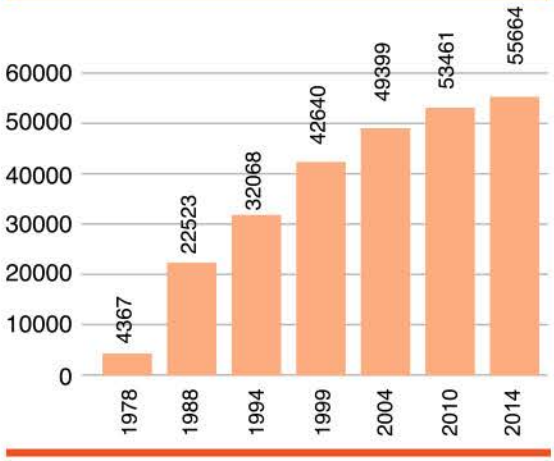
Power Distribution

Power Distribution

Distribution companies throughout the country are in charge of electricity distribution duty. Navigation, guidance and control of this extensive activity in the country require a coherent policy and foresight. It is required not only technical and engineering knowledge but also various views of management, economics and law. It was started with implementation of article 44 and privatization of distribution companies in 2012 and to be a growing trend.

Diagram (23): Number of Electrified Villages



Macro Views of Electricity Industry in Distribution Section

- Improving the quality of public service concerning on governmental policies and general satisfaction
- Implementation policies of article 44 and transfer distribution companies to private sector
- Development of economic attitudes of managers parallel with promotion of technical section
- Support of distribution section to reduce energy loss
- Development through of having company in members of the board of distribution companies
- Supervisory and legal infrastructure development to do governance tasks electricity industry after transferring companies

Distribution Networks

Electrical energy is distributed in medium and low-voltage levels that their statuses are as follows by the end year 2014:

Medium-Voltage Network

Medium-voltage network has usually 20 kV voltage level and in some parts, 33 and 11 kV are used for electricity distribution.

Length of medium-voltage networks had average growth 2.2 per cent compared to the previous year and reached 398,000 km.

Low-voltage lines

Low-voltage lines are 3-phase 380 V and single-phase 220 V and 50 Hz frequency. Length of low-voltage lines had average growth 3.3 percent compared to the previous year and reached 337,000 km.

Diagram (24): Number and Capacity of Distribution Network Transformers

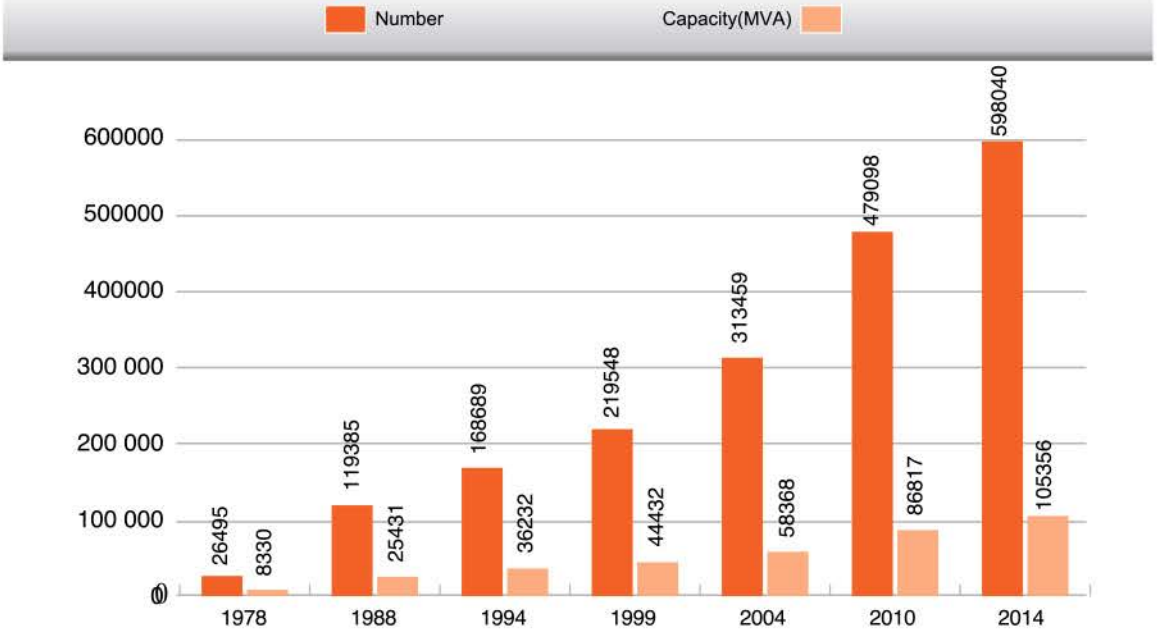
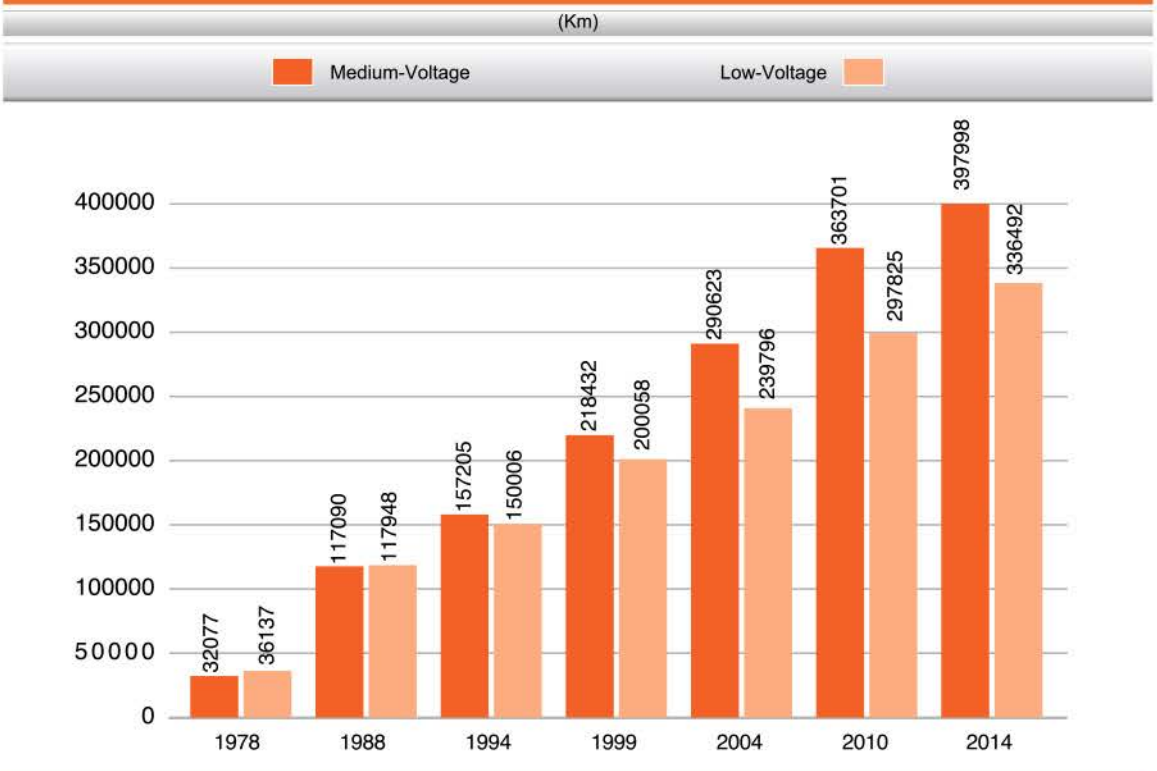


Diagram (25): Length of LV/MV Distribution Lines



Load and Generation Leveling

- Load and Generation Leveling
- Power Consumption in Various Sectors
- Load and Energy Levelizing

Load and Generation Leveling

In 2014, electric energy consumption has been increasing 8.1 percent comparing with it in the previous year and reached 219653 Million kWh. The management of the electric energy consumption and generation is defined as utilizing a collection of policies and implementations that leads to balancing between mentioned sectors. Generation management has brought all his effort in the field to supply a reliable energy which is economically assured. Diagram (27) shows load and generation leveling of electricity in different sections of consumption in the year 2014.

Mangment of Power Consumption

The measures carried out by power management office in regional electric companies are as follows.

- Cultural activities and awareness
- Studies on load and consumption patterns
- Evaluate potential solutions and their priority
- Demand side management programs
- Follow-up enforcement activities

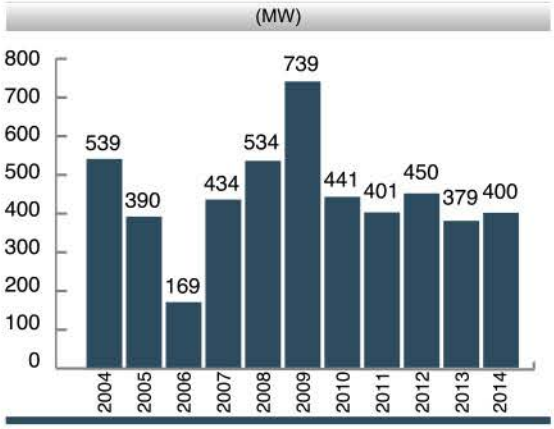
Power Consumption in Various Sectors

At most of the countries, power electric consumers are divided in 6 sectors named: residential, public, other consuming, industrial, agriculture and road lamination. By the end of 2014, number of customers and electric energy consumption has been 31672000 and 219653 Million kWh, which comparing with the previous year 4.6 and 8.1 percent growth is detected, respectively.

Load and Energy Leveling

Load factor and power plant performance efficiency were 67.1 and 49 percent in 2014. Energy loss in transmission and sub-transmission networks was 3.02 and 12.93 percent respectively and total loss of country's electricity network was 13.13 percent (Diagram (29)). Diagram (30) shows annual growth trend of power generation, supplied power and revised consumption need.

Diagram(26): Decrease Rate of Peak Load of Bulk Power System by Accomplishing the Large Scale Industries' Scheme



Diagram(27): Energy Generation and Consumption Levels in 2014

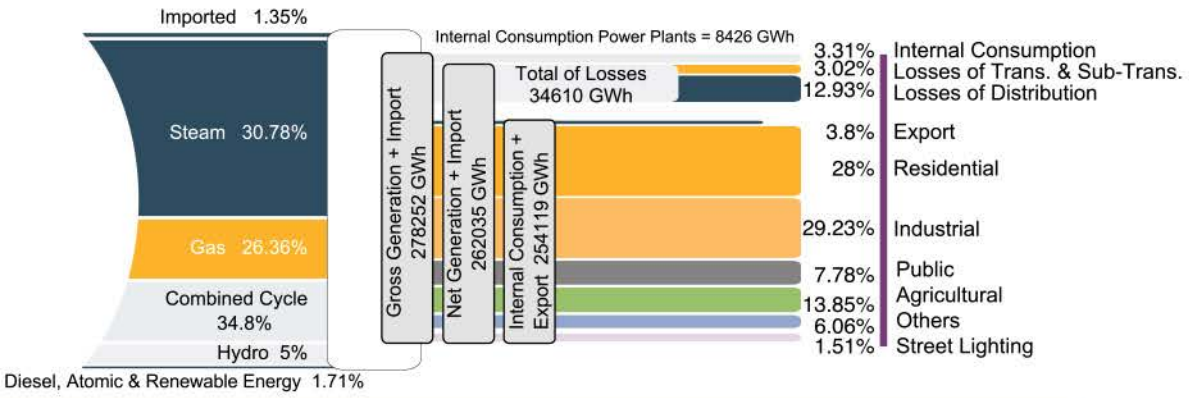


Diagram (28): Different Sectors' Share in Electricity Energy Consumption

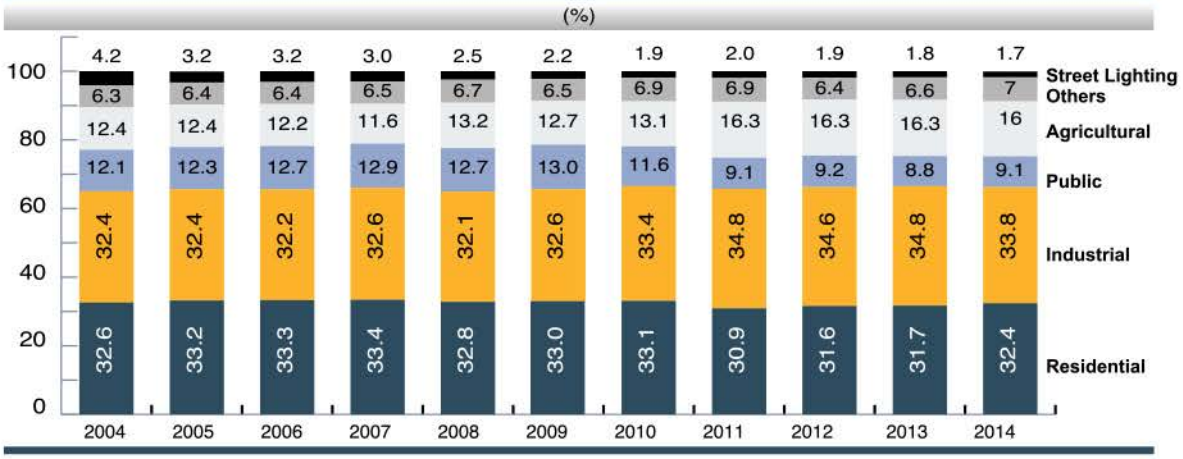


Diagram (29): Trend of Bulk Power System Loss Changing

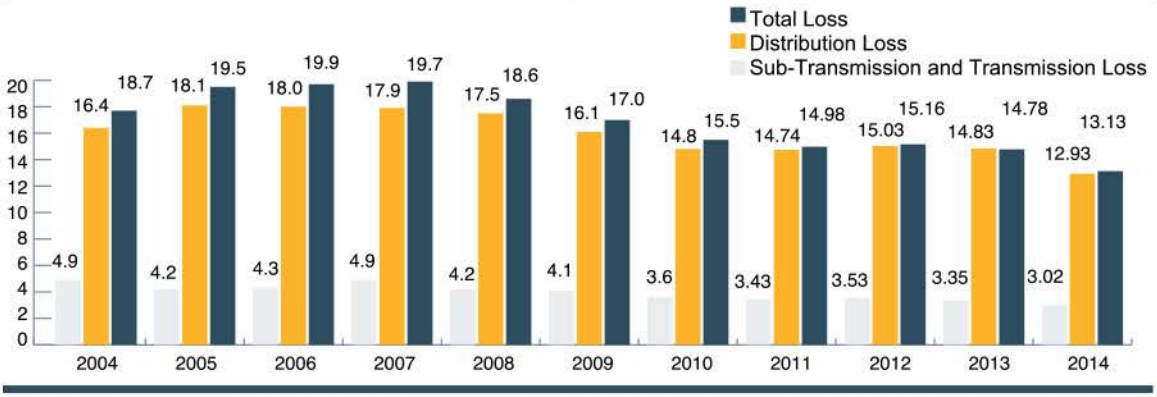
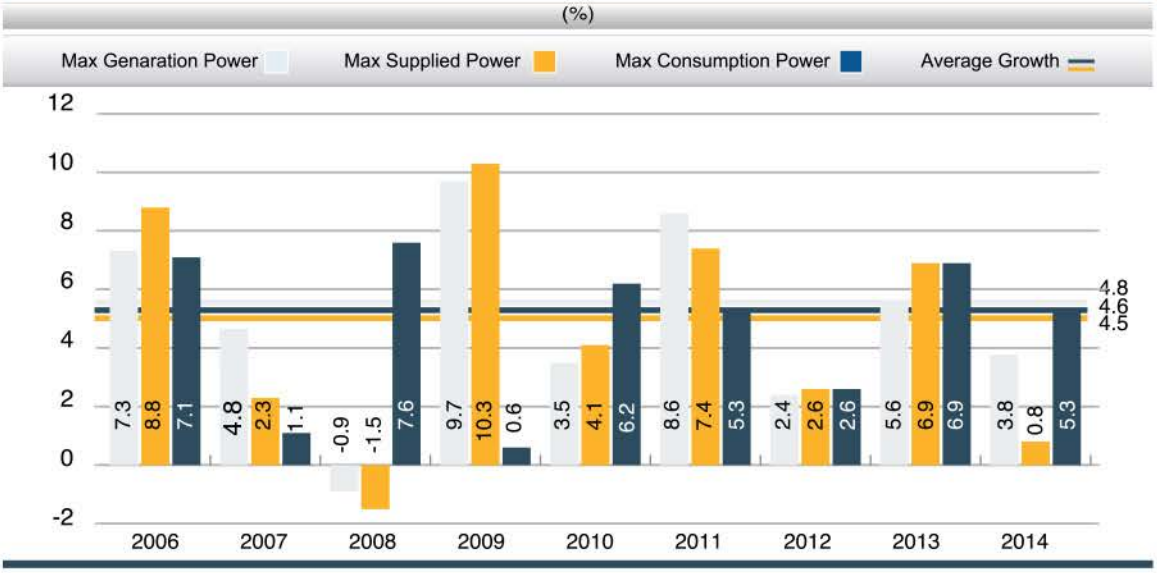


Diagram (30): Annual Growth Trend of Power Generation, Supplied Power and Revised Consumption Need



Power System Management and Leadership

- Deputy of Grid Operation
- Deputy of Planning and Security Network Monitoring
- Deputy of Power Market

Deputy of Grid Operation

- Management and ensuring of the accuracy and availability of the required data to conduct the missions of deputy units and coordination for improvement the quality and facilitating to prepare these data
- Management and ensuring of the accuracy and availability of performance of systems and the required equipment to conduct the missions of deputy units and coordination for improvement their performance
- Confirmation of the eligibility and capability of contractors and management and monitoring them
- Confirmation of the eligibility of new apparatus which are connected to the network
- Monitoring short and mid-term planning processes
- Responsibility for the changing caused by power market in a restructured condition
- On-line monitoring and control of voltage, frequency and demand response, economic and security measures, management of critical conditions of network and reclosing operation and extraterritorial obligations

Deputy of Planning and Security Network Monitoring

- Power network protection coordination
- Study and evaluation of power network security and reliability
- Preparing and evaluating the rules, standards and guidelines related to power network security and reliability development

Deputy of Power Market

- Planning and operation of power market and its development
- Planning to prepare more innovation and competition in power market
- Preparing a platform to define power market properly and knowledge management of effective parameters and power market's rules in electricity industry
- Interactions with deputy of grid operation for planning and operating unit commitment, information exchanging and the issues related to power plant units
- Interactions with deputy of planning and security network monitoring in order to connect power plant units to develop the competition

Human Resources

- Human Resources

Human Resources

Measures taken in the area of human resource development and training

- Implementation of a systematic model to manage training
- Preparing the supporting guidelines to implement the aforementioned model
- Standardization of characteristics of the job and professional courses of electricity industry
- Developing e-learning system for electricity industry training
- Creating interaction, collaboration and knowledge sharing, related business processes for learning management between subsidiaries
- Organizing Working Groups and professional committees for development and training of human resources in the electricity industry
- Active participation in the design of optimal organizational training model for water and power industry
- A memorandum of understanding with the inventor in order to promote entrepreneurship at TAVANIR

Measures taken in the area of managers services

- All matters related to the selection and appointment of senior managers
- Periodic follow-up and getting reports about implementation instructions to choose and appoint managers
- Meetings for the selection and appointment of senior managers
- Updating database of managers of subsidiary companies
- Evaluation of 418 middle-level and senior-level managers working in subsidiaries, power generation management (111 staff), Power Distribution (223 staff) and subsidiaries (84 staff) by management clinic

Table (2): Human Resources Improvement Indices in the Electric Power Industry in 2014 Compared with the Year 2013

Description	Unit	2014			2013			Change
		Amount	Man Power	Indice	Amount	Man Power	Indice	
Installed Capacity per Employment	MW/ Person	73152	9846	7.4	70279	10249	6.9	0.6
Gross Generation per Employment	10^6kWh/ Person	274480	9846	27.9	262192	10249	25.6	2.3
Transmission Lines per Employment	km-Circuit/ Person	50727	10252	4.9	50215	10470	4.8	0.2
Sub-Transmission Lines per Employment	km-Circuit/ Person	70024	10252	6.8	69304	10470	6.6	0.2
Transmission Substation per Employment	kVA/ Person	132167	10252	12.9	125908	10470	12.0	0.9
Sub- Transmission Substation per Employment	kVA/ Person	94330	10252	9.2	91108	10470	8.7	0.5
Length of MV Distribution Lines	km/ Person	397998	16441	24.2	389566	16499	23.6	0.6
Length of LV Distribution Lines	km/ Person	336491	16441	20.5	325868	16499	19.7	0.8
Capacity of Distribution Transformer per Employment	kVA/ Person	105356	16441	6.4	100787	16499	6.1	0.3
Electricity Sale per Employment	10^6 kWh/ Person	219653	16441	13.4	203088	16499	12.3	1.1
Number of Customer per Employment	10^3Customer/Person	31671	16441	1.9	30287	16499	1.8	0.1
Ratio of Higher Education Staff to Total Staff in Tavanir Co.	Percent	53.6			51.6			2.0
Ratio of Higher Education Staff to Total Staff in Other Tavanir Co.		65.9			62.9			2.9
Ratio of Higher Education Staff to Total Staff in Regional Electric Co.		37.6			34.7			2.9
Ratio of Higher Education Staff to Total Staff in Management Generation Co.		54.5			50.5			4.0
Ratio of Higher Education Staff to Total Staff in Distribution Co.		53.3			49.2			4.1
Ratio of Higher Education Staff to Total Staff in Industrial Electric Co.		48.1			44.2			4.0

Diagram (31): Separation of the Power Industry Personnel by Their Education in 2014

(%)

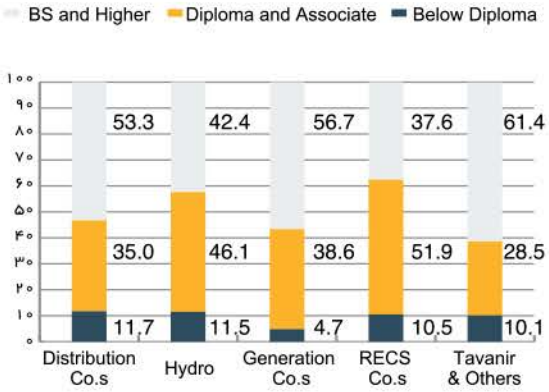
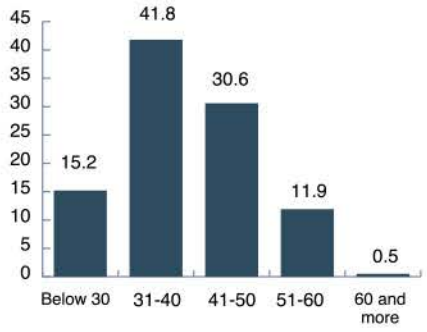


Diagram (32): Age Distribution of the Personnel in 2014

(%)



- Design and implementation of four training courses for managers and training over 7,000 people-hours in the year 2014
- Information, gathering and evaluation valuable management experiences of companies to present in 10th International Conference on Management
- Organizing for training Working Group meetings in other to evaluate and determine training model for managers based on competency standards
- Identify and analyze training needs of managers
- Organizing Working Group meetings in other to find managers
- Working Group meetings to motivate and retain managers

Diagram (33): Variations in the number of personnel from 2004 through 2014

(Person)

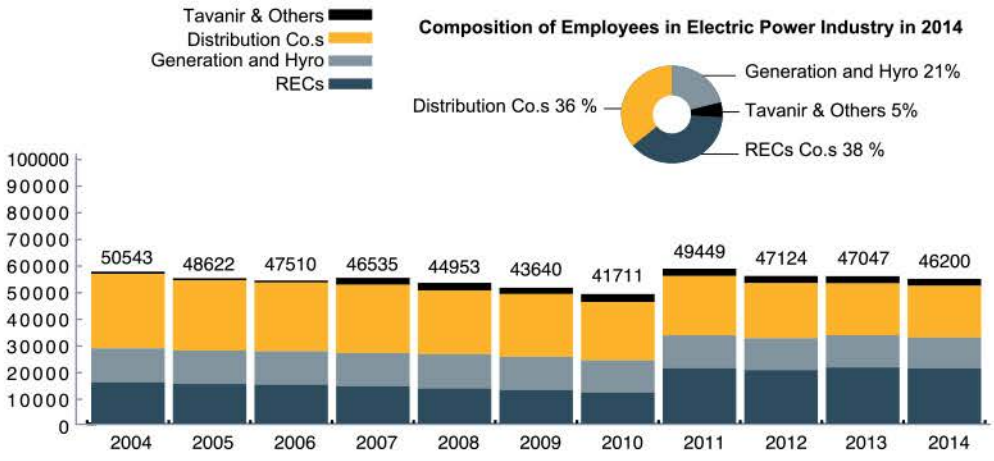
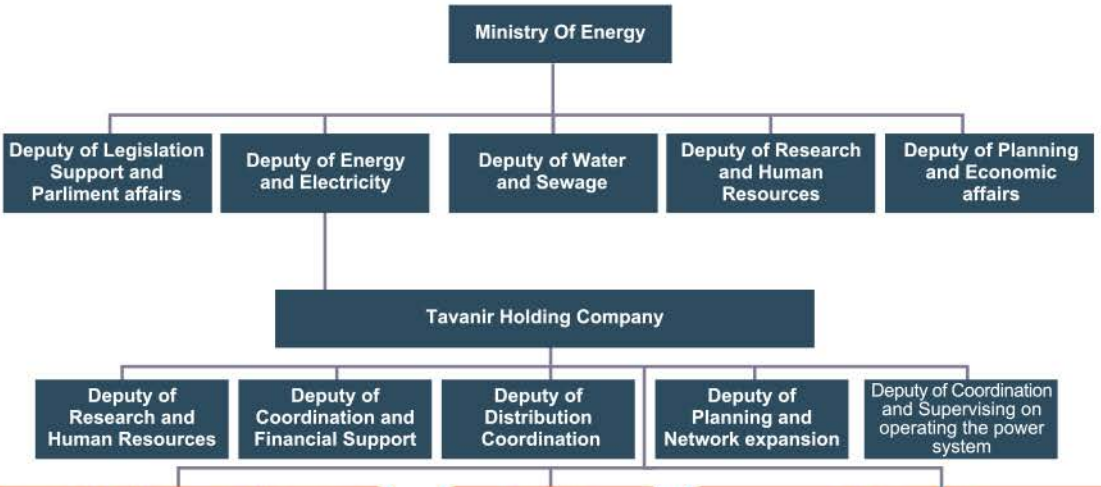


Diagram (34): Organizational Chart of Ministry of Energy (MOE); Electric Power Affairs



Regional El.Co.	Generation Management	Distribution
Azerbaijan	East Azerbaijan	Tabriz City
		East Azerbaijan
	West Azerbaijan	West Azerbaijan
		Ardebil Province
Bakhtar	Shahid Mufateh	Markazi Province
	Shazand	Hamedan Province
		Lorestan Province
Fars	Fars	Shiraz City
	South of Fars	Fars Province
		Bushehr Province
Gharb	Bistoon	Kermanshah Province
	Kurdistan	Kurdistan Province
		Ilam Province
Gilan	Gilan	Gilan Province
	Loushan(Shahid Beheshti)	
Hormozgan	Persian Gulf	Hormozgan Province
	Hormozgan	
Isfahan	Isfahan	Isfahan City
	Shahid Muntazeri	Isfahan Province
		Charmahal & Bakhtiari
Kerman	Kerman	North Kerman Province
	Zarand	South Kerman Province
Khorassan	Toos	Mashad City
	Mashad	Khorassan-e-Razavi Province
	Khayam	South Khorassan Province
	Khorassan Gas power plants	North Khorassan Province
	Sabz Binalood	
Khuzistan		Ahwaz City
	Ahwaz (Ramin)	Khuzistan Province
	Abadan	Kohgilooye & Buyer-Ahmad
Mazandaran	Neka (Shahid Salimi)	Mazandaran Province
		West of Mazandaran Province
		Golestan Province
Semnan	Semnan	Semnan Province
	Systan&Baluchistan Power Plants	Systan&Baluchistan Province
Systan & Baluchistan	Rey	Capital Tehran
	Shahid Muntazer Ghaem	Alborz Province
Tehran	Qom	Tehran Province
	Besat	Qom Province
	Shahid Rajaee	
	Shahid Firouzi Power Plant	
	Damavand	
	Parand	
Yazd	Yazd	Yazd Province
Zanjan	Zanjan	Zanjan Province
		Ghazvin Province

Other Companies
Iran Grid Management Co.(IGMC)
Iran Power Plant Maintenance Co.
Iran New Energies Org.(SUNA)
Iran Energy Efficiency Org.(SABA)

Improving Productivity

The most important activities carried out in EFQM in TAVANIR to support the subset companies

1. Planning and facilitating the implementation of self-assessment based on EFQM model in regional and distribution electricity companies
2. Planning and facilitating for definition, doing priority and implement of improvement projects due to self-assessment in subset companies
3. Prediction and planning of the necessary budget to do improvement projects due to self-assessment in subset companies
4. Study, confirmation and allocating budget of improvement projects due to self-assessment in subset companies
5. Evaluation the feedback reports of self-assessment and improvement projects caused by it in subset companies
6. Preparing, analysis and presentation of comparison reports of performances of FEQM of subset companies including self-assessment and related improvement project
7. Preparing and facilitating for definition, planning and implementation of FEQM projects
8. To facilitate formation and distribute the improvement knowledge among subset companies

The measures taken concerning EFQM and self-assessment project at TAVANIR based on the EFQM model

1. Working Group meeting concerning EFQM at TAVANIR in corporation with all senior managers
2. Surveying strengths and aspects which can be improved for each criterion and sub-criterion in the EFQM model
3. Scoring criteria and sub-criteria in Working Group meetings based on Radar Logic
4. Definition of improvement projects for each criterion and sub-criterion and consensus about them in Workshop meetings
5. Categorization and integration of improvement projects of electricity industry
6. Prioritizing of improvement projects by various units
7. Prioritizing of improvement projects at the company and as a comprehensive 3-year program
8. Preparation and presentation of self-assessment reports done at TAVANIR as a book including strengths, improvement areas, scores, improvement projects prioritized in various aspects in the form of a comprehensive 3-year program

Information Technology and Statistics

■ Information Technology and Statistics

Performance Report of Information Technology and Statistics Office

Information technology (IT) and statistics office at TAVANIR Company is responsible for policies and supervision on information technology developments in the electricity industry. In the 2014, the office presented its strategic plan named "Strategic plan of the information technology and statistics office at TAVANIR" for planning, coordination and optimal operation of information technology and statistics developments in electricity industry. This plan promotes information technology levels at TAVANIR and active companies of the electricity industry hopefully and enhance their capabilities to achieve their mission and goals.

Statistics Group

Attention to the data and statistics and establishment proper organization based on scientific principles and following the latest related technologies and timely and accurate data and statistics to reply to information needs of electricity industry managers in various levels can be efficient and useful to solve the electricity industry problems, capital losses and optimal planning. Since the statistics information produced in statistics group of TAVANIR is the only official reference for decision markers and macro management managers of electricity industry, its importance is significant. Statistics group activities of TAVANIR are included four areas as follows.

1- Publication Services

2- Information Technology Services

3- Services to meet the information and statistics needs

4- Information Management including

- Meetings and annual symposium with statistical units in subsidiaries to establish close relations, inform about promotion of statistical issues and sometimes handle their problems
- Accounting data and creating a profile at the end of each report
- Statistical coordination with the regions and headquarter before publishing each report
- Reducing both the time to provide statistical data and errors during information exchanging
- Needs assessment

Document Management Group

Library

Library services are included in four sections as follows: Reference, Organizing (Cataloging, Classification and Indexing), circulation desk, software programs and national and international standards and databases.

Knowledge Management

Knowledge management activities at TAVANIR and subsidiaries are as follows.

- Evaluation of the knowledge management establishment based on national EFQM model
- Executive phases of the knowledge management establishment
- Developing a knowledge management perspective
- Preserving and learning from previous organizational experience and knowledge
- Prevent from escaping the knowledge of people retiring
- Creating an interactive environment to share and interchange knowledge in the electricity industry
- Preparing knowledge management system mapping

Electricity Economy

- **Electricity Economy**

Electricity Economy

Electricity is one of energy types having significant application. In some applications, it can be replaced instead of other energy resources. With indentifying the electricity as one type of energy resource and its advantage of environmental impacts and in regard to rising fossil fuel energy costs led to promote power generation investments. This means that with having information about amount of electricity consumption, intensity of energy, composition of electricity subscribers and load curve the development degree of every country can be determined.

Electricity Tariff

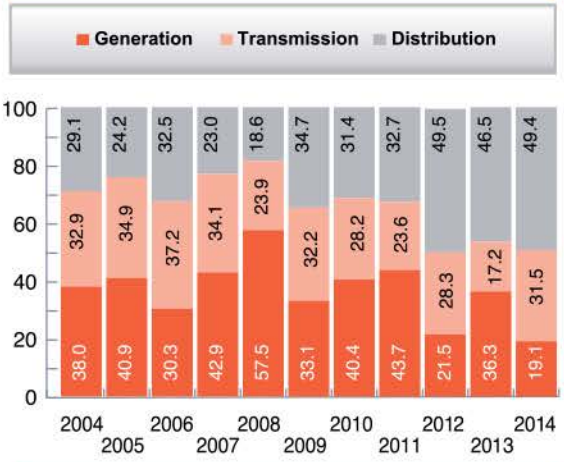
In general the tariff of electricity is divided into five main groups based on type of activity including domestic, public, agricultural, industrial and mineral and other consumptions.

In domestic section, regional differences have been considered in way that the country has been divided into five individual regions based on climate including a common region and four tropical regions.

Subsidies of Electric Energy

At present most of electricity customers have subsidies and the highest subsidy is related to agriculture sector. In 2014, the electricity cost with considering the cost of fuel (based on domestic prices) was 1107 Rials/kWh and the average selling price for every electricity kWh is 525.64 Rials.

Diagram (35): Share of Investment in Electric Power Industry

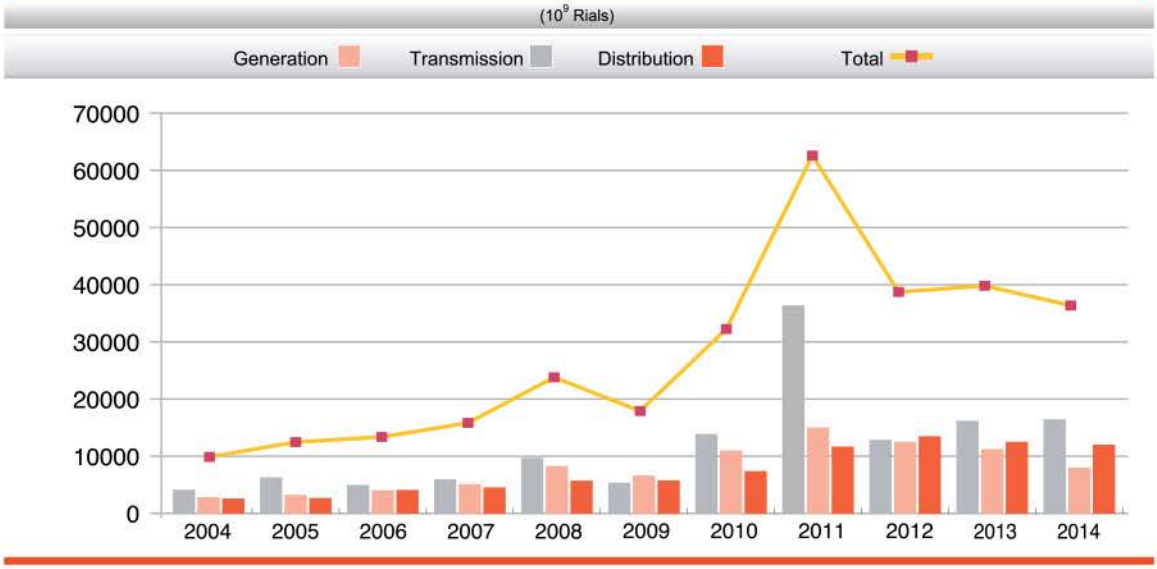


Table(3): Comparison, Sale Price & Cost of Final Price in 2013

(Rials/kwh)

Tariff	Average Cost With Fuel Subsidy	Average Selling Price
Residential	1400	439.41
Commercial	1094.8	617.61
Agricultural	1096.4	177.86
Industrial	1004.1	542.59
Others	1798.4	1663.69
Total	1131	525.64

Diagram (36): Investment in Electric Power Industry Facilities



Contents

Environmental Issues

■ Ecosystem in Electricity Industry

Activities about Environmental Issues in Power Generation Sector

Based on a memorandum of understanding between Ministry of Energy and Department of Environment, key goals of electricity industry about environmental issues are as follows.

1- Installation of online monitoring systems in power plants

2- Preparing a comprehensive program about waste management and waste created by power plants

3- Take whatever actions are necessary to use clean fuel (natural gas) in plants close large cities

4- The creation of a center for Health, Safety & Environment (HSE) at MoE and all subsidiaries

5- Increasing the maximum consideration to assess the environmental impact of the construction of new power plants and implementation of projects subject to environmental assessment

6- Actions and support mechanisms needed to develop and use renewable energies

Diagram (37): Share of Various Consumption Fuel in MOE Thermal Power Plants

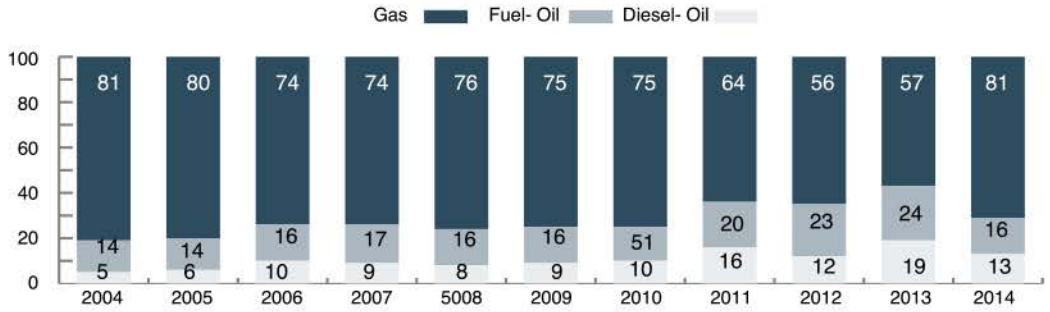


Table (4): Amount of Various Air polluting of MOE Thermal Power Plants Based on Power Plant Type in 2014

10^3 kg

Description	Nominal Capacity (MW)	NOx	SOX	Co2	Co	SPM	CH
Steam	15829	92217.2	4846441.1	58425643	103	13478.7	4905.1
Gas	26412	85613.8	76278.2	54196585	116.5	9433.4	2673.3
Combined Cycle	18493	76075	63276.9	48414498	104.8	8213.8	2313.1
Diesel	439	124.8	382.6	63552	0.1	23.9	7.7
Total	61143	254030.8	4986378.8	161100278	324.4	31149.8	9899.2

Table (5): Amount of Various Air polluting of MOE Thermal Power Plants Based on Fuel Type in 2014

10^3 kg

Fuel	Natural Fuel (10^6 Liter/10^6m^6)	NOx	SOX	Co2	Co	CH	SPM
Fuel Oil	10273	49316.8	470008.6	29373071	36.5	3945.3	9863.4
Diesel Oil	8871	43093.1	132096.8	21944307	33.1	2643.6	8254
Natural Gas	50172	143624.6	276.2	98189502	230.2	2716	11048
Total		236034.5	602381.6	149506880	299.8	9304.9	29165.4

Research Activites

Research Activities

The research office of TAVANIR Company is responsible for supervision duties, policy-making, management and preparing of standards related to research issues in electricity industry. It is included four expertise groups as follows:

- A group for coordination of research of regional and distribution electricity companies
- A group for national and development projects
- A group for connection with scientific and research centers
- A group for inspection and quality control of equipment manufacturing in industry electricity

The list of the completed research projects in 2014:

- Design and construction a 1 MVA HVDC Light
- Preparation of action plan describing ten duty strategies of MoE
- Preparation of standards for hybrid insulators
- Replacement of control systems of gas turbine in RAY power plant by digital systems

The list of the approved research projects in 2014:

- Design and construction a SVC to be installed in 63/20 kV LOSHAN substation
- Technical development design, construction and testing fuel nozzles for gas turbine GE-F9 and making a nozzle for installation and testing in a sample unit
- A study on application of Phosphonate-Based Inhibitors in cooling tower A feasibility study to develop a national software for GIS
- Transmission and sub-transmission network planning considering wind power plants connected to network and considering dynamic loading of lines
- Reliability Study on strengthen of RAMIN power plant connections to bulk transmission network

Actions about inspection and quality control of special equipments of electricity industry

- Preparing the documentaries to evaluate the eligibility of goods and technical services of electricity industry regarding the opinions of the technical deputies
- Recognizing international reference laboratories to carry out the type tests which cannot be done in the country
- Determining criteria and application forms related to the establishment of quality control (QC Plan) in the factories manufacturing of the equipment needed for electricity industry
- Determining criteria and forms related to the sampling of the product for testing by independent inspectors who have been approved by TAVANIR
- Trying to equip existing laboratories and establish new laboratories in the electricity industry to able to do type tests of the equipment needed by the electricity industry
- A quality control plan establishment in 40 wire and cable companies by independent inspectors who has been approved by TAVANIR
- Releasing of certification about compliance with standards for the production of 120 kinds of wires and cables
- Communication, coordination tests for a total of 250 companies
- Extension and releasing of certification about compliance with standards for the production of all kinds of ACSR wires and aluminum wires for 50 product types
- Sampling and testing of protective relays made by three domestic manufacturer and the approval of QC Plan and releasing certification about compliance with standards
- A qualification survey of the maintenance companies in generation section for 39 companies

Energy Efficiency

Energy Efficiency

Efficient energy use, sometimes simply called energy efficiency, is the goal to reduce the amount of energy required to provide products and services. The main activities about energy efficiency in 2014 are as follows.

1- Development plan to use low consumption lamps and optimizing of energy consumption
2- A plan to increase generation productivity in steam and gas power plants
3- Implementation of Iranian national advanced metering infrastructure plan (FAHAM)
4- Power loss plan and optimizing of energy consumption
5- A program about subsidy allocated to loan interest and managed funds

Privatization in Electricity Industry

Privatization in Electricity Industry with Regard to General Policies of article 44

Privatization in Electricity Industry with Regard to General Policies of article 44

Electrical energy consumption growth has accelerated in recent years. Consumption growth of subscriber and increase of their expectation of the level of quality of public services needs significant, dynamic and coherent investment in the electricity industry. Finance of these investments by governmental sector will impose a burden on the national budget and can't meet all the needs of this industry.

Increase the level of productivity of electricity industry needs to develop financial resources and competitive level in order to give better services and reduce the cost price electricity. Also giving the activities of the takeover and focusing on governance duties is one of the reasons that companies affiliated to the electricity industry have been pioneered in the private construction of the country. With preparing and releasing investment environment, the admission of capital and managerial capacity of the private sector has been provided.

Some of the electricity industry strategies to attract the private sector

- Attracting financial resources by using B.O.O and B.O.T. methods
- Develop guidelines to determine the suitable areas to invest by the private sector in the projects concerning on reducing the loss
- Preparing contracts to purchase the energy saved due to investments mentioned in the previous item
- Preparing opportunities to private investors
- Allocation of a part of electricity produced to export to other countries

Activities Related with Handing-over of Distribution Companies

After implementation the independence law of distribution companies from end of year 2006, totally 39 distribution companies are active as non-governmental organizations in the country managed by TAVANIR Company. For implementation article 44 for these companies and duties in budget law, TAVANIR Company, with regard to sensitivity and vitality of servicing by these companies and in order to correct decision and codification of basic strategies, has activated a collection of expert working groups in different aspects.

Future Prospects

- Future Prospects
- Generation
- Distributed Generation (DG) Units and Combined Heat & Power (CHP) Generation
- Expansionist Turbine Generator Units
- The Plans of Generating Efficiency Increasin
- Transmission
- Distribution

Future Prospects

Some focal points of the Electric Power Industry within the Fifth Socio-Economical Development Plan of I.R. Iran are loss reduction, power plant efficiency increase and load management. Operation of new installations, considering the demand for electricity and high rate of demand for electricity in the country, coordinating them with the existing installation, upgrading the quality of operation and service to the customers, optimization of costs of electric power generation using the continuous development of technical know-how, which by itself can be a lengthy discussion demanding hard task and heavy investment, all and all are seen at the horizon ahead of the Electric Power Industry and have been put on the agenda of this industry. In this section, we will have a glance at the future of the Electric Power Industry and its main development direction in the Fifth Socio-Economical Development Plan of the country and will compare it with the present situation. Table (7) provides the feature of the Electric Power Industry at the end of 2014.

GENERATION

The plan for development of the electric power generation of the country is based on the following policies:

- Considering the development of technology of gas turbine, possibility for manufacturing of its equipment in the country and increase of efficiency of this type power plant, it is intended to tend toward combined cycle power plants
- Accomplishment and operation of all under construction hydroelectric power plants
- Increase of spin reserve capacity of the generation system as well as improvement of the stability & reliability of the system from its present level and minimization of the electric power cut index
- Provision of a competitive environment for private sector participation in the field of power plant construction under B.O.O. & B.O.T. schemes
- Activation the power market for creating competitive environment in the generation and distribution sectors, increasing economic productivity and providing the required resources through the presence of the non-governmental investment. As it is estimated, the installed capacity of (governmental and private) power plants of the country may reach to 75284 MW by the end of 2015 that means until this year, 2132 MW has to be added to the existing power plant capacity. It is also anticipated to accomplish 1208 MW of this capacity increment through the private sector participation under two worldwide known schemes namely B.O.O. and B.O.T.

Tables (12) and (45) give the time table of all confirmed power plants including private and governmental power plants. The increasing trend of the capacity of all types of power plants from 2014 to the end of 2016 is as follows:

Combined Cycle Power Plants

The nominal capacity of combined cycle power plants will increase by approximately 3390 MW by the end of 2016 (It is worth mentioning that some of these power plants are as gas-turbines that will be gradually become as combined cycle). In the year 2014, capacity of combined cycle power plants was 18493 MW and capacity of these kinds of power plants will increase by 21884 MW by the end of 2016. In the year 2016, the total capacity of this type of power plant will reach to 27.1 per cent of total power plant capacity of the country.

Table (6): Outlook of the Electric Power Industry at the end of March, 2015

Description	Unit	Quantity
Installed Capacity(MOE)	MW	73152
Installed Capacity(The Whole Country)	MW	35075
400kV Transmission Lines Length	km-Circuit	19995
230kV Transmission Lines Length	km-Circuit	30732
132kV Sub-Transmission Lines Length	km-Circuit	22919
63,66 kV Sub-Transmission Lines Length	km-Circuit	47105
400 kV Transmission Substation Capacity	MVA	57143
230 kV Transmission Substation Capacity	MVA	75024
132 kV Sub-Transmission Substation Capacity	MVA	29269
63,66 kV Sub-Transmission Substation Capacity	MVA	65061
Medium Voltage Distribution Lines	km	397998
Low Voltage Distribution Lines	km	336491
Capacity of Distribution Transformers	MVA	105356
Max Supplied Load	MW	46828
Max. Demand	MW	48937
Annual Electricity Generation	GWh	274480
Number of Customers	10^3Customers	31672
Electricity Sale	GWh	219653

The increase of capacity of combined-cycle power plant, in addition to saving of fuel consumption due to its high efficiency in comparison with normal gas or steam power plant, has positive effects on environmental protection.

Gas-Turbine Power Plants

Although at the present price of natural gas delivered to the Ministry of Energy, gas-turbines with open cycle is also economical and acceptable but, from the national interest point of view changing this type of power plant into combined-cycle type is the policy of Iranian Electric Power Industry. The points which make this type of power plants attractive are easy construction in short period of time and more important than that domestic manufacturing possibility of major parts of this type of power plant.

In the year 2014, capacity of gas-turbine power plants was 26412 MW and capacity of these kinds of power plants will increase by 26437 MW by the end of 2016. In the year 2016, the total capacity of this type of power plant will reach to 32.8 per cent of total power plant capacity of the country.

Steam Power Plants

By the end of 2016, no new steam power plant will be added. With the same capacity by the end of 2014, the total capacity of this type of power plant will reach to 15830 MW that is 20.48 per cent of total power plant capacity of the country.

Hydro-Electric Power Plants

By completion under construction hydro-electric power plants, 1189 MW will be added to the present capacity of this type of power plant from 2015 to the end of 2016 and the total capacity of this type of power plant will reach to 15051 MW that is 18.7 per cent of total power plant capacity at that year. Hydro-electric power plants due to having a high maneuver power in operation are of brilliant importance in power system stability.

Construction of New Units of Nuclear Power Plant

Atomic Energy Organization of Iran has been prepared tender documents for construction of two new units of nuclear power plant of the third generation of pressurized light-water reactor type with capacity 1000-1600 MW in accordance with aims and duties and also legislation of the Islamic council dated in 22 May 2005 based on releasing the nuclear energy to extent of 20,000 MW of total electrical energy generation in the country. These tender documents have been drafted in the structure, details and general principles as follow:

- Experience of first unit of nuclear power plant in BUSHEHR
- Strategy of constructing 20,000 MW of nuclear electricity
- Explaining report of constructing the second nuclear power plant
- Regulations of nuclear power plant in Europe
- Recommendations of IAEA

Table (7): Operational Trend Forecast of New Power Plants

(MW)

Discretion	2015	2016	2017	2018
Steam	324	1128	975	975
Combined Cycle	808	1582	1282	0
Gas	25	0	0	0
Hydro	545	644	268	1185
Renewablle En.	230	490	690	1060
CHP	220	480	480	480
Total Increase	2132	5324	3695	3700
Total	2132	7456	11151	14851

Without doubt the realization of 20,000 MW of nuclear electricity needs proper positions in accordance with the rules and regulations of nuclear safety office and international standards. In this regard, Atomic Energy Organization of Iran has been drafted the bid documents to elect new positions in the country and identification stages of qualified advisors have been in action.

Distributed Generation (DG) Units and Combined Heat & Power (CHP) Generation

Using the distributed generation units with high efficiency in the distribution networks cause loss reduction and fuel consumption reduction. If along with this kind of units, facilities to produce heat and warm water are installed in the suitable regions, the efficiency will be near the two times. Therefore construction of this kind of power plants is caused increasing the efficiency and decrease in fuel consumption. It is predicted that by the end of the Fifth Socio-Economical Development Plan of I.R. Iran, 1640 MW of this power plants will be added to power plant capacities by the private and governmental sectors.

Expansionist Turbine Generator Units

In gas pressure reduction stations, the entrance gas pressure is often more than the pressure of the gas output. In the process of the pressure reducing a considerable amount of gas hidden energy during the process of suffocation was wasted as heat. To prevent the waste this energy with the use of expansionist turbines placed in parallel with breakers pressure valves, electricity production is done without fuel consumption. The capacity of this kind of turbines shall be determined with regard to the station capacity. It is predicted that by the end of the Fifth Socio-Economical Development Plan of I.R. Iran, 100 MW expansionist turbines will be installed in the pressure reduction stations.

The Plans of Generating Efficiency Increasing

It is necessary that in parallel with construction of new capacities of power plants, the following subjects in connection with the efficiency increasing of generating facilities in the Fifth Socio-Economical Development Plan are followed up:

- Rehabilitation
- Repowering
- Compensation for generation decreasing of gas and combined cycle units due to increase the entrance air
- Performance increasing of steam units

TRANSMISSION

Parallel to the increase in power generation capacity of the country, plan for construction of transmission and sub-transmission lines along with the power substations to meet the electricity demand of the country has been also included in the Fifth Development Plan. These installations are to be used for transmission of generated power and energy from new power plants to the customers, to improve the system reliabilities and cover larger area than that covered by the National Grid. Table (8) demonstrates the annual increase of these new installations.

DISTRIBUTION

Development of distribution network is a function of number of customers, type of customer, dispersion of customers, urban development and rural electrification program. Table (9) shows the annual increase of some of these parameters during years 2015 and 2018 of the Fifth Development Plan. As it can be observed from this table, the number of customers of the Electric Power Industry, with annual average rate of growth of 4 percent will increase from 31672 thousand customers to 35669 thousand customers and the energy sell with annual growth rate of 5.0 percent would increase from 219653 Million kWh to 254502 Million kWh. The length of distribution transmission lines with annual average rate of growth of 2.2 percent will reach to 785,000 km and the capacity of distribution substations with average rate of growth of 3.3 percent will increase to 116284 MVA.

Table (8): Forecast of Extensions in Sub-Transmission and Transmission Installation Until March 2018

Description	Voltage (kV)	End of 2015	End of 2016	End of 2017	End of 2018	Annual Growth (%)
Transmission Substation Capacity (MVA)	400&230	132167	137834	145048	152846	4.97
Sub-Transmission Substation Capacity (MVA)	63&66&132	94330	98108	104087	110549	5.4
Transmission Lines Length (km-Circuit)	400&230	50726	51364	54170	57202	4.1
Sub-Transmission Lines Length (km-Circuit)	63&66&132	70024	70980	75021	79389	4.3

Table (9): Forecast of Extensions in Distribution Installation Until March 2018

Description	Unit	End of 2015	End of 2016	End of 2017	End of 2018	Annual Growth (%)
Nomber of Customers	10^3 Customers	31672	33061	34356	35669	4
Energy Sales	10^6Kwh	219653	230448	242183	254502	5
Distribution Lines Length	Km	734489	751644	768641	784854	2.2
Sub-Transmission Substation Capacity	MVA	105356	109104	112794	116284	3.3