

# IRAN ENERGY SAVINGS PERFORMANCE CONTRACTING

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as required by Article 12 of the Law  
“Elimination of Competitive Production  
Barriers and Improvement of Financial  
System”

**2017**



**NIOC**

Iranian Fuel Conservation Co.

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**2017**

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## Executive Summary

The purpose of this document is to provide common set of principles and guidance to Energy Savings Performance Contracts (ESPCs) in Iran. This document targets a wide range of interested parties who would like to get involved in such Energy Savings Projects (EnSPs), from financiers to Energy Service Companies (ESCOs) to technology providers, either locally or internationally, and will assist them in effective ESPC projects.

Iran ESPCs, also known as Energy Performance Contracts, is an alternative financing mechanism that is adapted regarding national policies as well as energy users' inquiries to encourage private sector in financing and implementing energy conservation methods and energy efficiency technologies. There are also regulations that is officially authorized by Iranian Council of Ministers in August 2015 as required by Article 12 of the law called "Elimination of Competitive Production Barriers and Improvement of Financial System" to accelerate investment in cost effective energy conservation measures.

6 An ESPC is a working relationship between a governmental organization (typically refers to Ministry of Petroleum and its subsidiaries in this booklet), a financier, and an ESCO. By leveraging private sector financing and ESCO expertise under support of the existing infrastructure in Iran, ESPCs provide multiple benefits as following.

**a) Increased quality and value through:**

- Private-sector expertise in energy efficiency, renewable energy, water conservation, and reduced

greenhouse gas (GHG) emissions;

- Built-in incentives for ESCOs to provide high-quality equipment, timely services, and thorough project commissioning;
- Infrastructure improvements that pay for themselves over time;
- Healthier, safer working and living environments.

**b)** Flexible, practical contract and processes that ensure your agency achieves its energy-related goals through the following:

- Access to best practices, benchmarks, criteria and expertise in energy sectors developed over 17 years primarily by Iranian Fuel Conservation Co. (IFCO) to prepare preliminary feasibility studies;
- Provision of technical support, templates, schedules, contract formats, and other resources to propose the plan to Iran Economic Council;
- Guarantees for savings payback;
- Life-of-contract (LOC) support.

**c)** Expert, objective technical support through Measurement and Verification (M&V) assistance, which can be used by facility owners or energy efficiency project investors for the following purposes:

- To Minimize vulnerability to budget impacts due to volatile energy prices, weather, equipment failure, or any other relevant variables based on the case;
- To document financial transactions as the energy savings are the basis for performance-based financial payments;
- To enhance financing for efficiency projects through transparent and credible reports on the outcome of efficiency investments;

- To receive feedback on their Energy Conservation Measures (ECMs) which helps them adjust ECM design or operations to improve savings, achieve greater persistence of savings over time, and lower variations in savings.

Project facilitators (PFs) (typically refers to Iranian Fuel Conservation Company in this booklet), guide the acquisition team through development, awarding, and verification of savings from ESPC projects. PF assistance helps both governmental organizations and ESCOs avoid obstacles and expedite projects. A project facilitator serves as an experienced, unbiased advisor responsible for providing consultation and assistance with contractual and financial issues, technology and engineering issues as well as Measurement & Verification. They are also in charge of reviewing cost and technical offers by ESCOs to prepare a viable proposal to Iran Economic Council and receive approvals, which guarantees the plan enforcement. In a nutshell, IFCO cooperates with the interested parties throughout any projects, from the planning stage to the implementation phase.

- A list of IFCO`s ESPC authorized plans is provided in this booklet. It should be noted that this is not
- 8 all and there are still great potentials for proposals in different energy user sectors especially Iran oil, gas, petrochemicals and other energy-intensive industries including cement, iron and steel, brick, etc. IFCO welcomes cooperation in the approved or newly proposed Energy Efficiency projects. Please contact us for further information or in case of any



questions about the authorized plans and to propose new projects at following.

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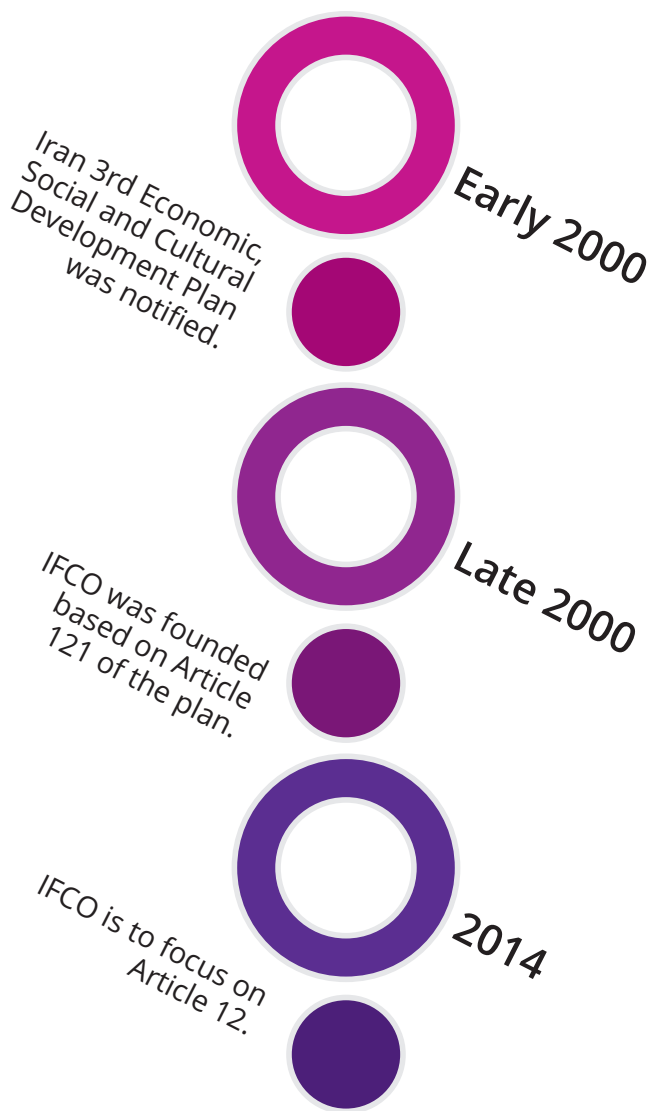
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## **Introduction of IFCO**

Iranian Fuel Conservation Company (IFCO) is a subsidiary of National Iranian Oil Company (NIOC) and is in charge of energy efficiency programs as the representative of Iran Ministry of Petroleum.

The timeline below shows IFCO`s history and policies through time, from its foundation in 2000 up to now. IFCO was founded based on Article 121 of Iran 3rd Development Plan, which was primarily focusing on energy saving policies. It has great records of various successful programs from energy management, energy efficiency plans for high energy-intensive industries and systems to standards and benchmarks in three main sectors (industrial, transport and building). Since 2014, IFCO has mainly focused on programs based on a law and its article known as Article 12 that is the main topic of this pamphlet and will be discussed thoroughly in the following parts.

Figure 1- IFCO`s history and policies through time

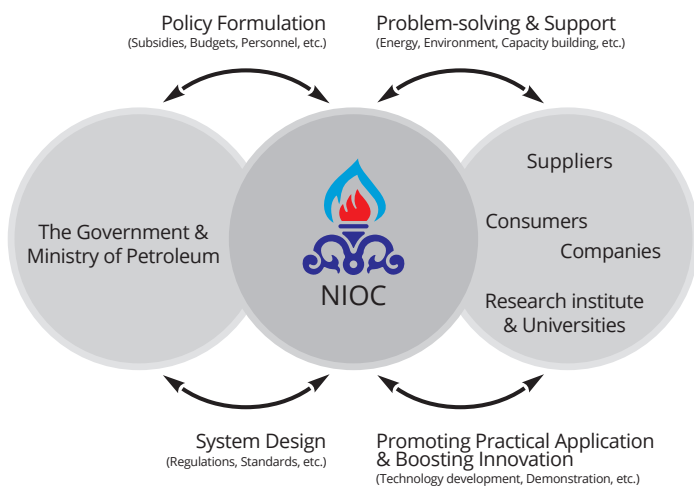


Based on Iran Energy Outlook, the energy consumption of the country should be 1609.5 Million Barrels of Oil Equivalent (MMBOE) by the end of 2020 if conservation approach is adopted and an average GDP growth of 8% is assumed. In this regard, IFCO targets to cover maximum possible shares of energy savings and pertinent carbon reduction through Energy Efficiency Programs on behalf of Iran Ministry of Petroleum.

Moreover, the main missions of IFCO are as follows and figure 2 illustrates who and how IFCO interacts with in Iran.

- Defining energy standards and criteria in all energy-user sectors;
- Demand management and implementing energy conservation policies in every sector;
- Developing any required regulations, framework, criteria, technical specifications and standards in the field of oil, gas and energy;
- Serving as project facilitator and motivating the initiatives aiming at energy savings and intensity reduction in accordance with Article 12.

Figure 2: IFCO`s organizational relations with other parties



### IFCO's Projects

Although Iran has abundant energy sources (both fossil fuels and renewable sources of energy) and is ranked among the top ten countries holding the largest oil and gas reserves worldwide, it also holds top ranks in terms of energy intensity and consumption due to its socio-economic structure and relevant policies.

High energy intensity in Iran can also emphasize the low productivity issues of the existing energy system. In other words, there are great potentials of energy savings as well as pertinent GHG reduction throughout our energy system due to losses from oil processing to conversion as well as transmission and distribution. The digits in Iran energy system compared to the developing countries with similar conditions, also highlights that a lot of energy is being wasted in demand side due to old technologies and infrastructures. This requires huge investment to increase efficiency and meet our energy optimization targets.

14 From another point of view, renewable sources of energy generally contribute very marginally to total energy supply in Iran despite its great potentials, which most likely relates to “easy” and “inexpensive” access to fossil fuels.

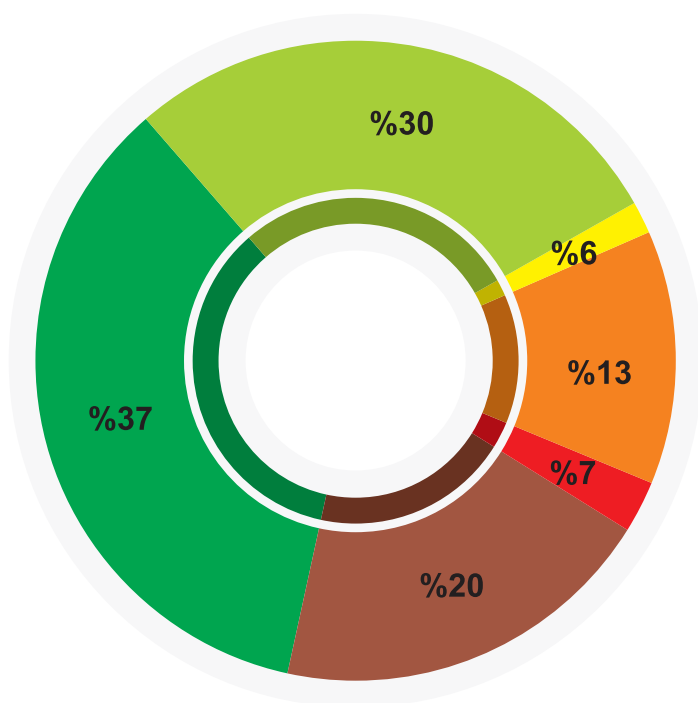
According to the mentioned bottlenecks, a set of policy recommendations and plans are strongly suggested under main categories where Article 12 forms the recent major tasks of IFCO. To meet our energy savings goals, Article 12 provides a legal foundation for governmental organizations (Ministry of Petro-

leum, Energy, etc.) to support and attract investment in energy and water savings at the macro level. Based on Article 12, IFCO plans to increase revenue and/or cut costs through:

- Saving inputs (e.g. energy savings projects, development of renewable energy)
- Reducing losses, wastes and costs (e.g. energy efficiency projects)
- Increasing production and services (e.g. projects aiming at increase in crude oil, gas and condensate production capacity)

To propose relevant projects in the most appropriate energy user sectors, a set of studies have been conducted based on Iran Energy Outlook that primarily focuses on demand side including industrial, transport, building, and agricultural sectors as well as petrochemicals. As discussed before while energy demand is expected to be 2147MMBOE in 2020 considering an average growth of 8% in GDP, there are also considerable potentials that amount to about 546 MMBOE energy savings and 155 million tones reduction in carbon. Figure 3 summarizes energy savings potentials by sector and identifies where ESPC projects shall be introduced in Iran. As graph suggests, industrial sector shows the greatest potential for energy savings as well as carbon reduction among all other sectors in demand side while transportation and building sectors hold the next ranks. Accordingly, we can refer to IFCO's authorized ESPC plans in table 1.

Figure3- Energy savings potentials by energy user sectors



- Transport
- Agriculture
- Other
- Petrochemical
- Building
- Industry



Table 1- IFCO`s authorized ESPC plans

Sector	No.	ESPC Plans	Plan Policy	Fuel Saved/Switched	Max Reimbursement (Million USD)	Duration (year)	Saving/Switching (Billion Liter or Cubic Meter)
Building	1	Central Heating Systems (600,000 boiler rooms)	Energy Efficiency	Natural Gas	2,000	2017-2026	15.4
	2	Renewal of City Bus Fleets (17,000 Vehicles)	Fuel Switching	Gas Oil	1,795	2017-2026	5.7
	3	Renewal of City Taxi Fleets (140,000 Vehicles)	Fuel Switching	Gasoline	635	2017-2024	7
	4	Renewal of Truck Fleets (65,000 Vehicles)	Energy Efficiency	Gas Oil	2,762	2017-2026	9.2
Transport	5	Railway	Energy Efficiency	Gas Oil	7,532	2017-2024	10.5
	6	3-Cylinder Engines (500,000 Vehicles)	Energy Efficiency	Gasoline	328	2018-2027	2
Industry	7	Agricultural Water Pumps	Fuel Switching	Gas Oil	1,650	2017-2028	8.7

## **Article 12 of the Law “Elimination of Competitive Production Barriers and Improvement of Financial System” (April 2015)**

All ministries especially ministries of Petroleum and Energy and their subsidiaries and affiliated companies as well as governmental organizations and institutions and all title and row holders in the country's total budget law are allowed to sign contracts regarding oil, gas, condensate and services which can be exported/imported at up-to-date market exchange rates or its equivalent in Iran Rials (IRR) and at non-subsidized prices in other cases, considering governmental, legal and other charges, up to one hundred billion US dollars (USD) along with five hundred thousand billion IRR every year, which will be adjusted up to an inflation rate of the prior year annually, where investment or actions by natural or legal persons, domestic or foreign, with priority of the private sectors or cooperatives can lead to production, export, quality improvement, savings or reduction in production costs, time reduction, improvement of environment quality, or reduction in loss of life and property.

*The government is obliged to:*

- 1-** Purchase the produced or saved commodities or services and their benefits or value based on the resulting revenue, savings, benefits or value.
- 2-** Pay back the investment and its yield along with governmental and legal charges as well as other incurred expenses or related benefits.

If all or parts of the required resources to run clauses 1 and 2 is provided from the country's total budget, then actions will be taken through the National Treasury while an agreement will be made with the Management and Planning Organization. These legal persons can sell the produced or saved commodities or services and the resulting benefits or value expected from the investment or actions inside or outside of the country (Iran), or take actions to operate and use the above, pursuant to a contract or an issued permit.

**A-** Oil and gas plans including the following: increase in crude oil, gas and gas condensate production capacity with the shared reservoirs on the top priority; increasing crude oil and gas condensate refining capacity; increase in petrochemical products; crude oil, gas condensate and natural gas storage in non-shared reservoirs and inside the country; gas storage throughout warm seasons to be used in high seasons; online conversion of oil, gas and gas condensate to other products or electricity; gas injection to domestic fields; growth in export and transit and swaps of crude oil, petroleum products, gas as well as gas condensate; reduction in amount of burning associated gas as well as gas condensate; switching from petroleum products to domestic or imported gas; and all plans which can increase production or savings of crude oil, condensate, gas and petroleum products.

**B-** Energy efficiency plans in different sectors including industrial sector with the energy-intensive industries, urban and suburban public and rail transportation as well as buildings on the top priority; developing

renewable resources of energy; promoting Compressed Natural Gas (CNG) or Liquefied Natural Gas (LNG) or Liquefied Petroleum Gas (LPG) mostly at large cities as well as the main routes between cities; producing fuel-efficient or electric vehicles or their replacement with old energy-intensive vehicles; reduction in freight and passenger transportation costs as well as decrease in ships demurrage fee (a form of liquidated damages for breaching the lay time); plans proposed regarding road, rail, air and sea transport; plans leading to GHG reduction; machinery and production units in agricultural sector.

20 **C-** Plans including new power plant construction with higher efficiency; increase in power plants production and thermal efficiency with steam unit installation in combined cycle power stations on the top priority including combined heat and power (CHP) as well as combined cooling, heat and power (CCHP) and distributed generation in small-scales (DG); developing renewable resources of energy; reducing energy loss in conversion, transmission and distribution; conservation and savings in power and energy consumptions; electrifying agricultural water pumps especially through renewable resources of energy including solar on the top list; switching from gas or petroleum products to electricity where possible and economic; increasing portion of electricity export and transit, power generation through fuel and gas losses at factories.

**D-** Construction of dams, ports, water and wastewater projects; plans to prevent salinity and low water quality; desalination and fresh water production through different methods with thermal recovery

methods on the top list; optimization and water savings while losses are reduced in water transmission and distribution; control and optimal utilization of inland, shared, and territorial waters as well as water sources that flows into the sea; plans dealing with wastewater collection and disposal along with all projects that lead to water quality improvement and reduce water consumption; drainage projects in agricultural lands and modern irrigation techniques; guarantees for water purchase or permits for water sales to investors in all cases including drinking and sanitary water, industrial, agricultural and irrigation water.

**E-** Other initiatives which can lead to quality or quantity improvement in production of commodities and services, or savings as well as loss prevention in resources including human and financial resource, environment and time.

**Note 1-** Technical, economic and environmental feasibility assessments, project schedule and maximum reimbursements, where government commitment is required, shall be submitted by the representative ministry to Iran Economic Council for approval. Economic Council shall review the proposal and declare its final decision, within a month of the plan receipt by its secretariat.

**Note 2-** National Development Fund and banks are required to allocate facilities and loans as foreign exchange or in Rials, to all feasible plans regarding their priority.

**Note 3-** Where investment or actions under this article leads to increase in basic earnings or cut public spending, government is obliged to repay the invest-

ment and its yield along with governmental and legal charges as well as other incurred expenses or related benefits based on the approved amount and arrangement by Iran Economic Council.

Ministry of Petroleum is obliged to repay investors or doers right at import or export prices (for fuels) as approved and notified by Iran Economic Council based on the resulting increase in present or future revenue or reduction in costs; in other cases the representative ministries and subsidiaries shall repay to investor or doers while it shall be debited against government account (Iran National Treasury) and settled simultaneously. In cases where investment or actions under this article might reduce revenue in executive agencies or governmental companies, the government is obliged to compensate for the resulting reductions.

This note does not include clauses A and B of Article 82 of the Fifth five-year Development Plan of the Islamic Republic of Iran.

**Note 4-** Government obligations subject to the clause E of this article is repaid based on the resulting revenues in the annual Budgets.

22 **Note 5-** Clauses of this article is implementing while investors who admit crude oil, gas condensate or petroleum products as their reimbursement are prioritized.

**Note 6-** The value of the saved fuel or energy will be calculated and repaid based on the fuel type and components within a year before the contract is signed, while import and export prices are considered.

**Note 7-** The representative ministries are allowed to purchase the produced or saved water, electricity, gas and petroleum products and other saved or produced commodities and services from non-governmental natural or legal persons, private or cooperative at export or import prices (for fuels) and purchase at non-subsidized prices in other cases or other investors. They are also allowed to invest in the context of job creation and projects dealing with acquisition of capital assets in every province and city. Investor can sell the saved or produced commodities or services inside or outside the country, if desired.

**Note 8-** In order to reduce costs and encourage users to consume less subsidized commodities and services, the representative ministries and their subsidiaries and affiliates are allowed by Economic Council approval to sell water, fuel, and other subsidized commodities and services at minimum prices or even free of charge proportional to reduction, where water, electricity, gas, petroleum products and other subsidized commodities and services are used less than specified limits while season, geographic zone, type of consumption and consumers will be considered.

Procedures for this note, including determination of specific consumption limits by geographic zones, type of consumption and consumers as well as consumption amount and price, will be approved by Economic Council along with joint proposals from Iran Management and Planning Organization as well as Ministries of Economic Affairs and Finance,

Petroleum and Energy, Industry, Mine and Trade, and Agriculture, within two months of the legislation notification.

Regulations for this article will be approved by Council of Ministers as offered by Iran Management and Planning Organization along with Ministries of Economic Affairs and Finance, Petroleum and Energy, within three months of the legislation notification.



## Article 12 Regulations (August 2015)

**Article 1-** All organizations subject to Article 12 of the Law on “Elimination of Competitive Production Barriers and Improvement of Financial System” that is briefly called “the Law” in this regulations, can sign necessary contracts with foreign or local individuals and companies with priority of private sectors or co-operatives, in accordance with applicable laws and regulations and in the field of their approved tasks, in order to save consumption and reduce losses and costs, increase production of commodities and services and other items subject to Article 12 of the Law which can lead to increase in revenue or reduce costs. The mentioned organizations shall manage that investment or actions in accordance with clause (2) in Article 12 of the Law, to be repaid only from additional income or obtained savings.

**Article 2-** The produced commodities or services agreed to the contracts subject to these regulations, shall be purchased by executive agencies up to total amount of investment only where the Law on “Implementing General Policies of Article 44 of Iran Constitution” allows the government to intervene. In case of investment in oil, gas and efficiency projects which lead to reduction in fuel consumption, the reimbursement through fuel savings or plan revenue will be guaranteed by subsidiaries of Ministry of Petroleum after an approval of Economy Council is received. In other cases subject to Article 12 of the Law, the investor can directly sell products or export produced commodities and services or can operate and use them pursuant their contract or issued license.

**Article 3-** About gratuitous payments to compensate investment or saving subsidies for energy carriers, water and subsidized commodities, the maximum aid will be done, proportional to the level of technology and up to total amount of investment or the savings period as approved by Iran Economic Council (whichever is less) as one of the followings (in descending order of priority):

**A.** For saved fuels and water, the same amount of the same energy carrier or water (less domestic price) and permits for sale and export can be delivered.

**B.** For petroleum products and gas, gratuitous payments equivalent to export prices of the saved fuel less its domestic price in the same year (export prices less costs and fines, where possible) will be considered; or the weighted average of domestic sales and exports is calculated for gas and electricity; and for water, the reimbursement is based on differences between water actual and determined prices.

**C.** In case of projects regarding loss reduction and efficiency improvement and development of renewable resources of energy in power networks, saving value will be calculated based on weighted average of actual consumptions of liquid fuel and natural gas prices.

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**D.** In case of saved natural gas in power plants, Ministry of Petroleum shall deliver crude oil at export up-to-date prices or pay its equivalent value to the investor regarding article 6 of this regulations (as investor`s request), while it shall be debited against government account (Iran National Treasury) and settled simultaneously.

**Article 4-** Professional qualifications of applicants and their ability to finance and competency to carry out the projects and work with ministries and their subsidiaries will be approved by Minister or their authorized person, and in case of other independent organizations should be approved by the highest authority of the organization.

**Article 5-** In order to prevent monopolies, executive agencies shall sign contracts subject to these regulations considering the law of tenders. Moreover, when investment and its related savings is done in private sector or cooperatives, the contractual cost or investment reimbursement shall not exceed the price of other similar signed contracts in the bid.

**Article 6-** Where repayment of the investment or produced commodities or services or gratuitous payment for specified savings in the contract, is funded through government revenues, reimbursement will be done while it is predicted and receives approval in annual budget, and can be delivered only after additional revenue or resulting savings deposits into Treasury account.

**Note-** Where repayment is done proportional to produced oil and gas or petroleum products as well as natural gas, after paybacks are done through Ministry of Petroleum and its subsidiaries (based on the approved tables by Iran Economic Council), Ministry of Petroleum will notify Treasury to consider debits and settle the repayments.

**Article 7-** In all contracts subject to these regulations, the technical, economic and environmental proposals, technological excellence compared to the existing level in country, Measurement and Verification

(M&V) plan, refund feasibility studies, table of investment and reimbursement through time as defined in clause 2 of Article 12 of the Law, or price of the purchased commodities, maximum reimbursement as the government commitment (where increase in public revenues or reduction in public costs occurs) and gratuitous payment to compensate investment or resulting savings, shall be approved by Iran Economic Council while jointly proposed by the representative ministry.

## Measurement & Verification (M&V)

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“Measurement and Verification” (M&V) is the process of planning, measuring, collecting and analyzing data for the purpose of verifying and reporting energy savings within an individual facility resulting from the implementation of energy conservation measures (ECMs). Savings cannot be directly measured, since they represent the absence of energy use. Instead, savings are determined by comparing measured use before and after implementation of a project, making appropriate adjustments for changes in conditions.

M&V activities consist of some or all of the following:

- Meter installation calibration and maintenance,
- Data gathering and screening,
- Development of a computation method and acceptable estimates,
- Computations with measured data, and
- Reporting, quality assurance, and third party verification of reports.

When there is little doubt about the outcome of a project, or no need to prove results to another party, applying M&V methods to calculate savings may not be necessary. However, it is still wise to verify (initially and repeatedly) that the installed equipment is able to produce the expected savings. Verification of the potential to achieve savings is referred to as operational verification, which may involve inspection, commissioning of equipment, functional performance testing and/or data trending. It also includes accounting of savings based on site energy

measurements before and after implementation of a project, and adjustments.

M&V is not just a collection of tasks conducted to help a project meet some protocols requirements. Properly integrated, each M&V task serves to enhance and improve facility operation and maintenance of savings. As shown in the figure below (Figure 4), M&V activities overlap with other project efforts (e.g. collecting data to both identify ECMs and establish energy baselines, commissioning and operational verification of installed ECMs, and installing monitoring systems to track and maintain savings persistence, etc.). Identifying these project synergies and establishing roles and responsibilities of involved parties during project planning will support a coordinated team effort. This can leverage complementary scopes and control M&V-related costs.

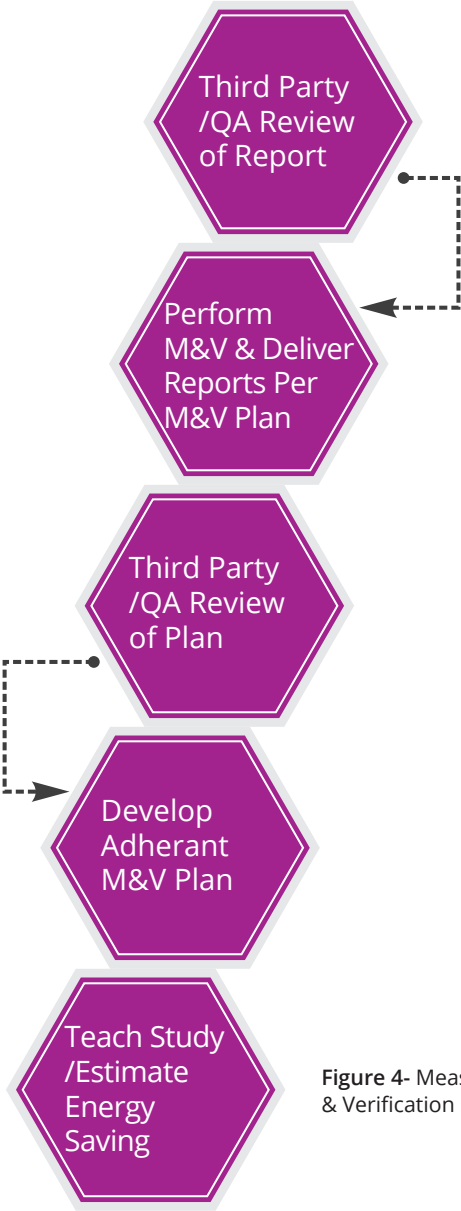


Figure 4- Measurement & Verification stepwise

# Increasing Efficiency in Central Heating Systems



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The plan aims at improving efficiency in 600,000 units of central heating systems, including 500,000 and 100,000 units in residential and commercial buildings respectively, which can lead to considerable reductions in natural gas consumption through defined strategies and actions (such as high-efficient condensing boilers and BEMS).



Table 2 summarizes the general information about the plan in two different scenarios. Simply put, the digits in the upper rows indicates the actual reimbursable information which can occur within 10 years from 2017 to 2026, while the information at the bottom stands for the predicted savings throughout the plan useful time considering ten-year lifetime for each unit.

**Table 2**  
General information about “Central Heating Systems Plan”

Reimbursement Period (Per Unit)	60	Months
Max Reimbursement (2017-2026)	2	Billion USD
Saving	15.4	Billion m3 NG
GHG Reduction	30.6	MMTCDE
Saving	30	Billion m3 NG
Saving Value (2017-2030)	3.9	Billion USD
GHG Reduction	60	MMTCDE

# Renewal of the City Bus Fleets



34 Although the operation of the bus network is one of the sources of fuel consumption as well as total emissions in Iran transport sector, it is considered as a serious problem especially in terms of pollution due to the vehicles age. In this regard, renewal of the city bus fleets is proposed as an ESPC plan, which aims at phasing out 17,000 old diesel-run buses from city fleets to make way for the eco-friendly CNG vehicles over a span of five years for execution.

Table 3 summarizes the general information about the plan in two different scenarios. In other words, the digits in the upper rows indicates the actual reimbursable information which can occur within 10 years from 2017 to 2026, while the information at the bottom stands for the predicted switching throughout the plan useful time considering ten-year lifetime for each new vehicle.

**Table 3**  
General information about “Renewal of City Bus Fleets”

Reimbursement Period (Per Unit)	7	Years
Max Reimbursement (2017-2026)	1.795	Billion USD
Switching	5.7	Billion Liter Gas Oil
Switching	8.5	Billion Liter Gas Oil
Switching Value (2017-2030) (at Oil 60 USD)	2.2	Billion USD

# Renewal of Taxi Fleets



36

This project is basically aiming at reducing gasoline consumption in the operating fleets through fuel switching. Accordingly, 140,000 gasoline-powered aging vehicles in Iran taxi fleets are considered to be phased out and replaced with new eco-friendly CNG vehicles. Natural gas vehicles (NGVs) can offer an array of economic and environmental benefits to Iran residents. These may include the economic benefits of a low-cost domestic fuel, reducing the transport

sector dependence on petroleum, improving regional air quality, and reducing greenhouse gas emissions. As plan includes both sedans and vans, reimbursement period varies over a span of five and seven years for each type respectively.

Table 4 summarizes the general information about the plan in two different scenarios. Simply put, the digits in the upper rows shows the actual reimbursable information which can occur within 8 years from 2017 to 2024, while the information at the bottom stands for the predicted switching throughout the plan useful time considering ten-year lifetime for each new vehicle.

Table 4 General information about “Renewal of Taxi Fleets”		
Reimbursement Period (Per Unit)	5 7	Years for Sedan Years for Van
Max Reimbursement (2017-2024)	635	Million USD
Switching	7	Billion Liter Gasoline
Switching	13.9	Billion Liter Gasoline
Switching Value (2017-2029) (at Oil 60 USD)	1.3	Billion USD

# Renewal of Truck Fleets



38

There are 120,000-130,000 vehicles in Iran's cargo truck fleet averaging over 25 years which has been blamed for excessive fuel consumption and air pollution. Accordingly, the government is determined to renew the domestic aging road fleet with 65,000 new vehicles jointly produced with more efficient high-tech engines. The move is aimed at reducing air pollution and fuel consumption in Tehran as well as other big cities across the country. It shall be noted

that the trucks are being financed via leasing, with 60-80% of the costs covered by governmental facilities whose portion is provided through ESPC repayment.

Table 5 summarizes the general information about the plan in two different scenarios. The digits in the upper rows stands for the actual reimbursable information which can occur within 10 years from 2017 to 2026, while the information at the bottom predicts the possible amount of savings throughout the plan useful time considering 25-year lifetime for each new vehicle.

**Table 5**  
General information about “Renewal of Truck Fleets”

Reimbursement Period (Per Unit)	7	Years
Max Reimbursement (2017-2024)	2.7	Billion USD
Saving	9.2	Billion Liter Gas Oil
GHG Reduction	24	MMTCDE
Saving	34	Billion Liter Gas Oil
Saving Value (2017-2045) (at Oil 60 USD)	12.6	Billion USD
GHG Reduction	89	MMTCDE



# Development of Rail Transport



40

With environmental and monetary costs of automobile transportation accruing, urban populations increasing, and cities attempting to reinvent their urban cores and polycentric business areas, it is no wonder that many municipalities and transit authorities are looking toward rail transport to accommodate current and future growth. Proponents of mass transport contend that such transportation reduces pollution via emissions and impervious surface re-



ductions, eases auto congestion, saves users costly fixed and incremental driving costs, and assists the handicapped, elderly, and low-income groups with access to work and amenities. Advocates also argue that mass transportation in the form of rail can act as a catalyst to economic development.

Accordingly, Iran Economic Council approved a similar plan considering development of rail transport in 2015 with required investment of 7.532 billion USD whose information is summarized in table 6. It should be noted that digits indicates the reimbursable savings only and the actual predicted savings throughout the plan useful time (equivalent to 40 years) is far more than this amount.

Table 6 General information about “Development of Rail Transport”		
Reimbursement Period (Per Unit)	8	Years
Max Reimbursement (2017-2024)	7.53	Billion USD
Saving Value (at Oil 60 USD)	4	Billion USD
Saving	10.5	Billion Liter Gas Oil
GHG Reduction	27.2	MMTCDE

## 3-Cylinder Engines



42

The basic advantage of a three-cylinder engine over a four-cylinder is that it is inherently more fuel efficient (as there's one cylinder less of volume of fuel to burn). The smaller the engine size, the less fuel it will burn and hence it is more fuel efficient, which can lead to lower pertinent carbon emissions.

Besides, since there is one cylinder less in a three versus a four-cylinder engine, there is a lower surface area of metal-to-metal contact (pistons mov-

ing inside the cylinder) compared to a four-cylinder engine and fewer joints (piston to crankshaft). This makes for better mechanical advantage as less fuel is wasted in overcoming friction. Moreover, there is considerable weight saving in the engine. This gives carmakers a lighter engine, which translates to lower kerb weight for the car and hence marginally better fuel efficiency as well.

According to what is discussed, the plan is aimed at manufacturing 3-cylinder cars to replace with the old existing sedans throughout the country. The summary of the plan is given in table 7 where the digits in the upper rows stands for the actual reimbursable information which can occur within 10 years from 2018 to 2027, while the information at the bottom predicts the possible amount of savings throughout the plan useful time considering ten-year lifetime for each new vehicle.

**Table 7**  
General information about “3-Cylinder Engines”

Reimbursement Period (Per Unit)	5	Years
Max Reimbursement (2018-2027)	328	Million USD
Saving	2.0	Billion Liter Gasoline
GHG Reduction	3.9	MMTCDE
Saving	3.8	Billion Liter Gasoline
Saving Value (2018-2032) (at Oil 55 USD)	624	Million USD
GHG Reduction	7.3	MMTCDE

# Electrifying Agricultural Water Pumping Systems



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Agriculture is the backbone of our country, where large per cent of the population depends on agriculture directly or indirectly. Therefore, farmers are forced to provide enough energy through electric or diesel pumps for irrigation.

Investment decisions are mainly based only on the cost for purchasing a technology, neglecting the operational, maintenance and replacement costs. When comparing diesel and solar water pumps (for example) in terms of

total costs over the minimum 20-year lifespan of the solar panels, one must add the cost of fuel that has to be delivered to the borehole for the next 20 years, to the cost of the diesel pump itself. From another point of view, using electric-powered water pumping solution means easier access as well as less fouling of waterways and far less erosion of banks besides carbon reduction. According to what is discussed above, the plan is defined as removal of gas oil consumption in agricultural sector through replacing the existing diesel-engine water pumps with electric services. Various scenarios including power grid, DG, solar panels and wind turbines can be used to power new pumping systems. The summary of the plan is given in table 8 where power grid scenario is considered in calculations. The digits in the upper rows stands for the actual reimbursable information which can occur within 12 years from 2017 to 2028, while the information at the bottom predicts the possible amount of switching throughout the plan useful time considering ten-year lifetime for each new pumping system.

**Table 8**  
General information about “Electrifying Water Pumping Systems”

Reimbursement Period (Per Unit)	8	Years
Max Reimbursement (2017-2028)	1.65	Billion USD
Switching	8.7	Billion Liter Gas Oli
Switching	10.9	Billion Liter Gas Oli
Switching Value (2017-2030) (at Oil 60 USD)	1.8	Billion USD

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