



MESSAGE

India is on the cusp of a new-age industrial revolution. The changing economy is a fundamental driver of its energy development. Industry-led growth requires at least 10 times more energy per unit of value addition compared with growth led by the services sector. With strong economic growth and 'Make in India' at the centre-stage of India's growth story, the country can't afford to ignore the importance of energy efficiency.

Despite progress in recent years, current market barriers significantly impede large-scale adoption of efficiency solutions. In economies that have implemented proactive policy measures, there is a marked increase in the diffusion of more efficient technologies. This has been achieved through policies and regulations combined with enabling the market forces to push for higher efficiency technologies.

With a view to realizing the immense potential for energy efficiency in industries, EESL has identified energy-efficient motors as the technology of focus for entry into the industrial sector. The National Motor Replacement Program (NMRP) is EESL's pioneering effort to make energy efficiency the first fuel in the industrial sector.

The Vision Document (2019-2024) for the NMRP focuses on the paradigm that an accelerated transformation is possible through a well-timed and targeted intervention. For the five-year timeline, considering 10% market capture, the market potential for energy-efficient motors is estimated at approximately 10 million motors (in number) with an investment potential of around INR 1,253 crores. Capturing the whole market is estimated to lead to energy savings of approximately 22 billion kWh per year and emission reduction of 18.3 million tonnes of CO2 equivalent annually. EESL is committed to support the efforts of industries in adopting energy efficiency measures and is ready to provide investment and transaction-based services to industries in their effort to transition into an energy-efficient and sustainable future.



Saurabh Kumar Managing Director Energy Efficiency Services Limited (EESL)



MESSAGE

Energy is the prime mover of economic growth and vital to the sustenance of a modern economy. It is becoming increasingly clear that energy efficiency can bring many significant economic and environmental benefits. In theindustrial sector, which consumes around 40% of the electricity consumed, there exist enough opportunities to harness the benefits of energy efficiency. About 70% of the electricity consumed by industries are contributed by motors & motor driven systems.

The National Motor Replacement Program (NMRP) which is EESL's first of its kind program for industrial sector was conceptualised after due consultation with industries & other stake holders. NMRP will address the replacement of the installed stock of IE1 & sub-IE1 motors with IE3 motors. Secondly, the overall goal is to bring down the cost of IE3 motors, and stimulate the voluntary adoption of IE3 for new installations. This will take the market higher than the Minimum Energy Performance Standard (MEPS) of IE2 which was mandated from 01.01.2018.

The market potential for energy efficient motors within the program timeline is enormous and is likely to have a catalyzing effect on the entire value chain. We are hopeful that NMRP would lay the foundation for a thriving ESCO market in the industrial segment, a significant portion of which has been untapped so far.

We have consciously instituted a review mechanism as a part of NMRP to make necessary course corrections as and when required. Our experience with previous programs suggests that well-timed and targeted interventions can lead to significant impact in terms of market penetration. This document has made an endeavor to set out long term goals and practicable pathways to achieve the same. It is hoped that this document effectively illustrates the benefits of NMRP's value proposition to all concerned stakeholders positively influences market action in the way forward.



Soumya P. Garnaik

Executive Director
Energy Efficiency Services Limited (EESL)



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1. INTRODUCTION

1.1. About Energy Efficiency Services Limited

Energy Efficiency Services Limited (EESL) was set up in December 2009 under the aegis of the Ministry of Power as a joint venture by the four central PSUs, i.e., NTPC Ltd., Power Grid Corporation of India Ltd., Power Finance Corporation Itd. and Rural Electrification Corporation Ltd. EESL aims to unlock the energy efficiency (EE) and demand side management (DSM) market and implement large scale EE projects.

EESL Vision

Universal access to sustainable energy solutions to enable a low carbon future, with significant economic and social impact.

EESL Mission

To enable ecosystems for responsible energy adoption with innovations and market creation approaches.

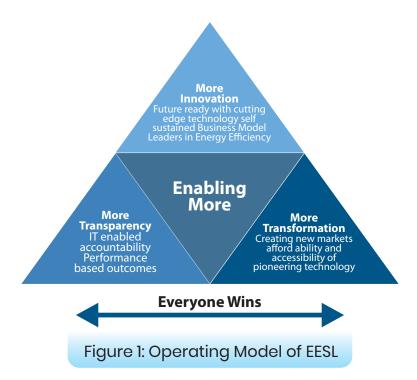
Objectives:

- To carry out and promote the business of Energy Efficiency and climate change including manufacture and supply of energy efficiency services and products.
- To provide consultancy services in the field of Clean Development Mechanism (CDM) projects, carbon markets, demand side management, energy efficiency, climate change and related areas.
- To act as resource center in the field of Energy Efficiency and take up the activities of capacity building, training and other related activities.
- To carry out such other activities as offered by the Central Govt., Bureau of Energy Efficiency or any other agency related to Energy Efficiency and Climate Change.



1.2. Operating Model

EESL works as a super energy service company (ESCO), a consultancy organization for energy efficiency and a resource center for capacity building of State Designated Agencies, utilities, financial institutions and other similar organisations EESL leads market-related actions of the National Mission on Enhanced Energy Efficiency (NMEEE). It is the first such company in South Asia working exclusively for the implementation of energy efficiency. EESL has designed an innovative business model which is able to seamlessly adopt emerging technologies in a manner that incentivizes all stake holders. As shown in , this model has a 3-pronged approach focussing on innovation, transparency and market creation across all its programs.





1.3. EESL's Journey So Far

EESL has been successful through its 'Demand Aggregation' model for different categories of products like domestic lighting, domestic ceiling fans, street lighting, agriculture pumps and electric vehicles for customers bases like residential, commercial, municipalities, agriculture and utilities. Between 2013 and 2017, the company's revenues have grown 46 times, while profits have soared over 50 times. In addition to its core objectives of energy and cost saving, EESL has also been able to create profound social impact. illustrates some of the key initiatives and their impact.

 UJALA LED bulbs procured and sold on either upfront cost basis/ on-bill financing 36,06,39,059 LEDs 	Street Lighting National Programme Retrofitting the entire conventional streetlights with LEDs 10,166,144 Streetlights completed as on date	 AgDSM Replacement of inefficient agricultural pump sets with BEE star rated pump sets 56,055 pumps installed 	Electric Vehicles Programme Introduction of 500,000 four-wheeler electric vehicles in India to replace the current fleet of ICE	
distributed till date	·	till date	vehicles in Govt. departments	
Key learnings				
 Zero subsidy model favoured by Govt. Technology leapfrog 	No upfront cost and 50% energy savingsTransparency	Both PMC and Cost plus annuity based model- entire savings with states	Pilot phase to build credibility in new technology	
led to supply chain reaction	of operations & outcomes for credibility	Creation of demand through built in incentives for farmers	Leverage existing relationships with Govt. for demand	
 Extended warranty ensured high quality 	incentives for farmers		aggregation	
Impact	Impact	Impact	Envisaged Impact	
46,835 million kWh energy saving	6828.01m kWh energy saving per year (Details a signal 4000)	Energy savings of 145.16 million kWh per year (Details a size of 145.16) (Details a size of 145.16) (Details a size of 145.16)	8000 Million litres fuel savings per year	
per year • 9377 MW avoided	(Potential savings:1900 Million kWh per year)	(Potential savings: 43 Billion kWh)	20 million tCO2 reduction per year	
peak demand	• 1138 MW avoided	26 MW avoided peak	reduction per year	
• 3,79,36,441 t CO2	t CO2 peak demand demand per year	1 1 1		
reduction per year	 47,00,000 tCO2 reduction per year 	• 1,07,422 tCO2 reduction per year	 	

Figure 2: EESL's Journey So Far

The industrial segment presents a new and significant market opportunity for EESL. Although there have been appreciable efforts to introduce energy efficiency through policy measures in industries, the potential for cross-cutting scalable technologies has been relatively untapped.

1.4. Drivers of Industrial Energy Efficiency in India

Energy efficiency is closely connected with reduction in greenhouse gas (GHG) emissions at the global as well as national level. Based on International Energy Agency (IEA) estimates, energy efficiency is projected to have a share of 51% in the cumulative abatement of energy-related emissions until the year 2035, which is significantly higher than the shift to alternative sources of energy. This underscores the high importance of energy efficiency in the national context in India, both from the perspective of energy saving as well as reduction in GHG emissions. illustrates the drivers for energy efficiency in India.

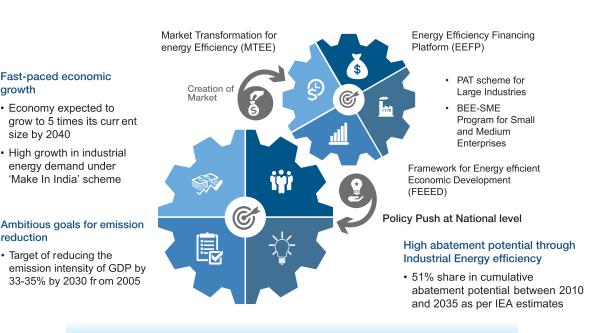


Figure 3: Drivers of Industrial Energy Efficiency in India

Based on the latest figures by Bureau of Energy Efficiency, the total energy consumption for the industrial sector in India is around 365 Million TOE. The International Energy Agency (IEA), in its publication India Energy Outlook 2015, has pegged the industrial consumption in India to increase to around 572 million TOE. With the economy expected to grow to five times its current size by 2040, energy demand in India is projected to increase at a very fast pace in the upcoming decades.

At the national level, there have been appreciable efforts to bring about a reduction in the energy consumption of major energy consuming industrial sectors. Given the immense potential in industrial energy efficiency, EESL proposes to enter the industrial segment with the objective of the replicating the success of its flagship 'Demand Aggregation model'. The subsequent sections of the document provide an overview of the genesis of this program, rationale for technology selection, framework of program roll-out and the impact envisaged through this endeavour. The targets and strategies set out in this document intend to consolidate EESL's position as the market leader in the energy efficiency sector. The plan would also serve as the basis to assess EESL's performance and provides a framework for concurrently monitoring its progress.

1. India Energy Outlook, 2010

Fast-paced economic

· Economy expected to

energy demand under

· Target of reducing the

'Make In India' scheme

size by 2040

growth

reduction

2. GENESIS OF 'NATIONAL **MOTOR REPLACEMENT PROGRAM'**

The Industrial sector accounts for around 40% of the electricity demand in India². With growth in the industrial sector in India pegged at a CAGR of 4.6% by IEA projections³, this consumption is expected to rise at a fast pace. A study by International Energy Agency⁴ calculated the share of motor and motor-driven electricity consumption in the total industrial electricity consumption to be ~69% of the industrial electricity consumption. Therefore, the concept of energy efficiency has immense benefits to offer in reducing energy consumption in motor and motor driven systems and associated GHG emissions. In order to achieve this objective, it is proposed to launch the National Motor Replacement Program.

2.1. Need for a dedicated programmatic intervention for Motors

In India, the penetration of energy efficient motors remains low and motors below IE2 have a substantial market share⁵. So far, India has been behind its global peers in terms of adoption of Minimum Energy Performance Standards (MEPS). Around 41 countries have made an effort to transition towards high efficiency motors and motor driven systems through regulatory measures and supporting policies. A majority of these countries have adopted IE3 as Minimum Energy Performance Standard (MEPS). Figure 4 depicts the advantages of transitioning to IE3 motors.



more efficiency as compared to le1 or non-IE motors.



Energy efficient motors run cooler and are more likely to withstand voltage variations than standard motors



motors more likely to withstand harmonics than standard motors



Energy efficient motors operate more quietly than standard motors.

Figure 4: Advantages of using IE 3 motors

"National Motor Replacement Program is designed to offer immense benefits to Industrial consumers from a commercial as well as technical perspective. We hope to have many industries participating in this program and reap rich dividends from it."

> Shri Saurabh Kumar, Managing Director, Energy Efficiency Services Ltd. (EESL)

- 2. ICAI Discussion Paper on High Efficiency Accelerated Motor Replacement Program.
- 3. India Energy Outlook, 2015.
- 4. Energy-Efficiency Policy Opportunities for Electric Motor-Driven Systems, IEA Whitepaper: 2011.
- 5. ICAI Discussion Paper on High Efficiency Accelerated Motor Replacement Program.

With effect from 1st January, 2018, the Department of Industrial Policy Promotion (DIPP) had issued a Quality Control Order⁶ requiring all imported and domestically manufactured motors to conform to the revised IS:12615 which specifies IE2 as the minimum efficiency class, It is also expected that BEE shall notify motor MEPS at IE2 level. While this is a welcome step, there is still more to be done, as the barriers to adoption of energy efficient motors are more complex in nature and span across behavioural, financial and market related aspects.

An EESL led voluntary motors replacement program would be well-aligned with national level priorities and objectives. Such a program would:

- Supplement the energy saving under the present and upcoming cycles of the Perform Achieve Trade scheme for large industries.
- Supplement the efforts under the BEE-SME program by accelerating the transformation of the installed stock.
- Enable to a higher level of IE3, than the expected MEPS of IE2 level, thereby complementing the Standards and Labelling program.
- Improve the cost-competitiveness of the Indian manufacturing industry, accelerate the adoption of world-class technologies by the Indian motor manufacturers and generate employment in manufacturing and services.

Therefore, going by the Business-as-usual approach, inefficiencies in motors and motor driven systems alone would present a significant loss to the nation in energy and monetary terms and the transition to energy efficient motors would take longer than expected.

 $6. \,Quality\,Control\,Order\,for\,adoption\,of\,IS\,12615; 2011\,as\,mandatory\,standard\,for\,Energy\,Efficient\,Induction\,Motors\,-Three\,Phase.$



2.2. Choice of Target segment

Motors can be classified into different types based on their operating characteristics. Among the different technologies and designs available, squirrel cage induction motors are relatively more frequently used in the Industrial context⁷. Squirrel cage induction motors are used in Agricultural, Industrial and Domestic applications depending on their capacity ratings. As per IEEMA data, Low Tension (LT) Squirrel Cage motors occupy a major share in the production (on kW) basis among all other categories of motors⁸ (Ref: and). In addition, these motors form the most commonly used category of motors in the industrial segment. Therefore, from the program perspective, **LT 3-phase squirrel cage motors have emerged as the subsegment of focus.**

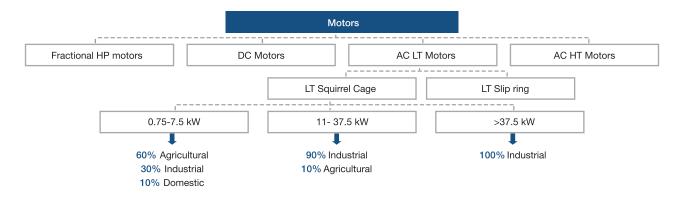


Figure 5: Classification of Motors (Source: BEE)

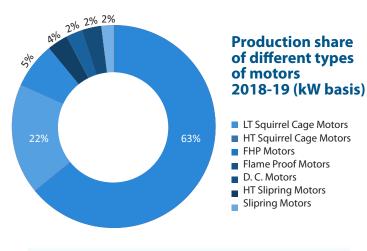


Figure 6: Production share of different types of motors (Source: IEEMA)

Squirrel cage induction motors are broadly classified into 3 range of frame sizes each of which has motors of different capacity ratings. These motors are mass produced and sold in standard sizes. They are easy to replace because manufacturers, wholesalers and industrial end users keep them in stock. These products have the advantage of standardized features (such as frame size, output power or torque, rotational speed, insulation, and protective coatings). In comparison, higher capacity motors are custom designed, built to order and assembled on site (within an electromechanical system) with much lower opportunity for scaling up.

^{7.} Energy-Efficiency Policy Opportunities for Electric Motor-Driven Systems, IEA Working Paper: 2011 8. IEEMA statistics for 2017





Figure 7: Classification of Sq. cage motors

LT Squirrel Cage motors of the frame size below 63 to 132 constitute a major share on the basis of number as well as kW (Ref: Figure 9). In addition to having a major share in production, this category of motors is also one of the fastest growing sub-segments within LT Squirrel Cage motors with a CAGR of >7%.

Share of different types of LT Sq. Cage Motors (nos.)

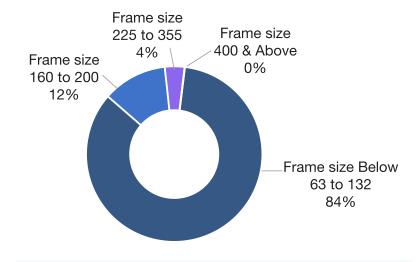
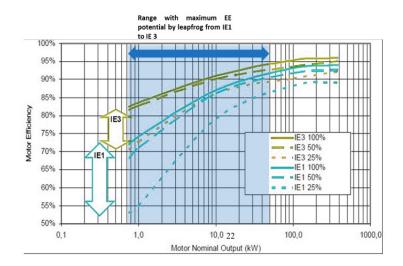


Figure 9: Share of Sq. Cage Motor ratings (Nos.)

A key benefit of replacing IE 1 motors by IE 3 motors is their better part load efficiency. As can be observed in , the energy saving potential by leapfrogging from IE1 to IE3 configuration is the highest in the range of 0.75kW to 75 kW. Therefore, for procurement, a target range of 0.75 kW to 75 kW has been chosen.



Major applications of motors

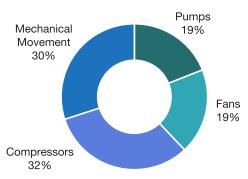


Figure 10: Partial Load efficiency of IE 3 and IE1 motors Source: A+B International, 2009.

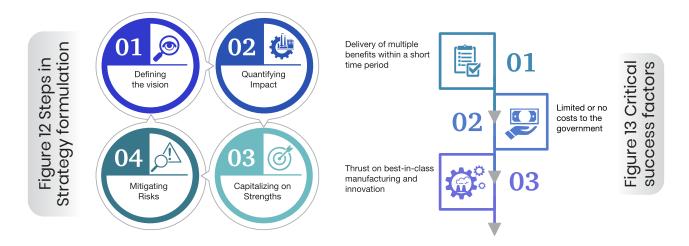
Figure 11: Estimated share of global motor electricity demand by end use Source: IEA 2011

As shown in, the major application of motors in industries in for operating pumps, fans and compressors and blowers. Therefore, this program will focus on loads like Pumps, Fans, Blowers, Compressors only. However EESL may look into other load types in the future, on the basis the technical & implementation feasibility. Overall, this program aims to cover all types of industries (PAT & large industries, SMEs) who use 3-phase squirrel cage induction motors (415V, 50Hz). In the 2nd year of the programme, the range may be extended depending upon the demand from the market.



3. PROGRAM STRATEGY

The strategy formulation for the program has revolved around four key aspects namely- defining the vision& mission, quantifying the impact, capitalizing on strengths and mitigating risks (Ref:). EESL's previous experience with programmatic interventions highlights a few critical success factors of the Bulk Procurement model (Ref:). The program design for the National Motor Replacement Program has been carried out to embody these design principles for delivering the maximum value to the stakeholders.



3.1. Defining the Vision & Mission

The vision for the National Motor Replacement Programme has been prepared to ensure alignment with the vision of EESL, nature of business and EESL's envisaged position in the market place. For ascertaining the overall impact of the programme, two scenarios have been compared:

- Scenario 1: Business as usual scenario, which considers no change from current market conditions.
- Scenario 2: Accelerated adoption scenario which envisages an accelerated replacement of old motors with IE 3 motors. The key considerations in this model are presented in .

For motors below 63 to 132 Frame size: Replacement of 50% of the existing stock of IE 1 motors in the next 2 years and no increase in the existing stock of Sub IE 2 motors.

Replacement of 25% of the existing stock of IE 2 motors in the next 2 years

For motors of 160 to 200 Frame size: Replacement of 30% of the existing stock of IE 2 motors in the next 2 years.

Replacement of 15% of the existing stock of IE 2 motors in the next 2 years.

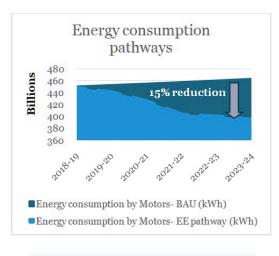
For motors of 225 to 355 Frame size: Replacement of 10% of the existing stock of IE 2 motors in the next 2 years.

Replacement of 5% of the existing stock of IE 2 motors in the next 2 years.

Figure 14: Key considerations in accelerated replacement



THE PROJECTED PATHWAYS FOR ENERGY CONSUMPTION AND REDUCTION IN GHG EMISSION UNDER THE TWO SCENARIOS ARE PROVIDED IN FIGURE 15 AND FIGURE 16 RESPECTIVELY.



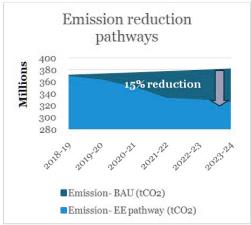


Figure 15: Energy consumption pathways

Figure 16: Emission reduction pathways

The envisaged transition in the technology mix of motors due to the accelerated replacement is presented in Figure 17.

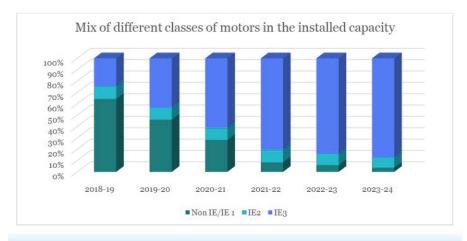


Figure 17: Envisaged Transition in motor technology mix

The **program timeline has been set at 5 years** as it is expected that at the end of 5 years, the program impact is expected to make EE motors self-sustaining as a technology. Towards the end of this timeline, it is expected that IE 4 motors may be well commercialized in India which have 3-4% higher efficiency than IE3 motors. At this time, EESL may consider to shift to higher standards while doing procurement.

EESL estimates the market for energy efficient motors to be ~10 million nos. motors by 2023-24 out of which the share of different segments is presented in .

The investment potential for energy efficient motors until 2023-24 is estimated at ~ **INR 12,534 Crore*.** The share of the different frame size categories is presented in Figure 19.



Figure 18: Replacement market for IE3 motors

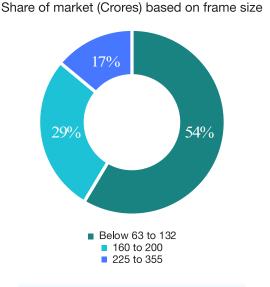


Figure 19: Size of replacement market

It is estimated that **10% of the total market size** (in number terms can be captured over the next 5 years (2019-20 to 2023-24). Accordingly, the Vision and Mission statement for National Motor Replacement Programme have been formulated.

Vision

"Phase-out non-efficient motors from industrial sector by enabling market transition into higher efficiency motors through innovative financing mechanism"

Mission

"Achieve transformation of at least 10% of the replacement market for IE 3 motors and motor-driven systems until 2023-24"

3.2. Quantifying Impact

National Motor Replacement Programme is envisaged to have a wide-ranging impact of direct and indirect nature as presented in Figure 20.

^{*}Based on PwC Market Analysis

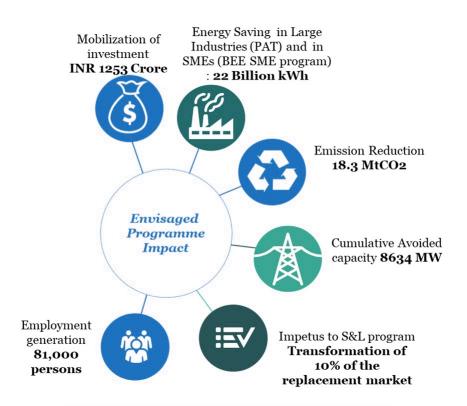


Figure 20: Envisioned program impact

The program is estimated to lead to fulfil its market creation objective through mobilization of investment to the tune of INR 1,500 Crore, which is expected to get paid back within 1-1.5 years. In addition to significant energy and emission savings, National Motor Replacement Program is also expected to lead to cumulative avoided capacity of up to 8634 MW and employment generation (direct & indirect) for around 1 lakh persons.

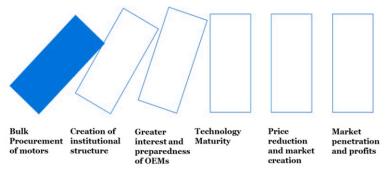


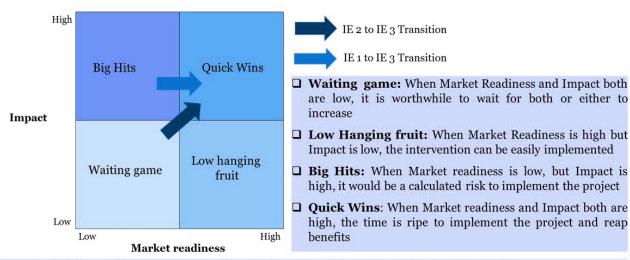
Figure 21: Envisioned program impact

Considering vast potential, the EESL's entry into the different motor segments would be carried out in a phased manner as represented in Figure 21.

3.3. Capitalizing on strengths

3.3.1. Leveraging existing partnerships for Demand Aggregation

Owing to its existing relationships with several companies in the industrial segment and central/industry bodies (such as BEE, State Distribution Utilities etc.), which have been built as a part of its ongoing programs, EESL has ample opportunity to leverage the same for demand aggregation. As the level of market attractiveness for the transitions envisaged (IE 1 to IE 3 and IE 2 to IE 3) is different, the phasing of the procurement is expected to follow a carefully calibrated approach (Ref: Fig 22).



- > IE 1 to IE 3 transition would take to the adoption process from being a Big Hit to a Quick Win
- > IE 2 to IE 3 transition would take the adoption process from the Waiting game stage to a Quick win

Figure 22: Prioritization matrix for EE motor transition

- Owing to a gap of 6-8% between the efficiency of IE 1/Sub IE 1 and IE 3 motors, the potential for energy reduction is high leading to low payback period. Therefore, it is proposed to target IE 1/Sub IE-1 motors replacement in the demand aggregation on an immediate basis.
- The transition from IE 1 to IE 3 motors would involve measures to ensure market readiness, which is envisaged to be done through a combination of bulk procurement and creation of institutional structure. The gap between the efficiency of IE 2 motors and IE 3 motors is relatively lower (2-3%) leading to relatively higher payback period as compared to the transition from IE1 to IE 3. The demand aggregation for this segment is proposed to be carried out in the medium term.

3.3.2. Quick Resource mobilization

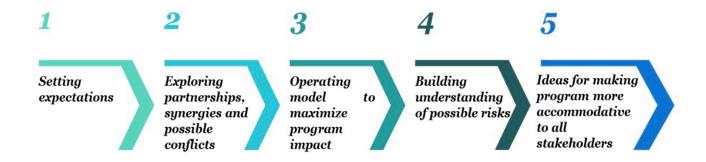
National Motor Replacement Program is essentially envisaged as a bulk procurement and sale program. Depending on the off-take of different models developed as a part of NMRP, the human capital requirements may vary. Over the years, through the experience gathered through its programmatic interventions, EESL has developed the capability to mobilize and deploy human capital at a fast pace. This capability is seen by EESL as crucial to ensure adherence to the program timelines and objectives.

As far as the financing requirement is concerned, **the ability to raise low cost capital from Bilateral/Multilateral agencies** is seen by EESL as its competitive advantage. It is envisaged that the capital requirements for NMRP would be met through sources such as Market Bonds, Commercial Finance and International Finance in addition to own equity. EESL is already accessing Lines of Credit & TA grants from Multilateral Agencies such as ADB, UNEP and GEF. The existing relationship with these international agencies would be leveraged as a part of the NMRP programme as well.

3.4. Mitigating risks

While the opportunity is huge, EESL has also foreseen a few risks, for which mitigating steps have been taken. With the objective of ensuring that the program is structured by giving due consideration to the perspectives of all relevant stakeholders, multiple rounds of stakeholder consultations were carried out with Multilateral agencies, motor manufacturers, end users and various industries and industry bodies.

These discussions revolved round the following themes:



In these stakeholder consultations, the program idea was presented to OEMs, Industry and other important stakeholders in the motor manufacturing value chain and the participants were briefed on the envisaged institutional structure, benefits and overall impacts. Thereafter, industry views were sought on risks and challenges foreseen, sectors to be targeted and phasing of the program for optimal results. The feedback and discussions in the stakeholder consultation were used to build a perspective of the market, which was used to structure the models for implementation, development of business case for industries, phasing of the program and plan for program awareness and dissemination activities (Ref: Table 1).

Table 1 Barriers and Mitigating elements in program

Barrier foreseen	Nature of risk	Risk rating	Mitigating elements incorporated in operating framework
High upfront costs for consumer/ Non availability of funds for CAPEX	Supply side and Demand side		 Targets for price reduction due to bulk procurement On-bill financing option to consumer for payment
Apprehensions about 'Shared savings model' in context of motors	Technology risk		 Pilot projects for all motor ratings included as a part of the program Motor performance documentation to state what ambient and over-temperatures are allowed, and to what extent motors and systems can be safely operated in overload conditions to overcome the fear that stoppage of motors would disrupt production
Long delivery time of motors	Supply side	•	Fixed delivery timeline after placing Letter of Indent
Lack of demand from industries	Demand Side		 Leveraging the existing network of EESL with various institutions across India to identify consumers who are interested in the implementation Phasing of program to capture the easier and bigger segment (rating wise) before moving to relatively difficult segments. Inclusion of add-on features such as extended warranty, after sales support and option for PMC services to make the proposition more attractive Exploring synergies in demand aggregation through empanelled partners. Specifying minimum lot size per industry Consumer awareness program to address resistance to change



4. Program Implementation Framework

NMRP would be open for participation to any industrial unit (existing or new) throughout India. The program would involve replacement of existing inefficient motors (non-IE/ IE1) with 2 pole/4-pole/6 pole foot/flange mounted LT induction motors (IE3). Procurement would be done through National and International Competitive bidding. The following section describes the key features of the service to be offered to the industries.

4.1. Business model and its value proposition

Energy efficiency can move to the top of the list of corporate priorities if the proposals reflect distinct corporate needs. Industrial facility managers usually have to convince corporate management to make energy efficiency improvements, which are often deprioritized compared to production related CAPEX investments. An effective way to address this is to strategize and disseminate the economic impact of the efficiency improvement to users. Considering thelifecycle costing approach, initial purchase cost is around 3% of the total life cycle cost, whereas energy cost accounts for around 90% of the total life cycle cost. Therefore, a conscious endeavourwill be made to use this approach for securing customer buy-in. Pilot projects can be of great help in establishing the energy savings claimed by the motor manufacturers.

Benefits to customer



- Energy Savings & Cost savings
- Access to superior 'green' product
- Financial advantage through EESL's business model

Benefits to motor manufacturers



- Better capacity utilization through increased demand for IE3 motors
- Enhanced market reach
- Market expansion for the motor replacement market

Benefits to Government/Utilities



- Reduced peak demand
- Creating market transformation through energy efficient product
- Support to DSM Program

Benefits to Nation

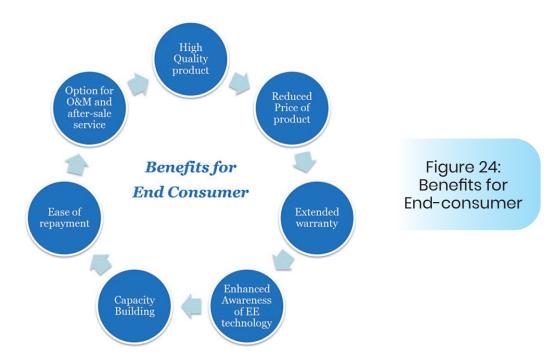


- Reduced power shortages
- Energy Security
- Contribution to India's climate change goals by reducing GHG emissions

Figure 23: Benefits to key stakeholders

Table 02: Key features of EESL proposition to Industries

Attributes	butes CONVENTIONAL MODEL EESL MODEL	
Motor Type Offered	IE2 / IE3 motors	IE3 motors
Warranty	18 months from delivery date	36 months from delivery date
Capital Investment	Investment by End User	Investment by EESL (ESCO Mode)
Pricing	Retail price offered by dealers 20-25% reduction from retail price - discovered through	
Procurement of Product	Direct purchase or bidding	Bulk procurement through open bidding



"NMRP, is going to be a huge game changer because of its innovative design. It is expected to help industries overcome the "first cost" financial barrier for replacing their old, inefficient motors and enjoy the advantage through higher energy savings and lower electricity bills.

Mr. Mayur Karmarkar MD, International Copper Association of India (ICAI) Two primary business models, namely PMC model and ESCO model are proposed for NMRP. The applications considered for the motor replacement are Pumps, Fans, Blowers and Compressors.

Model # 1: Supply Contract /Project Management Consultancy (PMC) Model: In this model, the end user shall bear the product cost as discovered through open competitive bidding done by EESL. EESL shall provide PMC support to the end users.

The PMC support includes the following:

Motor load survey: Estimation of baseline inventory and energy consumption through structured and scientific approach (Optional)

Finalization of the scheme for replacement: Number of motors to be replaced, technical specifications, estimation of energy saving, investment requirement etc.

Procurement of Motors: Transparent & fair procurement process done on behalf of end user through open competitive bidding model.

Supply of Motors to User Site: Facilitation/Management of supply of motors to the user site with due coordination with the supplier

Warranty Obligation: Ensuring 3 years' warranty obligation with the supplier

Update in National Motor Dashboard: Estimated Energy Saving and other benefits to be reflected in a national dashboard. A one-time PMC fee is payable by end user to EESL for the above responsibilities which is about 8 - 10% of the material cost. The payment terms will be mutually decided between the end user and EESL.

Model # 2: Shared Saving, Energy Servicing Company (ESCO) Model: In this model, the entire up-front investment will be done by EESL in addition to the PMC activities as described above. Here, the project cost will include material cost-plus PMC fees plus the interest rate on debt and return on equity of the EESL investment. The repayment to EESL by the user can be done through Equated Quarterly Instalments (EQIs) for a maximum of three-years period. It is observed that the repayment amount to EESL by the end-user is about 50-70% of the monetized savings accruing through the improvement in efficiency of the motor. The key costs borne by EESL in the two business models is provided in the infographic shown below:



Shared savings/ESCO model

- · Inventory collection
- · Facilitation in Procurement
- · Warranty (Extended)
- Investment by EESL
- Project Monitoring

Supply Contract - PMC model

- · Inventory collection
- Facilitation in Procurement
- · Warranty (Extended)
- Project Monitoring

Figure 25: Key costs borne by EESL in its business models

4.2. Program Administration

EESL will be the program administrator and will have direct agreement with the consumer (industry). The role of program administrator will be aggregating the demand, procurement of material, providing upfront financing, obliging warranty till project duration. The roles of other key stakeholders are presented in figure 26:

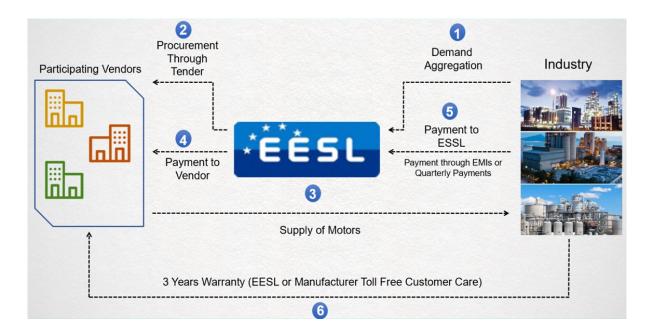


Figure 26: Program administration

• **Demand Aggregation:** Empanelment of agencies would be carried out to act as "Demand Aggregator". These agencies would identify and facilitate the engagement and tie-up with industries and industry bodies for seamless demand generation through the program duration.

- **Demand Aggregation:** Empanelment of agencies would be carried out to act as "Demand Aggregator". These agencies would identify and facilitate the engagement and tie-up with industries and industry bodies for seamless demand generation through the program duration.
- Outreach: A separate agency would be engaged to carry out outreach activities. This agency would work in close co-ordination with EESL to spread program awareness across different geographies and across different industry segments.
- **Supply & installation:** EESL will supply the motors to the industry. The Vendors would distribute the motors to the Client Industries under EESL supervision. However, the installation will be done by the clients themselves after receiving the motors.
- After sales service: In addition, the supplier would be responsible for after sale service. The supplier shall maintain a functional toll-free Customer Care Helpline Number for recording consumers' complaints and ensure appropriate course of action is initiated against each complaint. The supplier shall have to resolve all complaints received to the satisfaction of the consumer. The installation of motors would be carried out by the end-user as per the specifications.
- **Post Installation verification:** EESL may conduct random visit to the industries site to see the implementation work, check & verify installation by industry.

Program Web Portal and Dashboard: EESL has developed a Program Web Portal and Dashboard which will facilitate demand aggregation, effective program management as well as display the impact of the program through a "Dash Board". Figure 27 presents the key stages from the beginning till the end.

This online platform will not only help industries to enrol in the NMRP by submitting their request for motors replacement to EESL but also provide complete tracking of the project starting from their enquiry submission till the repayment of the delivered motors.

The portal is extremely user friendly in terms of access to information regarding NMRP on aspects like key features of the program, product technical details, case studies and benefits for different stakeholders.

For the users, one of the key features on the web portal is an energy savings & payback calculator that is convenient, easy-to-use tool for understanding the amount of energy & cost savings potential and carbon emission reduction. It is also helpful in analysing the simple payback period for recovering the incremental cost users pay to purchase the IE3 motors.

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Website Link: www.motor.eeslindia.org

Vision Document



Figure 27: Process flow in Program Dashboard



AN OVERVIEW OF THE TIMELINES FOR VARIOUS ACTIVITIES IS PROVIDED IN TABLE 3.

S. No.	Activity	Timeline (Days)
Α	Receipt of Query from client	Day 0
В	Submission of draft proposal by EESL	Day 5
c	Letter of Intent from client to EESL	Client dependent
D	Motor load survey (Optional)	15 Days (from C)
E	Submission of revised proposal	2 Days (from D)
F	Letter of Acceptance by client to EESL	Client dependent
G	Agreement signing	15-20 Days (from F)
н	Procurement of materials by EESL and supply to client	45-60 Days (from G)
1	Completion certificate by client to EESL	Maximum 180 Days (from H)
J	Payment to EESL	As per agreement

Table 03: Timelines for various activities of implementation

NMRP plans to develop a recycling program at a later stage to scrap the old, inefficient motors which are replaced with IE3 motors. This would not only reduce inefficiencies that linger in the system due to recycling of old motors, but also have potential for reducing the cost of the new motors.

4.3. Program Monitoring and progress evaluation

A regular evaluation of processes and results is vital to success of any plan. As a part of the strategy formulation exercise, a mechanism has been developed to track the progress of the program. The mechanism has been made flexibly designed to accommodate any changes that may be needed to meet the goals. The following parameters would be tracked on a continuous basis to evaluate progress:

- Change in market conditions that may require a change in corporate direction.
- New entries in the marketplace that may pose a competitive threat.
- Success of the EESL in translating strategy into actionable steps.



Annual Review

True end of State end of State

Figure 28: Review mechanism

The program evaluation will be done on a continuous basis through the Dashboard, which would be developed on the lines of the existing dashboards for other programs such as UJALA, SLNP etc. In addition, as illustrated in the Implementation roadmap, medium term and long-term reviews would also be carried out. A three-tier review structure in addition to the concurrent review through the dash board is proposed. This would comprise of Phase reviews, Annual reviews and Program reviews (Ref: Fig 28)

4.4. Pilot Studies

As a part of the NMRP, EESL undertook various pilot studies of total 36 motors (in Ahmedabad, Surat, Jamnagar & Mumbai). These pilot studies were carried out by reputed energy audit firms and with support of Institute of Sustainable Communities (ISC).

- **Objective:** Quantifying the energy saving and potential of implementation of 36 nos. IE3 motors across the different motor ratings chosen to be procured as a part of Phase-1.
- **Process:** The process of pilot implementation involved the steps illustrated in the infographic shown below.
- Type of Industries: Brass, Textile, Chemical and Automobile.
- **Type of Load:** Compressors, pumps, fans and blowers.
- **Process:** The process followed for implementing the pilot comprised of the stages as indicated in .



Initial preparatory works

- Meeting of project team with EESL Meeting of selected units
- Formulating project schedule and identifying primary data required
- Interaction meetings with the concerned departments of the plant

Establishment of Baseline

- Collecting information on inventory and operating parameters
- Measurement of electrical and mechanical parameters
- Measurement of functional parameters of the driven system
- Analysis of measured/collected data to evaluate SEC
- Preparation of recommendation of proper sizing of the motor

Procurement, Installation and Commissioning

- Preparation of technical specifications and bidding documents
- Preparation of comparative documents of bidders
- Procurement of IE motors and verification of supplier certification
- Facilitation of replacement of identified motors
- Collection of implementation certificate

Post implementation M&V

- Measurement of the electrical and mechanical parameters
- Measurement of functional parameters of the driven system
- Analysis and presentation of energy performance improvement, deemed saving and other notable observation during pre and post implementation
- Documentation of results

Figure 29: Stages in Pilot Implementation

Output: The activities shown in translated into the following outputs:

Baseline report containing specific power consumption and recommendation of proper sizing of the motor Procurement and installation of IE3 motors

Final report containing observations, recommendation and techno-economic evaluation



Figure 30: On-site motor replacement



Figure 31: Measurement and Verification



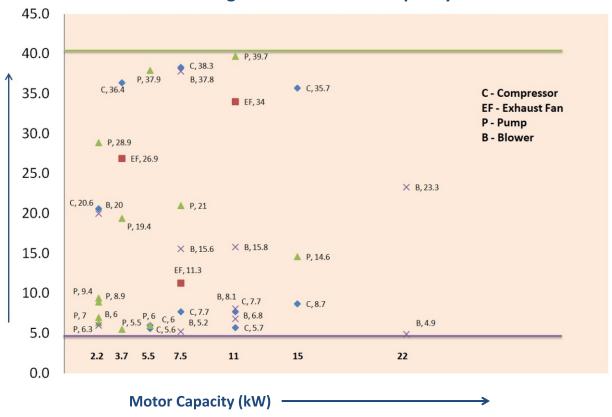
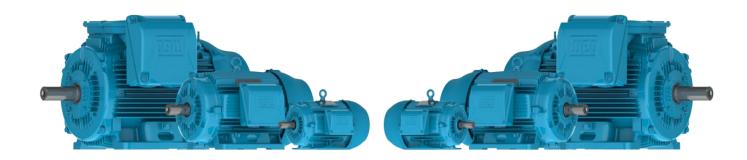


Figure 32: kWh savings in various motor capacities

Results: Power savings were observed across all the pilot installations of IE3 motors, which varied across different installations due to difference in operating parameters. Various benefits were derived after retrofitting IE3 motors which are 4.9 to 39.7% kWh saving, 0.6 to 2.2% increase in speed, 8.4 to 17% decrease in bearing temperature, (3 to 5.6%) decrease in vibrations level (Horizontal & Vertical). Overall, the pilot program was successful in meeting its stated objective of establishing energy savings through motor replacement.



4.5. Case Study of Implementation: Textile Sector

Customer: Banswara Syntex Limited

Year of Implementation	2018
Type of Investment	Medium; Zero Capital Investment by Customer
Annual Energy Savings (kwh)	2,44,094 units
Annual Cost Savings (INR)	14,64,563
Payback Period	2 years 5 months

BANSWARA Syntex Ltd. is one of the largest single-mill set ups of fiber-dyed yarn in ASIA. It is a government-recognized Four Star Export House having IS/ISO 9001:2008 certification & IS/ISO 14001:2004 certification by the Bureau of Indian Standards. Banswara approached Energy Efficiency Services Ltd. (EESL) to participate in its National Motor Replacement Program (NMRP) to replace its old motors with IE3 motors. In the 1st Phase itself, 125 nos. motors were identified for replacement ranging from 3.7kW, 5.5kW, 11kW, 15kW & 22kW, 4 Pole. Under NMRP, EESL offered to supply IE3 motors through its ESCO mode which would help to reduce the financial burden on the customer and simultaneously enjoy the savings from the first day of installation itself. Here, the entire investment was done EESL starting from motors procurement, negotiating extended warranty and supplying of motors to the particular site as desired by the customer. The repayment for the procured motors was decided mutually by EESL and customer to be in Equated Quarterly Instalments (EQI) in a time span of 3 years.

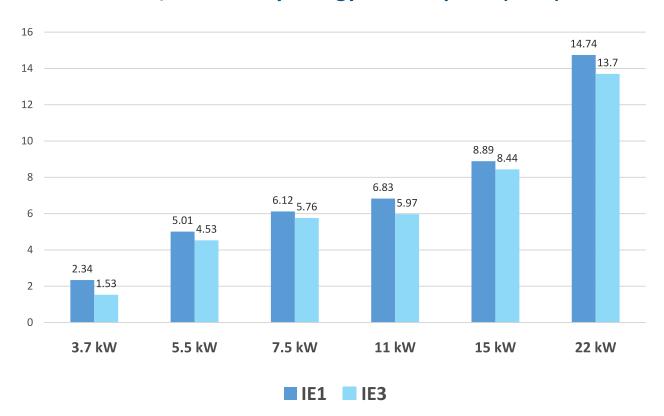
4.5.1. Procurement and Supply of Motors

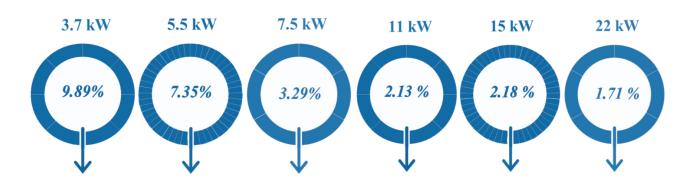
Inventory Collection was done through EESL's specially designed WEB Portal to facilitate customers in ease of sending enquiry and closing the order with EESL. The procurement of IE3 motors of reputed brands was done by EESL on behalf of customer through a fair & competitive bidding process. This could help in achieving lower market prices with extended warranty terms for the customer. The entire project was closely monitored by EESL from start to end including the complaint management system for the customer.

4.5.2. Implementation

The required IE3 motors were supplied to the customer as per their delivery schedule. The old inefficient motors were replaced by IE3 motors and installed by the customer in a staggered manner so that the plant production was not hampered. The replacement activity resulted in decent savings in each rating(kW) of motor and the results were monitored over a period to establish the energy & cost savings through installation of IE3 motors. The hourly energy consumption & annual energy savings (%) are as under-

IE1 v/s IE3 Hourly Energy Consumption (kWh)





Ratings wise Energy Savings (%)

4.5.3. Conclusion

The procurement of motors under the ESCO Mode, not only resulted in energy savings but also provided financial support to the customer to invest in replacing the motors at a larger scale. This Shared Savings approach was effectively utilised in repaying the project cost which was around 20% of the savings received by the customer every quarter. Thus, the customer could reap benefits of the program by enjoying annual cost savings of Rs.15 Lakhs with an annual investment of Rs.12 Lakhs. The total payback period for recovering the incremental cost of IE3 motors under this project was estimated around 2 years 5 months.



Total Energy Savings in Units

66,866 kWh



Total Cost Savings at rate of ₹6 / unit

43.93 Lakhs



Cost of Investment for 125 nos. IE3 Motors for

35.88 Lakhs



Simple Payback Period

2.4 years



Energy Efficiency Services Limited

EESL Established in 2009, EESL is a joint venture of PSUs under Ministry of Power (Govt. of India), like NTPC Limited, PFC, REC and PGCIL which was set up to create and sustain markets for energy efficiency in the country. EESL is leading the market related activities of the National Mission for Enhanced Energy Efficiency (NMEEE), one of the 8 national missions under Prime Minister's National Action Plan on Climate Change (NAPCC). Since its inception, EESL has been pioneer in implementing large scale energy efficiency projects in India through innovative financing and service mechanism. The Flagship LED programs like UJALA and Street Lights are testimony to EESL's success stories over last 3-4 years which has not only created market transformation in energy efficiency but also been able to result employment, CO2 emission reduction and improving lifestyle of fellow citizens. EESL is engaged with various stakeholders and entities like end users, electricity utilities, state governments, manufacturers, service providers, Financial institutions and test laboratories to bring success to these programs. EESL looks forward to provide investment and transaction based services to Industries in their effort to transition into an energy efficient and sustainable future.



International Copper Association India

The International Copper Association India (ICA India) is a member of Copper Alliance and the Indian arm of the International Copper Association Limited (ICA), the leading not for profit organization for the promotion of copper worldwide set up in 1959. ICA India was formed in 1998 to actively associate with the growing number of copper users in India. The objective is to "Defend and grow markets for copper based on its superior technical performance and its contribution to a higher quality of life worldwide". ICA India conducts various programs in the interest of Electrical Safety, Energy Efficiency and Sustainability, employing a mix of market development and regulation advocacy approach to encourage the use of copper.

As a knowledge partner, ICA India has partnered with EESL since 2017 for supporting the National Motor Replacement Program in terms of developing program framework, demand aggregation & capacity building of industries to address the technical barriers related to adoption of energy efficient motors.





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OUR SUPPORTING PARTNERS





