IPENZ ENGINEERS NEW ZEALAND

ENGINEERING HERITAGE NEW ZEALAND

IPENZ Engineering Heritage Register Report

Dunedin Gasworks

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Aerial photograph of the Dunedin Gasworks, *circa* 1960s. Dunedin City Council (DCC) Archive, DCC G photo 4.

Contents

A. General information

Name: Dunedin Gasworks

Alternative names: Dunedin Corporation Gasworks; Dunedin City Corporation Gasworks; Dunedin City Council Gasworks; Dunedin Gas Light and Coke Company (Limited) Gasworks; Dunedin Gasworks Museum; Dunedin Gas Works; Dunedin Municipal Gasworks

Location:

20 Braemar Street

South Dunedin

Dunedin

Otago

Geo-reference: Latitude: -45.893, Longitude: 170.502

Legal description: Lot 6 DP 21969 (CT OT13C/927), Otago Land District

Access information: The public can access the site during museum opening hours. These details are available on the Dunedin Gasworks Museum website (www.gasworksmuseum.org.nz).

Map courtesy of GoogleEarth

City/District Council: Dunedin City Council

IPENZ category: Engineering Site

IPENZ subcategory: Manufacturing and Industrial Processing

IPENZ Engineering Heritage number: 2380

Date registered: 25 February 2014

Other IPENZ recognition: Plaque (presented during 1989 IPENZ Annual Conference)

Other heritage recognition:

- *New Zealand Historic Places Trust*: Dunedin Gasworks Exhauster and Boiler House, Category 1 historic place (Register No. 4399); Fitting Shop (Smithy or Purifier House), Category 1 historic place (Register No. 4401); Gasholder of 1879, Category 1 historic place (Register No. 4398)
- *Local Authority District Plan*: Dunedin City District Plan (operative May 2012), References: B021 [Fitting Shop] and B022 [Exhauster and Boiler House]
- *Other:* New Zealand Archaeological Association Site Record: 144/472

B. Description

Summary

In 1863 the Dunedin Gasworks was the first place in New Zealand to produce manufactured coal gas. It closed in 2001 and the remaining structures and plant now form the Dunedin Gasworks Museum.

Manufactured coal gas, or town gas, was first used in Dunedin for central city street lighting. The enterprise was led by important Southern Hemisphere gasworks engineer and developer, Stephen Stamp Hutchison, and the Dunedin Gas Light and Coke Company. Other main centres soon followed suit and within a few decades most large towns and cities in New Zealand had at least one gasworks. During the 1880s demand grew and gas heating and cooking gained popularity. The Gasworks was also essential to local industry, powering it as well as supplying coal gas by-products - coke and tar.

For many years the local council considered buying Dunedin Gasworks and, after much debate, on 1 January 1876 it became the owner. The Gasworks was generally a profitable business for the Council, although less so as electricity rose to prominence. By the 1980s the feasibility of manufacturing coal gas had declined, so Dunedin stopped in 1987. The Council then converted the Gasworks for Liquid Petroleum Gas (LPG) and tempered LPG distribution until 2001.

When manufactured coal gas ceased the Dunedin Gasworks Museum Trust was established, their goal being the preservation of aspects of the Gasworks. The Museum opened in 2001 and consists of the Gasholder frame (1881), the brick Fitting Shop (*circa* 1900), and Engine House whose earliest sections are thought to date from the 1860s or ‘70s. This building has the gasworks’ landmark chimney attached to it, and also features the Gasworks’ remaining working steam engines ranging in date from the 1860s to the 1960s. Various processing and storage tanks are also still present.

Gasworks were an essential part of many people’s lives from the mid to late 19th century and into the 20th. Complexes as complete as the Dunedin Gasworks are now globally rare, which means this place has special engineering heritage value.

Historical narrative

In 1840 Ōtākou Marae on the Otago Peninsula was one of the Treaty of Waitangi signing places. Four years later Ngāi Tahu sold the Otago block to the Crown.[1] Located at the east end of Otago Harbour, Dunedin was founded in 1848. The town was laid out by New Zealand Company surveyor, Charles Kettle (1821-1862). Promoted initially as the New Edinburgh settlement, the Scottish flavour of the first European settlers was imprinted on the town by Kettle. The name Dunedin is the Gaelic earlier version of Edinburgh. The new town's main roads, Princes and George Streets, also referenced counterparts in the Scottish capital.[2] Most of the Otago settlement immigrants were from Scotland, and in particular were Free Church Presbyterians.[3] The town's first boom came courtesy of the Otago gold rush beginning in 1861. This meant that within a few years Dunedin's population jumped from under 2,000 to approximately 15,000, making it New Zealand's largest city.[4]

While manufactured coal gas lighting had been introduced in London in 1812, it was not until 1841 that the first Southern Hemisphere use of commercial gas lighting occurred in Sydney. Melbourne did not follow until 1856 with supply from the Melbourne Gas and Coke Company. It was their recently fired engineer, Stephen Stamp Hutchison, who came to Dunedin in the early 1860s promoting the idea of creating gas lighting in the prospering town, on a much larger scale than the individual tallow gas system used in the Commercial Inn from 1858.[5] The gold rush period saw significant development in Dunedin, with water supply and sewage works

[1] Te Maire Tau, 'Ngāi Tahu - The Ngāi Tahu claim,' *Te Ara - the Encyclopedia of New Zealand*. URL: http://www.TeAra.govt.nz/en/photograph/1634/otakou-marae (updated 15 November 2012); Te Maire Tau, 'Ngāi Tahu - The Ngāi Tahu claim,' *Te Ara - the Encyclopedia of New Zealand*. URL: http://www.TeAra.govt.nz/en/ngai-tahu/page-8 (updated 22 September 2012).

[2] Malcolm McKinnon, 'Otago places – Dunedin,' *Te Ara - the Encyclopedia of New Zealand*. URL: http://www.TeAra.govt.nz/en/otago-places/page-6 (updated 17 December 2012); Malcolm McKinnon, 'Otago places – Dunedin,' *Te Ara - the Encyclopedia of New Zealand*. URL: http://www.TeAra.govt.nz/en/interactive/35351/roadside-stories-dunedin-edinburgh-of-the-south (updated 14 December 2012); Brad Patterson, 'Kettle, Charles Henry - Kettle, Charles Henry,' from the *Dictionary of New Zealand Biography* in *Te Ara - the Encyclopedia of New Zealand*. URL: http://www.TeAra.govt.nz/en/biographies/1k11/kettle-charles-henry (updated 30 October 2012).

[3] John Wilson, 'Scots - The Otago settlement,' *Te Ara - the Encyclopedia of New Zealand*. URL: http://www.TeAra.govt.nz/en/scots/page-3 (updated 13 July 2012).

[4] McKinnon (updated 17 December 2012).

[5] 'Light and Power,' eMelbourne: the Encyclopedia of Melbourne Online, URL: http://www.emelbourne.net.au/biogs/EM00854b.htm (accessed 12 June 2013); PG Petchey, 'History of the Dunedin Gasworks,' unpublished report for the Dunedin Gasworks Museum Trust, 2009, 2; 'City of Melbourne Gas and Coke Company,' *The Argus*, 29 July 1862, 6. It seems that Hutchison, along with others, was fired for misconduct regarding misleading annual reporting, 'The Melbourne Gas Company,' *The Argus*, 12 October 1860, 1; *Otago Witness*, 23 January 1858, 4.

being a focus, as well other considerable infrastructure works such as the Princes Street cutting and the use of the Bell Hill spoil for harbour reclamations.[6]

Hutchison was a determined advocate of towns and cities having coal manufactured gas supplies. In mid-1862 Hutchison was instrumental in the formation of the Dunedin Gas Light and Coke Company, becoming a shareholder as well as its engineer, and later its manager of works.[7] Within months of the Dunedin Gas Light and Coke Company's establishment, Hutchison saw to it that the company's plant was imported (mostly from Melbourne). The construction of the gasworks in South Dunedin therefore progressed well, and pipes for street lighting gas were being laid by late 1862.[8] The Town Board was responsible for the creation of the lamps and, after an installation delay, 150 of them lit central Dunedin from September 1863, along Princes, George and Stuart Streets.[9] This meant that the Gasworks was New Zealand's first to produce gas. There was opportunity for private and commercial customers to buy gas for lighting too. However, for most people the initial pricing was prohibitive.[10]

Hutchison's subsequent career had many ups and downs. For example, he was declared bankrupt in 1868. At the time he was the lessee of Dunedin Gasworks, so his brother seems to have taken over the lease and then sold the business within a few years.[11] In 1873 Hutchison was a consulting gas engineer offering his services to the Invercargill Borough Council among others. By 1881 he had moved to Blenheim where he constructed a gasworks to supply the Borough.[12] He was also successful in building the Caversham Gasworks to supply the southern Dunedin suburbs of Caversham, Mornington, Roslyn, and St Kilda in 1882.[13] However, in the mid-1880s he seems to have left New Zealand, bankrupt once again, returning to Australia to

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[6] KC McDonald, *City of Dunedin: A century of civic enterprise* (Dunedin: Dunedin City Corporation, 1965), 64-66; 'Dunedin's Engineering Heritage Trail: Walk 2 – the Exchange Route,' IPENZ Engineering Heritage Otago Chapter. Available from IPENZ Engineering Heritage: http://www.ipenz.org.nz/heritage/itemdetail.cfm?itemid=2465 (accessed 25 June 2013).

[7] 'Dunedin Gas Light and Coke Company,' *Otago Witness*, 31 May 1862, 2.

[8] 'The Town Board,' *Otago Daily Times*, 29 October 1862, 5; Petchey, 2.

[9] 'Meeting of the Town Board,' *Otago Witness*, 11 September 1863, 7; McDonald, 63-64; 'History of Gasworks: Distribution of Gas,' Dunedin Gasworks Museum, URL: http://www.gasworksmuseum.org.nz/index.php?option=com_content&view=article&id=62&Itemid=66 (accessed 2 July 2013).

[10] Petchey, 3.

[11] *The Southland Times*, 7 October 1868, 2; Petchey, 3-4.

[12] 'Borough Council,' *Southland Times*, 26 March 1880, 2; 'Public Notice,' *Marlborough Express*, 7 July 1881, 3

[13] 'Caversham Borough Council,' *Otago Daily Times*, 28 August 1880, 5; 'The New Suburban Gasworks,' *Otago Daily Times*, 8 September 1882, 2. The Caversham Gasworks was purchased by the Council in 1907. McDonald, 273-74

pursue projects there.[14] In 1887 he described himself as "the largest gas proprietor and speculator in the colonies".[15] In 1890 Hutchison had moved on again, this time working in Noumea, before returning to Australia and getting himself into further financial strife.[16] It is not surprising that Hutchison kept gaining contracts despite his financial track record, because gas engineering was a particularly specialist field, combining civil, mechanical and chemical engineering.[17]

Figure 1: South Dunedin, showing Gasworks [date unknown]. DCC Archive, DCC G Photograph Collection

In late 1870 a consortium led by Henry Alers Hankey bought the Dunedin Gasworks.[18] The private contract for Dunedin's gas supply expired in 1875 so in the early 1870s the Council considered its options. Although a report, which they commissioned, was scathing of the existing plant the Council eventually offered to

[14] *Queenscliff Sentinel*, 21 January 1884, 1. In June 1885 Hutchison was reported to have been brought back to New Zealand to face charges of bankruptcy fraud. This seems to have stemmed from his investment in Dunedin's Suburban Gasworks project, of which the Caversham Gasworks resulted. Hutchison had expended between £4-5,000 on the project when the Maori Hill Borough Council contract was rescinded in late 1882. 'Summary of the New Zealand news,' *South Australian Register*, 29 June 1885, 6; 'Maori Hill Borough Council,' *Otago Daily Times*, 26 October 1882, 3.

[15] 'Ordinary Meeting,' *Border Watch*, 12 February 1887, 2.

[16] 'Local and General News,' *Marlborough Express*, 2 October 1890, 2; 'Our Victorian Letter,' *Otago Witness*, 15 April 1903, 13.

[17] RC Pemberton, 'Gasworks' Practice: An outline of the process of town gas manufacture,' *New Zealand Engineering*, 3:10 (October 1948), 979. Here Pemberton is discussing the requirements in the mid-20th century. However, these attributes would have been applicable to earlier gas engineers.

[18] 'Notice Dunedin Gas Works,' *Otago Daily Times*, 22 December 1870, 2; McDonald, 126.

purchase the Gasworks for £49,400. If Hankey had not accepted the proposal then the Council was prepared to construct its own new works. However, it officially became the owner of the existing Gasworks on 1 January 1876. The Council appears to have been motivated by a need to ensure the gas supply, demanded by its growing population, at a reasonable cost.[19] Dunedin was New Zealand's largest urban centre again between 1878 and 1881.[20] It was around this period that the Council undertook the first significant upgrade of the gaswork's facilities, constructing a new retort house and gasholder costing £50,000.[21]

Municipally owned gasworks seem to have been a hot topic nationally in 1876. In addition to the Dunedin City Corporation's purchase there was also debate in Parliament over the clause in the Municipal Corporations Act Amendment Bill which gave councils grounds to build their own gasworks. Nelson's City Council seem to have been the first municipality in New Zealand to own a gasworks, with theirs completed in 1874.[22] Some thought it unfair that councils would be able to undercut established businesses, and also be financially propped up by taxpayers if works ran at a loss. However, the clause passed for further committee consideration on the grounds that councils were significant users of gas and "they had a perfect right to make it cheaper if they could do so".[23] At the time there were around 10 privately owned gasworks in New Zealand, in the main centres and larger towns, such as Ashburton, Napier and Thames.[24] Indeed, initially in Dunedin the Council did run the gasworks at a loss, but by the late 19th century it was making a tidy profit.[25] Eventually other councils followed Nelson and Dunedin's lead in running gasworks, and by 1890 this was the case in Blenheim, Invercargill, Masterton, Oamaru and Westport.[26]

In 1899 a Dunedin councillor stated the Gasworks was obsolete and that "[i]t was only a matter of years when the council would face the question of lighting the city with

[19] Petchey, 4; Purchase of the Gasworks,' *Otago Witness*, 23 October 1875, 18.

[20] McKinnon (updated 17 December 2012).

[21] McDonald, 144.

[22] 'City Council,' *Colonist*, 5 September 1874, 3. Dunedin followed Nelson, then Oamaru and Invercargill later in 1876.

[23] 'The General Assembly,' *Otago Witness*, 5 August 1876, 9.

[24] This figure is derived from a list of companies produced in the *Appendix to the Journals of the House of Representatives* in 1889 and then cross referenced with PaperPast articles to ascertain whether they had been established before 1876. This figure is an approximation as there may have been gasworks present in 1876 which subsequently went out of business. 'Return of Gas Companies in the Colony,' *Appendix to the Journals of the House of Representatives 1889*, H-49. Available at www.atojs.natlib.govt.nz (accessed 11 June 2013).

[25] McDonald, 144, 273.

[26] 'Return of Gas Companies in the Colony'.

electricity".[27] However, the number of gasworks around New Zealand peaked during the First World War and it took several decades for the dominance of gas to be seriously challenged by electricity.[28] Throughout the early 20th century Dunedin's gasworks continued to turn a profit for the Council. However, in the 1930s competition from electricity began to take its toll and the gas department was forced to reduce prices and launch gas appliance promotional campaigns in attempts to keep customers.[29]

Of its main areas of business during the early 20th century the gasworks was perhaps the Council's "least obtrusive".[30] Although the gasworks was still recognised as useful by Dunedin's citizens its "grimy, unlovely buildings, set in drab surroundings" did not have the public appeal of transport, water supply or electricity assets.[31] However, the coal shortages during World War Two affected supply, as elsewhere in New Zealand, and the plight of gas was not helped nationally by the Government deciding not to install gas appliances in state housing anymore.[32] Evidence of the mid-20th century competition between gas and electricity heating up is perhaps provided by a Dunedin City Council Electricity Department sub-station being built on the south corner of the Gasworks' site in 1954.

In 1949 a paper published in *New Zealand Engineering* pronounced that despite "oil, water power and atomic energy, coal still remains the prime source of the world's power".[33] Motivated by the interests of the coal industry the Government began to subsidise the price of gas. However, the coal miner's strike of 1951 further compromised the Dunedin Gasworks supply and justified an earlier decision to lessen dependence on coal by constructing the Gasworks' Water Gas Plant. Two units were imported from England and came into use in late 1952. Moreover, further upgrades were undertaken in the early 1960s as a response to increasing consumption. This included a "complete break from traditional coal carbonisation" with the installation of oil gasification plant.[34] Three P3 Reforming Plants were installed between 1964 and 1966. Complete change to oil gasification was projected for the works by 1976 and was progressing well by 1973 with a tender being accepted for further plant – two

[27] 'The Gas Question,' *Otago Daily Times*, 15 June 1899, 8.

[28] 'The Inauguration of Woodall-Duckam Continuous Vertical Retort Plant for the City of Dunedin,' 1962, 9. Archives New Zealand (ANZ), AALR W3266 873 Box 74 52/962/42 [R8275411] ; Petchey, 7.

[29] Petchey, 7.

[30] McDonald, 346.

[31] Ibid.

[32] Petchey, 8.

[33] R Worley, 'The Reconstruction of the Auckland Gasworks,' *New Zealand Engineering*, 4:1-2 (January-February 1949), 57.

[34] Petchey, 9.

Micro-Simplex Reforming Plants. However, the economies oil promised completely disappeared with the Arab Oil Crisis, beginning in October 1973. Therefore, the transformation of Dunedin Gasworks halted abruptly and coal carbonisation methods continued.[35]

With electricity dominating, the end of the Dunedin Gasworks seemed inevitable by the 1980s, compounded by aging plant and structures which required expensive upgrades.[36] Christchurch's gasworks had closed in late 1981 and the site cleared, and most others gasworks around the country had closed by this time or were about to.[37] Although revenue was over $2 million in the early 1980s, the Dunedin Gasworks' profit margins could not justify expenditure on significant upgrade works, especially since consumption had been declining for over a decade.[38] The Government coal subsidy was due to end in April 1984, so in 1983 the Council was investigating replacing coal with reformed Liquid Petroleum Gas (LPG) for fuelling the city's gas supply, which involved a "relatively inexpensive" conversion of existing reforming plant.[39] This eventually led to the coal carbonising plant being shut down in June 1987.[40]

The Gasworks had the distinction of being the first and final place to produce manufactured coal gas in New Zealand. Its vertical retort house, the last of its kind nationally, was demolished in 1989.[41] In 1990 tempered LPG was opted for, which meant the creation of a fully automated plant, only feeding central city customers using a reduced mains network. This continued from the site until 2001.[42] However, the Council's involvement in operating the Gasworks ceased a few years earlier when in 1999 they sold the remaining processing plant to Todd Energy, trading as Nova

[35] Ibid., 8-10

[36] Ibid., 10

[37] John S Pollard, *Requiem for a Gasworks* (Christchurch: Canterbury University Press, 1987), 186-87; Lloyd Smith to Karen Astwood, 10 July 2013. IPENZ.

[38] 'Gas Department: Operations account for the year ended 31st March 1982.' ANZ, AATJ W4897 6091 Box 234 4150/D1 pt1 [R22238082]; D L Lawrence, 'Conversion of Dunedin Gas Works to LPG,' 6 October 1983. ANZ, AATTJ W4897 6091 Box 234 4150/D1 pt1 [R22238082]; WS Atkins and Partners, 'The Future of Manufactured Gas for Dunedin,' The New Zealand Gas Council and Dunedin City Council Gas Department, June 1971, 1. ANZ, AALR W3266 873 Box 74 52/962/42 [R8275411].

[39] Chris Black, 'The national cost of supplying LPG vs natural gasoline to Dunedin (Study 1), 29 February 1984; W. McMeeking to Hon. WF Birch, 28 July 1983. ANZ, AATTJ W4897 6091 Box 234 4150/D1 pt1 [R22238082].

[40] Petchey, 11.

[41] 'A history of the Gasworks,' Dunedin Gasworks Museum, URL: http://www.gasworksmuseum.org.nz/index.php?option=com_content&view=article&id=58&Itemid=29 (accessed 1 July 2013).

[42] Petchey, 11; Lloyd Smith, email message to author, 10 July 2013. The reduced mains network meant that suburban customers either changed to LPG tanks or converted to electricity.

Energy from the Hillside Road remnant of the original Dunedin Gasworks site. It was also that year the Council discontinued processing landfill gas at Green Island. Therefore, 1999 marked a complete withdrawal of the Council from gas production operations after just under 130 years of involvement.[43]

Figure 2: Doris Lusk, *Gasworks and foreshore, Dunedin*, ca. 1935, oil on canvas, 293 x 340mm, acc: 79/13, Hocken Collections *Uare Taoka o Hākena*

In the early to mid-20th century, gasworks were prominent features of the skylines of many New Zealand's cities and towns. For many they became iconic local features and some were even the subject of paintings by important New Zealand artists such as Doris Lusk (Figure 2) and Rita Angus.[44] As well as the Dunedin Gasworks the city also had Hutchison's Caversham Gasworks. However, this was mostly demolished to make way for Dunedin's Southern Motorway in the 1980s.[45] With the cessation of coal gas manufacture at the Dunedin Gasworks there were concerns that a valuable and rare aspect of New Zealand's industrial and engineering heritage could be lost.

[43] Lloyd Smith, email message to author, 6 August 2013. IPENZ.

[44] Denis Glover, 'Rita Angus: Impressions by some friends,' *Art New Zealand*, URL: http://www.art-newzealand.com/Issues1to40/Angus03dg.htm (accessed 16 September 2013). Rita Angus painted the Woolston Gas Works, Christchurch.

[45] Petchey, 5. Petchey notes that in the late 20th century only the Caversham Gasworks Governor House remained. However, this seems to have been subsequently demolished. Lloyd Smith, email message to author, 6 August 2013.

As a result a group, led by the Director of the Otago Settlers Museum Elizabeth Hinds, formed the Dunedin Gasworks Museum Trust in 1988.[46] It was also during this period that the heritage importance of some of the Gasworks buildings and structures were recognised by the New Zealand Historic Places Trust. This included adding the 1881 gasholder, exhauster and boiler house, and purifier house to the National Register of historic places in March 1988.[47] In 1989 IPENZ presented a plaque recognising the Gasworks' engineering heritage.[48]

The Dunedin Gasworks Museum Trust has gradually worked to restore the structures and plant. Still managed by the Trust on behalf of the Dunedin City Council, the remaining structures now form a museum, opened in 2001, conserving and demonstrating knowledge about how gasworks' functioned and the important social and economic role they played.[49] Globally, the Gasworks is claimed to be one of only three preserved gasworks museums, and according to Sir Neil Cossons, former Chairperson of English Heritage and patron of the museum, it has "the best examples of an operating Gaswork's plant in the world".[50]

[46] 'Gasworks Museum,' Dunedin City Council, URL: http://www.dunedin.govt.nz/your-council/dunedin-history/architectural-history/gasworks-museum (accessed 1 July 2013); '374150 Dunedin Gasworks Museum Trust,' Companies Office Societies and Trust online, URL: http://www.societies.govt.nz/cms/banner_template/SOCAGENT (accessed 1 July 2013). The founding Trustees were: Elizabeth Hinds, Edward Sutherland, George Emerson, Michael Hitchings, Thomas Brooking, and Geoffrey Thornton.

[47] Category 1 historic places: Gasholder of 1879 (Register No. 4398), URL: http://www.historic.org.nz/TheRegister/RegisterSearch/RegisterResults.aspx?RID=4398; Dunedin Gasworks Exhauster and Boiler House (Register No. 4399), URL: http://www.historic.org.nz/TheRegister/RegisterSearch/RegisterResults.aspx?RID=4399; and Fitting Shop (Smithy or Purifier House) (Register No. 4401), URL: http://www.historic.org.nz/TheRegister/RegisterSearch/RegisterResults.aspx?RID=4401 (accessed 3 July 2013).

[48] 'Gasworks an engineering heritage,' *New Zealand Engineering*, 44:3 (April 1989), 50.

[49] 'Gasworks Museum'.

[50] 'About,' Dunedin Gasworks Museum, URL: http://www.gasworksmuseum.org.nz/ (accessed 1 July 2013). It is unclear what the criteria were for determining whether a place could be termed "preserved" gasworks. Internationally some examples of gasworks heritage can be found in Fakenham and Leicester in England, Biggar in Scotland, Carrickfergus in Ireland, as well as Warsaw in Poland and Athens in Greece. Lloyd Smith email message to author, 10 July 2013.

Social narrative

Before European settlement the south Dunedin area was swampy, but drainage schemes and reclamation created an area known as The Flat. Suburbs in the area, such as South Dunedin and Caversham, developed quickly from the early 1860s and the landscape made it particularly suitable for industrial installations, of which the Dunedin Gasworks was an early example. The industrial character of southern Dunedin was cemented in 1874 with the beginnings of the Hillside Railway Workshops. Because manual labourers and unskilled workers generally lived near their workplaces, South Dunedin was particularly synonymous with a working-class society from the late 19th century and well into the 20th (Figure 3).[51] For example, it was only in the late 20th century that the residences opposite the Gasworks' site on Braemar Street were redeveloped into commercial and light industrial buildings.[52]

Figure 3: South Dunedin, *circa* 1900 [the Gasworks is top left]. DCC Archive, DCC G Photograph Collection

[51] Barbara Brookes et. al. (ed.), *Sites of Gender: Women, men and modernity in Southern Dunedin, 1890-1939* (Auckland: Auckland University Press, 2003), 18-21. Hillside Railway Workshops began on a reasonably small scale as a repair installation, but was expanded significantly in the early 1880s and then again in the 1920s. See Matthew Wright, *New Zealand's Engineering Heritage, 1870-2000* (Auckland: Reed, 1999), 33.

[52] See the title page image. Braemar Street is along the bottom of this 1960s photograph, and when comparing this with the Google Earth and Streetview images (2013) only the double gabled cottage on the corner of Braemar and Lourne Street remains.

The lighting from manufactured coal gas was said to be “a great civiliser; and wherever it is in use, person and property are more secure”.[53] Even into the 1960s the gas industry was promoted as facilitating model, modern, home life: “selling hot water and comfortable living, selling dry clothes and better cooking”.[54] After Dunedin, it was Christchurch’s turn to be civilised in December 1864.[55] In 1861 *Daily Southern Cross* journalist noted that Nelson would be installing gas street lighting soon, and that Auckland should follow its lead. However, Auckland ended up beating Nelson when it achieved gas street lighting in 1865.[56] Then there was a flurry of gasworks construction in Wellington, Nelson, and larger towns during the 1870s and 1880s.[57] By 1916 56 gasworks had been constructed around New Zealand.[58] This reflects the fact that manufactured coal gas was socially and economically important to New Zealanders from the mid to late 19th century.

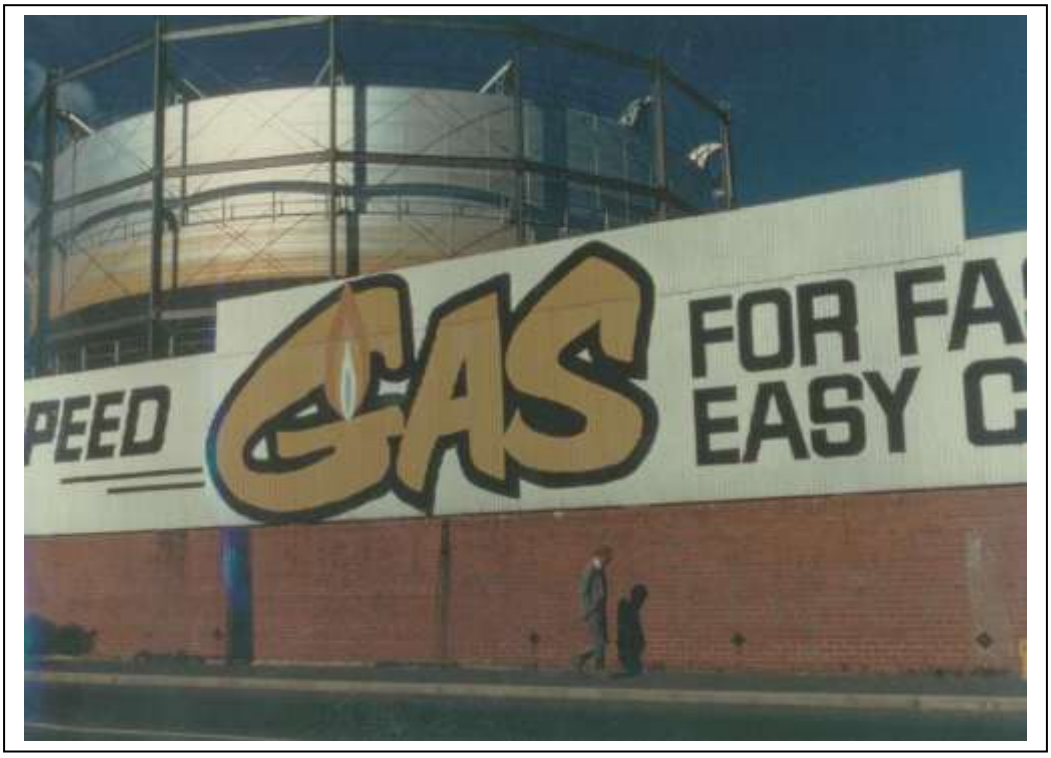

Figure 4: Gasholder and sign, circa 1970s. Dunedin City Council Archive, DCC G photo 18

[53] ‘Local Summary,’ *Daily Southern Cross*, 5 November 1861, 2.

[54] ‘The Inauguration of Woodall-Duckam Continuous Vertical Retort Plant for the City of Dunedin’.

[55] Pollard, 2.

[56] ‘Local Summary,’ *Daily Southern Cross*; ‘Auckland Gas Company Limited,’ *Daily Southern Cross*, 21 July 1866, 6 ‘Nelson City Gasworks,’ *Journal of the Nelson and Marlborough Historical Societies*, 1: 3, (November 1983), 16. URL: http://nzetc.victoria.ac.nz/tm/scholarly/tei-NHSJ04_03-t1-body1-d2.html (accessed 25 June 2013).

[57] Geoffrey Thornton, *New Zealand’s Industrial Heritage* (Wellington: Reed, 1982), 129, 131.

[58] Megan Cook, ‘Energy supply and use - Coal and coal gas,’ *Te Ara - the Encyclopedia of New Zealand*, URL: http://www.TeAra.govt.nz/en/energy-supply-and-use/page-7 (updated 13 July 2012).

While initially being predominantly used for lighting, by the 1880s attention was turning to domestic and commercial gas cooking and heating. New Zealand's first gas cooking stoves had been introduced almost as soon as gasworks began to be established, but were not immediately popular because of the relative expense in running them.[59] For example, gas stoves were available for purchase in Dunedin by 1865, but had second billing to kerosene counterparts.[60] However, by the 1880s the lower gas prices meant cooking with it was more feasible. To engender support for this diversification the City Council's Gas Supply Committee organised an exhibition of gas stoves in the Town Hall in October 1884, most of which had been manufactured locally. During the event "[u]pwards of a hundred ladies and a considerable number of gentlemen" tasted delights from the cookers, such as grilled chops, puddings and pastries.[61] Gas stoves were promoted as a way of "economising time and labour".[62] Of course, similar arguments were later given when promoting electric equivalents, with the added attraction that it was a cleaner alternative to manufactured coal gas.[63]

The Dunedin Gasworks was an important source of power for Dunedin's industries in the mid to late 19th century and into the 20th century.[64] By 1905 Otago was acknowledged as the leading manufacturing and industrial area in New Zealand, with an equivalently large workforce.[65] As the provincial capital, a lot of industry was based in Dunedin, and the Dunedin and Caversham Gasworks were essential to this success. This reliance on manufactured coal gas appears to have continued because in 1962 promotional material stated that "[m]any modern factories just cannot do without gas".[66] Industry and the economy also depended on by-products from manufacturing coal gas. For example, among other things the tar was used for sealing roads, and coke for smelting iron.[67]

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[59] David Burton, 'Cooking - Cooking technology,' *Te Ara - the Encyclopedia of New Zealand*. URL: http://www.TeAra.govt.nz/en/cooking/page-1 (updated 3 April 2013).

[60] 'Cooking stoves,' *Otago Daily Times*, 26 April 1865, 8.

[61] 'Gas Stoves,' *Otago Daily Times*, 27 October 1884, 4.

[62] 'Gas Cooking-Stoves,' *Otago Daily Times*, 30 October 1884, 4.

[63] Cook, 'Energy supply and use - Coal and coal gas'.

[64] Ibid.

[65] 'Industrial,' in *The Cyclopedia of New Zealand [Otago and Southland Provincial Districts]* (Christchurch: The Cyclopedia Company, 1905), 23. URL: http://nzetc.victoria.ac.nz/tm/scholarly/tei-Cyc04Cycl-t1-body1-d1-d1-d14.html (accessed 10 July 2013).

[66] 'The Inauguration of Woodall-Duckam Continuous Vertical Retort Plant for the City of Dunedin'.

[67] Lloyd Smith, email message to author, 10 July 2013.

Physical narrative

Former Christchurch Gasworks Chief Chemist, John Pollard, describes what happens to coal, a complex solid, under various conditions:

> When coal is heated in the absence of air, some of its constituents leave at low temperatures, some recombine chemically, yet others decompose in contact with the hot walls of the container…When the right coal is used it first melts, then froths up like hokey-pokey, and the volatile product escapes. The porous residue solidifies to coke. As the volatiles cool, some condense into a watery liquid mingled with tar. These leave behind a mixture of gases.[68]

After purification these gases were hydrogen, methane, ethylene, acetylene, and benzene.[69]

The process for manufacturing this combination gas involved coal being shovelled into a retort, heated and then left to carbonise for eight hours or more. There could be several retorts within a Retort House. The result was gas and coke. The coke would be cooled and carted away. When the accumulated gases in the retorts had gathered sufficiently pressure pushed it through a process which separated out the tar. Exhausters then pumped the remaining gas through a condensing process centred in the Boiler House (where more tar was removed) and then the gas was purified, before being captured in the gasholder where it was stored for use. In this way the gasholder tank would rise during the day and would typically lower during the increased evening demand. Another iconic feature of gasworks was their large chimneys associated with the Boiler House. The powerhouse of a gasworks was the engine house.[70]

At its height of production, the Dunedin Gasworks' land parcel occupied almost the entire South Dunedin block between Andersons Bay and Hillside Roads, and Braemar and McBride Streets. The entrance was formerly on Anderson Bay Road.

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[68] Pollard, 10.

[69] Ibid., 9-10

[70] Ibid., .26; 'History of Gasworks: Gas Production,' Dunedin Gasworks Museum, URL: http://www.gasworksmuseum.org.nz/index.php?option=com_content&view=article&id=61&Itemid=65 (accessed 2 July 2013); 'History of Gasworks: What the gasworks complex did,' Dunedin Gasworks Museum, URL: http://www.gasworksmuseum.org.nz/index.php?option=com_content&view=article&id=60&Itemid=64 (accessed 2 July 2013).

However, with the 1990 subdivision of the site it was necessary to transfer this to Braemar Street.[71]

Lot 6 of the subdivision included a cluster of the Gasworks' buildings and structures, including (from Braemar Street to back of site) the Gasholder and Fitting Shop, a grouping of detarrer and ammonia washer tanks, the "L" shaped Exhauster, Engine, and Boiler Houses building, cupping the Condenser Towers and boiler Chimney, and a large oil tank behind the building. At the Braemar Street south corner of the site is a small concrete and brick Dunedin City Council Electricity Department sub-station dating to 1954.

Museum visitors now enter the site through the remaining gasholder frame, whose tank has been removed. This is one of the oldest structures on the site. Despite having 1879 inscribed on the structure, its installation actually dates from the first Council upgrade of facilities in 1881.[72]

The brick Fitting Shop building is thought to date to *circa* 1900, have originally housed the purifiers, and may have been built in conjunction with the installation of a carburated water-gas plant. It is thought to have been converted from a Purifier House to a Fitting Shop in the 1920s. The building is 29 metres long and consists of a main central space with two flanking rooms that were an exhauster and meter room respectively.[73]

The Gasworks' largest remaining building is thought to be another late 19th and early 20th century brick structure. The earliest part of this multi-room building, the balance room, was potentially constructed before 1879, and subsequent extensions seem to have occurred periodically until 1907.[74] It has been suggested that the Gasworks' chimney possibly dates from around the 1880s.[75] However, it is likely that it was constructed at a similar time to the Boiler House, *circa* 1907.[76]

[71] Deposited Plan 21969, Otago Land District (1990). See title page image. Lot 6, which encompasses the remaining structures and buildings, is slightly less than the bottom right quadrant of the gasworks site as depicted in this photograph.

[72] Gasholder of 1879, Category 1 historic place (Register No. 4398).

[73] Fitting Shop (Smithy or Purifier House), Category 1 historic place (Register No. 4401); Lloyd Smith, email message to author, 6 August 2013.

[74] Dunedin Gasworks Exhauster and Boiler House, Category 1 historic place (Register No. 4399).

[75] Petchey, 5.

[76] Dunedin Gasworks Exhauster and Boiler House, Category 1 historic place (Register No. 4399).

This building contains the Engine House Museum with its range of steam engines, most of which are still in working order. The oldest of these is an 1860s beam engine, but there are also examples of rotative beam and horizontal engines. These date from the late 19th to the mid-20th century. For example, the horizontal Bryan Donkin Booster engine was installed in 1926 (Figure 5), and the Reader Exhauster, a high pressure vertical single cylinder engine, was purchased second-hand in 1965.[77]

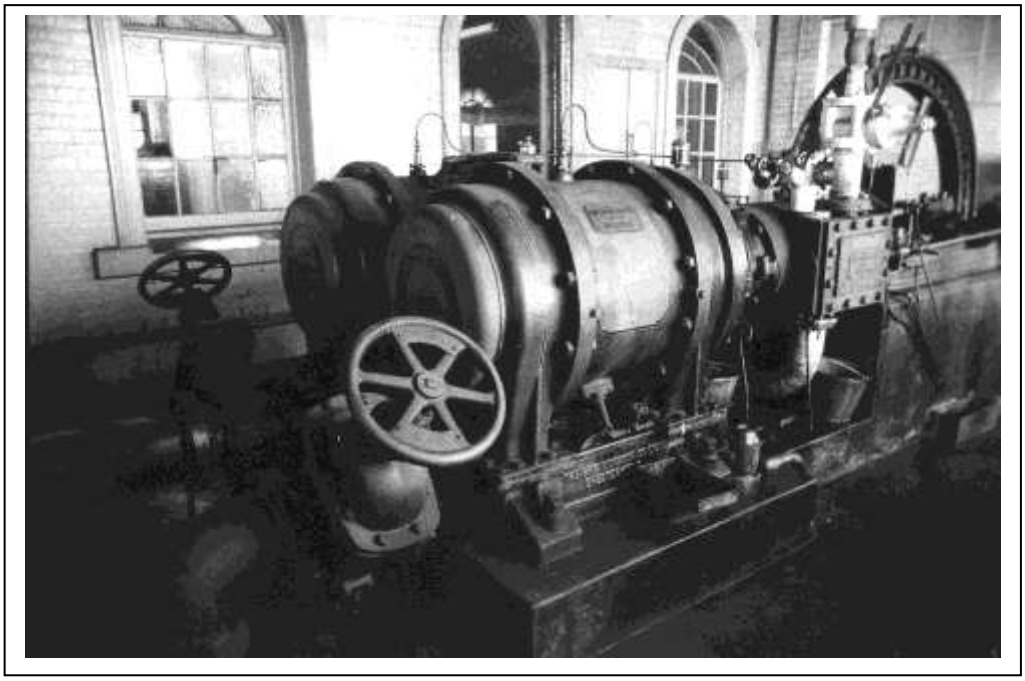

Figure 5: Donkin Booster engine, *circa* 1987. Photographer: David Mann. DCC Archive, DCC G Photograph Collection

Key physical dates

1862-63	Dunedin Gas Light and Coke Company Gasworks constructed
1860s	Beam engine installed
1881	Gasholder installed
circa 1900	Purifier House constructed
1903	Purifier House repaired after an explosion
circa 1907	Construction of Engine House
circa 1920s	Purifier House converted to a Fitting Shop
1926	Bryan Donkin Booster engine installed
1954	Electricity substation built

[77] 'Engines,' Dunedin Gasworks Museum, URL: http://www.gasworksmuseum.org.nz/index.php?option=com_content&view=article&id=63&Itemid=67 (accessed 10 July 2013).

1965	Reader Exhauster installed
1990	Site subdivided
1987	Manufacture of coal gas stops
1989	Vertical Retort House demolished
2001	Gasworks closes. Conservation works and display installation for Dunedin Gasworks Museum opening

C. Assessment of significance

The Dunedin Gasworks has special historical, social, and economic significance for the city and New Zealand. The former Dunedin Gasworks buildings, structures, and plant, now constituting the Dunedin Gasworks Museum, are also a globally rare time capsule of this essential 19th century industrial process. This place had initial associations with the prolific Southern Hemisphere gasworks engineer, promoter, and investor, Stephen Stamp Hutchison, and is significant as the first New Zealand place to produce manufactured coal gas in 1863. Dunedin Gasworks later became New Zealand's second municipally owned gasworks, and ended up being the country's last operating gasworks. The demise of gasworks around the world by the late 20th century reflects changing technologies and social and economic circumstances. The establishment of the Dunedin Gasworks Museum Trust, and subsequently the creation of the Dunedin Gasworks Museum, demonstrate community esteem for, and the outstanding engineering heritage importance of, the Dunedin Gasworks.

Therefore, Dunedin Gasworks is of sufficient engineering heritage significance to merit inclusion on the IPENZ Engineering Heritage Register.

D. Supporting information

List of supporting information

'Dunedin's Engineering Heritage Trail: Walk 2 – the Exchange Route,' IPENZ Engineering Heritage Otago Chapter, URL: http://www.ipenz.org.nz/heritage/itemdetail.cfm?itemid=2465 (accessed 25 June 2013).

New Zealand Historic Places Trust Register information:

Dunedin Gasworks Exhauster and Boiler House, Category 1 historic place (Register No.4399), URL: http://www.historic.org.nz/TheRegister/RegisterSearch/RegisterResults.aspx?RID=4399 (accessed 3 July 2013).

Gasholder of 1879, Category 1 historic place (Register No.4398), URL: http://www.historic.org.nz/TheRegister/RegisterSearch/RegisterResults.aspx?RID=4398 (accessed 3 July 2013).

Fitting Shop (Smithy or Purifier House), Category 1 historic place (Register No.4401), URL: http://www.historic.org.nz/TheRegister/RegisterSearch/RegisterResults.aspx?RID=4401 (accessed 3 July 2013).

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'History of Gasworks: Gas Production' (accessed 2 July 2013).
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Otago Daily Times, 29 October 1862, 26 April 1865, 22 December 1870, 28 August 1880, 8 September 1882, 26 October 1882, 27 October 1884, 30 October 1884, 15 June 1899.
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