CHAPTER III
ELECTRICITY AND ECONOMIC DEVELOPMENT

The prosperity of a country depends directly upon the development of agriculture, industry, transport services including railways and roads, shipping and communication facilities. All these require electricity. In addition electric power is required for domestic lighting, cooking, use of mechanical gadgets like refrigerators, air conditioners etc. With the growth of population and with the increase in the use of modern gadgets in daily life, it is quite natural that demand for domestic use would grow at a faster rate.

3.1 Historical Development of Electricity Industry in Iran

In 1871 with the discovery of Gram Machine, it became possible to transfer mechanical energy to electric energy and after eleven years Thomas Edison was able to discover electricity and its commercial use in large quantity in New York. Three years after Edison's discovery the first electricity generator started working in Iran in 1886 during the reign of Nasseroddin Quajar. It had a 3Kw capacity and was used for lightening of King's Palace. It had engine of the type Otto-Deutz and used coal as input.
Later on another generator with a capacity of 12 Kw was purchased by King Muzaffaroddin for the lightening of Imam Reza's Dome. Three years later, again another generator with a capacity of 25Kw was purchased by the private sector and was used for Tehran.\textsuperscript{1,3}

However, the first serious attempt to supply electricity for commerce and business was made by Hag Aminoazzarb, one of the leading traders of Iran. He got installed a generator with a capacity of 400 Kw which provided electricity for Tehran. His institute later on, was called "Edareh Cheragh Bargh " meaning "The Office of Electricity Light". In 1937 Escoda, a Checkoslovakian company started its electricity production in Iran. It had a capacity of 6400 Kw. This was followed by different other companies spreading in different towns and provinces. In 1962, 32 private companies were engaged in electricity production in the country.\textsuperscript{4,4}

3.2 Electricity Industry During Planning Era

Iran started its development planning in 1948. Before the Islamic Revolution, it had already had development plans, and after the revolution, the country managed to implement two development plans. We shall discuss briefly below the position of electricity industry during the planning periods.\textsuperscript{3,5}
3.2.1 The First 7-Year Development Plan
(September 1948—September 1955)

The First Development Plan in Iran was initiated after the end of the Second World War, apparently for the sake of Iran's reconstruction and development. It was a general plan for government expenditure for a total of 62 billion Iranian Rials ($920 million). This was later revised downward to 21 billion Rials ($320 million) due to the shortage of financial resources and lack of qualified human power.

The first 7-Year Plan consisted of a collection of public sector projects which were rather inadequately inter-related and devoid of unity and comprehensiveness. Inevitably, a large number of difficulties occurred in its implementation. There was a shortage of reliable statistics and data. The persons in charge of the Plan were inadequately informed about the state of affairs in the country. Moreover, the specialists involved in the plan were also not adequately informed and the persons to prepare and implement the plan properly were very few in number.

Despite all the difficulties, however, the implementation of the first plan did start and the foundations of Plan Organisation as the country's planning agency were laid in 1949. Industry occupied a prominent place in this plan.
However, the young Plan Organisation had just begun to implement the first plan, when following the nationalisation of oil industry in the year 1951, the flow of oil revenue was interrupted due to the economic embargo on Iran by the West. This, in addition to the shortage of finance from other sources was among the obstacles to success.\textsuperscript{3,8}

On the whole the sum of 250 million Rials (US$3.75 million) were invested by private and public sectors for the development of electricity industry. This amount was mainly spent for the purchase and installation of generators of 50 to 150 Kw capacities.

3.2.2 The Second 7-Year Development Plan
(September 1955—September 1962)

With the resumption of oil payments in 1954, it was decided that a new development plan should be worked out to suit the altered circumstances. Thus Plan Organisation embarked on the Second Seven-Year Development Plan in 1955. The Second Plan like the first was primarily a grouping of government capital investment projects, mainly executed by foreign contractors, the Plan Organisation's own staff of specialists and foreign consultants.

The Second 7-Year Plan began in a more favourable circumstances and in a period of greater prosperity. The reactivation of Iran's oil industry provided a solid financial basis
for the plan and there were no major obstacles to prevent the execution of large scale projects. The Second Plan's mission was to lay down the essential infrastructure for the economic transformation which was expected. The construction and development of electricity industry were decided to be stated in four regional centres which include (1) Khuzestan, (2) Tehran (3) Other big towns such as Isfahan, Tabriz, Shiraz and Mashad and (4) other small towns.

Investment in electricity in the first two centres were mainly for development and operation, while the latter two were mainly for distribution and lightening services of 167 projects.

During the Second Plan, 144 projects were financed and completed, and this increased the power generation capacity of the country significantly. During this plan, Dez Dam hydro electric power house with a capacity of 91 Megawatt (in the first phase), Safid Rood Dam hydroelectric power house with a capacity of 35 Megawatt, and Tarasht Steam Power Plant with a capacity of 50 Megawatt were the achievements of the Second Plan in the field of power industry.

3.2.3 The Third Five Year Development Plan
(September 1962—March 1968)

Problems of fiscal control and organisational efficiency became increasingly critical during the second plan. This led to the establishment of Economic Bureau which became the
Division of Economic Affairs in 1958. A staff of completely Iranian economists, many of whom returned recently from graduation study abroad, were recruited for the Division of Economic Affairs. In addition, a team of economic advisors drawn from Europe and North America was attached to the Division of Economic Affairs. The group remained on the scene until September, 1962. During the Third 5 Year Plan, although 8 centres at first were envisaged for production and development of electricity, later on, these centres were increased to eleven. In this plan, electricity generation to the tune of 433 Megawatt was set up for general consumption and electricity generation to the tune of 361 Megawatt was left exclusively for industrial sector. During the Third Plan, 9 thermal plants, 4 water generators, 6 gas plants and 18 diesel plants were set up to produce electricity so as to increase the total electricity generation capacity of the country to 827.2 Megawatt. During the Third Plan various transmission lines of 132 to 230 kilovolt were started. The length of these lines were 710 kilometres including 270 kilometres from Dez Dam to the city of Abadan.

During the Third Plan, it was decided to organise the industry in order to integrate the working of the different decision making centres and avoid parallel expenditure and scattered investment into a unified body so that decisions could
be taken in a better way and management could control the working of industry more efficiently. Thus, in 1962 the "Electricity Organisation of Iran" was set up. With the establishment of the "Ministry of Water and Electricity" in 1964, the Electricity Organisation became affiliated to the newly setup Ministry of Water & electricity. But later on, it became an autonomous organisation under the Ministry. The head of the Electricity Organisation got the rank of Deputy Minister in Electricity Industry in 1965.

3.2.4 The Fourth 5-Year Development Plan
(March 1968--March 1972)

The Fourth 5-Year Plan was considered to be a turning point in the history of Iranian Economy in terms of both its technical nature and the economic growth that was expected. The general goals of this plan were spressed industrialisation, development of agriculture, and raising of farmers' income to avoid the migration of rural families to cities.

Another goal of the Fourth Plan was to raise public welfare and propagation of social services among different social groups, especially low-income groups.

The Fourth 5-Year Plan exceeded its predecessors in terms of the level of investment and expenditures envisaged. It put the volume of public sector development expenditures actually to 765 billion Rials ($10.9 billion) i.e. more than three
times as much as the level of development expenditures envisaged under the Third Plan. This, in addition to investment on the part of the private sector, was expected to raise national income from about 457.8 billion Rials ($6.54 billion) at the end of the Third 5-Year Plan to 868 billion Rials ($12.4 billion) at the end of the Fourth 5-Year Plan. In other words, it was envisaged that the economy will grow at an average annual rate of 9.4 percent and that the national income will increase by about 57 percent over the five year period in the Fourth Plan.

The implementation of the Fourth Plan resulted in the expansion of economic activities in both public and private sectors.49

During the Fourth 5-Year Plan, the relative share of agriculture in GDP declined to 6.5 percent, while the relative shares of services, oil products and industry and mines increased to 3.6, 2.1 and 0.9 percentage points respectively. As a result, agriculture which in 1967 made the greatest contribution to GDP, lost its relative position to industry and mines.

The main objectives of electricity industry during the Fourth 5-Year Plan were

1. Development and integration of the activities of electricity industry all over the country and increase in the efficiency of the management.
(2) Increase in electricity consumption by an average annual growth rate of 22 percent and provision to supply 12 million Kilowatt/h at the end of the Plan and to increase the public sector capacity to generate electricity to the extent of 2563 Megawatt.

(3) Development of distributional channels, and construction of 2150 kilometres of transmission lines of different capacities.

(4) Development and distribution of rural electricity.

The performance of electricity industry during the Fourth 5-Year Plan included installation of hydropower of 495 Mw., steam power of 403 Mw., gas power of 128 Mw and diesel power of 126 Mw., which together fulfilled more than 72 percent of the plan objectives.

As for electricity production during the Fourth Plan, 72.4 percent of the plan objectives were fulfilled, so that in 1972, more than 9550 million kilovolt electricity was produced and in the field of transmission, a total of 3079 kilometres of transmission lines with the capacity of 230 Kv and length of 2385 kilometres and with the capacity of 132 KV and length of 694 kilometres were constructed. At the same time efforts were made to reduce the transmission and distribution losses so that by the end of the plan, the extent of losses decreased from 25 percent of the total output to almost 13 percent.
3.2.5 Fifth 4-Year Development Plan (March 1973-March 1977)

The Fifth Development Plan of Iran started in March, 1973 is distinguishable from the predecessors, not only by the size of public investments but also by the inclusion of private sectors investment as well. The Fifth Plan initially called for total investment of 2461 billion Rials ($35.2 billion) during its five year period of the Plan. Of the total, 1549 billion Rials ($22.1 billion) were from private sector investment. The bulk of the public sector investment was to be financed by the anticipated total oil revenues of about $24.6 billion in the Fifth 4-year Plan period.

With quadrupling of Iran's revenue from oil export in 1974, the revenues estimated from oil sector in the plan period were revised to a new figure of $98.2 billion.

The huge jump in oil income permitted a revision of all the sectors of the Fifth Plan and there was an increased spending on economic development, social welfare, defence infrastructure and provision for doubling of investment was submitted to Parliament in December, 1974. In total 310 billion Rials ($4.43 billion) were invested by the public sector for electricity generation during the Fifth Plan. Of this, 37.8 percent ($1.67 billion) was invested for production activities, 10.2 percent ($452 million) for transmission, 19.5 percent ($864
million) for distribution of electricity and 5.5 percent ($ 243 million) for rural electrification. The main objective was to provide enough electricity for industrial, agricultural and household sectors at low rates and to increase efficiency and the quality of production and distribution.

During the Fifth 4-Year Plan production capacity of electricity of the country increased from 2094 Mw in 1972 to 7550 Mw in 1977 (260% increase over a period of 5 years) and the length of transmission and distribution lines increased from 4149 kilometres in 1972 to 10933 kilometres in 1977 (163% increase over a period of 5 years). Electricity consumption increased from 8200 million Kw/h in 1972 to 16295 million Kw/h at the end of the fifth plan (98.7% increase over a period of 5 years). Electricity production increased from 6870 Megawatt in 1972 to 15755 megawatt in 1977 (129% increase over a period of 5 years). During the Fifth Plan serious efforts were made to increase efficiency of management and staff in production and distribution. As a result, the percentage of losses in output decreased from 9.3 at the end of Fourth Plan to 7.4 at the end of Fifth Plan.

It should be mentioned that the sixth plan was prepared, but due to the victory of Islamic Revolution of 1979 it could not be implemented and, therefore, it had to be suspended. After the Revolution, the government realised that it should
adopt planning. Therefore, by now, two development plans have been designed and implemented since 1988.

After the Revolution in 1979 and outbreak of Iran-Iraq war in 1980, all the activities were concentrated towards supporting the war. But even then during 1979-1988, on an average, 1800 villages were electrified annually. Thus by the end of 1980, the total number of villages electrified increased to 22541.

After the war it was found that over 2210 Mw capacity of electricity was destroyed by the war. Dams, power plants and electric lines had been damaged. So, large efforts were needed to reconstruct them and install new capacity. Therefore, heavy investment was made for development of electricity. Thus by 1997 the total capacity of electricity generation increased to 92310 million Kwh, total number of customers increased to 13.550 million and rural electrification increased to 37094 villages. As a result of these developments, Iran ranks first among Middle East and West Asian countries and is 21st in the World. (see Table)

3.3 Sources of Electric Power

There are four main sources of generation of electric power in Iran, viz. Hydel Power, Thermal Power, Gas and Diesel.
3.3.1 Hydroelectric or Hydel Power

About 2000 years ago, during the first century B.C. it was discovered that the force of falling water acting on a water wheel could be used to ease human labour. Well before the discovery of electricity, various types of indigenously contrived water wheel mechanisms were connected by rotating shafts and cogwheels to mills for grinding grain and sawing wood. By the 13th Century water power was used to operate hammers in the ironworks of Western Europe, and by the 16th Century the water wheel was the primary source of industrial energy in that part of the world. The steam engine eventually replaced water power in many applications, but in selected locations and for certain purposes, water power continued to be the preferred energy source. As the nations developed, mills were established at sites with reliable waterfall of sufficient volume and velocity. Communities then grew up around these mills. Dams were built at many such sites to control and reserve the flowing water and to distribute the flow over the seasons evenly. After electricity came into practical use, water wheels were used to drive generators. It then became reasonable to locate hydroelectric plants at a distance from population centres.

There are many obvious advantages to hydroelectric power. There are no polluting emissions into the air or water.
and no waste heat is rejected as thermal pollution. The operation of hydroplants relies only on renewable resources and they have long lives and slow depreciation. They respond well to sudden changes in demand, making hydroelectricity well suited to matching peak loads. The dams can serve multiple purposes, e.g. for storing water for irrigation, for flood control, and for drinking water supply. The water stored in the reservoir of the dams can also empower a hydroelectric plant as it flows to its other tasks.

For Iran which is located in an arid and semi-arid region, and due to the unfavourable distribution of surface water, to fulfill water demands, and fluctuations of yearly seasonal streams, dam construction is of huge importance.

In 1970 installed capacity of hydro power was 517 Mw, but it increased to 1953 Mw by 1990 and to 1999 Mw in 1997, i.e., more than 285 percent increase during the 28-year period.

It has, however, been argued that hydel projects take a long period of gestation as compared to thermal projects. Though it is correct, even then greater reliance has been placed on hydro-projects. But due to easy availability of huge amount of oil and gas reserves in Iran and shortage of electric energy, more emphasis has been on the utilisation of this source of power. Consequently, electricity generation of steam plants increased from 434 Mw in 1970 to 8086 Mw in 1990 (an
increase of 1760 % over a period of 21 years) and 11685 Mw in 1997 (an increase of 44 % over a period of seven years). From available gas resources electricity generation increased from 135 Mw in 1970 to over 3640 Mw in 1990 (an increase of about 2820 % over a period of 20 years) and 8896 Mw in 1997 (an increase of 125 % over a period of 7 years).

3.4 Structure of Electricity System

The first electricity system was organised along decentralised lines. The large power losses of direct-current transmission necessitated small locally situated power stations. Edison, the early pioneer of electricity, therefore, arrived at an integrated organisation of all the central stations, supplying lighting to users. His vision for the organisation of the electricity industry was, therefore, a large number of small services oriented utilities.311

However, the industry gradually moved towards a large integrated system. The first important invention to move electricity beyond the local level was the transformer. This made it possible to link urban centres to power stations situated far away, thermal to hydro power stations, and rural to urban areas. The transformer stimulated further technological developments. Alternating current became the dominant technology and the turbine replaced the steam engine. Overtime, steam-turbine sizes increased a thousand-fold, as did the voltage in transmission systems. The efficiency of steam
turbines increased seven times. These various economies of scale pushed down the real price of electricity over the course of a century, providing a basis for mass consumption and the emergence of national utility.

The growing social importance of electricity triggered legislation and regulation. In the beginning of the 20th Century, the new technological development of electricity and its perceived character of natural monopoly led to public intervention, firstly through private franchised monopoly and then gradually in many cases to full public ownership.

The dominant mode for electricity sector organisation was now characterised by the conceptualisations of electricity as a public infrastructure and part of the process of nation building. It was a basic factor in industrial policy, and an important service to be made accessible to all the consumers. In this period large investments were, therefore, made in electricity systems, and subsidies were often made available to expand electrification to the rural areas.12

The post World-War II put the electricity sector in focus as a major factor for modernisation, and again pushed the electricity supply industry on the agenda for decision making and strengthening the public ownership position. The development of nuclear and other large scale technologies in many cases created a symbiotic relationship between utilities and electrotechnical suppliers giving rise to some of the most
powerful techno-industrial clusters in the world. The power centre of these clusters varied. For several countries, the purchasing of turn-key power stations led to a run-down of utility design and construction departments, whereas utilities in other countries maintained their own technological competence in this field.

The perception of electricity as a public infrastructure with natural monopoly characteristics and organisation of theis sector into publicly owned or franchised institutional monopolies led to a build-up of powerful sectoral configurations, dominantly operating as closed national systems. Co-ordination of this system is undertaken by an organisation which is centralised at national level. In Iran it comes under the control of the Ministry of Energy.

In 1963 the Iran Electric Authority (IEA) was established to carry out the national power development programmes and regulate different small electricity companies scattered all over the country. In 1964 the IEA was given ministerial status and "the Ministry of Water and Power" was established. The was Ministry renamed as the "Ministry Of Energy" in 1974. This Ministry is responsible for setting up the overall national energy policy, ensuring an optimum use of national energy and water resources, conducting studies and researches on different sources of energy, and estimating the amount of energy which can be produced annually etc. \(^{3,13}\)
NOTES & REFERENCES: CHAPTER III


3.2 Centre for Science and Technology (1982): *The State of India's Environment*, Delhi, p. 156

3.3 Razzaghi, E. (1991): *Economy of Iran*, Nay Publisher, Tehran, pp. 89-93


3.5 For the Controversy regarding when, where and how began the idea of planning in Iran, see Baldwin, C. (1971): *Planning and Development in Iran* (1900-1970), Oxford University Press.

3.6 Rial (Rl.) is Iran's unit of money. Official rate of one Rial (September, 2000) is equal to US$ 1/1750.

For example: 1000 Rls = $ 0.571
175000 Rls = $ 100

Upto 1981, one rial was equivalent to $1/70.

3.8 For more information in these respects see:


3.10 Farhang, M (1977): The Economic Life of Iran, 2nd ed. Abu Rayhan Publisher, Tehran

