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Executive Summary



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Energy Systems Group working in conjunction with the State of Michigan, Department of Technology, Management and Budget (DTMB) and the Michigan Department of Corrections (MDOC), presents a comprehensive phase 100 study technical energy assessment audit. This audit report is to provide the basis for a future energy efficiency contract project at the MDOC Facilities located in Ionia Michigan, collectively referred to as the Ionia Complex. This report covers four (4) MDOC Facilities, and one (1) Central Power Plant within the Ionia Complex, and includes: Richard A. Handlon Correctional Facility (MTU), Ionia Correctional Facility (ICF), Bellamy Creek Correctional Facility (IBC), Michigan Reformatory (RMI) and Southern Region (Ionia Hub) Central Power Plant.

Richard Handlon Facility (MTU) houses general population prisoners, along with other prisoners who have been placed in the Social Skills Developmental Unit (SSDU) and the Residential Treatment Program (RTP). The SSDU serves prisoners who are lacking skills necessary to live normal productive lives: some are considered developmentally disabled, many with long histories of institutionalization. The RTP is an integral component of the mental health continuum of care, which includes outpatient mental health teams, crisis stabilization programs, and inpatient hospital units. MTU was opened in 1958, houses 1,295 inmates, with 318,861 square foot of facilities.

The Ionia Correctional Facility (ICF) is comprised of five Level V housing units and two Level II housing units. Two of the Level V housing units are designated Administrative Segregation, which includes Detention, Temporary Segregation and Secure Status Out-Patient Treatment cells, the remaining three are general population units. The Level V housing consist of five bi-level, double winged single cell units, consisting of day room area, showers, laundry room, staff offices and a fence-in activity and recreational yard for the security Level V prisoners. The Units designated Administrative Segregation affords prisoners outdoor recreation in single occupancy security exercise modules. The Level II housing consists of a large pole-barn construction divided into two units with 140 beds in each unit. The units

have shower, laundry, and recreation areas. The Level II prisoners have separate yard areas, with access to a weight pit, basketball courts, volleyball, baseball, horseshoes, and a running track. Jobs are available for all Level II prisoners, which includes a Michigan State Industries factory which employs Level II prisoners. The Prisoner Services building contains classrooms, an auditorium, a gymnasium, a weight room, commissary (prison store) and a barbershop. A separate building contains food service, prisoner and staff dining, health care, prisoner property, and maintenance. The Administrative building contains the institutions Control Center, Record Office, Business Office, visiting areas, staff training, and a disciplinary and parole board hearing room. ICF was opened in 1987, houses 706 inmates, with 295,000 square foot of facilities.

Bellamy Creek Correctional Facility (IBC) is the most recent facility built by the Michigan Department of Corrections. It is a multi-level facility housing Level I, Level II, Level IV and general population prisoners. It also houses protective housing and administrative segregation prisoners. Prisoners serve institutional needs in areas such as food service, the library, recreational aides and maintenance workers. IBC was opened in 2001, houses 1,888 inmates, with 463,459 square foot of facilities.

The Michigan Reformatory (RMI) is a multi-level Correctional Facility; it houses prisoners classified to Level II and Level IV. The prison is on 40 acres of land 15.8 acres inside the walls. RMI was opened in 1880, houses 1,316 inmates, with 449,141 square foot of facilities.

The Central Plant has three boilers that are over 40 years old. The boilers provide steam to the RMI, the IBC Dormitory, ICF and MTU. The steam in each facility is used for heating, domestic hot water, kitchen equipment (kettles, combi oven, steamers) and clothes dryers.

ESG has investigated, identified and proposed energy conservation measures (ECMs) facility improvements to reduce energy costs at all four facilities and Central Power Plant. This assessment documents recommendations for ECMs based on an accumulative 15 year savings period without increasing current utility costs to the facilities.

ESG calculated energy baselines and from those energy baselines; calculated the associated energy savings and utilized only ECMs that could collectively pay for themselves via savings in a 15 year period. All costs and savings in this report are estimated to be plus or minus 10%. In calculating costs for each ECM, ESG utilized our direct experience with the purchase and installment of many types of the equipment recommended in each ECM. ESG also utilized engineering firms, outside contractors, manufacturers and vendors to provide us with pricing and needs.

Savings were calculated utilizing the agreed upon baselines for energy and water consumption and calculated based on DOE2 program, standard engineering methods, and our direct experience and to meet the standards of measurement and verification. Utility savings, Utility rebates, and future utility increases were utilized. ESG took care to ensure recommended ECMs would comply with the high safety and security standards of MDOC Facilities.

The phase 100 study conducted by ESG has identified five primary ECMs: 1) ECM #1: Heating System Upgrade/Mechanical Re-commissioning, this ECM will address decentralizing RMI, MTU, ICF and the IBC dormitory from an existing central steam plant. ECM #2: Lighting Upgrade, addresses lighting retrofits and upgrades in all facilities. ECM #3: Building Envelope, is smaller in scope but is all facilities. ECM #4: Water/Sewer Conservation is suggested for all facilities and was designed to provide the department fo corrections with identical water conservation equipment throughout the Ionia complex. ECM #5: Energy Management Sys. Upgrade/Expansion/Variable Speed Drives at IBC the existing system will upgraded to optimize the sytem. At MRI and the IBC dorm a new system will be added to enhance the decentralization. MTU and ICF new systems will be installed for conversion to digital and temperature controls. All systems will be open protocol and nonproprietary. Total estimated cost for theses ECM's is \$35,049,163 and total estimated savings over 15 years is \$38,689,408. The ECM's are detailed in the report. Below are summaries for the ECMs.

Energy and Water Savings Measures

ECM #	ECM	Total cost	Energy Cost Avoidance	Maintenance Savings ^{*1}	Energy Avoidance				Simple Payback
					Electric KWH	Natural Gas MCF	Water KGAL	Sewer KGAL	
1	HEATING SYSTEM UPGRADE/MECHANICAL RE-COMMISSIONING	\$21,031,349	\$666,331	\$170,000		42,053	26,565	61,373	31.8
2	LIGHTING UPGRADE	\$3,389,155	\$254,661		2,808,673				13.3
3	BUILDING ENVELOPE	\$119,919	\$9,996			1,636			12.0
4	WATER/SEWER CONSERVATION	\$7,789,147	\$680,676			3,975	81,438	81,438	11.4
5	UPGRADE/EXPANSION/VARIABLE SPEED DRIVES	\$2,719,594	\$111,152		754,234	7,015			24.5
		\$35,049,163	\$1,722,816	\$170,000	3,562,907	54,679	108,003	142,811	20.3

*1 Maintenance savings is the reduction in chemical usage and costs at the central steam plant.

Base Year Utility Summary

Utility	Savings	Utility Cost Savings (\$/ yr)	Base Year Utility Cost ^{*1}	% Utility Savings
Electricity	3,562,907 KWH	\$322,954	\$1,782,171	18%
Natural Gas	54,679 MCF	\$334,088	\$1,925,145	17%
Water	108,003 KGAL	\$264,606	\$647,479	41%
Sewer	142,811 KGAL	\$801,168	\$2,171,199	37%
Total		\$1,722,816	\$6,525,994	26%

*1 Utility costs based on base year unit cost as used for the ECM's

Measurement and Verification

Suggested Measurement and Verification for the ECM's would utilize the International Performance Measurement and Verification Protocol (IPMVP) Concepts and Options for Determining Energy and Water Savings Prepared by Efficiency Valuation Organization www.evo-world.org September 2010 EVO 10000 – 1:2010. We recommend utilizing IPMVP Option A, Retrofit Isolation for ECM #2 Lighting upgrade. Option A is defined by IPMVP as; *“Section 3.4.1 Option A -Option A involves isolation of the energy use of the equipment affected by an ECM from the energy use of the rest of the facility. Measurement equipment is used to isolate all relevant energy flows in the pre-retrofit and post-retrofit periods. Only partial measurement is used under Option A, with some parameter(s) being stipulated rather than measured. However such stipulation can only be made where it can be shown that the combined impact of the plausible errors from all such stipulations will not significantly affect overall reported savings.”* IPMVP Option C is recommended for ECM #1, ECM #3, ECM #4 and ECM #5. Option C is defined by IPMVP as: *“Option C involves use of utility meters or whole building sub-meters to assess the energy performance of a total building. Option C assesses the impact of any type of ECM, but not individually if more than one is applied to an energy meter. This Option determines the collective savings of all ECMs applied to the part of the facility monitored by the energy meter. Also, since whole building meters are used, savings reported under Option C include the impact of any other changes made in facility energy use (positive or negative). Option C may be used in cases where there is a high degree of interaction between installed ECMs or between ECMs and the rest of the building, or the isolation and measurement of individual ECM(s) is difficult or too costly”.*

For Option C we recommend the monitoring Gas Meter Numbers; 8267304, 29002733, 5520490, 56035230, 6707159, 810731. Monitoring Electric Meters Numbers; 5678048, 8112/6166269, 83183182, 58763055, 83710310. Monitoring Water Meter's with Accounts numbers of; 3638070000, 3638020000, 3638030000, 3638040000, 3642000000, 3642000000, 3640000000, 3643000000, 3643010000, 3638050000, 3638060000, 3642120000, 3642110000. For Option C we do not need to monitor; Gas meters 6238600, 23183060, 40187285, or monitor Electric meter numbers; 82518997, 63492344,, 88830809 and Water Account numbers 3638080000,3638090000, 3638000000. An additional gas meter to be added at each the Dormitory, ICF, and MTU as part of ECM #1, Utilizing these two options estimated annual Measurement and Verification cost should range from \$110,000 to 120,000.

This report has been separated by Facility and each Facility report contains the write ups for each individual ECM including detailed baselines for each Facility, detailed breakdown for each ECM for each Facility, individual ECM utility savings, utility cost savings, and implementation cost including design and engineering, project management, contingency, performance, overhead and profit (All cost and savings are +/- 10%). Based on Federal Energy Management Program Energy Escalation Rate Calculator (EERC) 3.86% escalation was used for 15 year savings calculations. “The Energy Escalation Rate Calculator computes an average annual escalation rate for fuel prices from the annual energy price forecasts of the DOE Energy Information Administration. This rate can be used to escalate contract payments in Energy Savings Performance Contracts and Utility Energy Services Contracts when the payments are based on projected annual energy cost savings.”

Ionia Campus Project Cost and Savings Summary: 15 year

Construction Cost Estimate

Client	MDOC and DTMB	Estimate/Rev. Date:	2-13-13
Project	Ionia Correctional Facilities (ICF, IBC, MTU, RMI)	Contract #:	Y12299
Location	Ionia, MI		

	PROJECT		TOTAL
(1)	HEATING SYSTEM UPGRADE/MECHANICAL RE-COMMISSIONING		\$14,534,610
(2)	LIGHTING UPGRADE		\$2,342,220
(3)	BUILDING ENVELOPE		\$82,875
(4)	WATER/SEWER CONSERVATION		\$5,383,022
(5)	ENERGY MANAGEMENT SYS. UPGRADE/EXPANSION/VARIABLE SPEED DRIVES		\$1,879,492
(6)			
(7)			
(8)			
(9)			
(10)	Total Direct Cost		\$24,222,219
(11)	Project Management	5.0%	\$1,211,111
(12)	Performance Bond	1.0%	\$242,222
(13)	Contingency	10.0%	\$2,422,222
(14)			\$0
(15)	Sub total		\$28,097,774
(16)	Overhead	10.0%	\$2,809,777
(17)			\$30,907,551
(18)	Profit	5.0%	\$1,545,378
(19)	Project Total With Overhead and Profit		\$32,452,929
(20)	Engineering	8.0%	\$2,596,234
(21)	Project Total With Overhead and Profit and Engineering		\$35,049,163
	Total Energy Savings Over 15 years including annual 3.86% cost increases		\$35,428,444
(22)	Total Operational Savings Over 15 years including annual 3.86% cost increases		\$3,260,964
	Total Energy and Operational Savings Over 15 years		\$38,689,408
	Over the 15 year term the Savings exceed the Total Project Cost		\$3,640,244
	Annual M&V cost		\$110,000-\$120,000

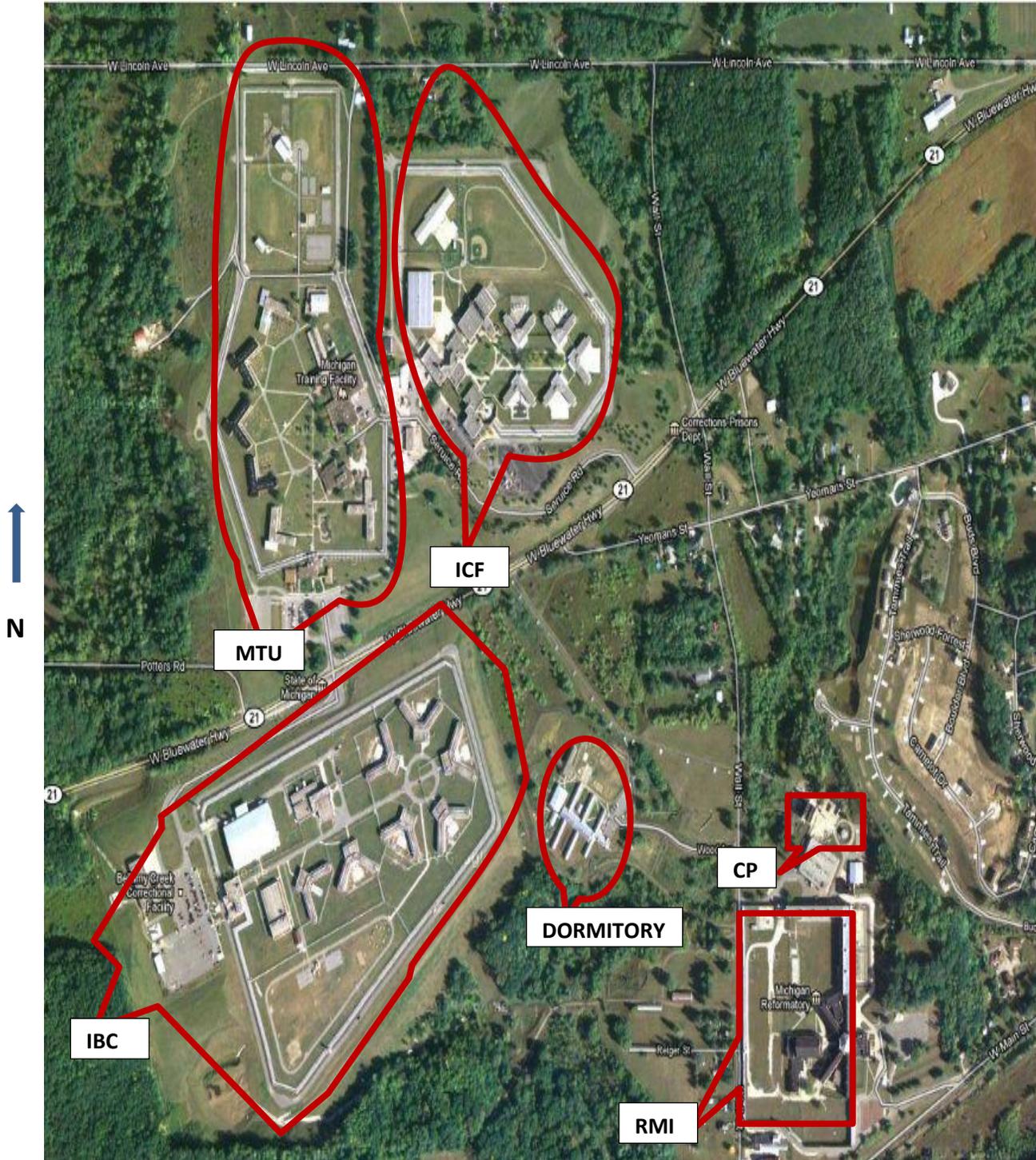
		Qty.	Unit	Unit Cost	Total
	HEATING SYSTEM UPGRADE/MECHANICAL RE-COMMISSIONING				
(1)	Convert MTU and ICF to hi efficiency hot water heating, install new steam boilers at Dorm, RMI.	1	LS	\$ 14,534,610	\$14,534,610
(2)					\$0
(3)	TOTAL HEATING SYSTEM UPGRADE/MECHANICAL RE-COMMISSIONING			\$14,534,610	
	LIGHTING UPGRADE				
(1)	ICF	1	LS	\$588,814	\$588,814
(2)	IBC	1	LS	\$668,703	\$668,703
(3)	MTU	1	LS	\$568,814	\$568,814
(4)	RMI	1	LS	\$515,889	\$515,889
(5)					
(6)	TOTAL LIGHTING UPGRADE			\$2,342,220	
	BUILDING ENVELOPE				
(1)	ICF	1	LS	\$21,625	\$21,625
(2)	IBC	1	LS	\$35,350	\$35,350
(3)	MTU	1	LS	\$20,650	\$20,650
(4)	RMI	1	LS	\$5,250	\$5,250
(5)	0				\$0
(6)	TOTAL BUILDING ENVELOPE			\$82,875	
	WATER/SEWER CONSERVATION				
(1)	ICF	1	LS	\$829,432	\$829,432
(2)	IBC	1	LS	\$1,778,712	\$1,778,712
(3)	MTU	1	LS	\$792,330	\$792,330
(4)	RMI	1	LS	\$1,982,548	\$1,982,548
(5)					\$0
(6)	TOTAL WATER/SEWER CONSERVATION			\$5,383,022	
	ENERGY MANAGEMENT SYS. UPGRADE/EXPANSION/VARIABLE SPEED DRIVES				
(1)	ICF	1	LS	\$852,933	\$852,933
(2)	IBC	1	LS	\$120,240	\$120,240
(3)	MTU	1	LS	\$726,968	\$726,968
(4)	RMI	1	LS	\$179,350	\$179,350
(5)					\$0
(6)	TOTAL ENERGY MANAGEMENT SYS. UPGRADE/EXPANSION/VARIABLE SPEED DRIVES			\$1,879,492	

Estimates +/- 10% and are based on Means, past experience, vendor pricing and contractor review.



Proprietary and Confidential

IONIA COMPLEX OVERVIEW



- KEY:**
- ICF** - Ionia Correctional Facility
 - IBC** - Bellamy Creek Correctional Facility
 - MTU** - Richard A. Handlon Correctional Facility
 - RMI** - Michigan Reformatory
 - CP** - Central Boiler Plant