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WATER REUSE AND ENVIRONMENTAL CONSERVATION PROJECT

CONTRACT EDH-I-00-08-00024-00 ORDER 04

SUMMARY REPORT FOR P2/EMS ASSESSMENTS OF PARTNER INDUSTRIAL FACILITIES

December 2014

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USAID Jordan

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The authors' views expressed in this document do not necessarily reflect the views of the United States Agency for International Development or the United States Government.

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LIST OF ACRONYMS

COR	Contracting Officer's Representative
EMS	Environmental Management System
FTM	Facility Team Member
GoJ	Government of Jordan
HVAC	Heating, Ventilation and Air Conditioning
IQC	Indefinite Quantity Contract
ISO	International Organization for Standardization
JOD	Jordanian Dinar
KPI	Key Performance Indicator
kWh	Kilowatt Hours
MoEnv	Ministry of Environment
MOU	Memorandum of Understanding
P2	Pollution Prevention
PTM	Project Team Member
PV	Photo Voltaic
QMS	Quality Management System
RSS	Royal Scientific Society
SME	Small and Medium Enterprises
USAID	United States Agency for International Development
WAJ	Water Authority of Jordan
WRECP	Water Reuse and Environmental Conservation Project

1 INTRODUCTION AND OVERVIEW

The purpose of this report is to summarize Pollution Prevention (P2) and Environmental Management System (EMS) Assessments conducted by the United States Agency for International Development (USAID) Water Reuse and Environmental Conservation Project (WRECP) at 31 industrial facilities in the Hashemite Kingdom of Jordan (Jordan) over the period from September 2012 to January 2014. This report aims to improve industrial environmental management through technical and institutional support by expanding P2 and EMS knowledge within industrial sectors in Jordan and by identifying opportunities to implement EMS and P2 programs tailored to each partner facility.

Cost savings is the main motivator for industry to institute P2 and conservation measures. However, other benefits include improved health and safety for workers and the community; community recognition for enhanced social responsibility; reduced consumption of energy, water, and raw materials; and reduced likelihood of pollution to the environment from wasteful practices and mismanaged waste. These benefits ultimately contribute to sustainable economic development in Jordan.

This report includes P2 assessment results analysis and presents the main findings sorted by industry sector and size.

Confidentiality of company-specific data is maintained through reporting data generally by sector and size without mentioning partner facility names. This approach maintains the confidentiality of the assessed facilities as agreed in the Memorandums of Understanding (MOUs) that were previously signed by each of the project partners.

Material covered in this report includes:

- Project/task objectives
- The initial Industry Survey (that was conducted earlier to prioritize and select the project partners)
- Partner training, knowledge sharing, and benchmarking
- Small and Medium Enterprises' (SMEs') access to financing
- Assessments, including status of assessments and reports, analysis of results, and major findings
- Upcoming steps
- Conclusions

Many of the options that have been proposed to the project partners and that are expected to result in potential savings in the water, energy, and material usage and waste disposal areas – commonly referred to as the proposed P2 options - have been financially and technically analyzed.

It should be noted that the actual savings expected to result from implementing the proposed P2 options will be affected by the partners' proper implementation, as well as by other factors such as proper design, water and electricity tariffs, raw material costs, and waste disposal costs.

1.1 Project/Task Objectives

The USAID WRECP (the project) provides consulting engineering services to the Government of Jordan (GoJ), directed at specific targets consistent with USAID's Strategic Objective to achieve "Enhanced Integrated Water Resources Management." The project is a task order under the USAID Global Architecture and Engineering Indefinite Quantity Contract

(IQC), EDH-I-00-08-00024-00. This five-year project began on 1 August 2010 and extends until 30 July 2015.

The project provides capacity building technical assistance and training to support key institutions, such as the Ministry of Environment (MoEnv) and national laboratories, for improved environmental governance; engineering feasibility studies for industrial waste management and landfill rehabilitation; industrial wastewater treatment system designs; reclaimed water reuse pilot projects; and pollution prevention initiatives with selected industries. The project has four major tasks:

- Task 1: Institutional and Regulatory Strengthening
- Task 2: Pollution Prevention and Industrial Waste Management
- Task 3: Disposal Site Rehabilitation and Feasibility Studies
- Task 4: Water Reuse for Community Livelihood Enhancement

The scope of this report and the P2/EMS assessments are part of Task 2. Pollution prevention (P2) means reducing or eliminating waste at the source by modifying production processes, promoting the use of non-toxic or less-toxic substances, implementing conservation techniques, and re-using materials rather than putting them into the waste stream. Thus, it is a tool for improving the eco-efficiency of an industrial facility. In turn, the industrial facility can use fewer resources and generate less waste, while maintaining or increasing its rate of production.

The P2 assessment is an integral component of the EMS assessment that has been conducted by the project EMS assessment team for the partner facilities. The P2 assessment provides a tool for each partner facility to achieve a comprehensive EMS, particularly in relation to sources of inefficiencies and how to reduce them. The list of recommended P2 options in the related P2 assessment reports will help in identifying environmental aspects and impacts at the partner facilities, as well as objectives and targets that are recommended in each facility's EMS (and are requirements of the ISO 14001: 2004 international standard).

The EMS assessment is intended to improve each facility's understanding of the elements of the EMS outlined in ISO 14001 and enable a quick review of facility operations to determine how they measure up to the standard. The EMS assessment serves as the starting point of a gap analysis to identify management tools or other changes that might be implemented in the organization to help improve overall environmental performance.

Note that the P2 and EMS assessment reports for each facility were officially submitted to the respective partner/facility representative(s) and to USAID Jordan as they were completed.

1.2 Timeframe & Considerations

The ongoing plan for each assessed facility is to develop a P2 Options Implementation Plan which should detail the required resources and timeframe for implementation, as well as the measurements needed to evaluate the benefits of implementation.

After the facilities have had time (typically within 6 to 18 months) to develop plans and implement many of the recommendations of the P2 and EMS assessments, the project will conduct a P2/EMS audit of each facility to evaluate how the implementation has progressed.

In accordance with the terms of the MOU, the partner facilities have agreed to observe the findings of the P2/EMS assessment teams and follow up on the recommended set of improvements. Implementation plans should be developed to address the P2 options and

gaps identified by the EMS assessment teams. The project has been providing advice and follow-up regarding the partners' implementation plans.

The results of the audits will then be compiled into one P2/EMS audit summary report, which will document proposed actions and the related savings. Like this report, the audit summary report is intended to be published in a way that does not break the terms of the Non-Disclosure Agreements that have been signed with the project's partners.

1.3 Overview

The project signed Memorandums of Understanding (MOUs) with 30 partners to assess 32 facilities

Out of the 32 facilities, 31 have been P2 and EMS assessed. One partner did not respond or participate.

Table 1 summarizes the partner facilities' cooperation level throughout P2/EMS assessments and reporting. It profiles each facility in terms of size and industry sector, and summarizes the level of cooperation shown during the assessments. Note: In order to maintain confidentiality, each partner facility was assigned a generic number for inclusion in the table.

In terms of cooperation with assessors, around 39% of the project partners (facilities) showed an "excellent" level of cooperation; 39% of the facilities showed a "good" level of cooperation; and 23% showed a "fair" level of cooperation. No partners showed a poor level of cooperation, not counting the one facility that was not assessed at all due to its lack of responsiveness following the signing of the MOU.

From the time of the MOUs through development of P2 Implementation Plans, changes in many partner facilities' management teams were significant and caused mostly negative impacts on those facilities' overall assessments and implementation progress.

Table 2 presents major analysis results including the sum of the proposed P2 investment and estimated savings under each sector for common P2 option categories and for all options under each sector and for the total project. The table also presents the average payback period for common P2 option categories.

The combined P2 assessments of all 31 facilities generated 293 P2 options with an overall investment cost of approximately 7.8 million Jordanian Dinars (JOD). Financial savings were estimated at approximately 2.7 million JOD/yr.

The proposed options have been considered based on the payback periods and the investment costs, detailed in Section 4. The recommended options (i.e., those that are not cost prohibitive and have a short payback period) are those that have the greatest chances of implementation in the project partner facilities, with the potential for applicability to other similar facilities in Jordan.

The 12 partner facilities within the 'Chemical & Cosmetic' industrial sector had the biggest share of the proposed options with an estimated investment cost of approximately 5.9 million JOD and an estimated savings of nearly 1.8 million JOD/year. The highest proposed investment cost and number of proposed options for the Chemical and Cosmetic sector were related to improvements to material handling and alternative material usage.

In terms of proposed options categories, five solar photo voltaic (PV) electricity generation options were proposed to two different sectors, "Chemical & Cosmetics" and "Engineering", with an estimated investment cost of more than 2.3 million JOD. The high investment cost

and lengthy payback period of the solar PV-related options appear to be the main barriers from implementing these options by many facility owners/management.

2 BACKGROUND – THE INITIAL INDUSTRY SURVEY

The main objective of the WRECP Task 2 is to guide and assist specific industrial facilities to prevent pollution and conserve both water and energy. This was achieved by identifying the industrial sectors where assistance would be most fruitful, providing training to a broad array of facilities within those industrial sectors, and then selecting and providing in-depth assistance to those industrial facilities where the project can make the greatest impact. At the start of the Task, a survey was designed to begin the process of identifying those facilities.

A comprehensive list of industrial facilities was prepared; the facilities were classified by parameters such as sector, location, and size. A methodology was prepared and used to define the industrial sectors that would be the project's highest priorities. The methodology considered several factors necessary for achieving sustainable development, including economic importance, environmental importance, social importance, and potential for growth. The five sectors selected were:

1. Food supplies, agriculture and livestock
2. Engineering, electrical industries and information technology
3. Chemical and cosmetics
4. Therapeutics and medical devices
5. Packing, packaging, paper, carton and stationery*

** Note that the Jordan Chamber of Industry Board of Directors report the Packaging, Paper and Plastic sector as two sub-sectors: Plastic and Rubber industries; and Packaging, Paper, and Carton industries.*

The project surveyed 400-plus industrial facilities. The project team selected 150 companies based on the following factors identified in the survey results:

- Water consumption
- Energy consumption
- Liquid and solid waste quantities
- Quality management system (QMS) and EMS implementation
- Willingness of industrial facilities to cooperate with the project

Training was offered to the selected facilities. A total of 151 people were trained (112 men and 39 women).

From those selected facilities, 65 facilities that appeared to have the greatest chance of success were invited to sign MOUs to participate in P2/EMS assessments, with a goal of partnering with 40 facilities. Thirty partners signed the related MOUs to participate in the P2/EMS assessments at 32 facilities (since one of those partners had three different production facilities to be assessed) in five industrial sectors geographically distributed throughout Jordan.

Figure 1 summarizes the project partner selection process.

Geographic distribution was considered through the selection process. Figure 2 shows the geographic distribution of the 400+ surveyed facilities.

The geographical distribution of the 32 selected partners' facilities reflects the proportional distribution of the surveyed facilities: Eighteen were located in Amman, 2 in Aqaba, 2 in Irbid, 9 in Zarqa, and 1 in Mafraq.

The sector-based distribution is as follows: 12 facilities were classified under the Chemical sector; 4 under the “Engineering, Electrical Industries and Information Technology” sector; 8 under the “Food supplies, Agriculture and Livestock” sector; 3 under the “Therapeutics and Medical Devices” sector; and 5 under the “Packing, Packaging, Paper, Carton and Stationery” sector.

Based on the results of the surveys from the 400 facilities, water consumption and wastewater generation quantities in the industrial facilities are directly proportional to the facility size, except in cases where the water is used as the main ingredient in the final product. The collected information also showed that only 12% of industrial facilities have their own wastewater treatment systems to either reuse the reclaimed wastewater or to meet the industrial wastewater pretreatment discharge limits set by the Water Authority of Jordan (WAJ) for discharge into the sewer network. Approximately 54% of industrial facilities send their untreated wastewater by tanker trucks for off-site disposal by others, often with no knowledge of when and how it is ultimately disposed of.

The average monthly energy consumption in the “chemical and cosmetics” and “packing, packaging, paper, cartons and stationary” sectors exceeded 200,000 kilowatt hours (kWh)¹, which is higher than that of the other sectors. This is primarily due to the energy-intensive processes used in these industrial sectors. The “engineering, electrical and information technology (IT)” sector had the lowest average monthly energy consumption of approximately 100,000 kWh². Table 3 summarizes electricity consumption and related costs to industry based on the Industry Survey of 400 facilities in Jordan.

The total cost of energy for industrial facilities depends on the cost of electricity and of other sources of energy, such as fuel oil, diesel, and liquefied petroleum gas (LPG). Using more than one source of energy (such as diesel fuel or heavy fuel oil to produce steam or hot water or to fuel the HVAC system, in addition to electricity or natural gas) significantly affects a facility’s total production cost, since the consumption of other fuel (i.e., diesel fuel, heavy fuel oil) is relatively high compared to the consumption of electricity or natural gas.

Of the surveyed facilities, 47% reported low to medium impact of energy prices to their overall costs.

Most industrial facilities that reported medium or high impact of energy cost also reported the use of diesel fuel. Industrial facilities with processes that require a heat source(s) are more affected by energy cost than other industrial facilities that use only electricity to operate their equipment.

It should be noted that nearly 82% of industrial facilities that reported medium or high impact of energy cost also reported monitoring their energy consumption. However, the survey data showed that this monitoring was done only by looking at energy use invoices and comparing them with previous months. Closer monitoring of energy use (e.g., by process or equipment) can indicate areas that would most benefit from energy-conserving improvements such as automating processes, controlling the operation of auxiliary systems (lighting, fans, pumps), and managing down energy use/demands at peak periods to avoid peak demand rates. Most of these industrial facilities reported that they have never conducted an energy audit.

Most of the surveyed facilities reported that the cost of water results in a low impact on their overall facility operating costs. Table 4 summarized water consumption and related costs to industry based on the Industry Survey of 400 facilities in Jordan.

¹ Size-based weighted average

² Size-based weighted average

USAID Water Reuse and Environmental Conservation Project
Completion Report For P2/EMS Assessments Of Partner Industrial Facilities

The majority (86%) of the surveyed industrial facilities do not monitor their water and/or energy consumption. This is a significant finding since current practices do not provide a system to identify process areas and auxiliary utilities with high water and energy consumption. Therefore, there is a lack of data on which to base specific actions to reduce consumption and operating costs.

Detailed survey findings are presented in the Industry Survey Report, prepared by AECOM under the project and submitted to USAID Jordan on 28 April 2012, ref. ACM-AID-0274.

3 ASSESSMENT IMPLEMENTATION STEPS

3.1 Training

Technical staff from 150 industrial facilities in Jordan received project-provided training on techniques for saving water and energy. The primary goal was to raise awareness about ways to increase their competitiveness in the global market through environmental responsibility. The training sessions were followed by the selection of 32 “industrial partners,” who received individualized technical assistance from the USAID WRECP.

The training sessions covered EMS, pollution prevention, and financing for green investments. The sessions addressed technical and financing options specific to each of five industrial sectors in Jordan:

1. Food supplies, agriculture and livestock
2. Engineering, electrical industries and information technology
3. Chemical and cosmetics
4. Therapeutics and medical devices
5. Packing, packaging, paper, carton and stationery

Case studies were presented, to demonstrate the tangible benefits of implementing P2 and environmental conservation measures. In the subsequent project assistance to the 32 project partners, the project team identified opportunities for cost savings and P2 through more efficient use of materials, energy, and water, and then evaluated the technical and economic feasibility of selected P2 options.

3.2 Knowledge Sharing

Aside from the training provided by the project team, the project partners also benefitted from the knowledge sharing facilitated by the Network for Jordanian Industrial Sustainability (The Network).

The Network is an initiative funded by the USAID Water Reuse and Environmental Conservation Project. It is meant to help enhance the industrial sector in Jordan by providing a platform for knowledge sharing and cross-sector communication.

The Network provides targeted access to information mostly tailored to the Jordanian context. It works to provide tools for industries that help improve their competitiveness through more efficient use of natural resources, such as water, other raw materials, and energy. For example, the resources on The Network offer concrete ways in which industrial facilities can:

- Use effective cooling systems to increase the efficiency of electrical motors
- Manage energy loads and redistribution of loads and pressure on adaptors
- Use high-efficiency motors and co-generation systems
- Use recovered heat energy
- Improve the efficiency of combustion
- Improve the efficiency of insulation for steam and hot water pipes
- Properly define production methods and the order of production lines to optimize the energy being used

The Network functions in two ways: through its interactive web portal (www.JordanNetwork.net) and through live events, such as workshops and training sessions,

as well as site/facility visits. Site/facility visits are conducted by Network teams to provide the facilities with information on best practices and technical solutions and/or improvements adopted by other facilities to solve similar issues.

On 10 December 2013, The Network was handed over to the Royal Scientific Society (RSS) for co-hosting with continued USAID WRECP support for one year. The RSS has committed to sustain The Network activities after USAID WRECP support has ended.

To date, The Network has hosted and/or co-hosted 25 live events with over 650 participants. The Network web portal includes over 930 resources, and has over 1,350 users. For more information, please contact info@JordanNetwork.net.

3.3 Performance and Benchmarking

The P2 assessments addressed material, energy and water consumption, as well as waste management, at the selected partner facilities.

To evaluate the facilities' performance in these areas, key performance indicators (KPIs) needed to be established. For energy and water, the KPIs often represent the total consumption divided by the total production in one year. For materials, it is the waste material generated divided by the total quantity of raw material consumed.

The project intended to compare the facility-specific KPIs to benchmarks available in equivalent industries worldwide. The P2 teams conducted a comprehensive search in the literature in an attempt to identify benchmark KPIs. However, in most cases, data was not available for equivalent industries. Therefore, it was agreed that the KPIs identified were primarily "internal" benchmarks for each facility to monitor its performance and evaluate improvements. The facility-specific KPIs are presented in each facility's P2 assessment report.

3.4 Assessments & Reports

P2 and EMS assessment activities began on 9 September 2012 and the last individual assessment was completed on 16 January 2014.

The P2 assessments were carried out following the *Guide to Pollution Prevention in Selected Jordanian Industries* prepared by the project to facilitate the assessment. The guide is also based on international references, including "Guide to Industrial Assessment for Pollution Prevention and Energy Efficiency", EPA/625/R- 99/003, June 2001 (EPA).

The P2 assessment phases are summarized in Figure 3:

- Planning and organization
- Assessment
- Evaluation and feasibility
- analysis
- Reporting
- Implementation and continuation

Project staff visited 31 of the 32 project partner facilities to conduct P2 assessments. One facility was not assessed at all due to its lack of responsiveness, following the signing of the MOU.

The P2 assessments were carried out by a team (the P2 team) comprising project team members (PTM) and facility team members (FTM). Focus areas at each facility were identified, specifically consumption of energy, use of water, management of raw materials,

and generation and management of waste. Detailed visits were carried out to collect necessary data and establish the material, water and energy flow analyses. The main facility inputs and outputs, together with an overview of the facility and key flows of environmental resources, were obtained. Data was obtained from the technical persons in charge and the records of the facility. The project had developed P2 assessment forms in advance of the site visits in order to provide a consistent format for data collection at all the partner facilities. These P2 assessment forms were used at each site. The consumption rates of resources and the overall amounts of waste material generated were documented. Environmental KPIs were determined and current facility performance to the KPIs was established.

A number of P2 options were generated by the team for each partner facility. These included directly implementable P2 options (no-cost/low-cost options) and P2 options that require a higher level of investment, as reviewed in consultation with the facility management. The PTM and FTM then selected a subset of P2 options that were then technically and financially analyzed.

Twenty-nine P2 Assessment Reports were completed. (Note: For one of the partners, the assessment findings for 3 separate facilities belonging to the same company were combined into one P2 assessment report.) Reports were submitted directly to each individual partner and a copy of each report was made available to USAID's designated Contracting Officer's Representative (COR) for confirmation.

Each partner facility agreed to execute a P2 implementation plan and the project will be providing advice and follow up during implementation. The facility must take periodic measurements where necessary and keep records concerning the implementation of the options. This information is to be used during the audit phase of the project in assessing the KPIs identified and the effectiveness of the implemented measures.

As the P2 assessments reports were completed, a separate project team of EMS experts began contacted the P2-assessed partner facilities to schedule the site visits for EMS assessments. Project staff visited 26 of the partner facilities to conduct EMS assessments. For one of the partners, the assessment findings for three separate facilities belonging to the same company were combined into one EMS assessment report. Three facilities were ISO 14001 certified; therefore, no EMS reports were prepared for those partners. The EMS assessments were intended to improve the industrial partners' understanding of the elements of the EMS outlined in the ISO 14001: 2004 international standard and enable a quick review of facility operations to determine how they measure up to the standard. These assessments served as the starting point of a gap analysis to identify management tools or other changes that might be implemented in the organizations to help improve overall environmental performance, including reductions in water use, energy consumption, raw material consumption, waste generation and other impacts.

The EMS assessments included several stages of documentation review and site assessment. The EMS assessment team carried out field visits of the partner facilities. During the visits, the team interviewed facility staff, reviewed EMS documentation, and explored the facilities' EMS.

The process started with a review of available documentation related to the facility's environmental performance, mainly the Industrial Pollution Prevention Assessment Reports prepared for each partner. These P2 report defined the key environmental concerns identified by the project's P2 assessment team. These concerns and identified areas for enhancing environmental performance were considered the milestones for defining environment-related objectives.

Other reports (e.g., legal requirements register - environment, water consumption monitoring, water quality tests, and external audit reports) that were made available by the partner facilities were reviewed to gain a better understanding of the environmental and management performance of the facilities. In addition, a pre-visit EMS questionnaire was completed by the facility, identifying the current status of compliance with the requirements of the ISO 14001: 2004 standard from the facility's point of view.

These documents were reviewed and validated by the EMS assessment team, which focused on identifying the current practices adopted by the facility and defining their level of satisfaction of the ISO 14001: 2004 standard. This process normally includes a minimum of one visit to the facility before the assessment team can define the gaps. Improvement recommendations to correct these gaps were shared and discussed with the facilities' representatives.

The EMS assessment reports described the partner facilities' readiness to fulfill the requirements of the ISO 14001: 2004 standard and to define their priorities for taking corrective actions to satisfy these requirements and bridge the identified gaps. Each report included a checklist assessing the level to which the current facility practices conform to the requirements, arranged in accordance with the structure/sub-clauses of the ISO 14001: 2004 standard.

After receiving the EMS assessment reports, the partner facilities are expected to develop a detailed EMS implementation plan to address the identified gaps.

Figure 4 provides a schematic description of the EMS assessment methodology.

As part of its EMS, each partner facility will need to establish, implement and maintain programs for achieving its objectives and targets. Program activities will include:

- Designation of responsibility for achieving objectives and targets at relevant functions and levels of the organization
- Designation of the means/resources and time-frame by which they are to be achieved

Twenty-six EMS assessment reports have been issued and delivered to the respective facilities (i.e., those that did not already have an EMS in place) and a copy of each report was made available to USAID's designated COR for confirmation.

3.5 Access to Finance

Recent surveys revealed that SMEs have to pay attention to environmental issues as one of the most important aspects of sustainability. SME owners are concerned about the environment; however, it is not a simple task to convert their concern into implementing P2 and/or EMS actions.

SMEs may lack the financial resources and/or the knowledge of how to implement environmentally friendly practices. Increasing SMEs awareness of environment regulations and standards is a challenge. In the surveys, a minority of SMEs adopted environmentally friendly actions to deal with issues such as recycling, renewable energy, energy savings and water conservation and reuse.

According to "Access to Finance for Small and Medium Enterprises in Jordan", August 2012, prepared as part of the project, the most critical issue facing most SME owners was financing environmental conservation and water treatment. SMEs experience difficulties in accessing banks and financial institutions to finance their projects. Possibly, the SMEs lack knowledge of finance, banking and/or the accounting techniques necessary to seek and obtain

financing. To overcome these obstacles, USAID WRECP is providing interested SMEs with technical assistance and access to green finance from commercial banks and donors in Jordan.

This project is providing technical support to assist in the completion of applications for financing upon request by an interested partner. In addition, upon request, further technical support may be provided to the partners, consisting of feasibility studies, designs, and cost analysis.

The project has produced “Access to Finance for Small and Medium Enterprises in Jordan”, August 2012, and the leaflet entitled “How to Obtain Funding for Green Water and Energy Investments”. This information is intended to present SMEs’ P2/EMS Implementation Plans to the agencies and banks that offer affordable financing for such investments. Significant sources of financing were identified, and detailed guidance for obtaining financing for implementation of P2 and environmental conservation measures was provided, to enable the selected project partners to pursue the suggested P2 measures. Additional information on the financing aspects of implementation was provided in training modules.

4 RESULTS ANALYSIS

The results of the P2 assessments, specifically the optional actions for savings in the water, energy, and material usage and waste disposal areas, provide a road-map for potential investors to identify industrial sectors and technologies in which to invest. A range of options with varying payback periods are identified for consideration by the project partners and potential investors. Special focus is given to options in the “good practice and awareness” category, since they have the shortest payback period; however, all financially feasible options/interventions were provided to the project partners (in the facility-specific P2 assessment reports) to consider in developing facility-specific action/implementation plans.

4.1 Raw data

Options for P2 were developed for each of the assessed facilities. Table 5 summarizes and compares the potential savings associated with the estimated costs to implement 13 categories of P2 options across 5 industrial sectors.

Overall, 293 implementation options have been proposed for the project partners as a result of the P2 assessments. The total implementation cost of those options is estimated to be 7.8 million JODs.

There is a high variation in the investment cost of the different options, due to the unique nature of the options. Some options relate to general maintenance that requires low investment cost and have relatively short payback periods in general; other options, such as electricity generation through PV energy, require high investment cost and longer payback periods.

4.2 Selection Criteria and Data Screening

Based on the experience gained from the industrial survey and the P2/EMS assessments, the following observations can be made:

- Facilities’ owners and managers favor options with short payback periods over other options. Options with payback periods less than or equal to 1.5 years are likely to be directly adopted and implemented.
- Options with payback periods between 1.5 and 3.0 years have a good chance to be considered for immediate or future implementation.
- Options with payback periods of more than 3.0 years have a poor chance to be considered and implemented.

Table 6 summarizes the investment values for the P2 options for the above-mentioned payback periods.

Figure 5 graphically represents the proposed P2 options categorized by payback period intervals for all of the proposed options. Figure 6 graphically represents the proposed shorter payback period options only (i.e., those with payback periods of less than 3.0 years) and only compares proposed costs of options with payback periods of less than or equal to 1.5 years and of payback periods between 1.5 and 3.0 years.

4.3 Analysis Results and Data Interpretation

Investment costs and payback periods for 13 categories of options across 5 industrial sectors are summarized both in Table 7 and Table 8 for options with payback period ranges of less than or equal to 1.5 years and 1.5-3.0 years, respectively. Note that the P2 options with payback periods greater than 3 years were presented in the facility-specific P2 assessment reports. A summary of the results is presented, below, by industrial sector.

Chemical and Cosmetics Sector

In the “Chemical and cosmetics” sector, a total of 5.9 million JOD of improvements were identified (by far the largest for the five sectors) with an average payback period of 1.7 years.

Analysis of the proposed options with payback periods in the range of less than or equal to 1.5 years revealed that options that relate to general maintenance (boiler calibration and insulation, network and devices maintenance, air compressors, etc.) correlate to reasonable investment cost and shorter payback periods. For example, P2 options with a total of 22,000 JOD and 26,000 JOD in costs were proposed under the categories of “Air Compressors (Air Leaks and Air Pressure Adjustment)” and “Boilers (Calibration and Insulation)”, respectively. The average payback periods for the proposed groups were 0.3 and 0.7 year, respectively.

The relatively low investment costs for P2 options related to maintenance for this sector make these options more attractive for implementation by facility managers and owners than other P2 options with similar payback periods.

Similarly attractive are P2 options for this sector that fall under the category of “Material (Handling & Alternatives)” with a total investment cost of 96,000 JODs and an average payback period of 0.6 years.

Engineering Sector

In the “Engineering” sector, a total of 1.3 million JOD of improvement were identified with an average payback period of 2.2 years.

Analysis of the proposed options with a payback period in the range of less than or equal to 1.5 years revealed that options that relate to general maintenance, such as boiler calibration and insulation, correlate to moderate investment cost and shorter payback periods. P2 options with a total of 20,000 JOD and an average payback period of 0.7 year were proposed under this category.

The “Engineering” sector’s attention should be directed to options that correlate to lighting. P2 options with a total of 73,000 JOD and with an average payback period of 1.3 year were proposed under this category.

Food Sector

In the “Food” sector, a total of 275,000 JOD of improvements were identified with an average payback period of 2.0 years.

Analysis of the proposed options with a payback period in the range of less than or equal to 1.5 years revealed that most of the proposed P2 options for this sector fall under “Good Practice and Awareness”. The proposed options under this category had an investment value of 24,100 JOD and an average payback period of 0.7 year.

The relative low investment costs and the short payback periods for P2 options that fall under the “Boilers (Calibration and Insulation)” category make them attractive to this sector. P2 options with a total of 19,500 JOD and payback period of 0.7 year were proposed to the “Food” sector under this category.

Medical Devices Sector

In the “Medical Devices” sector, a total of 86,000 JOD of improvements were identified with an average payback period of 1.6 years.

Analysis of the proposed options with a payback period in the range of less than or equal to 1.5 years revealed that options that relate to general maintenance (like boiler calibration and insulation, network and devices maintenance, air compressors, etc.) correlate to likely acceptable investment cost and shorter payback periods. All such P2 options for this sector totaled 23,500 JOD, with an average payback period of 0.5 year.

Options with shortest payback period fall under the categories for “Good Practices and Awareness” and “Water Treatment (Reuse and Recycle)”. It should be noted that only three of our partners (out of 32) come from this sector.

Paper Sector

In the “Paper” sector, a total of 227,000 JOD of improvements were identified with an average payback period of 1.1 years.

Analysis of the proposed options with a payback period in the range of less than or equal to 1.5 years revealed that options that relate to general maintenance (like boilers calibration and insulation, network and devices maintenance, air compressors, etc.) correlate to likely acceptable investment cost and shorter payback periods. For example, P2 options under the category for “Boilers (Calibration and Insulation)” had a total investment cost of 57,000 JOD and an average payback period of 0.6 year; and P2 options under the category for “Material Handling and Alternatives” had a total investment cost of 77,000 JOD and an average payback period of 0.7 years.

4.4 Results Projection

The average of the investment opportunities per partner facility was calculated in each of the five industrial sectors. The total Kingdom-wide investment opportunities per sector were calculated by multiplying the average investment opportunities per partner facility per sector by the total number of facilities (including non-partners) under each sector. Table 9 summarizes the estimated investment opportunities for P2 improvements in Jordanian Industrial Sectors.

Analysis of investment options with payback periods of less than or equal to 1.5 years shows that the “Engineering” sector has the most opportunity for improvement with an estimated investment value of 160 million JOD, followed by the “Paper & Packaging” sector with an estimated investment value of 30 million JOD.

The investment opportunities with payback periods of less than or equal to 1.5 years for P2 improvements in other sectors are estimated to cost 22 million JOD, 11 million JOD, and 682,000 JOD for the “Food”, “Chemicals”, and “Medical Devices” sectors, respectively.

The investment opportunities across Jordan for all 5 sectors total 364 million JOD.

5 UPCOMING STEPS

After receiving the P2/EMS reports, facilities received a post-report delivery visit to explain/discuss the reports with the related facility's management and to help them draft a P2 implementation plan. Each industrial facility was requested to execute a P2 implementation plan as agreed-to in the MOU.

The project is providing advice and follow-up during implementation, which is on-going at this time. Each facility was requested to take periodic measurements where necessary and keep records concerning the implementation of the options. This information will be used during the audit phase of the project in assessing performance relative to the KPIs identified and the effectiveness of the implemented measures.

This P2 assessment was an integral component of the EMS assessment conducted by the project EMS assessment team. The P2 assessment provides a step toward development of a comprehensive EMS, with the identification of sources of environmental inefficiencies and options to mitigate them. The list of recommended P2 options in each P2 assessment report helps identify the environmental aspects and impacts, as well as objectives and targets that are recommended in each facility's EMS (and are requirements of the ISO 14001: 2004 international standard).

After the facility has had time to develop and implement the recommendations of the P2 and EMS assessments, the project will conduct an audit of each facility to evaluate how the implementation of recommended options has progressed.

By the end of the project, the P2 Task will have generated two reports for each facility (a P2 assessment report and an EMS assessment report), as well as this P2/EMS summary report. Furthermore, once the audits have been completed, an audit summary report will be prepared.

The audit summary report will include the results of the audits, summarizing the impact of the implemented options and highlighting success stories from various industry partners. The audit report will be published in a way that respects the non-disclosure agreements that were signed with the project partners.

Toolkits to help other industrial facilities (i.e., non-project partners) conduct their own P2/EMS assessments are being prepared by the project. These toolkits will be published under The Network for Jordanian Industrial Sustainability web portal; www.JordanNetwork.net.

6 CONCLUSIONS

This report contains a large quantity of data that can be used to inform a wide variety of interests and perspectives. Looking beyond the 31 partner facilities discussed in this report, we can utilize the data gathered to project potential savings across the entire Jordanian industrial community. Ultimately, Jordan will benefit from the implementation of the recommended options beyond the 31 partner facilities, by becoming more globally competitive through reduced costs associated with lower energy consumption, lower water usage, lower raw materials usage, and reduced waste generation.

Conclusions based on the experience gained through assessing the project partners are summarized below.

Water

Current water prices appear to have a minor effect on the overall cost of most products manufactured in Jordan. This conclusion is supported by survey results indicating that almost 79% of the facilities' owners/managers share this belief. The current water tariff does not incentivize facility owners to invest in water-reducing devices or other water usage reduction techniques/processes.

The project's financial analysis concluded that this fact will remain valid even if a future tariff is imposed to ensure a full cost-recovery value. Many conclusions and recommendations can be derived from this fact, including but not limited to the following:

- It is challenging to convince facilities' owners/management to adopt water-saving measures based on the current water tariffs.
- Increasing the water tariff for industrial users could incentivize the industrial sector to use water more efficiently (i.e., using less fresh water and recycling/reusing certain industrial wastewaters).
- Ministry of Water and Irrigation and the related bodies may want to consider factors other than the financial ones in determining current and future water tariffs for the industrial sector. Other drivers in this regards may include scarcity of water resources, sustainability, and investors' responsibilities to the community.
- Legislation regarding fresh and reclaimed water use for the industrial sector, as well as regarding industrial wastewater effluent quality, may need to be revised.

Energy

The total cost of energy for industrial facilities depends on the cost of electricity and of other sources of energy, such as fuel oil, diesel, and liquefied petroleum gas (LPG). Using more than one source of energy (such as diesel fuel or heavy fuel oil to produce steam or hot water or to fuel the HVAC system, in addition to electricity or natural gas) significantly affects a facility's total production cost, since the consumption of other fuel (i.e., diesel fuel, heavy fuel oil) is relatively high compared to the consumption of electricity or natural gas. The implementation of P2 options related to energy that were identified by the project can provide significant financial savings for, as well as a reduction in pollution (e.g., carbon dioxide (CO₂), sulfur dioxide (SO₂), nitrogen oxides (NO_x), and particulates) from, the partner facility. It can also provide a roadmap for non-partner facilities to achieve similar savings and pollution reductions.

Based on the current (2012) tariffs and prices for selling electricity back to the grid, the payback periods for the proposed PV system options varied from 8 to 10 years. Facilities' owners/managers are likely to determine that the investment cost to implement power generation through PV is too high and the payback period is too long to make adopting such systems financially feasible.

Five PV electricity generation systems with an estimated implementation cost of approximately 2.3 million JOD were proposed to the project partners. Financial savings that would result from these investments were estimated based on the electricity tariff for calendar year 2013. In addition to longer payback periods, the high investment costs for PV electricity generating systems are a barrier to installing them in Jordanian industrial sectors in general.

Financial analysis carried out for the investigated PV systems showed that these options will remain likely infeasible even if the tariff went up according to the published policy in this regards.

As stated in an article on *renewableenergyworld.com* on December 12, 2012, “The Jordanian government ... subsidizes more than half the cost of electricity to consumers.” Over the past few years, new tariff implementation has resulted in increased costs of electricity to consumers. Over the same time period, Jordan’s Electricity Regulatory Commission introduced tariffs to be paid for generation from various renewable technologies. At the time of writing of this report, it is noted that the electricity tariff is changing, yet again. The announced strategy in this regard states that the electricity tariff will be eliminated by 2017.

Incentive schemes developed and promoted by the GoJ are worth further consideration to attract the industrial sector to investments in renewable energy. Such schemes may include implementing more favorable rates for buying/selling electricity from off-grid PV systems for the industrial sector. More broadly, governmental incentives for investments in renewable energy sources within Jordan could provide relief from Jordan’s dependence on natural gas imports, which are under threat from regional instability, and ease financial pressure on the GoJ treasury resulting from its subsidizing the cost of electricity to consumers.

The fact that energy use prices are supplemented by the government and that there is a lack of incentive to reduce energy use, may explain the circumstance whereby the majority of industrial facilities (86%) in Jordan do not monitor their energy consumption. While the industries monitor overall energy consumption (i.e., via their main facility meters), they generally do not utilize meters on significant consumptive units (e.g., hot water systems, HVAC systems and production lines) to monitor the energy balance in their facilities. Without the more detailed unit-specific usage data, it is difficult to target where the most significant improvement/savings could be gained. Further, many facilities are not attentive to maintenance activities, in general, despite the low investment cost and, in many cases, relatively high cost savings that could result. For example, many investment options that relate to general maintenance can be recovered within a payback period of (or less than) one year. The demonstrated value of such maintenance activities should provide significant incentive for implementation of these options by industrial facilities.

Materials and Waste

The P2 assessments identified many options for partner facilities to reduce raw materials consumption and waste generation. The types of reductions proposed were very site specific and not easily quantified and/or compared from facility to facility; therefore, there are no comparison tables in this report for materials and waste corresponding to those for the water and energy options.

The individual partner reports provide materials and waste P2 options, including investment cost and financial savings when the partners were able to provide sufficient data.

The types of reductions in raw materials consumption proposed included items specific to the industry type. Examples of raw materials reductions included the following:

- Chemicals, including volatile organic compounds (VOCs), paints, metals, lead, and limestone
- Packaging materials, including cardboard, plastic, paper, and Styrofoam
- Food products, including chickens, beef, vegetables, spices, herbs, and cooking oils

The types of reductions in waste generation proposed in the P2 options were also specific to the industry type, and in many cases, projected a reduction in water and energy use, as well as a reduced load on wastewater treatment (either on site or off site) and/or improved wastewater effluent quality. In some cases, the raw materials options proposed conservation so that waste would not be generated from the start (or a reduced amount of waste would be generated). In other options, the option proposed included reuse of the waste on site or by third-parties as a substitute for a raw material. Other waste options proposed recycling of the

wastes generated to recover valuable raw materials and reduce the amount of material being sent to landfills. Examples of the types of wastes proposed for recycling or reuse included the following:

- Slag and lead waste
- Toxic and other hazardous wastes
- Food waste
- Wastewater, including lower biological oxygen demand (BOD) and chemical oxygen demand (COD)

There were also intangible benefits identified from the materials and waste options, such as:

- Reduced risk of employee (and facility neighbors') exposure to toxic and other harmful chemicals
- Improved industrial hygiene of facility workers
- Improved housekeeping and inventory systems
- Reduced odors
- Reduced risk of fires and explosions
- Reduced risk of spills and losses (including dusts), lowering the risk of air, soil and groundwater contamination
- Reduced pressure on landfills
- Improved employee job satisfaction
- Improved community relations

Extrapolation of Data

Using the data collected from in-depth assessments of 31 industrial partners, we have extrapolated savings to quantify the potential saving of energy, conservation of water, reduction in raw material usage, and reduction in waste generation at a macro-economic level across the entire Kingdom of Jordan. In extrapolating the data over the known industrial facilities in Jordan, the following assumptions are made:

- Baseline consumption is drawn from the findings of the survey of 398 facilities across five sectors (Industry Survey Report, June 2012).
- Potential savings are based on findings from the detailed assessment of 31 partner facilities across the same five sectors, as summarized in this report.
- Potential savings identified in each of the five sectors are representative of all industrial facilities in the same sector Kingdom-wide.
- The number of facilities in each sector in Jordan is based on the Jordan Chamber of Industries, Board of Directors Report, 2013.

Table 10 provides a tally of the facilities considered in this extrapolation of data.

Based on these assumptions, there is substantial opportunity for improvement within these five industrial sectors in Jordan, specifically to:

- Reduce water consumption by 869,506 cubic meters per year
- Reduce energy consumption by 656,733 megawatt-hours per year
- Reduce materials lost as waste and realize JOD 8,665,240 in potential savings

Environmental Management Systems

There was a wide range of understanding of EMS amongst the facility partners visited. Some already had or used to maintain ISO 14001: 2004 certification. Others were not familiar at all with the concepts and principals of EMS.

The vast majority of the 26 facilities visited had little-to-no conformity with the sub-clauses of the ISO 14001:2004 standard. The one-on-one meetings held between the project EMS experts and the partners served as an excellent educational outreach, heightening awareness of the concepts and elements of a comprehensive EMS to the partner facilities' management.

During the P2/EMS audit phase, the project will assess the partners' implementation of EMS concepts at their facilities.

TABLES

Table 1: Level of Cooperation the Project Partners Showed to P2/EMS Assessors throughout the Assessment Phase

WRECP Partner Info.			Assessment Phase
No.	Facility Size	Sector	Partners Cooperation Level with the Assessments
1	Large	Food and Agriculture	Good
2	Small	Packaging	Good
3	Medium	Chemical	Excellent
4	Medium	Food	Excellent
5	Large	Food	Excellent
6	Medium	Chemical	Good
7	Medium	Chemical	Excellent
8	Large	Food	Excellent
9	Medium	Medical Devices	Good
10	Medium	Engineering	Fair
11	Medium	Packaging	Good
12	Medium	Chemical	Excellent
13	Medium	Chemical	Excellent
14	Medium	Chemical	Excellent
15	Small	Food	Fair
16	Medium	Chemical	Excellent
17	Medium	Engineering	Good
18	Medium	Chemical	Fair
19	Medium	Food	Excellent
20	Medium	Packaging	Good
21	Large	Engineering	Fair
22	Large	Engineering	Excellent
23	Small	Chemical	Fair
24	Medium	Chemical	Excellent
25	Medium	Chemical	Fair
26	Small	Chemical	Good
27	Large	Medical Devices	Good
28	Medium	Packaging	Good
29	Medium	Food	Good
30	Medium	Packaging	Good
31	Medium	Medical Devices	Fair
Summary			
Number of small size facilities			4
Number of medium size facilities			21
Number of large size facilities			6
Number of facilities that showed "Excellent" Level of Cooperation			12
Number of facilities that showed "Good" Level of Cooperation			12
Number of facilities that showed "Fair" Level of Cooperation			7
Number of facilities that showed "Poor" Level of Cooperation			0

Table 2: P2 Options/Sector-Based Investment and Savings

Options Categories	Chemical and cosmetics	Engineering	Food	Medical Devices	Paper	Grand Total	Payback Period (yr)
Boilers (Calibration & Insulation)							
Sum of Proposed Investment (JOD)	47,950	47,500	29,500	15,300	63,500	203,750	0.7
Sum of Financial savings (JOD/yr)	62,300	34,000	41,260	14,650	120,920	273,130	
Number of Proposed Options	11	5	16	7	5	44	
Good practices & Awareness							
Sum of Proposed Investment (JOD)	17,900	1,500	38,100	5,100	1,100	63,700	0.3
Sum of Financial savings (JOD/yr)	30,410	10,360	63,250	135,300	2,000	241,320	
Number of Proposed Options	17	3	18	2	3	43	
Lighting							
Sum of Proposed Investment (JOD)	9,350	90,016	55,871	3,020	5,630	163,887	1.8
Sum of Financial savings (JOD/yr)	3,590	61,600	20,760	1,060	2,800	89,810	
Number of Proposed Options	3	7	11	2	4	27	
Maintenance (Network & Devices)							
Sum of Proposed Investment (JOD)	23,300	1,800	7,800	6,500	16,200	55,600	1.2
Sum of Financial savings (JOD/yr)	16,100	2,020	6,900	11,930	9,200	46,150	
Number of Proposed Options	10	4	7	3	2	26	
Material Handling & Alternatives							
Sum of Proposed Investment (JOD)	2,745,421	8,200	8,900	7,500	77,100	2,847,121	3.9
Sum of Financial savings (JOD/yr)	608,400	17,350	26,473	2,500	70,450	725,173	
Number of Proposed Options	23	5	8	3	5	44	
Others							
Sum of Proposed Investment (JOD)	3,700	17,200	100			21,000	2.2
Sum of Financial savings (JOD/yr)	1,600	7,600	300			9,500	
Number of Proposed Options	4	3	1			8	
Photovoltaic (PV) Energy							
Sum of Proposed Investment (JOD)	1,540,000	900,000				2,440,000	9.2
Sum of Financial savings (JOD/yr)	180,700	84,000				264,700	
Number of Proposed Options	2	2				4	
Power Quality (Factors)							
Sum of Proposed Investment (JOD)	61,500		10,500	3,500		75,500	1.1
Sum of Financial savings (JOD/yr)	51,150		11,477	9,000		71,627	
Number of Proposed Options	3		1	2		6	

Table 2: P2 Options/Sector-Based Investment and Savings

Options Categories	Chemical and cosmetics	Engineering	Food	Medical Devices	Paper	Grand Total	Payback Period (yr)
Pumps & Fans (Variable Speed Drives)							
Sum of Proposed Investment (JOD)	4,500		16,400		3,700	24,600	2.7
Sum of Financial savings (JOD/yr)	930		6,650		1,450	9,030	
Number of Proposed Options	1		5		1	7	
Solar Thermal							
Sum of Proposed Investment (JOD)	75,000	16,000	71,500	400	50,000	212,900	3.4
Sum of Financial savings (JOD/yr)	24,555	5,000	21,400	200	11,600	62,755	
Number of Proposed Options	2	1	5	1	1	10	
Cooling System (Chillers, Towers, etc)							
Sum of Proposed Investment (JOD)	1,335,725	13,675	10,970	1,200	1,542	1,363,112	4.5
Sum of Financial savings (JOD/yr)	285,950	7,400	5,220	1,010	3,000	302,580	
Number of Proposed Options	12	1	5	1	2	21	
Water Audits & Saving Devices							
Sum of Proposed Investment (JOD)	12,000	10,800	9,950	2,100	2,000	36,850	0.5
Sum of Financial savings (JOD/yr)	51,510	12,950	9,940	2,600	1,850	78,850	
Number of Proposed Options	4	5	9	2	1	21	
Air Compressors (Air Leaks & Pressure adjustment)							
Sum of Proposed Investment (JOD)	22,900		12,200	41,000	5,900	82,000	0.2
Sum of Financial savings (JOD/yr)	457,240		13,950	7,350	19,480	498,020	
Number of Proposed Options	6		7	3	8	24	
Water Treatment (Reuse & Recycle)							
Sum of Proposed Investment (JOD)	14,800	200,000	3,000	100	100	218,000	3.3
Sum of Financial savings (JOD/yr)	16,240	44,000	4,770	600	100	65,710	
Number of Proposed Options	4	1	1	1	1	8	
Total Sum of Proposed Investment (JOD)	5,914,046	1,306,691	274,791	85,720	226,772	7,808,020	-
Total Sum of Financial savings (JOD/yr)	1,790,675	286,280	232,350	186,200	242,850	2,738,355	-
Total Number of Proposed Options	102	37	94	27	33	293	-

Table 3: Electricity Consumption and its Impact to Overall Cost (Based on Industry Survey of 400 Facilities in Jordan)

ID	Sector	Average Electric Consumption (kWh/month)				Electricity Price Impact (Nos)				
		Small-size Facilities	Medium-size Facilities	Large-size Facilities	Weighted Avg.	Impact Type	Small-size Facilities	Medium-size Facilities	Large-size Facilities	Weighted Avg.
1	Agriculture, food and livestock	46,461	157,090	487,302	129,074	High	13	12	4	12
						Medium	23	20	1	20
						Low	22	22	2	20
2	Chemicals and cosmetics	37,033	697,849	190,862	214,064	High	7	8		7
						Medium	4	3		3
						Low	43	9	3	32
3	Engineering, Electrical industries and information technology	21,138	161,690	351,922	101,640	High	10	6		8
						Medium	9	6	4	7
						Low	28	26	2	25
4	Therapeutic and medical devices	22,152	105,158	601,729	157,484	High	2	2	1	2
						Medium	1	6	3	4
						Low	8	6	1	6
5	Packing, packaging, paper, cartons and stationery	54,489	200,333	2,690,931	238,700	High	18	10	1	14
						Medium	11	11	2	11
						Low	17	9	1	13

Table 4: Water Consumption and its Impact to Overall Cost

ID	Sector	Average Water Consumption (m ³ /month)				Water Price Impact (Nos)				
		Small-size Facilities	Medium-size Facilities	Large-size Facilities	Weighted Avg.	Impact Type	Small-size Facilities	Medium-size Facilities	Large-size Facilities	Weighted Avg.
1	Agriculture, food and livestock	735	2,100	10,242	2,062	High	3	3	2	3
						Medium	13	7	2	9
						Low	41	43	5	39
2	Chemicals and cosmetics	342	5,271	5,948	1,945	High	2	2		2
						Medium	7	2	1	5
						Low	45	16	2	35
3	Engineering, Electrical industries and information technology	212	930	1,679	609	High		1		0
						Medium	6	2	4	4
						Low	41	35	2	36
4	Therapeutic and medical devices	330	627	1,654	689	High		1		0
						Medium	3	2	1	2
						Low	8	11	4	9
5	Packing, packaging, paper, cartons and stationery	82	748	46,903	2,641	High		1		0
						Medium	3	3		3
						Low	44	26	4	35

Table 5: P2 Options/Sector-Based Investment and Payback Analysis

P2 Options Category	Chemical and Cosmetics	Engineering	Food	Medical Devices	Paper	Grand Total
Air Compressors (Air Leaks & Pressure adjustment)						
Proposed Investment (JOD)						
Sum	22,900		12,200	41,000	5,900	82,000
Average	3,817		1,743	13,667	738	3,417
Min	100		200	200	100	100
Max	20,000		4,800	40,000	2,400	40,000
Payback Period (yr)						
Averag	0.7		1.3	2.7	0.7	1.1
Min	0.0		0.0	0.4	0.1	0.0
Max	2.4		3.3	6.7	3.6	6.7
Boilers (Calibration & Insulation)						
Proposed Investment (JOD)						
Sum	47,950	47,500	29,500	15,300	63,500	203,750
Average	4,359	9,500	1,844	2,186	12,700	4,631
Min	1,000	1,000	500	600	1,000	500
Max	18,000	17,000	4,000	4,000	52,000	52,000
Payback Period (yr)						
Averag	1.0	2.0	1.6	1.7	1.1	1.5
Min	0.2	0.3	0.3	0.4	0.2	0.2
Max	3.0	3.5	5.9	3.0	1.8	5.9
Cooling System (Chillers, Towers, etc)						
Proposed Investment (JOD)						
Sum	1,335,725	13,675	10,970	1,200	1,542	1,363,112
Average	111,310	13,675	2,194	1,200	771	64,910
Min	1,000	13,675	800	1,200	300	300
Max	1,250,000	13,675	3,300	1,200	1,242	1,250,000
Payback Period (yr)						
Averag	1.9	1.8	2.1	1.2	0.5	1.8
Min	0.4	1.8	1.1	1.2	0.2	0.2
Max	6.0	1.8	4.1	1.2	0.8	6.0

Table 5: P2 Options/Sector-Based Investment and Payback Analysis

P2 Options Category	Chemical and Cosmetics	Engineering	Food	Medical Devices	Paper	Grand Total
Good Practices & Awareness						
Proposed Investment (JOD)						
Sum	17,900	1,500	38,100	5,100	1,100	63,700
Average	1,053	500	2,117	2,550	367	1,481
Min	200	200	100	100	100	100
Max	5,000	1,000	12,500	5,000	500	12,500
Payback Period (yr)						
Averag	1.0	0.5	1.6	0.2	0.6	1.1
Min	0.2	0.1	0.2	0.0	0.2	0.0
Max	5.0	0.8	12.5	0.3	1.0	12.5
Lighting						
Proposed Investment (JOD)						
Sum	9,350	90,016	55,871	3,020	5,630	163,887
Average	3,117	12,859	5,079	1,510	1,408	6,070
Min	400	450	700	700	270	270
Max	5,250	59,500	16,296	2,320	2,460	59,500
Payback Period (yr)						
Averag	3.2	2.4	3.4	2.6	2.3	2.9
Min	2.2	1.0	1.4	2.0	1.0	1.0
Max	4.4	4.3	5.5	3.3	3.4	5.5
Maintenance (Network & Devices)						
Proposed Investment (JOD)						
Sum	23,300	1,800	7,800	6,500	16,200	55,600
Average	2,330	450	1,114	2,167	8,100	2,138
Min	300	100	400	1,000	200	100
Max	15,000	800	2,000	3,500	16,000	16,000
Payback Period (yr)						
Averag	1.6	1.2	3.2	1.3	1.1	1.9
Min	0.3	0.6	0.2	0.1	0.1	0.1
Max	6.0	2.5	8.0	2.8	2.1	8.0

Table 5: P2 Options/Sector-Based Investment and Payback Analysis

P2 Options Category	Chemical and Cosmetics	Engineering	Food	Medical Devices	Paper	Grand Total
Material Handling & Alternatives						
Proposed Investment (JOD)						
Sum	2,745,421	8,200	8,900	7,500	77,100	2,847,121
Average	119,366	1,640	1,113	2,500	15,420	64,707
Min	200	200	100	500	100	100
Max	1,912,721	5,000	2,000	5,000	70,000	1,912,721
Payback Period (yr)						
Averag	1.8	1.2	1.1	2.8	0.7	1.5
Min	0.1	0.1	0.1	1.7	0.2	0.1
Max	9.1	2.0	2.0	5.0	1.1	9.1
Others						
Proposed Investment (JOD)						
Sum	3,700	17,200	100			21,000
Average	925	5,733	100			2,625
Min	200	200	100			100
Max	1,500	12,000	100			12,000
Payback Period (yr)						
Averag	3.0	2.0	0.3			2.3
Min	0.7	0.2	0.3			0.2
Max	7.5	4.6	0.3			7.5
Photovoltaic (PV) Energy						
Proposed Investment (JOD)						
Sum	1,540,000	900,000				2,440,000
Average	770,000	450,000				610,000
Min	290,000	350,000				290,000
Max	1,250,000	550,000				1,250,000
Payback Period (yr)						
Averag	9.5	10.7				10.1
Min	8.1	10.6				8.1
Max	10.9	10.8				10.9

Table 5: P2 Options/Sector-Based Investment and Payback Analysis

P2 Options Category	Chemical and Cosmetics	Engineering	Food	Medical Devices	Paper	Grand Total
Power Quality (Factors)						
Proposed Investment (JOD)						
Sum	61,500		10,500	3,500		75,500
Average	20,500		10,500	1,750		12,583
Min	500		10,500	1,000		500
Max	45,000		10,500	2,500		45,000
Payback Period (yr)						
Averag	0.9		0.9	0.4		0.8
Min	0.3		0.9	0.2		0.2
Max	2.0		0.9	0.6		2.0
Pumps & Fans (Variable Speed Drives)						
Proposed Investment (JOD)						
Sum	4,500		16,400		3,700	24,600
Average	4,500		3,280		3,700	3,514
Min	4,500		1,000		3,700	1,000
Max	4,500		8,600		3,700	8,600
Payback Period (yr)						
Averag	4.8		2.8		2.6	3.1
Min	4.8		1.1		2.6	1.1
Max	4.8		5.6		2.6	5.6
Solar Thermal						
Proposed Investment (JOD)						
Sum	75,000	16,000	71,500	400	50,000	212,900
Average	37,500	16,000	14,300	400	50,000	21,290
Min	30,000	16,000	1,500	400	50,000	400
Max	45,000	16,000	28,000	400	50,000	50,000
Payback Period (yr)						
Averag	3.1	3.2	3.2	2.0	4.3	3.2
Min	2.8	3.2	2.7	2.0	4.3	2.0
Max	3.4	3.2	4.0	2.0	4.3	4.3

Table 5: P2 Options/Sector-Based Investment and Payback Analysis

P2 Options Category	Chemical and Cosmetics	Engineering	Food	Medical Devices	Paper	Grand Total
Water Audits & Saving Devices						
Proposed Investment (JOD)						
Sum	12,000	10,800	9,950	2,100	2,000	36,850
Average	3,000	2,160	1,106	1,050	2,000	1,755
Min	500	800	50	100	2,000	50
Max	10,000	3,000	4,000	2,000	2,000	10,000
Payback Period (yr)						
Averag	1.0	1.3	1.1	0.6	1.1	1.1
Min	0.2	0.5	0.2	0.2	1.1	0.2
Max	2.5	2.0	2.5	1.0	1.1	2.5
Water Treatment (Reuse & Recycle)						
Proposed Investment (JOD)						
Sum	14,800	200,000	3,000	100	100	218,000
Average	3,700	200,000	3,000	100	100	27,250
Min	800	200,000	3,000	100	100	100
Max	12,000	200,000	3,000	100	100	200,000
Payback Period (yr)						
Averag	1.1	4.5	0.6	0.2	1.0	1.4
Min	0.2	4.5	0.6	0.2	1.0	0.2
Max	2.6	4.5	0.6	0.2	1.0	4.5
Proposed Investment (JOD)						
Sum	5,914,046	1,306,691	274,791	85,720	226,772	7,808,020
Average	57,981	35,316	2,923	3,175	6,872	26,649
Min	100	100	50	100	100	50
Max	1,912,721	550,000	28,000	40,000	70,000	1,912,721
Payback Period (yr)						
Averag	1.7	2.2	2.0	1.6	1.1	1.8
Min	0.0	0.1	0.0	0.0	0.1	0.0
Max	10.9	10.8	12.5	6.7	4.3	12.5

Table 6: P2 Proposed Options Categorized by Payback Period Intervals

ID	Options Categories	Proposed Investment (JOD)					P2 Proposed Investment (JOD)														
		Max	Min	Average	Standard Deviation	Sum	Max.			Min.			Average			Standard Deviation			Sum.		
							Payback Period (years)			Payback Period (years)			Payback Period (years)			Payback Period (years)			Payback Period (years)		
							<=1.5	1.5-3	>3	<=1.5	1.5-3	>3	<=1.5	1.5-3	>3	<=1.5	1.5-3	>3	<=1.5	1.5-3	>3
1	Air Compressors (Air Leaks & Pressure adjustment)	40,000	100	3,417	8,770	82,000	20,000	2,400	40,000	100	1,200	2,000	1,778	1,867	14,800	4,675	611	21,825	32,000	5,600	44,400
2	Boilers (Calibration & Insulation)	52,000	500	4,631	8,403	203,750	52,000	18,000	10,500	800	500	1,000	4,998	4,020	4,500	10,119	5,431	5,220	129,950	60,300	13,500
3	Cooling System (Chillers, Towers, etc)	1,250,000	300	64,910	271,707	1,363,112	42,500	13,675	1,250,000	300	1,200	2,500	6,510	4,543	418,590	11,883	5,162	720,022	84,627	22,715	1,255,770
4	Good practices & Awareness	12,500	100	1,481	2,126	63,700	5,000	200	12,500	100	200	500	1,276	200	3,750	1,313		5,838	48,500	200	15,000
5	Lighting	59,500	270	6,070	11,553	163,887	59,500	12,600	16,296	700	700	270	19,559	4,082	3,333	27,146	3,738	4,979	78,235	48,984	36,668
6	Maintenance (Network & Devices)	16,000	100	2,138	4,009	55,600	2,000	16,000	15,000	100	400	400	873	3,783	3,960	658	6,086	6,199	13,100	22,700	19,800
7	Material Handling & Alternatives	1,912,721	100	64,707	295,298	2,847,121	70,000	300,000	1,912,721	100	200	1,000	6,266	34,744	392,120	16,530	99,481	763,216	181,700	312,700	2,352,721
8	Photovoltaic (PV) Energy	1,250,000	290,000	610,000	440,908	2,440,000			1,250,000			290,000			610,000			440,908			2,440,000
9	Power Quality (Factors)	45,000	500	12,583	17,022	75,500	16,000	45,000		500	45,000		6,100	45,000		6,850			30,500	45,000	
10	Pumps & Fans (Variable Speed Drives)	8,600	1,000	3,514	2,632	24,600	1,200	8,600	4,500	1,200	1,800	1,000	1,200	4,475	2,750	#DIV/0!	2,900	2,475	1,200	17,900	5,500
11	Solar Thermal	50,000	400	21,290	16,789	212,900		45,000	50,000		400	11,000		15,475	25,167		20,773	14,261		61,900	151,000
12	Water Audits & Saving Devices	10,000	50	1,755	2,195	36,850	10,000	3,000		50	500		1,941	1,160		2,444	1,050		31,050	5,800	
13	Water Treatment (Reuse & Recycle)	200,000	100	27,250	69,913	218,000	3,000	12,000	200,000	100	800	200,000	1,040	6,400	200,000	1,184	7,920		5,200	12,800	200,000
14	Others	12,000	100	2,625	4,118	21,000	5,000	1,500	12,000	100	1,500	1,500	1,200	1,500	6,750	2,130		7,425	6,000	1,500	13,500
All Categories		1,912,721	50	26,649	159,448	7,808,020	70,000	300,000	1,912,721	50	200	270	3,669	9,090	130,957	9,815	36,744	368,647	642,062	618,099	6,547,859

Table 7: P2 Proposed Options with Payback Range of 0.0-1.5 Years Across Industry Sectors

P2 Options Category	Chemical and Cosmetics	Engineering	Food	Medical Devices	Paper	Grand Total
Air Compressors (Air Leaks & Pressure adjustment)						
Proposed Investment (JOD)						
Sum	21,700		5,800	1,000	3,500	32,000
Average	4,340		1,450	500	500	1,778
Min	100		200	200	100	100
Max	20,000		4,800	800	1,300	20,000
Payback Period (yr)						
Averag	0.3		0.5	0.7	0.3	0.4
Min	0.0		0.0	0.4	0.1	0.0
Max	0.7		1.2	0.9	0.5	1.2
Boilers (Calibration & Insulation)						
Proposed Investment (JOD)						
Sum	25,950	20,000	19,500	7,500	57,000	129,950
Average	2,883	10,000	2,167	2,500	19,000	4,998
Min	1,000	3,000	800	1,500	1,000	800
Max	7,500	17,000	4,000	4,000	52,000	52,000
Payback Period (yr)						
Averag	0.7	0.7	0.7	0.7	0.6	0.7
Min	0.2	0.3	0.3	0.4	0.2	0.2
Max	1.5	1.1	1.1	0.9	1.2	1.5
Cooling System (Chillers, Towers, etc)						
Proposed Investment (JOD)						
Sum	79,485		2,400	1,200	1,542	84,627
Average	9,936		1,200	1,200	771	6,510
Min	1,000		800	1,200	300	300
Max	42,500		1,600	1,200	1,242	42,500
Payback Period (yr)						
Averag	0.8		1.2	1.2	0.5	0.9
Min	0.4		1.1	1.2	0.2	0.2
Max	1.5		1.3	1.2	0.8	1.5

Table 7: P2 Proposed Options with Payback Range of 0.0-1.5 Years Across Industry Sectors

P2 Options Category	Chemical and Cosmetics	Engineering	Food	Medical Devices	Paper	Grand Total
Good Practices & Awareness						
Proposed Investment (JOD)						
Sum	16,700	1,500	24,100	5,100	1,100	48,500
Average	1,113	500	1,607	2,550	367	1,276
Min	200	200	100	100	100	100
Max	5,000	1,000	4,000	5,000	500	5,000
Payback Period (yr)						
Averag	0.6	0.5	0.7	0.2	0.6	0.6
Min	0.2	0.1	0.2	0.0	0.2	0.0
Max	1.1	0.8	1.3	0.3	1.0	1.3
Lighting						
Proposed Investment (JOD)						
Sum		72,850	4,685		700	78,235
Average		36,425	4,685		700	19,559
Min		13,350	4,685		700	700
Max		59,500	4,685		700	59,500
Payback Period (yr)						
Averag		1.3	1.4		1.0	1.2
Min		1.0	1.4		1.0	1.0
Max		1.5	1.4		1.0	1.5
Maintenance (Network & Devices)						
Proposed Investment (JOD)						
Sum	7,100	1,400	1,400	3,000	200	13,100
Average	1,014	467	700	1,500	200	873
Min	300	100	400	1,000	200	100
Max	2,000	800	1,000	2,000	200	2,000
Payback Period (yr)						
Averag	0.7	0.8	0.8	0.5	0.1	0.7
Min	0.3	0.6	0.2	0.1	0.1	0.1
Max	1.0	1.3	1.3	0.9	0.1	1.3

Table 7: P2 Proposed Options with Payback Range of 0.0-1.5 Years Across Industry Sectors

P2 Options Category	Chemical and Cosmetics	Engineering	Food	Medical Devices	Paper	Grand Total
Material Handling & Alternatives						
Proposed Investment (JOD)						
Sum	95,700	2,000	6,900		77,100	181,700
Average	5,981	1,000	1,150		15,420	6,266
Min	200	1,000	100		100	100
Max	60,000	1,000	2,000		70,000	70,000
Payback Period (yr)						
Averag	0.6	0.1	0.8		0.7	0.6
Min	0.1	0.1	0.1		0.2	0.1
Max	1.3	0.2	1.4		1.1	1.4
Others						
Proposed Investment (JOD)						
Sum	700	5,200	100			6,000
Average	350	2,600	100			1,200
Min	200	200	100			100
Max	500	5,000	100			5,000
Payback Period (yr)						
Averag	0.8	0.7	0.3			0.7
Min	0.7	0.2	0.3			0.2
Max	0.8	1.3	0.3			1.3
Power Quality (Factors)						
Proposed Investment (JOD)						
Sum	16,500		10,500	3,500		30,500
Average	8,250		10,500	1,750		6,100
Min	500		10,500	1,000		500
Max	16,000		10,500	2,500		16,000
Payback Period (yr)						
Averag	0.4		0.9	0.4		0.5
Min	0.3		0.9	0.2		0.2
Max	0.6		0.9	0.6		0.9

Table 7: P2 Proposed Options with Payback Range of 0.0-1.5 Years Across Industry Sectors

P2 Options Category	Chemical and Cosmetics	Engineering	Food	Medical Devices	Paper	Grand Total
Pumps & Fans (Variable Speed Drives)						
Proposed Investment (JOD)						
Sum			1,200			1,200
Average			1,200			1,200
Min			1,200			1,200
Max			1,200			1,200
Payback Period (yr)						
Averag			1.1			1.1
Min			1.1			1.1
Max			1.1			1.1
Water Audits & Saving Devices						
Proposed Investment (JOD)						
Sum	11,500	6,000	9,450	2,100	2,000	31,050
Average	3,833	3,000	1,181	1,050	2,000	1,941
Min	500	3,000	50	100	2,000	50
Max	10,000	3,000	4,000	2,000	2,000	10,000
Payback Period (yr)						
Averag	0.5	0.6	0.9	0.6	1.1	0.8
Min	0.2	0.5	0.2	0.2	1.1	0.2
Max	1.0	0.8	1.5	1.0	1.1	1.5
Water Treatment (Reuse & Recycle)						
Proposed Investment (JOD)						
Sum	2,000		3,000	100	100	5,200
Average	1,000		3,000	100	100	1,040
Min	1,000		3,000	100	100	100
Max	1,000		3,000	100	100	3,000
Payback Period (yr)						
Averag	0.2		0.6	0.2	1.0	0.4
Min	0.2		0.6	0.2	1.0	0.2
Max	0.2		0.6	0.2	1.0	1.0

Table 7: P2 Proposed Options with Payback Range of 0.0-1.5 Years Across Industry Sectors

P2 Options Category	Chemical and Cosmetics	Engineering	Food	Medical Devices	Paper	Grand Total
Proposed Investment (JOD)						
Sum	277,335	108,950	89,035	23,500	143,242	642,062
Average	4,019	6,809	1,746	1,567	5,968	3,669
Min	100	100	50	100	100	50
Max	60,000	59,500	10,500	5,000	70,000	70,000
Payback Period (yr)						
Averag	0.6	0.7	0.8	0.5	0.6	0.6
Min	0.0	0.1	0.0	0.0	0.1	0.0
Max	1.5	1.5	1.5	1.2	1.2	1.5

Table 8: P2 Proposed Options with Payback Range of 1.5-3.0 Years Across Industry Sectors

P2 Options Category	Chemical and Cosmetics	Engineering	Food	Medical Devices	Paper	Grand Total
Air Compressors (Air Leaks & Pressure adjustment)						
Proposed Investment (JOD)						
Sum	1,200		4,400			5,600
Average	1,200		2,200			1,867
Min	1,200		2,000			1,200
Max	1,200		2,400			2,400
Payback Period (yr)						
Averag	2.4		2.1			2.2
Min	2.4		2.0			2.0
Max	2.4		2.1			2.4
Boilers (Calibration & Insulation)						
Proposed Investment (JOD)						
Sum	22,000	17,000	7,000	7,800	6,500	60,300
Average	11,000	8,500	1,400	1,950	3,250	4,020
Min	4,000	1,000	500	600	1,500	500
Max	18,000	16,000	2,600	3,000	5,000	18,000
Payback Period (yr)						
Averag	2.4	2.5	2.0	2.5	1.7	2.2
Min	1.7	2.0	1.7	2.0	1.7	1.7
Max	3.0	2.9	2.6	3.0	1.8	3.0
Cooling System (Chillers, Towers, etc)						
Proposed Investment (JOD)						
Sum	3,740	13,675	5,300			22,715
Average	1,870	13,675	2,650			4,543
Min	1,200	13,675	2,000			1,200
Max	2,540	13,675	3,300			13,675
Payback Period (yr)						
Averag	2.8	1.8	2.1			2.3
Min	2.5	1.8	1.7			1.7
Max	3.0	1.8	2.5			3.0

Table 8: P2 Proposed Options with Payback Range of 1.5-3.0 Years Across Industry Sectors

P2 Options Category	Chemical and Cosmetics	Engineering	Food	Medical Devices	Paper	Grand Total
Good Practices & Awareness						
Proposed Investment (JOD)						
Sum	200					200
Average	200					200
Min	200					200
Max	200					200
Payback Period (yr)						
Averag	2.0					2.0
Min	2.0					2.0
Max	2.0					2.0
Lighting						
Proposed Investment (JOD)						
Sum	8,950	14,844	19,830	700	4,660	48,984
Average	4,475	4,948	4,958	700	2,330	4,082
Min	3,700	840	700	700	2,200	700
Max	5,250	12,600	8,560	700	2,460	12,600
Payback Period (yr)						
Averag	2.5	2.1	2.2	2.0	2.3	2.2
Min	2.2	1.8	1.6	2.0	2.2	1.6
Max	2.9	2.4	2.8	2.0	2.5	2.9
Maintenance (Network & Devices)						
Proposed Investment (JOD)						
Sum	800	400	2,000	3,500	16,000	22,700
Average	800	400	1,000	3,500	16,000	3,783
Min	800	400	1,000	3,500	16,000	400
Max	800.0	400.0	1,000.0	3,500.0	16,000.0	16,000.0
Payback Period (yr)						
Averag	1.6	2.5	2.0	2.8	2.1	2.2
Min	1.6	2.5	2.0	2.8	2.1	1.6
Max	2	3	2	3	2	3

Table 8: P2 Proposed Options with Payback Range of 1.5-3.0 Years Across Industry Sectors

P2 Options Category	Chemical and Cosmetics	Engineering	Food	Medical Devices	Paper	Grand Total
Material Handling & Alternatives						
Proposed Investment (JOD)						
Sum	302,000	6,200	2,000	2,500		312,700
Average	151,000	2,067	1,000	1,250		34,744
Min	2,000	200	1,000	500		200
Max	300,000	5,000	1,000	2,000		300,000
Payback Period (yr)						
Averag	1.9	1.9	2.0	1.7		1.9
Min	1.9	1.7	2.0	1.7		1.7
Max	2.0	2.0	2.0	1.7		2.0
Others						
Proposed Investment (JOD)						
Sum	1,500					1,500
Average	1,500					1,500
Min	1,500					1,500
Max	1,500					1,500
Payback Period (yr)						
Averag	3.0					3.0
Min	3.0					3.0
Max	3.0					3.0
Power Quality (Factors)						
Proposed Investment (JOD)						
Sum	45,000					45,000
Average	45,000					45,000
Min	45,000					45,000
Max	45,000					45,000
Payback Period (yr)						
Averag	2.0					2.0
Min	2.0					2.0
Max	2.0					2.0

Table 8: P2 Proposed Options with Payback Range of 1.5-3.0 Years Across Industry Sectors

P2 Options Category	Chemical and Cosmetics	Engineering	Food	Medical Devices	Paper	Grand Total
Pumps & Fans (Variable Speed Drives)						
Proposed Investment (JOD)						
Sum			14,200		3,700	17,900
Average			4,733		3,700	4,475
Min			1,800		3,700	1,800
Max			8,600		3,700	8,600
Payback Period (yr)						
Averag			2.5		2.6	2.5
Min			1.7		2.6	1.7
Max			2.9		2.6	2.9
Solar Thermal						
Proposed Investment (JOD)						
Sum	45,000		16,500	400		61,900
Average	45,000		8,250	400		15,475
Min	45,000		1,500	400		400
Max	45,000		15,000	400		45,000
Payback Period (yr)						
Averag	2.8		2.8	2.0		2.6
Min	2.8		2.7	2.0		2.0
Max	2.8		2.8	2.0		2.8
Water Audits & Saving Devices						
Proposed Investment (JOD)						
Sum	500	4,800	500			5,800
Average	500	1,600	500			1,160
Min	500	800	500			500
Max	500	3,000	500			3,000
Payback Period (yr)						
Averag	2.5	1.7	2.5			2.0
Min	2.5	1.6	2.5			1.6
Max	2.5	2.0	2.5			2.5

Table 8: P2 Proposed Options with Payback Range of 1.5-3.0 Years Across Industry Sectors

P2 Options Category	Chemical and Cosmetics	Engineering	Food	Medical Devices	Paper	Grand Total
Water Treatment (Reuse & Recycle)						
Proposed Investment (JOD)						
Sum	12,800					12,800
Average	6,400					6,400
Min	800					800
Max	12,000					12,000
Payback Period (yr)						
Averag	2.1					2.1
Min	1.6					1.6
Max	2.6					2.6
Proposed Investment (JOD)						
Sum	443,690	56,919	71,730	14,900	30,860	618,099
Average	26,099	4,378	3,119	1,656	5,143	9,090
Min	200	200	500	400	1,500	200
Max	300,000	16,000	15,000	3,500	16,000	300,000
Payback Period (yr)						
Averag	2.3	2.0	2.2	2.2	2.1	2.2
Min	1.6	1.6	1.6	1.7	1.7	1.6
Max	3.0	2.9	2.9	3.0	2.6	3.0

Table 9: Estimated Investment Opportunities in Jordanian Industrial Sectors

ID	Sector	# of Partners Facilities	Total # of Ind. Facilities in Jordan	Average Facility Investment Cost (JOD) for Options with Payback Periods of			Estimated Investment Opportunities in Jordan (JOD) for Options with Payback Periods of		
				<1.5 years	1.5-3.0 Years	0.0-3.0 Years	<1.5 Years	1.5-3.0 Years	0.0-3.0 Years
1	Agriculture, Food and Livestock	7	1,722	12,719	10,247	22,966	21,902,610	17,645,580	39,548,190
2	Chemicals and Cosmetics	12	487	23,111	63,384	86,496	11,255,179	30,868,147	42,123,326
3	Engineering, Electrical industries and Information	4	5,884	27,238	14,230	41,467	160,265,450	83,727,849	243,993,299
4	Therapeutic and Medical Devices	3	87	7,833	4,967	12,800	681,500	432,100	1,113,600
5	Packing, Packaging, Paper, Cartons and Stationery	5	1,061	28,648	6,172	34,820	30,395,952	6,548,492	36,944,444
Summary									
Average		6	1,848	19,910	19,800	39,710	44,900,138	27,844,434	72,744,572
Sum		31	9,241	99,550	99,000	198,550	224,500,691	139,222,168	363,722,859

Table 10: Industrial Facilities for Data Extrapolation

Sector	Number of Partner Facilities Assessed by Project by Sector	Total Number of Industrial Facilities Registered in Jordan by Sector	Total Number of S, M, and L Industrial facilities in Jordan by Sector (JCI 2009, 50)*
Chemical	12	1,722	91
Engineering	4	487	400
Food	7	5,884	412
Medical Devices	3	87	57
Packaging	5	1,061	199

* Note: This column does not include Micro-sized facilities, which were not part of the scope of the project.

FIGURES

Figure 1 Partners Selection Methodology

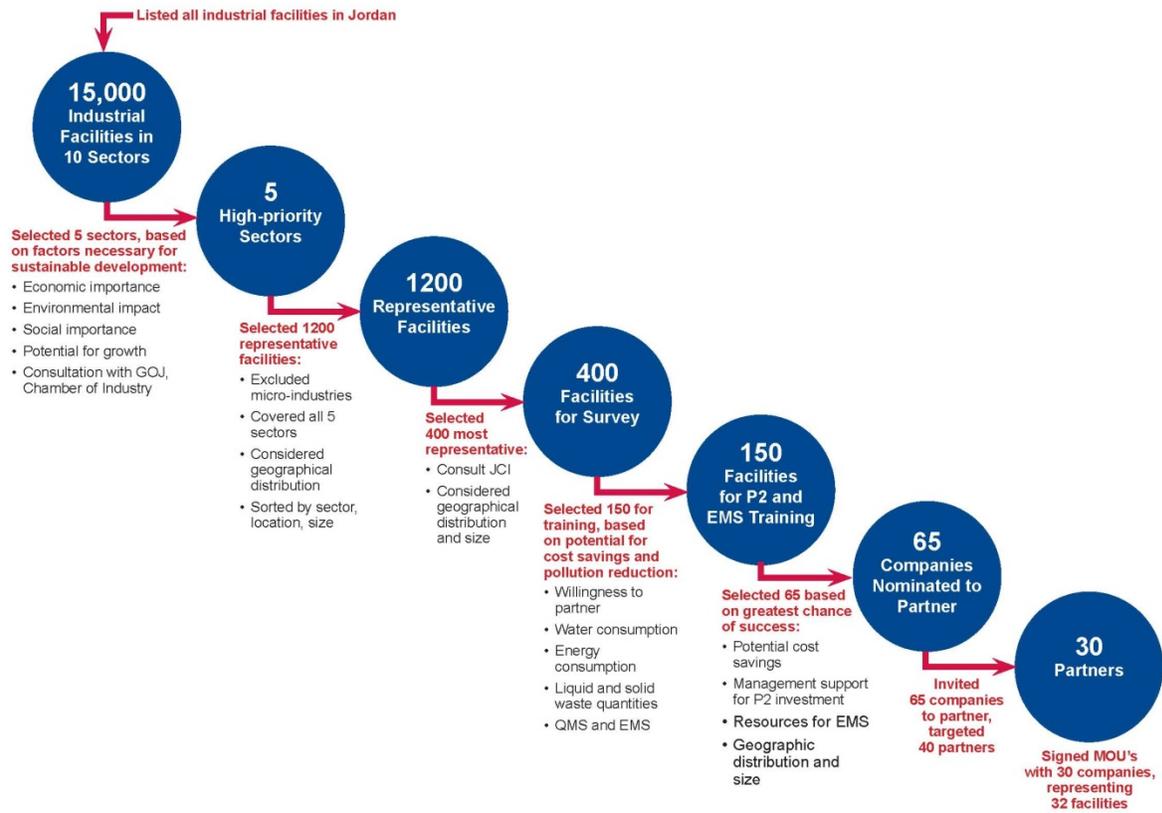


Figure 2 Geographic Distribution of the Surveyed Facilities

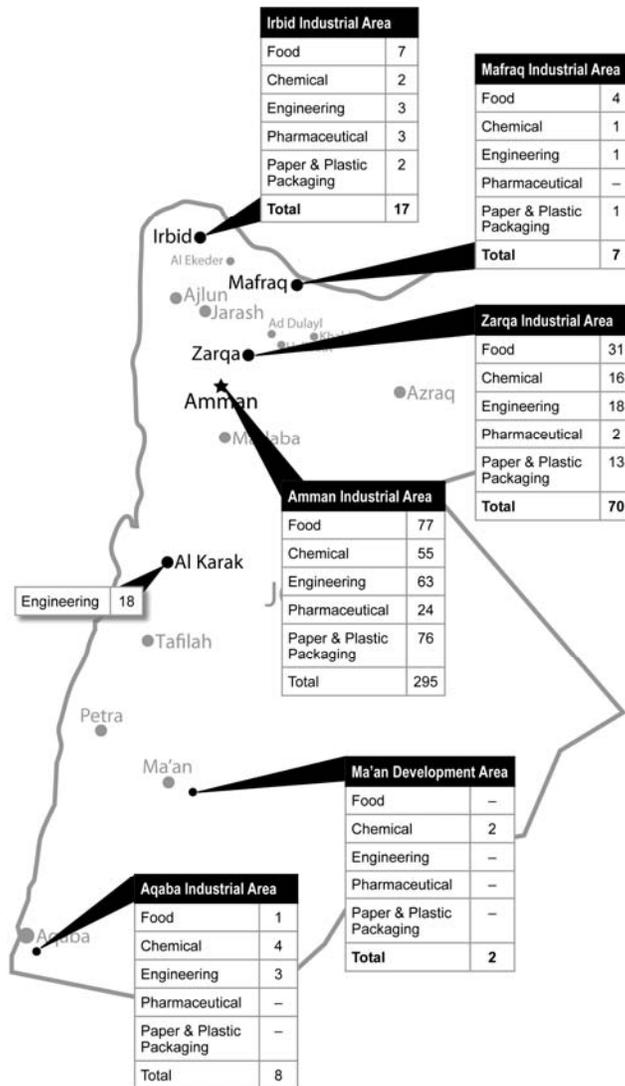
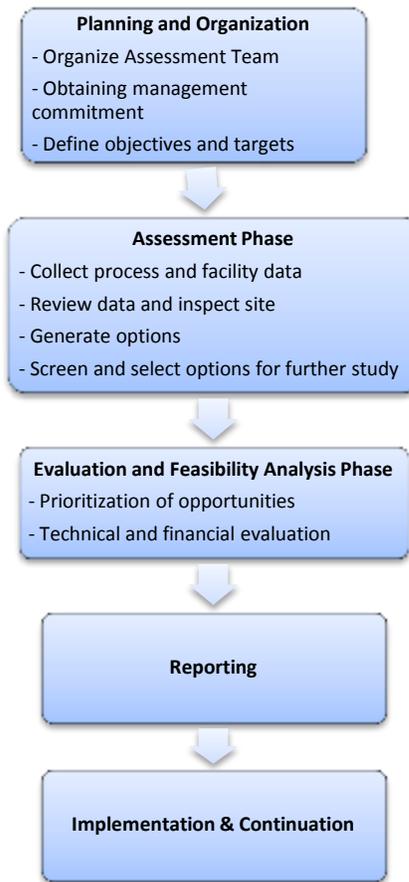


Figure 3: Outline of P2 assessment phases



Source: "Guide to Industrial Assessment for Pollution Prevention and Energy Efficiency", EPA/625/R-99/003, June 2001.

Figure 4: EMS Assessment Protocol

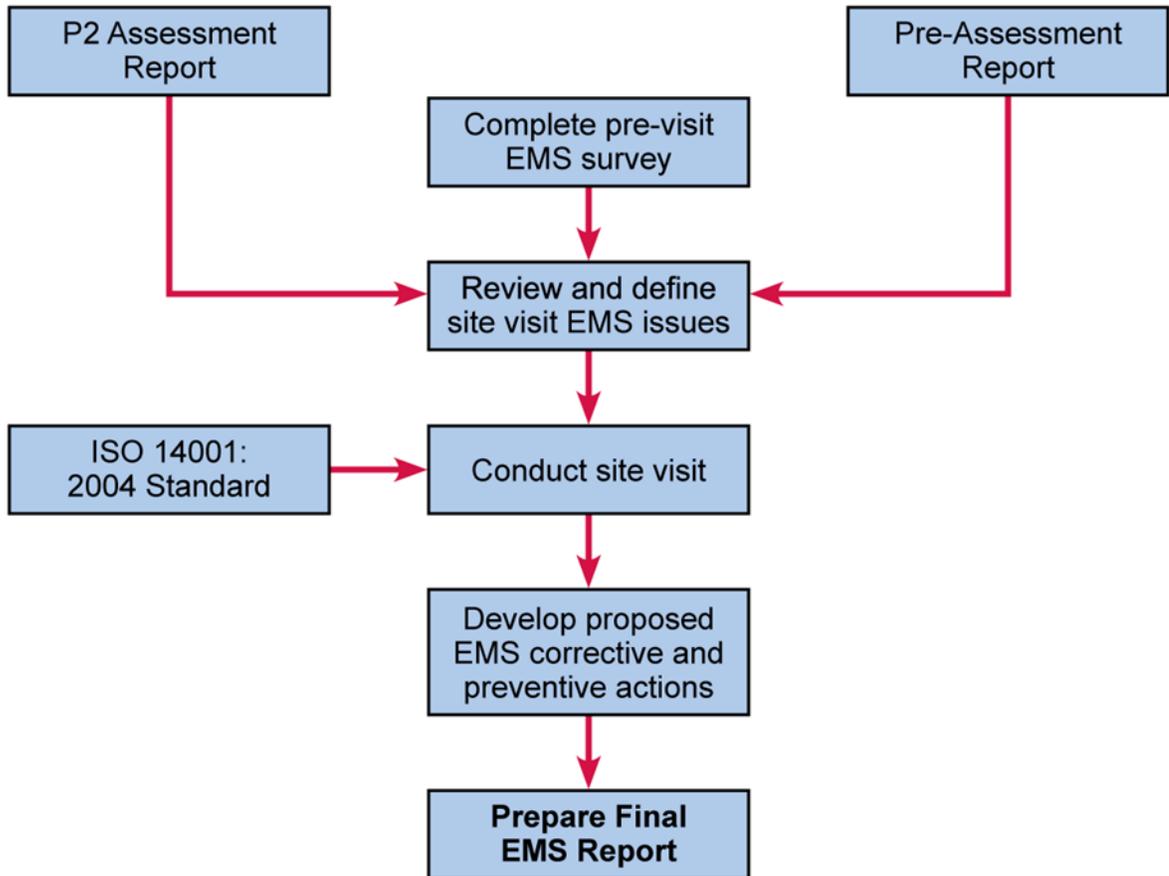


Figure 5: P2 Proposed Options categorized by payback period intervals

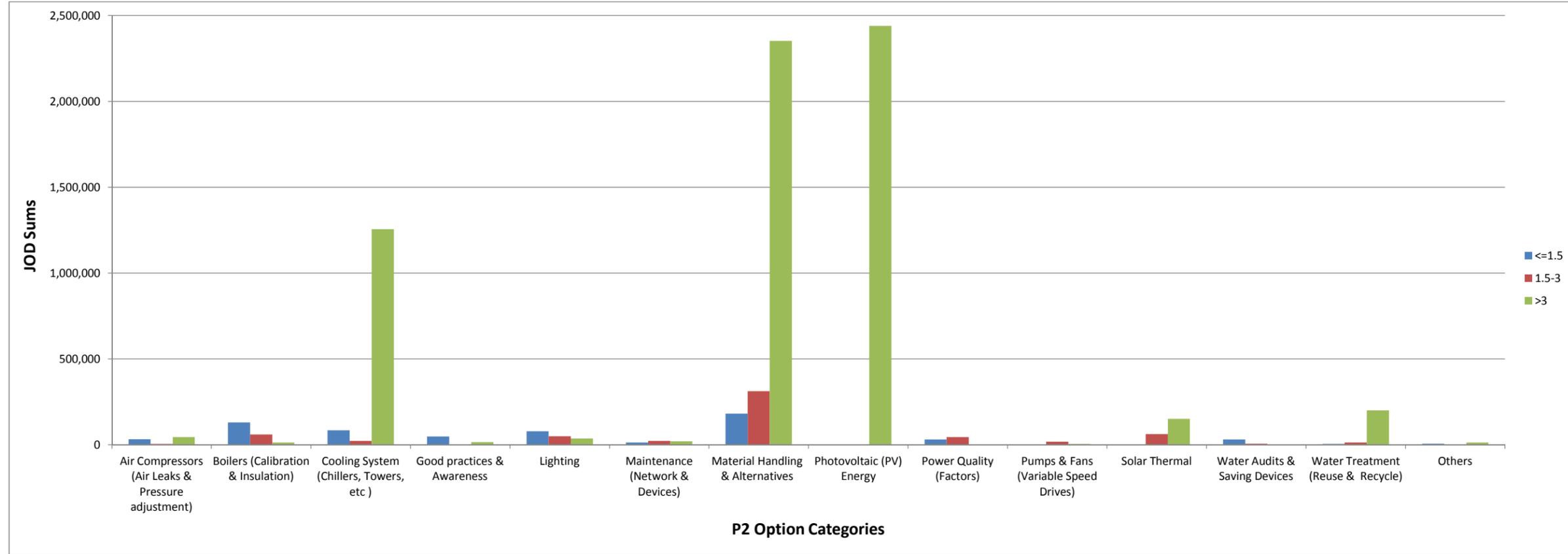


Figure 6: Cost of Proposed P2 Options Categorized by Payback Periods 0.0-1.5 and 1.5-3.0 Years

