ongoing Development

Going forward, BC Hydro plans to further develop the cumulative savings M&V 2.0 software tool. Following beta testing, additional customer engagement and feedback features will be added. Release of the tool is currently slated for 2017.

## Project Summary

In working to develop a customer-facing M&V 2.0 tool, BC Hydro partnered with researchers at Lawrence Berkeley National Laboratory (LBNL) to analyze a set of historic program data, and to incorporate uncertainty quantification into gross savings calculations.

## Exploratory Findings

Savings were computed using an M&V 2.0 baseline model for a set of fifty-one commercial buildings that underwent retrocommissioning and in some cases retrofits. Three quarters of the buildings were well-suited to the M&V 2.0 approach, passing the modeling goodness of fit recommendations in ASHRAE Guideline 14. Savings for the majority of the buildings were estimated with uncertainty levels that met or surpassed the ASHRAE guideline.

## Ongoing Development

In their ongoing efforts, BC Hydro plans to:

- Complete development of the customer-facing M&V 2.0 tool.
- Provide the tool to customers as part of a toolkit that will also include benchmarking (using Portfolio Manager) and a tool to detect anomalous energy consumption.

## Use M&V 2.0 In Your Efforts

Visit <http://eis.lbl.gov/> for more information. Contact us if you are interested in obtaining M&V 2.0 code or piloting commercial M&V 2.0 tools in your efficiency programs: [jgranderson@lbl.gov](mailto:jgranderson@lbl.gov) or [sgfernandes@lbl.gov](mailto:sgfernandes@lbl.gov)