

THE GAS INDUSTRY IN MÁLAGA (1854-2009)

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1.- Introduction.

At the end of the XVIII century, William Murdock and Philippe Lebon, simultaneously developed gas technology obtained from coal and wood. The London firm Gas Light and Coke Company, which was founded in 1812, was the first company to produce and commercialize gas.

The introduction of gas technology on the Continent was more or less immediate but its diffusion was slow. Belgium (Brussels 1818) was the first country to benefit from gas technology. France was the second in 1820 followed by Germany in 1827, Austria in 1833, and Italy in 1837. As regards Spain, experiments with gas for lighting were carried out in Cadiz and Granada in 1807. In 1826, the Real Junta de Comercio de Barcelona (Board of Commerce of Barcelona) was illuminated, and in 1832 Puerta del Sol in Madrid. However, the real beginnings of the gas technology in Spain date from 1842, when the Ramblas in Barcelona was lit. A year later, Charles Lebon and his Catalan partners set up the Sociedad Catalana para el Alumbrado de Gas (Catalan Society for gas lighting, also known as La Catalana). Barcelona was followed by Valencia in 1844, and Cádiz and Málaga in 1846. Our study is centred on one of the earliest places that produced and consumed gas, e.g Malaga, where the Larios and the Heredia families first used gas to light their textile industry Industria Malagueña¹. Unfortunately, given the absence of

1 FALKUS, Malcolm E. (1967) "The Britain Gas Industry before 1850", *Economic History Review*, vol. XX, núm. 2, 494-508. SUDRIÀ, C. (1983) "Notas sobre la implantación y el desarrollo de la industria del gas en España, 1840-1901", *Revista de Historia Económica*, núm. 2, 60-61. PAQUIER, Serge; WILLIOT, Jean-Pierre (2005) "Origen et diffusion d'une technologie nouvelle aux XIXe siècle". In: PAQUIER, S.; WILLIOT, J.-P. (dirs.) *L'industrie du gaz en Europe aux XIXe et XXe siècles*, Bruxelles, Peter Lang. FÁBREGAS, Pedro (1989) "Gas Cádiz 1845-1969", *Cuadernos de Historia*, núm. 1, 7-9. FÁBREGAS, Pedro (1993) *Un científico catalán en el siglo XIX. José Roura y Estrada (1787-1860): enseñanzas técnicas y gas de alumbrado en la modernización del país*, Barcelona, Enciclopèdia Catalana. ARROYO, Mercedes (2002) "Estrategias empresariales y redes territoriales en dos ciudades españolas, Barcelona y Madrid (1832-1923)", *Historia Contemporánea*, núm. 24, 137-160.

documents about this small factory, our study starts in 1854, when the Société pour l'Éclairage de Málaga began to use gas for street lighting.

Gas offered numerous advantages. Gas could be transported continuously from distant places and the gas system could be adapted easily to different locations and to changes in technology. It could be distributed through a network, and conferred prestige on town halls and shops. It also contributed to public security. Gas was a considerable improvement on the earlier systems for lighting such as candles, tallow lamps and oil lamps. It played an important role in factories because it provided lighting and powered engines with the result that productivity rose as employees could work night shifts. Moreover, steam engines could be replaced by new machines using gas. Finally, gas put an end to a life style that depended on sun light, i.e. oil lamps only lit up cities in the earlier hours of the evening and were extinguished when there was a full moon².

The present study seeks to analyse the different periods of gas production and consumption in Malaga from 1854 to the present. This study analyses a series of statistics concerning the above factors, which influence its development: the technology used, company management, the spread of electricity and butane gas, the socioeconomic structure and the number of inhabitants. The development of gas in Malaga may be divided into three stages: 1) Gas obtained from coal (1854-1968); 2) Gas obtained from oil (1969-1992); and 3) Natural Gas (1993-2009).

The case of Málaga is of special interest because it has always been one of the biggest cities in Spain -79.000 inhabitants in 1854 and 566.000 at present- and was one of the most industrialized cities between 1830 and 1920. Malaga benefited from the profitable overseas trade especially based on the export of agricultural products in the last third of the XVIII century. This helped a large number of industries, especially some of the main textile and iron and steel industries of the country such as Manuel Heredia's foundry, which was set up in 1833 in Málaga, and the textile industry Industria Malagueña in 1846. Other activities include the production of containers, chemicals (soap, sulphuric acid...), and agricultural industries (wine, liquor and raisins)³.

2 FALKUS, Malcolm E. (1982) "The early development of the British Gas Industry, 1750-1815", *Economic History Review*, vol. XXXV, núm. 2, 217-234. ARROYO, Mercedes (1996) *La industria del gas en Barcelona (1841-1933)*, Barcelona, Ediciones del Serbal. FERNÁNDEZ PARADAS, Mercedes (2009a) *La industria del gas en Córdoba (1870-2007)*, Madrid, Lid Editorial, 21.

3 PAREJO, Antonio (2009a) *Historia Económica de la provincia de Málaga*, Málaga, Diputación

2. Gas obtained from coal (1854-1968).

There are four main reasons why Málaga was one of the first cities in Spain to use gas: 1) It carried out leading industrial and commercial activities; 2) It was the fifth most populous Spanish city; 3) It had a strategically important port, suitable for coal imports; and 4) The possibility of constructing a railway line, in the short term, to the coal fields of Bélmez, in Córdoba⁴.

In 1846 the factory of Industria Malagueña was lit by gas. Two years later Empresa General de Alumbrado de Gas began to build a gasworks. The Empresa General de Alumbrado de Gas was founded in 1846, when the British entrepreneurs, Manby and Partington, set up Sociedad Madrileña para el Alumbrado de Gas. This company created Empresa General Peninsular de Alumbrado por Gas in the same year with the aim of extending its activity to other places in Spain like Valencia, Cadiz, Santander and Málaga between 1846 and 1848. However, this initiative came to nothing because of the problems arising from the supply of coal, the diversity of the activity, and the changes in the economic system. Consequently, the construction of the gasworks in Málaga was never completed.

In 1848, in Madrid, the British managers were dismissed and Melitón Martín took over their jobs, but he was subsequently replaced by Gregorio López de Mollinedo. Despite these changes, business did not improve. On 11th August 1852, its director Luis Gosse⁵ obtained a monopoly on public and private lighting supply in Málaga for the next 20 years with a set price of 0,158 peseta/m³ for the public sector and 0,578 peseta/m³ for the private one.

The factory was built on the outskirts of Málaga at Arroyo del Cuarto, where other industries were located. This location was suitable given its proximity to the port and to the future railway station of Ferrocarriles Andaluces, thereby facilitating transport of coal and its waste products⁶. Street lighting

Provincial de Málaga, 127-128.

4 The railway line Córdoba-Málaga was finished in 1865. The connection Bélmez-Córdoba was completed in 1873. This mineral turned out to be more expensive than the British one. MORILLA, José (1984) "El ferrocarril de Córdoba a la Cuenca hullera de Espiel y Bélmez (1852-1880)", *Revista de Historia Económica*, núm. 1, 83-104.

5 Probably, he is the French industrial engineer who also built various factories in France and the first one of Portugal, in Lisbon. CARDOSO DE MATOS, Ana (2009) "Gas industry and urban modernisation: Lisbon in the 19th and 20th centuries", *TST. Transportes, Servicios y Telecomunicaciones. Revista de Historia*, núm. 16, 68.

6 The railway station was inaugurated in 1864. HEREDIA, V. (2000) "Edificios industriales en Málaga (1906-1913)", *Isla de Arriarán*, vol. XVI, 202-203.

by gas replaced oil lamps in 1854. In the same year Gosse sold the business to the Vautier Group of Lyon, which in turn created la Société pour l'Éclairage de Málaga (also known as Compañía Lionesa de Gas) in 1859⁷. This Group was led by the engineer Emile Vautier, who together with the Société pour l'Éclairage de Málaga was also active in cities in France, Germany and Italy⁸. Thus, it was a French company that offered gas lighting as in many other cities in Spain.

Let us turn our attention to the evolution of gas production and consumption up to 1968 (Graph 1 and Table 2). First, it should be pointed out that we lack the necessary information about gas production for every year. However, gas production is well-documented in the years between 1880-1935 and 1943-1968, but in the years prior to this information we only have data from 1863 -1.950.000 m³. From 1880 onwards, we can distinguish the following periods: 1) 1880-1895⁹, 2) 1900-1913, 3) 1914-about 1921, 4) 1923-1929, 5) 1931-1939, 6) 1943-1950, and 7) 1951-1968.

In the first period (1880-1895), production was more or less steady around 20%. It was lower than in 1863, possibly due to a decrease or even a “depression” in consumption. There was a period, especially from 1890, in which the economy and population suffered a recession not only in the capital city but in the whole province of Málaga, which led to a fall in the average per capita income. This occurred in the context of the turn-of-the-century crisis, which triggered a reorganization of the system of production in Málaga. This was due to the globalization in the last years of the XIX century, when Countries like Argentina or the USA joined the competitive world market and became leading industrial and agricultural producers. This affected world trade in Europe, but Málaga faced the new difficulties posed by these new rivals in the market with success. It focused on agro-industrial products such as wine, oil and sugar, gaining markets abroad. Moreover, the province of Málaga

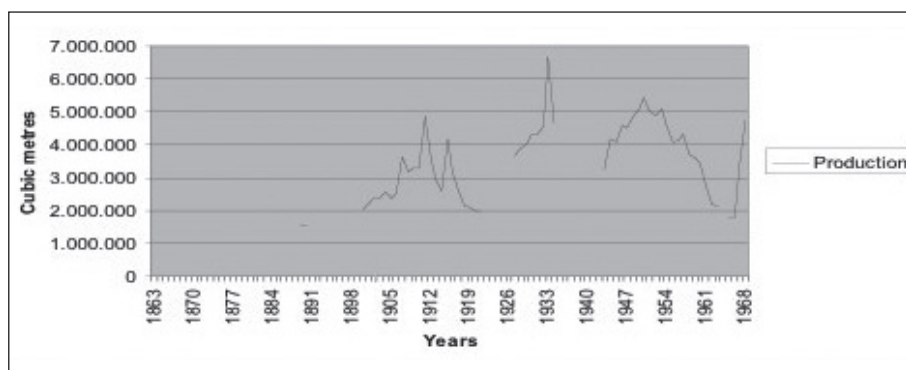
7 FÁBREGAS, Pedro (2003) *La Globalización en el siglo XIX: Málaga y el gas*, Sevilla, Ateneo de Sevilla, 19-24. ARROYO, Mercedes (2006a) “Actitudes empresariales y estructura industrial. El gas de Málaga, 1854-1929”, *Scripta Nova*, núm. 215, 5.

8 In 1889, Theodore succeeded his father Émile Vautier and he sold the company in 1924. Refer to Grupo Vautier: FÁBREGAS (2003), 26-28 and 84-89; and ARROYO (2006a), 6.

9 According to Mercedes Arroyo, there was a previous period, which is characterised by the accumulation of debt by towns for their consumption of gas. The gas business had been doing badly since the Revolution of 1868. Ten years later, the engineer Pierre Cazenave considered the situation *untenable*. Arroyo emphasizes low investment as the reason for the minimal activity and later paralysation of production. This strategy contrasts with that of *La Catalana de Gas*. ARROYO (2006a).

developed activities of the II Industrial Revolution such as electricity, chemistry and metallurgy¹⁰. However, it was not until 1910 that the economy recovered.

Figure 1. Production of gas obtained from coal in Málaga (1863-1968)



Source: Table 2.

Despite the stagnation of gas production between 1880 and 1895 (below we will see a moderate increase during the last years of the century), there were several changes in infrastructure, in consumption and in the sale of by-products¹¹. In 1879, the company employed the engineer Henri Auguste Pelegrin, who specialized in building factories and had introduced gas in Japan. During his stay in Málaga (1879-1882), he renovated the gasworks. He added a new 1,800 m³ gasholder to the two old ones. He introduced two purifiers, a bigger production meter and a new cast-iron piping system, which led to an increase of 8% in productivity¹². Probably, the renovation was triggered by the arrival of electricity, which would eventually rival gas¹³. In 1887,

10 PAREJO (2009a), 127-128.

11 The banker, Ignacio Sabater y Arauco was also employed as an administrator in order to improve the firm. ARROYO (2006a).

12 FÁBREGAS (2003), 68 and 77. A description of the factory in 1861, in LACOMBA, Juan Antonio (1988) "Descripción de la industria malagueña en un momento de expansión (1861)" *Revista de Estudios Regionales*, núm. 20, 211-231.

13 The first Spanish electrical company Sociedad Española de Electricidad was founded in 1881. MALUQUER DE MOTES, J. (1992) "Los pioneros de la segunda revolución industrial en España: la Sociedad Española de Electricidad (1881-1894)", *Revista de Historia Industrial*, núm. 2, 121-141. LUSA MONFORTE, Guillermo (2003) "La Escuela de Ingenieros Industriales de

Lionesa produced electricity using steam engines and gas to work dynamos for the celebration of the anniversary of the city's Reconquest (1487) in that year. In July, the company asked the town hall for permission to light the streets with electricity¹⁴.

As regards gas consumption, there were changes in the income obtained from lighting: in 1878, the company obtained 61,2% of its income from public consumption and 38,8% from the private sector; in 1882, these figures were inverted, 37,3% from the public and 62,7 from the private sector¹⁵. The reason

Barcelona y la introducción de la electricidad en España". In: *Actes de la VII Trobada d'Història de la Ciència i de la Tècnica*, Barcelona, Institut d'Estudis Catalans. In 1882, the first proposal to the town council to introduce electrical lighting in Málaga was not successful. The few power stations located in Málaga at the end of 19th century did not obtain benefits. The steam engines used were not efficient or profitable. The electrical supply was poor and expensive because of the absence of new technology. They were incapable of large-scale production or for the transport of low voltage current, so they had to be built near the consumers. This changed with the setting up of Hidroeléctrica del Chorro, which used waterfalls to produce electricity far from the city of Málaga, thanks to the advances in the creation of alternating current and high voltage current. SUDRIÀ, Carles (1990) "La industria eléctrica y el desarrollo económico en España". In: GARCÍA DELGADO, J. L. (ed.) *Electricidad y desarrollo económico: perspectiva histórica de un siglo: Hidroeléctrica del Cantábrico S. A. 75 aniversario*, Oviedo, Hidroeléctrica del Cantábrico, 158.

14 The corporation appointed a committee that accepted *Lionesa's* petition but in the end the gas firm did not sell electricity. Archivo Municipal de Málaga (AMM), box 1.960. With referente to electricity in Málaga: CRISTÓFOL DE ALCARAZ, Federico (1997) *Algunas notas sobre la electrificación en Málaga*, Málaga, Centro de Ediciones de la Diputación Provincial de Málaga; and ALARCÓN PORRAS, Francisca (2000) *Historia de la electricidad en Málaga*, Málaga, Editorial Sarriá. Spanish gas companies took different measures to counteract the competition from electricity companies: they were in favour of the defence of monopoly; land and subsolil use; the introduction of new technologies; business management, "price wars", and they tried to have a share in the new business of electricity. FERNÁNDEZ PARADAS, Mercedes (2005) "El alumbrado público en la Andalucía del primer tercio del siglo XX: una lucha desigual entre el gas y la electricidad", *Historia Contemporánea*, núm. 31, 601-621; (2006a) "El alumbrado público de gas en la Andalucía del primer tercio del siglo XX", *CIUDAD Y TERRITORIO. Estudios Territoriales*, núm. 147, 127-138; and (2009b) "Empresas y servicio de alumbrado público por gas en España (1842-1935)", *TST. Transportes, Servicios y Telecomunicaciones. Revista de Historia*, núm. 16, 109-131. In Málaga, *Lionesa* used the first three strategies. In Catalonia, ALAYO I MANUBENS, Joan Carles (1993) *Evolució de la tecnologia de la producció i distribució d'energia elèctrica. Catalunya en el període de 1880 a 1920*, Escola Tècnica Superior d'Enginyers Industrials de Barcelona, Tesis Doctoral. In Galicia, MARTÍNEZ, Alberte; MIRÁS, Jesús (2009) "Empresas y ayuntamientos en la industria del gas en Galicia, 1850-1936", *TST. Transportes, Servicios y Telecomunicaciones. Revista de Historia*, núm. 16, 141-147. In Reus, MOYANO I JIMÉNEZ, Florentí (2009) *Un model d'empresa energètica local: "Gas Reusense" (1854-1969)*, Doctoral Thesis, Universitat Rovira i Virgili, 386-407 and 479-556. In Italy, GIUNTINI, Andrea (2009) "La parábola del gas in Italia dal carbone al metano dalle origini ottocenteschi ad oggi. Aspetti economici, tecnologici e finanziari in chiave comparative", *TST. Transportes, Servicios y Telecomunicaciones. Revista de Historia*, núm. 16, 45-46.

15 By this time, private consumption stood for 60% of the sales; trade, housing and industries

for this was that a year earlier, 1881, the gas company and the town hall had signed a new contract whereby the price of street lighting would be reduced to 0,22 peseta/m³¹⁶. Moreover, street lighting would be cut by 30%, because the 140 litres/hour burners would be replaced by 100 litres/hour burners with the result that the gas bill would come down by 37%. It was also agreed to install regulators¹⁷ and change the nozzles. In addition, it was decided that the debt would be paid off by settling the debts of the previous month and part of the monthly arrears¹⁸.

As Fábregas points out, this decision of the town hall to reduce gas production and consumption allowed Lionesa to attract more customers¹⁹. In 1887, gas consumption accounted for an average of 11,09 m³ per inhabitant, higher than that of Almería (6,04) and Granada (5,4), but lower than Córdoba (20,3) and Cádiz (38,5). Barcelona had the highest consumption levels in Spain, 80 m³ per inhabitant²⁰. The low level of consumption in Málaga may therefore be attributed to the low incomes of the working population in Málaga, 47% of which were employed in the primary sector²¹.

Another innovation was the increase in the sales of by-products. These represented 28% of the income in 1880, increasing up to 32% in 1882. This increase came about because more coal than coke was being used in the ovens. As a result, coke sales increased since it was more expensive than coal²².

Despite these reforms and improvements, gas production did not increase. Business had come to a “standstill” as shown by a report of 1883. The reasons

stood for 40%. FÁBREGAS (2003). ARROYO (2006a).

16 They were some of the lowest and most competitive prices in Spain. FERNÁNDEZ PARADAS (2009a), 67.

17 Regulators controlled the gas flow and pressure in the gas lamps, and the gas quality was improved. MARTÍNEZ, Alberte (Coord.); MIRÁS, Jesús; LINDOSO, Elvira (2009) *La industria del gas en Galicia: del alumbrado por gas al siglo XXI, 1850-2005*, Barcelona, Lid Editorial, 59.

18 AMM, box 58 C. From the beginning the debt was not being paid. In 1860, the debt amounted to 57,642 pesetas and to 600,000 pesetas in 1885. The agreement of 1881 proved a disaster in this respect. The problem affected almost every area where public gas was being used. FERNÁNDEZ PARADAS (2006a), 44.

19 With reference to the agreement of 1889 and others of 1866 and 1877: GARCÍA DE LA FUENTE, Dionisio (1984) *La Compañía Española de Gas, S. A., Más de cien años de empresa*, Paterna (Valencia), CEGAS, 112-114.

20 FERNÁNDEZ PARADAS (2009a), 65.

21 The rest was shared by industry (27%) and services (26%). MORALES, Manuel (1984) *Economía y sociedad en la Málaga del siglo XIX*, Málaga, Diputación Provincial, 26-27.

22 FÁBREGAS (2003), 72, 78 and 182.

for this were as follows: 1) Potential customers supplied themselves; 2) There were four areas -La Pelusa, Huelín, El Molinillo and La Malagueta-²³ without gas supplies; 3) Only 13 families paid for private gas consumption; 4) Given the bad relations between the gas company and the shopkeepers, the latter decided to close their establishments earlier and reduce gas consumption; and 5) It was not possible to use gas in cookers and to produce power during daytime because the pressure was too low²⁴.

Street lighting was improved and extended by the gas company in the following years. In 1887 street lighting was illuminated by gas in La Malagueta and El Molinillo. In 1891, 30 street lights were installed in the new Larios Street using the "La Industrial" system. These lamps were much more efficient than the ones installed by "Siemens" in the nearby Plaza de la Constitución. Two years later, the town council decided to use the La Industrial system to light every street in Málaga²⁵. Then, in 1893, the gas company issued a leaflet, which listed the advantages of gas over electricity, emphasizing its affordability, usefulness and safety. It also advocated the use of gas engines in smaller factories in place of steam machines because they were easy to use and silent. These engines did not pollute so much, they could be installed in smaller places, they needed less personnel and they were safe with no risk of explosion or fire²⁶.

The second period is from 1900 to 1913. In these years, the production rose as a result of the increase in the number of gas consumers in the last years of the XIX century. In 1900, 2.020.275 m³ were produced, 4% more than in 1863 and 12% more than in 1895.

The information we have concerning the consumers supplied by Incandescencia de Gas in 1901, founded by J. Polonio, a former production manager in the gas firm of Málaga, is as follows: the exact number of consumers was 674, as shown in table 1. This information is very interesting because

23 The working-class areas La Pelusa and Huelin appeared between 1861 and 1868. There were factories in La Malagueta and El Molinillo. HEREDIA (2000).

24 ARROYO, Mercedes (2000a) "Iniciativas empresariales e innovación tecnológica. La industria del gas en la España del siglo XIX", *Scripta Nova*, núm. 69. FÁBREGAS (2003), 79.

25 AMM, boxes 1958-1959, 1961 and 1963-1966. MORALES, Manuel (1982) *Málaga en el siglo XIX. Estudios sobre su paisaje urbano*, Málaga, Diputación Provincial de Málaga, 18. With reference to the Siemens lighter see: ARROYO (1996), 319 and 325.

26 COMPAÑÍA DE GAS DE MÁLAGA (1893) *El gas y sus aplicaciones*, Málaga, Tipografía de El Diario de Málaga. According to FALKUS (1967), 495, from the 1880s, British gasworks compete with the electricity companies by extending gas introduction on heating and cookers.

we can draw some important conclusions. First, this company was a strong competitor of the Lionesa, supplying pipes and gas equipment. Second, it had numerous and diverse customers, which indicated that gas use was being widely extended. The largest group was private households (242); it is worth emphasizing that in 1883 only 13 houses were supplied with gas. This group was followed by wine cellars and shops, imported foodstuff establishments and grocer's shops (187). In general, almost every group of consumers belonged to the service sector. Only three factories (one producing chocolate, another boxes and one making lemonade)²⁷ used gas on their premises, which is a surprising fact. As we have mentioned before, the gas network was widespread and Incandescencia de Gas attracted customers from every area.

Table 1. Groups supplied by Incandescencia de Gas in 1901

Groups of customers	Number
Houses	242
Wine cellars and shops	91
Imported foodstuff establishments and grocer's shops	67
Hairdresser's and barber's	29
Textile shops	23
Baker's and flour merchant's	15
Hotels, inns and guest houses	15
Tailor's and hat shops	14
Printer's and stationery shops	13
Civilian and lay, military and church and charity buildings and corporations	12
Cafés and pubs	12
Chemist's and household goods shops	12
Packaging and trinket shops	10
Cake and sweet shops	9
Tabacconist's	9

²⁷ We have found very little information about the consumers supplied by Lionesa, nothing about the other two companies that sold gas equipment in the city: Juan García Luna and Enrique Pardo. PÉREZ LÓPEZ, Enrique (1904) *Guía oficial de Málaga y su provincial para 1904*, Málaga, Tipografía de la "Guía Oficial", 286. In any case, as from the end of 19th century, the important factories in Málaga used electricity. AMM, box 4.540.

Jewellery shops, watchmaker's and silversmith's	8
Dressmakers	8
Loans banks	7
Shipping offices and agencies	7
Butcher's and pork butcher's	6
Foundries and factories	6
Schools	6
Electrical goods and hardware shops and furniture shops	6
Leisure centres	5
Gunsmith's and cutler's shops	4
Coal merchant's and legumes shops	3
Perfumeries, glove and shirt shops	3
Ironmonger's	3
Dairies	3
Paintings shops, tiles, china and glassware shops	3
Fashion houses	3
Limited companies	2
Various	18*
Total	674

Source: Archivo Díaz de Escovar, box 7. Made by the author.

*This group consisted of sewing machines shops, guitar shops, dry-cleaner's, lottery offices, fried fish shops, chairmaker's workshops, boilermaker's shops, marble cutter's workshops, saddleries, chest-makers, "bauleria" and bathroom equipment shops.

Between 1900 and 1906, gas production rose by 25%, an average of 5% per year²⁸. Between 1907 and 1913 it was 30% higher than that in 1906. In this year, 3.5 million m³, was produced. This rise in production occurred in the context of a decrease in per capita income²⁹, which continued until 1910 in the

²⁸ Street lighting was reduced between 1900 and 1907, so, it was private consumption that helped to increase gas production. ARROYO (2006a), 13-14. There was a novelty in this period; in 1900, Aüer lamps were introduced and competed strongly with electricity well into the 20th century. GONZÁLEZ, María Ángeles; BRENES, Francisca (1992) "La implantación de la industria del gas en Málaga", *Jábega*, núm. 72, 67.

²⁹ The gross product per capita in the province changed from 1,436\$ in 1890 to 1,418\$ in 1910. PAREJO (2009a), 132.

province of Málaga. The number of potential consumers rose slightly, exceeding by 6,000 the number in 1910; in total they amounted to 136,000 inhabitants. This meant that gas production per inhabitant in 1910 had reached its highest point, 24 m³. A rate that would not be equalled until 1990.

Although the period 1900 to 1913 was one of growth, the increase in electricity production was even higher. The two most important electrical companies, the German Siemens Elektrizische Deutsche and the English The Málaga Electricity, increased their production significantly and from 1903 they bought what was necessary from Hidroeléctrica del Chorro³⁰. In 1913, Siemens and The Málaga Electricity were the leaders in the lighting business, 64% of their income coming from lighting, most of which was from private households³¹.

The reaction of Lionesa was to make changes to its gas equipment in order to meet the challenge from the electrical companies. La Lionesa, in 1912, bought 6 "Lachomette" ovens with 54 retorts and other technologies that would maintain the heat in the ovens. Thus, they were able to burn 54 tons of coal per day producing 19.500 m³/day, 10 times more than in the old factory³².

The third period is from the beginning of WWI (1914) to the early 1920s. During the war, gas production fluctuated. It alternated between sharp rises and extremely abrupt falls and from 1917 gas production continued to fall reaching in 1921 the point at which it equalled that of 1900. The reason for this was that WWI affected Spain and all Europe. In these years, many gasworks (including power stations) had production problems because of a lack of coal with the result that the price went up³³. Thus, gas production became more expensive than electricity from hydroelectric power stations. In addition, the Government made a mistake when passing some laws such as the Real Decreto de 15 de julio de 1916, to ensure the coal supply. As a result of this law, one half of street lighting (either by gas or electricity) had to be turned off everywhere from eleven o'clock at night if it was produced from

30 For example, between 1901 and 1908, the daily production for lighting of both electricity companies was multiplied by 2.6. *Estadística del Impuesto sobre el Consumo de luz de gas, electricidad y carburo de calcio*. Years 1901 and 1908.

31 *Estadística del Impuesto sobre el Consumo de luz de gas, electricidad y carburo de calcio*. Año 1913.

32 GARCÍA DE LA FUENTE (1984), 182-183. FÁBREGAS (2003), 135. HEREDIA, Guillermo; LORENTE, Virginia (2003) *Las fábricas y la ciudad (Málaga, 1834-1930)*, Málaga, Arguval, 82.

33 FÁBREGAS (1989), 39. FERNÁNDEZ PARADAS (2009a), 94-95.

coal³⁴. After the end of the war, the gas company did not make any headway largely because of the Government policy of protectionism. Even after the war, consumers were forced use Spanish coal because of the high tariff on imported coal³⁵.

At the outbreak of the war, Lionesa informed the town hall of Málaga that it would have coal only until the end of 1914 since it had not managed to obtain more coal³⁶. A decision was therefore taken: 1) to lower the gas pressure in order to reduce private consumption; 2) reduce street lighting by half an hour or a quarter of an hour; and 3) to turn off the lighting half an hour or one hour before midnight and in the mornings to turn off the lighting as soon as it was feasible. These measures were accepted by the town council³⁷.

In May 1917, Siemens and Málaga Electricity sought permission from the town council to introduce electricity to light the town centre. At the same time, the gas company gave an ultimatum to the town council to clear its outstanding debt and reminded the town council that the electricity firms would not have enough coal to supply light³⁸.

In early 1918, street lighting was *extremely limited*. The gas company sought to reduce it even more since it was using different raw materials in the production of gas. On 19th February, it obtained permission so only 850 burners operated from twelve midnight to daybreak³⁹.

Electricity companies were also affected by the same problem. Siemens and The Málaga Electricity depended increasingly on Hidroeléctrica del Chorro. It was not unusual for bills to remain unpaid. The German firm was undergoing economic difficulties after WWI. Consequently, in the early 1920s, El Chorro bought the two companies through its branch Eléctrica Malagueña⁴⁰. Despite these hardships, in 1920 Siemens and The Málaga Electricity were supplying a large number of consumers in the city, obtaining

34 FERNÁNDEZ PARADAS (2009b), 124-125.

35 SUDRIÀ, Carles (1984) "Atraso económico y resistencia a la innovación: el caso del gas natural en España", *Documents d'Anàlisi Geogràfica*, núm. 5, 89.

36 It tried to replace English coal with Spanish coal but it was unsuccessful. RAMOS, María Dolores (1987) *La crisis de 1917 en Málaga*, Málaga, Diputación Provincial de Málaga, 94.

37 AMM: *Actas Capitulares*, 7th August 1914; and *El Popular*, 8th August 1914.

38 AMM, box 4.689.

39 AMM, box 4.540.

40 *Anuario Financiero y de Sociedades Anónimas*. 1926, 482.

86% of the income from electricity consumption⁴¹.

In the early years of the 1920s, prospects did not augur well for Lionesa because it had lost its old share in the lighting business⁴². However, in 1923 a new company, Sociedad General de Aguas de Barcelona, took control of the Lionesa in a period of economic and demographic boom⁴³, which brought some relief to business. On 30th July 1924, Aguas de Barcelona founded Sociedad para el Alumbrado de Málaga, replacing the French company⁴⁴. This was possible because foreign capital investments in gas shrank markedly because of the strong economic nationalism of the dictatorship of Primo de Rivera. The government had made it difficult for foreign companies to invest in Spain since the beginning of the century. This policy together with the problems arising from WWI, obliged foreign companies to sell their assets.

The fourth stage spans from 1923 to 1929. In this period, the number of customers multiplied by 5; there were 2,149 customers in 1923 and 10,390 in 1929. Consumption also increased, from 1.6 million m³ in 1923 to 4 million in 1929⁴⁵. The investments in 1924 in the gas system and factories improved

41 *Estadística del Impuesto sobre el Consumo de luz de gas electricidad y carburo de calcio. Años 1920-1921*. Almost all income came from private lighting because the number of street lamps by electricity was small (197 lamps in 1918). In 1920, the gas company had 2,149 customers while *Siemens* and *Málaga Electricity's* customers amounted to 11,440. ALARCÓN PORRAS (2001), 56-60. Concerning the spread of electrical lighting in Andalusia and Spain: NÚÑEZ ROMERO-BALMES, Gregorio (1995) "Empresas de producción y distribución de electricidad en España (1878-1953)", *Revista de Historia Industrial*, núm. 7, 39-80; and FERNÁNDEZ PARADAS (2006b); and (2008) "La industria eléctrica y el negocio del alumbrado en España (1901-1935)", *Ayer*, núm. 71, 245-265.

42 The same occurred in Spain and Andalusia. In Andalusia, there were 12 factories selling gas lighting in 1913, but only 7 survived by 1920. This was a consequence of different problems that had already appeared in the last third of 19th century: the dependence on English coal; the low demand by industries and, in general, by the population; town halls' debts; the introduction of electricity using thermal power; and the electricity that was produced from water on a large scale from the beginning of 20th century. FERNÁNDEZ PARADAS (2006a), 128; and (2009b), 125.

43 In these years, the gross provincial product rose an average of 2.8% a year. The population of Málaga capital grew (38,000 inhabitants more between 1920 and 1930) arriving at 188,000 inhabitants in 1930. PAREJO (2009a), 132. Another positive factor that increased the consumption in Málaga was the rise in wages. VELASCO GÓMEZ, José (2008) *La Segunda República en Málaga 1931-1936*, Málaga, Ágora, 33. As it is known, it was a prosperous period throughout Spain. COMÍN, Francisco (2002) "El periodo de entreguerras (1914-1939)". In: COMÍN, F.; HERNÁNDEZ, M.; LLOPIS, E. (eds.) *Historia Económica de España. Siglos X-XX*, Barcelona, Crítica.

44 FÁBREGAS (2003), 137. ARROYO (2006a), 15.

45 Coke production also increased considerably; 5,2 tons in 1923, 6,9 in 1929. This tendency continued until 1934 (8 tons). MINISTERIO DE INDUSTRIA Y COMERCIO: (1934) *Estadística general del consumo de carbones por las distintas industrias. Año 1933*; and (1935) *Estadística general*

efficiency and the number of costumers that used gas for cooking and lighting increased⁴⁶. The gas company also supplied some factories that had been self-sufficient until that time. According to Arroyo, this was possible thanks to a business policy accepting short term and long term risks. Private consumption, which accounted for 70% of the income in 1929, helped to strengthen the sales system. Street lighting was also extended to new urbanized areas such as Ciudad Jardín in 1929. So, between 1925 and 1929, profits grew substantially⁴⁷.

Another factor was the new contract with the town council that would expire in 1927. As a result of this agreement, Sociedad General de Aguas de Barcelona sold Sociedad para el Alumbrado de Málaga to its branch Compañía Española de Electricidad y Gas Lebon, which had been acquired in 1925⁴⁸. Thus, Alumbrado de Gas became a branch of the last company. The contract, which was signed at the end of 1928, would last 15 years. The contract fixed the price of gas for street lighting at 0.305 pesetas/m³, but no price was set for private consumption⁴⁹.

The following period, from 1931 to 1939, is one for which there are few data, only sufficient to know about the new problems facing the business. Between 1931 and 1935 the sales of gas remained at about 4,5 million m³ but in 1938 they fell to 3,8 million. The number of consumers also decreased, from 11.216 in 1931 to 8.315 in 1936 and 8.318 in 1938. This can be attributed to the fall in the gross provincial product per inhabitant, which occurred in these years⁵⁰. Events such as the Wall Street Crash, the political and social instability of the II Republic⁵¹ and the Civil War took a considerable toll on

del consumo de carbones por las distintas industrias. Año 1934.

46 Something similar occurred in Lisbon and Córdoba. ARROYO, M; MATOS, A. Cardoso de(2009) "La modernización de dos ciudades: las redes de gas de Barcelona y Lisboa, siglos XIX y XX", *Scripta Nova*, núm. 296. About gas use in houses: ARROYO, Mercedes (2003) "Gas en todos los pisos. El largo proceso hacia la generalización del consumo doméstico del gas", *Scripta Nova*, núm. 146.

47 ARROYO (2001) and (2006a), 16.

48 This group was also formed by: the gas factories of Granada and Valencia, the electricity and gas plants of Cádiz, Murcia and Santander and the electric plant of Puerto de Santa María. Compañía de Gas y Electricidad Lebon, controlled by Banca Arnús-Garí, was set up in December 1923 by Compagnie Centrale d'Éclairage par le Gas. Lebon et Cie. FÁBREGAS (2003), 138-140. ARROYO (2006a), 15.

49 GARCÍA DE LA FUENTE (1984), 115-116.

50 PAREJO (2009a), 131-132.

51 In 1931, 40 of the 189 gas employees, were members of Unión General de Trabajadores. In 1932, Sociedad para el Alumbrado de Málaga, ran the company again in order to face the

gas consumption.

At the outbreak of the Civil War, a committee of workers seized control of the company, which continued functioning. However, the inefficient use of the facilities, poor maintenance and coal shortages considerably affected the quality of the service⁵². This poor maintenance and the lack of repair equipment led to the fall of the roof of the gasholder and to an increase in leaks in the gas distribution system. As a result, between 1935 and 1938, gas sales dropped by 5% and the number of consumers fell by 9%⁵³.

In December 1939, the company underwent a financial reorganization; Sociedad para el Alumbrado de Málaga changed its name to Gas para Alumbrado y Suministros, GASUM SA and the capital rose from 3,5 to 15 million pesetas⁵⁴.

We do not have much data about the early years of the postwar period but we know that GASUM suffered losses⁵⁵. In 1941, the factory shut down for 3 months⁵⁶. At that time Málaga had the same infrastructure as in 1912,

workers' demands. In addition to the social unrest, there was a financial problem after the embezzlement of 300.000 pesetas by the Accountant manager. FÁBREGAS (2003), 145-147. VELASCO GÓMEZ (2008), 32 and 80.

52 When the Civil War broke out, Compañía Española de Gas y Electricidad Lebon suffered some changes: some committees of workers took control of the head offices in Barcelona, the factories in Santander, Valencia and Murcia and the branch in Málaga; the factories in Cádiz and Granada, and the branches Electra Peral Portuense and Gas y Electricidad de San Fernando remained under the supervision of Consejo de Administración (Board of directors). GARCÍA DE LA FUENTE (1984), 41. The plant in Alicante was also controlled by a workers council. GARCÍA DE LA FUENTE, Dionisio (2006) *Una historia del gas en Alicante*, Madrid, LID Empresarial, 279.

53 GÓMEZ, Gil (1937) *Málaga bajo el dominio rojo*, Cádiz, Establecimientos Cerón, 176. GARCÍA DE LA FUENTE (1984), 221. ARROYO, Mercedes (2001) "Banca, infraestructuras urbanas y estrategias empresariales. La fábrica de gas de Málaga (1923-1940)". In: *Actes del 3er Congreso de historia catalano-andaluza. Cataluña y Andalucía, 1898-1939*, Barcelona, Ediciones Carena, 297-325. Between 1930 and 1935 gas consumption stagnated. See Figure 1.

54 *Anuario Financiero y de Sociedades Anónimas. 1940*, 271. In 1940 GASUM bought the gas factory in Cádiz and the gas and electricity factories in San Fernando and Chiclana to Compañía de Electricidad y Gas Lebon. GARCÍA DE LA FUENTE (1984), 148-149. ARROYO (2001).

55 COMPAÑÍA ESPAÑOLA DE ELECTRICIDAD Y GAS LEBON (1945) *Memoria. Ejercicio de 1944*, 5.

56 In this year the coal consumption was only a half of that consumed in 1939. MINISTERIO DE INDUSTRIA Y COMERCIO (1942b) *Estadística general del consumo de carbones por las distintas industrias y almacenistas. Año 1941*, Madrid, 94-95. In 1941, the coal shortage made the gas sales fall enormously in all the plants of the company, except in that located in Santander. GARCÍA DE LA FUENTE (1984), 45. During the Franco dictatorship, the gas industry suffered many problems derived from intervencionist policies, especially on the products used in the manufacture process -mainly coal- and on transport. The Government passed a series of regulations for its distribution, but the gas business was not included and for some months

and also a plant to produce water gas and other gas producers for lean gas; the two types of gas were implemented at an unknown date. Moreover, they were equipped with the machinery for tar and ammoniacal sulphate dehydration⁵⁷.

After 1943 we can distinguish another period. This period is marked by the elimination of gas lamps in the streets. Nevertheless business increased until 1950. Between 1943 and 1950, gas production stepped up from 3,2 million m³ to 5,4, a rate of 16% per year. Thus, Málaga became one of the most important gas producers of Spain, occupying the 7th place with 5 million m³ in 1949, a long way from Barcelona and Madrid, with 87 and 47 m³ respectively⁵⁸. This increase was due to the coal supplied by Sociedad Hulleras e Industrias⁵⁹ given that other factories were affected by the shortage of coal. In any case, the gas factory was obliged to use other raw materials. In 1947, 10.500 tons of coal were extracted, 109 from wood and timber and 85 from grape pomace and nut shells⁶⁰.

The number of customers increased at a rate of 2% per year. In 1949, it reached the same levels as in the prewar years⁶¹, amounting to 8.355 consumers. Private household consumption represented 94,3% of the customers and industries accounted for 5,7%, consuming 88,3 and 11,7% of gas, respectively. The increase in the population (from 40.000 inhabitants in the 1940s to 238.000 inhabitants in 1950) played a key role in boosting gas consumption. However, the consumption levels could have been higher if individual incomes had

gas factories were not supplied. As a result, from the end of 1941, a quantity of coal was fixed for gas factories. The problem was that the agreed supply was irregular and not always the fixed quantity arrived. So, many factories had to stop their activity and others had to close down. VIDAL BURDILS, Francisco (1949) "La industria del gas en España I", *Acero y Energía*, núm. marzo-abril, 95-96. FERNÁNDEZ PARADAS (2009a), 126-127. With reference to Galicia see: LINDOSO, Elvira (2009) "Declive y restauración del gas en Galicia, 1936-2005", *TST. Transportes, Servicios y Telecomunicaciones. Revista de Historia*, núm. 16, 159-160; and MARTINEZ; MIRÁS; LINDOSO (2009), 328-329.

57 MINISTERIO DE INDUSTRIA Y COMERCIO (1942a) *Catálogo oficial de la Producción Industrial de España. Tomo II*, Madrid, Ministerio de Industria y Comercio, 1.044. About the water gas and lean gas, ARROYO (1996), 321.

58 VIDAL BURDILS (1949), 97.

59 COMPAÑÍA ESPAÑOLA DE ELECTRICIDAD Y GAS LEBON (1944) *Memoria. Ejercicio de 1942*, 3. SINDICATO VERTICAL DE AGUA, GAS Y ELECTRICIDAD (1948) *Datos estadísticos técnicos de las fábricas de gas españolas 1930-1947*, Madrid, 10.

60 These raw materials had serious disadvantages. For instance, the amount and quality was inferior to that of coal. SINDICATO VERTICAL DE AGUA, GAS Y ELECTRICIDAD (1948).

61 On the evolution of the number of consumers supplied by Grupo Lebon, see GARCÍA DE LA FUENTE (1984), 215.

risen. It was not until 1951 that the product per person reached the level of 1929⁶².

The last stage extends from 1951 to 1968. This was a period marked by a crisis, leading to a sharp decrease in gas production and in the number of consumers⁶³. In 1966 only 1,7 million m³ were produced, 66% less than in 1950 and, the same amount as in 1895! Production in 1967-1968 rose due to the increase in population and income, although it was still lower than that of 1950⁶⁴, i.e. 13% lower in a period of demographic and economic boom⁶⁵.

The introduction of butane and propane gas constituted a strong challenge to coal-based gas and was the main reason for its decline. In 1953, Spanish refineries began to sell butane and propane gas, and the company BUTANO was founded in 1957. This company sought to take advantage of the cuts in electricity supply, which reappeared in 1956-1957⁶⁶. Butane gas was well received by the population and industry because it was cheap, efficient and easily transported. Butane gas became more popular because of the poor quality of traditional gas. The supply system was improved, and natural gas and gas of naphtha were also marketed⁶⁷. In 1961, in the province

62 At that time, the *per capita* income in the province was a bit lower than in Andalusia and 70% lower than in Spain. PAREJO (2009a), 131; and (2009b) *Historia Económica de Andalucía Contemporánea*, Madrid, Editorial Síntesis, 251. On the economy and society of Málaga in the postwar period: CERÓN TORREBLANCA, Cristian (2007) *“La paz de Franco”, la posguerra en Málaga: desde los oscuros años 40 a los grises años 50*, Málaga, Universidad de Málaga. The increase of gas consumption during the 1940s could be related to the electricity restrictions and cuts as occurred in Barcelona. ARROYO; CARDOSO DE MATOS (2009).

63 In Málaga, during the period 1951-1968, the consumption by household customers and industry stayed the same, with a slight decrease in the former. From 1952, the number of customers in the city of Barcelona grew. SINDICATO NACIONAL DE AGUA, GAS Y ELECTRICIDAD (1958) *Estadística comparativa de la industria del gas. Año 1957*, Madrid; (1960a) *Datos estadísticos técnicos de las fábricas de gas españolas. 1950-1955*, Madrid; (1960b) *Estadística comparativa de la industria del gas en España durante los años 1957, 1958 y 1959*, Madrid; *Datos estadísticos técnicos de la industria del gas*, Años 1961-1968, Madrid. ARROYO, Mercedes (2006b) “Los cambios en el proceso de producción y de distribución de gas en Barcelona y su *hinterland* (1930-1961). Entre el gas de hulla y el gas natural”, *Scripta Nova*, núm. 218.

64 In the case of the by-products, during the second half of the 1950s and the 1960s, almost all were coke, small quantities of pitch, tar and oil. SINDICATO NACIONAL DE AGUA, GAS Y ELECTRICIDAD: (1957) *Estadística comparativa de la industria del gas. Año 1956*, Madrid; (1960a); and (1962).

65 Between 1950 and 1970 population grew to around 100.000 people. On the *per capita* income in Málaga, see PAREJO (2009a), 223.

66 FÁBREGAS (2003), 154-159. SÁNCHEZ GUTIÉRREZ, María Matilde (2006) *La regulación del sector del gas natural*, Valencia, Tirant lo Blanch, 64.

67 FÁBREGAS, Pedro (1986) *La industria del gas en España. Un ensayo de interpretación histórica*, Barcelona, Aria, 7.

of Málaga, there were 19.457 butane consumers compared with only 4.614, who continued to use coal-based gas⁶⁸.

Other factors such as low tariff, overmanning and the anachronistic infrastructure all contributed to the decline of the business. As for prices, these did not rise at the same rate as those of the raw materials, transport and wages. As a result, the gas companies were dissatisfied and demanded the Government to raise the price of gas and the tariffs for the renting and maintenance of the gas meters⁶⁹.

The Government agreed to the above proposals, but continued to drag its feet and the companies did not get what they had expected. In 1952, the gas factory in Málaga was allowed to increase gas tariffs by 25%. In 1954, it fixed the price for domestic and industrial consumption at 2,12 pesetas/m³, higher than in other factories in Spain. The average cost for both groups of consumers was 1,9 pesetas/m³⁷⁰. In 1956, the salaries of miners went up. In 1957, the Government set the price for household and industries at 2,34 pesetas/m³. In 1959, the price of gas was raised to 3,71 and 3,72, in both cases, and from 1962 to the end of the 1960s it rose to 4,26 pesetas/m³⁷¹. As regards the work force, between 1950 and 1965 this fell by 62%. Only 81 employees retained their jobs, a reduction similar to that in production and in the number of customers⁷².

The other big problem was the age of the factory. However, in 1950, a Woodall-Duchman oven was installed; an oven of two vertical chambers, working continuously, which was much more efficient than those using retorts⁷³. Some of the old horizontal ovens of 1852 and some of the inclined ones of 1912 continued to operate in the factory. In the following years, a number of electrical engines were introduced; in 1955, there were 32 of these

68 SINDICATO NACIONAL DE AGUA, GAS Y ELECTRICIDAD (1962), 72.

69 COMPAÑÍA ESPAÑOLA DE ELECTRICIDAD Y GAS LEBON (1952) *Memoria. Ejercicio 1951*, 7.

70 COMPAÑÍA ESPAÑOLA DE ELECTRICIDAD Y GAS LEBON (1954) *Memoria. Ejercicio 1953*, 7. SINDICATO NACIONAL DE AGUA, GAS Y ELECTRICIDAD (1960a), 50-51.

71 COMPAÑÍA ESPAÑOLA DE ELECTRICIDAD Y GAS LEBON (1957) *Memoria. Ejercicio 1956*, 6. SINDICATO NACIONAL DE AGUA, GAS Y ELECTRICIDAD (1959) *Estadística comparativa de la industria del gas. Año 1958*, Madrid, 16-17; and (1970) *Datos estadísticos técnicos de la industria del gas. Año 1969*, Madrid. On the prices of gas in Spain and Galicia: FERNÁNDEZ PARADAS (2009a), 130-131; and MARTÍNEZ; MIRÁS; LINDOSO (2009), 337.

72 FÁBREGAS (2003), 159.

73 FALGUERAS, Francisco (1969) *Una industria centenaria*, Catalana de Gas y Electricidad, Mecanografiado, 15.

engines in the gas factories⁷⁴. But these improvements were too little and too late because what the industry really needed was to abandon the old system of gas production by coal and use new raw materials like natural gas and oil⁷⁵.

First, Málaga used oil as a raw material. In the early 1960s, an attempt was made to produce gas through a thermal cracking process using light naphtha, but this was unsuccessful. In 1964, Electricidad y Gas Lebon decided to continue production in those factories with better prospects for the future. The decisions reached were the following: 1) the production systems were to be changed, beginning with Málaga; 2) the factories in San Fernando and Granada were to be closed; and 3) the name of the company was to be changed to Compañía Española de Gas SA because it was no longer an electricity company⁷⁶.

It was the company Catalana de Gas y Electricidad, now Gas Natural SA, which reorganized the gas industry. As from 1965, this company controlled the Compañía Española de Gas SA, which was the owner of gasworks in Cádiz and Málaga. In 1968, in Málaga, Gas Natural SA set up two Cifuindus plants that used light naphthas in the catalytic cracking process, with a production of 50.000 m³/day⁷⁷. In Spain, Catalana de Gas y Electricidad was the first gas company to use this type of plant in 1956. The new infrastructure was easier to set up and operate; it was open to change, and oil was much cheaper, easier and cleaner to use than coal⁷⁸. In Málaga, the new factory was opened in 1969, and the factory for gas production from coal was closed down.

3.- Gas made from oil (1969-1993).

The production of the new gas from naphthas increased spectacularly. As shown in Figure 2 and Table 2, gas production doubled between 1969 and

74 SINDICATO VERTICAL DE AGUA, GAS Y ELECTRICIDAD (1948), 7; and (1960a). GARCÍA DE LA FUENTE (1984), 183.

75 Between 1940 and 1965, at least 26 factories in Spain were provisionally or partially closed. FERNÁNDEZ PARADAS (2009a), 134.

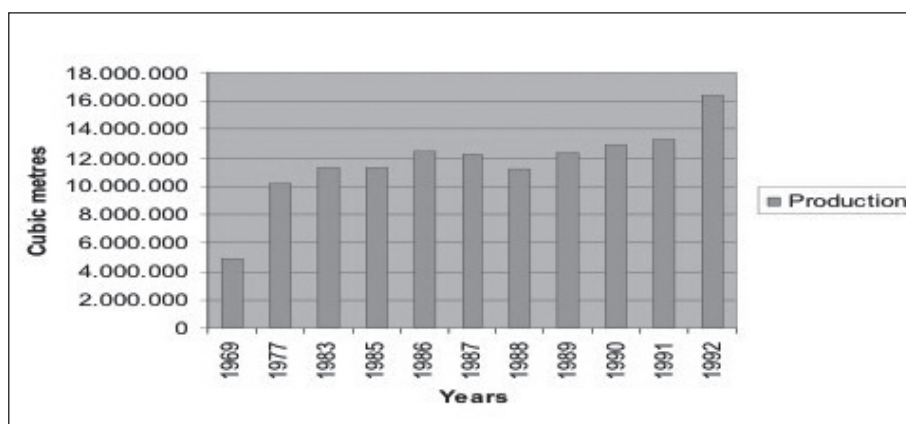
76 In 1956, Electricidad y Gas Lebon absorbed its branch GASUM. GARCÍA DE LA FUENTE (1984), 50-57, 116 and 222.

77 Sevilla and Murcia also adopted the Cifuindus system for their factories. FALGUERAS (1969), 63. GARCÍA DE LA FUENTE (1984), 183, 187 and 342.

78 SUÁREZ CANDEIRA, Daniel (1962) *Situación actual de la industria del gas. Subcomisión v. 3: Industria del gas*, Madrid, Consejo Económico Sindical Nacional, 26. SUDRIÀ, Carles (1996) "El gas natural en España: una perspectiva en el largo plazo", unpublished.

1977. This coincided with a period of economic expansion in Málaga that lasted from 1960 to 1976⁷⁹. In 1983, the production showed a small increase but rose by 45%, in 1992 (16,4 million m³)⁸⁰, which was an average of 4,5% yearly. In this period gas production considerably exceeded population growth whose rate was 0,5% a year⁸¹.

Figure 2. The production of gas made from oil in Málaga (1969-1992)



Source: Table 2.

The number of customers also rose (6.697 in 1969, 12.807 in 1983 and 15.249 in 1993). In 1993, domestic consumption accounted for 95% of the customers who used two thirds of the gas, and the remaining 5% corresponded to the service sector that used the other third⁸². It should be noted that there were no industrial consumers.

In 1992 some improvements were implemented, e.g. a plant of propane-air mixture -which was a mixture of 60% of propane and 40% of air-. This mixture could be exchanged with manufactured gas with the result that the

⁷⁹ Those periods of expansion also occurred in: 1833-1870, 1910-1930, 1960-1976 and 1993-2006. PAREJO (2009a), 287.

⁸⁰ In this period, almost all data about the yearly production are underestimated since they refer to gas sales. At that time, the High Calorific Power of gas in Málaga reached 4.200 kilocalorie/m³. GAS ANDALUCÍA (1989) *Memoria Ejercicio 1988*, 15.

⁸¹ Between 1969 and 1993 the population of Málaga grew by 160.000 people, exceeding 530.000 inhabitants. INEbase (<http://www.ine.es>).

⁸² MINISTERIO DE INDUSTRIA (1994) *Estadística de la industria del gas. Año 1993*, Madrid.

large demand was satisfied. Such was the situation before the implementation of natural gas⁸³. Moreover, the emission system was improved in order to increase gas pressure, which helped to maintain the same gas pressure throughout the distribution system⁸⁴.

4.- Natural Gas (1994-2009).

Despite being profitable, Catalana de Gas understood the potential advantages of natural gas, i. e. the need to replace gas from oil with natural gas. As stated above, the advantages of the new gas are manifold: natural gas does not need a factory to be produced with the result that investment and labour costs are considerably reduced. It is not toxic because its combustion process produces minimal pollution. It produces more calorific power than the manufactured process and the heat can be more easily controlled. Moreover, there are very few gas leaks. Natural gas is not very expensive, making it a rival for oil and electricity. It can even replace electricity in almost all of its uses, helping to diversify the energy sources for consumption. In 1969, La Catalana began to sell natural gas in Barcelona⁸⁵. However, in Andalusia, in particular in Seville, it was not until 1991 that manufactured gas was completely replaced by natural gas⁸⁶.

Gas Andalucía supplies Andalusia and Málaga with natural gas⁸⁷. The *Protocolo de Intenciones para el Desarrollo de la Industria del Gas en España*, signed in 1985, opened up new opportunities for the expansion of the sector. In 1987, Gas Andalucía was founded thanks to the capital of 1,000 million pesetas, invested by Repsol Butano SA (33.5%), Sociedad para la Promoción y Reconversión Económica de Andalucía SA (33%), and Catalana de Gas SA (33.5%). In 1995, Catalana de Gas SA, now Gas Natural SDG, became the only shareholder of Gas Andalucía⁸⁸.

83 The same occurred in Cádiz. GAS ANDALUCÍA (1989), 15.

84 GAS ANDALUCÍA (1992) *Informe Anual. Año 1991*.

85 MARTOS-O'NEALE DE CASTRO, Francisco (1969) "El gas natural y su futuro en España", *Economía industrial*, núm. 70, 31-40. SUDRIÁ (1984); and (2000) "L'arribada del gas natural a Catalunya, una iniciativa pionera i privada". In: MALUQUER, J. (ed.) *Tècnics i tecnologia en el desenvolupament de la Catalunya Contemporània*, Barcelona, Enciclopèdia Catalana. FÁBREGAS (2003), 164-169.

86 GAS ANDALUCÍA (1992).

87 In the province of Málaga, this company controls almost the whole natural gas market. Ronda is the only town that is supplied by a different company, Meridional de Gas, from the group Endesa. *Boletín Oficial de la Junta de Andalucía*, 10th September 1998.

88 GAS ANDALUCÍA (1992-1995) *Informe anual*. Years 1991-1994.

From its inception the aims of Gas Andalucía (Gas Natural Andalucía since 2000) have been the following: 1) to use only natural gas as raw material at the expense of naphtha (this was achieved in the mid 90s); and 2) to supply the largest number of towns possible. Let us now examine the achievements of Gas Natural Andalucía in the province of Málaga.

In 1993 the installation of plants in Málaga and Cádiz, where liquefied natural gas was brought and regasified, put an end to naphtha as a raw material in Andalucía⁸⁹. In Málaga, this new industry was set up in the Polígono Industrial del Guadalhorce.

In the province of Málaga, natural gas was introduced progressively until it completely replaced manufactured gas in 1997⁹⁰. Since 2001 it has been extended to other towns of the province. Today, the main coastal towns such as Fuengirola, Mijas, Torremolinos, Benalmádena, Estepona, Rincón de la Victoria... and also those in the interior such as Ronda, Antequera and Vélez-Málaga can use natural gas. It caters for more than a million people, exceeding 70% of the population of the province⁹¹. This has been due to a complex and efficient gas pipeline system, whose most important pipelines include: Puente Genil-Málaga, 120 kilometres, and working since 2002; Málaga-Estepona (Phase I), 69 kilometres, since 2005; and the branches Málaga-Rincón de la Victoria, 26 kilometres, since 2006⁹². All are connected with the gas pipeline Tarifa-Córdoba, which in turn is connected to the Magreb-Europa pipeline (coming from Algeria), which is linked to the Basic Network of Gas Pipelines.

The natural gas network of Gas Natural Andalucía has grown considerably since 2001. It had 268 kilometres in that year and 802 kilometres in 2008. It represents 24% of the regional network. Málaga is the second most important province after Seville in Andalucía⁹³.

89 At that time the distribution of natural gas had already begun in Seville, Huelva and Córdoba. GAS ANDALUCÍA (1994).

90 Between 1994 and 1996 the production of manufactured gas was around the same level as that at beginning of the 90s. MINISTERIO DE INDUSTRIA: (1995) *Estadística de la industria del gas. Año 1994*, Madrid; and (1997) *Estadística de la industria del gas 1996. Gas manufacturado. Sectores consumidores*, Madrid. GAS ANDALUCÍA: (1994); and (1998) *Informe Anual 1997*.

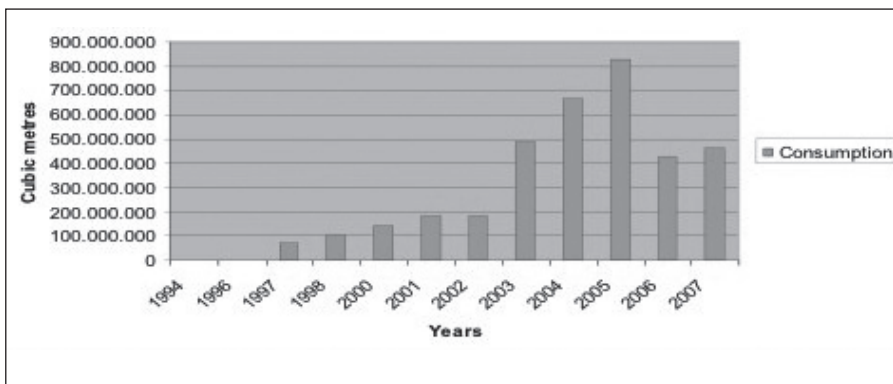
91 GAS NATURAL ANDALUCÍA (2005-2007) *Informe Anual. Years 2004-2006*. In 2008, Málaga totalled 1,563,261 inhabitants. INSTITUTO DE ESTADÍSTICA DE ANDALUCÍA (2009) *Málaga. Datos estadísticos 2009*, Málaga, 64.

92 COMISIÓN NACIONAL DE ENERGÍA (2007) *Información básica de los sectores de la energía 2007*, Madrid, 108.

93 The network of manufactured gas pipelines was transformed, so, in 1997 it measured 201 kilometres. GAS ANDALUCÍA (1998). GAS NATURAL ANDALUCÍA (2002) *Informe Anual 2001*; and (2009) *Informe Anual 2008*.

Gas consumption has increased considerably (Figure 3⁹⁴ and Table 2). Between 1994 and 1996 consumption of manufactured gas was around 13-14 million m³, while consumption of natural gas was only 1 million m³⁹⁵. But the situation changed after 1997 because only natural gas was supplied (73 million m³ in that year). The year 2001 marked a sharp increase in gas consumption, which coincided with the spread of the new gas system to other municipalities. Thus, consumption amounted to 488 million m³ in 2003, 666 million in 2004 and 827 in 2005, falling to 440 million in 2006-2007. This dramatic rise in 2005 was due to the increase in incomes of the working population and also to the boom in the construction industry⁹⁶. At present, Cádiz and Huelva are the Andalusian provinces with the highest consumption levels, and Málaga is the 6th province a long way behind these two⁹⁷.

Figure 3. The consumption of natural gas in Málaga (1994-2007)



Source: Table 2.

⁹⁴ This diagram represents only natural gas consumption.

⁹⁵ The Superior Calorific Power of natural gas = 10.000 kilocalories, so, 1 m³ = 10.000 kilocalories. In 1994 and 1996 the gas consumption in Málaga was as follows: 94% of manufactured gas and 6% of natural gas.

⁹⁶ The growth of the working population has been greater than that of the total population. This is due to the fact that now, women, also work and children remain at home longer, so the number of wages in every family has risen. In 2000, the family income per inhabitant in the province was a bit higher than the Andalusian average, but quite a bit lower than the national total. Regarding the population, between 2001 and 2007, it grew by more than 36.000 people in the capital city of Málaga. PAREJO (2009a), 250. INSTITUTO DE ESTADÍSTICA DE ANDALUCÍA (2009), 60-61.

⁹⁷ There are industries in both provinces that consume great quantities of gas. GAS NATURAL ANDALUCÍA (2009).

In Málaga, natural gas arrived at a time of total transformation of the gas sector. These changes entailed the replacement of the traditional control system, in which local government concessions had been in operation since the middle of the XIX century. After 1996, a new phase based on liberalisation was initiated in order to meet EU regulations.

Let us now turn our attention to some of the most important laws governing the gas industry. The Real Decreto Ley de 7 de junio de 1996, passed by the Partido Popular (the right-wing party) was designed to help third-party access to the gas pipeline network. This law authorized all industries that signed a contract for a minimum supply of 1,2 MNm³ for 24 months and for their own consumption to use the infrastructure for the transport of natural gas.

The Real Decreto de 6 de septiembre de 1996 revoked the previous clause, but permitted the inclusion of a third-party into the gas network and also the plants of regasification that supplied it. In order to liberalise the gas market the Real Decreto Ley de 16 de abril de 1999 reduced the consumption level necessary for meeting the conditions of a qualified consumer until January 2008 when all consumers were included. The Real Decreto de 3 de agosto de 2001 set tariffs on natural gas sales and sought to charge all consumers for the costs of the distribution process. The Real Decreto de 27 de diciembre de 2002 distinguished between tariff contracts and those of a liberalised market. The former was suitable for consumers that had not been previously approved and the latter was for recognized consumers that had been supplied by a third-party in this free market.

The socialist government modified the Ley de Hidrocarburos de 1998 through the Ley de 2 de julio de 2007. It consolidated the relaxation of restrictions. It decided to separate legally and functionally the network activities of production from those of supply and to end the competition between distributors and commercial groups in the supply sector. All this was possible because of measures such as the elimination of the tariff system and the creation of a new last resort tariff to which only certain consumers could have recourse depending on the market and its evolution⁹⁸. To ensure the

98 The tariff-paying groups are classified, depending on their consumption levels into different groups: Group 1. Industrial consumers connected to a gas pipeline with a maximum pressure higher than 60 bars; Group 2. Industrial consumers connected to a gas pipeline with a pressure higher than 4 bars and the same or lower than 60 bars; Group 3. Consumers connected to a gas pipeline whose pressure is the same or lower than 4 bars, that is the supply for establishments and houses; Group 4. All that use natural gas as fuel, supplied through piping, in industrial activities or processes, but special processes or activities with an intermittent gas consumption or even gas cuts. These consumers of group 4 are obliged to have another alternative energy source. Moreover, they cannot contract a quantity lower

supply of gas to consumers with a lower level of domestic consumption and to small businesses, the aforementioned last resort tariffs applied by suppliers were incorporated. These suppliers had to charge the price set by the Government. Moreover, it set some dates when tariffs would disappear, i. e. after 2007. Two important dates should be noted: 1) The 1st January 2008, the tariff system was eliminated⁹⁹; and 2) The 1st July 2010, when the consumers (belonging to Group 3 with a consumption rate of 1 GW/year)¹⁰⁰ were able to enjoy the special tariff discussed in the foregoing paragraph.

In the province of Málaga, the process of relaxing restrictions in the gas sector developed as follows. Before this process began, in 1996, the domestic customers, 3.053 consumers, supplied by Gas Andalucía, represented 98% of the total and consumed 58% of the natural gas sold. The rest of the consumers represented commerce, mainly the service sector. Since then, the number of customers has been rising. In 2001, there were 32.143 customers and in 2008, 70.666. Thus, there were 4,52 customers per 100 inhabitants, a little higher than the Andalusian average (4,42) but much lower than the national figure (15,01)¹⁰¹.

Since 1 January 2003, it became possible to choose freely between the different gas suppliers. In this way there were two markets: one regulated and the other unregulated. In Málaga, in 2004, 75% of the customers chose the regulated option and 25% belonged to the other group¹⁰². However, this changed in 2007 because the latter accounted for 33%. The biggest change occurred at the end of 2008, when all the

than 8.600.000 kWh/year or 26.000 kWh/day, and they cannot be connected to a gas pipeline whose pressure is the same or lower than 4 bars. Power stations are in this group; and 5. Raw Material Tariff. Consumers that use gas as raw material. About the liberalization: ARIÑO ORTÍZ, G. (2006) "El proceso de liberalización gasista española en el contexto regulatorio europeo". In: PÉREZ MORENO, A. (coord.) *El derecho de la energía. XV Congreso Italo-Español de profesores de derecho administrativo*, Sevilla, Instituto Andaluz de Administración Pública, 255-274; SÁNCHEZ GUTIÉRREZ (2006); and FERNÁNDEZ PARADAS (2009a), 142-146.

99 According to *Orden de 30 de julio de 2007*, as from the 1st July 2008, if any consumer supplied by a distributor, has not yet chosen a commercial group, it will be supplied by the commercial group taken as a last resort from the same distribution company.

100 This part has been modified because as from the 1st of July 2009 and obeying the order ITC/1251/2009, only those consumers connected to a gas pipeline whose pressure is the same or lower than 4 bars and whose yearly consumption is lower than 50.000 kWh, will be able to enjoy the Tariff of Last Resource. Namely domestic consumers.

101 COMISIÓN NACIONAL DE ENERGÍA (2009) *Información básica de los sectores de la energía 2009-*, Madrid, 121-122.

102 In 2004, in Spain, 78% of customers were in the regulated market and 22% in the free one; and in Andalusia, 80% in the regulated and 20% in the other. COMISIÓN NACIONAL DE ENERGÍA (2005) *Análisis sobre la evolución y la demanda de gas natural y el número de consumidores durante el año 2004*, Madrid.

consumers formed part of the free market.

In Málaga, in the period 2004-2007, the customers of both markets belonged to the following groups of consumers: about 99,9% to Group 3 (domestic-commercial consumers) and 0,1% to Group 2 (industrial consumers connected to a gas pipeline with pressure higher than 4 bars and lower than 60 bars). In 2007, the most important customers were: one company in the primary sector (25% of the total consumption), 7 industries of energy transformation (35%), and 66.737 domestic consumers (18% of the consumption)¹⁰³.

In 2010, the combined-cycle plant of Gas Natural is expected to come into operation in the Parque Tecnológico de Andalucía in Málaga. The plant will have a power of 400 megawatts and it will supply half a million people, once it starts production¹⁰⁴.

5.- Conclusion.

Málaga was one of the first cities in Spain to have gas because of a variety of factors: its growing population, its commercial and industrial activities, its port and the construction of a railway system that would facilitate the importation of coal. Gas was first introduced in 1846 in one of the most important industries of Málaga, Industria Malagueña, for its own consumption. In 1854, Empresa General de Alumbrado de Gas began to produce gas for street lighting. In the same year, its manager Luis Gossé sold the business to the French group Vautier, which founded the Societé pour l'Éclairage de Málaga in 1859. Hence, this service was provided to almost all cities in Spain by a French company.

The story of gas in Málaga involves 3 stages: 1) 1854-1968, gas made from coal; 2) 1969-1992, gas made from oil; and 3) 1993-2009, natural gas.

As gas was a product only commercialized in the domestic market until 1992, its evolution depended on the socioeconomic characteristics of the area. Moreover, the introduction of new energy sources adversely affected its

103 In addition to these consumers in Málaga, there were other important customers in Spain and Andalusia, those of the "chemical and petrochemical industries" and those of the "building material industry". MINISTERIO DE INDUSTRIA (2008) *Estadística de la industria del gas 2007*, Madrid. The sources of information used in this paper have not examined the effects of the worldwide economic crisis started in 2007 on the gas in Málaga.

104 *Málaga Hoy*, 14th December 2009.

progress. These were electricity in the 1880s, especially in its hydraulic form, at the start of the XX century, and butane gas in the 1950s.

It should be noted that the early commercial activities in Málaga laid the foundation of its first industries in the 1830s, which helped to make it a very attractive market for gas companies. However, the large factories produced their own gas supply and when electricity arrived they made use of it. Moreover, given that the income of almost every inhabitant in Málaga was very low, gas consumption was also low since gas was considered to be a luxury product. Another problem was that the coal supply located at some distance in Córdoba increased transport costs.

Different periods may be distinguished in each stage. Thus between 1880 and 1968 there were periods of recession: 1) 1880-1895; 2) the WWI and 3) the early part of the 1920s, years in which gas production rose and fell continuously before falling sharply; 4) the 1930s; and 5) from 1951 to 1968. The periods of positive growth were as follows: 1) the early years of the XX century before WWI; 2) the Primo de Rivera dictatorship (1923-1929); and 3) from 1943 to 1950.

The strategy of the Lionesa was instrumental in overcoming the problems. For example, throughout the 1880s and the first half of the 1890s, it employed highly skilled staff (Pelegrín y Sabater), and made changes in the factory to meet the challenge of electricity. The Lionesa also opened its market to private consumers and improved and extended lighting to other areas. These reforms were implemented in a period of recession, and marked the start of a more positive period for the gas sector. In 1912, the factory underwent new reforms. And from 1923 to 1929, the new owner of the gas company Sociedad General de Aguas de Barcelona reorganized the business at a crucial time. It introduced gas for cooking and lighting, thereby attracting more customers in the domestic sector.

Manufactured gas was unable to compete with butane gas, the use of which increased considerably after the 1950s. Butane was cheaper and easier to use whereas the technology of gas production was obsolete and the service was poor. But, once again, the gas industry was obliged to meet new challenges and began to use oil for gas production. In 1969, in Málaga, this was successfully initiated by Compañía Española de Gas, later forming part of Gas Natural.

Manufactured gas using oil was produced until 1993 and its production increased markedly between 1969 and 1977. The year 1992 marked the onset

of the era of natural gas. Manufactured gas was to be replaced by natural gas, but a new plant of propane air was built. Although this process started in 1969 in Spain, it was not until 1991 that Gas Andalucía definitively replaced manufactured gas by natural gas in Andalusia, in particular in Seville. In Málaga, natural gas began to be used in 1994 and manufactured gas had disappeared altogether by 1997. Since 2001, the main cities of the province of Málaga have been supplied with natural gas, constituting a market of more than 1 million consumers, 70% of its population. All this has been possible because of massive investments in transport and distribution networks that connected Málaga with the national network. Between 2001 and 2007 gas consumption increased enormously, reaching 827 million m³ in 2005, which represents the highest level in the history of gas consumption in Málaga. This high level of consumption was due to the rise in incomes and to the boom in the building sector. All these changes occurred at a time of profound reorganization in the gas sector. This reorganization sought to relax restrictions imposed in 1996. Thus on 1 January 2003, it was possible to buy natural gas from different commercial companies. At present, all gas is supplied in the free market.

Table 2. Production, consumption, customers and gas network length in Málaga (1863-2008)

Years	Production (m ³)	Consumption (m ³)	Customers	Network length (metres)
1863	1.950.000			
1880	1.594.876			
1882	1.580.110			
1889	1.551.250			
1890	1.551.250			
1893	1.620.600			
1895	1.788.500			
1900	2.020.275			
1901	2.207.520			
1902	2.366.295			
1903	2.380.895			
1904	2.571.060			
1905	2.380.895			
1906	2.518.500			
1907	3.616.785			
1908	3.192.655			
1909	3.288.285			
1910	3.288.285			
1911	4.876.306			
1912	3.551.760			
1913	2.927.869			
1914	2.597.508			
1915	4.155.218			
1916	3.184.960			
1917	2.613.075			
1918	2.157.032			
1919	2.110.988			
1920	2.006.233			
1921	2.006.233			
1923		1.600.000	2.149	
1924		1.800.000	2.567	
1925	3.222.485	2.225.000	5.463	

1926		3.366.950	7.635	
1927	3.686.925	3.686.925		
1928	3.886.275	3.886.275	9.669	
1929	4.014.325	4.014.325	10.390	
1930	4.312.260	4.312.260	11.103	
1931	4.326.546	4.326.546	11.216	
1932	4.539.900	4.539.900		
1933	6.660.964	4.589.400		
1934	4.665.225	4.665.225		
1935	4.676.825	4.676.825	9.140	
1936			8.315	
1938	3.799.000	3.799.000	8.318	100.000
1943	3.260.000		7.399	104.739
1944	4.179.000			
1945	4.095.000			
1946	4.574.000			
1947	4.508.000	3.793.832	8.140	75.000
1948	4.856.000			
1949	5.099.000		8.355	
1950	5.415.000		7.990	115.476
1951	5.012.000			
1952	4.911.000		7.328	
1953	5.089.000			
1954	4.585.000		6.646	
1955	4.106.000	2.955.364		
1956	4.147.000	2.924.854	6.118	116.850
1957	4.326.000	3.017.356	6.208	116.881
1958	3.719.000	2.650.778	5.929	116.983
1959	3.590.000	2.502.668	5.638	116.795
1960	3.441.000	2.315.591	5.096	116.196
1961	2.746.000	2.079.171	4.614	116.056
1962	2.173.000		4.257	116.056
1963	2.138.000		4.178	116.056
1964			3.886	116.056
1965	1.794.000		3.488	116.117
1966	1.788.000		5.886	123.870

1967	3.380.000		5.886	130.701
1968	4.738.000		6.915	
1969	4.890.000	4.068.000	6.697	136.513
1977	10.139.000			
1983	11.269.048	11.269.048	12.807	
1985	11.334.000	10.280.952	12.163	181.000
1986	12.456.000	11.591.429	12.694	
1987	12.293.809	12.293.809	12.879	
1988	11.217.381	11.217.381	13.085	184.900
1989	12.387.381	12.387.381	13.439	184.500
1990	12.928.571	12.928.571	13.968	195.100
1991	13.283.571	13.283.571	14.569	200.000
1992	16.392.619	16.392.619	14.965	208.000
1993		14.562.381	15.689	211.000
1994		13.578.067	16.552	
1995				198.000
1996		15.144.029	18.316	
1997		73.300.000	19.808	201.000
1998		99.700.000	22.135	212.000
1999				
2000		142.000.000		230.000
2001		182.000.000	32.143	268.000
2002		183.000.000	36.215	302.000
2003		488.000.000	40.566	347.000
2004		666.000.000	47.080	378.000
2005		827.000.000	56.428	489.000
2006		427.000.000	61.742	
2007		462.000.000	66.731	520.000
2008			70.666	

Sources: The production in 1863, in GONZÁLEZ; BRENES (1992). The production in 1880, 1882, 1938, 1943-1969 and 1977, in FÁBREGAS (2003), 63 and 171. 1889-1900, 1906-1907, 1909, 1910, in *Estadística de la Contribución Industrial*. 1901-1905, 1908, 1916-1918, 1920-1921 and 1925, in *Estadística del Impuesto sobre el Consumo de luz de gas, electricidad y carburo de calcio*. 1910-1915, it is an estimate based on the production figures for 1910 and the income obtained from lighting between 1910-1915. 1919, in *Anuario Estadístico de España. Año 1922-1923*. 1927-1935, in MINISTERIO DE INDUSTRIA Y COMERCIO *Estadística general del consumo de carbones*. Years 1933-1935. This source shows the same levels of production and consumption for 1934. The information for 1927-1932 and 1934 refers to the gas sales and they are underestimated. Finally this has been used because the production shown in *Estadística del Impuesto sobre el Consumo...* were lower than those of gas

consumption. 1983 and 1986-1992, in MINISTERIO DE INDUSTRIA *Estadística de las industrias del gas*. Years 1983 and 1986-1992. The data for 1983 and 1987-1992 are also underestimated because they refer to consumption. 1985, in MINISTERIO DE INDUSTRIA *Estadística de fábricas de gas. Año 1985*. The consumption levels in 1923-1925, in ARROYO (2006a). 1926-1935, in MINISTERIO DE INDUSTRIA Y COMERCIO *Estadística general del consumo de carbones*. Years 1933-1935. 1938, in FÁBREGAS (2003), 189. 1947 and 1955, in: SINDICATO VERTICAL DE AGUA, GAS Y ELECTRICIDAD (1948); and SINDICATO NACIONAL DE AGUA, GAS Y ELECTRICIDAD (1960^a). 1956 and 1960-1961, in COMPAÑÍA ESPAÑOLA DE ELECTRICIDAD Y GAS LEBON *Memorias*. Years 1956 and 1960-1961. 1957-1959 and 1964-1969, in SINDICATO NACIONAL DE AGUA, GAS Y ELECTRICIDAD: *Estadística comparativa de la industria del gas*. Years 1957-1959; and *Datos estadísticos técnicos de la industria del gas*. Years 1964-1969. 1983, in MINISTERIO DE INDUSTRIA *Estadística de las industrias del gas. Año 1983*. 1985, in MINISTERIO DE INDUSTRIA *Estadística de fábricas de gas. Año 1985*. 1986-1994 and 1996, MINISTERIO DE INDUSTRIA *Estadística de las industrias del gas*. Years 1986-1994 and 1996. 1997-1998, in GAS ANDALUCÍA *Informe anual*. Years 1997-1998; and 2000-2007, in AGENCIA ANDALUZA DE LA ENERGÍA *Datos energéticos de Andalucía*. Years 2003-2007. For the customers of 1923-1924 and 1929, in ARROYO (2001). The ones of 1925-1928, 1935, 1938, 1943 and 1949-1950, 1952 and 1954, in FÁBREGAS (2003), 189. 1930-1931, in COMPAÑÍA ESPAÑOLA DE ELECTRICIDAD Y GAS LEBON *Memoria. Ejercicio de 1931*. 1936, in ARROYO (2001). 1947, in SINDICATO VERTICAL DE AGUA, GAS Y ELECTRICIDAD (1948). 1956-1959, in SINDICATO NACIONAL DE AGUA, GAS Y ELECTRICIDAD: *Estadística comparativa de la industria del gas*. Years 1956-1959. 1960-1969, in SINDICATO NACIONAL DE AGUA, GAS Y ELECTRICIDAD *Datos estadísticos técnicos de la industria del gas*. Years 1960-1969. 1983, 1986-1994 and 1996, in MINISTERIO DE INDUSTRIA *Estadística de las industrias del gas*. Years 1983, 1986-1994 and 1996. 1985, in MINISTERIO DE INDUSTRIA *Estadística de fábricas de gas. Año 1985*. 1997-1998, in GAS ANDALUCÍA *Informe anual*. Years 1997-1998. 2001-2002, in GAS NATURAL ANDALUCÍA *Informe Anual*. Years 2001 and 2002. 2003-2005, in COMISIÓN NACIONAL DE ENERGÍA *Análisis de la evolución de la demanda de gas natural y el número de consumidores durante el año*. Years 2003-2005. 2006-2008, in COMISIÓN NACIONAL DE ENERGÍA *Información básica de los sectores de la energía*. Years 2008 and 2009. Network length in 1938, in MINISTERIO DE INDUSTRIA Y COMERCIO (1942^a). 1947, in SINDICATO VERTICAL DE AGUA, GAS Y ELECTRICIDAD (1948). 1956 and 1958-1959, in SINDICATO NACIONAL DE AGUA, GAS Y ELECTRICIDAD *Estadística comparativa de la industria del gas*. Years 1956 and 1958-1959; 1967, in SINDICATO NACIONAL DE AGUA, GAS Y ELECTRICIDAD *Datos estadísticos técnicos de la industria del gas. Año 1967*. 1985, in MINISTERIO DE INDUSTRIA *Estadística de fábricas de gas. Año 1985*. 1988-1991, 1993 and 1997-1998, in GAS ANDALUCÍA *Informe anual*. Years 1988-1991 and 1993 and 1997-1998. 1992, in MINISTERIO DE INDUSTRIA *Estadística de las industrias del gas*. Year 1992. 1995, in Oilgas "Producción y consumo de gas en España en 1995", *Oilgas*, núm. 342. 2001-2006 and 2008, in GAS NATURAL ANDALUCÍA *Informe Anual*. Years 2001-2006 and 2008. The rest of years in FÁBREGAS (2003), 189-190.