



FACILITIES DIVISION

ERNEST ORLANDO LAWRENCE BERKELEY NATIONAL LABORATORY

FY 2009

Advanced Water Metering Plan

April - 2009

The following certify that this document is executed in good faith per the requirements of the DOE/UC contract.


Prepared by: Michael Dong, Utility Section Manager


Date


Approved by: Ken Fletcher, Operations Manager,
Facilities Division


Date

LBNL Advanced Water Metering Plan FY 2009

1. Purpose and Scope

The Energy Independence and Security Act of 2007 (EISA), Section 434 requires advanced metering equivalent to that required for electric power, under the Energy Policy Act 2005 (EPAAct 2005), be provided for natural gas, water and steam. Metering, where life-cycle cost-effective, shall be completed by the end of FY 2015. This requirement is implemented in Department of Energy (DOE) Order 430.2B, Attachment 1 – Contractor Requirements Document (CRD). The DOE Order, CRD paragraph 6.d requires installation, to the maximum extent practicable, of devices that measure consumption of potable water, electricity, steam, and natural gas in each building and other facilities and grounds. DOE has provided guidance for the development of metering plans to meet these requirements. This document is, “*Metering Best Practices – A guide to Achieving Utility Resource Efficiency*”, dated October, by DOE – Energy Efficiency and Renewable Energy (DOE – EERE).

2. Responsibility

Lawrence Berkeley National Laboratory (LBNL) Facilities Division – Operations is responsible for planning and executing the Advanced Water Metering Plan. Specific responsibilities and individual assignments are provided in Section 8 of this plan.

3.0 Existing Water Metering Infrastructure & Retrofit Plans

LBNL receives domestic water supplies from the East Bay Municipal Utilities District (EBMUD) via the University of California at Berkeley (UCB) campus. LBNL is rebilled by UCB for consumption based on meter readings and analysis by UCB. Invoices most often lag by three-months or more.

A detailed survey of LBNL building water metering was conducted at the beginning of 2009. Only **building 67, and 84 the recently** completed, LEED-Gold Certified, Molecular Foundry is fitted with whole building water metering. Water meters are installed for most cooling tower systems where over 80% of LBNL water consumption occurs.

During FY 2008 LBNL consumed 84 million gallons of water at a cost of \$469,000. If only 20% of LBNL’s water use is non process (non cooling tower) related, a savings of 2.5% per the above referenced guidance, would generate only \$2,350 of potential cost savings. This is not enough to install even a single water meter. Thus, this metering plan is focused on improving metering at LBNL cooling tower systems.

A tabulation of current water meters and scopes of work for conversions to “advanced water meters” is provided in Attachment 1. All existing meters are manual read types. They can be converted to “advanced” status by arranging to transmit the consumption signal to the FMCS. Conversion to “Advanced Meter” status assumes replacing or retrofitting of existing meters with electronic reader heads and connection of the reader head signal to

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LBNL's Facility Management Control System (FMCS), a dedicated fiber optic communications system.

Planned advanced water metering activities for FY 2009 through FY 2015 are also indicated on the tabulation in Attachment 1. It is noted that most LBNL cooling tower systems are already fitted with water meters.

3.1 Existing LBNL Water Meters & Screening for Advanced Metering

All LBNL buildings and cooling tower installations were screened for practicable, life-cycle cost-effective, advanced water meter installations, per the above referenced guidance. Metering locations were screened based on existing measured water consumption. Additional metering locations were selected where existing cooling towers are known to serve large process cooling loads with poor water consumption records. The resulting planned advanced water metering installations include:

Cost-Effective Meter Locations (>15,500 Gallons / Year)	16
<u>Locations for Advanced Meters Identified for Other Reasons</u>	<u>12</u>
Total Advanced Water Meters in Metering Plan	28

3.2 Advanced Water Metering Status and Planned Installations

Advanced Water meters are planned to be installed, supported from internal funding. Advanced water meters are scheduled for installation as follows:

Planned for Installations in FY 2010	6
Planned for Installations in FY 2011	11
Planned for Installations in FY 2012	3
Planned for Installations in FY 2013	4
Planned for Installations in FY 2014	4
<u>Planned for Installations in FY 2015</u>	<u>0</u>
Total Advanced Water Meters	28

4.0 Use of Metered Data

There are three (3) major uses for the metered data.

4.1 Data Collection and Analysis

The collected data are analyzed to help identify potential water efficiency improvements and to assure proper cooling tower operations.

4.2 Measurement and Verification of ESPC and In-House Project Savings

It was expected that a sitewide energy savings performance contract (ESPC) would be executed in CY 2008. The project was delayed, and ultimately cancelled in early 2009 due to poor economics. Advanced water meters planned as part of the ESPC project would have facilitated development of baseline water usage data and

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measurement and verification of the water savings to a higher degree of confidence. Data from existing and planned advanced water meters, supported from other funding sources, will help LBNL to develop better in-house water conservation measures, assure more reliable cooling tower operations and to verify their post-installation effectiveness.

4.5 Planning and Reporting

Existing standard water meters are read on a monthly basis. A utility worker reads the water meters. The utilities worker is not always available to complete reading all the water meters during the same day or even during the same week due to other competing priorities such as end of the year rush. This results in inconsistent data because the data time span is not the same. Time spans range from 3 to 6 weeks instead of a consistent 1-month span. Advanced metering will provide consistent data and will help to increase the overall productivity of the Laboratory.

5.0 Building and Cooling Tower System Meter Screening

All LBNL buildings are defined as laboratory / industrial buildings, thus, qualify for installation of advanced water meters “to the maximum extent practicable” as DOE O 430.2B Attachment 1, paragraph 6d requires. LBNL interprets this requirement to mean that advanced water meters shall be life-cycle cost-effective. Evaluation of water meters followed guidance provided in “*Metering Best Practices – A guide to Achieving Utility Resource Efficiency*”, dated October, by DOE – EERE.

Whole building water meter installations are not cost effective at LBNL when cooling tower and process water needs are excluded. Cooling tower and process water systems (LCW, IHW, and Boiler Makeup) were evaluated using this same guidance; 28 “practicable” locations were found.

Potential water cost savings resulting from water management and awareness program actions facilitated by easily available water consumption data from advanced metering systems are compared to installation costs. The reference cited above provides guidance concerning anticipated energy savings, stating:

DOE/EE-0312 stipulates a minimum cost savings realized of 2 percent. Because it is anticipated that sites will use the data for several purposes including cost allocation, time-of-use metering, and/or energy use diagnostics, energy savings exceeding 2.5 percent should be realized.

Building water savings of 2.5% is assumed for analysis purposes. Since only about 20% of LBNL water total water use in FY 2008 is estimated to be non-process, advanced metering could only generate about \$2,300 per year of savings site-wide. This level of savings is not enough to justify even a single advanced water meter on a whole building basis.

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Rather, cooling tower systems are screened for life-cycle cost-effective advanced water meter installations by determining potential water cost savings based on FY 2008 consumption data. It was determined that minimum annual water consumption of 15,500 gallons (\$38,000 annual water cost) would justify an advanced meter. Detailed calculations are included as Attachment 2.

6.0 Site Metering Financing Plan

- 6.1 ESPC Financing: It was previously decided by Laboratory management, with DOE - BSO acknowledgement, to defer major advanced water meter installations to the ESPC contract. As is stated above, the ESPC was cancelled in February-2009 due to economic concerns. Should another ESPC project be developed at LBNL in the future, advanced metering will be considered. However, this plan does not rely on ESPC funding for implementation.
- 6.2 Institutional Funding: With cancellation of the ESPC project, revised planning has been developed, primarily employing institutional funding.

7.0 Installation Schedule

The installation schedule for advanced water meters is provided in Attachment 1. A summary of the installation schedule is provided below. All advanced water meters will be installed and commissioned as scheduled, by 30-September-2015, subject to actual availability of funding from the sources as indicated:

7.1 FY 2010 Activities and Installations:

Secure internal, LBNL funding for advanced water meter installations;
install advanced water meters at:

- B50B W50B CT#3 Makeup
- B50B W50B CT#4
- B50B W50B Sand Filter
- B67A W67A LCW MakeupB90
- B88 W88 CT#2 Makeup
- B88 W88 LCW

7.2 FY 2011 Installations:

- B34 W34 CT#1 Makeup
- B34 W34 CT#2 Makeup
- B37 W37 CT Makeup
- B37 W37 LCW Makeup
- B37 W37 TRW

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B50 W50 Boiler Makeup
B62 W62 CT Makeup
B62 W62 Mech IHW
B62 W62 Mech LCW Makeup
B66 W66 Mech LCW Makeup
B74 W74 Boiler Makeup

7.3 FY 2012 Installations:

B70A W70A CT Makeup
B70A W70A LCW Makeup
B71 New B71 CT - Makeup

7.4 FY 2013 Installations:

B67 W67 CT Makeup
B74 W74 CT Makeup
B84 W84 HPCW
B84B W84B CT#1&2 Makeup

7.5 FY 2014 Installations:

B50A W50A CT#5 Makeup
B50A W50A CT#6 Makeup
B50A W74 CT Makeup
B86 W86 Building

8.0 Program Support Requirements

- 8.1 Michael Dong, Utility Manager: Mr. Dong is responsible for the Advanced Electrical Metering Plan and the analysis of the metering system and its data.
- 8.2 Jim Murphy, Plant Operations Service Supervisor: Mr. Murphy is responsible for the installation and commissioning of the advanced meters.
- 8.3 Blair Horst, Sustainability Coordinator / Energy Manager: Mr. Horst is responsible for reporting advanced electric metering plans as assuring these plans are aligned with DOE requirements.

9.0 Site Staff Accountability

- 9.1 Michael Dong, Utility Manager

Any questions about this Advanced Metering Plan should be directed to Michael Dong, 510-486-6458.

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9.2 Jim Krupnick, LBNL Energy Champion

10.0 Annual Metering Program Progress

Progress toward meter installation goals will be reviewed annually as LBNL reports progress toward meeting the various performance measures.

Advanced Water Metering Activities Plan - FY 2009

Attachment 1

Building Number	Existing Water Meter Description	Water Meter Location	3-Months Metered Gal/Yr	16-Months Metered Gal/Yr	Metering is Cost Effective	Planned Install Year
25	W25 CITY	B25	N/A	N/A	No	
25	W25 HPCW	B25 southend	N/A	N/A	No	
25	W25 LCW	B25 R174 LCW Cabinet	N/A	N/A	No	
34	W34 CT#1 Makeup	B34 roof	N/A	N/A	Yes	FY 2011
34	W34 CT#2 Makeup	B34 roof	1,214,596	1,802,202	Yes	FY 2011
34	W34 Sand Filter	B34 R100 1st floor	N/A	N/A	No	
37	W37 CT Blowdown	B37 roof	255,615	441,135	No	
37	W37 CT Makeup	B37 roof	4,768	5,145	Yes Check Multiplier	FY 2011
37	W37 LCW (Emerg.)	B37 R103 1st floor	3,883	138,920	No	
37	W37 LCW Makeup	B37 R103 1st floor	93,859	351,888	Yes	FY 2011
37	W37 Sand Filter	B37 2nd floor	423 -Min	143,864	No Check Multiplier	
37	W37 TRW	B37 R203 2nd floor	30,559	47,318	Yes	FY 2011
50	W50 Boiler Makeup	B50 R4009	17,664	10,104	Yes	FY 2011
50	W50 CT Blowdown	B50 roof penthouse	0	0	No	
50	W50 CT Makeup	B50 roof penthouse	349	155	No	
50A	W50A CT Blowdown	B50A R141	30,598	178,408	No	
50A	W50A CT#5 Makeup	B50A roof	33,984	47,189	Yes	FY 2014
50A	W50A CT#6 Makeup	B50A roof	38,748	38,647	Yes	FY 2014
50B	W50B CT#3 Makeup	B50B roof	194	66	Yes Check Multiplier	FY 2010
50B	W50B CT#4 Makeup	B50B roof	N/A	N/A	Yes	FY 2010
50B	W50B Mech Blowdown	B50B R0243	N/A	133,926	No	
50B	W50B Sand Filter	B50B roof	6,127 -Min	6,837 -Min	Yes	FY 2010
62	W62 CT Blowdown	B62 CT Pad	20,265	48,811	No	
62	W62 CT Makeup	B62 CT Pad	365,722	606,960	Yes	FY 2011
62	W62 Mech DHW	B62 R033	0	0	No	
62	W62 Mech IHW	B62 R033	12,167	16,337	Yes	FY 2011

Advanced Water Metering Activities Plan - FY 2009

Attachment 1

Building Number	Existing Water Meter Description	Water Meter Location	3-Months Metered Gal/Yr	16-Months Metered Gal/Yr	Metering is Cost Effective	Planned Install Year
62	W62 Mech LCW Makeup	B62 R033	97	107,752	Yes	FY 2011
62	W62 Sand Filter	B62 CT Pad	0	15	No	
66	W66 Mech LCW Makeup	B66 R111	1,977	266,204	Yes	FY 2011
66	W66 Mech TRW Makeup	B66 R110	190	37	No	
67	W67 CT Makeup	B67 CT Pad	1,062,302	1,394,506	Yes	FY 2013
67	W67 CW Building Service	B67 Pit near road	N/A	N/A	No	
67A	W67A CT Blowdown	B67A R101	N/A	N/A	No	
67A	W67A LCW Makeup	B67A R101	1,614,935	N/A	Yes	FY 2010
70A	W70A CT Blowdown	B70A R3329	45,397	63,080	No	
70A	W70A CT Makeup	B70A CT Pad	523,547	675,471	Yes	FY 2012
70A	W70A LCW Makeup	B70A Loading Dock	1,890,434	365,890	Yes	FY 2012
70A	W70A Sand Filter	B70A CT Pad	0 -Min	0 -Min	No	
71	New B71 CT - Makeup	B71 CT	N/A	N/A	Yes	FY 2012
71	New B71 CT - Blowdown	B71 CT	N/A	N/A	No	
74	W74 Boiler Makeup	B74 R177	11,866	32,695	Yes	FY 2011
74	W74 CT Blowdown	B74 R117	N/A	N/A	No	
74	W74 CT Makeup	B74 roof	146,297	812,179	Yes	FY 2014
74	W74 LCW Supply	B84 receiving area	1,179	12,260	No	
74	W74 Sand Filter	B74 roof	17	29	No	
77	W77 CT#3 Blowdown	B77 R239	N/A	N/A	No	
77	W77 CT#3 Makeup	B77 R239	N/A	N/A	Yes	FY 2013
77A	W77A TRW Effluent	B77A TCP	32,496	31,893	No	
83	W83 DI Supply	B83 R150	2,764	536	No	

Building Number	Existing Water Meter Description	Water Meter Location	3-Months Metered Gal/Yr	16-Months Metered Gal/Yr	Metering is Cost Effective	Planned Install Year
84	W84 ICW Makeup to HHW Sys	B84 2nd fl. Mech. Rm.	N/A	1,872	No	
84	W84 HPCW	B84 westside	3,842,918	N/A	Yes	FY 2013
84B	W84B B84/74 DI Makeup	B84B R092	1,158,305	1,737	No	
84B	W84B CT#1&2 Blowdown	B84B R092	N/A	N/A	No	
84B	W84B CT#1&2 Makeup	B84B R200	0	13,540	Yes	FY 2013
84B	W84B CT#1&2 Overflow	B84B R200	1,369	3,812	No	
86	W86	B86 UG Box-Mech Pad	1,074,849	N/A	Yes	FY 2014
88	W88 CT#2 Blowdown	B88 R181	52,089	158,900	No	
88	W88 CT#2 Makeup	B88 CT Pad	1,095,375	18,446	Yes	FY 2010
88	W88 LCW	B88 R181	63,761	36,191	Yes	FY 2010
88	W88 Sand Filter	B88 CT Pad	0	32	No	
Totals					28	

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	Sustainability Coordination ENGINEERING NOTE	NAME BI Horst
		DATE 29-Apr-09
SUBJECT	Advanced Water Metering Cost Effectiveness	SHEET 1 of 2

Cooling Tower Systems to receive advanced water metering per EISA / DOE O 430.2B requirements and DOE-FEMP guidance are selected using an approach based on records of cooling tower system water consumption.

Advance Meter Installations based on Existing Annual Water Use Records

Minimum Annual Water Cost to Justify installation = \$38,640 (see calculations, below)

Water Savings due to Advanced Metering

Water savings captured from an advanced water meter installations: 2.5%

DOE/EE-0312 stipulates a minimum cost savings realized of 2 percent. Because it is anticipated that sites will use the data for several purposes including cost allocation, time-of-use metering, and/or energy [and water] use diagnostics, energy [and water] savings exceeding 2.5 percent should be realized. Reference: DOE Buildings Electric Metering Guidance 9/27/2006, FEMP Document # 2006.100 Rev 0

LBNL Water Cost

FY 2008 Consumption: 84 million gallons Cost: \$469,021 = \$5.584 / K-Gal

Economic Viability

Advanced Water Meter installations must pay back installation costs within ten (10) years.

Advance Meter Operations & Maintenance Costs

Advanced meter and system operation and maintenance costs \$25 per month.

MINIMUM ANNUAL BUILDING NATURAL GAS CONSUMPTION

A threshold annual natural gas cost is determined for a building below which advanced metering cannot capture enough natural gas cost savings to recover the investment. It is assumed that installation costs must be recovered, paid back, within 10-years. Additionally, a \$25 per month O&M cost is expensed.

Minimum Annual Building Natural Gas Cost =

{ (Meter Installation Cost \$5,500 ÷ 10 years) + (\$25 per month O&M x 12) } ÷ 2.5%

AG Advanced Meter Install Cost: \$6,660 Threshold \$38,640 Water = 6,900 K-Gal / Year

UG Advanced Meter Install Cost: \$18,660 Threshold \$86,640 Water = 15,500 K-Gal / Year

Meter Installations Cost

AG Accessible CT Location Description	Labor	Material	Total
New Water Meter (exposed, exterior)	\$1,600	\$500	\$2,100 2 Plumbers 1-day
Conduit, Cabling and IT Connect	\$3,200	\$250	\$3,450 2 Electricians 2-days
Subtotal			\$5,550
Internal Loads 20%			\$1,110
Advanced Water Meter Installation Cost			\$6,660
Underground Location Description	Labor	Material	Total
New Water Meter (exposed, exterior)	\$1,600	\$500	\$2,100 2 Plumbers 1-day
UG Meter in Christy Box, with line locating, etc.			\$10,000 Allowance based on practice
Conduit, Cabling and IT Connect	\$3,200	\$250	\$3,450 2 Electricians 2-days
Subtotal			\$15,550
Internal Loads 20%			\$3,110
Advanced Water Meter Installation Cost			\$18,660



**Sustainability Coordination
ENGINEERING NOTE**

NAME BI Horst

DATE 29-Apr-09

SUBJECT **Advanced Water Metering Cost Effectiveness**

SHEET **2 of 2**

Check on Domestic Water Uses

FY 2008 Water Consumption				84,000,000 Gallons	
LBNL Population				4,000 PN	
WC Uses	Male	2 /day x	2.5 gpf =	10,000 gpd	
	Female	5 /day x	2.5 gpf =	25,000 gpd	
Urinal Uses	Male	3 /day x	2.0 gpf =	12,000 gpd	
Hand Washing	Male	5 /day x	1.0 gpf =	10,000 gpd	
	Female	5 /day x	1.0 gpf =	10,000 gpd	
				<hr/>	
				67,000 gpd	
Work Days		250 D/Yr		16,750,000 gpy	
				19.94%	
Total Potential Water Savings from Advanced Building Metering				418,750 gpy	
Potential Cost Savings				\$2,300 / Year	