GEF-6 REQUEST FOR PROJECT ENDORSEMENT/APPROVAL

PROJECT TYPE: Full-sized Project
TYPE OF TRUST FUND:GEF Trust Fund
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PART I: PROJECT INFORMATION

Project Title: Egyptian Programme for Promoting Industrial Motor Efficiency			
Country(ies):	Egypt	GEF Project ID:[1]	9423
GEF Agency(ies):	UNIDO (select) (select)	GEF Agency Project ID:	160007
Other Executing Partner(s):	Ministry of Trade and Industry (MoTI) Egyptian National Cleaner Production Center (ENCPC) Federation of Egyptian Industries (FEI)	Submission Date: Re-Submission Date:	04/20/2018 05/25/2018 06/04/2018
GEF Focal Area (s):	Climate Change	Project Duration (Months)	48
Integrated Approach Pilot	IAP-Cities ☐ IAP-Commodities ☐ IAP-Food Security ☐	Corporate Program: SGP ☐	
Name of Parent Program	[if applicable]	Agency Fee ($)	261,250

A. FOCAL AREA STRATEGY FRAMEWORK AND OTHER PROGRAM STRATEGIES[2]

Focal Area Objectives/Programs	Focal Area Outcomes	Trust Fund	(in $) GEF Project Financing	(in $) Co-financing
(select) CCA-1 (select)	Promote Innovation, Technology Transfer and Supportive Policies and Strategies / Program 1: Promote timely development, demonstration and financing of low carbon technologies and mitigation options	GEFTF	2,750,000	16,800,000
	Total project costs		2,750,000	16,800,000

B. PROJECT DESCRIPTION SUMMARY

Project Objective: To reduce GHG emissions by facilitating and supporting market penetration of highly energy efficient motor systems in the industrial sector in Egypt.

Project Components/ Programs	Financing Type[3]	Project Outcomes	Project Outputs	Trust Fund	(in $) GEF Project Financing	(in $) Confirmed Co-financing
1. Conducive Policy and Legal Environment for Energy Efficient (EE) Motors	TA	1.1 Legislative and regulatory frameworks for EE motors developed	1.1.1 Recommendations on policy tools and guidelines for the deployment of EE motors developed 1.1.2 Action plans and guidelines to support rewinding shops in adapting to the changes in the industrial motors marketplace developed 1.1.3 Action plan to support local industries in the development of EE and clean technologies for motor systems developed 1.1.4 Energy Service	GEFTF	550,000	800,000

[1] Project ID number remains the same as the assigned PIF number.
[2] When completing Table A, refer to the excerpts on GEF 6 Results Frameworks for GETF, LDCF and SCCF and CBIT programming directions.
[3] Financing type can be either investment or technical assistance.

			Company (ESCO) market support policies and tools developed			
2. Awareness and Capacity Building on Energy Efficient Motors Systems	TA	2.1 Key stakeholders trained and awareness campaign conducted on EE motors and motor systems	2.1.1. National awareness campaign on the benefits of EE upgrades to Electric Motor Driven Systems (EMDS) 2.1.2. Peer-to-peer platform for information exchange, cooperation and partnerships among seekers and providers of services and information on EE motors systems developed 2.1.3. Information gained through the 30 demonstration projects (Output 3.1.3) disseminated 2.1.4. 300 x industrial end users, suppliers, and motor system optimization experts trained 2.1.5. 20 local rewinding and refurbishing workshops capacity improved	GEFTF	550,000	2,300,000
3. Technical Assistance for Technology Demonstration and Upscaling	TA	3.1 Technology demonstrations and mechanism to support wide-scale deployment are in place	3.1.1. Detailed motor efficiency audits for 40 selected enterprises conducted by UNIDO-trained motor system optimization experts 3.1.2. Technical and business advisory services for 30 motor upgrade projects development facilitated 3.1.3. System optimization for EMDS implemented and EE motors installed in 30 enterprises 3.1.4. Public private partnerships with international suppliers developed to accelerate the deployment of EE motors	GEFTF	455,000	7,200,000
4. Support for developing the ESCO market, with a specific focus on EMDS optimization and motor upgrades	TA	4.1 ESCO models to provide energy efficiency services to industry piloted	4.1.1. Contractual framework for energy performance contracting (ESCO business models) developed 4.1.2. Measurement and Verification (M&V) tools established and made available to ESCOs, M&V providers and industry 4.1.3. 5 x ESCO businesses developed and established	GEFTF	445,000	1,800,000
	Inv		4.1.4. Revolving fund to offer project-based financing packages for system optimization Energy Performance Contracting (EPC) projects introduced	GEFTF	500,000	3,650,000

5. Monitoring and Evaluation	TA	5.1 Project progress towards objectives continuously monitored and evaluated	5.1.1. Project progress monitored, documented and recommendaed actions formulated 5.1.2. Mid-term review (MTR), Terminal Evaluation (TE) conducted in a timely manner	GEFTF	75,000	250,000
			Subtotal		2,575,000	16,000,000
			Project Management Cost (PMC)[4]	GEFTF	175,000	800,000
			Total project costs		2,750,000	16,800,000

C. CONFIRMED SOURCES OF CO-FINANCING FOR THE PROJECT BY NAME AND BY TYPE

Please include evidence for co-financing for the project with this form.

Sources of Co-financing	Name of Co-financier	Type of Cofinancing	Amount ($)
GEF Agency	UNIDO	In-kind	220,000
GEF Agency	UNIDO	Grants	80,000
Recipient Government	Ministry of Trade and Industry	In-kind	5,250,000[5]
Others	Commercial International Bank (CIB)	Loans	10,000,000
Others	MSME Development Agency	Loans	1,250,000
Total Co-financing			16,800,000

D. TRUST FUND RESOURCES REQUESTED BY AGENCY(IES), COUNTRY(IES), FOCAL AREA AND THE PROGRAMMING OF FUNDS

GEF Agency	Trust Fund	Country Name/Global	Focal Area	Programming of Funds	(in $)		
					GEF Project Financing (a)	Agency Fee a) (b)[2]	Total (c)=a+b
UNIDO	GEF TF	Egypt	Climate Change	(select as applicable)	2,750,000	261,250	3,011,250
Total Grant Resources					2,750,000	261,250	3,011,250

a) Refer to the Fee Policy for GEF Partner Agencies

[4] For GEF Project Financing up to $2 million, PMC could be up to10% of the subtotal; above $2 million, PMC could be up to 5% of the subtotal. PMC should be charged proportionately to focal areas based on focal area project financing amount in Table D below.

[5] Letter for EUR 4,250,000. Exchange rate for the month of March 2018 is used to calculate the US$ equivalent.

E. PROJECT'S TARGET CONTRIBUTIONS TO GLOBAL ENVIRONMENTAL BENEFITS[6]

Provide the expected project targets as appropriate.

Corporate Results	Replenishment Targets	Project Targets
1. Maintain globally significant biodiversity and the ecosystem goods and services that it provides to society	Improved management of landscapes and seascapes covering 300 million hectares	*hectares*
2. Sustainable land management in production systems (agriculture, rangelands, and forest landscapes)	120 million hectares under sustainable land management	*hectares*
3. Promotion of collective management of transboundary water systems and implementation of the full range of policy, legal, and institutional reforms and investments contributing to sustainable use and maintenance of ecosystem services	Water-food-ecosystems security and conjunctive management of surface and groundwater in at least 10 freshwater basins;	*Number of freshwater basins*
	20% of globally over-exploited fisheries (by volume) moved to more sustainable levels	*Percent of fisheries, by volume*
4. Support to transformational shifts towards a low-emission and resilient development path	750 million tons of CO_{2e} mitigated (include both direct and indirect)	***Direct: 0.598*** ***Indirect:1.922*** ***Total:2.52***
5. Increase in phase-out, disposal and reduction of releases of POPs, ODS, mercury and other chemicals of global concern	Disposal of 80,000 tons of POPs (PCB, obsolete pesticides)	*metric tons*
	Reduction of 1000 tons of Mercury	*metric tons*
	Phase-out of 303.44 tons of ODP (HCFC)	*ODP tons*
6. Enhance capacity of countries to implement MEAs (multilateral environmental agreements) and mainstream into national and sub-national policy, planning financial and legal frameworks	Development and sectoral planning frameworks integrate measurable targets drawn from the MEAs in at least 10 countries	*Number of Countries:*
	Functional environmental information systems are established to support decision-making in at least 10 countries	*Number of Countries:*

F. DOES THE PROJECT INCLUDE A "NON-GRANT" INSTRUMENT? No

[6] Update the applicable indicators provided at PIF stage. Progress in programming against these targets for the projects per the *Corporate Results Framework* in the *GEF-6 Programming Directions*, will be aggregated and reported during mid-term and at the conclusion of the replenishment period.

(If non-grant instruments are used, provide an indicative calendar of expected reflows to your Agency and to the GEF/LDCF/SCCF/CBIT Trust Fund) in Annex D.

PART II: PROJECT JUSTIFICATION

A. DESCRIBE ANY CHANGES IN ALIGNMENT WITH THE PROJECT DESIGN WITH THE ORIGINAL PIF[7]

The project strategy remains largely the same as in the PIF but with incremental activities now organized into five thematic components: (1) developing a conducive legal and regulatory environment for energy efficient motors, (2) building awareness and capacity on EE motor systems, (3) providing technical assistance for technology demonstration and upscaling, (4) supporting the development of the ESCO market, and (5) monitoring and evaluation of the project.

The main change introduces a new thematic focus on ESCO business and market development. At the PIF stage, basic information on the status of the ESCO market in Egypt was presented, proposing that an assessment of the ESCO market landscape be completed in the project preparation grant (PPG) phase. Activities related to the ESCO market were mainly included in Component 3 in the PIF, which focused on technology demonstration upscaling.

During the PPG, an in-depth assessment of the ESCO market landscape determined how to best support ESCOs and expand their business to finance and implement motor systems energy efficiency measures. The findings of this assessment have been incorporated into the baseline assessment as well as the project activities. A new component—Component 4—has been added to highlight the importance of ESCO models to the project strategy for market transformation. This new component also addresses comments made by Germany to realize the project's potential to lead to a transformative change in the industrial sector.

Component 1

At the PIF stage, Component 1 had three outputs focusing on (1) benchmarking identified sectors that hold the greatest potential for EE savings; (2) creating policy recommendations and roadmaps for the deployment of EE motors, including ESCO incentives; and (3) supporting local industries to produce EE equipment and motors. However, stakeholder interviews and the baseline assessment conducted during the PPG phase have changed the focus of this component.

To strengthen the project's baseline assessment, UNIDO has engaged an international consultant to complete the benchmarking of industrial sectors, focusing on estimating the energy savings potential for cost-effective motor systems optimization (MSO) measures and motor replacement, during the PPG phase instead of the project implementation phase. A copy of the motor system cost curves in the Egyptian market is attached as annex .. to this document.

Since the approval of the PIF, the International Finance Corporation (IFC) Smart Technology and Energy Efficient Production (STEP) has provided support to the Government of Egypt (GoE) in developing the policy and regulatory framework to promote the use of EE motors in the industrial sector through the Minimum Energy Performance Standards (MEPS) for industrial motors program. As a result, the focus has shifted away from developing a high-level policy roadmap to developing operational tools and guidelines to be used by the GoE in promoting energy efficiency in motor systems.

In addition to supporting local manufacturing, the focus of this Component now also includes improving the rewinding industry. During the PPG phase, the rewinding industry was identified as needing technical support to upgrade its processes and cope with the negative impact of policies promoting energy efficient motors on demand for rewinding services.

Additionally, the ESCO assessment undertaken by UNIDO during the PPG phase revealed the need for specific policy-level interventions to support the ESCO market.

Therefore, Component 1 has been revised to include the following four outputs: (1) recommendations on policy tools and guidelines for the deployment of EE motors developed; (2) action plans and guidelines to support rewinding shops in adapting to the changes in the industrial motors marketplace developed; (3) supporting local industries to produce EE equipment and motors; and (4) ESCO market support policies and tools developed.

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[7] For questions A.1 –A.7 in Part II, if there are no changes since PIF , no need to respond, please enter "NA" after the respective question.

Given the expanded scope of this component and the increased focus on operational tools and guidelines, an additional $300,000 of GEF grant financing was reallocated from Component 3 to this component.

Component 2

The main change for Component 2 focuses on the structure and organization of the capacity building trainings. Separate outputs providing trainings for system optimization practitioners, venders, and industrial enterprise personnel from the approved PIF have been combined into one output (Output 2.1.4). The structure of the training courses will have two levels: a user-level training for system optimization practitioners, vendors and traders of motor systems, and industrial end users and an expert-level training designed specifically for system optimization practitioners. The basic training will give system optimizers, vendors, traders and industrial enterprises the opportunity to meet each other, share knowledge, and network.

Furthermore, a new Output 2.1.5 has been introduced to focus on proving capacity building to staff and owners of rewinding workshops to promote the best practices developed in Component 1. The project will also focus on raising awareness and disseminating information about 30 demonstration projects, instead of only 20 projects (See Component 3 for full explanation).

Component 2 has been revised to include the following five outputs: (1) national awareness campaign on the benefits of EE upgrades to EMDS; (2) peer-to-peer platform for information exchange, cooperation and partnerships among seekers and providers of services and information on EE motors systems developed; (3) information gained through the 30 demonstration projects disseminated; (4) 300 x industrial end users, suppliers, and motor system optimization experts trained; and (5) 20 x local rewinding and refurbishing workshops capacity improved.

Component 3

As mentioned above, the main change to Component 3 was to create a new thematic area—Component 4— to highlight the importance of the ESCO market to the project strategy. Thus, the activities focused on ESCO business models and market development have been removed from this component.

Additionally, the number of motor efficiency audits has increased from 30 to 40, and the project has clarified that these audits will be conducted by the system optimization practitioners trained in Component 2. After consulting the budget, the number of demonstration projects has risen from 20 to 30 to promote wider dissemination and market impact of these success stories.

Component 3 now has four outputs, namely: (1) detailed motor efficiency audits for 40 selected enterprises conducted by UNIDO-trained motor system optimization experts; (2) technical and business advisory services for 30 motor upgrade projects facilitated; (3) system optimization for EMDS implemented and EE motors installed in 30 enterprises (4) public private partnerships with international suppliers developed to accelerate the deployment of EE motors.

Component 4

As explained above, Component 4 now focuses on ESCO market transformation. The component is designed to overcome the challenges identified in the ESCO assessment, specifically: lack of an enforceable contractual framework, lack of M&V frameworks and expertise, and lack of access to finance for ESCOs.

Component 4 now has four outputs, namely: (1) contractual framework for energy performance contracting [ESCO business models] developed; (2) M&V tools established and made available to ESCOs, M&V providers and industry; (3) ESCO businesses developed and established; (4) revolving fund to offer project-based financing packages for system optimization EPC projects introduced.

Component 5

Component 4 on monitoring and evaluation has been moved to the new Component 5. Component 5 focuses on monitoring and evaluation with two outputs, namely: (1) project progress monitored, documented and recommended actions formulated (2) Mid-term Review (MTR) and Terminal Evaluation (TE) conducted in a timely manner.

The co-financing for monitoring and evaluation in Component 5 has been reduced and reallocated to investment co-financing for Componen

A.1. *Project Description*. Elaborate on: 1) the global environmental and/or adaptation problems, root causes and barriers that need to be addressed; 2) the baseline scenario or any associated baseline projects, 3) the proposed alternative scenario, GEF focal area[8] strategies, with a brief description of expected outcomes and components of the project, 4) incremental/additional cost reasoning and expected contributions from the baseline, the GEFTF, LDCF, SCCF, CBIT and co-financing; 5) global environmental benefits (GEFTF) and/or adaptation benefits (LDCF/SCCF); and 6) innovativeness, sustainability and potential for scaling up.

1) the global environmental and/or adaption problems, root causes, and barriers that need to be addressed

The project is aligned with and contributes to the GEF's CCM area strategies and objectives as it promotes policies that support the development of low carbon technologies and miitagtion options and demonstrate innovative mechanisms and solutions for technical assistance and financing.

In 2014, Egypt emitted 272.69 $MtCO_{2eq}$. [9] Although only accounting for 0.6% of the total greenhouse gas (GHG) emissions worldwide, the country is one of the fastest growing emitters in the world and one of the most vulnerable places to climate change adversities. In fact, Egypt's GHG emissions have grown by over 121% between 1990 and 2014. The GHG emissions growth rate is even higher for the electricity/heat consumption which grew by 244% over the same period[10].

Like other emerging economies, Egypt faces the challenge of ensuring industrial growth and development while stabilizing or even reducing resource inputs and safeguarding the environment. During the fiscal year 2015/2016, the industrial sector consumed approximately 38,310 GWh of electricity, which represented 24.66% of the national electricity consumption amounting to 155,318 GWh.[11]

Over the last decade, industrial energy productivity in Egypt has not improved at the same rate nor received the same attention as labor and material productivity partly because of low energy prices due to significant government subsidies. According to the "*Egypt: Improve Efficiency"* report of the World Bank, most industrial processes and equipment in Egypt consume 20% or more energy than international best practices.[12]

Egypt has actively participated at the Conference of Parties (COPs) of the UNFCCC. National efforts are being made to reduce GHGs emissions in different sectors including energy, transportation and industry. In its INDCs, Egypt has committed to focusing on energy efficiency and renewable energy as key mitigation measures. Specific interventions for the industrial sector include EE improvements and solar energy. The GoE also reinforces its commitment to energy subsidy reform, creating a conducive environment for increased energy efficiency and clean technology use.[13]

Barriers

The main barriers to wide-scale adoption of EE in EMDS, including motor system optimization measures and motor upgrades, include: unconducive policy and legal environment, including support and incentives for ESCOs; limited awareness of EE benefits and savings opportunities among industrial enterprises and decision-makers; low availability of EE motors for purchase on the local market; and inadequate access to finance and business models to support EE adoption.

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[8] For biodiversity projects, in addition to explaining the project's consistency with the biodiversity focal area strategy, objectives and programs, please also describe which Aichi Target(s) the project will directly contribute to achieving..

[9] World Resource Institute, *CAIT Climate Data Explorer:* http://cait.wri.org/profile/Egypt

[10] Ibid

[11] EgyptERA, *Indicators of Electricity Consumption in Productive Sectors, Annual Report 2015/2016*

[12] The World Bank (2010), *Egypt: Improve Energy Efficiency*, http://www-wds.worldbank.org/external/default/WDSContentServer/WDSP/IB/2012/06/05/000427087_20120605093931/Rendered/PDF/693100ESW0P1210WB0EE0September02010.pdf (March, 2016).

[13] Arab Republic of Egypt, *Egyptian Intended National Determined Contribution*

Barrier	Description and component which will address this barrier
Policy and regulatory barriers	*Unconducive policy and legal environment for EE industrial motors* While a variety of policies and strategies have been adopted to support EE in Egypt, the majority of EE legislation has been focused on buildings. However, the Industrial energy efficiency project financed by the GEF and implemented by UNIDO (UNIDO-GEF4 IEE project) identified the introduction of MEPS for EE motors as a high impact area. tThe Ministry of Trade and Industry of Egypt and the International Finance Corporation (IFC) have jointly developed these standards through the STEP project. It is expected that the GoE will adopt the IE3 motor efficiency standard by 2020. Since the MEPS only regulate the purchase of new EE motors, further policy and regulatory efforts are needed to promote the deployment of EE motors and other motor system optimization measures. Therefore, Component 1 seeks to support the deployment of EE motors and MSO measures by overcoming policy, legal, and financial barriers as well as by developing support policies for ESCOs. *Unconducive policy and legal environment for ESCOs* There are no incentives for ESCOs in Egypt. Neither government agencies or donor-funded projects are actively promoting ESCO business models to achieve increased industrial energy efficiency. Furthermore, framework conditions, such as standard contracts and dispute resolution mechanisms, governing EPC in Egypt are nonexistent. For example, in the event of a contract dispute or nonpayment, ESCOs must take the matter to the court system, which could take years to resolve. Therefore, Component 4 will focus on creating framework conditions to support the ESCO market, such as working with lawyers to create a standardized EPC contract as well as arbitration and dispute mechanisms. Additionally, an official certification framework for MSO experts and ESCOs will be developed. Standardized EPC contracts and ESCO certification will build trust between ESCOs and the industrial sector and, therefore, facilitate ESCO market development.
Awareness barriers	*Limited awareness among motor system end-users of the potential energy and cost savings of MSO and EE motor upgrades as well as their technical feasibility* While many industrial enterprises are aware of the cost saving benefits of EE in general, top management have limited awareness on the benefits, feasibility, and energy savings associated with replacing old electric motors or of implementing motor system optimization measures. Consequently, purchasing decisions for new motors often favor first cost, low efficiency electric motors. Therefore, Component 2 aims at removing awareness barriers to create sustainable structural and behavioral changes through national awareness campaigns, a peer-to-peer platform for end users and service providers, and success stories dissemination.
Information barriers	*Limited information to showcase the benefits of EE motors systems in industry* The majority of industrial enterprises do not know or are skeptical about existing technical and financial opportunities related to EE motors upgrades and MSO. This may be caused by the lack of demonstration projects showcasing the potential energy savings of EE motors and MSO across different industrial sub-sectors within the country. Therefore, Component 3 will provide technical assistance to pilot the use of EE in EMDS at the enterprise level. As demonstration projects are completed, the benefits and risks of upgrading to EE motors and implementing MSO will be better understood by the relevant industrial stakeholders. It is expected that these demonstration projects will pave the way for other enterprises, with similar characteristics and needs, to incorporate EE in EMDS. Case studies and reports about these demonstration projects will be used for the awareness campaigns conducted under Component 2, providing reliable data to make the economic case for EE in EMDS. *Limited industrial statistics on EE motors and MSO measures*

Barrier	Description and component which will address this barrier
	Baseline information does not exist on EE motors and MSO cost savings potential across different industrial applications. Therefore, during the PPG stage, an energy cost curve exercise has indentified the EE measures resulting in the greatest energy savings across various industrial sectors. This information will be validated during the project implementation and shared with relevant stakeholders, including the GoE, industrial enterprises, suppliers, system optimization experts, and ESCOs. *Inadequate verification mechanisms for EE-related energy savings* To showcase the benefits of EE motor upgrades and MSO, national standards for M&V and advanced testing facilities for motor system efficiency are needed to verfiy energy and cost savings achieved through these projects. Therefore, Component 1 supports policy tools and guidelines to create independent M&V frameworks and protocols. Additionally, Component 4 focuses on training and accrediting independent M&V experts and supporting the funding and development of a mobile testing lab to verify EE EMDS improvements.
Technical capacity barriers	*Limited national technical capacity specialized on EE motors and MSO measures* Industrial enterprises often do not have the necessary expertise to identify and address opportunities related to EE motor systems. Therefore, Component 2 will build national capacity by providing user-level training for 300 system optimization practitioners, local vendors, traders, suppliers, and industry staff and expert-level training for 50 system optimization practitioners. UNIDO's training modules on system optimization for industrial motors developed by UNIDO-GEF 4 IEE project will be translated into Arabic and adapted for this new training format.
Financial barriers	*Inadequate incentive schemes and financial mechanisms to foster EE in the industrial sector, including motor system optimization measures and motor replacement* Currently, financial mechanisms to support wide-scale deployment of EE in EMDS are limited. For example, one main barrier to replacing old, inefficient motors is the inherent costs incurred during the identification, purchase and shut down period required to service or replace motors. Without financial support, EE motors will not be widely adopted, as few industries have the financial means to do so without additional funding. Therefore, Component 4 will develop and pilot ESCOs as a sustainable mechanism to deliver upfront financing support of EE projects. ESCOs and MSO experts supported by UNIDO will play a key role in connecting industrial enterprises with financing options for these EE in EMDS upgrades. Opportunities for financing will include a new revolving fund sponsored by UNIDO to encourage high potential MSO measures; the EBRD-funded GEFF Egypt credit line, and the Green for Growth Fund. Furthermore, Component 3 will facilitate public-private partnerships with international suppliers of EE motors to extend soft-financing options to industrial enterprises that would like to replace their inefficient motors.
Availability barriers	*Low availability of affordable EE motors and equipment in the market* The market in Egypt is flooded with inefficient, old, and counterfiet motors and equipment. Highly efficient motors are not locally produced but imported at relatively high prices. Most of the motors produced in Egypt by companies, such as Daoud and Shobra Company, are low efficiency motors. Other efficiency-improving equipment such as VSD and invertors are also not readily available in the market. Therefore, Component 3 will focus on building public-private partnerships to work directly with suppliers and offer more affordable EE motors and equipment.

Barrier	Description and component which will address this barrier
Organizational structure barriers	*Limited EE strategy and planning on an enterprise level* Within industrial enterprises, top-level management are often unaware of the benefits, particularly the energy and costs savings, of EE motors upgrades and MSO. Staff members who are aware of the benefits of EE in EMDS interventions are often not in a position to authorize EE motor upgrades or MSO projects. Therefore, many enterprises may not have an integrated, organizational strategy and planning process for EE improvements. Therefore, Component 2 will offer training for managers and staff on energy management, and Component 3 will offer energy audits and technical assistance to selected industrial enterprises so they can begin to strategize about EE in EMDS on an enterprise level. *Principal agent barrier: Conflicting interests in EE by Original equipment Manufacturers (OEMs) and industrial enterprises* Most industrial motors are integrated into larger systems by OEMs. When OEMSs purchase these motors, they tend to minimize costs without considering the energy efficiency level of the motor. The interests of these OEMs are often directly in conflict with industrial end users, who may be interested in purchasing more expensive EE motors for the long-term cost savings. As a result of this process, industrial enterprises usually have little or no information about the EE level of the motors purchased within these larger systems. Therefore, Component 2 will focus on raising the awareness and training industrial stakeholders to take into account EE concerns when working with OEMs to purchase these larger systems.

2*) the baseline scenario or any associated baseline projects*

Electricity Consumption in Industrial Electric Motor Driven Systems

The Government of Egypt has identified energy efficiency in EMDS as one of the highest impact opportunity areas to increase industrial energy efficiency while combating climate change. Estimates suggest that Egypt has a total stock of 950,000 motors (larger than 1hp), with an installed capacity of over 17GW. The industrial sector accounts for 86% of the installed capacity, with the remaining 14% attributed to the agricultural and commercial sectors.[14] Motor systems consume 60% of the total industrial electricity demand in Egypt accounting for approximately 23,463 GWh.[15]

The non-metallic minerals sub-sector (including cement) followed by the primary metal and food and beverage had the highest levels of motor system electricity consumption in 2015. Based on this data and other factors, the project will select three target sectors during the inception phases to receive technical assistance and support for technology demonstration projects.

[14] World Bank (2017) Egypt Local Manufacturing Study Preliminary Results
[15] Global Efficiency Intelligence, LLC (November 2017) Energy Efficiency and GHG Emissions Reduction Potential in Industrial Motors in Egypt.

FIGURE 1 INDUSTRIAL MOTOR SYSTEMS ELECTRICITY USE BY MANUFACTURING SUBSECTORS FOR EGYPT IN 2015

Manufacturing subsectors	Industrial motor systems electricity use (GWh)
Food, beverage and tobacco product	2,502
Textiles, apparel and leather product	1,837
Pulp and paper and wood products	995
Chemical	1,820
Plastics and rubber products	995
Non-metallic minerals	6,358
Primary metal	5,019
Fabricated metal product	644
Electronic product and electrical equipment	475
Other manufacturing industries	2,818
Total	**23,463**

Source: Study on EE and GHG emission reduction potential from EE motor systems in Egypt undertaken by Global Efficiency Intelligence, LLC Analyses as part of the PPG phase (Full report in Annex I to this document)

EE Potential in Industrial EMDS

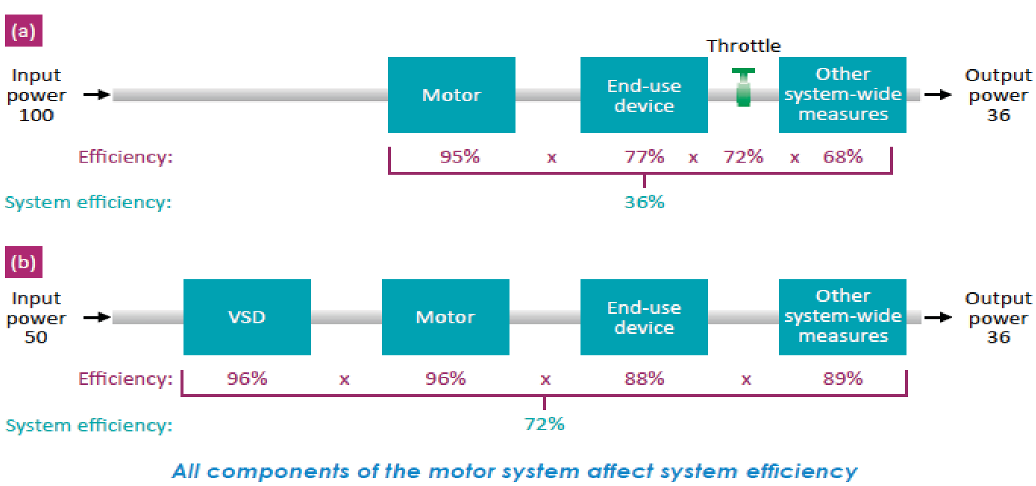
The adoption of EE motor systems in Egypt remains significantly low as industries have enjoyed subsidized energy prices, which will be gradually removed over the next few years. The market is saturated with low-cost, low-efficiency ("no-brand"), and counterfeit motors. A survey conducted by the IFC STEP project revealed that over 60% of the installed motors were below standard efficiency and more than half (56.3%) are over 10 years old. Only 24% of the surveyed motors had VSDs installed on them.

Furthermore, energy efficient IE1 to IE3 motors only account for around 22% of total installed industrial motors.[16] Less than 1% of the motors were IE3 or higher.[17] IE2 and IE3 motors are usually ordered by multinational companies who can finance the price premium for efficient motors, and the motors take around 2-3 months for delivery.[18]

[16] Ibid.
[17] Cairo University (2016), *Market Analysis for the Motor Market in Egypt for Energy Efficient Motor Standards and Labelling Program,* submitted to the World Bank Group. In 2016, the IFC STEP project commissioned a survey of the existing industrial motor stock. The survey covered a sample of 104 industrial enterprises with over 46,000 installed motors. The surveyed enterprises accounted for approximately 3% of total industrial electricity consumption and represented a wide range of industrial sub-sectors, including building materials, chemicals, textiles and garments, packaging and printing, and food
[18] UNIDO PPG Report

EMDSs are comprised of electric motors driving different equipment systems such as pumps, fans, compressed air systems, material handling, processing systems, etc. While motor efficiency improvements or replacement will increase the motor system's efficiency, there are numerous other measures at the system-level that can produce significant energy savings. Therefore, this project will focus on the cumulative energy savings that may be achieved from optimizing the efficiency of electric motor driven systems, including improving the efficiency of the equipment driven by the motor. Optimization measures such as predictive maintenance, avoiding oversized motors, and matching motor systems to specific needs may improve the energy efficiency of EMDSs significantly. By looking beyond even the motor systems to the efficiency of end-use devices, additional energy savings may be achieved.[19]

FIGURE 2 ILLUSTRATION OF TWO INDUSTRIAL ELECTRIC MOTOR-DRIVEN SYSTEMS: (A) NORMAL AND (B) EFFICIENT



Note: VSD = variable speed drive.

Source: IEA, 2016

In Egypt, the three main EMDSs—industrial pump systems, fan systems, and compressed air systems— together account for 45% of electricity use in industrial motor systems. Motor system optimization measures, including low and no-cost measures, combined with motor replacement could result in over 40% total technical electricity savings potential.[20]

In Egypt, the share of total technical electricity-savings potential for industrial pump systems compared to total pump systems energy use is 49%. The share of total technical electricity-savings potential for industrial fan systems compared to total manufacturing fan systems energy use in Egypt is 38%. The share of total technical electricity-savings potential for industrial compressor systems compared to total manufacturing compressor systems energy use is 39%. These are very large and significant saving potential that policy makers in Egypt cannot afford to ignore.[21]

[19] International Energy Agency (IEA). 2016. World Energy Outlook 2016. Paris, France.

[20] Ibid.

[21] Global Efficiency Intelligence, LLC (November 2017) Energy Efficiency and GHG Emissions Reduction Potential in Industrial Motors in Egypt.

FIGURE 3 INDUSTRIAL MOTOR SYSTEMS ELECTRICITY-SAVINGS POTENTIAL IN EGYPT IN 2015

	Cost-effective Energy Saving Potential (GWh/yr)	Technical Energy Saving Potential (GWh/yr)
Pump systems	1,813	2,068
Fan systems	1,008	1,212
Compressed air systems	952	1,269

Industrial Pump Systems: Cost effective measures include isolate flow paths to nonessential or non-operating equipment; fix leaks, damaged seals, and packing; trim or change impeller to match output to requirements; remove sediment/scale buildup from piping; use pressure switches to shut down unnecessary pumps; and install variable speed drives.

FIGURE 4 CUMULATIVE ANNUAL ELECTRICITY SAVING AND CO2 EMISSION REDUCTION POTENTIAL FOR EFFICIENCY MEASURES IN INDUSTRIAL PUMP SYSTEMS IN EGYPT RANKED BY FINAL COST OF CONSERVED ENERGY (CCE)

No.	Energy Efficiency Measures	Cumulative Annual Electricity Saving Potential (GWh/yr)	Final Cost of Conserved Energy (US$/MWh-Saved)	Cumulative Annual CO2 Emission Reduction Potential (kton CO2 /yr)
1	Isolate flow paths to nonessential or non-operating equipment	516	0	301
2	Fix Leaks, damaged seals, and packing	618	22	360
3	Trim or change impeller to match output to requirements	1,058	22	617
4	Remove sediment/scale buildup from piping	1,219	29	711
5	Use pressure switches to shut down unnecessary pumps	1,362	33	794
6	Install variable speed drive	1,753	51	1,022
7	Replace pump with more energy	1,974	77	1,151

	efficient type			
8	Replace motor with more efficient type	2,022	162	1,179

Notes: 1) Energy savings are based on 100% adoption of the efficiency measures. 2) The energy and CO_2 savings presented for each measure are the cumulating savings from that measure and all previous measures with lower CCE. 3) This analysis provides an indication of the cost-effectiveness of system energy efficiency measures at the country level. The cost-effectiveness of individual measures will vary based on plant-specific conditions.

Source: Study on EE and GHG emission reduction potential from EE motor systems in Egypt undertaken by Global Efficiency Intelligence, LLC Analyses as part of the PPG phase (Full report in Annex I to this document)

Industrial Fan Systems

Cost effective EE measures include fix leaks and damaged seals; insolate flow paths to nonessential or non-operating equipment; correct damper problems; repair or replace inefficient belt drives; correct poor airflow conditions at fan inlets and outlets; and install variable speed drives.

FIGURE 5 CUMULATIVE ANNUAL ELECTRICITY SAVING AND CO2 EMISSION REDUCTION POTENTIAL FOR EFFICIENCY MEASURES IN INDUSTRIAL FAN SYSTEMS IN EGYPT RANKED BY FINAL CCE

No.	Energy Efficiency Measures	Cumulative Annual Electricity Saving Potential (GWh/yr)	Final Cost of Conserved Energy (US$/MWh-Saved)	Cumulative Annual CO_2 Emission Reduction Potential (kton CO_2 /yr)
1	Fix Leaks and damaged seals	126	3.3	73
2	Isolate flow paths to nonessential or non-operating equipment	385	3.9	224
3	Correct damper problems	477	4.5	278
4	Repair or replace inefficient belt drives	555	8.0	323
5	Correct poor airflow conditions at fan inlets and outlets	708	10.6	413
6	Install variable speed drive	1,008	50.7	588
7	Replace oversized fans with more efficient type	1,172	65.9	683
8	Replace motor with more energy efficient type	1,212	128.6	707

Notes: 1) Energy savings are based on 100% adoption of the efficiency measures. 2) The energy and CO_2 savings presented for each measure are the cumulating savings from that measure and all previous measures with lower CCE. 3) This analysis provides an indication of the cost-effectiveness of system energy efficiency measures at the country level. The cost-effectiveness of individual measures will vary based on plant-specific conditions.

Source: Study on EE and GHG emission reduction potential from EE motor systems in Egypt undertaken by Global Efficiency Intelligence, LLC Analyses as part of the PPG phase (Full report in Annex I to this document)

Industrial Compressed Air Systems

Cost effective EE measures include fix leaks, adjust compressor controls, and establish ongoing plan; initiate predictive maintenance program; install sequencer; improve end use efficiency, shut-off idle equipment, engineered nozzles, etc.; and eliminate inappropriate compressed air uses.

FGURE 6 CUMULATIVE ANNUAL ELECTRICITY SAVING AND CO2 EMISSION REDUCTION POTENTIAL FOR EFFICIENCY MEASURES IN INDUSTRIAL COMPRESSED AIR SYSTEMS IN EGYPT RANKED BY FINAL CCE

No.	Energy Efficiency Measures	Cumulative Annual Electricity Saving Potential (GWh/yr)	Final Cost of Conserved Energy (US$/MWh-Saved)	Cumulative Annual CO2 Emission Reduction Potential (kton CO2 /yr)
1	Fix Leaks, adjust compressor controls, establish ongoing plan	365	7	213
2	Initiate predictive maintenance program	505	12	294
3	Install sequencer	679	17	396
4	Improve end use efficiency; shut-off idle equip, engineered nozzles, etc.	794	20	463
5	Eliminate inappropriate compressed air uses	952	33	555
6	Eliminate artificial demand with pressure optimization/control/ storage	1,018	54	593
7	Correct excessive pressure drops in main line distribution piping	1,048	73	611
8	Match air treatment to demand side needs	1,094	108	638
9	Size replacement compressor to meet demand	1,184	141	690
10	Improve trim compressor part load efficiency; i.e. variable speed drive	1,269	153	740

Notes: 1) Energy savings are based on 100% adoption of the efficiency measures. 2) The energy and CO2 savings presented for each measure are the cumulating savings from that measure and all previous measures with lower CCE.
3) This analysis provides an indication of the cost-effectiveness of system energy efficiency measures at the country level. The cost-

effectiveness of individual measures will vary based on plant-specific conditions.

Source: Study on EE and GHG emission reduction potential from EE motor systems in Egypt undertaken by Global Efficiency Intelligence, LLC Analyses as part of the PPG phase (Full report in Annex I to this document) (Methodology in Section 2)

Value Chain for EE Motors

EE Equipment and Motor Manufacturers/Suppliers

Over 70% of motors are imported across industrial and commercial sectors in Egypt.[22] 74% of imported motors come from the European Union through manufacturers, such as ABB and Siemens.[23] Egyptian manufacturers, such as Daoud, Shobra Company, Siems, and Gemeco[24], account for around 30% of the total market, producing primarily low efficiency motors and equipment.[25] Currently, most of the motors produced in Egypt are used in pumps for irrigation and wastewater.[26]

Egyptian motor manufacturers and equipment suppliers currently produce 30,000-50,000 low efficiency (-IE1) motors each year but are actively exploring opportunities to upgrade their production line and manufacture higher efficiency models, dependent upon sufficient market demand. Shobra Company, for example, is exploring partnerships with international investors and motor manufacturers to upgrade their production line. Daoud would also like to upgrade their production lines to IE3 and export their motors to Europe. If demand expands for highly efficient industrial motors increases, Egyptian motor manufacturers could expand rapidly into this new market.

ABB and Siemens also plan to discontinue manufacturing IE1 and IE2, thus removing these motors from the market in Egypt and leaving industrial enterprises dependent on less reliable, cheaper motor suppliers.[27]

Rewinders

Low labour and high material costs make rewinding old motors more attractive to industrial enterprises than buying more efficient, expensive new motors. Instead of replacing damaged motors with high efficiency ones, most industrial facilities rewind these motors at one of the many rewind shops throughout industrial cities in Egypt. In fact, the IFC STEP survey revealed that over 95% of installed motors have been rewound at least once.[28]

Rewinding shops for the most part do not follow strict quality control systems or testing processes. Therefore, neither rewinders nor end users are able to verify if the energy efficiency of the motor has been reduced substantially through the rewinding process.[29]

ESCOs

The ESCO market in Egypt remains underdeveloped. Based on negative experiences working with ESCOs in the 1990s, the industrial sector lacks trust in the ESCO model. Factory owners tend to be reluctant to provide ESCOs with production data or access to the manufacturing process, making it difficult to estimate and verify savings associated with EE improvements. While a handful of ESCOs are currently in operation, including Forbes Marshall, Edison, and ConsuKorra, these companies tend to focus on simple EE measures such as lighting.

As energy prices rise and awareness of EE benefits improves among industrial enterprises, there is an unprecedented opportunity to scale-up the ESCO model in Egypt. During stakeholder consultations conducted during the PPG phase, both industrial enterprises and investors expressed interest in revisiting the ESCO model. Multiple enterprises expressed their willingness to work with ESCOs on EE projects and potential investors who are seeking opportunities to diversify their portfolios and explore new markets for their capital.

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[22] Lawrence Berkley National Laboratory (2017), *Scenario Analysis and Policy Roadmap for Energy Efficient Motor Standards and Labelling Program for Egypt,* submitted to the World Bank Group.

[23] Ibid.

[24] Cairo University (2016), *Market Analysis for the Motor Market in Egypt for Energy Efficient Motor Standards and Labelling Program,* submitted to the World Bank Group.

[25] Lawrence Berkley National Laboratory (2017), *Scenario Analysis and Policy Roadmap for Energy Efficient Motor Standards and Labelling Program for Egypt,* submitted to the World Bank Group.

[26] UNIDO PPG Baseline Assessment Report

[27] Ibid.

[28] Cairo University (2016), *Market Analysis for the Motor Market in Egypt for Energy Efficient Motor Standards and Labelling Program,* submitted to the World Bank Group.

[29] UNIDO PPG Baseline Assessment Report

Stakeholders agree that the main challenges to the ESCO market in Egypt are related to framework conditions. These barriers include lack of EPC contractual frameworks, dispute resolution mechanisms, independent M&V protocols, and quality assurance on the ESCOs and energy service providers in this sector. Supporting these framework conditions will help build trust and new business relationships between ESCOs and industrial enterprises.

There are also several drivers and strengths of business environment in Egypt that support the development of the ESCO model as well as framework conditions. EE motor upgrades represent an ideal opportunity to pilot the ESCO model, due to the simplified process of monitoring and verifying the savings achieved. Additionally, there are lawyers in Egypt who can draft standardized EPC contracts consistent with international standards and arbitration processes that can be customized to resolve potential conflicts between ESCOs and their clients.

Energy Performance Contracting (EPC) provides financing mechanisms for energy efficiency projects based on the expected cost savings. Through energy performance guarantees, ESCOs estimate the expected energy and cost savings from the project and then share the actual savings achieved with the end user or client. There are five main types of EPC business models: Shared Savings, Guaranteed Savings, Lease Rental Model, BOOT (Build-Own-Operate-Transfer) Model, and BOO (Build, Own, and Operate) Model. The primary difference between these business models is related to which actor (the ESCO or the end user) assumes financial risk.

- **Shared Savings:** The ESCO assumes the financial risk by financing the project with its own funds or loans. Both the ESCO and the end user take on the performance risk and share the cost savings achieved.
- **Guaranteed Savings:** The end user finances the project through loans from a bank or by leasing the equipment. However, the ESCO assumes the performance risk by guaranteeing the cost savings. If the cost savings fall short, the ESCO covers the difference; if the project exceeds expectations, the additional cost savings are shared between the ESCO and end user.
- **Lease Rental Model:** The end users lease the equipment from the supplier and make regular payments to the principal and interest. Usually the cost savings achieved cover these payments, and the end user will own the equipment upon full repayment.
- **BOOT Model:** The ESCO finances, owns, and operates the equipment for a specific period before transferring ownership to the end user.
- **BOO Model:** Private organizations build, own, and operate the energy efficiency equipment and projects in a factory or facility.

During the PPG phase, it became clear that the best ESCO model for the industrial sector in Egypt is Shared Savings. The ESCO makes the initial motor or equipment investment and the subsequent cost savings achieved from the EE improvements are shared between the ESCO and the industrial enterprise. This model to a large extent resembles the lease rental model, which is already common in Egypt. The main difference is that the technical and financial risks related to the realization of promised savings are undertaken by the ESCO instead of the end user.

There are many baseline conditions, policies, and projects that will serve as drivers of change and foster the wide-scale adoption of EE motors and MSO interventions.

Baseline policies

In 2007, the GoE undertook a major energy reform to reduce the massive public spending destined to energy subsidies, which was regarded as the first step in a longer process of energy reform. Still in 2013, energy subsidies reached approximately $16 billion, representing more than 20% of the national budget expenditures.[30] As such in 2014, the Egyptian Government introduced a plan to completely phase out electricity subsidies by 2019 causing electricity prices to progressively double over 5 years. Due to the devaluation of the Egyptian pound in 2016, electricity tariffs will now be raised on a regular basis until 2021.

In 2015, the Egyptian Electricity Law was adopted including a chapter on EE with provisions related to cogeneration, standards and labelling which targets to improve by 20% EE by 2020, considering 2008 as the baseline. Furthermore, the law includes (but is not limited to) expanding the label and standards program for equipment and appliances as well as developing a phase out plan for inefficient equipment.[31] The program covers refrigerators, air conditioners, washing machines, electric water heaters and Compact

[30] IFC (2015), *Energy Efficient Industries - Market and Investment Opportunities in Egypt.*
[31] Hafez A. El-Salmawy, *Egyptian Power Sector Reform and New Electricity Reform and New Electricity Law,* http://www.ecrc.org.eg/backend/uploads/documents/Dr.Hafez%20El-Salmawy%20-%20EgyptEra.pdf, (February, 2016).

fluorescent lights (CFLs) and accredits the Energy Efficiency Testing Laboratories established at the New and Renewable Energy Authority premises. [32]

The Egyptian government has recognized that a programme targeting motor efficiency in the country presents a cost-effective opportunity to significantly lower future energy demands, reduce potential supply shortages and improve energy security. The government has included a specific measures addressing industrial motor efficiency in the draft National Energy Efficiency Action Plan (NEEAP) 2017- 2020.

Following the development and adoption of the Industrial Energy Efficiency (IEE) strategy and policy recommendations delivered within the UNIDO- GEF 4 IEE project, the Ministry of Trade and Industry requested the project to integrate the IEE policy recommendations into sectoral strategies. The project has put forward a set of policy recommendations for the first two sectors, namely chemical and building materials. MEPS for crosscutting industrial equipment, including motors, is among the policy recommendations for these two sectors.

Additionally, the GoE is in the process of adopting a decree for the MEPS for industrial motors, supported through the IFC STEP project.The Egyptian Organization forStandards (EOS) has published the voluntary test method (ES2623-1) and energy class thresholds (ES2623-3) to begin this process. MoTI, EOS, General Organization for Import and Export Control (GOEIC) and Industrial Control Agency (ICA) have formed a steering committee to coordinate activities and engage with various stakeholders to support the MEPS policy. The standard will most likely require a full transition to IE3 motors by 2020, and the decree is expected to be issued in 2018. The standard, however, will only apply to the purchase of new motors and will not mandate or facilitate the replacement of existing motors. Existing industrial motors may still be resold on the internal market.

While energy efficiency standards and labeling provide a policy tool to regulate the supply of energy efficient industrial motors, the intervention falls short of creating an enabling environment for market upscaling and replacement of existing motors. Industrial enterprises will also need access to financing options in order to upgrade to energy efficient motors. However, financial tools and incentives to promote the uptake of highly efficient industrial motors currently do not exist. Furthermore, recent economic reform and financial instability, which resulted in the devaluation of the Egyptian pound and high interest rates, necessitate providing additional financing support and options to catalyze investment in industrial energy efficiency.

Baseline projects

During the PPG phase, several baseline projects were identified that promote industrial EE interventions and finance. While these projects improve the general environment for EE investments and diffusion, none of them focus specifically on developing the market for industrial motor system optimization and EE motor deployment by supporting industrial enterprises and ESCOs.

Smart Technology and Energy Efficient Production (STEP)- International Finance Corporation (IFC), World Bank: Launched in 2015, this ongoing project assists the Government of Egypt to increase industrial energy security and improve their international competitiveness by moving towards EE motor systems and clean technologies. The STEP project has collaborated with the GoE to develop standards and labels/MEPS for EE industrial motors and facilitate the transition to IE3 energy efficient motors. The STEP project also encourages the use of energy efficient technologies through knowledge sharing and training. UNIDO and IFC have worked closely to ensure a coordinated approach as the STEP project is expected to continue through 2018. The proposed project will complement the STEP project by increasing the capacity of market actors to undertake EE motor deployment in anticipation of the implementation of MEPS.

Clean Technology Manufacturing Value Chains, Trade and Competitiveness Global Practice, World Bank: Launched in 2017, this project provides assistance to the Minitry of Trade and Industry to promote investment in energy efficient technology production within the local manufacturing sector. The outcomes of the project include developing policy and regulatory frameworks to catalyze investment in the manufacture of energy efficient technologies and increasing the use of energy efficient technology within the industrial sector. The objective is to implement a sustainable strategy that utilizes local value chains to meet demand for energy efficient technology in Egypt. The project will stengthen linkages between local manufacturers of energy efficient motors and other products, suppliers, and industrial enterprises/end users. The proposed project will expand upon the strategies indentified by the clean technology manufacturing project by implementing an action plan to support local manufacturing of EE motor systems.

The Federation of Egyptian Industries (FEI) is a group of indusrial associations committed to driving industrial economic growth in the domestic and export markets. It has 16 chambers and 17 decision support committees that develop programs and services to facilitate and support the various industrial associations within Egypt. FEI currently hosts the Industrial Modernization Center (IMC), which implements renewable Energy, EE and Environment Protection Project.The project aims at limiting polluting emissions and reducing the specific energy consumption per product unit without any negative impact on its quality or quantity in terms of EE. To reach these goals, IMC provides technical support to the industrial sector through performing Preliminary Energy

[32] Ibrahim Yasssin Mahmoud, *Development in Egyptian Energy Efficiency Policy*, http://www.eeiggr.com/CONFERENCES/04_Sudan/EE%20POLICIES%20mod2.pdf, (January, 2016).

Audits (PEA) and delivering energy efficiency Technical Assistance (TA) services as well as by fostering the implementation of energy management systems. The project has provided more than 600 energy audits and TA services in the field of EE. Furthermore, it has encouraged a favorable technology transfer environment to enhance technological and non-technological innovation while stimulating the set-up of a supply chain in the EE sector.[33] The proposed project will build upon the IMC project by supporting technology demonstration for motor system optimization and EE motor deployment in the industrial eector as well as developing the market for ESCOs.

The Green Economy Financing Facility (GEFF Egypt) – European Bank for Reconstruction and Development (EBRD), French Development Agency (AFD), and the European Investment Bank (EIB): Launched in November 2016, the GEFF Egypt project is a $140 million credit line dedicated to EE and renewable energy private sector investments in Egypt. GEFF Egypt offers flexible loans worth up to five million dollars to businesses, service providers, ESCOs, and producers through participating financial institutions, including Qatar National Bank and the National Bank of Kuwait. Additionally, GEFF Egypt offers free technical assistance and investment incentives to assist businesses in managing their energy consumption. The project is collectively managed by MWH Global and the Regional Center for Renewable Energy and Energy Efficiency (RCREEE). The proposed project will support industrial enterprises in designing motor system optimization and EE motor deployment projects and refer them to GEFF Egypt to receive financing. The Green for Growth Fund (GGF) - KfW Development Bank and the EIB: GGF entered the Egyptian market in 2016 following its approved expansion into the Middle East and North Africa. GGF's investments seek to achieve a 20% reduction in energy consumption and/or a 20% reduction in CO_2 emissions. GGF provides funding to local financial institutions that on-lend to private sector companies and households investing in EE and RE that meet GGF energy saving and/or emissions targets. Three banks in Egypt have signed agreements with the GGF: 1) Alex Bank obtained a USD$20 million senior loan from the GGF; the bank will on-lend to RE and EE investments throughout the country. 2) National Bank of Egypt (NBE) also obtained a USD$30 million loan from the GGF in early 2017 to finance measures reducing energy consumption and CO_2 emissions in Egypt. 3) The Banque du Caire is the latest bank to partner with GGF, receiving a USD$10 million loan to support EE and RE investments. The proposed project will support industrial enterprises in designing motor system optimization and EE motor deployment projects, which may be eligible to receive financing from GGF.

European Fund for Sustainable Development – External Development Plan, European Union: Launched in 2016, the €4.1 billion fund will support sustainable development across Africa through 2020. Its focus areas include sustainable energy and connectivity and micro, small, and medium enterprise financing. The EFSD gives priority to investment opportunities that would otherwise not receive funding and that promote job creation through MSMEs. The proposed project will assist industrial enterprises and ESCOs in developing bankable projects and investment plans, which will increase their chances of receiving funding.

3) the proposed alternative scenario, GEF focal area strategies, with a brief description of expected outcomes and components of the project

The proposed project aims to reduce GHG emissions in Egypt by improving the efficiency of EMDS and accelerating the market penetration of EE motors in the industrial sector. The project will focus on both on cost-effective motor system optimization measures and the replacement of inefficient motors, which may result in a 40% reduction in energy use.

This objective will be achieved through a market transformation strategy that includes five key elements: (i) strengthening the domestic legislative and regulatory framework related to energy efficiency in EMDS; (ii) conducting a comprehensive public awareness programme to generate demand for energy efficiency upgrades to EMDS; (iii) building local technical capacity to identify and implement appropropriate efficiency measures for EMDS; (iv) developing and facilitating technology demonstration projects to showcase the savings potential of EE motors and MSO measures; and (v) enabling the ESCO market and promoting innovative ESCO business models.

A detailed description of the means by which the project will accelerate the deployment of EE electric motors and implementation of motor system optimization is found below.

- **Component 1: Conducive Policy and Legal Environment for EE Motor Systems**

This component seeks to support MOTI in developing an enabling policy environment to transform the market for EE in EMDS. With the technical assistance provided through this project, MOTI and other relevant stakeholders will develop policy tools to accelerate the phase out of old motors and adoption of MSO measures, support rewinding shops and their workers in upgrading their practices or moving to new sectors, and develop contractual and accreditation frameworks to enable ESCO business models. By working on these three policy tracks in parallel, the project will make sure that the new demand for EE MSO measures and motors will create new business opportunities for ESCOs while mitigating the negative impact that the rewinding industry may experience from the push toward higher energy efficiency of motor systems. This component will be led by MOTI as it covers policy dimension. In order to ensure the buy in and ownership of relevant stakeholders, thematic working groups will be formed as

[33] IMC, Vision and Mission, http://www.imc-egypt.org/index.php/en/imc, (February, 2016).

required to support the project implementation. The need to establish such working groups and the various topics will be determined during the project implementation.

This component is divided in four outputs:

Output 1.1.1. *Recommendations on policy tools and guidelines for the deployment of EE motors developed*

This output will build on the MEPS for industrial motors by providing support to MOTI in drafting and adopting additional policies to accelerate the upgrading of the installed industrial motors stock. Based on the priorities of MOTI, the proposed policy tools may include recommendations for accelerating the replacement of larger, older, and inefficient installed motors; guidelines for integrating motor efficiency standards into government procurement processes; or financial and fiscal incentives for industries to upgrade motors and motor systems.

An inventory of the existing motor stock will be developed. The data collected to develop the inventory will be aggregated, visualized and made available to decision makers in the public and private sectors to inform policy and investment decisions. MOTI shall lead the development of the recommendations and ensure their acceptance.

Output	**Activity**
Output 1.1.1. Recommendations on policy tools and guidelines for the deployment of EE motors developed	1.1.1.1 Develop an inventory of the existing motor stock in the industrial sector
	1.1.1.2 Propose a list of possible policy tools and guidelines based on international best practices and assist policymakers in selecting the tools and guidelines that are appropriate for the Egyptian context
	1.1.1.3 Develop the selected tools and guidelines through a participatory process involving the relevant public and private sector actors
	1.1.1.4 Support the relevant public-sector entities in disseminating the tools and guidelines to the relevant stakeholders

Output 1.1.2. *Action plans to support rewinding shops in adapting to the changes in the industrial motors marketplace developed*

With the adoption of the MEPS and the acceleration of inefficient motor replacement through this project, the demand for sub-standard rewinding services will most likely decrease. This output, therefore, will provide necessary technical assistance to MOTI to draft and adopt new action plans to upgrade existing rewinding operations to follow standard quality control and EE testing processing and when necessary, to re-integrate rewinders who lose their businesses and jobs into the labor market.

Guidelines for best practices in motor rewinding will be developed to assist rewinding shops in upgrading their practices in order to remain competitive and provide high-quality services to their industrial clients. The guidelines will be discussed and presented to rewinding shops and other stakeholders to ensure acceptance and buy in.

Output	**Activity**
Output 1.1.2. Action plan and guidelines to support rewinding shops and their workers in adapting to the changes in the industrial motors marketplace developed	1.1.2.1 Perform a rapid assessment of the potential impact of changes in the industrial motors marketplace on the rewinding industry, including potential loss of employment or business
	1.1.2.2 Identify cost-effective measures to mitigate the negative impacts and develop a roadmap for the implementation of these measures
	1.1.2.3 Develop guidelines for best practices in motor rewinding
	1.1.2.4 Support the relevant public-sector entity in the dissemination and implementation of the action plan

Output 1.1.3. *Action plan to support local industries in the development of EE and clean technologies for motor systems developed*

While the EE market in Egypt is expected to grow in the near future, the local supply of EE and clean technology for motor systems remains underdeveloped as several barriers are faced by potential EE motor system manufacturers. In fact, Egyptian players are not yet able to manufacture EE Motors and Variable Speed Drives (VSDs) locally. This output will build upon the strategies identified by the World Bank to promote the local manufacturing value chain of EE industrial equipment and motors. It will support local manufacturers in the production of EE motor systems through the development of an action plan and business-to-business matchmaking. The Federation of Egyptian Industries, particularly the Engineering Chamber will play a key role in developing the action plan and validating the targets with industry representatives.

Output	**Activity**
Output 1.1.3. Action plan to support local industries in the development of EE and clean technologies for motor systems developed	1.1.3.1 Conduct an assessment for upgrading local manufacturing of EE industrial motor systems
	1.1.3.2 Conduct feasibility analysis of investment opportunities for local manufacturing and feeder industries of EE industrial motor systems
	1.1.3.3 Develop the action plan for supporting local industries
	1.1.3.4 Support the relevant public-sector entity in the dissemination and implementation of the action plan
	1.1.3.5 Create opportunities for match-making and business-to-business networking within the value of EE industrial motor systems

Output 1.1.4. *ESCO market support policies and tools developed*

Currently, there are no support policies in place to enable the development of a market for ESCO services. This output will support the drafting and adopting of new support policies and tools that will enable ESCO business models. Special attention will be given to policy and regulatory tools that build trust in the marketplace for such models. These tools will include a certification framework for ESCOs, an M&V protocol for motor system energy efficiency projects, and an accreditation framework for independent M&V providers. These tools will help the industrial enterprises to select trustworthy ESCOs and will allow both parties to ascertain the level of realized savings in case of disputes.

A working group will be set-up under the chairmanship of MOTI and will include relevant stakeholders such as EGAC/EOS and representatives of banks, private sector and ESCOs. The working group will take into account the relevant issues and barriers highlighted by different groups and the framework conditions for ESCO accreditation in Egypt and ensure the buy-in of all stakeholders.

Output	**Activity**
Output 1.1.4. ESCO market support policies and tools developed	1.1.4.1 Perform a rapid assessment to validate the findings of the ESCO assessment undertaken during PPG phase and confirm the selection of ESCO business models
	1.1.4.2 Develop an accreditation scheme for ESCOs
	1.1.4.3 Develop an M&V framework and operational guide for motor system applications
	1.1.4.4 Identify and adapt a certification scheme for M&V service providers

- **Component 2: Awareness and Capacity Building on Energy Efficiency in Motors and Motor Driven Systems**

This component aims at removing information barriers to induce sustainable structural and behavioral changes in Egypt. Furthermore, it builds the technical capacity in the local market for MSO, EE industrial motors upgrades, and ESCO business models.

This component is divided in five outputs:

Output 2.1.1. *National awareness campaign on the benefits of EE upgrades to Electric Motor Driven Systems in the industrial sector conducted*

This output will focus on increasing awareness among manufacturers, industrial end-users, service providers and motor system suppliers on the technical and economic benefits of EE in EMDS. The awareness raising activities will be especially targeted at decision-makers in the sectors with the greatest potential for EMDS optimization and upgrades such as chemicals and metals. Further details on the high priority sectors and related potential in sectors is outlined in Table 1 under the baseline description. The campaign will leverage existing institutional structures to reach its target audience, such as chambers of industry, investor associations of industrial cities, among others. Activities will be carried out in cooperation with the ENCPC, being the entity within MOTI mandated with promoting EE within the industrial sector. The activities will include hosting workshops, conferences, and stakeholder engagement meetings and creating an award for "EE EMDS Champion," as part of the Ministry's Innovation Award.

In delivering the campaign, the ENCPC will tareget the key industrial zones and hubs in Egypt and work through the chambers of the Federation of Egyptian Industries to ensure the optimal outreach to industry.

Output	**Activity**
Output 2.1.1. National awareness campaign on the benefits of EE upgrades to Electric Motor Driven Systems	2.1.1.1 Organize 20 workshops, conferences and stakeholder engagement meetings over the life of the project
	2.1.1.2 Develop and distribute leaflets that highlight the technical, economic, financial and environmental benefits of energy efficiency upgrades to industrial motors and motor systems
	2.1.1.3 Prepare and disseminate press releases via various media sources
	2.1.1.4 Establish an Annual Innovation Award on EE in motors and motor systems with a sub-category that focuses on women champions

Output 2.1. 2. *Peer-to-peer platform for information exchange, cooperation and partnerships among seekers and providers of services and information on EE in EMDS developed*

Peer-to-peer learning is often a powerful driver for companies to implement EE technologies and reap the productivity or competitive advantages their peers have enjoyed from similar investments. The development of a platform that links industrial enterprises and energy service providers with their peers will facilitate information exchange, cooperation and partnerships. This component will build upon the peer-to-peer network model established for the petrochemical industry during the UNIDO-GEF4 IEE project This peer-to-peer platform will be developed in cooperation with the relevant chambers within the Federations of Egyptian Industries and the relevant holding companies in the targeted sectors. The platform host will be determined during the project implementation taking into account the sustainability for hosting the platform.

Output	**Activity**
Output 2.1.2. Peer-to-peer platform for information exchange, cooperation and partnerships among seekers and providers of services and information on EE in EMDS developed	2.1.2.1 Hold a series of consultations with the relevant stakeholders and potential members to finalize the design of the network, including goals, activities, timelines, operational modality, and plan for sustainability
	2.1.2.2 Develop an online platform to host the network
	2.12.3 Hold regular in-person meetings and networking events for members
	2.12.3 Monitor the performance of the P2P network and implement corrective actions to

	stimulate engagement, if necessary

Output 2.1.3. *Information gained through the 30 demonstration projects disseminated*

Once the demonstration projects for motor systems optimization and EE motor upgrades under component 3 have been implemented, the results will be extensively documented and publicly disseminated through case studies, web stories, and/or official reports. The success stories and lessons learned will facilitate the replication of these measures throughout the industrial sector. These case studies will also encourage industrial enterprises to experiment with ESCO business models since they will have a better sense of the savings potential of the practices and technological solutions that the ESCOs are proposing. The project will work with willing university professors to disseminate the case studies to engineering students throughout the country in order to prepare the next generation of engineers with the necessary knowledge about energy efficiency in EMDS. The case studies will be disseminated on the ENCPC website and included in information packages developed by the center.

Output	**Activity**
Output 2.1.3. Information gained through the 30 demonstration projects disseminated	2.1.3.1 Document and disseminate best practice case studies of the demonstration projects using multimedia channels including print, video and social media postings
	2.1.3.2 Organize up to 5 technical tours for technical experts and interested end-users to the demonstration projects

Output 2.1.4. 300 x *Industrial end users, suppliers, and motor system optimization experts trained*

A 2-day “user-level” training course in motor system optimization will be offered to 300 factory engineers, managers and procurement officers as well as motor suppliers, traders and vendors. The trainings include modules on the benefits of energy efficient motors and motor systems, variable speed drives (VSD), and step-by-step processes for conducting energy assessments and measurements. The user-level training will provide opportunities for these stakeholders to share knowledge about EE interventions and network about future projects. Top managers of industrial enterprises will be invited to the user-level trainings in order to equip decision-makers with the knowledge to make informed decisions about investments in the motor systems. An international expert will deliver the first cycle of the training and work on developing local talents and trainers for delivering the next cycles of training.

The user-level training will be followed by an “expert-level” training offered by international experts to 50 local MSO experts. Five training modules will be offered covering the following types systems: general motors, pumping systems, compressed air systems, fan systems, and refrigeration. At the end of the course, the MSO practitioners will receive a certification in motor system optimization.

This intensive training will be followed with coaching over a 12-month period. After completing the training, these local experts will assist industry in implementing the motor system efficiency audits, system optimization projects, and EE motor replacement/upgrades for industrial enterprises in component 3. As part of component 4, 20-30 of the system optimization practitioners will be encouraged and supported to form ESCOs and use EPC to initiate MSO and EE motors projects.

Similar to the user-level training, an international expert will deliver the first cycle of the training and work on developing local talents and trainers for delivering the next cycles of training. To ensure the long-term sustainability of these capacity building efforts, the project will facilitate a technical working group that brings together relevant actors from the public and private sector, including MOTI, universities and training centers, and the FEI. This working group will formalize a certification scheme for graduates of MSO training programs. Furthermore, the project will build upon the initiative launched by the GEF-funded IEE project to integrate MSO training into the curriculum at Cairo University.

Output	Activity
Output 2.1.4. 300 x Industrial end users, suppliers, and motor system optimization experts trained	2.1.4.1 Identify training providers
	2.1.4.2 Prepare 2-day “user-level” basic training material on the benefits of motor system optimization and EE motors based on UNIDO’s *Manual for Industrial Motor Systems Assessment and Optimization*
	2.1.4.3 Deliver “user-level” training to 200 industrial enterprise staff members, including engineers, procurement officers, and managers
	2.1.4.4 Deliver “user-level” training to 100 motor suppliers and vendors staff members, including sales representatives, inventory managers, and top mangers
	2.1.4.5 Prepare “expert-level” advanced training material on motor system optimization based on UNIDO’s *Manual for Industrial Motor Systems Assessment and Optimization*
	2.1.4.6 Deliver “expert-level” training to 50 energy professionals with mentoring and coaching over a period of one year

2.1.5. 20 x Local rewinding and refurbishing workshops capacity improved

This output will build upon the guidelines and best practices developed for the rewinding and refurbishing industry under Component 1. The project will improve the capacity of workshop staff and owners through a combination of training courses and on-the-job training sessions. The training material will be developed during the implementation.

Output	Activity
Output 2.1.5. 20 x Local rewinding and refurbishing workshops capacity improved	2.1.5.1 Prepare training materials based on the guidelines for best practices in motor rewinding from Output 1.1.2
	2.1.5.2 Deliver the training to the staff of 20 rewinding workshops
	2.1.5.3 Provide on-the-job training for staff of 10 rewinding workshops in order to upgrade their practices

- **Component 3: Technical Assistance for Technology Demonstration and Upscaling**

This component will provide technical assistance to demonstrate the multiple benefits of adopting EE in EMDS at enterprise level. These demonstration projects will focus on commercialized energy efficiency measures relating to industrial motor systems in Egypt in order to increase the potential for rapid market uptake of these measures once their benefits have been demonstrated. The demonstration projects, especially those involving significant investments in motor replacement, will be done in partnership with financial institutions offering soft financing solutions for EE upgrades or international suppliers of industrial motors who can offer preferential pricing and soft financing terms. The experience gained from these partnerships to support demonstration projects will sustain the momentum of the market transformation after the end of the project.

This component is divided in four outputs:

Output 3.1.1. *Detailed motor efficiency audits for 40 selected enterprises conducted by UNIDO-trained motor system optimization experts*

This output will focus on identifying and selecting enterprises where the demonstration projects will have the highest potential impact. From the potential enterprises identified, 40 will receive detailed energy audits for EMDSs conducted by the MSO experts trained in component 2. The audits will identify the list of measures to be implemented in each of the enterprises and provide an opportunity to build relationships between the industrial enterprises and SO experts to initiate no- or low-cost EE interventions.

The selection criteria for the enterprises will be confirmed during the inception phase but will most likely include factors such as the existence of an energy manager; willingness of the management to allocate human resource and co-financing for the implementation of demonstration projects; the energy-intensity of the enterprise; and having a minimum installed capacity of electric motors of around 250 kW. A call for proposals will be disseminated through the FEI and other channels to select 40 industrial enterprises, which shall participate in technology demonstration activities. Trained local experts will be paired with participating companies to deliver the support required and have the practical part of the training.

Output	**Activity**
Output 3.1.1. Detailed motor efficiency audits for 40 selected enterprises conducted by UNIDO-trained motor system optimization experts	3.1.1.1 Carry out consultations with the relevant stakeholders to validate the targeted sectors and selection criteria for enterprises
	3.1.1.2 Select and sign agreements with 40 companies where motor efficiency audits will be conducted
	3.1.1.3 Conduct detailed audits for EMDS using the MSO experts being trained under Activity 2.1.4.6

Output 3.1.2. Technical and business advisory services for 30 motor upgrade projects development facilitated

This output will provide technical and business expertise to develop pilot projects involving EE in motor driven systems for 30 out of the 40 enterprises. The assistance offered will include: technical feasibility, financial analysis, selection of technologies, assessment and reduction of risk as well as support in the development of bankable projects or/and preparation of applications for projects.

Output	**Activity**
Output 3.1.2. Technical and business advisory services for 30 motor upgrade projects development facilitated	3.1.2.1 Design demonstration projects for 30 enterprises based on the audit results, including engineering designs, technical specifications, implementation plans, O&M requirements, etc.
	3.1.2.2 Produce bankable feasibility studies for the demonstration projects
	3.1.2.3 Support the 30 enterprises in developing funding proposals to apply for loans to finance the portions of the pilot projects that will not be covered from the revolving fund under Output 4.1.4. or the entirety of the project if ESCO involvement is ruled out by the owner

Output 3.1.3. *System optimization for EMDS implemented and EE motors installed in 30 enterprises*

Motor system optimization and motor replacement measures will be implemented in 30 enterprises to showcase the technical and economic benefits of EE in EMDS. It is anticipated that ESCOs, formed by or employing the system optimization experts trained in component 2, will be engaged in the installation work for the 30 demonstration projects. These projects will include a mix of no-to-low cost measures as well as higher capital cost measures such as motor replacement. Funding for the implementation of the low-cost measures can be drawn directly from the project's revolving fund established under Component 4. Motor replacement will be funded through one of the EE credit-lines available in the market or installment plans offered, directly by the suppliers with support from the project, or through the project's revolving fund if it is implemented by an ESCO.

Output	**Activity**
Output 3.1.3. System optimization for EMDS implemented and EE motors installed in 30 enterprises	3.1.3.1 Provide technical assistance to the enterprises in the procurement of the selected equipment and services for the pilot projects
	3.1.3.2 Provide assistance to the enterprises in overseeing the implementation of the demonstration projects

	3.1.3.3 Monitor, verify and report on the performance of the demonstration projects

Output 3.1.4. *Public private partnerships with international suppliers developed to accelerate the deployment of EE motors*

This output will support the ongoing discussions between MOTI and international suppliers to create an appropriate public-private partnership to upscale the replacement of inefficient motors. A forum for cooperation between international suppliers, such as ABB and Siemens, industrial enterprises, and MOTI will be created to formulate and execute joint activities and initiatives that contribute to other outputs in this project. Activities will include collaborating on M&V efforts, including funding and developing a mobile testing lab for motor systems; funding a training lab at a local university to give students access to state of the art equipment; and developing easy payment options for industrial facilities implementing demonstration projects.

Output	**Activity**
Output 3.1.4. Public private partnerships with international suppliers developed to accelerate the deployment of EE motors	3.1.4.1 Support the development of a public private partnership involving international suppliers and the GoE and industrial enterprises.

- **Component 4: ESCO model to provide energy efficiency services to industry piloted**

The project will provide technical assistance and financing options to support the development of ESCOs and pilot EPC business models. This component will address the main barriers facing ESCOs in Egypt, including the lack of a standard contractual framework and lack of independent M&V protocols to determine energy savings achieved through EPC projects. Additionally, a $500,000 revolving fund will be created to provide small loans to ESCOs and system optimizers to conduct system optimization projects with the industrial enterprises in component 3. The component has four outputs.

Output 4.1.1. *Contractual framework for energy performance contracting ESCO business model developed*

Currently, contractual frameworks and enforcement mechanisms for EPC do not exist in Egypt. This project will provide technical assistance to standardize contracts and develop arbitration and dispute resolutions mechanisms. Activities include: creating a standard contract for energy performance contracting, with a focus on EMDS; developing arbitration and dispute resolution protocols; and providing three trainings for independent arbitration bodies in Egypt on ESCO-related contracts. This is one of the ouputs which will also require detailed consultations with different partners, which will be facilitated through a working group.

Output	**Activity**
Output 4.1.1. Contractual framework for energy performance contracting developed	4.1.1.1 Create a standard contract for EPC in motor system optimization projects
	4.1.1.2 Develop arbitration and dispute resolution protocols
	4.1.1.3 Provide three trainings for independent arbitration bodies in Egypt on EPC contract disputes
	4.1.1.4 Provide hands-on assistance to the arbitration bodies on contract resolution, if necessary.

Output 4.1.2. *M&V tools established and made available to ESCOs, M&V providers, and industry*

Establishing M&V protocols will make EPC more attractive to industrial enterprises and enable independent verification of the energy savings achieved. The project will provide technical assistance to develop M&V tools and make them available to ESCOs, M&V providers, and companies. Activities include: creating a standard M&V plan for EMDS projects and training 10 independent M&V service providers, who have an opportunity to become accredited through Component 1.

The proposed project also plans to support and facilitate a public-private partnership between an international supplier and MOTI to fund and develop a mobile testing lab. The testing lab will provide independent verification of the energy savings achieved from motor system optimization and EE motor deployment.

Output	Activity
Output 4.1.2. M&V tools established and made available to ESCOs, M&V providers, and industry	4.1.2.1 Create a standard M&V plan for EMDS projects
	4.1.2.2 Support establishing a mobile testing lab to support M&V activities
	4.1.2.3 Train 10 independent M&V service provider and assist them in becoming certified under Activity 1.1.4.4.

Output 4.1.3. *ESCO businesses developed and established*

The project will provide technical assistance to develop appropriate ESCO business plans and standardize operational modalities and best practices. Following business plan development, at least five ESCOs will be established and are expected to be operational by the end of the project. It is expected that some of the system optimization experts trained in component 2 will be interested in founding or working for ESCOs and/or utilizing the EPC model.

Output	Activity
Output 4.1.3. ESCO businesses developed and established	4.1.3.1 Develop the operational modalities for the ESCO business models selected under Activity 1.1.4.1
	4.1.3.2 Promote the selected ESCO business models to the enterprises and energy professionals receiving training and technical assistance under Outcomes 2 and 3
	4.1.3.3 Provide mentoring and coaching in the implementation of the selected ESCO models to at least five energy professionals or companies
	4.1.3.4 Support the implementation of the ESCO accreditation scheme developed under Activity 1.1.4.2

Output 4.1.3. *Revolving fund to offer project-based financing packages for system optimization EPC projects introduced*

A $500,000 revolving fund will be created to provide small loans to ESCOs and system optimizers to conduct motor system optimization projects with the industrial enterprises selected in component 3. This fund will help create an enabling environment for ESCOs and/or EPC, covering upfront labor and material costs associated with small-to-medium motor system optimization projects. As part of this output, a suitable institution will be identified through a tender process to host the revolving fund. Opportunities to create synergies with existing revolving funds in the country will be explored. The revolving fund will be managed by the selected institution in line with management guidelines to be pre-defined in the terms of reference of the fund. The decision to finance a project shall strictly follow the established procedures and be endorsed by UNIDO and the MOTI. Prior to the end of the project, the responsibility for the monitoring of the fund and approval of project financing shall be passed on to the MOTI.

To ensure that the bank has the expertise required in operating the fund, ten bank officers will be trained in EPC project assessment. The ESCOs and SO experts will also receive hands-on training in financial analysis, to assess the feasibility of various EPC projects. The fund aims to receive 30 loan applications for EMDS projects and disburse at least 10 small loans during the life of the project.

Output	Activity
Output 4.1.4. Revolving fund to offer project-based financing packages for system optimization EPC projects	4.1.4.1 Set up a revolving fund with a local bank or institution
	4.1.4.2 Train 10 staff members of the participating bank or institution in the identification, development and evaluation of ESCO projects

introduced	4.1.4.3 Train industrial enterprises and MSO experts in financial analysis
	4.1.4.4 Assist the industrial enterprises and energy professionals in developing financial plans and loan applications for projects
	4.1.4.5 Provide hands-on mentoring and coaching to the local participating bank or institution in operating the revolving fund
	4.1.4.6 Monitor, verify and report on the performance of the revolving fund

- **Component 5: Monitoring and Evaluation**

Output 5.1.1. *Project progress monitored, documented, and recommended actions formulated*

The project will go through a project preparatory phase, in which the detailed operational procedures and other implementation issues will be specified and prescribed. During the project implementation, the PIRs will be prepared at least once per year to monitor the progress achieved since the start of the project or previous reporting periods. The PIRs will determine the level of progress being made toward the project outcomes and will identify course correction if needed.

Output	**Activity**
Output 5.1.1. Project progress monitored, documented, and recommended actions formulated	5.1.1.1 Conduct inception workshop and prepare inception report
	5.1.1.2 Monitor indicators in project results framework
	5.1.1.3 Monitor environmental and social risks
	5.1.1.4 Prepare GEF Project Implementation Report (PIR)

Output 5.1.2. *Mid-term Review (MTR) and Terminal Evaluation (TE) conducted in timely manner*

An independent Mid-term Review (MTR) will take place at the mid-point of project implementation. The MTR will determine the progress being made toward the achievement of outcomes and will identify course correction if needed. Additionally, the project will undergo an independent TE three months prior to the end of the project and will be undertaken in accordance with UNIDO and GEF guidance. The final evaluation will focus on the delivery of the project's results as initially planned as well as the impact and sustainability of results, including the contribution to capacity development and the achievement of global environmental benefits/goals.

Output	**Activity**
Output 5.1.2. Terminal Evaluation (TE) conducted in timely manner	5.1.2.1 Update Terminal GEF tracking Tool
	5.1.2.2 Conduct Independent Terminal Evaluation

4) incremental/additional cost reasoning and expected contributions from the baseline, the GEFTF, LDCF, SCCF, CBIT, and co-financing

There are many external factors that will serve to promote energy efficiency in industrial motor systems. These factors include the GoE's introduction of MEPS for industrial motors and adoption of major energy subsidy reforms. As energy prices increase and MEPS for industrial motors come into effect, the industrial sector will begin to see a gradual shift to more efficient motor system in order to comply with the new regulations and maintain their profit margin and competitiveness.

However, without policies and support programs in place to encourage motor system optimization and the replacement of old inefficient motors, the industrial sector will continue to find it more attractive to maintain the status quo, postpone the decision to upgrade inefficient motors and continue to rewind old motors due to the low cost of rewinding and electricity compared to the higher costs of new efficient motors. The recent devaluation of the Egyptian Pound has effectively doubled the prices in local currency of imported EE motors while the cost of electricity has increased at a comparatively lower rate due to the GoE's decision in 2016 to slow down the subsidy removal. As a result, the feasibility of replacing motors has been negatively impacted since the GoE began considering the MEPS in early 2016 prior to the devaluation of the Egyptian Pound (EGP).

Therefore, the uptake of EE motors in the market will likely be slow, especially when taking into account the persistence of the market barriers outlined earlier in this document. In order to facilitate and accelerate the deployment of EE EMDS in Egypt, the proposed project will take a systematic approach to overcome current barriers and transform the market for motor systems through the coverage of the following incremental costs. The GEF grant will be used to provide:

a. Development of policy recommendations to accelerate the replacement of the old, inefficient motors while creating new business opportunities for ESCOs and mitigating the negative impact on the rewinding industry. The incremental costs of this component will cover the analytical work required to provide the GoE with a menu of cost-effective means to achieve these policy targets. The GEF grant will reduce the risk of adopting inappropriate policies due to insufficient knowledge, competencies and analysis.
b. Development and implementation of a national awareness campaign on the benefits of EMDS as well as a platform for information exchange, cooperation and partnerships among EMDS seekers and providers. The incremental costs of this component will cover the development of high-quality content and logistical support for workshops, conferences, seminars, newsletters, trade fairs, etc.
c. Training of 300 key stakeholders on EE motors and motor system optimization in order to build national capacity. The stakeholders will be chosen from national experts, vendors and traders of motor systems and industry staff. The project will cover the costs of stakeholders' formal training as well as on-the-job training in Egypt and abroad.
d. Technical and financial assistance to pilot and demonstrate advanced EE EMDS ends users' benefits. The GEF project funding will cover the initial costs of implementing energy audits and provide partial non-grant funding for the implementation of demonstration projects in 30 enterprises. The pilot projects will not only serve as success stories to engender confidence within industries to invest in such projects, but will also form the basis of an inventory of Egypt-specific best practices in EE upgrades to motor systems.
e. Technical and financial assistance to develop and establish appropriate mechanisms to support wide-scale and sustainable uptake of energy efficiency improvements in motor systems. The GEF project funding will cover the costs of developing the tools necessary to enable ESCO business models as means to mitigate the financial and technical risks related to EE upgrades to motor systems. These tools do not currently exist in the market and their absence is cited as the main cause of the underdevelopment of the ESCO market. No other national or donor-funded project is currently working on the development of these tools. They include certification schemes for service providers, M&V protocols and tools, contractual frameworks and dispute resolution mechanisms, and a US$ 500,000 revolving fund to cover small to medium EE motor system investments. The GEF grant will also cover the development of public-private partnerships that could form the basis for a sustainable national program to upgrade the industrial motor stock in Egypt beyond the life of the project.

There will be significant contributions from the GoE and baseline projects to support the achievement of project targets. The contributions will come from public sector agencies, private sector companies and financial institutions. For example, the GoE will allocate resources to disseminate and implement the policy proposals, guidelines, and tools developed by the project and continue the introduction and enforcement of the MEPS. Local commercial banks such as CIB, who is administering the Green Economy Financing facility of the EBRD, committed to work with the programme to provide financing for larger EE motor system and replacement projects that will not be covered by the UNIDO revolving fund. Further co-financing will be allocated to attract new investments that support the deployment of EE motors. Finally while the project will support local manufacturers of the EE motors by delivering training, the MSME agency will provide loans to eligible companies to upgrade their manufacturing practices and enable a better quality manufacturing of EE motors.

5) global environmental benefits (GEFTF) and or adaptation benefits (LDCF/SCCF)

The project will result in considerable global environmental benefits in terms of the GHG emissions reductions that will be reached through a substantial reduction in electricity consumption by implementing energy efficiency measures in EMDS in 30 enterprises. The calculation of the GEBs following the GEF methodology is presented below:

Direct emission reductions

The complexity and investment-level of the demonstration projects will fall in three categories: high, medium and low. These categories have been created based on the results of motor system optimization audits and case studies developed as part of the

GEF-4 IEE project. Each category will have 10 demonstration projects in order to produce a diverse group of case studies and best practices. Annex E details the GWh savings resulting from the implementation of the 30 demonstration projects. Direct savings total 4,166,400 GJ over a ten-year period, which is the equivalent of 598,000 tonnes of CO_2 saved over a 10-year time frame.

The cost effectiveness of the project in terms of the CO_2 savings per $ invested is estimated at around $4.6/tonne.

Indirect emission reductions – top down

According to the cost curves analysis conducted during the PPG phase, the technical potential for electricity savings from common motor system efficiency measures in pumping, compressed air and fan systems is equal to 4,503 GWh per year. Assuming a modest causality rate of 40%, the indirect top-down emission savings caused by the proposed project can be estimated at 9,306,890 tonnes CO_2 saved over a 10-year time frame.

Indirect emission reductions – bottom up

There will be a significant amount of indirect CO_2 emission reduction, due to expected transformative impact of the GEF-supported activities as explained in this document. Assuming a modest replication factor of 3, indirect emission reductions attributable to the project is estimated at 1,922,143 tonnes of CO_2 over the average lifetime of the investments of 10 years.

6) innovativeness, sustainability and potential for scaling up

The project demonstrates innovativeness, sustainability and potential for scaling up through its strategic components:

Innovation – The innovativeness of the project is based on its targeted technology, as EE motors system interventions have been relatively overlooked. While some governments are proactive on EE, few have put in place the resources or policy processes likely to realize substantial energy savings by introducing EE motor systems. Apart from the innovative choice of technology, the project will analyze the current barriers faced by ESCOs in Egypt in order to design innovative business plans and operational modalities that maximize their interventions on larger EE investments, such as process-related systems (EE motors) and motor systems (pumps, compressors, fans and other systems). By involving ESCOs in EE interventions without adding unnecessary costs and complexities, the project is expected to produce a behavioral change on the end-users of motors. As such, industries that would have been discouraged to adopt EE technologies due to large up-front investments will have the possibility to convert energy inefficiencies into future cash flows while paying the energy saving investments from savings resulting from the ESCOs intervention.

Market transformation – The project aims to achieve long-term market transformation in motor systems through an integrated approach that addresses both demand and supply sides. On the demand side, the project will support the GoE in developing and adopting policies that will generate demand for motor systems EE components and services. The policies will be complemented with a national awareness campaign to achieve higher acceptance, better understanding and more support for energy efficiency in motor systems, especially among the top management of the industrial sector. The awareness campaign will be enhanced with real-life data and success stories from the demonstration projects to overcome any residual skepticism in the marketplace. On the supply side, the project will increase the number of qualified motor system optimization experts who are able to offer their services. The support for ESCOs will increase the supply of integrated technical and financing packages to improve the energy efficiency of motor systems in the industrial sector. The project's support for public private partnerships with international suppliers will also improve the availability EE motors and system components in the Egyptian market.

Sustainability – The sustainability of the project will be ensured through the active involvement of national institutions as well as the sound transition of activities and responsibilities taking place during the implementation phase. The project will develop policy recommendations enabling a conducive policy environment and a national awareness campaign leading to lasting changes in the energy efficient motor systems market. Furthermore, the 30 pilots are expected to broadly document and disseminate the knowledge gained in order to encourage all potential end-users – not merely those participating directly in the demonstration projects – to incorporate EE EMDS in their industrial operations.
The project will train 50 MSO experts from diverse sectors on energy efficiency measures related to EMDS in order to expand the national talent pool. After concluding their training and as the demand for specialized energy services increases, these experts will have the expertise needed to support the sustainable implementation of further national or regional projects. To ensure the sustainability of the training, the course is being integrated into the curricula of the University of Cairo.

The project will also create an enabling environment for ESCOs and support a few of the trained MSO experts to develop ESCOs that will carry on designing and implementing financially feasible EE motor system projects after the end of the project. The ESCOs will have access to a $500,000 revolving fund that will be transferred to MOTI at project closure. Trained bank officers and financial tools will ensure the continued operation of the fund and the development of similar funds in the future.

Potential for scaling-up – The project has a high scaling-up potential for the widespread adoption of EE components and services for motor systems in the industrial sector. The motors efficiency base as well as the market penetration of EE motors remains significantly low and rewinding practices persist in the sector. The demonstration projects under Component 3 will showcase the technical feasibility and commercial viability of EE motors for potential investors and will provide persuasive information for decision makers in the industrial and governmental sectors. Additionally, the establishment of ESCOs will be of crucial importance as they will facilitate the upfront financing often needed to adopt EE motor projects. To scale the up the capacity building activities, the MSO training materials may also be integrated into the curriculum of local universities.

A.2. Child Project? If this is a child project under a program, describe how the components contribute to the overall program impact.

No

A.3. Stakeholders. Identify key stakeholders and elaborate on how the key stakeholders engagement is incorporated in the preparation and implementation of the project. Do they include civil society organizations (yes ☐ /no☒)? and indigenous peoples (yes ☒ /no☐)? [34]

Stakeholder	Mandate and Role
Ministry of Trade and Industry (MOTI)	**Mandate:** MOTI is responsible for overseeing activities related to industrial development and international trade. The Ministry will be the chair of the project steering committee (PSC). **Role:** MOTI will be the Government counterpart responsible for the overall coordination and monitoring of this project as well as ensuring that the project outputs are aligned with the Ministry's plans and strategies. MOTI will contribute to Component 1 (Outputs 1.1.1, 1.1.2, and 1.1.3) and Component 3 (Output 3.1.4).
Egypt National Cleaner Production Centre (ENCPC) of the Ministry of Trade and Industry	**Mandate:** The ENCPC is one of the centers within the Industrial Council for Technology Innovation within MOTI. ENCPC's primary mandate is to provide technical assistance to the industrial sector on issues of clean technology. The Centre provides the Egyptian industrial sector technical assistance for technology transfer in the fields of resource efficiency, industrial waste valorization, and energy efficiency and renewable energy applications. In addition, the ENCPC implements innovative designs and supports companies to carry out product development. **Role:** The ENCPC will act as the executing agency for this project. The Centre has strong relationships with governmental stakeholders, suppliers, and industrial enterprises and has played a key role in coordinating and managing the IFC STEP project. Therefore, the ENCPC will focus on project outcomes such as creating policy recommendations and tools in Component 1 (Outputs 1.1.1, 1.1.2, and 1.1.3); raising awareness and trainings on the benefits of EE EMDS in Component 2 (Outputs 2.1.1, 2.1.4, and 2.1.5); and; supporting industrial enterprises and demonstration projects (Outputs 3.1.1 and 3.1.3); The Centre is also well-positioned to ensure the sustainability of EE interventions in the industrial sector after project completion.

[34] *As per the GEF-6 Corporate Results Framework in the GEF Programming Directions and GEF-6 Gender Core Indicators in the Gender Equality Action Plan, provide information on these specific indicators on stakeholders (including civil society organization and indigenous peoples) and gender.*

Stakeholder	Mandate and Role
Egyptian Environmental Affairs Agency (EEAA)	**Mandate:** EEAA represents the executive arm of the Egyptian Ministry of State for Environmental Affairs. The Administrative Council of the Agency is composed of the Minister of Environmental Affairs as Chairman, with the EEAA Chief Executive Officer as Vice Chairman, plus representatives from the ministries involved in environmental issues, non-governmental organizations (NGOs), the State Council, the public business sector, universities and scientific research centers. The main functions of EEAA include: • Formulating environmental policies. • Preparing the necessary plans for environmental protection and environmental development projects, following up their implementation, and undertaking pilot projects. In addition, EEAA is the National Authority in charge of promoting environmental relations between Egypt and other countries, as well as regional and international organizations. **Role:** The Agency is the national focal point for all GEF projects and activities. It is the main coordinating entity responsible for monitoring progress towards the nationally determined contribution (NDC) and as such will track the contribution of the project towards the NDC. It will serve as a member of the Project Steering Committee.
Industrial Development Authority (IDA)	**Mandate:** IDA is responsible for the implementation of industrial policies developed by the Ministry of Trade and Industry and its affiliated entities. It also promotes industrial investments, setting and implementing land development policies. IDA's mission is to enhance Egypt's growth rate through cooperation and coordination with its partners to facilitate industrial expansion, enable the private sector to develop industrial zones and ensure an effective, organized and friendly business environment. **Role:** IDA will contribute to Component 1, promoting policy tools and guidelines promote industrial EE motor deployment (Output 1.1.1); supporting action plans for local manufacturing (Output 1.1.3); and assisting with re-integrating the rewinding industry (Output 1.1.2).
Egyptian Organization for Standardization and Quality (EOS) - Under MOTI	**Mandate:** EOS is the official body responsible for standardization and certification activities, ensuring quality control and increasing the competitiveness of Egyptian products in the international and regional markets. It also focuses on consumer and environment protection. EOS is a member of the International Organization for Standardization (ISO). **Role:** EOS will assist with Component 1 and Component 4: developing policy tools and guidelines (Output 1.1.1) and supporting the accreditation and certification of ESCOs MSO experts (Output 1.1.4 and Output 4.1.3).
Federation of Egyptian Industries (FEI)	**Mandate:** FEI is a group of industrial associations with It has 16 Chambers and 17 Decision Support Committees that develop programs and services to facilitate and support the various industrial associations within Egypt. FEI's business agenda is: • To directly represent members' interests before governmental and legislative bodies, as well as other local and international associations. • To participate in developing policies and legislation that result in encouraging investment and developing suitable environments conducive to rapid growth of national economy. • To advocate for structural reforms that lead to transparency in governmental legislative and enforcement practices. • To contribute to the development of Egyptian industry by adopting new technology and international quality standards.

Stakeholder	Mandate and Role
	Role: FEI will play a role in promoting the peer-to-peer knowledge sharing platform in Component 2 (Output 2.1.2) and disseminating calls for proposals for industrial enterprises to benefit from energy audits and demonstration projects in Component 3 (Outputs 3.1.1, 3.1.2 and 3.1.3).
General Organization for Import and Export Control (GOIEC)– under MOTI	**Mandate:** The General Organization for Import and Export Control is an authority directly affiliated to the Minister of Economy and Foreign Trade which main functions are: • Import and export control • Issuance of Certificates of Origin **Role:** The organization's role in the project will focus on Component 1: developing policy tools and guidelines to promote EE motor deployment (Output 1.1.1) and support the action plan for local manufacturing (Output 1.1.3).
Energy Efficiency Unit (EEU) of the Egyptian Ministry of Electricity and Renewable Energy (MOERE)	**Mandate:** The mandate of the Ministry is to provide electricity to all consumers over the country. EEU has the responsibility to implement, monitor and evaluate the progress of the National Energy Efficiency Action Plan (NEEAP) of Electricity Sector (2012 -2015). **Role:** The EEU will serve as a member of the PSC and participate in the skills and certification working group.
Financial institutions and banks	**Mandate:** Financing facilities, such as GEFF Egypt and the Green for Growth Fund, and banks, such as the National Bank of Egypt and the Qatar National Bank, provide loans with incentive schemes to facilitate private investment in energy efficiency and renewable energy. **Role:** These financing facilities and banks will provide credit lines for ESCOs and industrial enterprises to undertake EE motor upgrades and MSO projects. In Component 3 (Output 3.1.3) and the implementation of the revolving fund in Component 4 (Output (Output 4.1.4). A qualified financial institution will be selected to manage the revolving fund following a competitive bidding process or otherwise will make use of existing schemes in Egypt.
Private sector	**Mandate:** Suppliers, such as ABB and Siemens, offer EE equipment and motors for use in industrial enterprises and factories. Local manufacturers, such as Daoud and Shobra Company, and their feeder industries present untapped opportunities to upgrade their systems and processes to produce local EE motor systems. ESCOs offer energy efficiency services to industrial enterprises through innovative business models and recover their investments based on realized savings. **Role:** These private companies will cooperate with MOTI and industrial enterprises by forming public-private partnerships in Component 3 (Output 3.1.4). They may play a key role in funding and building a mobile testing lab used to independently verify energy savings achieved through EE motor deployment and motor system optimization measures (Component 4, Output 4.1.2). . Suppliers may also be engaged to create soft financing models for industrial enterprises to utilize for EE motor upgrades. Local manufacturers will receive support and upgrades from this project to produce highly efficient motor systems in Component 1 (Output 1.1.3).. ESCOs will play an important role in implementing motor system energy efficiency projects in industrial facilities in Component 4 (Ouput 4.1.3)..
Associations promoting GEEW and gender focal points	**Mandate:** Stakeholders will also include relevant gender focal points and experts, as well as local and international associations and/ or agencies promoting gender equality and women's empowerment, in particular those focusing on the nexus between gender, energy needs and entrepreneurship such as the Global Women Network for the Energy Transition (GWNET) or

Stakeholder	Mandate and Role
	the Women in Sustainability, Environment and Renewable Energy (WISER) . **Role:** Gender focal points, experts, and organizations will ensure the project meets its sex-disaggregated indicators, especially with regards to ensuring women's participation in awareness raising campaigns and MSO trainings in Component 2 (Outputs 2.1.1 and 2.1.4).
Regional Center for Renewable Energy and Energy Efficiency (RCREEE)	**Mandate:** An intergovernmental organization that aims to enable and increase the adoption of renewable energy and energy efficiency practices in the Arab Region. **Role:** RCREEE will help disseminate the results of the programme at the regional level. In addition, considering its role in managing the Green Energy Financing Facility and the new fund provide by the Green for Growth Fund, RCREEE will be a key partner in the operationalization of the ESCO revolving fund.

A.4. Gender Equality and Women's Empowerment. Elaborate on how gender equality and women's empowerment issues are mainstreamed into the project implementation and monitoring, taking into account the differences, needs, roles and priorities of women and men. In addition, 1) did the project conduct a gender analysis during project preparation (yes ☒ /no☐)?; 2) did the project incorporate a gender responsive project results framework, including sex-disaggregated indicators (yes ☒ /no☐)?; and 3) what is the share of women and men direct beneficiaries (women 25 %, men 75 %)? [35]

In 2016, the Global Gender Gap report ranked Egypt 132 out of 144 countries in terms of women's economic participation and opportunity and 138 in terms of labor force participation. In the formal private sector, women have limited job opportunities.[36] According to the World Bank, females labor force participation is 22.93% compared to 78.18% for males in Egypt. Female employees in industry represent only 5.02% of total female employment; whereas males in industry represent 29.37% of total male employment.[37] Additionally, significant wage gaps exist in the industrial sector with women earning on average 23% less than men.[38]

Reflecting UNIDO's commitment to gender equality and women's empowerment, the project will ensure that both women and men are provided equal opportunities to participate in and benefit from the project, without compromising the technical quality of the project results. Specifically, the project will focus on gender mainstreaming in the following areas:

- Efforts will be made to promote participation of women as trainees and facilitators in awareness raising and training activities. Women from the public and private sector will comprise 30% of participants in workshops, conferences, and stakeholder engagement meetings to raise awareness of the benefits of EE in EMDS in the industrial sector.

- Both the user- and expert-level MSO training courses will engage women as participants and facilitators; at least 20% of the total participants will be women. The project will expand upon the success of the GEF-funded UNIDO IEE project's energy management training courses: 23% of overall participants were women and 8% of participants in the expert-level MSO course were women.

- After attending these trainings, women system optimization experts will also receive gender-sensitive support in forming ESCOs and/or use EPC to initiate new MSO and EE motors projects in the industrial sector. In this manner, women will become

[35] Same as footnote 8 above.
[36] World Economic Forum (2016) *Global Gender Gap Report, Egypt:* http://reports.weforum.org/global-gender-gap-report-2016/economies/
[37] The World Bank (2014-2016) *Statistics for Industrial Sector in Egypt: https://data.worldbank.org/indicator/SL.IND.EMPL.ZS*
[38] IARIW CAPMAS Egypt (2015) *An Analysis of the Gender Pay Gap in the Egyptian Labour Market*

empowered actors, able to start their own energy services businesses, advocate for EE interventions and develop and implement demonstration projects.

- When selecting industrial enterprises for demonstration projects and technical assistance, factories and manufacturers with women managers and workers will be given preference. As industrial enterprises adopt EE measures, they will experience resulting energy cost savings, which could lead to business growth and further improvements in to the work environment. These opportunities could indirectly impact women workers in the industrial sector, for example, by creating new job opportunities.

- Gender-sensitive recruitment will be practiced at all levels when possible, especially in selection of project staff and consultants.

- Decision-making processes within the project will consider gender dimensions. With regards to project management, the Project Steering Committee meetings will invite observers to ensure that gender dimensions are represented. Also, during project implementation, the project team will consult with stakeholders promoting gender equality and women empowerment issues. These consultations are particularly relevant in Component 1, focusing on policy recommendations and tools. Therefore, during the policy creation process, special attention will be paid to promote gender equality and integration of youth.

- When additional assessments and monitoring and evaluation activities are conducted as part of project implementation, sex-disaggregated data will be collected.

- All knowledge management activities will be gender mainstreamed. This includes integration of gender dimensions into publications, for instance presenting sex-disaggregated data, gender-energy nexus theory, gender sensitive language in publications, photos showing both women and men, and avoid presenting stereotypes, as well as assuring that women, men and the youth have access to and benefit from the knowledge created.

A.5 Risk. Elaborate on indicated risks, including climate change, potential social and environmental risks that might prevent the project objectives from being achieved, and, if possible, the proposed measures that address these risks at the time of project implementation.(table format acceptable):

Risk	**Level**	**Description and Mitigation**
Policy recommendations are not approved or effectively enforced by relevant authorities	Low	The project will develop policy recommendations and tools in close collaboration with all relevant stakeholders including: policy makers, industrial sector representatives and EE motors manufacturers. By creating final recommendations, tools, and action plans in an inclusive, collaborative manner, it is expected that the recommendations are adopted and effectively enforced.
Users of old motors do not want to purchase EE motors	Medium	End users of industrial motors may not want to replace their old motors, especially if they are still functional. The project will include comprehensive awareness raising and promotion activities to ensure that end users fully understand the benefits of EE motors, especially from an energy and cost savings perspective. Through the ESCO business models, the up-front cost of replacing the motors will be shifted to the ESCO and its financing institutions and therefore reduce this risk.
ESCOs local market remains underdeveloped	Medium	The ESCO market in Egypt is underdeveloped as there is limited expertise, awareness and service supply in the country. To mitigate this risk, the project has identified the challenges faced by local ESCOs, especially with regards to working with industrial enterprises.

Risk	Level	Description and Mitigation
		The project will provide technical support to the relevant stakeholders to develop a contractual framework for EPC, an accompanying dispute and arbitration mechanism, independent M&V protocols, business plans and operational modalities, and opportunities to access finance for MSO and EE motors upgrades. It is expected that the ESCOs market will expand and the industrial sector will be eager to seek ESCOs services.
Industrial enterprises receiving TA and/or the ESCOs might not be able to come up with the required co-financing	Medium	Industries, especially SMIs, might not be able to access financing to cover system optimization and motor upgrade projects. This could cause delays in the demonstration projects, limiting the opportunity to disseminate success stories and to develop case studies. The demonstration projects will be designed so that milestones can be documented and disseminated with the aim of encouraging knowledge sharing and peer-to-peer dialogue. In order to mitigate the cost and risk factors, the project will establish a $500,000 revolving fund with a participating financial institution to support small-scale MSO projects. The project will also partner with GEFF Egypt to facilitate access to the credit for EE motor upgrades and promote public-private partnerships to accelerate investments in EE motors deployment and ESCOs.
Climate change risk	Low	Climate change would not impact the implementation of this project.
Socio-economic risk: Industrial enterprise owners lose interest in the programme due to lower energy prices and longer payback periods	Low	The Government of Egypt has extended its five-year plan to phase out energy subsidies until 2021, which means that the costs for energy in the industrial sector will rise each year. Furthermore, the lack of security of the energy supply has become a major driver for industrial consumers to adopt EE measures. The project will highlight the benefits both financial and social of energy efficient motors to mitigate this risk.
Economic and financial instability	Medium	Future economic and financial instability in Egypt could result in currency devaluation and increased interest rates. Changes in the financial market could affect the ability of industrial enterprises to access finance. Increased interest rates could make EE investment, especially motors upgrades, unattractive for industrial enterprises. This project, therefore, will provide a $500,000 revolving fund with stable terms and conditions, so that ESCOs and industrial end users can access finance for MSO upgrades and support public-private partnerships with suppliers to offer low prices and soft-financing options for EE motors upgrades.
Social and Gender Risk: There could be a risk of resistance against the involvement of women or activities that promote GEEW. Or there could be a lack of interest in, the project activities from stakeholders, especially with regard to the active promotion of gender equality. Low participation rates of suitable female candidates due to lack of interest, inadequate project activity or missing qualified female population within engineering	Low	To mitigate this risk the project will pursue thorough and gender responsive communication showing the benefits of gender equality for both women and men, and ensure stakeholder involvement at all levels, with special regard to involving both women and men, as well as CSOs and NGOs promoting GEEW, and gender experts. This shall mitigate social and gender related risks, promote gender equality, create a culture of mutual acceptance and understanding, and maximize the potential contribution of the project to improving gender equality in the energy field. To attract qualified female candidates to the project, adequate and gender responsive communication strategy will be carried out by reaching out to women's groups and associations, while also making trainings and workshops accessible for women, e.g. by providing safe transport, offering childcare, offering trainings at suitable times for women when children are in school and day-care, etc. If necessary

Risk	Level	Description and Mitigation
sector.		and in the scope of the project additional bridging courses for women will be considered, developed and implemented to empower women.

A.6. Institutional Arrangement and Coordination. Describe the institutional arrangement for project implementation. Elaborate on the planned coordination with other relevant GEF-financed projects and other initiatives.

As the GEF Implementing Agency, UNIDO holds the ultimate responsibility for the implementation of the project, the delivery of the planned outputs, and the achievement of the expected outcomes. The Ministry of Trade and Industry will act as the governmental counterpart of UNIDO. ENCPC will represent the Ministry and act as the executing agency for the project during the three-year timeframe.

UNIDO will oversee project implementation, ensuring that all activities are carried out in strict compliance with UNIDO/GEF procedures. Additionally, UNIDO will oversee the Project Management Unit (PMU), manage the overall project budget, prepare financial and progress reports for the GEF and the Project Steering Committee (PSC) in a timely manner, and coordinate the budgeted M&E plan.

Furthermore, UNIDO will support the PSC, executing agency, and the Project Management Unit (PMU) to coordinate and network with other related initiatives and stakeholders in Egypt. UNIDO will appoint a UNIDO Project Manager and mobilize additional technical, administrative, and financial services needed as through UNIDO Headquarters and the UNIDO Regional Office in Cairo.

Project Steering Committee

The Project Steering Committee (PSC) will be established during the inception phase to provide strategic guidance on the project execution and to facilitate the coordination of various stakeholders, including the GoE, industrial enterprises and associations, energy service providers, and banks and financial institutions. To ensure sustainability, strategic relevance and effective national coordination, PSC members will be chosen from key governmental organizations and associations, including MOTI, the Federation of Egyptian Industries, and the MOERE Energy Efficiency Unit (EEU). The PSC will meet every six months. The role of the PSC includes:

- Review and approve project plans and progress reports
- Provide strategic advice on work plans
- Approve major changes to the project budget in terms of outcomes, outputs, and budget, in line with GEF policy GEF/C.52/Inf.06/Rev.01
- Mobilize relevant partners and stakeholders
- Provide recommendations to the project on sustainability and new opportunities and priorities not anticipated in the original project document
- At least two working groups will be formed to ensure local ownership and provide technical direction—one focusing on skills and certification and the other focusing on financing and ESCOs.

Specialized Thematic Working Groups

Technical and policy level working groups encompassing representatives of relevant Government agencies, private sectors, experts, NGOs and others will be formed to ensure the full buy in and local ownership of solutions. The working groups will cover topics such as certification of experts or ESCOs, the legal framework for ESCOs. The PMU shall support and call for the meetings of the working group and facilitate the hiring of experts or development of material and reports required to support decision making and discussions within the working group.

Executing Agency

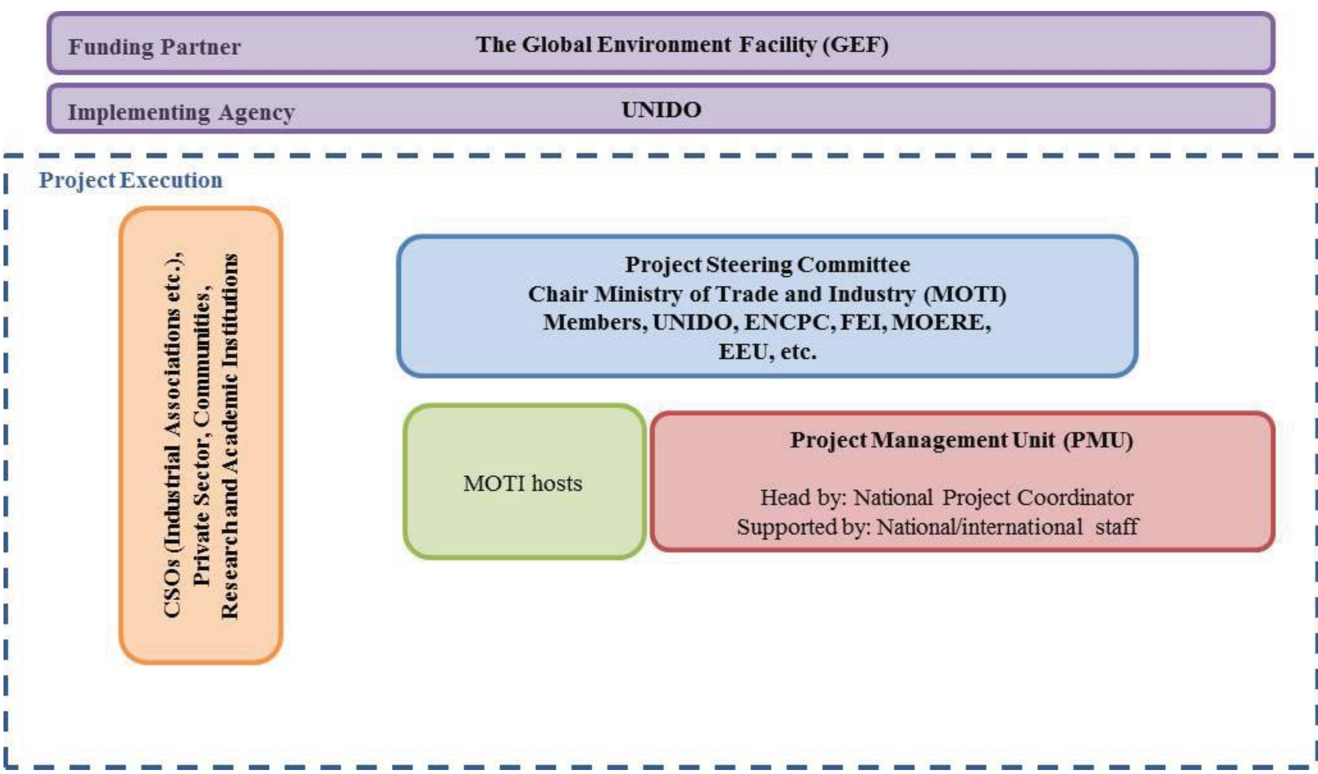
As the executing agency, the ENCPC's main responsibilities include: representing MOTI; hosting the Secretariat of the PSC; facilitating relationships with governmental stakeholders, industrial enterprises, and suppliers; and coordinating with other projects, such as the IFC STEP project and the World Bank local manufacturing project. The ENCPC will provide support for the development of policy tools and action plans, operational support for awareness-raising activities, including workshops, conferences, and trainings, and technical support for the scaling-up of demonstration projects. The ENCPC will have a contract with UNIDO to carry out agreed activities for the execution of the project based on specific TORs related to hiring and procuring relevant national and international expertise needed to support the project implementation. The assigned budget of the contract will cover the cost for technical assistance, organizing workshops and trainings, and transportation and miscellaneous costs related to ministry staff.

Project Management Unit

The PMU will manage the project execution on a day-to-day basis. The unit will be headed by a national project coordinator, who will be a non-voting member and secretary of the PSC. The PMU will have two technical experts providing technical inputs to the various project outputs and an administrative assistant. The unit will contract additional technical and support staff as needed.

The PMU team will work closely with direct beneficiaries and key stakeholders, including governmental organizations and trade associations (EEAA, MOTI, IDA, EOS, and FEI); energy service providers; suppliers; and industrial enterprises. The project management team will carry out activities under the guidance of UNIDO, report to the Project Steering Committee, and work in close coordination with the executing partner's technical staff. The PMU, indicatively to be hosted by MOTI but to be confirmed in the inception phase, will report to the director of the ENCPC and work in close coordination with the ENCPC team.

Full or partial title and ownership of equipment purchased under the project may be transferred to natioClimanal counterparts and/or project beneficiaries during the project implementation as deemed appropriate by the UNIDO Project Manager in consultation with project stakeholders



Coordination with Other GEF-financed Projects and Initiatives

Since 2011, there are a number of GEF funded programmes implemented by UNIDO aiming at encouraging industrial energy efficiency in Egypt. The project will build on the GEF-4 IEE project. The project focused on reducing GHG emissions by establishing a policy environment that enables and supports sustainable adoption of EE technology and management as an integral part of the industrial sector's business practices. The project's accomplishments include: 1) preparing a policy proposal to accelerate the rate of EE in the industrial sector, 2) developing a cadre of well-trained and equipped energy management experts able to assist industries in developing and implementing energy management systems and 3) facilitating energy efficient

interventions for large scale industries including iron and steel, chemicals, glass and others. Re than fifty industrial enterprises implemented energy management systems.
The project will also collaborate with the World Bank's Smart Technology and Energy Efficient Production and the Clean Technology Manufacturing projects. Both projects will assist the GoE to promote investment in energy efficiency in the manufacturing and industrial sector through policy interventions, such as standards and labels and strategies to support local manufacture of EE motors and equipment.

Finally, the project will collaborate with EE and RE financing facilities, including GEFF Egypt and the Green for Growth Fund, to provide financing options for EE motor upgrades and MSO improvements for ESCOs and industrial enterprises. These credit lines are supported by the European Bank for Reconstruction and Development, French Development Agency , and the European Investment Bank.

The project will also collaborate with the industrial energy efficiency accelerator programme, which was approved by the GEF in April 2017 and is currently under implementation by UNIDO. The accelerator is a global platform targeting engagement across 15 high priority countries on industrial energy efficiency and delivers support across four pillars: policy, financing, development of a pipeline and capacity building. The accelerator also supports sub-regional and gloval networks for exchanging of best practices on industrial energy efficiency policies and programmes. The knowledge and experience as well as tools developed within the accelerator can also be deployed and disseminated through the present project.

Additional Information not well elaborated at PIF Stage:

A.7 *Benefits.* Describe the socioeconomic benefits to be delivered by the project at the national and local levels. How do these benefits translate in supporting the achievement of global environment benefits (GEF Trust Fund) or adaptation benefits (LDCF/SCCF)?

Coordination with Other GEF-financed Projects and Initiatives

The project will build on the GEF 4 project "Industrial Energy Efficiency in Egypt" which is currently being implemented by UNIDO. The project aims at reducing GHG emissions by establishing a policy environment that enables and supports sustainable adoption of EE technology and management as an integral part of the industrial sector's business practices. It is expected that the project will finalize by the end of 2016 or mid-2017.

The project will also collaborate with the World Bank's Smart Technology and Energy Efficient Production (STEP) and the Clean Technology Manufacturing projects. Both projects will assist the GoE to promote investment in energy efficiency in the manufacturing and industrial sector through policy interventions, such as standards and labels and strategies to support local manufacture of EE motors and equipment.

Moreover, the project will collaborate with EE and RE financing facilities, including GEFF Egypt and the Green for Growth Fund, to provide financing options for EE motor upgrades and MSO improvements for ESCOs and industrial enterprises. These credit lines are supported by the European Bank for Reconstruction and Development (EBRD), French Development Agency (AFD), and the European Investment Bank (EIB).

At the global level, the project will feed into the United for Efficiency and the Appliance Acclerator run by UN Environment, where motors are one of the appliances targeted by the accelerator. At the same time, the project will make use of resources developed within that accelerator such as the motor policy guide.

In addition, UNIDO co-leads the industrial energy efficiency accelerator, whose first operational phase was supported by the GEF in April 2017. The accelerator targets initiating industrial energy efficiency programmes in up to 15 high impact countries by the year 2025. Egypt will benefit from the tools and resources developed within the accelerator and participate in regional and global networks for sharing of best practices.

The project will also support positive socio-economic benefits related to the energy efficiency savings and emissions reductions achieved:

1) At a local level, industrial enterprises will reduce their energy costs. Cost savings achieved could result in improved financial stability for the enterprises, additional job opportunities for workers, and improved work environments and job security. Industrial enterprises may become more competitive on the local and global market and even expand their production or explore new business opportunities.

2) At a local level, developing the ESCO market will lead to MSME business creation, as MSO experts utilize new business models and gain increased opportunities to grow their businesses through trainings they receive and the relationships they develop with industrial enterprises.

3) At a national level, the industrial sector will reduce fossil fuel consumption related to electric motors and lower GHG emissions from the industrial sector. The project will support the achievement of global environmental benefits through direct GHG emissions reduction totaling 598,000 tonnes of CO_2 over a 10-year time frame and indirect GHG emission reductions totaling 1,922,143 tonnes of CO_2 over the same period.

4) At a national level, by promoting EE in the industrial sector, Egypt will ensure its energy security, reducing energy demand on its overburdened national grid and decreasing dependence on fossil fuel power generation. The potential for energy savings from motor system optimization in industrial pumping, compressed air and fan system is captured in the table below

	Technical Energy Saving Potential (GWh/yr)	**Cost-effective Energy Saving Potential (GWh/yr)**	**# of households supplied with Electricity**	**Avoided Capacity (MW)**
Pump systems	2,068	1,813	624,203	300
Fan systems	1,212	1,008	358,967	165
Compressed air systems	1,269	952	338,983	155
Total	4,549	3,773	1,322,153	620

Assuming that the average industrial tariff is $30,000 per GWh, the potential financial savings for the Egyptian economy from cost-effective motor system optimization measures in the three key industrial systems exceeds $113 million per year.

A.8 *Knowledge Management.* Elaborate on the knowledge management approach for the project, including, if any, plans for the project to learn from other relevant projects and initiatives (e.g. participate in trainings, conferences, stakeholder exchanges, virtual networks, project twinning) and plans for the project to assess and document in a user-friendly form (e.g. lessons learned briefs, engaging websites, guidebooks based on experience) and share these experiences and expertise (e.g. participate in community of practices, organize seminars, trainings and conferences) with relevant stakeholders.

The project will build on previous industrial energy efficiency interventions which are part of the UNIDO Programme on Energy Management System and System Optimization Implementation in Industry and are currently active in 17 developing countries and emerging economies. To support that programme, UNIDO developed training materials and tools for motors, fans and pumps, which will be used for the motor programme in Egypt. Numerous case studies from other countries such as South Africa, Vietnam and others will be shared through this programme to inspire actions in Industry.The project will consider the lessons learned and knowledge acquired through the programme and particularly from the" GEF-4 IEE project currently implemented by UNIDO.

The knowledge management approach focuses on sustaining energy efficiency activities in the industrial sector amongst a range of stakeholders, including industrial enterprises, suppliers, MSO experts, ESCOs, and financial institutions. The intended outcome of these activities is to raise awareness of the benefits of EE motor upgrades and MSO measures in order to catalyze market transformation. During and after the project, case studies, web stories, and official reports featuring success stories and demonstration projects will be shared publicly with a wide range of stakeholders. The project will also host workshops, conferences, and meetings with key stakeholders to widely disseminate the benefits, success stories, and lessons learned related to these EE in EMDS interventions. Finally, the project will create an online and off-line peer-to-peer network to facilitate information exchange, networking and long-term partnerships between industrial enterprises and energy service providers.

Within the industrial energy efficiency accelerator, there is ample opportunities to make use of the tools and material developed within the programme to improve outreach and disseminate it globally. At the same time, Egypt can exchange and benefit from the experience of other countries that are part of the platform. For example, Morocco is one of the first countries that committed to being part of the accelerator and Tunisia and Algeria are among the list of priority countries. Efforts are being made to establish a sub-regional group for sharing of best practices, tools and resources which also includes Egypt.

To easily share knowledge and lessons learned within and beyond the project intervention zone, UNIDO's Open Data Platform will be used to collect relevant reports and data on demonstration projects. Data gained from this project will add to ongoing efforts by UNIDO to create a database featuring statistics on energy efficiency interventions, including the overall energy savings achieved and the specific EE measures and interventions carried out to achieve them.

B. DESCRIPTION OF THE CONSISTENCY OF THE PROJECT WITH:

B.1 *Consistency with National Priorities*. Describe the consistency of the project with national strategies and plans or reports and assessements under relevant conventions such as NAPAs, NAPs, ASGM NAPs, MIAs, NBSAPs, NCs, TNAs, NCSAs, NIPs, PRSPs, NPFE, BURs, INDCs, etc.:
The project is aligned with Egypt's national priorities, supporting the GoE to achieve its EE goals through the promotion of an enabling political and technical environment that successfully integrates EE motors and MSO in the industrial sector.

The project is consistent with Egypt's INDCs, which recognizes energy efficiency as the cornerstone of its efforts to decouple energy demand and economic growth. The GoE has also committed to increasing awareness of key stakeholders on energy efficiency and renewable energy, improving the legal frameworks to promote sustainable and decentralized development, and reforming energy tariff subsidies.

In line with its international commitments, the government has adopted several measures to increase both rational use of energy and renewables in the energy supply mix including the Mandatory EE Code for residential (2006), commercial (2009) and governmental (2011) buildings, the National Energy Efficiency Action Plan (2012-2015), Electricity Law (2015) as well as MEPs and labeling schemes for selected equipment and appliances.[39]

Furthermore, a comprehensive set of industrial energy efficiency strategies and policies have been jointly developed by UNIDO and the Government of Egypt through EEAA, MIFT and FEI and have been presented to the Cabinet of Ministers for adoption. The IFC STEP project has also worked with MOTI to develop MEPS for industrial motors for adoption later this year. The goal of these strategies and policies is to drive the industrial sector demand for EE, to ensure responsive supply and to support the GoE to create an enabling environment for scaling-up of EE interventions.

C. DESCRIBE THE BUDGETED M &E PLAN:

In order to comply with the Monitoring and Evaluation policy of UNIDO as well as with the requirements from the GEF and the Egyptian government, progress reports shall be shared between the project's stakeholders on a regular basis. The progress reports shall summarize the progress of all components against the targets laid out in the Log frame and shall include inputs from relevant counterparts. The UNIDO Regional Representative in Egypt, the Project Manager in Headquarters and the field project team are expected to closely monitor the project through regular consultations with the counterparts and participation in the key meetings of the project. Nevertheless, the National Project coordinator will be responsible for continuous monitoring of project activities execution, performance and track progress towards milestones.

The Project Result Framework (LogFrame) in Annex A provides the performance and impact indicators for project implementation along with teir corresponding means of verification. These will form the basis on which the project's M&E Plan will be built. The semi-annual reports to be submitted to the PSC and annual implementation reports to be submitted to the GEF verify the actual progress against the work plan approved by the PSC. Thus, M&E enables the project manager to take corrective measures in case there are significant deviations between the forecasted work plan and actual implementation.

The Project will undergo an independent Mid-term Review (MTRs) at the mid-point of project implementation, i.e. the end of year two. The MTR will assess the progress made toward the achievement of outcomes and will identify course correction, if needed.

An independent terminal Evaluation (TE) will take place after the major project activities are completed in accordance with UNIDO and GEF guidance. The terminal evaluation will focus on the delivery of the project's results as initially planned. The terminal evaluation will look at impact and sustainability of results, including the contribution to capacity development and the achievement of global environmental benefits/goals. The TOR for this evaluation will be prepared by the UNIDO Project Manager based on guidance from the UNIDO Independent Evaluation Division (IED).

The terminal evaluation should also provide recommendations for follow up activities and requires a management response. During the last 3 months of the project implementation, the project team will prepare the Final Evaluation Report. This comprehensive report will summarize the results achieved (objectives, outcomes, outputs), lessons learned, problems met and areas where results may not have been achieved. It will also lay out recommendations for any further steps that may need to be taken to ensure sustainability and replicability of the project's results.

According to the Monitoring and Evaluation policy of the GEF and UNIDO, follow-up studies like Country Portfolio Evaluations and Thematic Evaluations can be initiated and conducted. All partners and contractors are obliged to (i) make

[39] RCREEE, *Egypt Country Profile 2013*.

available studies, reports and other documentation related to the project and (ii) facilitate interviews with staff involved in the project activities. UNIDO as the Implementing Agency will involve the GEF Operational Focal Point and project stakeholders at all stages of the project monitoring and evaluation activities in order to ensure the use of the evaluation results for further planning and implementation. According to the Monitoring and Evaluation policy of the GEF and UNIDO, follow-up studies like Country portfolio evaluations and thematic evaluations can be initiated and conducted. All project partners and contractors are obliged to (i) make available studies, provide reports or other documentation related to the project and (ii) facilitate interviews with staff involved in the project activities

The table below provides a breakdown of the costs and activities related to the M&E plan.

M&E Activities	**Primary responsibility**	**Indicative costs to be charged to project budget**		**Timeframe**
		GEF Grant	**Co-financing**	
Inception Workshop	UNIDO, PMU	$10,000	$30,000	Within six months of the project start date
Inception Report	PMU	None	$30,000	Within 3 weeks of inception workshop
Monitoring of indicators in project results framework	PMU	None	$50,000	Annually
Mid-term Review (MTR)	UNIDO, PMU	$30,000	$60,000	End of year 2
Monitoring of environmental and social risks	UNIDO, PMU	None	None	Ongoing and reported annually
Independent Terminal Evaluation	UNIDO, PMU, and independent evaluation team	$35,000	$80,000	At least 3 months before project close date
Total indicative cost		**$75,000**	**$250,000**	

Legal Context

The Government of the Arab Republic of Egypt agrees to apply to the present project, mutatis mutandis, the provisions of the Standard Basic Assistance Agreement between the United Nations Development Programme and the Government, signed on 19 January 1987 and entered into force on 2 July 1987.

PART III: CERTIFICATION BY GEF PARTNER AGENCY(IES)

A. GEF Agency(ies) certification

This request has been prepared in accordance with GEF policies[40] and procedures and meets the GEF criteria for CEO endorsement under GEF-6.

Agency Coordinator, Agency Name	Signature	Date (MM/dd/yyyy)	Project Contact Person	Telephone	Email Address
Mr. Philippe R. Scholtès, Managing Director, Programme Development and Technical Cooperation UNIDO GEF Focal Point		06/04/2018	Ms. Rana Ghoneim, Department of Engergy, UNIDO	+43-1-26026-4356	r.ghoneim@unido.org

[40] GEF policies encompass all managed trust funds, namely: GEFTF, LDCF, SCCF and CBIT

ANNEX A: PROJECT RESULTS FRAMEWORK (either copy and paste here the framework from the Agency document, or provide reference to the page in the project document where the framework could be found).

Result	Indicator	Baseline and Targets	Source of Verification	Risk and Assumptions
Project Objective To reduce GHG emissions by facilitating and supporting market penetration of highly energy efficient motor systems in the industrial sector in Egypt	-Lifetime direct and indirect project CO_2 emission reductions from the replacement of inefficient motors and implementation of EMDS optimization by the end of the project, ktonnes CO_{2eq}	**Baseline:** 0 **Target:** Direct: 598 ktCO2 Indirect bottom-up: 1,922 ktCO2 Indirect top-down: 9,307 ktCO2 by 2031		**A:** Willingness of industry to invest in EE upgrades
	-MWh of annual reduced electricity consumption in Egypt through the installation and use of EE motors installed during the project by EOP	**Baseline:** 0 **Target:** 115,000 MWh by the end of the project		
	-Number of industrial facilities with firm plans to procure and install EE motors and complete MSO projects	**Baseline:** 0 **Target:** 30 industrial facilities implementing EE projects by the end of the project		
	-$ invested or firmly committed in EE motor	**Baseline:** 0		

Result	Indicator	Baseline and Targets	Source of Verification	Risk and Assumptions
	upgrades and EMDS optimization as a result of the intervention	**Target:** $4,000,000 invested within five years of the project end		
Component 1: Conducive Policy and Legal Environment for EE Motors				
Outcome 1.1: Legislative and regulatory frameworks for EE motors developed	- Policy tools and guidelines to promote EE motors and motor systems implemented - Action plans for upgrading rewinding shops and reintegrating rewinders into the job	**Baseline:** MEPS for industrial motors are currently being developed with support from the IFC. The MEPS is expected to go into effect no later than 2021. No other policy tools for EE motors and motor systems are being developed. **Target:** - 3 Policy tools and guidelines (gender responsive) to promote EE motors and motor systems developef - 2 Action plans (gender responsive) for upgrading rewinding shops and reintegrating rewinders into the	- Official documents and project reports produced by governmental institutions or UNIDO	**R:** Legislative and regulatory frameworks are not approved or effectively enforced by relevant authorities.

Result	Indicator	Baseline and Targets	Source of Verification	Risk and Assumptions
	market developed - ESCO market support frameworks established	job market developed - 3 ESCO market support frameworks established		
Output 1.1.1: Recommendations on policy tools and guidelines for the deployment of EE motors developed	-Number of recommended policy tools and guidelines applicable to energy efficient motors developed	**Baseline:** 1 MEPS for industrial motors are currently being developed with support from the IFC. The MEPS is expected to go into effect no later than 2021. No other policy tools or guidelines are being developed. **Target:** 3 policy tools and guidelines (gender responsive)	-Official documents and project reports	**A** – Commitment by the government of Egypt to create an enabling policy environment for energy efficient motors. **R** – Slow pace of government policy setting could hinder the ability of the project team to achieve targets within project lifetime. **R –** Lack of coordination among the different governmental stakeholders. **R –** More pressing budgetary priorities than promoting EE in the industrial sector.
Output 1.1.2: Action plans to support rewinding shops in adapting to the changes in the industrial	-Number of action plans and guidelines to support rewinders in upgrading their operations developed and adopted by the	**Baseline:** 0 **Target:** 1 action plan and 1 guidelines for upgrading operations (gender responsive)	-Action plans	**A –** Interest from relevant governmental stakeholders to provide policy support to the rewinders.

Result	Indicator	Baseline and Targets	Source of Verification	Risk and Assumptions
motors marketplace developed	relevant stakeholders -Number of action plans to support rewinders in reintegrating into the job market developed and adopted by the relevant stakeholders	developed **Baseline:** 0 **Target:** 1 action plan for reintegrating rewinders into the job market (gender responsive) developed by the end of year 2		**R –** Government is too slow to act in creating meaningful interventions for rewinders.
Output 1.1.3.: Action plan to support local industries in the development of EE and clean technologies for motor systems developed	-Number of action plans to support local industries -Number of matchmaking opportunities facilitated	**Baseline:** 0 **Target:** 1 action plan to support local industries (gender responsive) by the end of year 2 **Baseline:** 0 **Target:** 5 matchmaking events by the end of the project	-Official documents -Attendance sheets -Project reports	**A –** Interest in local manufacturing enterprises in upgrading to support the production of EE motor systems.
Output 1.1.4: ESCO market support policies	-Number of support frameworks for ESCO developed	**Baseline:** Currently there are no support policies in place for ESCOs	-Official documents	**A –** Willingness of governmental stakeholders to support the development of an ESCO market.

Result	Indicator	Baseline and Targets	Source of Verification	Risk and Assumptions
and tools developed		**Target:** 3 ESCO support frameworks developed	-Project reports	**R –** Negative perception of the feasibility of the ESCO model among public and private stakeholders.
Component 2: Awareness and Capacity Building on Energy Efficient Motors				
Outcome 2.1: Key stakeholders trained and awareness campaign conducted on EE motors and motor systems	-Number of key stakeholders with improved capacity - Number of peer to peer knowledge exchange platform utilized by stakeholders	**Baseline:** Limited awareness raising on EE motors conducted within the scope of the IFC project. **Target:** **-** At least 500 relevant stakeholders engaged through 20 events and publication of 30 case studies (at least 20% women) -300 end users, suppliers, and motor optimization experts with improved capacity in industrial motor efficiency (at least 20% women) -1 peer-to-peer knowledge exchanged platform created and used by recent trainees (gender responsive)	-Progress reports -Case studies and web stories -Agendas, minutes of meeting, and attendance sheets -Training materials, attendance sheets, and certification issued by UNIDO -Online knowledge exchange platform	See below

Result	Indicator	Baseline and Targets	Source of Verification	Risk and Assumptions
Output 2.1.1: National awareness campaign on the benefits of EE upgrades to Electric Motor Driven Systems	-Number of workshops, conferences, stakeholder engagement meetings -Number of people reached (disaggregated by sex) -Award for "EE EMDS Champion" [as part of the Ministry's Innovation Award] with a category for women.	**Baseline:** A few meetings conducted by IFC to promote MEPS/S&L for industrial motors **Target:** 20 workshops, conferences, and meetings conducted; 500 people reached (at least 30% women) 1 award ceremony within the life of the project	-Agendas, minutes of meeting, and attendance sheets	**A –** Support given by associations, chambers of industry, and other relevant stakeholders. **A –** Interest from the public and industrial actors in energy efficiency.
Output 2.1.2: Peer-to-peer platform for information exchange, cooperation and partnerships among seekers and providers of services and information on EE motors developed	-Number of peer-to-peer platforms established -Number of active participants on the platform (disaggregated by sex)	**Baseline:** 0 (Basic platform developed for IFC project but currently inactive) **Target:** 1 peer-to-peer platform 20 active participants (at least 20% women)	-Online platform -Progress reports	**A –** Willingness of industrial end users and service providers to exchange information through the online platform. **A –** Institutional support for the peer-to-peer network from the Federation of Egyptian Industries and the relevant chambers of industry.

Result	Indicator	Baseline and Targets	Source of Verification	Risk and Assumptions
Output 2.1.3: Information gained through the 30 demonstration projects disseminated	-Number of published case studies, web stories, or reports about 30 demonstration projects	**Baseline:** 0 **Target:** 30 case studies, reports, or web stories; reaching at least 200 people online (at least 30% women reached)	-Case studies -Web stories -Project reports	**A -** Interest from the general public and industrial sector in these success stories. **A –** Successful completion of 20 demonstration projects within the life of the project.
Output 2.1.4: Industrial end users, suppliers, and motor system optimization experts trained	-Number of Qualified System Optimization Practitioners (including experts, suppliers and enterprises) trained and certified (disaggregated by sex)	**Baseline:** 0 **Target:** 300 users, of which 50 certified system optimization experts (at least 20% women)	-Training attendance and certificates; training materials; exams and evaluation forms	**A –**Sufficient interest from the various groups in energy efficient motors. **R –** Time commitment for expert-level training and certification is prohibitively high for potential candidates.
Output 2.1.5: Local rewinding and refurbishing workshops technical capacity improved	-Number of staff from rewinding workshops trained in best practices	**Baseline:** 0 **Target:** Staff from 20 rewinding workshops trained on best practices for rewinding;	-Training attendance and certificates; training materials; exams and evaluation forms	**A –** Interest from rewinding and refurbishing workshops to improve their practices.
Component 3: Technical Assistance for Technology Demonstration and Upgrading				
Outcome 3.1: Technology demonstrations and mechanism to support wide-	-Mechanism to support the wide-scale deployment of EE	**Baseline:** No mechanism for the adoption of EE measures in motors available	-Audit reports -Feasibility studies	See below

Result	Indicator	Baseline and Targets	Source of Verification	Risk and Assumptions
scale deployment are in place	measures for motors in place	**Target:** - - At least 1 mechanism supporting the delivery of technical assistance and audits for EE motors in place	-Progress reports -MOUs	
Output 3.1.1: Detailed motor efficiency audits for 40 selected enterprises conducted by UNIDO-trained motor system optimization experts	-Number of detailed motor efficiency audits and technical assistance support conducted -Number of EE motor upgrade projects implemented with support from GEF	**Baseline:** 0 **Target:** 40 energy audits and technical assistance support to identify EE measures conducted 30 motor upgrade projects implemented	-Audit reports -Feasibility studies	**A –** Factory owners are willing to share data.
Output 3.1.2: Technical and business	-Number of pilot and business projects receiving technical and	**Baseline:** 0	- Progress reports - Minutes of	**A –** Factory owners are willing to share data and perceive the short- and long-term benefits of receiving

Result	Indicator	Baseline and Targets	Source of Verification	Risk and Assumptions
advisory services for 30 motor upgrade projects facilitated	business advisory services	**Target:** 30 enterprises and projects receiving TA	meeting with factories - Feasibility studies - MOUs	technical assistance.
Output 3.1.3: System optimization for EMDS implemented and EE motors installed in 30 enterprises	-Number of motor upgrade and system optimization projects implemented with support from GEF -Number of industrial facilities with firm plans to procure and install EE motors due the technical assistance provided by the project	**Baseline:** 0 **Target:** 30 EE motors and system optimization projects **Baseline:** 0 **Target:** 30 industrial facilities assisted	- Procurement documents - Progress reports - Invoices	**A –** The GOE continues to implement annual increases in energy prices over the next 5 years. **A –** Industrial EE credit lines and financing schemes continue to operate in Egypt and interest rates stabilize or decline during the life of the project. **A –** Factory owners are willing to invest in EE upgrades identified in the audits. **R –** Factory owners do not want to purchase EE motors.

Result	Indicator	Baseline and Targets	Source of Verification	Risk and Assumptions
				R – Factory owners can access co-financing for EE motor upgrades. **R –** The Egyptian pound continues to depreciate which increases the cost of imported motors, negatively impacting the feasibility of such investments.
Output 3.1.4: Public private partnerships with international suppliers developed to accelerate the deployment of EE motors	-Number of public-private partnerships with international suppliers -Number of EE motors projects initiated through these partnerships	**Baseline:** 0 **Target:** 1 public-private partnership **Baseline:** 0 **Target:** 10	-MOUs -Partnership and financial framework agreements -Progress reports	**A –** Availability and willingness of public sector counterpart. **R –** Partnerships slow to yield concrete projects.
Component 4: Support for developing the ESCO market, with a specific focus on EMDS optimization and motor upgrades				
Outcome 4.1: ESCO models to provide energy efficiency services to	- Number of EMDS optimization experts operating as ESCOs	**Baseline:** 0 **Target:** 5 ESCOs established	-Progress reports -Feasibility studies	**A –** Sufficient interest from debt and equity investors in supporting ESCO projects.

Result	Indicator	Baseline and Targets	Source of Verification	Risk and Assumptions
industry piloted	- Number of EMDS optimization projects implemented under the ESCO model -$ invested in ESCO projects	**Baseline:** 0 **Target:** 10 EMDS optimization projects implemented under the ESCO model **Baseline:** 0 **Target:** $500,000 invested	-Legal and business documents -M&V reports -Training materials, attendance sheets, certifications	**R –** Negative perception of the feasibility of the ESCO model among public and private stakeholders.
Output 4.1.1: Contractual framework for energy performance contracting [ESCO business models] developed	-Number of contractual frameworks developed -Number of arbitration and dispute resolution options identified and	**Baseline:** 0 **Target:** 1 standard contract for energy performance contracting, with a specific focus on EMDS **Baseline:** 0 **Target:** 1 guideline developed on arbitration and dispute resolution relating to EPC	-Standard contract document -Arbitration and dispute resolution guidelines -Training attendance and certificates; training materials; exams and	**A** – Availability of local legal experts with sufficient expertise to develop the standard contract. **A –** Willingness of arbitrators to participate in EPC contract dispute resolution.

Result	Indicator	Baseline and Targets	Source of Verification	Risk and Assumptions
	disseminated -Number of trainings for independent arbitration bodies	projects **Baseline:** 0 **Target:** 3 trainings for independent arbitration bodies in Egypt on ESCO contracts (at least 20% women participants)	evaluation forms	
Output 4.1.2: M&V tools established and made available to ESCOs, M&V providers and industry	-Number of M&V tools made available -Number of M&V service providers trained -Number of M&V service	**Baseline:** 0 **Target:** - 1 standard M&V plan for EMDS projects - 1 mobile testing lab to support M&V activities developed **Baseline:** 0 **Target:** 10 M&V service providers trained	-Mobile testing lab -M&V guidelines and documents -Training attendance and accreditation certificates; training materials; exams and evaluation forms	**A –** Interest from M&V consultants to receive training and become accredited. **A –** Successful implementation of M&V accreditation framework under Component 1.

Result	Indicator	Baseline and Targets	Source of Verification	Risk and Assumptions
	providers accredited	**Baseline:** 0 **Target:** 2 M&V service providers accredited		
Output 4.1.3: ESCO businesses developed and established	-Number of motor systems optimization experts/companies registered to implement EPC projects within the market	**Baseline:** 0 **Target:** 5 experts/companies (at least 1 women expert/women-led business)	-Project reports from ESCOs and motor systems optimization experts	**A –** ESCO business model will yield growth and profit. **R –** Lack of trust unable to be resolved between ESCOs and industrial clients.
Output 4.1.4: Revolving fund to offer project-based financing packages EPC projects introduced	-Number of financial institutions participating in the revolving fund -Number of bank officers trained in energy performance contract project assessment	**Baseline:** 0 **Target:** 1 participating financial institution **Baseline:** 0 **Target:** 10 bank officers trained (at least 30% women)	-Framework agreements with the banks -Training attendance and certificates; training materials; exams and evaluation forms -Loan applications	**A –** Willingness of motor system optimization experts to apply for and repay loans. **R –** Bank credit procedures prove too complex and strict for EPC contracts. **R –** Uncertain financial environment with fluctuating currency exchange

Result	Indicator	Baseline and Targets	Source of Verification	Risk and Assumptions
	-Number of energy service companies/MSO experts trained in financial analysis for EPC projects -$ invested in EMDS optimization projects during the life of the project	**Baseline:** 0 **Target:** 10 companies/MSO experts trained (at least 20% women) **Baseline:** 0 **Target:** $500,000 invested	-Financial analysis tools and reports -Project progress reports and evaluations - Contracts	rates and high interest rates.
Component 5: Monitoring and Evaluation				
Outcome 5.1: Project progress towards objectives continuously monitored and evaluated	-M&E plan created and implemented to capture project knowledge through regular progress reports and evaluations	**Baseline:** 0 **Target:** Implementation of M&E plan with regular deliverables, including progress reports, mid-term review and a	-M&E reports	See below

Result	Indicator	Baseline and Targets	Source of Verification	Risk and Assumptions
		terminal evaluation		
Output 5.1.1: Project progress monitored, documented and recommended actions formulated	-Number of evaluation reports completed	**Baseline:** 0 **Target:** 1 midterm review and 1 Terminal Evaluation	-Terminal evaluation	**A –** Adequate documentation and data available to complete evaluation report
Output 5.1.2. Terminal Evaluation (TE) conducted in a timely manner	Number of progress reports	**Baseline:** 0 **Target:** At least one progress report per year	-Progress reports	**A –** Adequate documentation and data available to complete progress report

ANNEX B: RESPONSES TO PROJECT REVIEWS (from GEF Secretariat and GEF Agencies, and Responses to Comments from Council at work **program** inclusion and the Convention Secretariat and STAP at PIF).

GEF Council Comments	UNIDO Response
Canada: This proposal highlights that the Egyptian Intended Nationally Determined Contribution (INDC) includes energy efficiency as a priority. We would like more detail to be provided on how the electric motor sector is addressed in the INDC.	*Response 1. Energy Efficiency in Industry is an integral part of the* Egyptian INDCr. Motor system energy efficiency represents a high impact opportunity to reduce GHG emissions in the industrial sector by reducing electrical demand of motor systems.
Canada: We request that the proposal clarify how the project will achieve the conversion of old motors for new, more efficient motors, particularly without implementing an incentive program. There seems to be a reliance on building awareness, changing legislation, and conducting feasibility studies. Unless strong justification can be provided otherwise, we suggest that some incentive program be considered.	*Response 2.* Please see section on the on **the proposed alternative scenario, Component 3 and 4** (page 29, paragraph 2)**,** which expands upon supporting technology demonstration projects, ESCO business models, and access to revolving funds and financing options to achieve market transformation.
Canada: We request that component 3, which discusses demonstration and upscaling, provide more detail on how this upscaling will occur. We also note that the amount of resources assigned to this budget line does not seem to be commensurate with upscaling an energy service company model. We recommend that the final project proposal fully develop a demonstration and upscaling program with sufficient resources allocated to this component.	*Response 3.* Component 3 from the PIF has been expanded to two components, Component 3 and 4, to provide significant resources and budget for both 30 technology demonstration projects and for upscaling the ESCO model. Please see section on **the proposed alternative scenario, Component 3 and 4** (page 29, paragraph 2) for more details.
Canada: Please provide clarification (including those listed above) and justification for estimated expected project impact of 1.92 million tCO2e. If these figures are accurate, the project is expected to be very cost effective at $8.75 per tonne CO2e and could provide lessons for others.	*Response 4.* The estimated project impact has been re-calculated during the PPG phase, based on existing baseline data. Please see section on the **global environmental benefits** (page 35, paragraph 4) and Annex E (page 65, paragraph 1) for more details. As a matter of fact, the recalculated figures show that the project will be even more cost effective at $4.6 per tonne CO_2.
Germany, However, the baseline scenario as presented in the PIF is not reflecting, what share energy efficiency could contribute to industrial energy demand reduction. The saving of 10-20% over the course of several years seems not ambitious enough.	*Response 5.* The baseline scenario has been strengthened during the PPG phase, using energy cost curve analysis to estimate the potential industrial demand reduction. Please see section on the **global environmental problems, root causes, and barriers** (page 9, paragraph 5) for more details.
Germany: Germany requests that the following points be taken into account during the drafting of the final project proposal: It should be	*Response 6.* The project has clarified its approach to reducing energy consumption in the industrial sector by emphasizing gains from both no- and low-cost MSO and

GEF Council Comments	UNIDO Response
emphasized that saving electricity is not only about replacing some equipment but also dependent on including such replacement in a new framework of how to tackle energy consumption in the industry in general. In parts this is done implicitly in the PIF in the different work fields of the proposed project. However, this should be strengthened in the line of argumentation.	EE motor deployment. Please see section on **the proposed alternative scenario** (page 23, paragraph 5) for more details.
Germany, CO2 mitigation costs of around 9$ per metric ton of CO2e, which is quite high considering that no other benefits (for biodiversity, land management etc.) are reached. These mitigation costs should be clarified in the project documents.	*Response 7.* The estimated project impact has been re-calculated during the PPG phase, based on existing baseline data. Please see section on the **global environmental benefits** (page 35, paragraph 4) and Annex E (page 65, paragraph 1) for more details. The recalculated figures show that the project will be more cost effective at $4.6 per tonne CO_2.
Germany: The project has the potential to lead to a transformative change in the industrial sector, significantly reducing electricity demand. This potential should be realized and proven to be sustainable.	*Response 8.* Please see section **on changes in alignment** (page 5, paragraph 1) for more details.
STAP comments	
The challenge will be to convince industries to spend more on purchasing more efficient motors to gain long term benefits rather than buy cheaper motors or continue to rewind old motors to extend their life. Financial support to encourage wise purchases of efficient motor designs for either new or replacement applications is necessary.	*Response 9.* Please see section on the on **the proposed alternative scenario, Component 3 and 4** (page 29, paragraph 2)**,** which expands upon supporting technology demonstration projects and access to revolving funds and financing options to promote EE motor deployment and achieve market transformation.
The capacity building approach is commendable, though the geographic distribution of those attending the 2 day user course, and of the location of the vendors is not clear, but hopefully they are spread widely throughout the industrial areas of the country so that wider dissemination can later result.	*Response 10.* The geographic distribution of the training courses will be identified in the inception phase.
How the ESCO will be selected is not clear, although the statement an ESCO "will be established" implies there are no existing companies suitable for the task. Perhaps the planned review of existing ESCOs should try and identify a company suitable for the task and that already exists.	*Response 11*. Indeed the ESCO market in Egypt is in-existent especially for this type of investment. Some small scale ESCOs were reported to be working on EE lighting in Egypt and may expand their work to cover motors and other EE measures in Industry with the adequate support. During the PPG, UNIDO conducted an in-depth assessment of the ESCO market landscape identifying how to best support new and existing ESCOs and expand their business to finance and implement motor systems energy efficiency measures. The findings of this

GEF Council Comments	UNIDO Response
	assessment have been incorporated into the baseline assessment as well as the project activities, including Component 1 and Component 4. The objective of the project is to create an enabling environment for ESCOs and includes to establish at least five ESCOs. Please see section on the on **the proposed alternative scenario, Component 4** (page 31, paragraph 3) for more details.
Based on having around 70% of electricity generation from natural gas giving a grid emissions factor of 455 g CO_2/kWh, the CO_2 emissions reductions calculated as 0.48 â€“ 0.97 Mt direct and 1.44-2.93 Mt indirect seem appropriate. However, the detailed baseline assessment of motor size and the 10% and 20% potential savings scenarios for direct emission reductions gives emission reductions of 0.27 Mt CO_2 and 0.54 Mt CO_2 respectively over 10 years. The reason for this anomaly between the two ranges quoted for direct emissions is not clear.	*Response 12.* The estimated direct emissions have been re-calculated during the PPG phase, based on existing baseline data. Please see section on the **global environmental benefits** (page 35, paragraph 4) and Annex E (page 65, paragraph 1) for more details.
Building on the existing energy efficient projects in Egypt makes sense. However, "innovativeness" is claimed for the project but the GEF has supported other similar electric motor projects elsewhere in the past. It would be beneficial to ascertain the learning experiences from these projects so that this project can benefit as a result and avoid any pitfalls. Also since the project includes training courses for electric motor users and disseminating information on improved motor product design and production, it would be useful to integrate experiences and lessons learned on improving the efficiency of electric motors from other countries, for example through IEA's implementing agreement - http://www.iea-4e.org/ and https://www.motorsystems.org/	*Response 13.* The project design has built upon the lessons learned and experiences of other UNIDO and GEF-funded projects focusing on promoting the efficiency of electrical motors in the industrial sector through awareness campaigns, training courses, and demonstration projects. The project approach differs from those promoted in other GEF financed projects on electrical motors as it moves beyond the adoptions of MEPs and the development of motor inventories into putting in place mechanisms for promoting EE motors and building adequate capacities at the national level to support that. Due consideration was given to other project approached and results and international work within the IEA and also the appliance accelerator of the Sustainable Energy for All, which looks into motors as one of the appliances.

ANNEX C: STATUS OF IMPLEMENTATION OF PROJECT PREPARATION ACTIVITIES AND THE USE OF FUNDS

A. Provide detailed funding amount of the PPG activities financing status in the table below:

PPG Grant Approved at PIF: **50,000**			
Project Preparation Activities Implemented	***GETF/LDCF/SCCF/CBIT Amount ($)***		
	Budgeted Amount	***Amount Spent Todate***	***Amount Committed***
Collection of supplemental/baseline data and analysis	15,000	15,000	0
Stakeholder Consultations	10,000	10,000	0
Design of the project structure	15,000	15,000	0
Project Strategy and implementation detailing	10,000	9,609	0
Total	**50,000**	**49,609**	**391**

ANNEX D: CALENDAR OF EXPECTED REFLOWS (if non-grant instrument is used**)**

Provide a calendar of expected reflows to the GEF/LDCF/SCCF/CBIT Trust Funds or to your Agency (and/or revolving fund that will be set up)

Not applicable

ANNEX E: ENVIRONMENTAL AND SOCIAL MANAGEMENT PLAN

1. Project Description

The project aims at creating the market conditions to accelerate the uptake of energy efficient motors in Industry through a range of measures on the policy, financing, awareness raising and technical assistance. The project will address motor system improvements and replacements in industries across Egypt. The participating industries will be identified during the project implementation through a call for interest and criteria for the selection , which will include among others the environmental and social safeguard aspects. The main issues identified during the PPG phase related to possible impacts on the rewinders, which will be mitigated through the policy and technical assistance components and the disposal of replaced motors, which will also be mitigated through developing a disposal plan.

2. Policy, legal, and administrative framework

The Egyptian Environmental Affairs Agency (EEAA) was established in 1982 and restructured according to Law 4/1994 to act as the executive agency of the Ministry of State for Environmental Affairs. EEAA is responsible for the formulation of environmental policies, the preparation of plans for environmental protection and setting the principles and procedures for mandatory Environmental Impact Assessment (EIA) of projects. EEAA also grants the required environmental approvals.

The existing policies and guidelines of EEAA especially law 4/1994 address the issues related to solid waste and hazardous wastes. The law does not address or mention e-waste of any type. The legislations related to e-wastes are distributed among various governmental organizations such as Ministries of environment, trade and industry, and communication and information technology.

Article 29 of Law No.4 guides the inclusion of new entries into the lists of hazardous wastes, providing that: The Ministers , as per their scope and mandate, and in coordination with the Minister of Health and the Environmental Affairs Agency, shall issue a table of the dangerous materials and wastes referred to in (the glossary) of the that article. Electronic wastes are listed in the lists of the respective industry sector and legalized by a ministerial decree since 2002. The interpretation of this list and associated decree needs more refinement, promotion and enforcement among the entities/individuals generating or trading e-wastes.

The relevant laws require the collection, refurbishment and recycling of electronic wastes as follows:

- Collection: The collection of e-waste is done through various channels, and almost entirely through the informal sector. E-waste is usually bought by street peddlers who roam the streets in carts calling for old household items and buying them at cheap prices. Some e-waste is bought by big waste dealersin lots or in tons on occasions when private or public organizations offer their e-wastes for sale in a formal bidding process. This is often functioning equipment that is obsolete for the organization. Some e-wastes are sorted out by scavengers from formal and informal dumpsites while others are collected from maintenance and repair workshops

- Refurbishment: The refurbishment industry is mostly composed of small workshops that are easily found by street peddlers and any other persons interested in selling obsolete equipment. These workshops either repair and resell the equipment or dismantle it and use its components and spare parts for servicing.
- Recycling: The outlets for the recycling of e-wastes are mostly workshops and informal vendors located in the poorer areas of Greater Cairo. The main markets are either sell throughout the entire week, or one day per week. These workshops are located in five areas. Otherwise, informal e-waste handling activities can be also found sparsely distributed throughout the city, and the cities of other governorates of Egypt. The recyclers often dismantle e-waste to sell each material independently, other recyclers burn integrated circuit boards and wires to extract copper, however no leaching is practiced. Some small workshops repair some of the old electric waste and resell it or dismantle the equipment and use as spare parts for repairing other equipment

Through the project outputs, environmental sound handling of dismantled motors will be integrated as part of the ESCO responsibilities within the ESCO framework. On the other side, the guidelines for rewinding will take into account the health and safety of technicians working in the rewinding workshops. In developing these policies and guidelines, the project will provide examples of best practices globally and refer to international guidelines available.

3. Environmental and social risks and mitigation measures

During the PPG, the project team in cooperation with the executing partner assessed the environmental and social impacts of the project. The table below provides an overview of the risks identified during the PIF and the mitigation actions suggested within the project to address these.

	E&S risks	**Mitigating Measure**	**Technical details of the mitigation technology, process, equipment, design and operating procedures**	**Location**	**Timeline, including frequency, start and end date**	**Responsibility**	**Cost of Mitigation (If Substantial; to be covered by the GEF grant or non-UNIDO co-financing)**
Risks identified during the PIF preparation and verified during the project preparation(PPG)	Replaced motors in industry are not disposed in a sustainable way.	The project will consider appropriate waste management for motors as part of the ESCOs strategy and workplan.	The project will build on different programmes such as those targeting e-waste to define a sustainable waste management scheme for the replaced technologies in close cooperation with the local authorities and the energy service companies, providing the services to industries.	Throughout Egypt	The timeline will be linked to the ESCO workplan.	Local authorities and UNIDO in close cooperation with the ESCOs	Part of the defined budget for Component 4.

	Rewinding of motors has health and safety implications on the technicians.	The project will develop and provide guidelines for motor rewinding.	The project will develop and provide relevant briefing materials that consider local traffic and road conditions minimizing the risks of cycling. Bicycle users will be instructed on these materials before renting a bicycle at the hiring stations. Furthermore, the horse carriages routes will be adapted for cyclists and marked accordingly. In the TORs of the sub-supplier, the provision of relevant briefing materials for the bicycles' users will be required.	Throughout Egypt	The timeline will be linked to the development of the guideline and the capacity .	Local authorities and UNIDO in close cooperation with the rewinding workshops.	Part of the defined budget for Component 2.
	Job loss for re-winders	The project mitigates this through supporting re-winders to upgrade their skills and practices or be reintegrated into the workforce.	The project will develop an action plans and guidelines to support rewinding shops in adapting to the changes in the industrial motors marketplace.	Throughout Egypt	The timeline will be linked to the development of the action plan and guideline to support rewinding shops.	Local authorities and UNIDO in close cooperation with the rewinding workshops.	Part of the defined budget for Component 1.

4. Environmental and social sustainability monitoring

The table below provides an overview of how the risks identified during the PPG will be monitored during the project implementation.

	E&S risks	Parameters to be measured	Monitoring methods and procedures used (e.g. sampling)	Timing/Frequency of measurement	Detection limit	Definition of thresholds	Sampling/monitoring location	Responsibility
Risks identified during the PIF preparation and verified during the project preparation(PPG)	Replaced motors in industry are not disposed in a sustainable way.	Disposal of motors as per the developed disposal strategy	As per disposal strategy	Following the dismantling of old motors and installation of new motors	-	-	Industries where replacements took place	Local authorities and UNIDO in close cooperation with the ESCOs
	Rewinding of motors has health and safety implications on the technicians.	Observing the guidelines developed for the rewinding	Random visits to rewinding workshops as part of the project monitoring to check if guidelines are observed	Regularly throughout the project	-	-	Rewinding workshops trained through the programme	Local authorities and UNIDO in close cooperation with the rewinding workshops.
	Job loss for re-winders	Re-winding workshops participating in the training and upgrading their businesses.	Random visits to rewinding workshops as part of the project monitoring to check if guidelines are observed	Regularly throughout the project	-	-	Rewinding workshops trained through the programme	Local authorities and UNIDO in close cooperation with the rewinding workshops.

5. Capacity development

The project includes a number of trainings to support the capacity building of local experts on the optimization of the motor systems, feasibility of replacements, the rewinding workshops and also the energy service companies. These are adequately described in the CEO endorsement document. As the E&S risks identified relate to the replacement of motors by ESCOs and the practices in rewinding workshops, UNIDO will work with the Ministry of Industry/ Egyptian National Cleaner Production Center and relevant partners on :

- Developing standard operating procedures for the waste disposal to be included into the ESCO operational guidelines through a consultative process with all relevant partners.
  Building the capacity of ESCOs on the implementation of the guidelines
- Training the ENCPC and/or other partners on monitoring the operations of ESCOs including their disposal practices.
- Including Health and safety occupational specialists in the development of guidelines for the retrofit.
- Training ENCPC and/or other partners on monitoring the implementation of the retrofitting guidelines.

6. Communication

As part of the GEF Annual Monitoring Report (AMR), UNIDO will annually communicate implementation progress on issues that involve ongoing risk to or impacts on the project stakeholders, and on issues that the consultation process or grievance mechanism has identified as of concern to those stakeholders. The ESMP will be disclosed on the UNIDO public website, under the following link: https://open.unido.org/index.html

The environmental and social risks, proposed mitigation actions and monitoring arrangements will be included in the annual reporting of UNIDO to GEF as part of the project AMR. Furthermore, reporting on the compliance with the ESMP will be made during the project steering committee meetings.

7. Stakeholder Engagement Plan

The selection of pilots to be supported in the implementation of motor efficiency measures will be done during the project implementation following criteria, which includes technical and financial parameters. Environmental and social parameters will also be included as part of the feasibility assessment of the projects. A stakeholder engagement plan is presented below will be developed and implemented within the support of ESCOs to pilot projects.

Consultation	Purpose	Participants	Lead/Chair	Reporting	Schedule
Initial	Project Start up: ➢ Project Overview ➢ Project Organization	EEAA, MTI, ESCOs,	EEAA and/or MTI	Inception phase report	Month 1 - 4

	➢ Project Schedule ➢ Social and Env Impacts ➢ ESMP				
Public consultation & site visit	➢ Adjusting of mitigation measures, if necessary; ➢ Impact of replacing and updating activities; ➢ Comments and suggestions	EEAA, MTI, ESCOs, industry associations, industries, motor re-winders, experts and resellers/recyclers of e-waste	EEAA and/or MTI	PIRs, MTR	Month 4- 24
Public consultation & site visit	➢ Effectiveness of mitigation measures; ➢ Impacts of project implementation; ➢ Comments and suggestions.	EEAA, MTI, ESCOs, industry associations industries, motor re-winders, experts and resellers/recyclers of e-waste	EEAA and/or MTI	PIRs, final evaluation	Month 25 - 48
Expert workshop or press conference	➢ Comments and suggestions on impacts; ➢ public opinions	Not foreseen individually but special sessions can be integrated to various workshops planned during the project			
Addressing Community Concerns	Consultation on Grievance Procedure	EEA, MTI, industries, motor re-winders, experts and resellers/recyclers of e-waste	EEAA and/or MTI	PIRs	Throughout project cycle

Annex E: ESTIMATED CO2 AND ENERGY SAVINGS

Over the life of the project, 30 industrial enterprises will receive TA to design and implement motor system optimization and EE motor deployment projects. Of the 30 demonstration projects, at least 10 will also benefit from soft financing through the revolving fund if they are implemented through an ESCO. The remaining 20 will rely on commercially available EE creditlines or equity.

Experience through the GEF-4 IEE project has shown that MSO and EE motor upgrade projects fall in three main categories based on complexity and investment level: high, medium and low. The table below provides a description and illustrative example of each category, the average annual savings expected from each category and the number of demonstration projects.

	Description/illustrative example	Investment Cost	Annual Savings	Number of Projects
High	Likely to be in energy-intensive industries such as steel or petrochechemicals. It involves the replacement of multiple large motors, the installation of VSD drives in large motor systems, or deep optimization of high-energy consumptive motor systems.	\$200,000 - \$500,000	10,000 MWh per year	10
Medium	Likely to be in medium-sized enterprises in the textile, glass, and paper sector. This type of project will include a combination of no-cost measures and small investment in replacement of motors or installation of VSD drives in smaller motors systems.	\$40,000 – \$60,000	2,000 MWh per year	10
Low	This type of project can be implemented in enterprises of all sizes that are not willing to make significant investments in equipment and hardware. The project will mainly consist of no-cost or very low-cost measures such as maintenance, fixing leaks and turning off equipment. Most of the costs with this type of project are labor-costs.	<\$10,000	400 MWh	10

The weighted average savings for the 30 demonstration projects is 4,133 MWh per year, which was input into the GEF/STAP GHG emissions calculation tool. The cumulative savings shown are in the table below:

	Total	***2019-2021***	***2022-2031***
Direct Electricity Savings (MWh)	1,157,333	173,600	983,733
Direct Total Energy Savings (GJ)	4,166,400	624,960	3,541,440
Direct GHG Emission Savings (tCO2)	598,000	89,700	508,300
Indirect Bottom-up Emission Savings (tCO2)	1,922,143		1,922,143
Indirect Top-down Emission Savings (tCO2)	9,306,890		9,306,890

Annex F: PROJECT BUDGET BREAKDOWN

GEF Grant Budget Component 1												
Outcome 1.1: Conducive Policy and Legal Environment for EE Motor Systems	**Type of Expense**	**Yr 1**		**Yr 2**		**Yr 3**		**Yr 4**		**Output Total**		**Execution Modality**
Output 1.1.1. Recommendations on policy tools and guidelines for the deployment of EE motors developed		**w/w**	**$**	**w/w**	**$**	**w/w**	**$**	**w/w**	**$**	**w/w**	**$**	
	International Expertise	8	20,000	14	35,000	0	0	0	0	22	55,000	Tender
	Local Travel		1,000		1,000		500		500		3,000	Execution Agreement with ENCPC
	National Expertise	20	20,000	25	25,000	10	10,000	5	5,000	60	60,000	UNIDO Technical Execution Support
	Training/Workshops		5,000		5,000		4,000		2,000		16,000	Execution Agreement with ENCPC
	Miscellaneous		1,000		1,000		1,000		1,000		4,000	Execution Agreement with ENCPC
	Output sub-total	28	47,000	39	67,000	10	15,500	5	8,500	82	138,000	
Output 1.1.2. Action plan and guidelines to support rewinding shops and their workers in adapting to the changes in the industrial motors marketplace developed		**w/w**	**$**	**w/w**	**$**	**w/w**	**$**	**w/w**	**$**	**w/w**	**$**	
	International Expertise	8	20,000	18	45,000	0	0	0	0	26	65,000	International tender
	Local Travel		1,000		1,000		1,000				3,000	Execution Agreement with ENCPC
	National Expertise	10	10,000	15	15,000	5	5,000	5	5,000	35	35,000	UNIDO Technical Execution Support
	Training/Workshops		5,000		5,000		5,000		4,000		19,000	Execution Agreement with ENCPC
	Miscellaneous		2,000		2,000		2,000		2,000		8,000	Execution Agreement with ENCPC
	Output sub-total	18	38,000	33	68,000	5	13,000	5	11,000	61	130,000	
Output 1.1.3. Action plan to support local industries in the development of EE and clean technologies for motor systems developed		**w/w**	**$**	**w/w**	**$**	**w/w**	**$**	**w/w**	**$**	**w/w**	**$**	
	International Expertise	8	20,000	18	45,000	0	0	0	0	26	65,000	Tender
	Local Travel		1,000		1,000		1,000				3,000	Execution Agreement with ENCPC
	National Expertise	15	15,000	20	20,000	15	15,000	10	10,000	60	60,000	UNIDO Technical Execution Support
	Training/Workshops		6,000		6,000		6,000		5,000		23,000	Execution Agreement with ENCPC
	Miscellaneous		2,000		2,000		2,000		1,000		7,000	Execution Agreement with ENCPC
	Output sub-total	23	44,000	38	74,000	15	24,000	10	16,000	86	158,000	
Output 1.1.4. ESCO market support policies and tools developed		**w/w**	**$**	**w/w**	**$**	**w/w**	**$**	**w/w**	**$**	**w/w**	**$**	
	International Expertise	14	35,000	14	35,000	0	0	0	0	28	70,000	Tender
	Local Travel		1,000		1,000						2,000	Execution Agreement with ENCPC
	National Expertise	15	15,000	20	20,000	0	0	0	0	35	35,000	UNIDO Technical Execution Support
	Training/Workshops		6,000		6,000						12,000	Execution Agreement with ENCPC
	Miscellaneous		2,500		2,500						5,000	Execution Agreement with ENCPC
	Output sub-total	29	59,500	34	64,500	0	0	0	0	63	124,000	
	TOTAL Outcome 1	**98**	**188,500**	**144**	**273,500**	**30**	**52,500**	**20**	**35,500**	**292**	**550,000**	

GEF Grant Budget Component 2

Outcome 2.1: Awareness and Capacity Building on Energy Efficiency in Motors and Motor Driven Systems	Type of Expense	Yr 1		Yr 2		Yr 3		Yr 4		Output Total		Execution Modality
Output 2.1.1. National awareness campaign on the benefits of EE upgrades to Electric Motor Driven Systems in the industrial sector conducted		**w/w**	**$**	**w/w**	**$**	**w/w**	**$**	**w/w**	**$**	**w/w**	**$**	
	Local Travel		3,000		3,000		3,000		3,000		12,000	Execution Agreement with ENCPC
	National Expertise	15	15,000	15	15,000	15	15,000	15	15,000	60	60,000	Tender
	Training/Workshops		10,000		15,000		10,000		10,000		45,000	Execution Agreement with ENCPC
	Miscellaneous		4,000		4,000		4,000		3,000		15,000	Execution Agreement with ENCPC
	Output sub-total	15	32,000	15	37,000	15	32,000	15	31,000	60	132,000	
Output 2.1.2. Peer-to-peer platform for information exchange, cooperation and partnerships among seekers and providers of services and information on EE in EMDS developed		**w/w**	**$**	**w/w**	**$**	**w/w**	**$**	**w/w**	**$**	**w/w**	**$**	
	Local Travel		1,000		1,000		1,000		1,000		4,000	Execution Agreement with ENCPC
	National Expertise	6	6,000	9	9,000	5	5,000	5	5,000	25	25,000	UNIDO Technical Execution Support
	Training/Workshops		1,500		1,500		1,500		1,500		6,000	Execution Agreement with ENCPC
	Miscellaneous		30,000		1,000		1,000		1,000		33,000	Tender
	Output sub-total	6	38,500	9	12,500	5	8,500	5	8,500	25	68,000	
Output 2.1.3. Information gained through the 30 demonstration projects disseminated		**w/w**	**$**	**w/w**	**$**	**w/w**	**$**	**w/w**	**$**	**w/w**	**$**	
	Local Travel				1,000		1,500		1,500		4,000	Execution Agreement with ENCPC
	National Expertise	0	0	5	2,000	5	5,000	5	5,000	15	12,000	UNIDO Technical Execution Support
	Training/Workshops				2,000		5,000		5,000		12,000	Execution Agreement with ENCPC
	Miscellaneous				1,000		2,000		2,000		5,000	Execution Agreement with ENCPC
	Output sub-total	0	0	5	6,000	5	13,500	5	13,500	15	33,000	
Output 2.1.4. Industrial end users, suppliers, and motor system optimization experts trained		**w/w**	**$**	**w/w**	**$**	**w/w**	**$**	**w/w**	**$**	**w/w**	**$**	
	International Expertise	10	25,000	19	47,500	19	47,500	5	12,500	53	132,500	UNIDO Technical Execution Support
	Local Travel		2,000		2,000		2,000				6,000	Execution Agreement with ENCPC
	National Expertise	0	0	0	0	20	20,000	13	13,000	33	33,000	UNIDO Technical Execution Support
	Training/Workshops		10,000		20,000		20,000		10,000		60,000	Execution Agreement with ENCPC
	Miscellaneous		6,000		6,000		6,000		6,000		24,000	Execution Agreement with ENCPC
	Output sub-total	10	43,000	19	75,500	39	95,500	18	41,500	86	255,500	
Output 2.1.5. Local rewinding and refurbishing workshops capacity improved		**w/w**	**$**	**w/w**	**$**	**w/w**	**$**	**w/w**	**$**	**w/w**	**$**	
	International Expertise	0	0	5	12,500	0	0	0	0	5	12,500	UNIDO Technical Execution Support
	Local Travel				0		1,000		1,000		2,000	Execution Agreement with ENCPC
	National Expertise	0	0	3	3,000	14	14,000	14	14,000	31	31,000	Tender
	Training/Workshops						5,000		5,000		10,000	Execution Agreement with ENCPC
	Miscellaneous						3,000		3,000		6,000	Execution Agreement with ENCPC
	Output sub-total	0	0	8	15,500	14	23,000	14	23,000	36	61,500	
	TOTAL Outcome 2	**31**	**113,500**	**56**	**146,500**	**78**	**172,500**	**57**	**117,500**	**222**	**550,000**	

GEF Grant Budget Component 3

Outcome 3.1 Technical Assistance for Technology Demonstration and Upscaling	Type of Expense	Yr 1		Yr 2		Yr 3		Yr 4		Output Total		Execution Modality
Output 3.1.1. Detailed motor efficiency audits for 40 selected enterprises conducted by UNIDO-trained motor system optimization experts		**w/w**	**$**	**w/w**	**$**	**w/w**	**$**	**w/w**	**$**	**w/w**	**$**	
	International Expertise	4	10,000	8	20,000	8	20,000	0	0	20	50,000	UNIDO Technical Execution Support
	Local Travel		1,000		2,000		2,000		1,000		6,000	Execution Agreement with ENCPC
	National Expertise	10	10,000	30	30,000	30	30,000	10	10,000	80	80,000	Tender
	Training/Workshops										0	Execution Agreement with ENCPC
	Equipment		50,000								50,000	Tender
	Miscellaneous		1,000		2,000		1,000		1,000		5,000	Execution Agreement with ENCPC
	Output sub-total	14	72,000	38	54,000	38	53,000	10	12,000	100	191,000	
Output 3.1.2. Technical and business advisory services for 30 motor systems efficiency projects facilitated		**w/w**	**$**	**w/w**	**$**	**w/w**	**$**	**w/w**	**$**	**w/w**	**$**	
	International Expertise	0	0	11	27,500	11	27,500	7	17,500	29	72,500	Tender
	Local Travel				1,000		1,000				2,000	Execution Agreement with ENCPC
	National Expertise	0	0	20	20,000	30	30,000	15	15,000	65	65,000	Tender
	Miscellaneous				2,000		2,000		1,000		5,000	Execution Agreement with ENCPC
	Output sub-total	0	0	31	50,500	41	60,500	22	33,500	94	144,500	
Output 3.1.3. System optimization for EMDS implemented and EE motors installed in 30 enterprises		**w/w**	**$**	**w/w**	**$**	**w/w**	**$**	**w/w**	**$**	**w/w**	**$**	
	International Expertise	0	0	5	12,500	5	12,500	5	12,500	15	37,500	UNIDO Technical Execution Support
	Local Travel				2,000		3,000		2,000		7,000	Execution Agreement with ENCPC
	National Expertise	0	0	10	10,000	10	10,000	10	10,000	30	30,000	UNIDO Technical Execution Support
	Miscellaneous				3,000		3,000		2,000		8,000	Execution Agreement with ENCPC
	Output sub-total	0	0	15	27,500	15	28,500	15	26,500	45	82,500	
Output 3.1.4. Public private partnerships with international suppliers developed to accelerate the deployment of EE motors		**w/w**	**$**	**w/w**	**$**	**w/w**	**$**	**w/w**	**$**	**w/w**	**$**	
	National Expertise	7	7,000	7	7,000	6	6,000	6	6,000	26	26,000	UNIDO Technical Execution Support
	Training/Workshops		3,000		3,000		3,000				9,000	Execution Agreement with ENCPC
	Miscellaneous		1,000		1,000						2,000	Execution Agreement with ENCPC
	Output sub-total	7	11,000	7	11,000	6	9,000	6	6,000	26	37,000	
	TOTAL Outcome 3	**21**	**83,000**	**91**	**143,000**	**100**	**151,000**	**53**	**78,000**	**265**	**455,000**	

GEF Grant Budget Component 4

Outcome 4.1 ESCO model to provide energy efficiency services to industry piloted	Type of Expense	Yr 1		Yr 2		Yr 3		Yr 4		Output Total		Execution Modality
Output 4.1.1. Contractual framework for energy performance contracting developed		**w/w**	**$**	**w/w**	**$**	**w/w**	**$**	**w/w**	**$**	**w/w**	**$**	
	International Expertise	10	25,000	10	25,000	0	0	0	0	20	50,000	Tender
	National Expertise	15	15,000	15	15,000	10	10,000	10	10,000	50	50,000	Tender
	Training/Workshops				6,000						6,000	Execution Agreement with ENCPC
	Output sub-total	25	40,000	25	46,000	10	10,000	10	10,000	70	106,000	
Output 4.1.2. M&V tools established and made available to ESCOs, M&V providers, and industry		**w/w**	**$**	**w/w**	**$**	**w/w**	**$**	**w/w**	**$**	**w/w**	**$**	
	International Expertise	9	22,500	9	22,500	0	0	0	0	18	45,000	Tender
	National Expertise	15	15,000	15	15,000	10	10,000	0	0	40	40,000	Tender
	Training/Workshops				4,000		4,000				8,000	Execution Agreement with ENCPC
	Miscellaneous		1,000		1,000		1,000				3,000	Execution Agreement with ENCPC
	Output sub-total	24	38,500	24	42,500	10	15,000	0	0	58	96,000	
Output 4.1.3. ESCO businesses developed and established		**w/w**	**$**	**w/w**	**$**	**w/w**	**$**	**w/w**	**$**	**w/w**	**$**	
	International Expertise	10	25,000	10	25,000	0	0	0	0	20	50,000	Tender
	National Expertise	10	10,000	20	20,000	20	20,000	10	10,000	60	60,000	Tender
	Miscellaneous		1,000		1,000		1,000				3,000	Execution Agreement with ENCPC
	Output sub-total	20	36,000	30	46,000	20	21,000	10	10,000	80	113,000	
Output 4.1.4. Revolving fund to offer project-based financing packages for system optimization EPC projects introduced		**w/w**	**$**	**w/w**	**$**	**w/w**	**$**	**w/w**	**$**	**w/w**	**$**	
	International Expertise	10	25,000	8	20,000	6	15,000	0	0	24	60,000	Tender
	National Expertise	10	10,000	20	20,000	20	20,000	20	20,000	70	70,000	Tender
	Miscellaneous		500,000								500,000	Financial management services
	Output sub-total	20	535,000	28	40,000	26	35,000	20	20,000	94	630,000	
	TOTAL Outcome 4	**89**	**649,500**	**107**	**174,500**	**66**	**81,000**	**40**	**40,000**	**302**	**945,000**	

GEF Grant Budget Component 5

Outcome 5.1: Project progress towards objectives continuously monitored and evaluated	Type of Expense	Yr 1		Yr 2		Yr 3		Yr 4		Output Total		Execution Modality
		w/w	**$**	**w/w**	**$**	**w/w**	**$**	**w/w**	**$**	**w/w**	**$**	
	International Expertise	0	0	0	0	0	0	16	40,000	16	40,000	UNIDO as Implementing Agency
	Local Travel										0	UNIDO as Implementing Agency
	National Expertise	0	0	25	25,000	0	0	0	0	25	25,000	UNIDO as Implementing Agency
	Training/Workshops		10,000								10,000	UNIDO as Implementing Agency
	Equipment										0	UNIDO as Implementing Agency
	Miscellaneous										0	UNIDO as Implementing Agency
	TOTAL Outcome 5	0	10,000	25	25,000	0	0	16	40,000	41	75,000	

GEF Grant Budget PMC

Project Management Costs (PMC)	Type of Expense	Yr 1		Yr 2		Yr 3		Yr 4		Output Total		Execution Modality
		w/w	$	w/w	$	w/w	$	w/w	$	w/w	$	
** For a detailed list of eligble costs under PMC, please refer to the below box.	Local Travel		1,750		1,750		1,750	0	1,750	0	7,000	Execution Agreement with ENCPC
	National Expertise (e.g. Project Coordinator)	50	28,125	50	28,125	50	28,125	50	28,125		112,500	UNIDO Administrative Execution Support
	National Expertise (e..g Procurement Specialist)	50	11,250	50	11,250	50	11,250	50	11,250	200	45,000	UNIDO Administrative Execution Support
	Equipment		3,500								3,500	Execution Agreement with ENCPC
	Miscellaneous		1,750		1,750		1,750		1,750		7,000	Execution Agreement with ENCPC
TOTAL PMC		100	46,375	100	42,875	100	42,875	100	42,875	200	175,000	

TOTAL		339	1,090,875	523	805,375	374	499,875	286	353,875	1,322	2,750,000	

Annex H – Project 4-YEAR TIMELINE

Outcome	Output	Activity	Year 1				Year 2				Year 3				Year 4			
			Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4
Outcome 1.1: Conducive Policy and Legal Environment for EE Motor Systems	Output 1.1.1. Recommendations on policy tools and guidelines for the deployment of EE motors developed	1.1.1.1 Develop an inventory of the existing motor stock in the industrial sector																
		1.1.1.2 Propose a list of possible policy tools and guidelines based on international best practices and assist policymakers in selecting the tools and guidelines that are appropriate for the Egyptian context																
		1.1.1.3 Develop the selected tools and guidelines through a participatory process involving the relevant public and private sector actors																
		1.1.1.4 Support the relevant public-sector entities in disseminating the tools and guidelines to the relevant																

Outcome	Output	Activity	Year 1				Year 2				Year 3				Year 4			
			Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4
		stakeholders																
	Output 1.1.2. Action plan and guidelines to support rewinding shops and their workers in adapting to the changes in the industrial motors marketplace developed	1.1.2.1 Perform a rapid assessment of the potential impact of changes in the industrial motors marketplace on the rewinding industry, including potential loss of employment or business																
		1.1.2.2 Identify cost-effective measures to mitigate the negative impacts and develop a roadmap for the implementation of these measures																
		1.1.2.3 Develop a guidelines for best practices in motor rewinding																
		1.1.2.4 Support the relevant public-sector entity in the dissemination and implementation of the roadmap																

Outcome	Output	Activity	Year 1				Year 2				Year 3				Year 4			
			Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4
	Output 1.1.3. Action plan to support local industries in the development of EE and clean technologies for motor systems developed	1.1.3.1 Conduct an assessment for upgrading local manufacturing of EE industrial motor systems																
		1.1.3.2 Conduct feasibility analysis of investment opportunities for local manufacturing and feeder industries of EE industrial motor systems																
		1.1.3.3 Develop the action plan for supporting local industries																
		1.1.3.4 Support the relevant public-sector entity in the dissemination and implementation of the action plan																
		1.1.3.5 Create opportunities for match-making and business-to-business networking within the value of EE																

Outcome	Output	Activity	Year 1				Year 2				Year 3				Year 4			
			Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4
		industrial motor systems																
	Output 1.1.4. ESCO market support policies and tools developed	1.1.4.1 Perform a rapid assessment to validate the findings of the ESCO assessment undertaken during PPG phase and confirm the selection of ESCO business models																
		1.1.4.2 Develop an accreditation scheme for ESCOs																
		1.1.4.3 Develop an M&V framework and operational guide for motor system applications																
		1.1.3.4 Identify and adapt a certification scheme for M&V service providers																
Outcome 2.1: Awareness and Capacity Building on Energy Efficiency in	Output 2.1.1. National awareness campaign on the benefits of EE upgrades to	2.1.1.1 Organize 20 workshops, conferences and stakeholder engagement meetings over the life of the project																

Outcome	Output	Activity	Year 1				Year 2				Year 3				Year 4			
			Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4
Motors and Motor Driven Systems	Electric Motor Driven Systems in the industrial sector conducted	2.1.1.2 Develop and distribute leaflets that highlight the technical, economic, financial and environmental benefits of energy efficiency upgrades to industrial motors and motor systems																
		2.1.1.3 Prepare and disseminate press releases via various media sources																
		2.1.1.4 Support MOTI in adding a new category to the Annual Innovation Award that focuses on women champions on EE in motors and motor systems																
	Output 2.1.2. Peer-to-peer platform for information exchange, cooperation and partnerships among seekers	2.1.2.1 Hold a series of consultations with the relevant stakeholders and potential members to finalize the design of the network, including goals, activities, timelines, operational modality,																

Outcome	Output	Activity	Year 1				Year 2				Year 3				Year 4			
			Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4
	and providers of services and information on EE in EMDS developed	and plan for sustainability																
		2.1.2.2 Develop an online platform to host the network																
		2.12.3 Hold regular in-person meetings and networking events for members																
		2.12.3 Monitor the performance of the P2P network and implement corrective actions to stimulate engagement, if necessary																
	Output 2.1.3. Information gained through the 30 demonstration projects disseminated	2.1.3.1 Document and disseminate best practice case studies of the demonstration projects using multimedia channels including print, video and social media postings																
		2.1.3.2 Organize technical tours to the demonstration projects																

Outcome	Output	Activity	Year 1				Year 2				Year 3				Year 4			
			Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4
	Output 2.1.4. 300 industrial end users, suppliers, and motor system optimization experts trained	2.1.4.1 Identify training providers																
		2.1.4.2 Prepare 2-day “user-level” basic training material on the benefits of motor system optimization and EE motors based on UNIDO’s *Manual for Industrial Motor Systems Assessment and Optimization*																
		2.1.4.3 Deliver “user-level” training to 200 industrial enterprise staff members, including engineers, procurement officers, and managers																
		2.1.4.4 Deliver “user-level” training to 100 motor suppliers and vendors staff members, including sales representatives, inventory managers, and top mangers																
		2.1.4.5 Prepare “expert-																

Outcome	Output	Activity	Year 1				Year 2				Year 3				Year 4			
			Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4
		level" advanced training material on motor system optimization based on UNIDO's *Manual for Industrial Motor Systems Assessment and Optimization*																
		2.1.4.6 Deliver "expert-level" training to 50 energy professionals with mentoring and coaching over a period of one year																
	Output 2.1.5. 20 local rewinding and refurbishing workshops capacity improved	2.1.5.1 Prepare training materials based on the guidelines for best practices in motor rewinding from Output 1.1.2																
		2.1.5.2 Deliver the training to the staff of 20 rewinding workshops																
		2.1.5.3 Provide on-the-job training for staff of 10 rewinding workshops in order to upgrade their practices																

Outcome	Output	Activity	Year 1				Year 2				Year 3				Year 4			
			Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4
Outcome 3.1 Technical Assistance for Technology Demonstration and Upscaling	Output 3.1.1. Detailed motor efficiency audits for 40 selected enterprises conducted by UNIDO-trained motor system optimization experts	3.1.1.1 Carry out consultations with the relevant stakeholders to validate the targeted sectors and selection criteria for enterprises																
		3.1.1.2 Select and sign agreements with 40 companies where motor efficiency audits will be conducted																
		3.1.1.3 Conduct detailed audits for EMDS using the MSO experts being trained under Activity 2.1.4.6																
	Output 3.1.2. Technical and business advisory services for 30 motor systems efficiency projects facilitated	3.1.2.1 Design demonstration projects for 30 enterprises based on the audit results, including engineering designs, technical specifications, implementation plans, O&M requirements, etc.																
		3.1.2.2 Produce bankable feasibility studies for the																

Outcome	Output	Activity	Year 1				Year 2				Year 3				Year 4			
			Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4
		demonstration projects																
		3.1.2.3 Support the 30 enterprises in developing funding proposals to apply for loans to finance the portions of the pilot projects that will not be covered from the revolving fund under Output 4.1.4. or the entirety of the project if ESCO involvement is ruled out by the owner																
	Output 3.1.3. System optimization for EMDS implemented and EE motors installed in 30 enterprises	3.1.3.1 Provide assistance to the enterprises in the procurement of the selected equipment and services for the pilot projects																
		3.1.3.2 Provide assistance to the enterprises in overseeing the implementation of the demonstration projects																
		3.1.3.3 Monitor, verify																

Outcome	Output	Activity	Year 1				Year 2				Year 3				Year 4			
			Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4
		and report on the performance of the demonstration projects																
	Output 3.1.4. Public private partnerships with international suppliers developed to accelerate the deployment of EE motors	3.1.4.1 support the development of a public private partnership involving international suppliers and the GoE and industrial enterprises.																
Outcome 4.1 ESCO model to provide energy efficiency services to industry piloted	Output 4.1.1. Contractual framework for energy performance contracting developed	4.1.1.1 Create a standard contract for EPC in motor system optimization projects																
		4.1.1.2 Develop arbitration and dispute resolution protocols																
		4.1.1.3 Provide three trainings for independent arbitration bodies in Egypt on EPC contract disputes																
		4.1.1.4 Provide hands-on assistance to the arbitration bodies on																

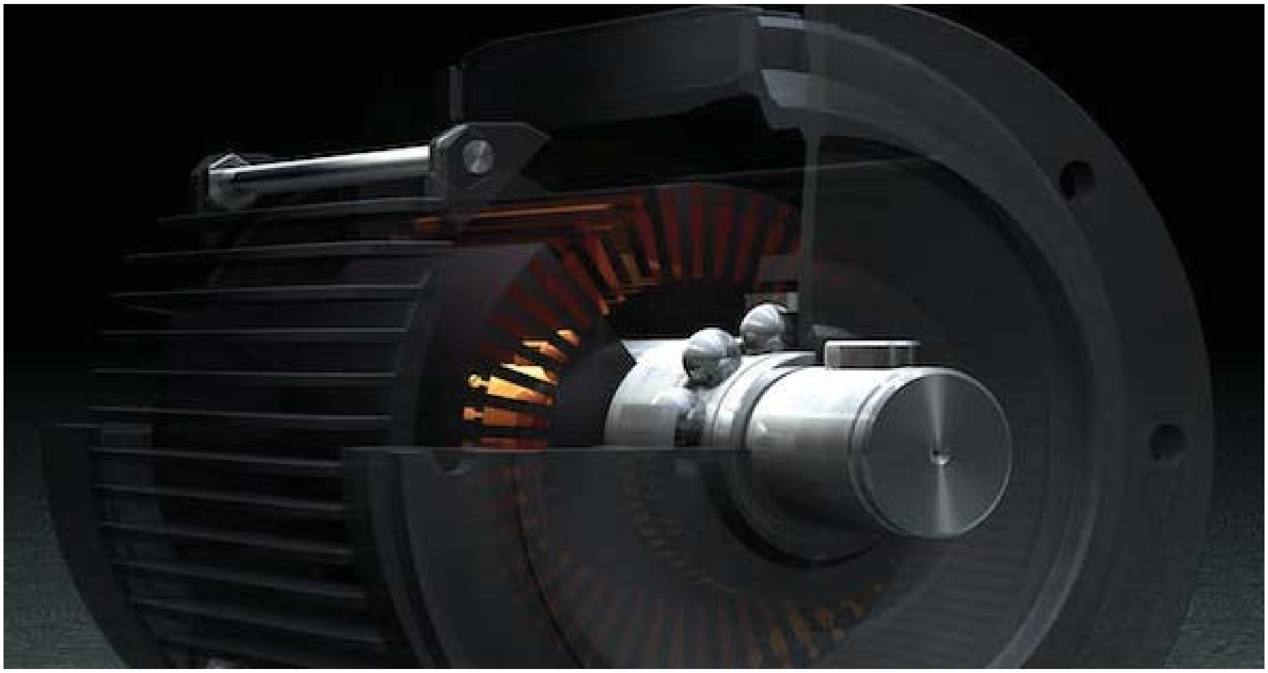
Outcome	Output	Activity	Year 1				Year 2				Year 3				Year 4			
			Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4
		contract resolution, if necessary.																
	Output 4.1.2. M&V tools established and made available to ESCOs, M&V providers, and industry	4.1.2.1 Create a standard M&V plan for EMDS projects																
		4.1.2.2 Support establishing a mobile testing lab to support M&V activities																
		4.1.2.3 Train 10 independent M&V service provider and assist them in becoming certified under Activity 1.1.4.4.																
	Output 4.1.3. 5 ESCO businesses developed and established	4.1.3.1 Develop the operational modalities for the ESCO business models selected under Activity 1.1.4.1																
		4.1.3.2 Promote the selected ESCO business models to the enterprises and energy professionals receiving training and technical assistance																

Outcome	Output	Activity	Year 1				Year 2				Year 3				Year 4			
			Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4
		under Outcomes 2 and 3																
		4.1.3.3 Provide mentoring and coaching in the implementation of the selected ESCO models to at least five energy professionals or companies																
		4.1.3.4 Support the relevant stakeholder in the implementation of the ESCO accreditation scheme developed under Activity 1.1.4.2																
	Output 4.1.4. Revolving fund to offer project-based financing packages for system optimization EPC projects introduced	4.1.4.1 Set up a revolving fund with a local bank																
		4.1.4.2 Train 10 staff members of the participating bank in the identification, development and evaluation of ESCO projects																
		4.1.4.3 Train industrial enterprises and MSO experts in financial																

Outcome	Output	Activity	Year 1				Year 2				Year 3				Year 4			
			Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4
		analysis																
		4.1.4.4 Assist the industrial enterprises and energy professionals in developing financial plans and loan applications for projects																
		4.1.4.5 Provide hands-on mentoring and coaching to the local participating bank in operating the revolving fund																
		4.1.4.6 Monitor, verify and report on the performance of the revolving fund																
Outcome 5: Monitoring and Evaluation	Output 5.1.2. Mid-term Review (MTR) and Terminal Evaluation (TE) conducted in timely manner	5.1.2.1 Conduct independent Mid-term Review																
		5.1.2.2 Conduct independent Terminal Evaluation																
	Output 5.1.1. Project progress monitored,	5.1.1.1 Conduct inception workshop and prepare inception report																

Outcome	Output	Activity	Year 1				Year 2				Year 3				Year 4			
			Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4
	documented, and recommended actions formulated	5.1.1.2 Monitor indicators in project results framework																
		5.1.1.3 Monitor environmental and social risks																
		5.1.1.4 Prepare GEF Project Implementation Report (PIR)																

Annex I – STUDY ON THE ENERGY EFFICIENCY AND GHG EMISSION REDUCTION POTENTIAL IN INDUSTRIAL MOTOR SYSTEM IN EGYPT



Energy Efficiency and GHG Emissions Reduction Potential in Industrial Motor Systems in Egypt

Executive Summary

According to the International Energy Agency (IEA), electric motor systems consume more than half of global electricity. Industrial electric motor systems account for approximately 70 percent of total global industrial electricity usage. Electric motors operate fans; pumps; and materials-handling, compressed-air, and processing equipment.

One major barrier to effective policy making and global action to improve the energy efficiency of industrial motor systems is lack of information on the magnitude and cost-effectiveness of the potential savings from energy-efficiency practices. This lack of information is part of the reason that there is no comprehensive energy-efficiency strategy or roadmap for industrial motors systems. It is much easier to quantify the incremental energy savings from substituting an energy-efficient motor for a standard motor than it is to quantify the energy savings from applying energy-efficiency practices to an existing motor system.

To address the lack of data on potential savings from industrial motor systems energy efficiency, UNIDO commissioned a study on the potential for EE and GHG emission reductions for industrial motor systems in Egypt with the support of global efficiency intelligency.

This report focuses on analyzing energy use and the potential for energy efficiency and carbon dioxide (CO_2) emissions reduction in three major industrial motor systems, i.e. pump systems, fan systems and compressed air systems in Egypt.

In this report, we analyze various energy-efficiency technologies and measures each industrial motor systems type. Using the bottom-up energy-efficiency cost curve model, we estimated *cost-effective* electricity-savings potentials for each industrial motor systems type in Egypt, separately. We also estimated total *technical* electricity-savings potentials (what is technologically possible), assuming 100% adoption of series of efficiency measures. Table 1 summarizes the energy-savings results.

TABLE 1 INDUSTRIAL MOTOR SYSTEMS ELECTRICITY-SAVINGS POTENTIAL IN EGYPT IN 2015

	Cost-effective Energy Saving Potential (GWh/yr)	Technical Energy Saving Potential (GWh/yr)
Pump systems	1,813	2,068
Fan systems	1,008	1,212
Compressed air systems	952	1,269

In Egypt, the share of total technical electricity-savings potential for industrial pump systems compared to total manufacturing pump systems energy use is 49%. The share of total technical electricity-savings potential for industrial fan systems compared to total manufacturing fan systems energy use in Egypt is 38%. The share of total technical electricity-savings potential for industrial compressor systems compared to total manufacturing compressor systems energy use is 39%.

Using the average CO_2 emissions factor of the electricity grid in Egypt, we also calculated the CO_2 emissions reduction associated with the electricity-savings potential. The CO_2 emissions reduction will help the country to meet its greenhouse gas emissions reduction targets. In addition, the reduction in demand for electricity generation will help to reduce other air pollutants emissions and improve local and regional air quality in cities and provinces.

The pump systems energy-efficiency cost curves show that two measures – “isolating flow paths to non-essential or non-operating equipment”, “Trim or change impeller to match output to requirements”, and “installing variable speed drives” – account for more than 65% of the energy-savings potential in industrial pump systems, and all are cost-effective.

The fan systems energy-efficiency cost curves show that two measures – “isolating flow paths to non-essential or non-operating equipment” and “installing variable speed drives” – account for about than half of the energy-savings potential in industrial fan systems, and both are cost-effective.

The compressed air systems energy-efficiency cost curves show that three measures – “Fix Leaks, adjust compressor controls, establish ongoing plan”, “Install sequencer”, and “Initiate predictive maintenance program” – account for more than half of the energy-savings potential in industrial compressed air systems, and all are cost-effective.

Among the key policy implications of our study is that the cost savings from cost-effective efficiency measures can bring down the cost of conserved energy (CCE) of many non-cost-effective measures to just below the unit price of electricity in Egypt. This indicates that effective, cost-efficient fiscal incentive programs for motor systems should bundle efficiency measures, which will maximize savings and allow the savings to pay for non-cost-effective measures whenever possible.

Energy efficiency in industrial motor systems stimulates economic growth and creates jobs in a variety of ways (direct, indirect, and induced jobs creation). Investment in energy efficiency creates more jobs per dollar invested than traditional energy supply investments. Energy efficiency also creates more jobs in the local economy, whereas energy supply jobs and investment dollars often flow outside the country.

Our approach can be considered a screening method for determining the energy-savings potential of efficiency measures that can assist national and local governments, policy makers, and utilities in understanding the potentials and cost of energy efficiency measures, as a basis for designing effective policies. Actual energy-savings potentials and costs of energy-efficiency measures and technologies will vary with plant-specific conditions.

Table of Contents

1. Introduction

Electric motors are used in the agricultural, commercial, industrial, residential, and transportation sectors, among others. Motor applications in each sector include (IEA, 2011a):

- Industrial applications: motors operate pumps, fans, and conveyors; delivering compressed air; providing motive power for other machinery
- Building applications: motors operate pumps; fans; conveyors; elevators; and compressors in heating, ventilation, and air- conditioning (HVAC) systems
- Appliance applications: motors operate refrigerators, air conditioners, personal computer and laptop fans, hard drives, cooking appliances, oven fans, extractor fans, garden appliances, and pool pumps
- Agricultural applications: motors operate pumps and various forms of conveyance
- Transportation applications: motors operate electric trains, trucks, cars, and motorbikes

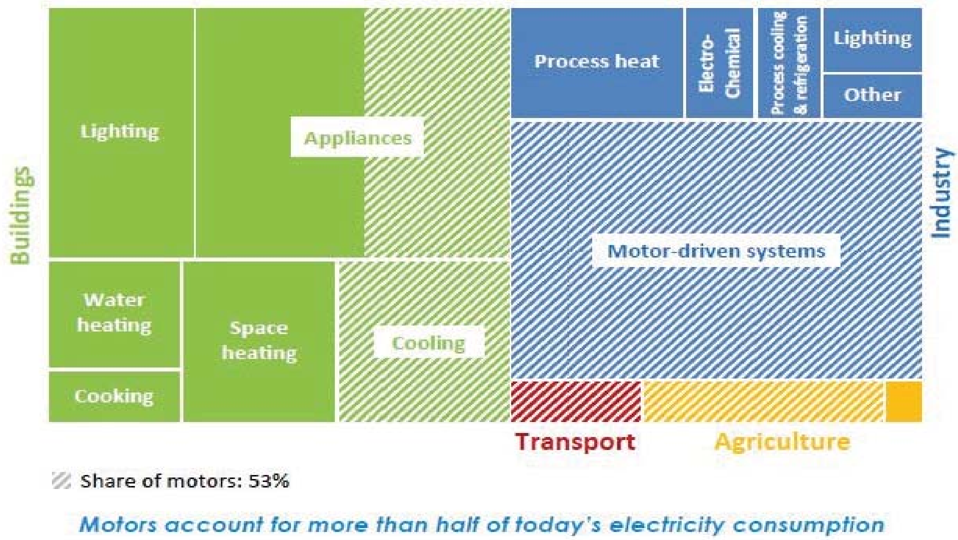
In all applications listed above, the electric motor is one part of the electromechanical system – the only part that, along with its controller, uses electricity. The amount of electricity needed for the motor to function depends on the magnitude of mechanical power needed as well as the extent of losses during power delivery. Although there are losses within the motor, the losses are greater within the mechanical system that distributes power from the motor to the final application (IEA 2011a).

There is wide range of electric motor sizes, from very small (less than 0.1 kilowatt [kW]) to extremely large (greater than 1,000 kW) (IEA, 2016). Mid-sized electric motors that have an average power output of 0.75 to 375 kW account for the largest percentage of motor electricity consumption. Although varying motor designs and technologies exist, energy-intensive asynchronous alternating-current (AC) induction motors are widely used and consume the most energy. Small electric motors are less efficient than larger, power-intensive motors (IEA 2011a).

According to the International Energy Agency (IEA), around half of global electricity consumption is attributable to electric motor systems (Figure 1). Industrial electric motor systems account for about 70% of total global industrial electricity usage.

Industrial motors are normally part of larger systems, and a key way to reduce motors' electricity consumption is to optimize other parts of the system in addition to the motor. Losses within electric motors are only a small share of the total losses experienced in the entire system of which the motor is a part. Figure 2 illustrates a typical industrial motor system made up of connected components. The efficiency of each component is important to the efficiency of the entire system.

FIGURE 1. GLOBAL TOTAL FINAL ELECTRICITY USE BY END USE IN 2014



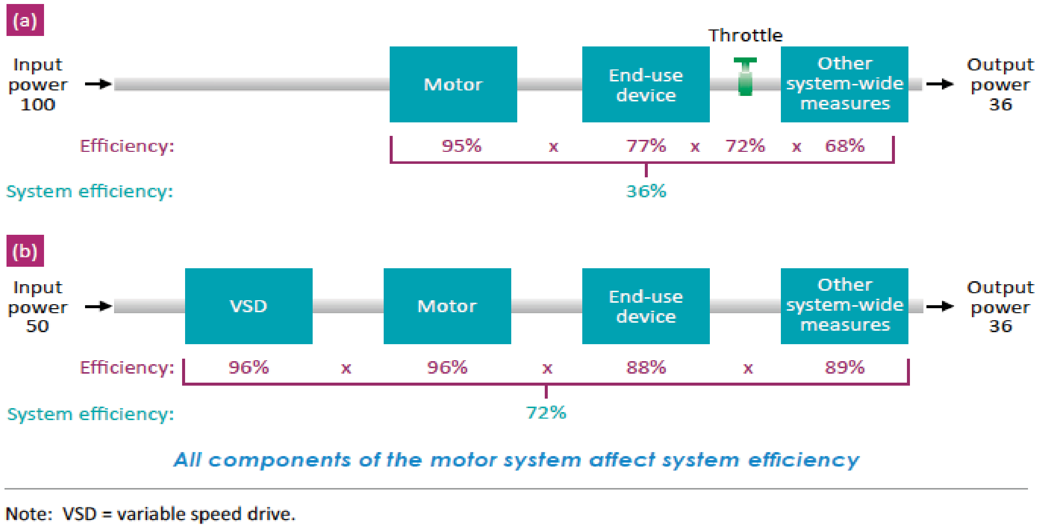
Source: IEA, 2016

In general, motors are usually fairly efficient, especially in developed and developing countries that have robust minimum energy performance standards (MEPS). MEPS are being adopted in more and more countries as well as becoming more stringent in countries where they have been established for a period of time. IEA predicts that, by 2040, premium efficiency standard (IE3) motors or better will account for approximately 60% of the electricity used by motor systems. Because motor efficiency improvements will only marginally increase the motor system's efficiency, we must look to improve the efficiency of the equipment being driven by the motor. Optimization measures such as predictive maintenance, avoiding oversized motors, and matching motor systems to specific needs could improve the energy efficiency of motor-driven systems significantly (IEA, 2016). Even more savings can be achieved by looking not only beyond the motor to the whole motor system but beyond the system to the end-use device, as shown in Figure 2.

In this report, we focus on pump systems, fan systems and compressed air systems which represent three main types of motor systems that together account for around 60% of electricity use in industrial motor systems.

The share of electricity used by pump, fan, and compressed air systems varies among manufacturing subsectors. Table 2 shows the share of total motor systems electricity use in each U.S. manufacturing subsector. It also shows the share of pump, fan, and compressor systems from total motor systems electricity use.

FIGURE 2 ILLUSTRATION OF TWO INDUSTRIAL ELECTRIC MOTOR-DRIVEN SYSTEMS: (A) NORMAL AND (B) EFFICIENT



Source: IEA, 2016

TABLE 1 SHARE OF MOTOR SYSTEMS ELECTRICITY USE IN EACH MANUFACTURING SUBSECTOR

Industrial Sub-sector	Motor Systems Electricity Use as % of Total Electricity Use in each Industrial Subsector *	Pump Systems Electricity Use as % of Motor System Electricity Use in the Subsector **	Fan Systems Electricity Use as % of Motor System Electricity Use in the Subsector **	Compressed Air Systems Electricity Use as % of Motor System Electricity Use in the Subsector **
Food, beverage, and tobacco products	83%	15%	7%	7%
Textile, apparel, and leather products	75%	16%	12%	12%
Pulp and paper and wood products	88%	43%	27%	6%
Petroleum and coal products	91%	47%	16%	25%
Chemicals	69%	35%	16%	37%
Plastics and rubber products	66%	14%	10%	11%

Non-metallic minerals	64%	13%	13%	11%
Primary metals	36%	8%	16%	14%
Fabricated metal products	57%	16%	11%	12%
Machinery	64%	16%	11%	11%
Electronic products and electrical equipment	63%	9%	7%	7%
Transport equipment	62%	13%	10%	11%
Other manufacturing industries	68%	32%	15%	17%

* These shares include process cooling and refrigeration and non-process-facility HVAC.

** These shares exclude systems that are in process cooling and refrigeration and non-process-facility HVAC.

Source: U.S. DOE, 2015

One of the major barriers to effective policy making and increased global action to improve energy efficiency in industrial motor systems is lack of information and data on the magnitude and cost-effectiveness of the energy-savings potential in industrial motor systems in individual countries. This lack of information creates an obstacle to developing a comprehensive strategy and roadmap for improving motor systems efficiency. It is far easier to quantify the incremental energy savings of substituting an energy-efficient motor for a standard motor in a motor system than it is to quantify the energy savings of applying other energy-efficiency practices to an existing motor system.

To address these barriers, Global Efficiency Intelligence, LLC. with the support from UNIDO conducted this study for industrial motor systems in Egypt. This report focuses on analyzing energy use, energy efficiency, and CO_2 emissions-reduction potential in industrial motor systems in Egypt.

2. Methodology

2.1. Scope of the study

We analyze the industrial motor systems energy-efficiency potential in Egypt.

The industrial sector in this report covers manufacturing subsectors. The base year for our analysis is 2015, the latest year for which energy-use data were available at the time of the study.

Country-specific data were collected from various sources. Electricity use for industrial subsectors in Egypt was calculated based on information from several sources as explained in the next subsection. Also collected were the average unit price of electricity for industrial users in Egypt in 2015 and the emissions factor for grid electricity in Egypt in 2015.

For this study, we built on the information collected and the method developed during our study for the United Nations Industrial Development Organization (UNIDO 2010). We refined the methodology from that study and used more recent data, applying it to Egypt.

To conduct these studies, we also developed a framework to obtain expert input to supplement existing data. We consulted 13 motor system experts on the percentage of system energy use by industrial sector, energy efficiency of systems in a market with a defined set of characteristics, creation of a list of common energy-efficiency measures, and the energy savings and implementation costs associated with these measures. A Delphi-type approach was taken in which several cycles of input, analysis, and review were performed to refine the expert input.

2.2. Estimation of Electricity Use by Industrial Motor Systems in Egypt, by Manufacturing Subsector

Because no database reports manufacturing subsector electricity use in Egypt, we estimated these values. The international energy agency (IEA) publishes national data on energy consumption for different countries including Egypt. In these data set, they report electricity use by different economy subsector (residential, commercial, industrial, and transport) and fuel (IEA 2017). This source does not report electricity use by manufacturing subsector for Egypt. For subsector level data, we used PWC (2015) report in which they had reported the share of electricity use in each industrial subsector in Egypt. We applied those shares to total electricity use by industry reported in IEA (2017) in order to estimate the manufacturing subsectors electricity use in Egypt in 2015.

Once we estimated the electricity use for each manufacturing subsector in Egypt, we used the ratios given for motor systems electricity use in U.S. DOE (2015) to estimate the energy use of these systems in the manufacturing subsector for Egypt. Table 2 in the Introduction section of this report shows the ratios used for this analysis.

2.3. Base-Case System Efficiency Scenario Definition

We established three base-case efficiency scenarios (LOW-MEDIUM-HIGH) for industrial motor systems based on previous research and expert input. There was a remarkable degree of agreement among the experts concerning the range of efficiency for each system type that could be expected in these base-case scenarios. After defining the base cases, we assigned base case values to Egypt studied, to establish a reference point for current motor system performance in the country. The base-case values were based on the information available for Egypt as well as on experts input.

The first step in establishing a base case was to create a unique list of system energy-efficiency practices representative of each of the three efficiency scenarios for motor systems. Tables A.1-A.3 in Appendix lists the practices assigned to each base-case efficiency level for industrial pump systems, fan systems, and compressed air systems, respectively.

We asked motor systems experts to estimate the range of system energy efficiency they would expect to see when auditing a system in an industrial facility with the characteristics given for each efficiency base-case scenario (LOW-MEDIUM-HIGH).

Table A.4-A.6 in Appendix shows the consolidated results, including the base-case values used in calculating the efficiency cost curves. There was a high degree of agreement among experts regarding the range of system energy efficiency that would be expected based on the list of characteristics assigned to the base cases. We used the average of low and high values for the LOW-MED-HIGH efficiency base cases in our analysis.

After defining the base-case efficiencies for each motor system, we assigned a base case to Egypt as a reference point for current industrial motor system performance in Egypt based on available information.

Table. shows the base-case efficiencies assigned for each industrial motor systems in Egypt

TABLE 2. BASE-CASE MOTOR SYSTEMS EFFICIENCIES ASSIGNED TO EGYPT

Motor System	Base Case Efficiency Level
Pump systems	LOW
Fan systems	LOW
Compressed air systems	LOW

2.4. Energy-Efficiency Measures and Their Savings and Costs

We developed a list of motor system energy-efficiency measures and asked motor system experts their opinion on energy savings likely to result from each measure implemented independent of the others, expressed as a percentage improvement over each of our base cases (LOW-MED-HIGH).

The experts were also asked to provide cost information for each measure, disaggregated by motor size range. The size ranges were selected based on categories developed for the most detailed motor system study available (U.S. DOE, 2002). In this study, “motor system size” refers to a motor system’s aggregate hp or kW. The costs provided are for when efficiency measures are implemented in systems with LOW base case efficiency level. However, for systems that have Medium or High efficiency base case, the cost of efficiency measures where reduced using an adjustment factor.

In addition to the energy-efficiency improvement cost, we asked experts to provide the useful lifetime of the measures, disaggregated into two categories of operating hours (1,000 - 4,500 hours per year and more than 4,500 hours per year). In some instances, the initial list of measures included several measures that would be unlikely to be implemented together (i.e., it is more likely that one would be selected). In those cases, we chose the most common measure based on experts’ judgment.

Tables 4-5 show example of typical percentage improvements in efficiency over each base case as well as an estimated typical capital cost of one motor system energy-efficiency measure, differentiated by system size. The actual installed cost of some system measures can be highly variable and dependent on-site conditions, including the number and types of end uses. The need to add or modify physical space to accommodate new equipment can also be a factor in installed cost.

TABLE 3 EXAMPLE ENERGY-EFFICIENCY MEASURE AND TYPICAL % EFFICIENCY IMPROVEMENT IMPACT ON PUMP SYSTEMS IN EGYPT

Energy-Efficiency Measure	Typical % improvement in energy efficiency practice		
	% Improvement over LOW eff. base case	% Improvement over MED eff. base case	% Improvement over HIGH eff. base case
Replace pump with more energy efficient type	20%	15%	5%

TABLE 4 EXAMPLE OF CAPITAL COST OF A TYPICAL PUMP SYSTEM ENERGY-EFFICIENCY MEASURE IN EGYPT

Energy-Efficiency Measure	Typical Capital Cost (*US$)*				
	≤50 hp	>50 hp ≤100 hp	>100 hp ≤200 hp	>200 hp ≤500 hp	>500 hp≤1000 hp
	≤37 kW	>37kW ≤75kW	>75kW ≤150kW	>150kW ≤375kW	>375kW ≤745kW
Replace pump with more energy efficient type	$7,200	$14,400	$18,000	$21,600	$50,400

Systems larger than 1,000 hp (745kW) are usually custom designed, and their cost is highly variable. The cost data from experts for this size system varied so much that it injected significant uncertainty into the final results, so we excluded systems larger than 1,000 hp (745kW) from the final analysis. Because systems larger than 1,000 hp account for about 4%, 17%, and 32% of total industrial pump, fan, and compressor systems electricity use in Egypt, respectively, excluding these systems from the analysis resulted in a proportional decrease in total system energy use and a corresponding decrease in the energy savings resulting from the energy-efficiency measures analyzed. This limitation should be considered when reviewing the results presented in this report.

This report uses the estimated full cost of the energy-efficiency measures analyzed rather than the incremental cost. This choice was based on the goal of our analysis, which was to assess the total potential for energy efficiency in industrial motor systems in the base year (2015) assuming a 100% adoption rate. Therefore, we assumed that all the measures are installed in the base year, so the full cost of the measures should be used because the existing systems are not all at the end of their lifetimes.

2.5. Development of Energy-Efficiency Cost Curves

The energy-efficiency cost curve (also known as the energy conservation supply curve) is an analytical tool that captures both the engineering and economic perspectives of energy efficiency. The curve shows energy-efficiency potential as a function of the marginal cost of conserved energy (CCE). CCE can be calculated from Equation A.1.

$$\textbf{Cost of Conserved Energy (CCE)} = \frac{\textbf{(Annualized capital cost + Annual change in O\&M costs)}}{\textbf{Annual energy savings}} \quad \textbf{(Eq. A.1)}$$

The annualized capital cost can be calculated from Equation A.2.

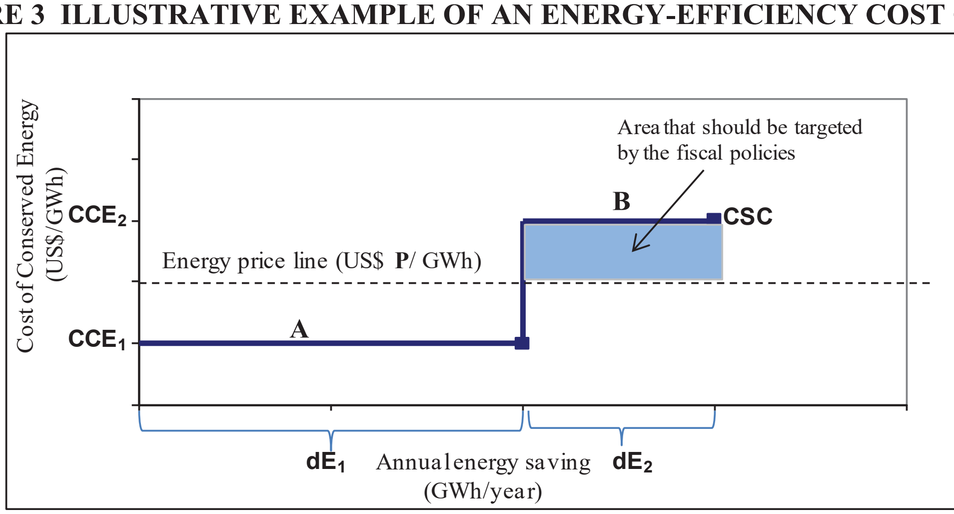
$$\textbf{Annualized capital cost} = \textbf{Capital Cost}*(d/\,(1-(1+d)^{-n}) \qquad \textbf{(Eq. A.2)}$$

d: discount rate, n: lifetime of the energy efficiency measure

In this study, because only one type of cost (capital cost) was available for each measure, the capital cost was used to calculate the CCE without regard for any change in operations and maintenance cost (given in Eq. A.1). Some of the measures themselves are improvements in maintenance practices.

After calculating the CCE for all energy-efficiency measures, the measures are ranked in ascending order of CCE. Also, on an efficiency cost curve, an energy price line is determined. All measures that fall below the energy price line are identified as “cost-effective.” That is, saving a unit of energy by means of the cost-effective measures is cheaper than buying a unit of energy. On the curves, the width of each measure (plotted on the x-axis) represents the annual energy saved by that measure. The height (plotted on the y-axis) shows the measure’s CCE. Figure 3 shows an illustrative example of an energy-efficiency cost curve for measures A and B.

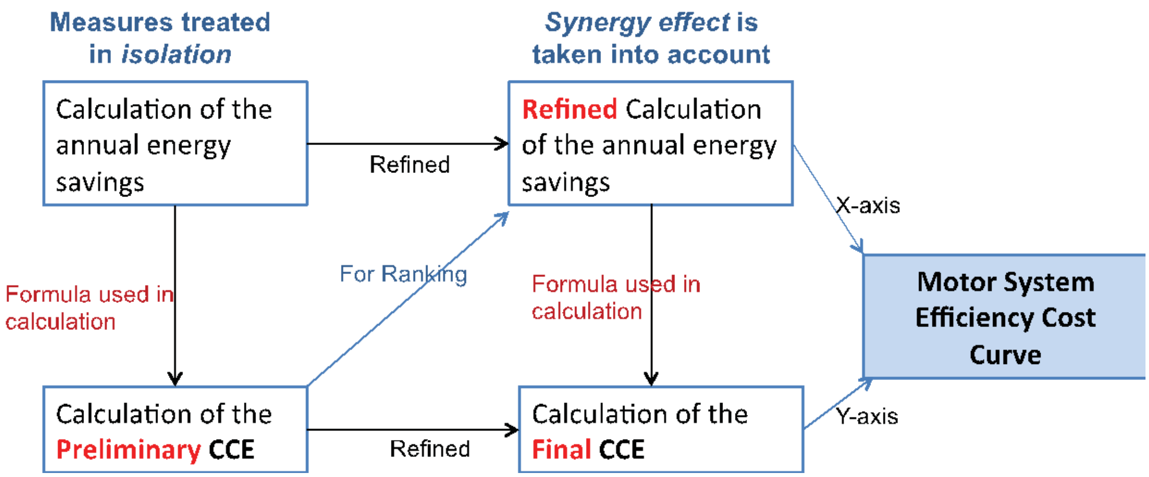
FIGURE 3 ILLUSTRATIVE EXAMPLE OF AN ENERGY-EFFICIENCY COST CURVE



In our analysis, a real discount rate of 15% was assumed. This choice seems to be reasonable since the commercial banks interest rates in Egypt are quite high and it was over 18% in 2017. The choice of the discount rate also depends on the purpose of the analyses and the approach (prescriptive versus descriptive) used. A prescriptive approach (also called social perspective) uses lower discount rates (4% to 10%), especially for long-term issues like climate change or public-sector projects (Worrell et al. 2004). Low discount rates have the advantage of treating future generations equal to our own, but they also may cause relatively certain, near-term effects to be ignored in favor of more uncertain, long-term effects.

Figure 4 is a schematic of the process of calculating motor system energy-efficiency cost curves. The details of each step are explained in the following sections.

FIGURE 4 CALCULATION PROCESS FOR CONSTRUCTING MOTOR SYSTEM ENERGY-EFFICIENCY COST CURVES



For calculating energy savings from each motor system efficiency measure, the following inputs were available:

- The efficiency base-case scenarios for motor systems (low, medium, high), developed as described above. As explained earlier, Egypt was assigned a base-case motor system efficiency.
- For each motor system efficiency measure, experts provided a typical percentage improvement in energy efficiency over each base-case efficiency.
- Electricity use in the manufacturing subsectors for Egypt.
- From the above information, the annual electricity savings can be calculated for each individual industrial motor system efficiency measure when measures are treated individually and can be implemented regardless of the implementation of other measures.

However, implementation of one measure can influence the efficiency gain from the next efficiency measure implemented. When the first measure is implemented, the base-case efficiency is improved. Therefore, the efficiency improvement of the second measure will be less than if the second measure was implemented first or considered alone. Because of this, in our analysis, the measures were treated in relation to each other (as a group). In other words, the efficiency improvement from implementation of one measure depends on the efficiency improvement achieved by the previous measures implemented. We call this the *synergy effect*.

In this method, the *cumulative* electricity savings are calculated by taking into account the synergy effect of the measures rather than by treating the measures in isolation from one another. For instance, the cumulative annual electricity savings from measure #3 include the efficiency gains from the previous measures implemented (measures #1 and #2).

Calculation of the cumulative savings rather than individual savings is also desirable because the cumulative electricity savings will be used to construct the motor system efficiency supply curves. At the same time, the ranking of the measures significantly influences the energy savings attributed to each measure. That is, given a fixed percentage improvement of efficiency from each individual measure, the higher the rank of the measure, the larger the contribution of that measure to the cumulative savings. To define the ranking of the efficiency measures before calculating the cumulative energy savings using the method described above, we calculated a preliminary CCE for each measure, treating each in isolation from the others, i.e., without taking any synergy effect into account. The measures were ranked based on their preliminary CCEs, and this ranking was used to calculate the final cumulative annual energy savings as well as the final CCE (Figure 4). Table 6 shows some of the assumptions used in the analyses.

TABLE 2. AVERAGE UNIT PRICE OF ELECTRICITY FOR INDUSTRY AND EMISSIONS FACTOR FOR GRID ELECTRICITY IN EGYPT IN 2015

	Egypt
Average unit price of electricity for industry in 2015 (US$/kWh)	0.06
Emission factor for grid electricity in 2015 ($kgCO_2$/MWh)	583

Sources: MERE 2017; IGES 2016

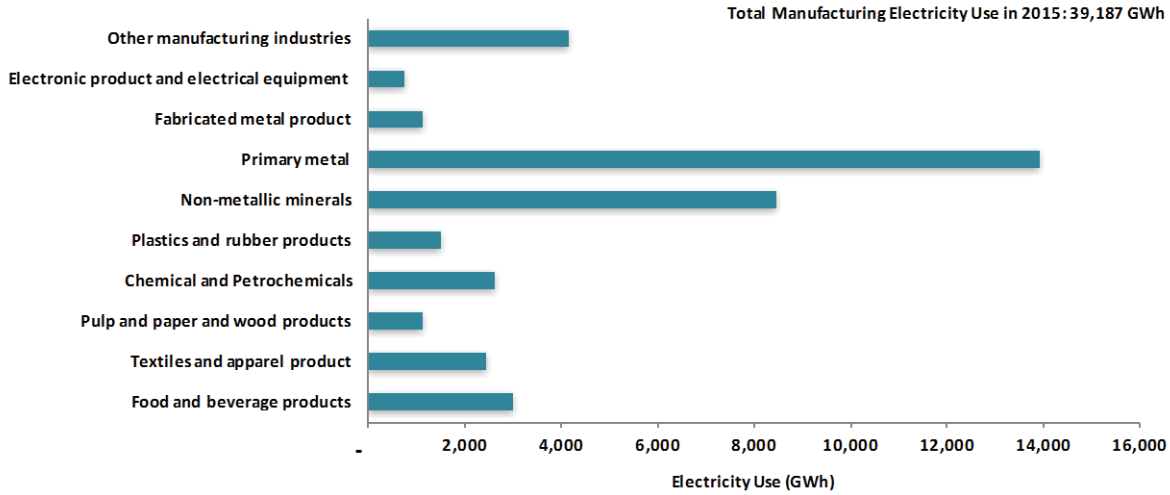
It should also be noted that the purpose of our analysis is to determine the cost-effectiveness of efficiency measures and estimate the total electricity savings potential for industrial motor systems. This study does not analyze scenarios based on the assumption of different penetration rates of the measures in the future; instead, we aimed to identify the magnitude of the total savings potential in 2015 and associated costs.

3. Energy Use in Manufacturing and Industrial Motor Systems in Egypt

3.1. Industrial Electricity Use in Egypt by Manufacturing Subsector

Using the methodology explained in Section 2, we estimated industrial electricity use in 2015, by manufacturing subsector, for Egypt (Figure 5). In Egypt, the primary metal industry had the highest electricity consumption in 2015 followed by the non-metallic minerals industry (dominated by the cement industry).

FIGURE 5 INDUSTRIAL ELECTRICITY USE BY MANUFACTURING SUBSECTOR IN EGYPT IN 2015



Source: Study on EE and GHG emission reduction potential from EE motor systems in Egypt undertaken by Global Efficiency Intelligence, LLC Analyses as part of the PPG phase (Full report in Annex I to this document)

3.2. Industrial Motor Systems Electricity Use in Egypt by Manufacturing Subsectors

Table 7 shows the estimated industrial motor systems electricity use by manufacturing subsectors for Egypt studied in 2015. We estimated these values for Egypt using the share of motor systems electricity use from total electricity use in each manufacturing subsector given in U.S. DOE (2015).

TABLE 6. INDUSTRIAL MOTOR SYSTEMS ELECTRICITY USE BY MANUFACTURING SUBSECTORS FOR EGYPT IN 2015

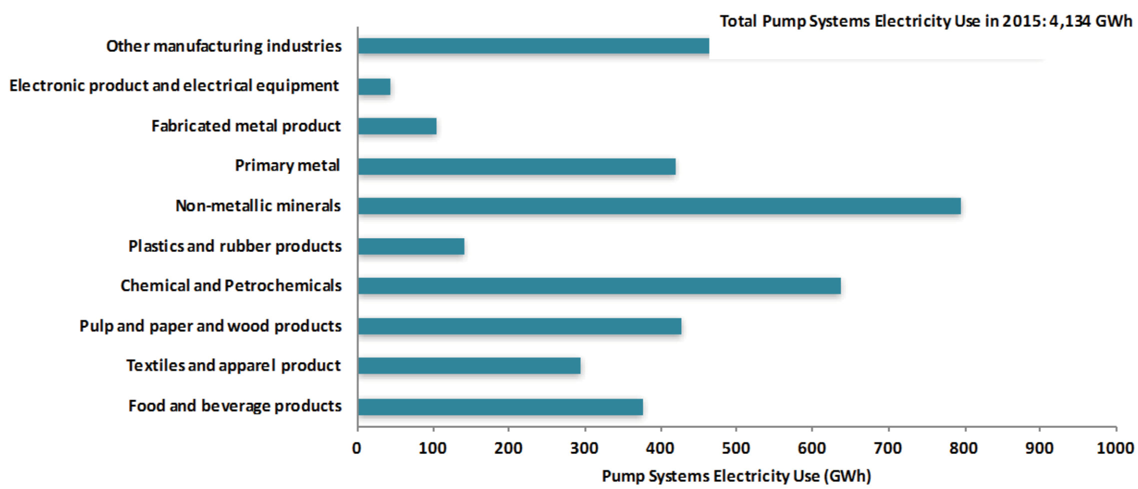
Manufacturing subsectors	Industrial motor systems electricity use (GWh)
Food, beverage and tobacco product	2,502
Textiles, apparel and leather product	1,837
Pulp and paper and wood products	995
Chemical	1,820

Plastics and rubber products	995
Non-metallic minerals	6,358
Primary metal	5,019
Fabricated metal product	644
Electronic product and electrical equipment	475
Other manufacturing industries	2,818
Total	**23,463**

Source Study on EE and GHG emission reduction potential from EE motor systems in Egypt undertaken by Global Efficiency Intelligence, LLC Analyses as part of the PPG phase (Full report in Annex I to this document)

Figure 6 shows that in Egypt, the non-metallic minerals industry had the highest pump systems electricity use in 2015 followed by pump systems in the chemical and petrochemical industry.

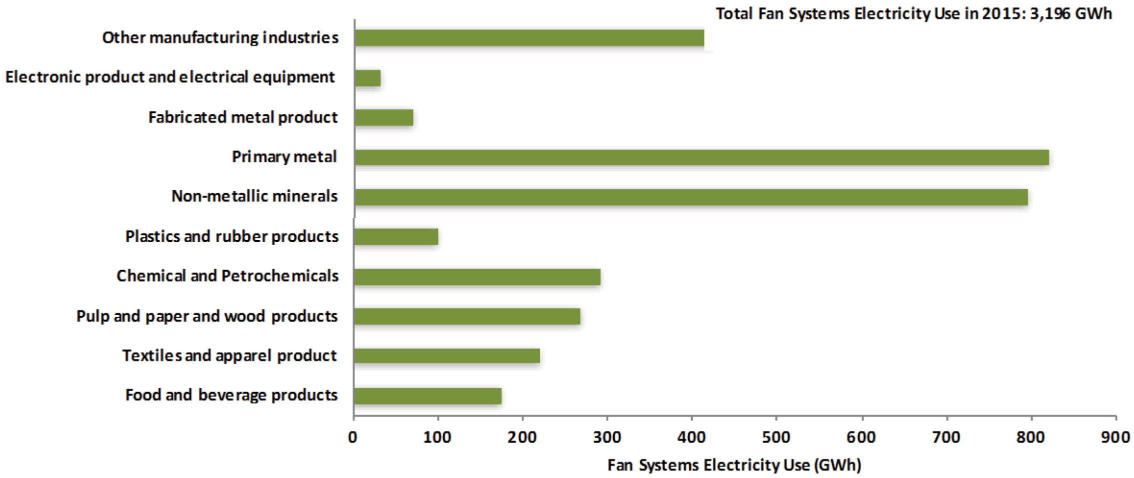
FIGURE 6 ESTIMATED INDUSTRIAL PUMP SYSTEMS ELECTRICITY USE BY MANUFACTURING SUBSECTORS IN EGYPT IN 2015



Source: Study on EE and GHG emission reduction potential from EE motor systems in Egypt undertaken by Global Efficiency Intelligence, LLC Analyses as part of the PPG phase (Full report in Annex I to this document)

Figure 7 shows that in Egypt, the primary metal industry had the highest fan systems electricity use in 2015 followed by fan systems in the non-metallic minerals industry.

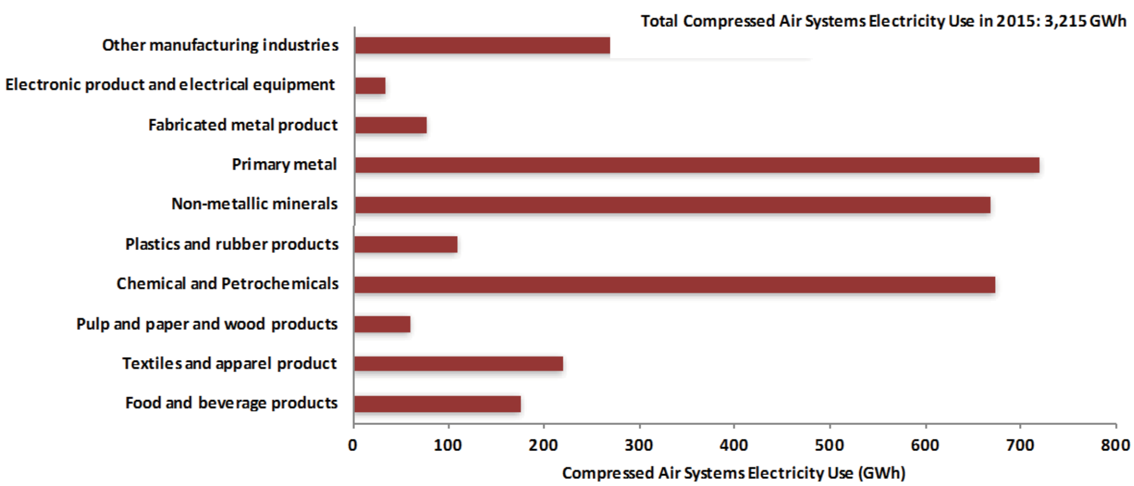
FIGURE 7 ESTIMATED INDUSTRIAL FAN SYSTEMS ELECTRICITY USE BY MANUFACTURING SUBSECTORS IN EGYPT IN 2015



Source: Study on EE and GHG emission reduction potential from EE motor systems in Egypt undertaken by Global Efficiency Intelligence, LLC Analyses as part of the PPG phase (Full report in Annex I to this document)

Figure 8 shows that in Egypt, the primary industry had the highest compressed air systems electricity use in 2015 followed by compressed air systems in the chemical and petrochemical industry and non-metallic minerals sector.

FIGURE 8 ESTIMATED INDUSTRIAL COMPRESSED AIR SYSTEMS ELECTRICITY USE BY MANUFACTURING SUBSECTORS IN EGYPT IN 2015

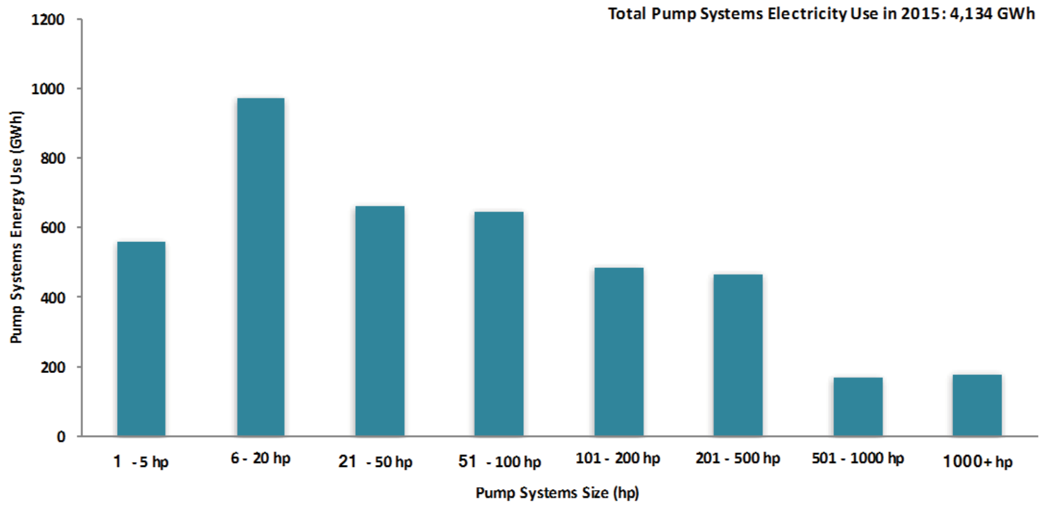


Source: Study on EE and GHG emission reduction potential from EE motor systems in Egypt undertaken by Global Efficiency Intelligence, LLC Analyses as part of the PPG phase (Full report in Annex I to this document)

3.3. Electricity Use in Industrial Motor Systems in Egypt by System Size

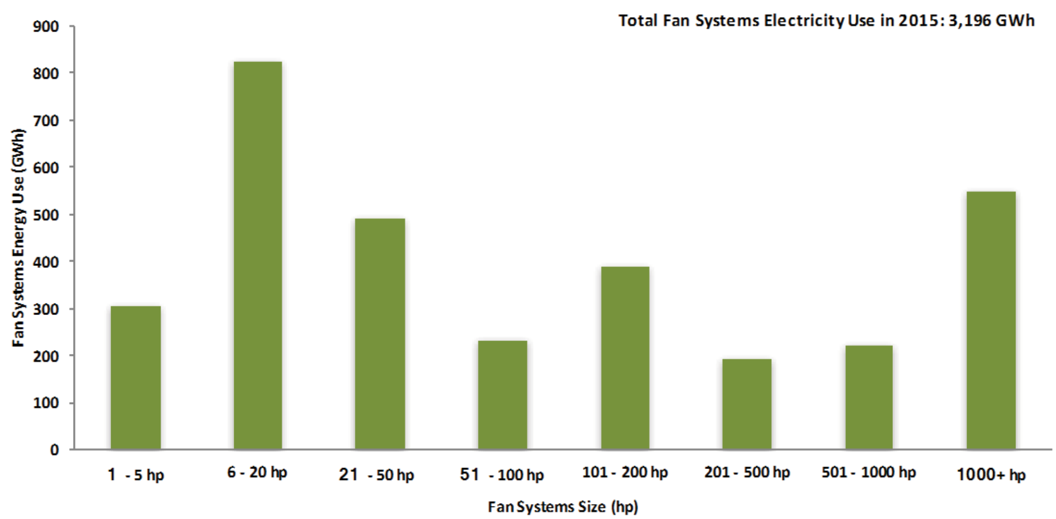
Figure 9-11 show the estimated industrial motor systems electricity use by system type and size in Egypt in 2015. It should be noted that the values for motor systems exclude energy use in motor systems that are in process cooling and refrigeration and non-process facility Heating, ventilation and air conditioning (HVAC). In Egypt, pump systems with size range of 6hp - 20hp has the highest share of total industrial pump systems electricity use. Similarly, fan systems with size range of 6hp - 20hp has the highest share of total industrial Fan systems electricity use. Compressed air systems with size range of over 1000hp has the highest share of total compressed air systems electricity use.

FIGURE 9 ESTIMATED INDUSTRIAL PUMP SYSTEMS ELECTRICITY USE BY SYSTEM SIZE IN EGYPT IN 2015



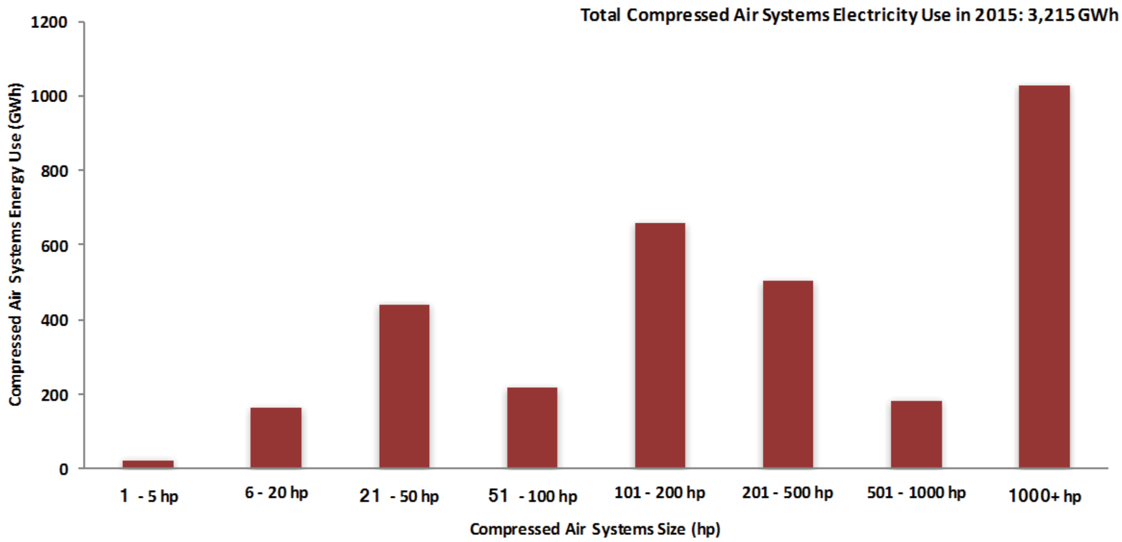
Source: Study on EE and GHG emission reduction potential from EE motor systems in Egypt undertaken by Global Efficiency Intelligence, LLC Analyses as part of the PPG phase (Full report in Annex I to this document)

FIGURE 10. ESTIMATED INDUSTRIAL FAN SYSTEMS ELECTRICITY USE BY SYSTEM SIZE IN EGYPT IN 2015



Source: Study on EE and GHG emission reduction potential from EE motor systems in Egypt undertaken by Global Efficiency Intelligence, LLC Analyses as part of the PPG phase (Full report in Annex I to this document)

FIGURE 1. ESTIMATED INDUSTRIAL COMPRESSED AIR SYSTEMS ELECTRICITY USE BY SYSTEM SIZE IN EGYPT IN 2015



Source Study on EE and GHG emission reduction potential from EE motor systems in Egypt undertaken by Global Efficiency Intelligence, LLC Analyses as part of the PPG phase (Full report in Annex I to this document)

As explained in methodology section, systems larger than 1000 hp (745kW) are usually custom-designed and the cost are highly variable for these systems. Therefore, we have excluded these systems from the energy saving and cost analyses in this report. Including systems larger than 1000 hp would significantly increase the energy saving potentials calculated in this report.

4. Energy-Efficiency Potential in Industrial Motor Systems in Egypt

Based on the methodology explained in section 2, we constructed energy-efficiency cost curves for the industrial motor systems in Egypt studied. Our purpose was to capture separately the cost-effective potential and total technical potential for electricity efficiency improvement in these systems by implementing eight energy efficiency measures. We also calculated the CO_2 emissions reduction potential associated with the electricity savings. These potentials are the total existing potentials for energy-efficiency improvement in industrial motor systems for the year 2015. In other words, the potential represented here assumes a 100% adoption rate. We are aware that a 100% adoption rate is not likely and that values approaching a high adoption rate would only be possible over a period of time. However, assuming different penetration rates for the energy-efficiency measures in the future was beyond the scope of our study. Note that the energy-savings analysis in this report excludes motor systems used for process cooling and refrigeration and non-process facility HVAC.

4.1. Energy-Efficiency Cost Curve for Industrial Pump Systems in Egypt

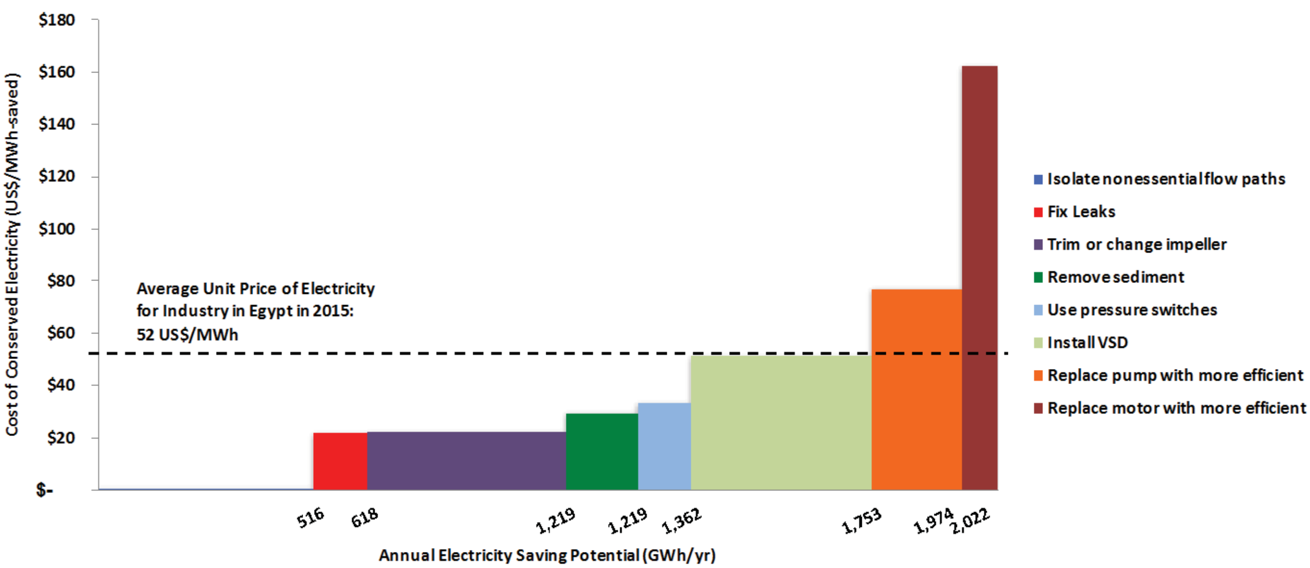
Figure 12 shows the energy-efficiency cost curve for industrial pump systems in Egypt. The y-axis on the graph shows the CCE, and the x-axis shows the cumulative annual electricity savings potential of efficiency measures. Table 8 lists the measures on the cost curve along with the cumulative annual electricity-savings potential and final CCE of each measure as well as the cumulative CO_2 emissions-reduction potential. The energy-efficiency measures in the gray area of the table are cost effective (i.e., their CCE is less than the unit price of industrial-sector electricity in Egypt in 2015), and the efficiency measures that are in the white area are not cost-effective.

Out of eight energy-efficiency measures, six are cost-effective. The most cost-effective measure for pump systems in Egypt is "isolating flow paths to non-essential or non-operating equipment", which has a CCE equal to zero. The second and third most-cost-effective measure are "Fix Leaks, damaged seals, and packing" and "Trim or change impeller to match output to requirements". Installing variable-speed drives (VSDs) on pumps has one of the largest energy saving potential and is also cost-effective.

The least-cost-effective measure (i.e., the one with the highest CCE) for Egypt's industrial pump systems is one that is commonly chosen: "replacing motors with more efficient types". Another interesting and possibly counter-intuitive finding is that the energy-savings potential from replacing motors is smaller than the energy-savings potential of all other efficiency measures studied and replacing motor also appeared to be not cost-effective.

Note that this analysis is intended to support policy makers, but is not a substitute for individualized assessments of motor system efficiency opportunities at a specific facility.

FIGURE 11 ENERGY EFFICIENCY COST CURVE FOR INDUSTRIAL PUMP SYSTEMS IN EGYPT



Source: Study on EE and GHG emission reduction potential from EE motor systems in Egypt undertaken by Global Efficiency Intelligence, LLC Analyses as part of the PPG phase (Full report in Annex I to this document)

TABLE 7 CUMULATIVE ANNUAL ELECTRICITY SAVING AND CO_2 EMISSION REDUCTION POTENTIAL FOR EFFICIENCY MEASURES IN INDUSTRIAL PUMP SYSTEMS IN EGYPT RANKED BY FINAL CCE

No.	Energy Efficiency Measures	Cumulative Annual Electricity Saving Potential (GWh/yr)	Final Cost of Conserved Energy (US$/MWh-Saved)	Cumulative Annual CO_2 Emission Reduction Potential (kton CO_2 /yr)
1	Isolate flow paths to nonessential or non-operating equipment	516	0	301
2	Fix Leaks, damaged seals, and packing	618	22	360
3	Trim or change impeller to match output to requirements	1,058	22	617
4	Remove sediment/scale buildup from piping	1,219	29	711
5	Use pressure switches to shut down unnecessary pumps	1,362	33	794
6	Install variable speed drive	1,753	51	1,022
7	Replace pump with more energy efficient type	1,974	77	1,151
8	Replace motor with more efficient type	2,022	162	1,179

Notes: 1) Energy savings are based on 100% adoption of the efficiency measures. 2) The energy and CO_2 savings presented for each measure are the cumulating savings from that measure and all previous measures with lower CCE.

3) This analysis provides an indication of the cost-effectiveness of system energy efficiency measures at the country level. The cost-effectiveness of individual measures will vary based on plant-specific conditions.

Source: Study on EE and GHG emission reduction potential from EE motor systems in Egypt undertaken by Global Efficiency Intelligence, LLC Analyses as part of the PPG phase (Full report in Annex I to this document)

Table 9 shows that the total technical energy-savings potential is 49% of total industrial pumping system electricity use in Egypt in 2015. This is a significant saving potential primarily because we assumed that compressed air systems in Egypt have LOW efficiency base case. This is in line with our previous studies for other developing countries (e.g. Thailand, Brazil, Vietnam). Egypt's industrial pump systems have a cost-effective potential of 42% of total industrial pumping system electricity use in Egypt in 2015.

TABLE 8 TOTAL ANNUAL COST-EFFECTIVE AND TECHNICAL ENERGY SAVING AND CO_2 EMISSIONS REDUCTION POTENTIAL IN INDUSTRIAL PUMP SYSTEMS IN EGYPT

	Cost-effective Potential	Technical Potential
Annual electricity saving potential for pump systems in Egypt's industry (GWh/yr)	1,753	2,022
Share of saving from the total pump system energy used in Egypt's industry in 2015	42%	49%
Share of saving from the total electricity used in Egypt's industry in 2015	4.5%	5.2%
Annual CO_2 emission reduction potential from Egypt's industry (kton CO_2/yr)	1,022	1,179
Number of households electricity consumption in Egypt that can be supplied by energy saved	624,203	720,188

Notes: 1) Savings are based on 100% adoption of the energy efficiency measures. 2) Systems larger than 1000 hp are excluded from the energy saving and cost analyses. 3) The energy saving potential exclude pump systems that are in process cooling and refrigeration and non-process facility Heating, ventilation and air conditioning (HVAC).

Source: Study on EE and GHG emission reduction potential from EE motor systems in Egypt undertaken by Global Efficiency Intelligence, LLC Analyses as part of the PPG phase (Full report in Annex I to this document

Table 10 shows the cumulative annual electricity-savings potential for industrial pump systems energy-efficiency measures in Egypt, by system size. The largest share of potential energy savings is in systems smaller than 50 horsepower (hp), with the next-largest share in systems that are between 51hp and 100hp.

As explained in the methodology section in Section 2, the implementation of one measure can influence the efficiency gain from the next efficiency measure implemented. That is, when one measure is implemented, the base-case efficiency is improved. Therefore, the efficiency improvement from the second measure will be less than if the second measure had been implemented first or was considered alone. Because of this, our analysis treated the measures in relation to each other (as a group). In other words, the efficiency improvement from implementation of one measure depends on the efficiency improvement achieved by the previous measure(s) implemented. We call this the *synergy effect*.

In this method, the *cumulative* electricity savings are calculated by taking into account the synergy effect of the measures rather than treating the measures in isolation from one another. For instance, the cumulative annual electricity savings from the implementation of measure #3 includes the efficiency gains from all the previous measures implemented (measures #1 and #2).

TABLE 9. CUMULATIVE ANNUAL ELECTRICITY SAVING POTENTIAL FOR EFFICIENCY MEASURES IN INDUSTRIAL PUMP SYSTEMS IN EGYPT BY SYSTEM SIZE (GWH/YR)

No.	Energy Efficiency Measures	≤50 hp (≤37 kW)	51-100 hp (38-75kW)	101- 200 hp (46-149kW)	201- 500 hp (150-373kW)	501-1000 hp (374 - 746kW)	Total
1	Isolate flow paths to nonessential or non-operating equipment	286	84	63	61	22	516
2	Fix Leaks, damaged seals, and packing	343	101	76	73	26	618
3	Trim or change impeller to match output to requirements	587	173	130	124	45	1,058
4	Remove sediment/scale buildup from piping	676	199	149	143	52	1,219
5	Use pressure switches to shut down unnecessary pumps	755	222	167	160	58	1,362
6	Install variable speed drive	972	286	215	206	74	1,753
7	Replace pump with more energy efficient type	1,094	322	242	232	84	1,974
8	Replace motor with more efficient type	1,121	330	248	238	86	2,022

Notes: 1) Energy savings are based on 100% adoption of the efficiency measures. 2) Energy savings presented for each measure is the cumulating savings from that measure and all previous measures with lower CCE.

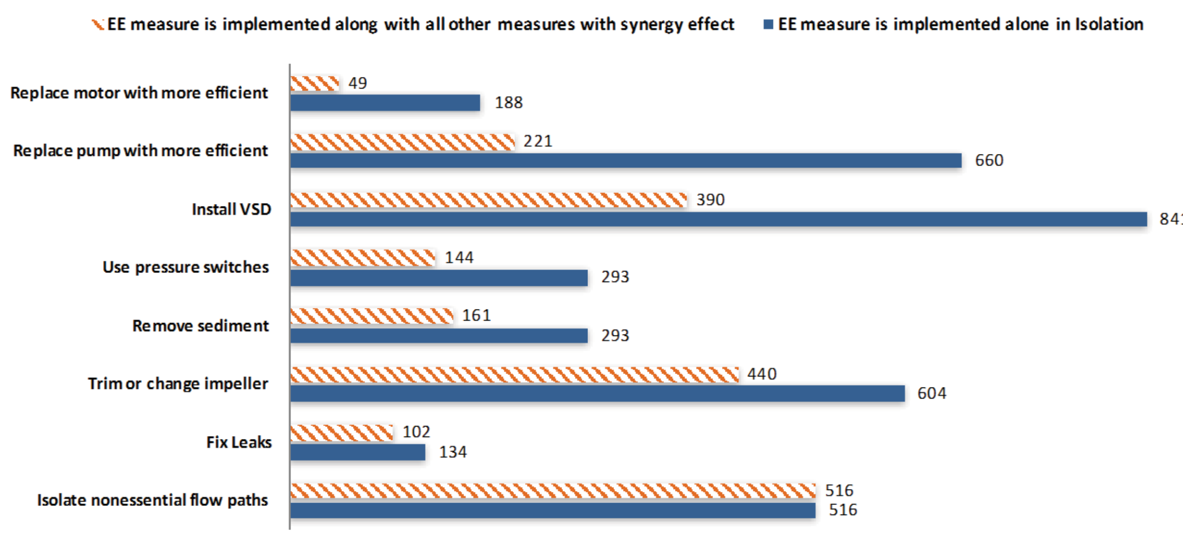
3) Systems larger than 1000 hp are excluded from the energy saving and cost analyses.

Source: Study on EE and GHG emission reduction potential from EE motor systems in Egypt undertaken by Global Efficiency Intelligence, LLC Analyses as part of the PPG phase (Full report in Annex I to this document)

However, if policy makers want to assess the impact of a single efficiency measure without considering the implementation of other measures, savings should be calculated for that particular measure implemented in isolation. Figure 13 compares the energy-savings potential for each efficiency measure implemented in isolation to the energy-savings potential for each measure implemented along with other measures; the latter is the savings value that we use on the energy-efficiency cost curve.

The measures that are less cost-effective on the efficiency cost curve and that appear at the top of the graph in Figure 13 show the largest differences between the energy savings calculated for the measure in isolation versus the energy savings calculated for the measure in combination with other measures. Note that summing up the energy savings of individual measures implemented in isolation will give an inaccurate result because of the synergy effect explained above.

FIGURE 2 COMPARISON OF ENERGY SAVING POTENTIAL (GWH/YR) FOR EACH EFFICIENCY MEASURE IN EGYPT WHEN EACH MEASURE IS IMPLEMENTED IN ISOLATION OR IS IMPLEMENTED ALONG WITH OTHER MEASURES



Source: Study on EE and GHG emission reduction potential from EE motor systems in Egypt undertaken by Global Efficiency Intelligence, LLC Analyses as part of the PPG phase (Full report in Annex I to this document)

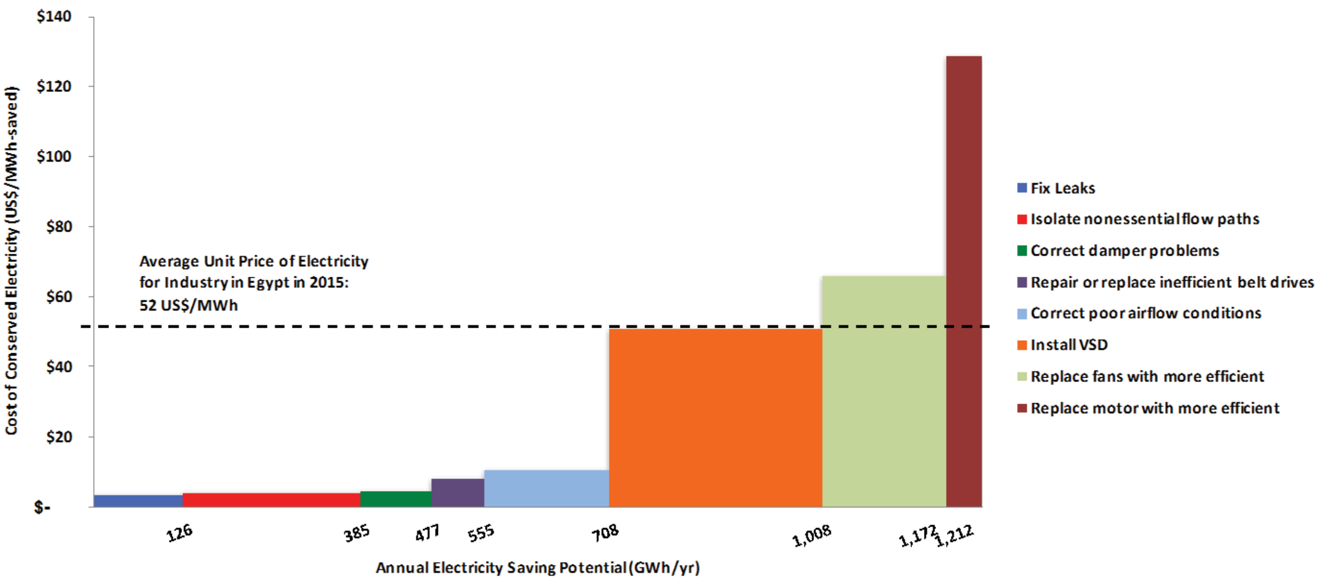
4.2. Energy-Efficiency Cost Curve for Industrial Fan Systems in Egypt

Figure 14 shows the energy-efficiency cost curve for industrial fan systems in Egypt. The y-axis on the graph shows the CCE, and the x-axis shows the cumulative annual electricity savings potential of efficiency measures. Table 11 lists the measures on the cost curve along with the cumulative annual electricity-savings potential and final CCE of each measure as well as the cumulative CO_2 emissions-reduction potential. The energy-efficiency measures in the gray area of the table are cost effective (i.e., their CCE is less than the unit price of industrial-sector electricity in Egypt in 2015), and the efficiency measures that are in the white area are not cost-effective.

Out of eight energy-efficiency measures, six are cost-effective. The most cost-effective measure for fan systems in Egypt is "fix Leaks and damaged seals" which has the lowest CCE. Installing variable-speed drives (VSDs) on fans has the largest energy saving potential and is also cost-effective.

The least-cost-effective measure (i.e., the one with the highest CCE) for Egypt fan systems is one that is commonly chosen: replacing motors with more efficient models. By contrast, installing a VSD on fan systems, which results in the highest saving potential, is cost-effective in Egypt. Another interesting and possibly counter-intuitive finding is that the energy-savings potential from replacing motors is smaller than the energy-savings potential of all other efficiency measures studied and this measure is not cost-effective.

FIGURE 13 ENERGY EFFICIENCY COST CURVE FOR INDUSTRIAL FAN SYSTEMS IN EGYPT



Source: Study on EE and GHG emission reduction potential from EE motor systems in Egypt undertaken by Global Efficiency Intelligence, LLC Analyses as part of the PPG phase (Full report in Annex I to this document)

TABLE 10 CUMULATIVE ANNUAL ELECTRICITY SAVING AND CO_2 EMISSION REDUCTION POTENTIAL FOR EFFICIENCY MEASURES IN INDUSTRIAL FAN SYSTEMS IN EGYPT RANKED BY FINAL CCE

No.	Energy Efficiency Measures	Cumulative Annual Electricity Saving Potential (GWh/yr)	Final Cost of Conserved Energy (US$/MWh-Saved)	Cumulative Annual CO_2 Emission Reduction Potential (kton CO_2 /yr)
1	Fix Leaks and damaged seals	126	3.3	73
2	Isolate flow paths to nonessential or non-operating equipment	385	3.9	224
3	Correct damper problems	477	4.5	278
4	Repair or replace inefficient belt drives	555	8.0	323
5	Correct poor airflow conditions at fan inlets and outlets	708	10.6	413
6	Install variable speed drive	1,008	50.7	588
7	Replace oversized fans with more efficient type	1,172	65.9	683
8	Replace motor with more energy efficient type	1,212	128.6	707

Notes: 1) Energy savings are based on 100% adoption of the efficiency measures. 2) The energy and CO_2 savings presented for each measure are the cumulating savings from that measure and all previous measures with lower CCE.

3) This analysis provides an indication of the cost-effectiveness of system energy efficiency measures at the country level. The cost-effectiveness of individual measures will vary based on plant-specific conditions.

Source: Study on EE and GHG emission reduction potential from EE motor systems in Egypt undertaken by Global Efficiency Intelligence, LLC Analyses as part of the PPG phase (Full report in Annex I to this document

Table 12 shows that the total technical energy-savings potential is 38% of total industrial fan system electricity use in Egypt in 2015. This is in line with our previous studies for other developing countries (e.g. Thailand, Brazil, Vietnam). We assumed that fan systems in Egypt have LOW efficiency base case. Egypt's industrial fan systems have a cost-effective potential of 32% of total fan system electricity use in Egypt in 2015.

TABLE 11 TOTAL ANNUAL COST-EFFECTIVE AND TECHNICAL ENERGY SAVING AND CO_2 EMISSIONS REDUCTION POTENTIAL IN INDUSTRIAL FAN SYSTEMS IN EGYPT

	Cost-effective Potential	Technical Potential
Annual electricity saving potential for fan systems in Egypt's industry (GWh/yr)	1,008	1,212
Share of saving from the total fan system energy used in Egypt's industry in 2015	32%	38%
Share of saving from the total electricity used in Egypt's industry in 2015	2.6%	3.1%
Annual CO_2 emission reduction potential from Egypt's industry (kton CO_2/yr)	588	707
Number of households electricity consumption in Egypt that can be supplied by energy saved	358,967	431,731

Notes: 1) Savings are based on 100% adoption of the energy efficiency measures. 2) Systems larger than 1000 hp are excluded from the energy saving and cost analyses. 3) The energy saving potential exclude fan systems that are in process cooling and refrigeration and non-process facility Heating, ventilation and air conditioning (HVAC).

Table shows the cumulative annual electricity-savings potential for industrial fan systems energy-efficiency measures in Egypt, by system size. The largest share of potential energy savings is in systems smaller than 50 horsepower (hp), with the next-largest share in systems that are between 101hp and 200hp.

TABLE 3 CUMULATIVE ANNUAL ELECTRICITY SAVING POTENTIAL FOR EFFICIENCY MEASURES IN INDUSTRIAL FAN SYSTEMS IN EGYPT BY SYSTEM SIZE (GWH/YR)

No.	Energy Efficiency Measures	≤50 hp (≤37 kW)	51-100 hp (38-75kW)	101- 200 hp (46-149kW)	201- 500 hp (150-373kW)	501-1000 hp (374 - 746kW)	Total
1	Fix Leaks and damaged seals	77	11	18	9	10	126
2	Isolate flow paths to nonessential or non-operating equipment	235	33	56	28	32	385
3	Correct damper problems	292	42	70	35	40	477
4	Repair or replace inefficient belt drives	339	48	81	40	46	555
5	Correct poor airflow conditions at fan inlets and outlets	433	62	103	52	59	708
6	Install variable speed drive	616	88	147	73	84	1,008
7	Replace oversized fans with more efficient type	717	102	171	85	97	1,172
8	Replace motor with more energy efficient type	741	106	177	88	100	1,212

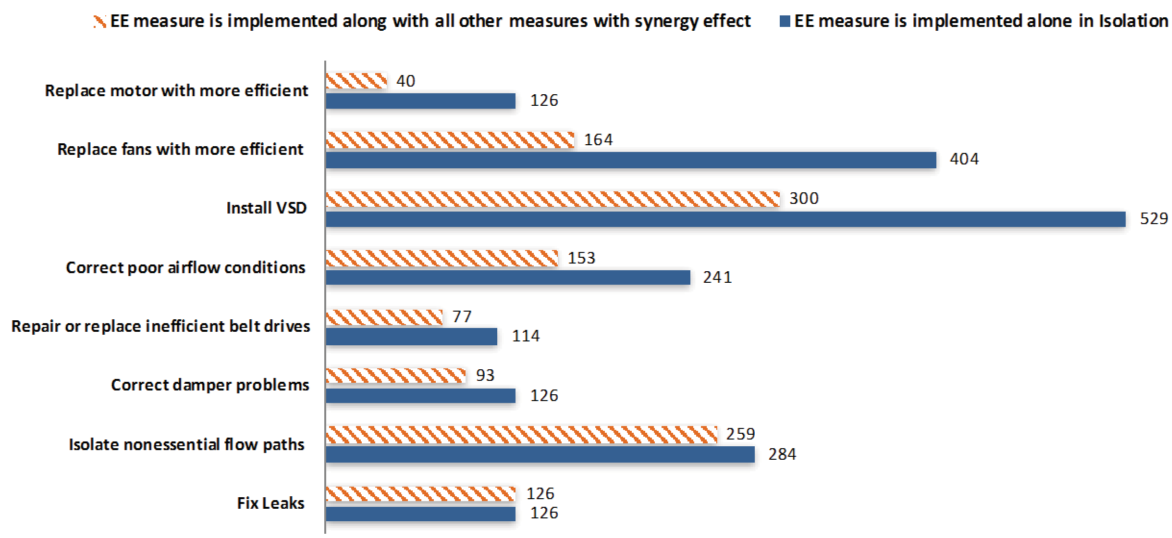
Notes: 1) Energy savings are based on 100% adoption of the efficiency measures. 2) Energy savings presented for each measure is the cumulating savings from that measure and all previous measures with lower CCE.

3) Systems larger than 1000 hp are excluded from the energy saving and cost analyses.

Source: Study on EE and GHG emission reduction potential from EE motor systems in Egypt undertaken by Global Efficiency Intelligence, LLC Analyses as part of the PPG phase (Full report in Annex I to this document

The measures that are less cost-effective on the efficiency cost curve and that appear at the top of the graph in Figure 15 show the largest differences between the energy savings calculated for the measure in isolation versus the energy savings calculated for the measure in combination with other measures. Note that summing up the energy savings of individual measures implemented in isolation will give an inaccurate result because of the synergy effect explained above.

FIGURE 14 COMPARISON OF ENERGY SAVING POTENTIAL (GWH/YR) FOR EACH EFFICIENCY MEASURE IN EGYPT WHEN EACH MEASURE IS IMPLEMENTED IN ISOLATION OR IS IMPLEMENTED ALONG WITH OTHER MEASURES



Source: Study on EE and GHG emission reduction potential from EE motor systems in Egypt undertaken by Global Efficiency Intelligence, LLC Analyses as part of the PPG phase (Full report in Annex I to this document)

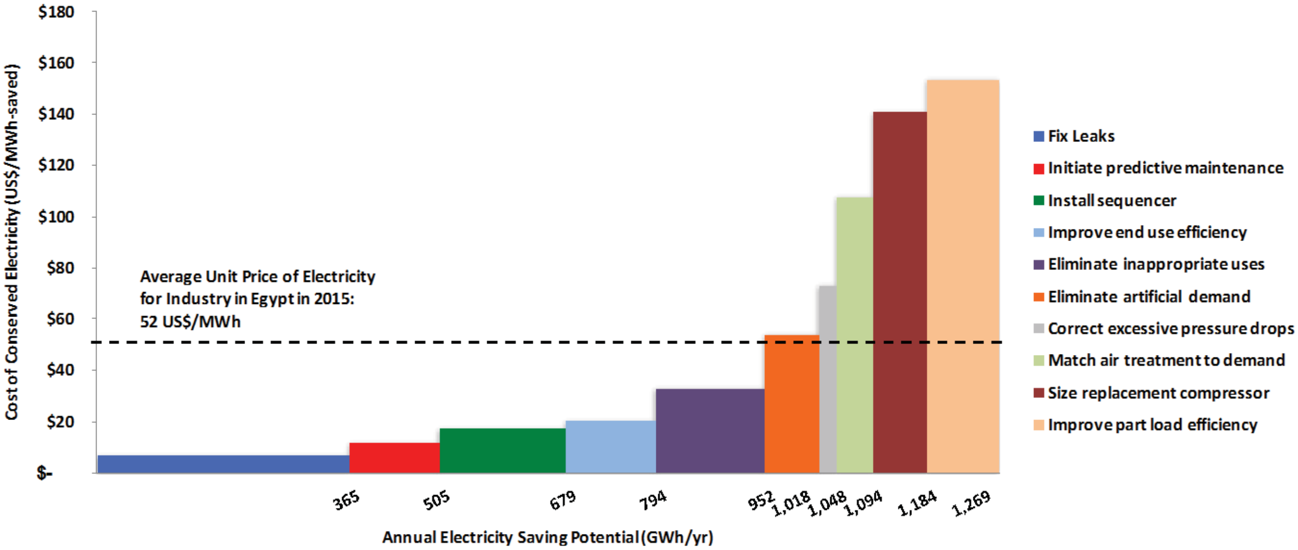
4.3. Energy-Efficiency Cost Curve for Industrial Compressed Air Systems in Egypt

Figure 16 shows the energy-efficiency cost curve for industrial compressed air systems in Egypt. The y-axis on the graph shows the CCE, and the x-axis shows the cumulative annual electricity savings potential of efficiency measures. Table 14 lists the measures on the cost curve along with the cumulative annual electricity-savings potential and final CCE of each measure as well as the cumulative CO_2 emissions-reduction potential. The energy-efficiency measures in the gray area of the table are cost effective (i.e., their CCE is less than the unit price of industrial-sector electricity in Egypt in 2015), and the efficiency measures that are in the white area are not cost-effective.

Out of ten energy-efficiency measures, five are cost-effective. The most cost-effective measure for comoressed air systems in Egypt is “Fix Leaks, adjust compressor controls, establish ongoing plan” which has the lowest CCE followed by “Initiate predictive maintenance program”.

The least-cost-effective measure (i.e., the one with the highest CCE) for Egypt compressed air systems is “Improve trim compressor part load efficiency; i.e. variable speed drive”. Also, it should be noted that the most cost-effective measure, “Fix Leaks, adjust compressor controls, establish ongoing plan”, has the largest energy saving potential as well.

FIGURE 15 ENERGY EFFICIENCY COST CURVE FOR INDUSTRIAL COMPRESSED AIR SYSTEMS IN EGYPT



Source: Global Efficiency Intelligence, LLC Analyses (Methodology in Section 2)

Table 15 shows that the total technical energy-savings potential is 39% of total industrial compressed air system electricity use in Egypt in 2015. This is a significant saving potential primarily because we assumed that compressed air systems in Egypt have LOW efficiency base case. Egypt's industrial compressed air systems have a cost-effective potential of 30% of total industrial compressed air system electricity use in Egypt in 2015.

TABLE 13 CUMULATIVE ANNUAL ELECTRICITY SAVING AND CO_2 EMISSION REDUCTION POTENTIAL FOR EFFICIENCY MEASURES IN INDUSTRIAL COMPRESSED AIR SYSTEMS IN EGYPT RANKED BY FINAL CCE

No.	Energy Efficiency Measures	Cumulative Annual Electricity Saving Potential (GWh/yr)	Final Cost of Conserved Energy (US$/MWh-Saved)	Cumulative Annual CO_2 Emission Reduction Potential (kton CO_2 /yr)
1	Fix Leaks, adjust compressor controls, establish ongoing plan	365	7	213
2	Initiate predictive maintenance program	505	12	294

3	Install sequencer	679	17	396
4	Improve end use efficiency; shut-off idle equip, engineered nozzles, etc.	794	20	463
5	Eliminate inappropriate compressed air uses	952	33	555
6	Eliminate artificial demand with pressure optimization/control/ storage	1,018	54	593
7	Correct excessive pressure drops in main line distribution piping	1,048	73	611
8	Match air treatment to demand side needs	1,094	108	638
9	Size replacement compressor to meet demand	1,184	141	690
10	Improve trim compressor part load efficiency; i.e. variable speed drive	1,269	153	740

Notes: 1) Energy savings are based on 100% adoption of the efficiency measures. 2) The energy and CO_2 savings presented for each measure are the cumulating savings from that measure and all previous measures with lower CCE.

3) This analysis provides an indication of the cost-effectiveness of system energy efficiency measures at the country level. The cost-effectiveness of individual measures will vary based on plant-specific conditions.

Source: Study on EE and GHG emission reduction potential from EE motor systems in Egypt undertaken by Global Efficiency Intelligence, LLC Analyses as part of the PPG phase (Full report in Annex I to this document

TABLE 14. TOTAL ANNUAL COST-EFFECTIVE AND TECHNICAL ENERGY SAVING AND CO_2 EMISSIONS REDUCTION POTENTIAL IN INDUSTRIAL COMPRESSED AIR SYSTEMS IN EGYPT

	Cost-effective Potential	Technical Potential
Annual electricity saving potential for compressed air systems in Egypt's industry (GWh/yr)	952	1,269
Share of saving from the total compressed air system energy used in Egypt's	30%	39%

industry in 2015		
Share of saving from the total electricity used in Egypt's industry in 2015	2.4%	3.2%
Annual CO_2 emission reduction potential from Egypt's industry (kton CO_2/yr)	555	740
Number of households electricity consumption in Egypt that can be supplied by energy saved	338,983	451,818

Notes: 1) Savings are based on 100% adoption of the energy efficiency measures. 2) Systems larger than 1000 hp are excluded from the energy saving and cost analyses. 3) The energy saving potential exclude compressed air systems that are in process cooling and refrigeration and non-process facility Heating, ventilation and air conditioning (HVAC).

Source: Study on EE and GHG emission reduction potential from EE motor systems in Egypt undertaken by Global Efficiency Intelligence, LLC Analyses as part of the PPG phase (Full report in Annex I to this document)

Table 16 shows the cumulative annual electricity-savings potential for industrial compressed air systems energy-efficiency measures in Egypt, by system size. The largest share of potential energy savings is in systems that are between 101hp and 200hp with the next-largest share in systems smaller than 50 hp.

TABLE 15 CUMULATIVE ANNUAL ELECTRICITY SAVING POTENTIAL FOR EFFICIENCY MEASURES IN INDUSTRIAL COMPRESSED AIR SYSTEMS IN EGYPT BY SYSTEM SIZE (GWH/YR)

No.	Energy Efficiency Measures	≤50 hp (≤37 kW)	51-100 hp (38-75kW)	101- 200 hp (46-149kW)	201- 500 hp (150-373kW)	501-1000 hp (374 - 746kW)	Total
1	Fix Leaks, adjust compressor controls, establish ongoing plan	105	36	110	84	30	365
2	Initiate predictive maintenance program	145	50	152	116	42	505
3	Install sequencer	195	68	204	156	56	679
4	Improve end use efficiency; shut-off idle equip, engineered nozzles, etc.	228	79	239	183	66	794

5	Eliminate inappropriate compressed air uses	273	95	286	219	79	952
6	Eliminate artificial demand with pressure optimization/control/storage	292	101	306	234	84	1,018
7	Correct excessive pressure drops in main line distribution piping	301	104	315	241	87	1,048
8	Match air treatment to demand side needs	314	109	329	252	91	1,094
9	Size replacement compressor to meet demand	340	118	356	272	98	1,184
10	Improve trim compressor part load efficiency; i.e. variable speed drive	364	126	381	292	105	1,269

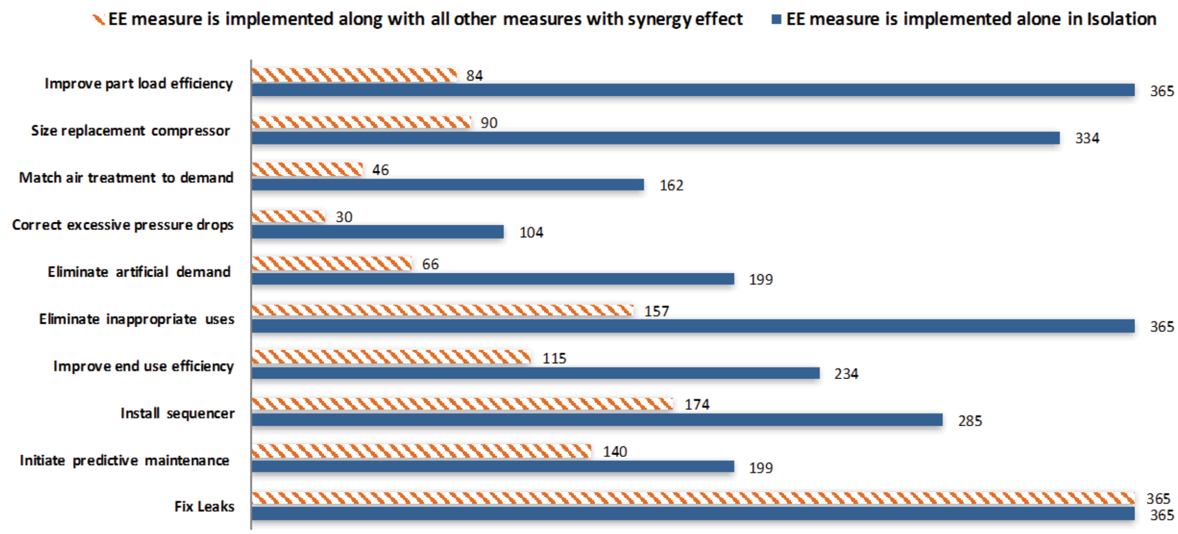
Notes: 1) Energy savings are based on 100% adoption of the efficiency measures. 2) Energy savings presented for each measure is the cumulating savings from that measure and all previous measures with lower CCE.

3) Systems larger than 1000 hp are excluded from the energy saving and cost analyses.

Source: Study on EE and GHG emission reduction potential from EE motor systems in Egypt undertaken by Global Efficiency Intelligence, LLC Analyses as part of the PPG phase (Full report in Annex I to this document

The measures that are less cost-effective on the efficiency cost curve and that appear at the top of the graph in Figure 17 show the largest differences between the energy savings calculated for the measure in isolation versus the energy savings calculated for the measure in combination with other measures. Note that summing up the energy savings of individual measures implemented in isolation will give an inaccurate result because of the synergy effect explained above.

FIGURE 16. COMPARISON OF ENERGY SAVING POTENTIAL (GWH/YR) FOR EACH EFFICIENCY MEASURE IN EGYPT WHEN EACH MEASURE IS IMPLEMENTED IN ISOLATION OR IS IMPLEMENTED ALONG WITH OTHER MEASURES



Source: Study on EE and GHG emission reduction potential from EE motor systems in Egypt undertaken by Global Efficiency Intelligence, LLC Analyses as part of the PPG phase (Full report in Annex I to this document)

5. Summary and Conclusions

The purpose of the analyses in this report was twofold: 1) to determine the energy use in industrial motor systems, by manufacturing subsectors, in Egypt, and 2) to quantify the potential for and costs of improving the energy-efficiency of industrial motor systems. We determined the costs of improving motor system energy efficiency by taking into account the costs of and energy savings from different energy-efficiency technologies and measures. Many cost-effective opportunities for motor systems energy-efficiency improvement have been identified but are infrequently adopted, leading to an "efficiency gap." Failure to adopt cost-effective efficiency improvements results from numerous obstacles, both monetary and non-monetary.

To estimate the cost-effective electricity-efficiency potentials of eight energy-efficiency technologies and measures for industrial motor systems, we used a bottom-up energy-efficiency cost curve model. We also estimated technical electricity-savings potentials, assuming 100% adoption of the efficiency measures. Table 17 summarizes the results for Egypt studied. We also calculated the CO_2 emissions-reduction potential associated with the electricity-savings potentials, using the average CO_2 emissions factor of the electricity grid in Egypt.

TABLE 16 TOTAL ANNUAL TECHNICAL ENERGY SAVING AND CO_2 EMISSIONS REDUCTION POTENTIAL IN INDUSTRIAL MOTOR SYSTEMS IN EGYPT

	Pump Systems	Fan Systems	Compressed Air Systems
Technical annual electricity saving potential (GWh/yr)	2,022	1,212	1,269
Associated CO_2 emission reduction potential from industry (kton CO_2/yr)	1,179	707	740

In Egypt, the share of total technical electricity-savings potential for industrial pump systems compared to total manufacturing pump systems energy use is 49%. The share of total technical electricity-savings potential for industrial fan systems compared to total manufacturing fan systems energy use in Egypt is 38%. The share of total technical electricity-savings potential for industrial compressor systems compared to total manufacturing compressor systems energy use is 39%. These are very large and significant saving potential that policy makers in Egypt cannot afford to ignore.

The total technical annual electricity saving potential in the three motor systems studied (pump, fan, and compressed air systems) is equal to annual electricity consumption of over 1.6 million households in Egypt.

In general, CCE has a direct relationship with the discount rate. For example, reductions in the discount rate will result in reductions in CCE, which can increase the cost-effective energy-savings potential (depending on energy prices). A higher energy price can result in more energy-efficiency measures being cost-effective by causing their CCEs to fall below the energy price line.

Because systems larger than 1,000 hp account for about 4%, 17%, and 32% of total industrial pump, fan, and compressor systems electricity use in Egypt, respectively, excluding these systems from the analysis resulted in a proportional decrease in total system energy use and a corresponding decrease in the energy savings resulting from the energy-efficiency measures analyzed. In other words, the energy-savings potentials would be greater if systems larger than 1,000 hp were included in the analysis.

It should be noted that some energy-efficiency measures provide productivity, environmental, and other benefits in addition to energy savings; however, quantifying these benefits is difficult and beyond the scope of this report. Including quantified estimates of other benefits could decrease CCE for the efficiency measures and thereby increase the number of measures that are cost-effective.

In addition, it is important to highlight that electricity is a final form of energy. If we convert the electricity saving calculated in this report to primary energy saving using average power generation efficiency and transmission and distribution losses, the primary energy saving can be up to around 3 times of the electricity saving values.

The approach used in this study and the model developed for this purpose should be viewed as a screening method and tool that can identify energy-efficiency measures and their energy-savings potential and costs to aid national and local governments, policy makers, and utilities in designing energy-efficiency policies. Actual energy-savings potentials and costs of energy-efficiency measures and technologies will vary in relation to plant-specific conditions. Effective energy-efficiency policies and programs are needed to realize (and ultimately exceed) current cost-effective potentials.

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Appendix

TABLE A.1. CHARACTERISTICS OF LOW-MEDIUM-HIGH EFFICIENCY BASE-CASE SCENARIOS FOR PUMP SYSTEMS

No.	LOW Efficiency Base-Case Scenario
1	Less than 10% of pump systems have been assessed for system energy efficiency.
2	Maintenance is limited to what is required to support operations.
3	Flow is typically controlled by throttling or bypass.
4	Flow regularly exceeds actual system needs.
5	Variable-speed drives are not commonly used
6	Motors of all sizes are routinely rewound multiple times instead of replaced.
7	~10% of the installed motors are high efficiency--either EPAct or EFF1 equivalent.
No.	**MEDIUM Efficiency Base-Case Scenario**
1	~20% of pump systems have been assessed for system energy efficiency.
2	Maintenance is a routine part of operations and includes some preventative actions.
3	System operators take steps to avoid controlling flow via throttling or bypass.
4	Efforts are made to efficiently match supply with demand.
5	Variable-speed drives are frequently proposed as a solution for flow control.
6	Motors $\geq$ 37 kW are typically rewound multiple times, and smaller motors may be replaced.
7	~25% of the installed motors are high efficiency--either EPAct or EFF1 equivalent.
No.	**HIGH Efficiency Base-Case Scenario**
1	30% or more of pump systems have been assessed for system energy efficiency.
2	Both routine and predictive maintenance are commonly practiced.
3	Flow is not controlled by throttling or bypass except in emergencies.

4	Fluid is only pumped where and when needed to meet demand.
5	Variable-speed drives are one of several flow-control strategies commonly applied to increase system efficiency.
6	Most facilities have a written rewind/replace policy that prohibits rewinding smaller motors (typ <37 kW).
7	50% or more of the installed motors are high efficiency--either EPAct or EFF1 equivalent.

TABLE A.2. CHARACTERISTICS OF LOW-MEDIUM-HIGH EFFICIENCY BASE-CASE SCENARIOS FOR FAN SYSTEMS

No.	**LOW Efficiency Base Case Scenario**
1	Less than 10% fan systems representing 40% of the connected fan load have been assessed for system energy efficiency
2	Maintenance is limited to what is required to support operations
3	Flow is usually controlled by dampers or bypass
4	Low cost fans types, like radial, are often used even in clean air applications
5	Fans are sometimes located on the dirty side of the process
6	Fans are sometimes oversized for the present load
7	Variable speed drives or variable inlet vanes are sometimes proposed as a solution for flow control
8	Motors of all sizes are routinely rewound multiple times instead of replaced
9	10% or less of the installed motors are high efficiency--either EPAct or EFF1 equivalent
No.	**MEDIUM Efficiency Base Case Scenario**
1	~30% fan systems representing 60% of the connected fan load have been assessed for system energy efficiency
2	Maintenance is a routine part of operations and includes some preventative actions
3	System operators take steps to avoid controlling flow via dampers or bypass
4	Airfoil or backward curved impellers are used in clean air handling applications
5	Fans are located on the clean side of the process whenever possible
6	Fans are chosen to efficiently serve a given condition

7	Variable speed drives or variable inlet vanes are frequently proposed as a solution for flow control
8	Motors ≥ 37 kW are typically rewound multiple times, while smaller motors may be replaced
9	~25% of the installed motors are high efficiency--either EPAct or EFF1 equivalent
No.	**HIGH Efficiency Base Case Scenario**
1	~50% fan systems representing 80% of the connected fan load have been assessed for system efficiency
2	Both routine and predictive maintenance are commonly practiced
3	Flow is not controlled by dampers or bypass except in emergencies
4	Fans are located on the clean side of the process whenever possible
5	Variable speed drives are one of several flow control strategies commonly applied to increase efficiency
6	Fans types are chosen based on the highest efficient type to serve a given condition
7	Fans are selected and procured so that typical process flow and pressure requirements are at or near Best Efficiency Point
8	Most facilities have a written rewind/replace policy that prohibits rewinding smaller motors (typ <45 kW)
9	50% or more of the installed motors are high efficiency--either EPAct or EFF1 equivalent

TABLE A.3. CHARACTERISTICS OF LOW-MEDIUM-HIGH EFFICIENCY BASE-CASE SCENARIOS FOR COMPRESSED AIR SYSTEMS

No.	**LOW Efficiency Base Case Scenario**
1	Less than 10% of compressed air systems have been assessed for system energy efficiency (both supply and demand side assessment)
2	Maintenance is limited to what is required to support operations
3	Compressor control is coordinated but poorly and a single trim compressor operates inefficiently
4	System pressure profile, supply / demand balance, and storage partially optimized
5	Leaks are ≥ 25%, but < 35% and are fixed irregularly

6	There is widespread inappropriate use of compressed air
7	Motors of all sizes are routinely rewound multiple times instead of replaced
No.	**MEDIUM Efficiency Base Case Scenario**
1	~20% of compressed air systems have been assessed for system energy efficiency (both supply and demand side assessment)
2	Maintenance is a routine part of operations and includes some preventative actions
3	Compressor control is coordinated and a single trim compressor operates efficiently
4	Variable speed drives are frequently proposed as a solution for flow control
5	Leaks are ≥ 15%, but < 25% and are fixed periodically
6	Inappropriate end use of compressed air has been reduced
7	Motors ≥ 37 kW are typically rewound multiple times, while smaller motors may be replaced
No.	**HIGH Efficiency Base Case Scenario**
1	~30% or more of compressed air systems have been assessed for system energy efficiency (both supply and demand side assessment)
2	Both routine and predictive maintenance are commonly practiced
3	Compressor controls and storage are used to efficiently match supply to demand
4	System pressure profile from supply to end use has been optimized
5	Leaks < 15%; Leaks management is ongoing
6	Inappropriate end use of compressed air has been minimized
7	Most facilities have a written rewind/replace policy that prohibits rewinding smaller motors (typ <37 kW)

TABLE A.4. CONSOLIDATED SYSTEM EFFICIENCY FOR LOW-MED-HIGH EFFICIENCY BASELINES

	Pump System Efficiency		
	low end (%)	high end (%)	Average (%) - used in the analyses
Low level of efficiency	20%	40%	30%

Medium level of efficiency	40%	60%	50%
High level of efficiency	60%	75%	68%

TABLE A.5. CONSOLIDATED SYSTEM EFFICIENCY FOR LOW-MED-HIGH EFFICIENCY BASELINES

	Fan System Efficiency		
	low end (%)	high end (%)	Average (%) - used in the analyses
Low level of efficiency	15%	30%	23%
Medium level of efficiency	30%	50%	40%
High level of efficiency	50%	65%	58%

TABLE A.6. CONSOLIDATED SYSTEM EFFICIENCY FOR LOW-MED-HIGH EFFICIENCY BASELINES

	Compressed Air System Efficiency		
	low end (%)	high end (%)	Average (%) - used in the analyses
Low level of efficiency	2.0%	5.0%	3.5%
Medium level of efficiency	4.8%	8.0%	6.4%
High level of efficiency	8.0%	13.0%	10.5%