# ireema TECHNICAL NOTE

Supporting Iran in implementation of an integrated energy efficiency market

Technical Note No. 9

# An investor's perspective on the M3E

*Stefan Gorgels*

*Lars Handrich*

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## About IREEMA

Iran belongs to the top ten greenhouse gases emitting countries in the world and the Iranian economy is the most energy intensive of all oil and gas producing nations. Domestic energy tariffs are set by administrative decree far below export market prices. Over the last decade, the energy productivity in Iran declined further. Iranian policy makers are aware of the need to the increase energy efficiency (EE) of the economy.

With the adoption of the Article 12 of the “Law on elimination of barriers to competitiveness and improving the country’s financial system” the legal basis was created for specific economic incentives for energy efficiency investments. Because the implementation mechanism is still to be developed, investment projects have not yet been implemented on a large scale.

The IREEMA project shall support Iran’s Vice-Presidency for Science and Technology to implement an integrated energy efficiency market in practice.

The project therefore aims at developing together with the responsible Iranian stakeholders an efficient implementation mechanism and to lower transaction costs for potential investors. In addition, the project aims at testing this approach in practice by developing the huge energy efficiency potential in the country in two main areas: the gas sector with special focus on the South Pars Special Economic Energy Zone (PSEEZ) in Assaluyeh and the sustainable energy supply in selected rural pilot areas. In case of necessity, adjustments of the implementation mechanism will be suggested accordingly to ensure proper functioning. The implementation mechanism shall become the corner stone of the integrated market for energy efficiency in Iran. Such a functioning mechanism could foster the implementation of Iran’s INDC and even raise the ambitions of policy makers.

IREEMA
c/o DIW Econ GmbH
Mohrenstraße 58
10117 Berlin, Germany

Project Manager: Dr. Lars Handrich

Tel: +49 (30) 2060 9720
Fax: +49 (30) 2060 97299

service@ireema.com
www.ireema.com

## درباره IREEMA

ایران در لیست ۱۰ کشور دارای بیشترین انتشار دی اکسیدکربن به جو قرار دارد و در میان تولیدکنندگان نفت و گاز، شدت انرژی اقتصاد ایران از همه بیشتر است. با اینحال، تعرفه های داخلی حامل های انرژی توسط دولت و به صورت یارانه ای معین می گردد. تعرفه های حاملهای انرژی در ایران بسیار پایین تر از قیمت صادراتی آنهاست. از این رو، در طی دهه گذشته، بهره وری انرژی در ایران به شدت افت کرده و دولت به اهمیت بهینه سازی مصرف انرژی پی برده است.

با تصویب ماده ۱۲ قانون «رفع موانع تولید رقابت پذیر و ارتقاء نظام مالی کشور» بستر قانونی مشوق‌های مالی برای سرمایه گذاری در امر بهینه سازی انرژي فراهم گشته ولی ازآنجا که ساز و کارهای اجرایی این مشوق ها هنوز پیاده سازی نشده اند، تاکنون سرمایه گذاری خاصی در این زمینه صورت نگرفته است.

پروژه ی IREEMA، معاونت علمی و فنآوری ریاست جمهوری ایران را در راستای ایجاد و توسعه ساز و کار بازار متمرکز بهینه سازی انرژي حمایت میکند.

لذا هدف این پروژه و ذینفعان مسوول، این است که در نهایت، ساز و کاری موثر و دارای کمترین هزینه جانبی، برای سرمایه گذاران بالقوه فراهم گردد. بعلاوه این پروژه در نظر دارد که رویکرد به دست آمده را به صورت عملی مورد آزمون قرار دهد؛ بدین صورت که پتانسیل بزرگ بالقوه بهینه سازی انرژی را در دو عرصه مهم اجرایی نماید: یک، در بخش گاز با تمرکز بر منطقه ویژه اقتصادی انرژي عسلویه؛ و دو، در بخش تامین پایدار انرژی در مناطق پایلوت روستایی منتخب. بر این اساس و در صورت نیاز، ساز و کار ایجاد شده با پروژه‌های واقعی سنجیده شده و در جهت رسیدن به بهترین شیوه و عملکرد، تغییرات لازم ایجاد می گردد. اجرای این مکانیسم، بنیان بازار متمرکز بهینه سازی انرژی را شکل خواهد داد و چنین ساز و کار موثری می تواند به ایران در اجرای اهداف INDC توافقنامه پاریس و به سیاست گذاران در رسیدن به اهداف بلند پروازانه بهره وری انرژي کمک رساند.

# Executive Summary

The functioning of the Market for Energy Efficiency and Environment (M3E) depends critically on the economic viability of M3E projects as perceived by investors. Investors will only participate in the M3E if the benefits of investing in energy efficiency under the M3E are large enough to recoup the investment costs quickly enough.

This paper adopts the perspective of a potential investor who considers investing in an energy-efficient electric motor. Based on real-world data from a brick factory, we evaluate the costs and benefits of two investment decisions. First, if an investor needs to decide whether to invest in a new motor or keep the old one, the total costs are compared to the total benefits of the new motor (total cost approach). Second, if the investor must invest in a new motor anyway, but needs to choose between motors of different efficiency levels and costs, the additional costs of the more energy-efficient motor are compared to the additional benefits (additional cost approach).

Although the M3E offers the additional benefit of selling saved energy to high-tariff domestic consumers, the motor replacement project is not economically viable when saved energy is sold domestically. The payback period is 15 years for the total cost approach and 8 years for the additional cost approach, substantially exceeding the investment horizon of Iranian investors of 3-5 years.

The economic viability of any M3E project ultimately depends on the certificate price at which saved energy can be traded. Two alternative price scenarios are compared to the reference scenario in which saved energy is sold domestically to a public consumer at a tariff of 2 476 IRR/kWh. In scenario 1, Iran imposes higher domestic tariffs (6,000 IRR/kWh) comparable to neighbouring countries. In scenario 2, exports of saved energy (7,804 IRR/kWh) are allowed under the M3E. Both scenarios significantly reduce the payback periods of the motor replacement project and thus improve its economic viability from the perspective of investors. Additionally, we compute the “shadow price” of economic viability, i.e. the minimum certificate price such that the payback period does not exceed the investment horizon of 3-5 years. Under the additional cost approach, the shadow price is 4,100 IRR for a payback period of 5 years and 6,800 IRR for a payback period of 3 years.

Additionally, we adopt a dynamic perspective to investigate how the opportunity cost of capital affect the economic viability of M3E projects. We approximate the opportunity cost of capital with the interest rate on bank deposits. Since investment costs are paid upfront and the benefits of energy-efficiency investment are paid year by year, discounting the costs and benefits by the opportunity cost of capital reduces the economic viability of M3E projects. The shadow price increases from 4.100 IRR to 5,400 IRR for a payback period of 5 years.

The economic viability of energy-efficiency projects is further limited by high inflation rates in Iran. Over the last decade, the general price level increased much faster than electricity and gas prices, such that investors expect the purchasing power of M3E benefits to decrease. Investors will thus discount future cash flows accordingly, thereby lengthening the payback periods and reducing the economic viability of M3E projects. High inflation rates are thus a major obstacle for a functioning M3E in Iran.

Finally, the complex M3E project cycle imposes transaction costs and uncertainties on potential investors that are hard to quantify in monetary terms, but may still deter potential investors.

To improve the economic viability of M3E projects, it is thus recommended to:

- increase certificate prices either by increasing domestic tariffs or by allowing for exports,
- control inflation,
- simplify the project cycle to reduce transaction costs and uncertainties.

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# List of Abbreviations

| | |
|---|---|
| CAPEX | Capital Expenditures |
| CBA | Cost-Benefit Analysis |
| $CO_2$ | Carbon Dioxide |
| EE | energy efficiency |
| IE1, IE2 | International Energy Efficiency Standard 1 and 2 |
| IREEMA | Iranian Energy Efficiency Market |
| IRR | Iranian Rial |
| kW | kilo Watt |
| kWh | Kilo Watt hour |
| Mio IRR | Million Iranian Rial |
| M&V | Monitoring & Verification |
| MWh | Mega Watt hour |
| M3E | Market for Energy Efficiency and Environment |
| NPV | Net Present Value |

# 1 Introduction

*Incentives for energy efficiency investments in Iran*

The Iranian economy is one of the world's most energy-intensive economies: for each unit of economic output, Iran uses more energy than most other countries[1]. This energy intensity is closely related to the fact that energy tariffs in Iran are exceptionally low by international standards. These low energy tariffs provide little economic incentives for firms and households to invest in energy-efficient technologies and products. Energy costs saved by investing in energy-efficient technologies are too small to amortise the investment cost. In short, investments in energy-efficient technologies are rarely economically viable.

The Market for Energy Efficiency and Environment (M3E) was introduced to provide economic incentives to private investors for investing in energy-efficient technologies. It does so by exploiting the complex structure of the Iranian energy tariff system, which charges different energy tariffs for different domestic consumer groups. Consumers with low energy tariffs who saved energy due to energy-efficiency investments can purchase this saved energy at their low tariff and then resell it at a higher price to consumers with a higher tariff. The functioning of the M3E thus depends on whether the additional benefit of trading saved energy in the M3E is sufficiently large to make energy-efficiency investments economically viable.

*An investor's perspective on the M3E*

To better understand which factors determine whether an M3E project is economically viable, this paper adopts the perspective of a potential investor. Based on the real-world example of a motor replacement project in a brick factory, we evaluate the costs and benefits of two investment decisions[2]. First, if an investor needs to decide whether to invest in a new motor or keep the old one, the total costs are compared to the total benefits of the new motor (total cost approach). Second, if the investor must invest in a new motor anyway, but needs to choose between motors of different efficiency levels and costs, the additional costs of the more energy-efficient motor are compared to the additional benefits (additional cost approach).

It will be shown that the economic viability of M3E projects depends crucially on the certificate price at which saved energy is sold. In particular, we develop two alternative scenarios with higher prices. In scenario 1, Iran imposes higher domestic tariffs comparable to neighbouring countries. In scenario 2, exports of saved energy are allowed under the M3E. Both scenarios significantly reduce the payback periods of the motor replacement project and thus improve its economic viability from the perspective of investors. Additionally, we compute the "shadow price" of economic viability, i.e. the minimum certificate price such that the payback period does not exceed the investment horizon of 3-5 years.

In addition, we adopt a dynamic perspective to investigate how the opportunity cost of capital and inflation affect the economic viability of M3E projects. Since investment costs are paid upfront and the benefits of energy-efficiency investment are paid year by year, discounting the costs and benefits by the opportunity cost of capital reduces the economic viability of M3E projects. Similarly, the fact that in Iran the general price level increased faster than energy tariffs in recent years induces investors to discount future cash flows due to an expected decrease in purchasing power.

[1] Enerdata Global Statistical Yearbook 2019.

[2] While the project covered in this paper uses electricity as the energy source, a similar analysis could be applied to another project based on natural gas, which is also covered by the M3E.

*Organization of the paper*

This technical note proceeds as follows. The second chapter provides technical background information on the motor replacement project. The third chapter conducts a cost-benefit analysis of a potential investor based on a static perspective. Chapter four focuses on the certificate price as a crucial determinant of economic viability. Chapter five discusses how dynamic factors such as the opportunity cost of capital and inflation affect the economic viability of the motor replacement project. The final chapter provides some concluding remarks and recommendations.

# 2 Background Information: Motor Replacement Project

*Investment decision for an energy-efficient motor*

In the following, the most important factors affecting the economic viability of an energy efficiency project are investigated in the example of an owner of a brick factory considering investing in an energy-efficient electric motor[3]. It is a real-world example from the Pilot Projects identified in the Ireema-project.

The motor replacement project is particularly informative, as it illustrates the basic trade-offs faced by investors. Furthermore, switching to a more efficient motor can be considered a typical project under the M3E since it can easily be replicated and scaled across factories and industries (see Technical Note 8: The standardization of projects in the M3E).

*Technical background on the motor replacement example*

The basic benefit of any energy efficiency investment is to save energy and reduce energy costs. In our example, the owner of a brick factory considers replacing the old motor currently in use (see **Figure 1**) with a new electrical motor of higher energy efficiency standards. However, a factory owner will only invest in a more energy-efficient motor if the benefits of the investment exceed its cost.

**Figure 1: Motor used in a brick factory in Iran**

Source: FICHTNER.

[3] The investor could be the owner of the brick factory or an external investor. The following analysis applies either way. For illustrative purposes, we assume that the owner is the investor. Therefore, we use the terms investor and owner interchangeably.

**Table 1** provides an overview of the technical specifications of the motor replacement project. It is presumed that project owners planning to buy a new motor can choose between motors of international efficiency standard 1 (IE1) and 2 (IE2)[4]. The IE2 standard is comparable to Iranian Energy Class C and is the most efficient motor standard available in Iran.

In the example of a brick factory, motors with a capacity of 15 KW are assumed to have an efficiency of 86.5% under the IE1 standard and 90.7% under the IE2 standard[5]. The energy efficiency of motors decreases with age. Therefore, for the motors to be replaced, it is assumed that their efficiency is 82% which is 5% lower than their original IE1 standard. It should further be noted that the brick factory's productivity is assumed to be unaffected by the efficiency level of the motor.

It is further assumed that a typical brick factory operates about 8 hours per working day and each motor is running in full load 3 working days per week over the whole year. This assumption accounts for downtimes due to weekends, holidays, production interruptions and intermittent production processes. In total, the motors are used 52 weeks per year x 3 days per week x 8 hours per day for 1248 hours at full load (compare **Table 1**).

**Table 1: Technical specifications: Electric motor efficiency levels**

| | |
|---|---|
| Motor size | 15 kW |
| IE1 efficiency standard | 86.5 % |
| IE2 efficiency standard | 90.7 % |
| Assumed baseline efficiency of old motor | 82.0 % |

Source: Own data collection for pilot projects

*Electricity consumption and $CO_2$ emissions using motors with different energy efficiency standards*

Based on the technical specifications provided above, **Table 2** presents the electricity consumption and $CO_2$ emissions for each motor. The annual electricity consumption of the baseline motor, i.e. the motor currently used, is 22.8 MWh, compared to 21.6 MWh for the IE1 motor and 20.6 MWh for the IE2 motor. The IE2 motor thus consumes 2.2 MWh or 10 per cent less electricity than the baseline motor currently in use. The IE1 motor consumes 1.2 MWh less electricity.

**Table 2: Electricity Consumption and $CO_2$ Emissions**

| | |
|---|---|
| Electricity consumption per year (Baseline) | 22.8 MWh/year |
| Electricity consumption per year (IE1) | 21.6 MWh/year |
| Electricity consumption per year (IE2) | 20.6 MWh/year |
| $CO_2$ Emissions per year (Baseline) | 13.5 t $CO_2$/year |
| $CO_2$ Emissions per year (IE1) | 12.8 t $CO_2$/year |
| $CO_2$ Emissions per year | 12.2 t $CO_2$/year |

[4]According to the classification of EU directive 2005/32/EG

[5] To be more precise, this example refers to a 15kW two-pole three-phase asynchronous induction machine.

Since the generation of electricity is associated with $CO_2$ emissions, a lower electricity consumption also implies a reduction in $CO_2$ emissions. **Table 2** shows that switching to an IE2 motor reduces $CO_2$ emissions by 1.3 tons per year, in comparison with the motor of the baseline scenario. Choosing an IE1 motor would only lead to saved emissions of 0.7 tons per year[6].

*Specifying the investment decisions*

The owner's investment decision may take two forms: First, the investment decision might be between investing in a new (more energy-efficient) motor or keeping the motor currently in use. Second, if the motor currently in use must be replaced, the investment decision is one between various new motors with different efficiency levels and costs. Both investment problems are closely related in the sense that once the owner has decided to replace the motor currently in use, the second question of which motor to invest in emerges naturally.

In the following, we will investigate each of the two investment problems separately for two main reasons. First, there are situations in which only one of the investment problems is relevant. Most importantly, the owner may be forced to invest in a new motor if the old motor must be replaced for technical reasons. In this case, the first investment problem of whether to invest at all is irrelevant, the only question remaining is which new motor to invest in. Second, there are important differences in how the costs and benefits are evaluated by the owner in each of the two investment problems. To decide whether to invest in a motor at all, the benefits of a replacement should be compared to the total cost of investing in a new motor (hence the total cost approach). When deciding between two motors, the additional benefits of the more efficient motor should be compared to its additional costs (hence the additional cost approach). Therefore, the following analysis will investigate each of the two investment problems separately.

# 3 Economic Viability: Static Perspective

In the following, a basic calculation of economic viability is provided on the example of the motor replacement project. This section evaluates the costs and benefits of motor replacement using a static approach. Section five includes dynamic factors such as capital costs and inflation in the analysis.

## 3.1 Investment Costs

As discussed above, the motor replacement project may be separated into two investment decisions from the perspective of the owner of the brick factory. First, the owner must decide whether to invest in a new motor or not. Second, given that the investor decides to invest in a new motor, he may need to choose between motors of varying efficiency standards and costs. In this section, the relevant investment costs for each of the two investment decisions - the **total cost approach** and the **additional cost approach** - are discussed separately.

*Total Cost Approach: Investing in a new motor rather than keeping the old one*

If the investor faces the decision of whether to invest in a new motor or keep the old motor, the economic viability of the investment should be evaluated based on the *total capital expenditures* (CAPEX) of the investment. Capital expenditures only capture costs of capital and do not include

[6] $CO_2$ emissions are computed based on the emission grid factor for 2021 of 0,000592 t CO2/kWh provided by UNFCC, available at: https://unfccc.int/climate-action/sectoral-engagement/ifis-harmonization-of-standards-for-ghg-accounting/ifi-twg-list-of-methodologies

variable or operating costs such as material or labour costs[7]. The payback period of the investment is then calculated as follows:

$$Payback\ Time = \frac{\text{Total}\ Capital\ Expenditures}{Total\ Benefits\ per\ year}$$

The payback time indicates how many years it takes until the accumulated yearly benefits pay back the investment cost.

*Additional Cost Approach: Investing in a new motor with higher or lower energy-efficiency standard*

In practice, the additional cost approach is more relevant if the investor must invest in a new motor anyway. This is the case if, for example, the old motor must be replaced for technical reasons. If the investor then needs to choose between different new motors, only the difference in costs between the motors should affect the investment decision[8]. In particular, if the choice is between motors of energy efficiency standard IE2 and IE1, only the *additional capital expenditures* (CAPEX) of the more efficient motor of IE2 standard should be compared to the additional benefits of the IE2 motor.

The payback period is then given by:

$$Payback\ Time = \frac{Additional\ Capital\ Expenditures\ of\ IE2\ compared\ to\ IE1\ Motor}{Additional\ Benefit\ per\ year}$$

**Table 3** presents an overview of capital expenditures for the IE1 and IE2 motors. The full capital expenditures for the IE1 standard motor are 60 million IRR compared to 80,6 million IRR for the IE2 motor. The additional cost of an IE2 motor is thus 20,6 million IRR.

**Table 3: Overview of Investment Costs**

| | |
|---|---|
| Total CAPEX IE1 Motor | 60 Mio IRR |
| Total CAPEX IE2 Motor | 80.6 Mio IRR |
| Additional CAPEX of IE2 Motor | 20.6 Mio IRR |

Source: Own data collection for pilot projects

## 3.2 Investment Benefits

The benefits from investing in an energy efficiency project under the M3E can be differentiated into two types of benefits: the benefit of reduced energy costs and the benefit from trading the saved energy within the M3E.

[7] Please note that we ignore the opportunity cost of capital for now. The opportunity costs of capital will be taken into account in chapter 5.
[8] Here we implicitly assume that the least efficient (and thus cheapest) motor will amortise given its crucial role in the production process.

*Benefits from the Reduction of Energy Costs*

First, the most obvious benefit from investing in an energy-efficient technology is the benefit of saving energy and reducing energy costs. The efficient motor allows the brick factory to produce the same output using less energy. The reduction in energy costs is equal to the amount of energy saved multiplied with the energy tariff paid by the project owner:

$$Reduction\ of\ Energy\ Cost = Amount\ of\ Energy\ Saved *\ Own\ Energy\ Tariff$$

Now we can compute the benefit of reduced energy cost for each of the two investment decisions. If the owner needs to decide between investing in a new motor of energy efficiency standard IE2 and keeping the old motor, the relevant amount of energy saved is given by the difference between the electricity consumption with the old motor and the IE2 motor. In this case, 2.190 kWh would be saved. Multiplying this amount of saved energy with the energy tariff of 978,67 IRR per kWh paid by the brick factory results in a reduction of energy costs of 2,14 Mio. IRR per year (Investment decision: IE2 vs old motor in **Table 4**).[9]

Alternatively, if the investor needs to decide between an IE1 motor and an IE2 motor, the relevant amount of energy saved is given by the difference in electricity consumption between these two motors. An IE2 motor consumes 1,002 KWh less than an IE1 motor, which multiplied with the energy tariff results in a reduction of the energy cost of 0.98 Mio. IRR for the IE2 motor compared to the IE1 motor (Investment decision: IE2 vs IE1 motor in **Table 4**).

**Table 4: Saving Energy and Reducing Energy Costs**

| | | |
|---|---|---|
| Electricity consumption with old motor (82% efficiency) | 22,829.27 | kWh |
| Electricity consumption with IE1 motor (86.5% efficiency) | 21,641.62 | kWh |
| Electricity consumption with IE2 motor (90.7% efficiency) | 20,639.47 | kWh |
| | | |
| **Investment decision: IE2 vs old motor** | | |
| Amount of Energy Saved | 2,189.80 | kWh |
| * Own Energy Tariff | 978.67 | IRR/kWh |
| **= Reduction in Energy Cost** | **2.14** | **Mio. IRR** |
| | | |
| **Investment decision: IE2 vs IE1 motor** | | |
| Amount of Energy Saved | 1,002.15 | kWh |
| * Own Energy Tariff | 978.67 | IRR/kWh |
| **= Reduction in Energy Cost** | **0.98** | **Mio. IRR** |

Source: Own calculations.

*Benefits from Trading in the M3E*

The second benefit of an energy efficiency project only arises if the investor participates in the M3E: it is the gain from trading energy saved. The M3E offers project owners the opportunity to buy the energy saved at their own tariff and then resell it to market participants with a higher energy tariff. The M3E

[9] The energy tariff is calculated as the average of the off-peak, mid-peak and peak tariff of industry with less than 30kw power.

trading benefit is thus given by the difference between the certificate price at which the saved energy is sold and the own energy tariff, multiplied with the amount of energy saved.

$$M3E\ Trading\ Gain = Amount\ of\ Energy\ Saved * (Certificate\ Price - Own\ Tariff)$$

It can be expected that the certificate price will be close to (though slightly less than) the higher energy tariff paid by the party that the certificate is sold to. Here we assume that the certificate will be sold to a public consumer. The certificate price is then assumed to be 2,476 IRR, which is the mid-peak tariff of public consumers with a power of less than 30 KW.[10]

Since the relevant amount of energy saved differs between both investment decisions, the M3E trading benefit differs as well. **Table 5** shows that when the investor needs to decide between investing in an IE2 motor and keeping the old motor, the M3E trading gain is 3.28 Mio. IRR. If the investor, however, chooses between an IE1 and IE2 motor, the relevant M3E trading gain is smaller, at 1.5 Mio. IRR, since the amount of energy saved with an IE2 compared to an IE1 motor is smaller than compared to an old motor.

**Table 5: M3E Trading Benefits**

| | | |
|---|---|---|
| **Investment decision: IE2 vs old motor** | | |
| Certificate Price | 2,476.00 | IRR/kWh |
| - Own Energy Tariff | 978.67 | IRR/kWh |
| * Amount of energy saved | 2189.80 | kWh |
| **= M3E Trading Gain** | **3.28** | **Mio. IRR** |
| | | |
| **Investment decision: IE2 vs IE1 motor** | | |
| Certificate Price | 2,476.00 | IRR/kWh |
| - Own Energy Tariff | 978.67 | IRR/kWh |
| * Amount of energy saved | 1,002.15 | kWh |
| **= M3E Trading Gain** | **1.50** | **Mio. IRR** |

Source: Own calculations.

It should be noted that when the investor decides between an IE1 and IE2 motor, the revenue that the investor receives when trading in the M3E is greater than the M3E trading gain that is relevant to the investment decision. This is because the actual revenue from trading in the M3E depends on the amount of energy saved *compared to the baseline*, i.e. the consumption with the old motor; while the M3E trading gain that is relevant for deciding between the IE1 and IE2 motor only includes the energy saved with the IE2 motor *compared to the IE1 motor* (which is more efficient than the old motor).

## 3.3 Economic Viability of the Motor Replacement with and without M3E

To evaluate the economic viability of the project from the perspective of the project owner, the benefits of the motor replacement project (section 3.2) are now compared to the investment cost

[10] We assume certificates are sold to public consumers because they are among the consumer groups with the highest tariff. But it should be noted that this is one of the best-case scenarios for the economic viability of M3E investments. If certificates were instead demanded by consumer groups with lower tariffs, the certificate prices would be lower too. We focus on the mid-range tariff of public consumers because investors will probably not be allowed to trade saved energy during peak times as electricity providers are already capacity constrained during peak times.

(section 3.1). Economic viability can be measured by the payback period, that is the number of years it takes until the accumulated yearly benefits pay back the investment cost[11]. The shorter the payback period, the more viable or attractive the investment project for an investor.

*Payback Time of Motor Replacement without M3E*

As a starting point, we compute the payback period for the motor replacement project *without participation in the M3E*. If the investor installs a new motor without trading the saved energy in the M3E, the only benefit is the reduction of energy cost. **Table 6** shows that the payback period is almost 38 years if the total cost approach is used, i.e. when the investor needs to decide whether to invest in an IE2 motor or to keep the old one. If the investor needs to decide between investing in an IE1 and IE2 and only the additional costs of the IE2 motor need to be paid back, the payback period is still 21 years. Both are very long payback periods.

**Table 6: Payback periods without M3E**

| | | |
|---|---|---|
| **Investment decision: IE2 vs old motor** | | |
| Investment cost (total cost of IE2 motor) | 80.60 | Mio. IRR |
| / Reduction in energy cost | 2.14 | Mio. IRR |
| **= Payback period** | **37.61** | **Years** |
| | | |
| **Investment decision: IE2 vs IE1 motor** | | |
| Investment cost (additional cost of IE2 compared to IE1) | 20.60 | Mio. IRR |
| / Reduction in energy cost | 0.98 | Mio. IRR |
| **= Payback period** | **21.00** | **Years** |

Source: Own calculations.

In Iran, investors generally have relatively short investment horizons due to an uncertain political and economic environment. For an investment project in Iran to be economically viable, the payback period should not exceed 3-5 years. Without participation in the M3E, the motor replacement project is thus not economically viable. The yearly reduction in energy costs is too small compared to the investment cost to induce investors to install an energy-efficient motor. The underlying problem is that the own energy tariff paid by the project owner is so low that any reduction in energy consumption will only lead to a small reduction in energy cost.

This is the main reason for Iran's exceptionally high energy intensity. Given that energy prices in Iran are so low, firms and households have little incentive to invest in energy-efficient technologies and products.

*Payback Time of Motor Replacement with M3E*

The M3E is motivated by the idea to encourage investments in energy efficiency by offering investors the additional benefit of selling the saved amount of energy at a higher price than their own tariff. The benefit of trading saved energy in the M3E reduces the payback period and thus makes any investment more attractive.

[11] Please note that we ignore the opportunity cost of capital for now. A net present value calculation will be conducted in chapter 5.

**Table 7: Payback periods with M3E**

| | | |
|---|---|---|
| **Investment decision: IE2 vs old motor** | | |
| Investment cost (total cost of IE2 motor) | 80.60 | Mio. IRR |
| / Total Benefits (Reduction in energy cost + M3E Trading Gain) | 5.42 | Mio. IRR |
| **= Payback period** | **14.9** | **Years** |
| | | |
| **Investment decision: IE2 vs IE1 motor** | | |
| Investment cost (additional cost of IE2 compared to IE1) | 20.6 | Mio. IRR |
| / Additional Benefits (Reduction in energy cost + M3E Trading Gain) | 2.48 | Mio. IRR |
| **= Payback period** | **8.3** | **Years** |

Source: Own calculations.

For the decision between investing in an IE2 motor and keeping the old motor, the payback period decreases from 38 years to 15 years, while it decreases from 21 years to 8 years, when deciding between investing in an IE1 and IE2 motor (see Table 7). This shows that the introduction of the M3E indeed substantially reduces the payback periods of energy efficiency investments and thus makes them more attractive for investors.

However, the payback periods for the motor replacement project are still considerably longer than the payback periods of 3-5 years required by investors in Iran. Therefore, it must be concluded that despite the M3E benefits, the motor replacement project is not economically viable from the perspective of investors. Investors will thus decide to not invest in energy-efficient motors and will not participate in the M3E.

# 4 Certificate Prices as a Crucial Determinant of Economic Viability

The previous analysis has shown that even the additional gains from trading in the M3E could not significantly improve the economic viability of investments in energy efficiency such as the replacement of electric motors. The economic viability of energy efficiency projects depends crucially on the certificate price at which the saved energy can be sold. Higher certificate prices imply that more projects become economically viable and more investors participate in the M3E. Therefore, the certificate price is the most important determinant of a functioning M3E.

In the M3E's current design, the certificate price is bound by the higher energy tariffs paid by domestic consumers in Iran. Even though there are considerable differences in domestic energy tariffs across different consumer groups, which the M3E is designed to exploit, the absolute level of energy tariffs in Iran is exceptionally low by international comparison. As the example of the brick factory has shown, even if saved energy can be sold to domestic consumers with one of the highest domestic tariffs, the certificate price will still be too low to make the investment viable.

*Scenarios for Determining the "Right" Certificate Price*

In the following section, we follow two approaches to obtain a better understanding of when certificate prices are high enough to make an investment in an energy-efficient motor economically viable.

First, we consider two scenarios with higher prices that could be realistic options within the M3E. Scenario 1 assumes that Iran imposes higher domestic energy tariffs, comparable to neighbouring countries. Scenario 2 assumes that the M3E allows for an export option. Second, we determine the right price by "backward induction", that is we compute the minimum electricity price that would need to prevail such that the payback period is no longer than 3-5 years. This is the "shadow price" which makes the investment economically viable from the perspective of investors.

*Scenario 1: Regional Prices*

In scenario 1, we consider the average electricity price of Iran's neighbouring countries as a meaningful alternative certificate price. This can be seen as a relevant scenario since Iran's neighbouring countries such as Iraq also have large resources of oil and gas and therefore share some major characteristics with the Iranian energy market. Therefore, the average electricity price of its neighbouring countries can be interpreted as a credible "hypothetical domestic price" for Iran. The regional average price – including Afghanistan, Azerbaijan, Iraq, Kuwait, Pakistan and Turkey - is about 6,000 IRR[12].

**Table 8** compares the payback periods with regional prices to the reference scenario with current domestic prices. As expected, the payback period becomes shorter with a higher certificate price. If the investor wanted to invest in a new motor anyway, the M3E could incentivize the investor to invest in the energy-efficient IE2 motor. Paying for the more expensive, but more energy-efficient IE2 motor would pay off after 3.4 years. If the investor were to decide whether to invest at all, using the total cost approach, the payback period would be around 6 years, slightly longer than the typical investment horizon of Iranian investors of 3-5 years.

*Scenario 2: Export Prices*

The M3E currently does not allow exporting electricity saved in an M3E project. However, in a forthcoming IREEEMA policy paper[13], it is argued that an export option for the M3E would comply with the general policies of development and resilience formulated by the Iranian government. In particular, it is stated in the executive directive of article 12 of the "law on competitive production and enhancement of financial system" that exports of saved energy should be allowed. In this section, we investigate in how far including an export option would increase the economic viability of investment projects and thereby contribute to establishing a functioning M3E. In particular, we assume that the certificate price is given by the export price of 7,804 IRR/kWh, which is the export price stated in the Plan and Budget Organization's (PBO) FY Budget Law.

With export prices, the M3E trading gain increases by more than 400% compared to the reference scenario with current domestic prices. As a result, the payback period becomes significantly shorter (see **Table 8**). For the first investment problem – the decision whether to invest in a new efficient IE2 motor or to keep the old one – the payback period decreases to around 4.7 years. For the second investment problem – when the investor needs to decide between a new IE1 or IE2 motor – the payback period even falls to 2.6 years. The investor would thus conclude that is economically viable to switch to a more efficient motor and would participate in the M3E. The exporting option thus makes participation in the M3E much more attractive for potential investors. This is true not only for the example of the brick factory but for any investment project since a higher certificate price implies shorter payback periods.

[12] Electricity prices were obtained from https://www.globalpetrolprices.com/electricity_prices/.
[13] IREEMA Policy Paper: Fundamentals of Bylaw on M3E and its Compatibility with Development Strategies

**Table 8: Payback periods for alternative certificate price scenarios**

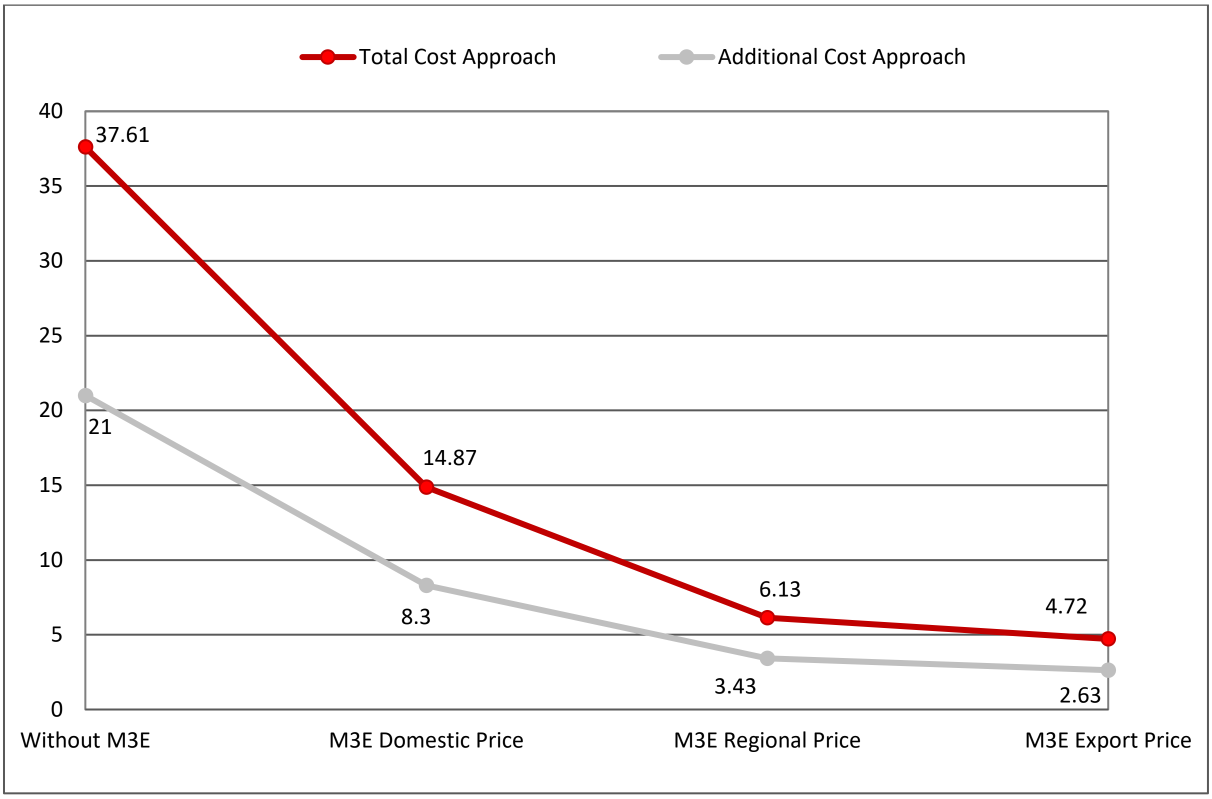
| | *Reference:* Domestic Price: 2,476 IRR | *Scenario 1:* Regional Price: 6,000 IRR | *Scenario 2:* Export Price: 7,804 IRR | |
|---|---|---|---|---|
| **Investment decision: IE2 vs old motor** | | | | |
| Investment cost (total cost IE2) | 80.6 | 80.6 | 80.6 | Mio. IRR |
| / Total benefits | 5.42 | 13.14 | 17.09 | Mio. IRR |
| (Reduction in energy cost + | 2.14 | 2.14 | 2.14 | Mio. IRR |
| M3E trading gain) | 3.28 | 11 | 14.95 | Mio. IRR |
| **= Payback period** | **14.87** | **6.13** | **4.72** | **Years** |
| | | | | |
| **Investment decision: IE1 vs IE2 motor** | | | | |
| Investment cost (additional cost IE2) | 20.6 | 20.6 | 20.6 | Mio. IRR |
| / Additional benefits | 2.48 | 6.01 | 7.82 | Mio. IRR |
| (Reduction in energy cost + | 0.98 | 0.98 | 0.98 | Mio. IRR |
| M3E trading gain) | 1.5 | 5.03 | 6.84 | Mio. IRR |
| **= Payback period** | **8.30** | **3.43** | **2.63** | **Years** |

Source: Own calculations.

**Figure 2** below provides an overview of the payback period for the different scenarios and investment decisions. Without the trading benefits of the M3E, the payback period of 38.4 years (total cost approach) respectively 21 years (additional cost approach) far exceed the investment horizon of investors. Within the M3E, the payback period crucially depends on the certificate price. Even if investors can sell their saved energy to high-tariff domestic consumers, the payback periods are still too long at almost 15 years and 8 years, respectively, to encourage investors to participate in the M3E.

However, there are two price scenarios which would significantly shorten the payback period and thus make M3E projects more economically viable. If the certificate price would increase to the level of energy prices in Iran's neighbouring countries, the payback period would drop to 3.4 years under the additional cost approach. If the M3E would include the option of exporting exporting surplus electricity that was saved through energy-efficiency measures, the payback period would decrease even further to only 2.6 years.

**Figure 2:** **Payback periods of motor replacement project in different price scenarios**




Source: Own illustration

*Calculating the "shadow price" of economic viability*

In this section, we turn the question around: instead of asking whether an investment would be economically viable under a given certificate price, we ask which certificate price would be required at a minimum to make an investment economically viable. We may call this minimum price the "shadow price" of economic viability.

The shadow price of economic viability depends on the investment horizon of investors. If we assume that investors invest as long as the payback period is not longer than 5 years, the shadow price can be inferred from the investment costs and the amount of energy saved by year. The shadow price is then the price such that the total benefits accumulated over five years equal the investment cost. When choosing between an IE2 and IE1 motor, the shadow price of economic viability is about 4,100 IRR per kWh for a payback period of 5 years. With a shorter investment horizon of 3 years, the shadow price increases to around 6,800 IRR per kWh.

This shows that certificate prices should be at least 4,100 IRR to 6,8000 IRR per kWh to incentivize investments by investors in Iran with a typical investment horizon of 3 to 5 years. In line with the results above, if the certificate price in the M3E were to increase to the regional average price of Iran's neighbouring countries of 6,000 IRR or if exports were allowed at 7,804 IRR, the certificate price would lie above the shadow price of economic viability and investments under the M3E would be economically viable.

**Table 9: Shadow prices of economic viability**

| | 3-year Payback Period | 5-year Payback Period | |
|---|---|---|---|
| **Investment decision: IE2 vs old motor** | | | |
| Investment cost (total cost IE2 motor) | 80.60 | 80.60 | Mio. IRR |
| / Total Benefits (Energy Saved per Year * Payback Period) | 6,569.40 | 10,949 | kWh |
| **Shadow Price** | **12,269** | **7,361** | **IRR / kWh** |
| | | | |
| **Investment decision: IE1 vs IE2 motor** | | | |
| Investment cost (additional cost) | 20.60 | 20.60 | Mio. IRR |
| / Total Benefits (Energy Saved per Year * Payback Period) | 3,006.45 | 5,010.75 | kWh |
| **Shadow Price** | **6,852** | **4,111** | **IRR / kWh** |

Source: own calculations.

# 5 Economic Viability: Dynamic Perspective

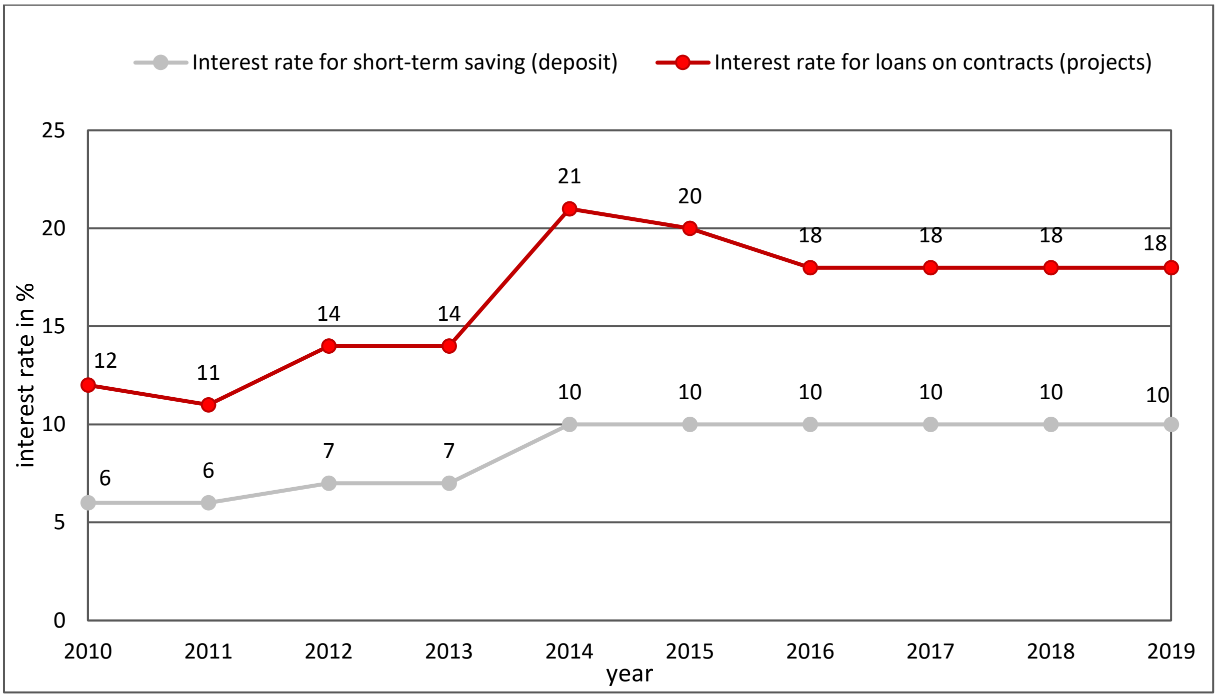
The previous analysis has already shown that typical energy efficiency investments such as the replacement of electric motors are not economically viable for investors under the M3E in its current design. However, the analysis was based on a static perspective, ignoring important dynamic factors that investors must consider in their investment decisions. This section reviews the cost-benefit analysis of the motor replacement project from a dynamic perspective. First, we analyse how opportunity costs of capital affect the project's economic viability. Second, we investigate how inflation affects the investment decisions under the M3E. Third, we briefly discuss how transaction costs and uncertainties related to the M3E project cycle may deter investors from participating in the M3E.

## 5.1 Opportunity Cost of Capital

When deciding to invest in a project, investors must consider the opportunity cost of capital. The opportunity costs of capital refer to the potential benefits an investor misses out on when choosing one investment over another. The opportunity cost thus depends on the next best alternative use of the capital to be invested. While different investors may face different investment options, any investor can deposit the investment amount in an interest-bearing bank account.

The bank interest rate can thus be used as a simple measure of the opportunity cost of capital. **Figure 3** shows the development of deposit and lending rates in Iran over the last decade. The deposit rate has been stable at 10 % and the lending rate at 18 % in recent years. These interest rates are relatively high by international comparison.

**Figure 3:** **Deposit and Lending interest rate from 2004 until 2016**




Source: Own presentation based on data from the Central Bank of the Islamic Republic of Iran, obtained from (Annual Review 1396 & https://cbi.ir/simplelist/1493.aspx).

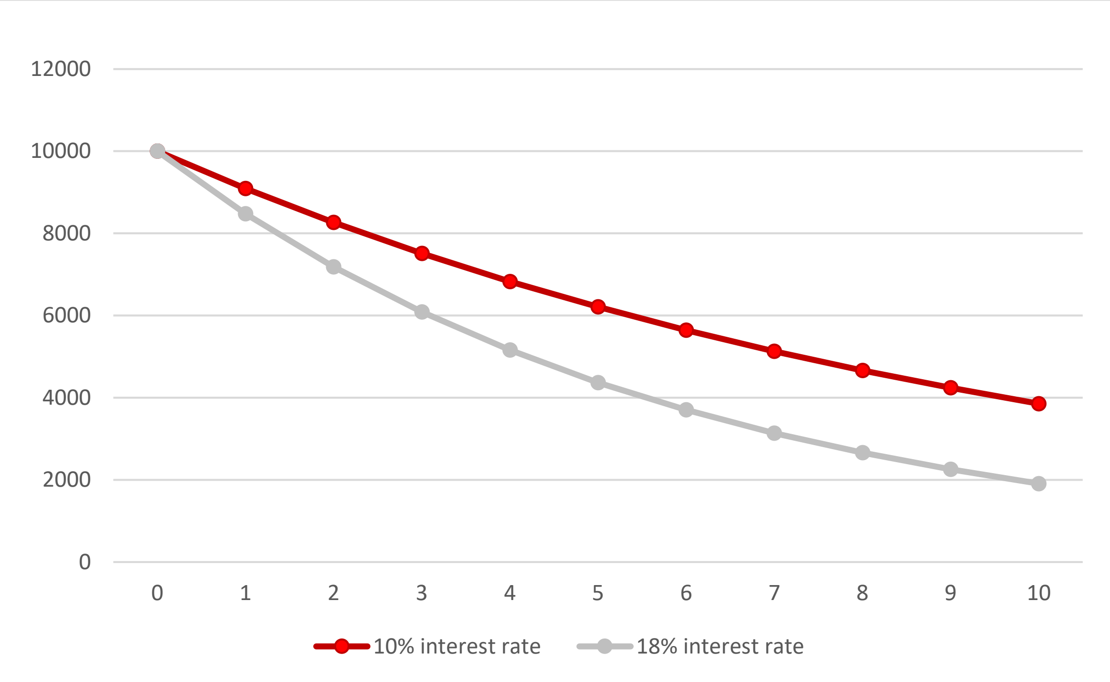
With high interest rates (or high opportunity costs of capital), future cash flows are valued less when evaluating the costs and benefits of an investment. Any investor would prefer to receive a given payment today rather than in the future because then she could earn interest on the payment. Therefore, future payments should be discounted accordingly when comparing cash flows paid and received at different points in time. In technical terms, the decision whether to invest in an energy-efficiency project should be based on the **Net Present Value** of the costs and benefits.

The **Net Present Value (NPV)** of any payment can be calculated as follows:

$$NPV\ of\ payment\ in\ year\ t\ = \frac{Payment}{(1+interest\ rate)^t}$$

The higher the interest rate and the further the payment lies in the future, the lower the net present value of any payment. For example, the net present value of 10,000 IRR received after one year at an interest rate of 10% is 9,091 IRR. If the payment were received after five years, the net present value would be only 6,209 IRR. At an interest rate of 18%, the net present value would be even lower at 4,371 IRR after five years.

**Figure 4: Exemplary patterns for discounting cash flows at different interest rates**




Source: own illustration.

*Review of economic viability with opportunity cost of capital*

In this section, we review the economic viability of the motor replacement project, accounting for the opportunity cost of capital by discounting future cash flows. In particular, we compute the net present value of the costs and benefits, using the deposit interest rate of 10%. This should be considered a lower bound estimate of the opportunity costs of capital faced by Iranian investors for two reasons. First, the lending interest rate for investors who need to obtain a bank loan to invest in an M3E project is much higher at 18%. Second, the opportunity cost of capital should also reflect the risk of a payment. Investors generally value riskier payments less and thus discount riskier payments with at a higher rate. Since investing in an M3E project is riskier than depositing money in a bank account, the 10% deposit rate probably underestimates the true opportunity cost of capital of an M3E project.

**Table 9: Payback periods with opportunity costs of capital**

| | ***Reference:*** **Domestic Price: 2,476 IRR** | ***Scenario 1:*** **Regional Price: 6,000 IRR** | ***Scenario 2:*** **Export Price: 7,804 IRR** | |
|---|---|---|---|---|
| **Investment decision: IE1 vs IE2 motor (Additional Cost Approach)** | | | | |
| Static perspective | **8.3** | **3.4** | **2.6** | **Years** |
| Dynamic perspective (incl. Opportunity Cost of Capital) | **18.6** | **4.4** | **3.2** | **Years** |

Source: own calculations.

**Table 9** shows the payback periods under the additional cost approach when using a net present value calculation to account for the opportunity cost of capital and compares them to the payback periods under the static approach. As expected, the payback periods increase sharply when accounting for the opportunity cost of capital. With current domestic prices, the payback period increases from 8.3 to 18.6 years, such that investments in the M3E are even less economically viable than under the static perspective. This is simply because the investment costs are paid immediately, while the benefits of reduced energy costs and trading in M3E accrue in the future. Consequently, they must be discounted.

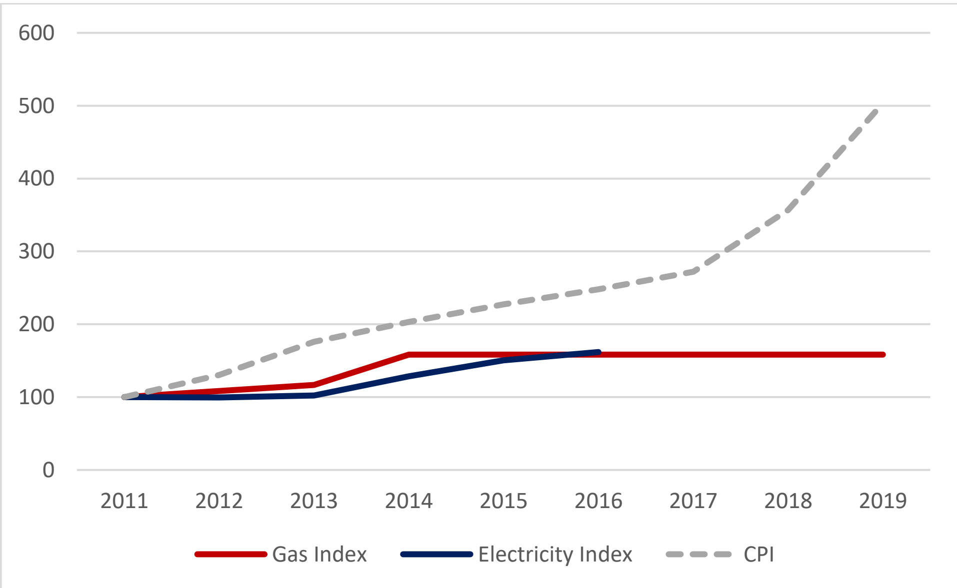
While the payback periods also increase for the alternative scenarios with regional prices (from 3.4 to 4.4 years) and export prices (from 2.6 to 3.2 years), the payback periods are still within the investment horizon of Iranian investors of 3-5 years.

We may also recalculate shadow prices of economic viability for the motor replacement project from a dynamic perspective. The shadow price is the minimum energy price such that the payback period is no longer than 3-5 years, while discounting the yearly benefits by an interest rate of 10 %. For the additional cost approach, the shadow price increases from 4,100 IRR to 5,400 IRR for a payback period of 5 years and from 6,800 IRR to 8,300 IRR for a payback period of 3 years.

## 5.2 Inflation

The economic viability of energy-efficiency projects is further limited by high inflation rates in Iran. In 2019, the inflation rate was 41.06 %[14]. More importantly, the general price level increased faster than energy tariffs over the last decade. Figure 5 below shows that consumer prices increased by 400 % between 2011 and 2019, while the gas tariffs increased by roughly 60% between 2011 and 2014 and then remained stable thereafter. Similarly, electricity prices increased by around 60 % between 2011 and 2016, muss less than the inflation rate over these years. If consumer prices continue to increase faster than energy tariffs, investors expect the purchasing power of future payments in the M3E to decrease.

**Figure 5: Consumer price inflation and energy tariffs over time**




Source: own illustration based on CPI data from World Bank.

[14] World Bank 2020, under: https://data.worldbank.org/indicator/FP.CPI.TOTL.ZG?locations=IR

A decrease in purchasing power has a similar effect on the economic viability of M3E projects as an increase in the opportunity cost of capital. Investors will respond to an expected decrease in purchasing power by discounting future cash flows accordingly. As we have seen above, discounting of future M3E benefits will increase payback periods of M3E investments and thus make investors less willing to participate in the M3E. Therefore, high inflation rates are a major obstacle for a functioning M3E in Iran[15].

## 5.3 Transaction costs and uncertainty

The economic viability of M3E projects is also constrained by several factors that are difficult to quantify but nevertheless important from the perspective of potential investors.

Firstly, the complex project cycle of the M3E imposes significant **transaction costs** on investors. High transaction costs[16] occur at all stages of the M3E project cycle.

- The project owner has to identify a project idea, which is complex and time-consuming as no best practices or verified project pipeline exist for the M3E.
- In the installation phase of the project, search and information costs arise for the project owner as he or she has to select an M&V company that will measure and verify the achieved energy savings.
- During the implementation of the project, high monitoring costs are incurred and will continue to apply for the lifetime of the project.

All in all, the whole project cycle is very time- and resource-intensive. While it is difficult to quantify these costs in monetary terms, investors will be deterred by these costs nevertheless. Therefore, Technical Note 8 *Standardization of Projects in the M3E* argues that a simplification of the project cycle for standard projects is crucial for improving the economic viability of M3E projects.

Secondly, closely related to the transaction costs are the pervasive **uncertainties inherent in M3E projects**. As mentioned above, an investment decision does not only depend on a comparison of expected benefits and costs but also on their risk, i.e., by how much benefits and costs may vary. Investors – especially in uncertain market conditions – tend to be rather risk-averse. As a result, they might choose not to invest even if the expected returns exceed the expected costs (including all transaction costs).[17]

Some of the risks arise due to the complex project cycle and uncertainties as to how the M3E will be institutionalized and operationalized. For example, it is not clear when and where exactly the certificates can be traded, at which price they can be sold and for how long they can be traded. Moreover, due to the complex project cycle, there is some uncertainty whether the project proposal and later on the M&V report will be approved or rejected.

These sources of fundamental uncertainties regarding the M3E project cycle cannot be easily quantified, which makes them challenging to deal with for potential investors and thus presents a

[15] However, it should be noted that higher inflation rates also imply lower real interest rates and thus reducing the opportunity cost of capital.
[16] In economics, transaction costs refer to the costs associated with participating in a market, such as costs for initiating a trade, information procurement costs, processing costs, etc. High transaction costs can prevent transactions, if for instance the initial information costs for a potential buyer are so high that the transaction becomes prohibitively expensive.
[17] One source of risk in the M3E is that it is not certain at which price the saved energy can be traded since there are various potential buyers with different tariffs. This impediment will be addressed in another policy paper.

severe obstacle for participation in the M3E. It is thus of utmost importance to reduce these uncertainties as much as possible by setting clear rules on how certificate prices are determined and when they can be traded.

# 6 Conclusion and Outlook

This technical note has shown that the economic viability of energy-efficiency investments in the M3E is constrained by several factors. Most importantly, certificate prices are too low to pay back investment costs quickly enough. The payback periods of a motor replacement project – a potential standard project under the M3E with wide application – are much longer than the typical investment horizon of Iranian investors of 3-5 years.

To improve the economic viability of M3E projects and to attract potential investors, it is therefore crucial to increase certificate prices. The shadow price of economic viability for a 5-year payback period amounts to 5,400 IRR when accounting for the opportunity cost of capital. In addition, two alternative scenarios were discussed which would significantly increase economic viability. In scenario 1, it was assumed that Iran imposes higher domestic tariffs comparable to neighbouring countries. In scenario 2, exports of saved energy were allowed under the M3E. While exports are ruled out in the M3E's current design, an export option for the M3E would comply with the general policies of development and resilience formulated by the Iranian government[18]. Exporting saved energy within the M3E would be an important step towards increasing the economic viability of M3E investments and establishing a functioning M3E.

The economic viability of energy-efficiency projects is further constrained by high inflation rates in Iran. Over the last decade, the general price level increased much faster than electricity and gas prices, such that investors expect the purchasing power of M3E benefits to decrease. Investors will thus discount future cash flows accordingly, thereby lengthening the payback periods and reducing the economic viability of M3E project. To provide a better environment for long-term investments in energy efficiency, it is necessary to control inflation.

Finally, the complex M3E project cycle imposes transaction costs and uncertainties on potential investors that are difficult to quantify in monetary terms, but may still deter potential investors. To reduce transaction costs and uncertainties and make participation in the M3E more attractive to potential investors, the project cycle should be streamlined and simplified for standard projects as proposed in IREEMA Technical Note No. 8 on the standardization of projects in the M3E.

[18] see forthcoming IREEMA Policy Paper on Fundamentals of Bylaw on M3E and its Compatibility with Development Strategies.

# 7 List of recent Technical Notes and Policy Papers

### *Technical Notes*

Technical Note 1: The benefits of guidelines for project implementation in the M3E

Technical Note 2: Establishing an MRV system in accordance with the rules of the market for energy efficiency and environment (M3E)

Technical Note 3: Eligibility criteria for projects in the M3E

Technical Note 4: A draft scheme for project implementation in the Market for Energy Efficiency and Environment (M3E)

Technical Note 5: Trade in energy savings: Overview on the mechanisms of Article 12 and the M3E

Technical Note 6: Energy Efficiency and Environment Market (M3E): Players and Their Roles

Technical Note 7: Standardization of Projects in the M3E

### *Policy Papers*

Policy Paper 1: Market-based instruments for energy efficiency worldwide – Review

Policy Paper 2: Energy Efficiency Funds: Insights from international experience

Policy Paper 3: Energy Efficiency Program in the Islamic Republic of Iran

Policy Paper 4: Review of Experiences of Energy Efficiency Program in the Islamic Republic of Iran

Policy Paper 5: Market for Energy Efficiency & Environment (M3E) – Energy Efficiency Program in the Islamic Republic of Iran

Policy Paper 6: Fundamentals of Bylaw on M3E and its Compatibility with Development Strategies

Policy Paper 7: Raising Energy Prices in Iran: “Forward Guidance” as Policy and Communication tool

# 8 References


Central Bank of the Islamic Republic of Iran (Bank Markazi Jomhouri Islami Iran). 2019. Annual Review 1396 (2017/18).

Enerdata Global Statistical Yearbook 2019. Available at https://yearbook.enerdata.net/

Plan and Budget Organization. FY 1398 Budget Law; 2019.