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URBAN ENERGY SERVICES PROGRAM SUSTAINABLE MUNICIPAL ENERGY SERVICES

SUPPLY SIDE ASSESSMENT OF THE ENERGY EFFICIENCY MARKET IN JORDAN

August 2010

This publication was produced for review by the United States Agency for International Development. It was prepared by Nexant, Inc. under Contract EIPP-I-02-03-00007-00

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DISCLAIMER

The author's views expressed in this publication do not necessarily reflect the views of the United States Agency for International Development of the United States Government

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1. EXECUTIVE SUMMARY

This report was prepared under the supervision of Nexant Inc. (Nexant) under contract with the United States Agency for International Development (USAID) to provide an overview on the current status of the supply-side of the energy efficiency market in Jordan. The main objective is to assess whether the current market for energy efficiency products and services is capable of supporting the expected growing demand on energy efficiency.

Mr. Amr Khadr, a Jordanian Marketing Consultant was retained by Nexant to conduct this assessment. During the period April-July 2010, he was able to collect the necessary market data as well as perform some analyses to arrive to a realistic view on the status of the supply-side of the energy efficiency market. Through a combination of field visits to companies working in the energy efficiency field and desk research efforts, Mr. Khadr was able to draw some conclusions that helped in shaping this assessment.

The conclusion of this work was that the current market capabilities is still in the development stage and energy service providers are mainly focusing on consulting services, energy audits and value engineering, while medium to large scale projects are still not properly served. Many of the basic systems and equipment exist in the market, but awareness at the consumer level remains limited.

Market players and experts attributed the slow development of this industry to some challenges and market barriers such as lack of financing, lack of awareness, un-clear custom tariffs, and lack of enforcement of building code and labeling of energy efficiency products.

The current companies operating in the energy efficiency area are capable of supporting existing market needs, but their ability to expand alongside increasing demand on efficiency may be challenged as building their capacity would require lead time. Therefore, it is critical to in developing an energy efficiency market in Jordan to prepare the supply-side of the energy services market through planned capacity building programs.

2. OVERVIEW AND OBJECTIVES

Under contract with USAID, Nexant is the technical assistance provider for the ‘Building Green’ activities which is contractually under the Sustainable Municipal Energy Services (SMES) Task order. ‘Building Green’ included work on increasing efficiency in public buildings through the conductance of energy audits in a group of buildings of different sizes and types. The main target was to produce a ‘model’ energy audit to be used for public buildings energy efficiency projects. Through subcontracting to three different local Energy Service Companies (ESCOs), Nexant conducted energy audits in four buildings and was able to finalize 2 model audits: one for Government administrative buildings, and one for a typical K-12 school.

One of the key elements of the technical assistance under this activity was the development of an assessment of the existing supply chain for energy services to determine whether their existing capacities and capabilities could meet the expected growth in demand on energy efficiency products and services. Included in this subtask was an identification of inexpensive, yet technically sound approaches for performance and savings verification.

Mr. Amr Khadr, a Jordanian Marketing Consultant was retained by Nexant to develop this market assessment. The focus of the assignment was on the evaluation of the current market profile related to delivering energy efficiency products and services through two main tasks:

- Review of available EE products and services and their associated suppliers
- Assessment of the existing suppliers’ abilities to deliver energy efficiency services

In conducting this assessment and during the period April to May 2010, Mr. Khadr was able to collect the necessary market data as well as perform various analyses to arrive to a realistic view on the status of the supply-side of the energy efficiency market. He gathered market information through a combination of desk research and field visits to relevant market players. In focus, there were two key items that should be documented not only for this assessment, but also for future market studies. These are:

1. A listing of existing energy service providers with their profiles.
2. A matrix of the types of services and products that are offered by each service provider.

Nexant also provided a summarized approach to simplified saving verification.

3. METHODOLOGY

The methodology used in conducting this market assessment employed both qualitative and quantitative approaches through both field and desk researches. The results of these efforts were utilized in analyzing and evaluating the supply-side of the energy efficiency market as well as mapping the relevant suppliers and vendors.

Field visits were undertaken in order to gather information on the market players, their abilities and current involvement. A questionnaire (see Appendix A) was designed for the purpose of the field visits and was used in structured interviews with a select group of companies the best represented the energy service market. Collected Data were then documented in tabular forms to facilitate their review and analysis.

Sources of data for this market assessment included the Department of Statistics (DoS), Jordan Customs Department, Ministry of Energy and Mineral Resources (MEMR), National Energy Research Center (NERC), the National Electric Power Company (NEPCO) and other market experts¹.

Energy service companies and suppliers/vendors of energy efficiency products and services contacted for this assessment were:

1. Energy Management Services – EMS (ESCO)
2. El Tayeh, Kilani and Partners Co. - terra Vertis (ESCO)
3. GreenTech for Sustainable Environment (ESCO).
4. Eco Engineering and Energy Solutions – EcoSol (ESCO)
5. United Company for Lighting Systems – Philips (Vendor)
6. Noor Ala Noor (Vendor)
7. Green Narmada (Vendor)
8. Izzat Marji Group (Vendor)
9. F. A. Kettaneh (Vendor)

¹ Dr. Mohammad Hamdan – Al Zaytona University

4. AVAILABILITY OF ENERGY EFFICIENCY PRODUCTS IN JORDAN

Through desk research and meetings with energy efficiency suppliers/vendors, energy market experts and government entities active in the energy efficiency field, the following list of available products in Jordan was prepared.

Table 1: Available energy efficiency products in Jordan

Category / Classification	Energy Efficiency Measure/Product
Lighting System	High Efficiency Fluorescents Lamps
	High Intensity Discharge Lamps
	Electronic Ballasts
	Occupancy Sensors
	Lighting Controllers
	Photo Sensors
Motors and Drives	High Efficiency Motors
	Adjustable Speed Drives
	Demand Controllers
	Soft Starters
	Power Factor Controllers
Co-Generation Systems	Packaged Co-Generation
	Gas Turbines
	Steam Turbines
	Heat Recovery Boilers
Pumps and Mechanical Fans	High Efficiency Pumps
	High Efficiency Fans
	Hydraulic Couplings
	Impeller Trimming
HVAC Systems	Heat Recovery Systems
	Energy Management Systems
	High Efficiency Packaged Rooftop Units
	Temperature & Humidity Sensors
Compressed Air	Energy Recovery Units
	Pre-coolers
	Compressor Staging Devices
	Energy Efficient Nozzles
	Variable Speed Compressors
Central Cooling Systems	High Efficiency Chillers
	Thermal Storage Systems
	Absorption Refrigeration

5. OPERATING ENERGY SERVICES COMPANIES (ESCOS) IN JORDAN

Based on the field visits and meetings with the four known to be operating ESCO's in Jordan, the following is a brief description on each ESCO. The questionnaire that was mentioned previously and included in Appendix A was used to compile enough data to develop these descriptions.

1. Energy Management Services (EMS)

EMS was established in 1991 in Jordan with an office in Dubai, which was established in 1996. The company has also two other offices, one in Qatar, and the other is in Saudi Arabia. Much of EMS recent work on Green Buildings has focused on energy & water efficiencies as well as improvements in indoor air quality that directly affects the health and well being of building occupants. EMS is also a registered service provider with several international and regional donor organizations promoting enterprising solutions in emerging markets. Their major service offerings include:

- Green solutions
- Smart property solutions
- Renewable energy
- Water management
- Gas solutions

EMS team consists of 10 engineers in addition to the management team who were able in the past 19 years to conduct and implement several projects in Jordan and the region. Some of these projects are as follows:

1. Two projects in Green Buildings.
2. Energy Value Analysis
3. Energy Auditing: Prince Hamzah Hospital, Orthodox Club, Yarmouk University.

They stated that their company was capable of conducting and implementing large scale projects but it would require hiring new employees and outsourcing to subcontractors.

Additionally, the company identified some of the main issues and actions that would be needed to develop and improve the energy efficiency practice in Jordan. These are:

1. Financing of EE projects.

2. Awareness is highly required.
3. The establishment of a reference entity that controls the deliverables, and quality of services offered by the ESCO's in Jordan.

2. El Tayeh, Kilani & Partners Co. (Terra Vertis)

Terra Vertis is a sustainability consulting provider of a diverse set of services to a broad client base. Established in 2007 with 15 employees, the company has categorized its services according to the current demand sectors -- Residential, Commercial and Industrial. Total Efficiency Solutions product will be focusing on commercial projects, while MEpower will be mainly targeting the industrial sector, and the 'Energy Doctor' product caters to the residential customers.

The company's service offerings cover training and consultancy programs for various stakeholder groups in fields of sustainability, corporate responsibility, energy efficiency, water consumption, waste and resource management. Terra Vertis customizes its services to its clients based on the size and scale of the client's facility, operations, resource consumption and needs. The nature of training programs could be conducted in two types; Public Program and In-House Training Program focusing on:

- CSR & Sustainability Consultancy
- CSR & Sustainability Audits & Reporting
- Environmental Efficiency Consultancy
- Value Engineering
- Innovation & Development

According to terra Vertis, the company has conducted several projects in the commercial and residential sectors with some of its clients included Aramex, Zara, Medas for Furniture, McDonalds, Industrial Complex and Amman Greater Municipality.

Terra Vertis stated that in order to be able to conduct and implement large scale projects, the company would need to increase its working force and consider joint venture with other companies.

Terra Vertis identified the following challenges facing the energy efficiency market in Jordan:

1. Lack of incentives.
2. Financing issues.

3. The lack of reference entity for all energy services companies.

3. GreenTech for Sustainable Environment

GreenTech was established in 2008 in Amman with its head office in Dubai, and currently employees 6 engineers. GreenTech utilizes knowledge-based services and products that improve operational performance, productivity, and efficiency while reducing costs, energy consumption, waste and pollution, thus contributing to a greener energy world and reducing the CO2 footprint.

GreenTech offers a diverse range of services, programs and products such as carbon management, value engineering, energy auditing/implementation, renewable energy design and implementation, Green Building Projects and LEED certifications.

According to GreenTech, the company is willing to participate and conduct large scale projects which would require outsourcing and hiring new employees to be able to design and implement the required services.

Some of their main projects conducted during the last two years are:

1. Energy Audit for 20 facilities (a project with SABEQ).
2. CBM joint venture with a British company.
3. Value Engineering for a tower in Saudi Arabia.
4. US Embassy energy audit and green building assessment.

The company identified the following challenges for the development of the energy efficiency market in Jordan:

1. Lack of incentives.
2. Lack of structured tariffs in the renewable energy law.
3. Lack of awareness for energy efficiency from the government side.

4. Eco Engineering and Energy Solutions (EcoSol)

Eco Engineering and Energy Solutions “EcoSol” (Limited Liability), was established in 2009 to assist governments, developers, industries and organizations with the efficient use of energy and water along with preserving the environment and natural resources.

They believe that their success is attributed to their commitment to maintain a balance between supporting economic development activities and the sustainability requirements. Their service offerings include:

- Energy Management
 - Energy Strategic Planning
 - Energy Infrastructure Assessment
 - Energy Auditing
 - Energy Performance Contracting
- Green Buildings and LEED certification
- Water Efficiency
 - Water Auditing
 - Water Sensitive Urban Design
 - Wastewater Management
 - Irrigation Solutions
- Renewable Energy
- Clean Development Mechanism “CDM”
- Design Auditing and Value Engineering
- Maintenance Services
- Engineering Solutions
- Workshops and training courses for companies

According to EcoSol, the company has conducted several projects in the areas of energy value engineering (Amman Ahlieh University), and energy auditing and implementation for three factories and hospitals. Additionally, the company is currently in the final stages of establishing a sub company for handling the implementation activities. Moreover, EcoSol, will establish branches in Saudi Arabia and Turkey within the coming two months. EcoSol stated that it was capable of conducting large scale projects with its current team (5 engineers), and outsourcing experts from Jordan. They however believe that the Jordanian energy efficiency market is rather limited. Some of their key observation on the energy efficiency practice in Jordan included the following:

1. Energy efficiency products should have standards and codes.
2. The EE industry should have one specific reference that organizes, develops and provide the required regulations for the energy service companies in Jordan.
3. There is need for clear and dynamic law governing EE in the market.
4. Incentives and awareness are needed to develop the market and ensure the needed growth.

Summary Profile for the 4 Identified ESCOs

The majority of the energy efficiency service providers identified that the implemented projects were mainly related to auditing, performance management and energy value engineering, targeting commercial and industrial sectors. Additionally, EcoSol, GreenTech and EMS identified that most of their staff were LEED AP-certified while Terra Vertis mentioned that its staff were currently being trained to be LEED AP- certified.

All interviewed ESCOs stated that they would require outsourcing arrangements and hiring new employees as well as consider joint ventures to be able to take on the implementation of large scale projects. The following table provides a summary profile for each of the 4 ESCOs identified.

Table 2: Summary Profile for ESCOs in Jordan

ESCO	EE MEasures	Services	Firm Size	Large Projects Implementation
EcoSol	Lighting Water Heating A/C Control System Power Factor	Consulting Contracting Training Supplying (as part of the service)	Small (5 engineers)	Part of Consortium
GreenTech	Lighting Water Heating A/C Control System Power Factor	Consulting Supplying (as part of the service)	Small (6 engineers)	Part of Consortium
EMS	Lighting Water Heating A/C Control System Power Factor Gas Solutions	Consulting Contracting Training Supplying (as part of the service)	Medium (10 engineers)	As a Main Contractor
Terra Vertis	Lighting Control System Water Heating	Consulting Supplying (as part of the service)	Medium (15 employees)	Part of Consortium

6. ENERGY SERVICES SUPPLIERS AND VENDORS

Realizing that there are other types of energy service providers that are different from the regularly used term ESCO, this assessment also included a sample of companies that provide either products or services related to energy efficiency. Five companies have been identified and contacted either by personal interviews, phone meetings or filling up the questionnaire. A brief profile has been prepared on each documenting their size, market history, specialization, and capabilities. These selected companies also represent a mix of new and long existing companies, small and large staff size and different areas of specialization.

1. United Company for Lighting Systems – Philips

Date of Establishment	1989
Branches / Showrooms	3
No. of Employees	5 Engineers
Products	Fluorescent Lamps, EE lamps, lighting systems, lighting decorations (Philips Brand)
Projects Implemented	Qatar Embassy, National Museum, National Library, Austria Embassy, ATV Studios.
Capability of Supplying Large Scale Projects	According to the United Company for Lighting Systems, the company is capable of supplying large scale projects
Limitations and development requirements	<ol style="list-style-type: none"> 1. High prices of EE lamps. 2. Awareness and initiatives are required by the government 3. Custom tariffs and codes regarding EE lamps are not clear.

2. Noor Ala Noor

Date of Establishment	1990
Branches / Showrooms	4
No. of Employees	9 engineers
Products	Lighting and electrical accessories (MEGAMAN, LEDS.C4, BLV).
Projects Implemented	Mariott Dead Sea Resort, Al Hamshary Mosque, Queen Alia International Airport
Capability of Supplying Large Scale Projects	According to Noor Ala Noor, the company is capable of supplying large scale projects
Limitations and development requirements	<ol style="list-style-type: none"> 1. Codes and standards for EE lights. 2. High prices of EE lights compared with individuals income. 3. Un clear custom duties (tariffs) on some EE lights

3. Green Narmada

Date of Establishment	2009
Branches / Showrooms	1
No. of Employees	8 employees, 4 engineers out of 8
Products	Under floor heating carbon film
Projects Implemented	<ol style="list-style-type: none"> 1. Mosques. 2. Chocolate Factory. 3. Yogurt Factory
Capability of Supplying Large Scale Projects	Currently in the development phase and will expand its services by contracting with public entities. Accordingly, the company showed willingness in supplying large scale projects in which the carbon film is manufactured locally and raw material imported from Korea.
Limitations and development requirements	<ol style="list-style-type: none"> 1. Custom duties (according to the customs law, energy efficiency products are custom free, however, the codes and tariffs are still not clear). 2. Lack of awareness for EE products.

4. Izzat Marji Group

Date of Establishment	1985
Branches / Showrooms	3
No. of Employees	170 employees, 45 engineers out of 170
Products	Heating Systems, Air Conditioning Systems, Sanitary Fixtures & Kitchen Sinks, Fixing Systems & Power Tools
Projects Implemented	Conducted several commercial, residential and industrial projects including private villas/apartments, King Abdullah Mosque, Mecca Mall, Ibn Al Haitham Hospital.
Capability of Supplying Large Scale Projects	According to Izzat Marji Group, the company is capable of supplying the energy efficiency heating systems, and energy efficiency air conditions for large scale projects.
Limitations and development requirements	<ol style="list-style-type: none"> 1. Lack of EE codes and standards. 2. Lack of awareness and incentives. 3. Lack of EE product labeling system.

5. F. A. Kettaneh

Date of Establishment	1985
Branches / Showrooms	2
No. of Employees	60 employees, 20 engineers out of 60
Products	The company has three divisions for the products range: Machinery (air compressors, CMT, IT, Hydro – Thrift), air conditioning, electrical division (Siemens industry, siemens energy, electrical cables, UPS systems)
Projects Implemented	Conducted several projects in commercial and banking sectors.
Capability of Supplying Large Scale Projects	According to F.A. Ketaneh, the company is capable of supplying the energy efficiency products, and energy efficiency air conditions for large scale projects.
Limitations and development requirements	<ol style="list-style-type: none"> 1. Lack of EE codes and standards. 2. Lack of awareness and incentives. 3. Lack of EE products labeling system. 4. Sales taxes and custom duties.

7. CONCLUSION

As a result of the interviews conducted with ESCOs, vendors, service suppliers and other experts, the supply-side service/delivery chain of the energy efficiency market in Jordan can be characterized as follows:

- The energy services market appears to be slowly growing reflecting the slow development of the demand side.
- Market players and experts attributed the slow development of this industry to some challenges and market barriers such as lack of financing, lack of awareness, un-clear custom tariffs, and lack of enforcement of building code and labeling of energy efficiency products.
- Energy service providers are mainly focusing on consulting services, energy audits and value engineering, while medium to large scale projects are still not properly served.
- Measuring and testing tools are not in abundance, but engineering expertise is available.
- Many of the basic systems and equipment exist in the market, but awareness at the consumer level remains limited.
- The current companies operating in the energy efficiency area are capable of supporting existing market needs, but their ability to expand alongside increasing demand on efficiency may be challenged. The lead time needed to build their capacity or expand the number of providers is likely to hinder the ability to meet the expected market demand on efficiency products and services.
- Most of the existing energy service providers will not be able to meet the needs of large size projects.
- Only one governmental organization exists to provide support and guidance to this service industry, but this organization is challenged by lack of funding, making it sometimes a competitor to the other energy service providers.
- A capacity building program is certainly needed to plan the growth of the service industry in order to meet the expected demand on energy efficiency products and services.

APPENDIX A: *SURVEY QUESTIONNAIRE*

Company Summary

Company Name _____

Location _____

No. of Employees _____

Establishment Date _____

Tel. Number _____

Company's main activities

Research Contracting Consulting Service Provider Supplier / Vendor

Company Classification

Non Profit Private Shareholding Public Shareholding Limited Liability Partnership

Certifications, if any _____

Energy Efficiency Awareness
Does the company continually update its information pertaining to energy efficiency in Jordan (current and previously conducted projects, studies and research developed, current and future projects)? Please explain.
Does the company provide specialized training courses to its employees regarding Energy Efficiency? Please Explain
How many EE Projects were conducted by your company within the past three years?
Did you contract / cooperate with other companies in designing / conducting EE projects? <input type="checkbox"/> Yes <input type="checkbox"/> No
Is the company aware of the incentives provided by the government concerning EE in Jordan? <input type="checkbox"/> Yes <input type="checkbox"/> No
Do you have the capability of conducting / implementing large scale projects? Please explain

Please mention some of the large scale projects conducted / implemented by your company throughout the last three years, in addition to the ones being implemented currently

Do you consider accepting more large scale projects?

Yes

No

If the answer to the above question is yes, what are the procedure(s) that you will follow for conducting such project(s)?

1. Training of employees
2. Hiring new employees
3. Sub-contracting with other companies
4. Outsourcing

If your company does not conduct / implement large scale projects concerning EE, are you planning to accept such projects in the near future?

Yes

No

In your opinion, what are the requirements that are needed to be taken into consideration for conducting / implementing such large project? You can choose more than one.

1. Hiring new employee(s)
2. Training current employees in the company
3. Contracting with other similar company(s)
4. Contracting with subject matter expert(s)
5. Other(s), please mention

Are you aware of the currently implemented renewable energy law?

Yes

No

<p>In your opinion, what do you suggest to develop the Energy Efficiency concept in Jordan?</p> <p>-----</p> <p>-----</p>
<p>In your opinion, what are the main limitations of Energy Efficiency initiatives?</p> <ol style="list-style-type: none">1. Lack of training courses2. Lack of incentives3. Lack of specialized staff / technician4. Lack of grants / financing issues5. Other(s), please mention.....

APPENDIX B: ENERGY EFFICIENCY PRODUCTS IMPORT ANALYSIS

According to the field and desk research conducted using information from the Department of Statistics and the Customs Department, and based on the meetings with the energy efficiency suppliers and vendors, Table 3 below illustrates the HS Code classification (per group) along with the description of each group in which the main energy efficiency product(s) belong(s) to.

The HS code can be divided into five groups, mainly:

1. Building envelope (insulation material)
2. Heating, ventilation, air conditioning and refrigeration
3. Lighting
4. Renewable- energy use in buildings
5. Stoves.

Table 3: Energy efficiency groups according to the HS Code

Group	HS Code	Description
Stoves	841919	Other Instantaneous or Storage Water Heaters, Non-electric
Heating, Ventilation, air conditioning and Refrigeration	841581	A Refrigerating Unit, a Valve for Reversal of the Cooling/heat Cycle
Building envelope	680690	Mineral insulating materials and articles
	701939	Glass-fiber insulating products
Lighting	853931	Fluorescent Lamps, Hot Cathode
	854140	Photosensitive Semiconductor Devices; Light Emitting Diodes

** Source: Department of Statistics – Jordan, UNComTrade.*

Table 4 below illustrates Jordan imports related to energy efficiency products according to the above classification for the years 2006-2008

Table 4: Main energy efficiency products Imports in 2006-2008

Group	HS Code	Import Quantity (Kg)/ Year		
		2006	2007	2008
Building envelope	680690	436,107	185,034	701,503
	701939	133,298	286,721	522,526
Heating, Ventilation, air conditioning and Refrigeration	841581	242,449	80,101	719,304
Stoves	841919	336,848	223,758	2,245,372
Lighting	853931	932,010	566,283	1,804,806
	854140	2,652	N/A	70,869

APPENDIX C: PROPOSED APPROACHES FOR SAVINGS MEASUREMENT & VERIFICATION

The following is a roadmap for conducting inexpensive, yet sound measurement and verification of energy savings for public buildings.

During the Energy Efficiency Audit:

- Toolkits should be created for small commercial and large commercial in the same manner as schools. Standardized audits cost less than custom audits. Toolkits also help in replicating and maintaining the quality of audits.
- For small commercial, the energy savings should be based on published specifications, e.g. for a roof top unit, the energy savings will be calculated based on name plate efficiency of the existing and proposed equipment. The hours of operations can be assumed or acquired from the facilities personnel.
- For large commercial, two weeks of monitoring should be performed on all major end-uses. For packaged HVAC system, it is recommended that kW measurement of at least 75% of the supply fans above 5 hp should be measured. For central chiller plants, chiller kW, supply and return chilled water temperature plus the kW of the condenser fan should be measured.
- All weather dependent measures should utilize at least a bin analysis to incorporate effects of local weather conditions. If the facility is more than 15,000 m² (160,000 ft²) with more than two end uses, it is recommended to use a whole building simulation program to correctly quantify the interactions between the different systems. For example if one system is supplying the kitchen and adjacent area of a hotel, then a bin analysis will not be able to correctly identify the load characteristics of the two spaces.
- Utility billing data if available should be utilized to calibrate the simulation model along with the monitored data.
- In case of a bin analysis, the utility data should be use to judge the reasonableness of the calculated energy consumption

Before and After Implementation of EE Projects:

- For small commercial applications, verified energy savings are based on nameplate and installed information. No monitoring should be required, e.g. for a lighting retrofit, energy savings will be verified by an inspection of the installed lighting fixtures and using the fixture wattage and assumed hours of operation.
- For large commercial, lighting measures will not require any monitoring. Verified savings will be based on installed fixtures and assumed hours of operation.
- For large commercials, HVAC measures with less than 5,000 kWh of savings will be verified in a similar manner to lighting.
- For HVAC measures larger than 5,000 kWh two weeks of monitoring data will be required of the end-use to verify the savings.
- For packaged rooftop units, supply air temperature, room temperature, supply fan and condenser fan kW should be measured
- For central plants, chiller kW, chilled water supply and return temperatures, condenser fan kW, boiler combustion fan kW and boiler flue gas temperature should be measured.

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