PATHWAYS FOR POWER

The Story of ElectraNet SA

Pathways for Power

ROB LINN

Rob Linn

~ *Preface* ~

The developments and achievements of South Australia's constantly changing electricity industry are often not obvious to the wider community. Yet the gradual spread of poles, wires and towers – from Adelaide's central business district to the remotest borders of this State – are part of a fascinating and often tumultuous history, which spans just over 100 years.

Indeed, this very obvious infrastructure is a constant reminder of the electricity industry's remarkable evolution, which has significantly supported the growth of this State's economy – particularly in rural South Australia.

My own career with ETSA and its subsequent "daughter" organisations spans some thirty years across the areas of generation, distribution and transmission. It has been a privilege to have been a part of some of the exciting and sometimes dramatic events that have unfolded during the continual development of South Australia's electricity industry.

The many employees of the Adelaide Electric Supply Company (AESCo) and its descendant organisations (the Electricity Trust, ETSA – and now ElectraNet SA – for the transmission activity) have cultivated a strong internal community environment, which has endured the challenges of rapid expansion and major restructuring. To have experienced the atmosphere of true camaraderie, highlighted time and time again within the pages of ElectraNet SA's founding history, is a heart-warming reflection. This atmosphere of goodwill and motivation is still powerfully evident within ElectraNet SA's highly skilled and dedicated personnel.

So as history repeats itself yet again in its eternal cycle, ElectraNet SA is now poised on the edge of a new and challenging era. The business is fully prepared and technologically advanced to successfully meet any challenges brought its way, as it moves from Government ownership into the private sector.

When an organisation aims to achieve a benchmark in leading edge

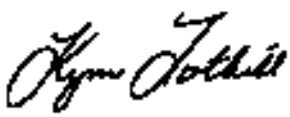
Kym Tothill
ElectraNet SA

technology and performance, however, it is easy to lose sight of important business origins and traditionally embraced ideals and values.

Pathways for Power – the Story of ElectraNet SA – is meant as a small legacy to South Australia: to those who built, maintained and operated the transmission system in South Australia; to those involved in the evolution of the National Electricity Market; and to our new owner. It provides a brief history which concentrates on the evolution of the high voltage transmission system and the associated power system Control Centre within South Australia.

My special thanks go to those past and current employees, quoted throughout the text, and the many others who have offered their memories and assistance. The time spared in their busy schedules, to assist in the assembly of this brief historical account, has certainly been appreciated. In addition, my sincere appreciation to Rachael Tomlins who has successfully and enthusiastically offered her time to co-ordinate the involvement of all these contributors.

I trust you will enjoy the tales woven within – a story that, even now, continues to unfold.



Kym Tothill
Chief Executive

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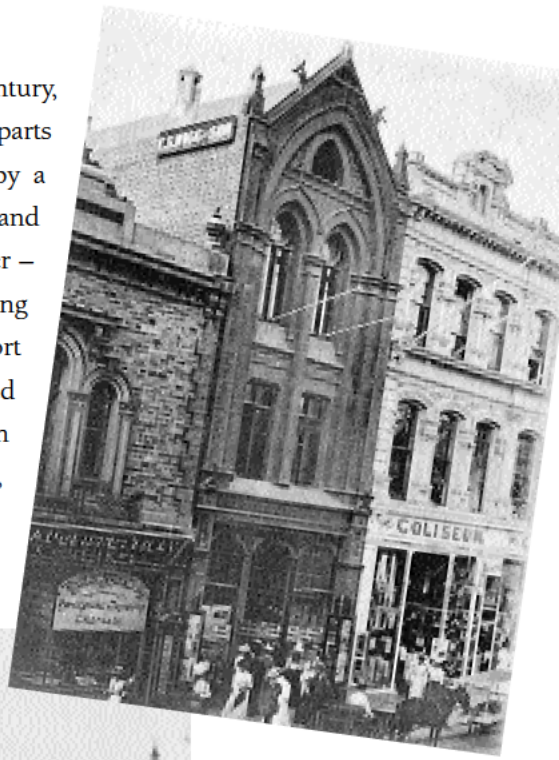
ElectraNet SA's 275kV steel latticework transmission tower in the foreground of Northern Power Station
ElectraNet SA

~ *At the Beginning* ~
1897–1946

First Steps

Throughout the last decades of the nineteenth century, many South Australians – along with their counterparts throughout the western world – were gripped by a fascination with electricity. A subject of conjecture and debate, that vital spark – electrical light and power – was considered, by many, as the way of an exciting future, and its use received its fair share of support from enthusiasts, as well as opposition from vested interests.[1] First promoted by private enterprise in South Australia, with assistance from the Colonial, then later the State, Government, the establishment of a viable electrical generation and



Adelaide, South Australia, in the late nineteenth century – a bustling city whose inhabitants were fascinated by the experimentation with electricity. At the stage that these photographs of Victoria Square and Rundle Street were taken, telegraphic cables are evident, but street lighting was still fuelled by gas
Historical Consultants Collection

distribution company took many years to achieve. However, long before electrical supply became a reality in South Australia, a vast amount of scientific research in Europe and North America had gone into its development.

The discovery and utilisation of electrical energy had proceeded in earnest during the entire nineteenth century. As one learned contemporary noted, 'the fundamental laws of attraction and repulsion between electrified bodies' had been the substance of significant research and initiative among some of the best scientists of the time.[2] Discoveries flowed from these investigations and the basic means of generating electricity was established. The work of Volta, Cavendish, Joule, Faraday, Kelvin, Maxwell and a host of other scientists provided a cumulative rush to achieve a practical use of this new electrical energy. As early as 1810, Sir Humphry Davy, for example, applied electrical current to produce light for the first time. When generators were developed that could produce electrical current for use on a practical scale, there was a rush towards the creation of companies or utilities for the generation and transmission of this newly unleashed energy. By the late 1870s–early 1880s, the invention of simple and effective arc and incandescent lamps made electricity a major competitor to gas for the lighting of the major cities of the western world.[3] Certainly at that time, English politicians and North American entrepreneurs were already planning the installation of major public electricity supply systems in their nations. In February 1882, Brighton (England) saw the introduction of the first permanent public electricity supply. This move was followed shortly after, by the installation of a central power generating station in New York.[4] Australians, and particularly South Australians, were following close behind their northern hemisphere counterparts in rapidly adopting this exciting new technology.

The system of transmitting energy from the generators to the customer was based on the methods established for carrying telegraphy (telephone) signals that were already developed in the 1830s and 1840s. Both overhead and underground electricity supply lines made either of zinc-coated iron wire, or of copper wire coated with rubber, were

developed specifically for this purpose. Underground wires were additionally sleeved within cast-iron piping, to provide protection for the cables.[5] By such methods, it was envisaged that it might be possible to light the streets of all of Adelaide and its suburbs, and then even to transmit electrical power to thousands of private homes. For those who believed in the essential usefulness of electricity, and its apparent superiority to other forms of energy, it was the only way forward.

However, in South Australia at the end of the nineteenth century, mainly due to the uncertainty about what such a new enterprise would bring in its wake, there were suddenly many legal and social hurdles to overcome. Not the least of these obstacles was a lively debate about the ownership and control of the mode of transmission of electricity. As one member of Parliament of that time indicated, the cables and wires that transmitted the power were, to him, the primary issue. 'Control of the wires', said this politician, 'was a matter of the greatest concern'.[6]

Finally, in December 1897, the debates and the arguments over the right to form a privately owned electricity supply company were finally resolved and the South Australian Parliament passed a Bill to achieve that end – although at that stage, the company could only generate and transmit power in the Port Adelaide area.[7]

So it was that in early 1898, the South Australian Electric Light and Motive Power Company built a small temporary powerhouse in a stable, adjacent to the store of William Marston, at the corner of St Vincent and Lipson Streets in Port Adelaide.[8] These operations were managed by Henry Phipps Onslow, later to become the Mains Superintendent for the future Adelaide Electric Supply Company Ltd (AESCo). Onslow, too, was the uncle of Sir Thomas Playford – South Australian Premier from 1938 to 1965 – the man who was later to single-handedly revolutionise South Australia's electricity supply.

Within this temporary powerhouse were three Galloway boilers, two 25KW and two 50KW Alley and McLellan high speed/single action/non-condensing steam engines, which were joined with Johnson and Phillips Direct Current (DC) generators to produce electricity.[9] For

Top Left: The Nile Street powerhouse, Port Adelaide – the first step in pioneering commercial investment in South Australia's electricity supply
ElectraNet SA

Top Right: F.W.H. Wheadon, an engineer with much experience in Great Britain, who became the driving force for South Australia's electricity business in the early twentieth century
ElectraNet SA

some months, the reliability of that supply was hampered by the inefficiency of the generating equipment and the poor quality of the underground cables transmitting the power. Henry Onslow noted that the contract work for the cabling had been 'pretty badly bungled' and wrote of the single, lead-sheathed, steel-armoured cable that was laid straight into swampy silt and, as a consequence, leaked in every joint.[10] Nonetheless it was an important beginning.[11]

Even at this point, South Australia's electricity supply business had brought together a formidable team of young, dedicated enthusiasts. These included J. Leask, A.L. Pank, E. Joyner, R. Edwards, W. Russell, J. Turner, B. Coleman and S. Newberry, all of whom were to continue to work for the future AESCo. While their enthusiasm drove the fledgling enterprise, it was the arrival, in July 1899, of F.W.H. ('Freddie') Wheadon – a young British engineer – as the operation's Chief Engineer, that dramatically pushed the electricity business forward in South Australia.

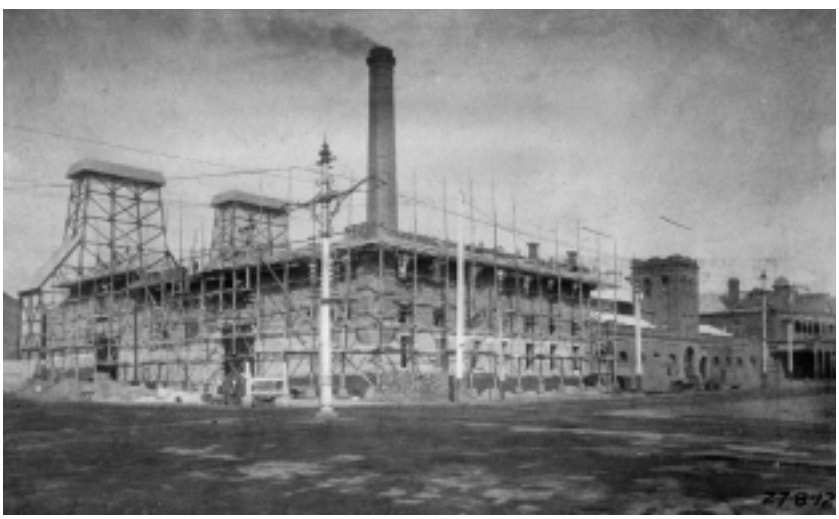
Electricity comes to the City of Adelaide

Wheadon's expertise and influence had almost instant effect. The Port Adelaide operation of the South Australian Electric Light and Motive Power Company took on a different, positive aspect. More importantly,

Wheadon's connections with British investors in electrical companies resulted in the purchase of the fledgling South Australian electricity business by the English Brush Electrical Engineering Company Ltd, during September 1899. Within a very short time, another firm, the Electric Light and Traction Company of Australia Ltd, whose investors had close association with the Brush Company and with Wheadon, saw the potential and purchased the Adelaide company as part of a move into the privately developing Australian electricity supply industry.[12]

Rather fortuitously, even before these sales, the Adelaide-based electricity company had already secured an agreement with the City of Adelaide to supply electricity for the purpose of providing street lighting in King William Street. Moreover, the agreement also allowed for the connection of private customers – something for which the company and Adelaide storekeepers soon eagerly enlisted. From that point, customer connection demand mushroomed. In time, this success began to lead to pressure for the construction of the necessary corridors for transmitting electricity at higher voltages to reach the outlying areas of Adelaide.

To supply these expectant demands for electricity, there was, of course, a need to provide a new generating plant within the City itself. It was decided that a new powerhouse was to be built at the intersection of



THE GRENFELL STREET POWERHOUSE UNDER CONSTRUCTION, 1901. THIS BUILDING BECAME A SIGNIFICANT LANDMARK
ELECTRANET SA

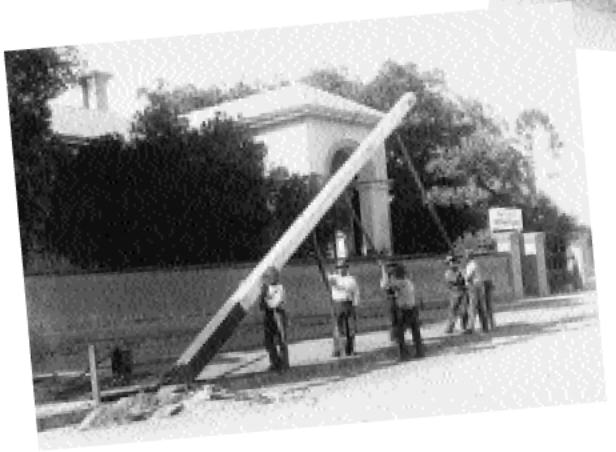
Laying electrical transmission lines underground in Adelaide, 1901–1902, stretching from Grenfell Street powerhouse, to Wakefield Street, to Victoria Square – passersby and traders take in the scene of labourers striving with picks and shovels. The Wakefield Street scene also shows boilers containing hot bitumen – the pitch was used for sealing joints in the cables and cable housing
ETSA Museum

Grenfell Street and East Terrace. While this new plant was under construction, a temporary generating plant was erected nearby in a galvanised iron shed at the corner of Tam O'Shanter Place and Devonshire Place, to meet the company's contracts for electricity with the City of Adelaide. The building of the Grenfell Street powerhouse progressed rapidly and it was subsequently opened on 19 November 1901. Indeed, the operation of the temporary plant in Devonshire Place only lasted for a few days beyond that date.

The new Grenfell Street powerhouse became a significant Adelaide landmark – driven by coal fired boilers and steam generators – and was soon distributing power from a DC generating plant with a capacity of 400KW through a network of newly installed underground and overhead cables. From that time, the streets of Adelaide – like those of most cities of the western world – were soon lined with timber posts topped with a maze of cables supporting the new technologies – telegraphy and electricity. However, even though the Grenfell Street powerhouse was a more efficient system than the Port Adelaide facility, there were still many teething problems in those early days, in the attempt to provide a reliable supply of electricity to many enthusiastic customers.[13]

Yet such disturbances did not hinder the spread of electricity delivery to Adelaide's suburbs and outlying townships, nor subsequently to the evolution of an electric tramway system in the Adelaide metropolitan area. The original supply of DC electricity began to be replaced by Alternating Current (AC), because of the ability to use transformers to simply raise the voltage to the levels which were needed for the transmission of electricity over longer distances. In 1902, North Adelaide became the first suburban supply – connected once again through underground electricity supply lines. Then, in 1905, a new company – the Adelaide Electric Supply Company Ltd (AESCo) – was incorporated, and almost immediately took up the challenge of meeting the demands of suburban customers.

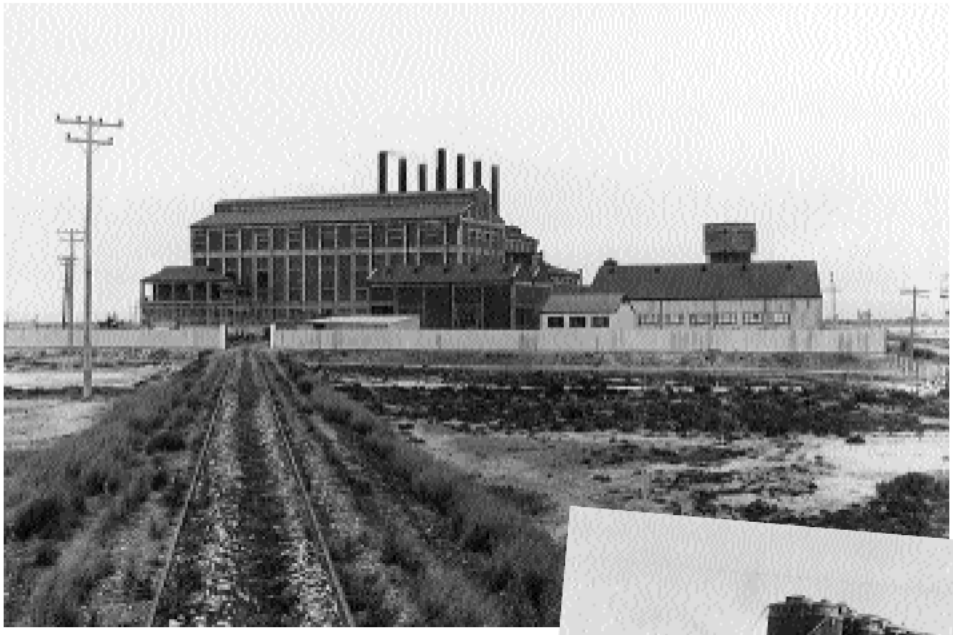
By the mid-1910s, electricity supply was being transmitted by 2,200 volt cables to more Adelaide suburbs – Norwood, Unley, Hindmarsh and Thebarton. Customer demand grew so dramatically that established lines, like that between Grenfell Street and Port Adelaide, had to be reinforced and increased in voltage, and in most areas the voltage of transmission was actually doubled to take extra customer demand.[14] By 1917, the demand on the Grenfell Street powerhouse had seen its generating capacity raised to 12,000KW.[15] At this time, the main building at this site also housed the AESCo's administrative offices – design, communications systems, switchboard, meter accounts and others.



Electrical transmission lines spread from the City of Adelaide to the nearby suburbs and villages. The first photograph shows the pole yard at which hardwood poles were stored for distribution by horse-drawn vehicle or, in this case, by motorised truck. Poles were manually unloaded and raised, which was labour intensive, tough and surprisingly successful
ETSA Museum

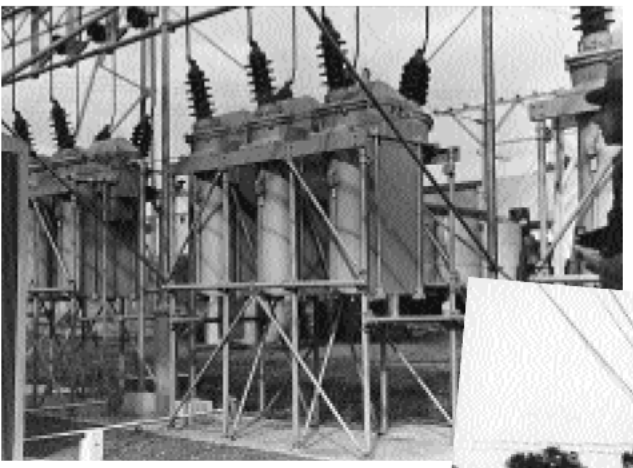
Osborne comes on-line

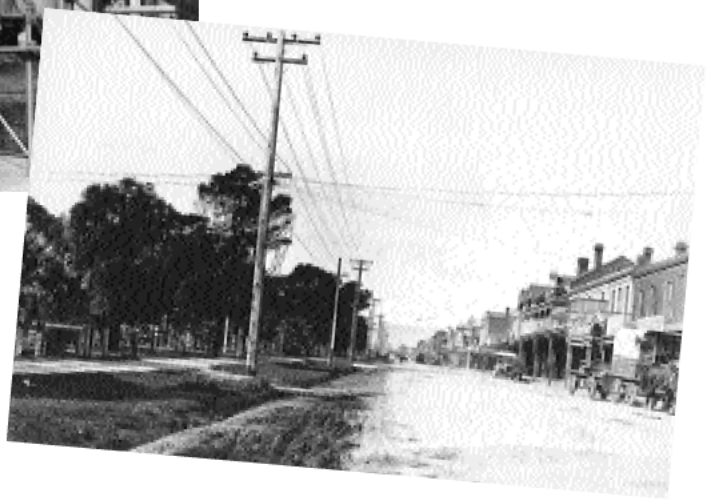
It became apparent to Wheadon, and other executives at AESCo, that customer demand would soon exceed the capacity of the Grenfell Street powerhouse. This decision, together with some environmental problems attached to that site (insufficient turbine condensing water supply, and problems with coal storage and ash handling and disposal, to name a few) necessitated the consideration of the construction of another facility in a more suitable, less populated location.[16] A site at Osborne on the Port River was chosen and planning commenced, just as the world witnessed the outbreak of hostilities in Europe in August 1914. With wartime demands and other headaches to deal with, AESCo put aside these construction plans for more certain times. Later, with the onset of peace in 1918, however, the plans were dusted off, and the London and local Boards immediately approved the proposal for the reclamation of the swamp site and the subsequent construction of the new powerhouse at Osborne.



Commissioned in August 1923, the coal fired Osborne "A" Power Station came on line with its 10MW turbo alternator generating directly into the newly constructed 33kV transmission system. In a real sense, Osborne provided the true beginning for South Australia's electrical transmission system. From there, two double circuit transmission lines hooked into substations at Birkenhead and Portland (later Port Adelaide) and then on to Adelaide, by way of lines passing through the suburb of Croydon. Another double circuit 33kV ring feed was taken off at Croydon and linked to substations at Richmond, Harrow, Unley and Norwood. These were all overhead transmission lines and, as Wheadon noted, 'this ring system of supply has proved a satisfactory method of ensuring continuity of supply at our main distribution centres in the metropolitan area'.[17] The electricity cables were suspended from wooden poles, including a number of cumbersome two-pole structures, that supported both the cables and main distribution transformers.

A view of Osborne "A" power station, 1924, from the west and, during the construction of the power station, on 21 May 1923, the hauling of massive transformers on a crocodile truck by horsepower
ElectraNet SA, ETSA Museum



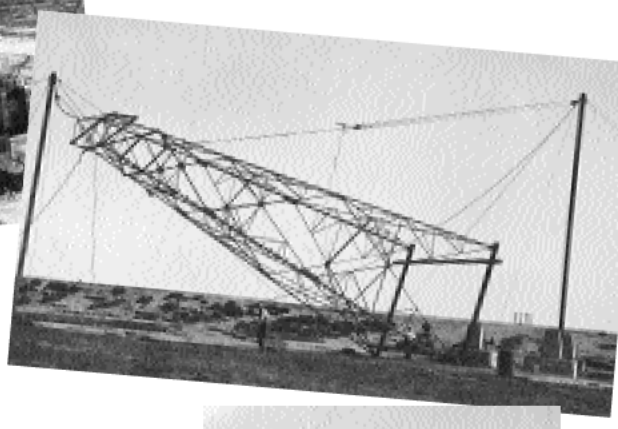


Top Left: Croydon substation, showing 33kV oil transformers
ETSA Museum

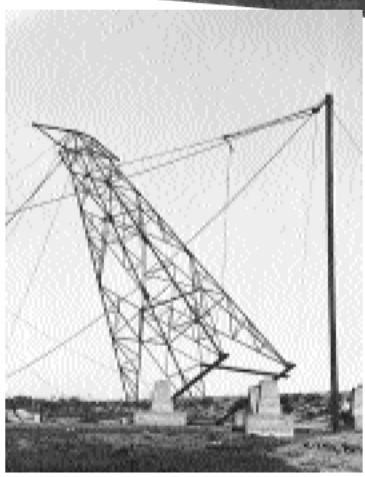
Top Right: 33kV lines at Port Road, Hindmarsh – typical of the network spreading to Adelaide from Osborne
ETSA Museum

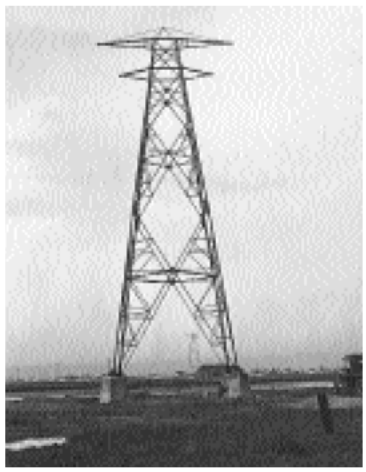
Not surprisingly, improvements to the power system, to keep up with customer demand, did not take long to arrive. In 1928 the third transmission line from the Osborne Power Station to the ring main supplying the metropolitan area to the Richmond substation was erected, and viewed as a major achievement of the time. One of the main reasons for this enthusiasm was the use of the newly designed steel and concrete 'Stobie' poles of various sizes, ranging in height from 15 metres to 25 metres, and in weight from 1.8 tonnes to 8.2 tonnes.[18] One of the line construction supervisors described something of the more difficult moments in constructing this particular line:

> Our experiences during the Port River crossing would make a novel in themselves. All material and gear required for the western side had to be floated across the river on a punt which was towed by a motor launch … On the eastern side things were not pleasant, as the site of the pole footing was below high water mark, and there was a very generous coating of mud over everything. Work to lay a 1.5 metre pipe



THE CROSSING OF THE PORT RIVER BY TRANSMISSION LINES WAS A DIFFICULT TASK. IN AUGUST 1924, TOWERS SUCH AS THIS ONE WERE ERECTED. THE SPAN BETWEEN TOWERS WAS ABOUT 300 METRES
ETSA MUSEUM





was completed between high tides. A hard crust of rock about 2.5 metres below the surface delayed operations, but nevertheless, everything on this line was ready for switching on 21 May 1928.

About 75 per cent of the 286 poles comprising the line were concreted directly into the ground, requiring about 480 tonnes of concrete. On reflection, I get a headache trying to work out how many metres of reinforcing rod were used. The insulators were of the 66,000 volt type from Osborne to Tapley's Hill Road, and 45,000 volt type from there to Richmond.[19]

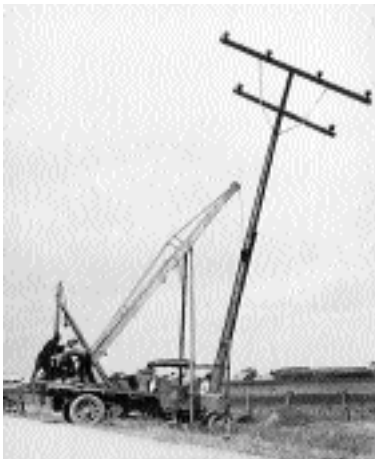
Stobie Poles and Rural Extensions

The new 'Stobie' poles used on this particular Osborne line actually revolutionised transmission line construction in South Australia – a State devoid of large tracts of native timber suitable for creating wooden power poles. The brainchild of James Cyril 'Cy' Stobie, it was described by him as

The number 4 line from Osborne, shown here from the railway bridge at Ethelton, used the newly designed Stobie pole in its construction. The Stobie pole was of enormous significance to the pace at which AESCo's system spread
ETSA Museum

> … an improved pole design adopted to be used for very many purposes, but particularly for carrying electric cables, telegraph wires … [it] consists of two flanged beams of iron or steel, preferably rolled steel joist of **I** or of channel sections, placed one beside the other with their flanges inward and preferably at a very slight angle one with the other and held together by means of tie bolts, the space between them being filled with cement concrete.[20]

Cheap and simple to manufacture and with a long life expectancy, these steel 'Stobie' poles were instrumental in the rapid expansion of AESCo's transmission lines. The new poles, coupled with the significant generation capacity of the Osborne Power Station, rapidly brought electricity supply to the outer metropolitan and near rural regions of South Australia.



Erecting poles on the Gawler to Templers transmission line
ETSA Museum

'Stobie' poles were also used on the main northern extension line that ran at single-phase 4,000 volts from Harrow substation to Gawler. Spaced approximately 185 metres apart, the poles carried steel reinforced aluminium cable on pin insulators. With plans to eventually run a 33kV supply to that area and beyond, to even further northern extensions, the system was changed to three phase and 7,000 volts after only twelve months operation, and was able to cater for increased customer demand for electricity. By that time, the town of Salisbury had been connected and an extension was rapidly planned to serve Nuriootpa, Angaston and Freeling. From September 1924, contractors erected a new line into the Barossa Valley and then on to Balaklava. The transmission line was then upgraded to 33kV direct from the Portland (later Port Adelaide) substation and was operational before

the end of July 1925. A testimony to the skill and dedication of those involved, the construction of the line caused much comment, humour and goodwill within the communities of the rural areas which it reached. A line construction manager remembered that:

> A hotel proprietor at one of the towns to be supplied had on several occasions made witty remarks about the slow progress of the job, and on this particular day during lunch,

MAP SHOWING AESCO'S TRANSMISSION SYSTEM IN 1926
ADELECT MAGAZINE

had made his little speech as usual. We advised him that he would have electric light in the hotel at 4.00pm, but he was prepared to bet he would not. A bet of drinks for all the employees on the job was made, that the hotel would be supplied by the time indicated, and the hotel proprietor accepted. He did not know that about that time, 30 thirsty linesmen would gradually drift into the hotel, some from Gawler, some from Greenock, and others from finishing up various duties on the final line construction. The electricity supply *was* turned on at 4.00pm, much to the dismay of the hotel proprietor, but he kept his word and paid up for the drinks for all the men.[21]

This first major extension into rural regions had begun in 1922 and was actually authorised by the passing of an Act of Parliament that allowed movement of electricity supply into country districts, and the spread of electricity then continued rapidly into these areas. By 1936, an enormous area of supply coverage had been achieved and F.W.H. Wheadon described with pride the move beyond the original Gawler electricity extension:

33kV lines in the mid-north town of Blyth, erected on Stobie poles
ETSA Museum

Eventually all the principal townships out to Jamestown, a route distance of 260 kilometres, were connected to the main power system. Later, extensions were carried out to Willunga in the South, 48 kilometres, and to Mount Pleasant, Kapunda, and Nairne. At the moment, our rural transmission system comprises 370 kilometres of 33kV lines, and 235 kilometres of 7.6kV lines, and embraces supply to practically all of the settled districts in what is known as the lower-north area of South Australia, with the exception of the Clare and Onkaparinga districts which are supplied by local private electricity generating and distribution companies. The country through which our rural power lines pass is very sparsely populated wheat land, and it is only by the most economical design of transmission lines and supporting structures that such an area could be justifiably served.[22]

Electric truck outside AESCo's building East Terrace, Adelaide. It was driven by 'Jack' Margitich between the late 1920s and early 1930s. 'Jack' worked for ETSA from 1918 to 1959. This electric truck had a speed of 20 mph, 3 tons capacity, a range of 40 to 50 miles and was used for deliveries around the City, to Port Adelaide and as far north as Salisbury. 'Jack's' grandson, Brian Margitich, works as a System Control Officer at ElectraNet SA in the System Control Centre
ElectraNet SA

In both the city and country, high voltage electricity cables were being rolled out and step-down distribution transformer stations built, with even more infrastructure being planned as demand grew rapidly from the South Australian domestic and industrial consumers.[23]

Maintenance and Control

The expansion of the electricity transmission system and the need to improve the reliability of the electricity network brought about the implementation of a year-round maintenance programme to avoid unnecessary breakdowns of the transmission system. In all of the drier Australian States, dust, coal ash and other material deposits on insulators frequently caused flash-overs and shutdowns of many electricity lines. In Victoria, for example, a major bushfire in the 1920s had placed an extensive layer of fine ash and soot on their transmission line insulators, triggering ongoing problems in maintaining a reliable electricity supply to

Maintenance was an essential part of AESCo's work. Staff are shown 'tapping up' Number 4 line at Ovingham
ETSA Museum

rural communities. Anxious to do away with as many of these problems as possible, the South Australian electricity authorities set about the periodic cleaning of all transmission line insulators, regular replacement of faulty insulators and tightening of all bolts and screws on the supporting poles. Naturally, maintenance was required more frequently on those transmission lines that ran adjacent to railway lines (due to coal fired trains) or near industrial sites such as cement works.

Clean-up line crews were deployed on a regular basis to all areas and employees became expert in a variety of situations, including the actual cleaning of live lines. It was no small task. The Gawler line alone required considerable resources to maintain, as this 1927 work summary account shows:

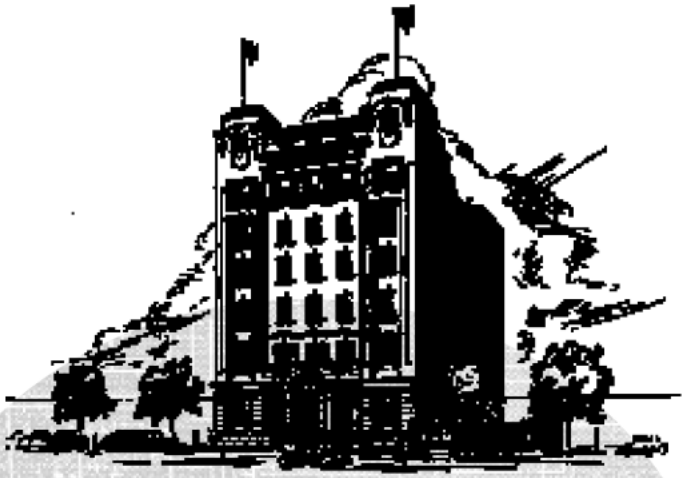
> Length of line overhauled, 40 kilometres; working time, 9 hours; number of men working, 100; insulators cleaned, 3,037; insulators changed, 70; pairs of straps bridged, 227; motor vehicles in attendance, 14.
>
> In addition, the men had to keep a sharp look out for cracks in insulators, burns on wooden crossarms, and defective poles, and report any unusual condition which came to their notice and which might subsequently lead to trouble on the mains.[24]

While the electricity cables, poles and insulators had to be carefully monitored to ensure a reliable supply of electricity, the control of the flow of electricity in the network was, itself, also of critical importance. In the first years of electricity generation and transmission in South Australia, such control was a rather haphazard affair. Gradually, by means of more efficient insulators and the use of copper as the main conductor in

transmission lines and cables, the power system became more reliable and manageable.

As F.W.H. Wheadon made clear, the control of the electrical power system and overhead lines and cables, in order to avoid overloading, was an important factor in improving customer service. He therefore encouraged both engineering and economic research into the subject of electricity load flow control and convinced his Board and staff of the necessity of achieving a properly managed power system, to achieve a high supply reliability and avoid overloading of lines and equipment. This vision was the precursor to the organisation's pioneering developments in supervisory control equipment, a leading edge position that has been maintained into 2000.

From 1926, when the Kelvin Building was completed for AESCo in North Terrace, Adelaide, a Mains Control Centre was established there. With subsequent developments, it was at the Kelvin Building that a Mains Control Officer oversaw, from 1940, an illuminated power system status diagram board, that was placed on top of a large, polished blackwood desk. The first of these specifically designated officers, Les Gill, had been appointed in 1936 – although others had been doing the job previously as part of their daily duties. At a glance, this officer was able to gain an understanding of the status of the entire South Australian electrical power system. That electrical system began at the Osborne Power Station and ran through the entire network of high voltage transmission lines with their associated substations.



Mains Control Officers, situated in the Kelvin Building, North Terrace, Adelaide, ensured the reliable supply of electricity
Jubilee Souvenir of public electricity supply in South Australia, 1949

Any part of that network could be disconnected at the direction of the Mains Control Officer by use of local circuit breakers or switches. Additionally, if a line became faulty, through a lightning strike or any other problem, a local circuit breaker would open automatically and isolate that

section of the network. The Mains Control Officer was then required to assess the alternatives for ensuring a rapid restoration of any disconnected customers. Again, if a section of any line in the network needed maintenance, the Mains Control Officer could arrange to disconnect it from the rest of the power system. This officer would then pass on, by telephone, accurate details of all parts of the power system which had been de-energised, to those preparing to work on it.[25] By this means, Mains Control and those involved with maintenance worked hand-in-hand to ensure a safe working environment, in addition to a reliable supply of electricity.

As F.W.H. Wheadon commented, all possible technical and safety arrangements were put in place 'to provide maximum reliability of supply for all consumers'.[26] Even if a fault occurred out of hours, a Mains Control Officer would be called to immediately attend to the matter and advise on the best and safest course of remedial action for resolving the problem.

AESCo, as part of the war effort, extended transmission lines to places like BHP's Rapid Bay quarries. Shown here is the line before it descends to the quarry and substation
ETSA Museum

Through the Second World War

By the time the Second World War broke out in September 1939, transmission lines extended far into the farmlands of South Australia. Also, in delivering electricity to industrial sites at places like BHP's quarries at Rapid Bay on the Fleurieu Peninsula, the South Australian power system began to use the best equipment that AESCo could purchase to ensure customer supply reliability.[27] The transmission and distribution lines had now spread throughout all of metropolitan Adelaide as well. By 1937, the Unley to Seacombe line had been constructed. Then, the year after, new substations were built at Port Adelaide, Woodville, Seacombe and Hindley Street, and the Brighton and Glenelg areas were connected to the 33kV power system. At Dry Creek, another substation was erected and

AESCo's Executive officers, 1946. Many of these were the pioneers of electrical supply in South Australia
Fifty Years of Progress

connected into a line running from Harrow through to the metropolitan abattoirs.

In 1940, as the serious demands of the Second World War began to impact on the community, new substations, lines and transformer stations were constructed to feed electricity to local munitions factories and important war-effort supply stores. The Port Adelaide to Penfield 33kV lines were excellent examples of the work of that time. In August 1943, a 66kV line to Morgan was completed to power the new Morgan–Whyalla water supply pipeline project. Numerous other transmission lines were urgently upgraded as part of this war effort.[28]

As the war drew to a close, the Adelaide Electric Supply Company faced pressure from the South Australian Government to pursue an even more rapid expansion than ever before. This Government also expressed its concern about the reliability of electricity supply as it was affected by difficulties in obtaining sources of good quality coal for the Osborne generating plant, due to on-going industrial disputes in New South Wales.

In response, the AESCo's Board and management continued to reflect proudly on the past record of the company. Indeed, from 1922, when AESCo had gained the authority to extend electricity supply to rural areas, the company had spent a total of £850,000 on the rural transmission system.[29] AESCo executives at that time looked at their results with some pride and believed that, in terms of assisting food and industrial production, they had made a significant contribution to this State. More than this, and despite the forces enveloping the company, the management actually had predicted that there would be a rapidly increasing demand for electricity after the war. The post-war outlook, they noted, would 'almost certainly involve further extensions to our generation, transmission, and distribution system in the near future'.[30]

The stage was obviously set after the end of the Second World War, for a major explosion of South Australia's electricity industry, in an environment of apparent concern by a progressive South Australian Government – that was not convinced that the AESCo had the capability or the financial backing to ensure the achievement of the needed rapid growth of a reliable supply of electricity for all South Australians in the future.

The grasping of the post-war opportunity, as it unfolded, would obviously occur under a very different scenario from that which had driven the development of electricity in South Australia during the first four decades of AESCo's existence.

~ *Unbounded Growth* ~ *1946–1986*

Thomas Playford's Vision

Thomas Playford was a man with a vision. In the late 1930s, as Premier of South Australia, Playford was driven by his perception of the need for South Australian industry and agriculture to grow in diversity and size. The major factor in supporting this growth, he reasoned, was the availability of an adequate, centrally planned electricity supply system serving the entire State. His objective was a secure electricity supply fuelled by South Australian coal and run by South Australian expertise – all under the close watch, if not control, of the State Government. Yet, inherent in all this, there was conflict with the already established private provider of electricity, the Adelaide Electric Supply Company (AESCo), who preferred to use the high quality New South Wales coal for the generation of electricity for South Australia, rather than experiment with the low quality coals of South Australia.

Tom Playford, long-serving Premier of South Australia, had a diverse and broad vision of how State-controlled electricity supply could assist the growth of industry. He is shown here at Leigh Creek, a spot for which he had great affection
ElectraNet SA

Indeed, Playford's vision for the future of South Australia did not sit easily with the views of AESCo's Board of Directors. The initial issue of contention surrounded use of coal from Leigh Creek for fuelling the Osborne Power Station. The boilers at this particular power station had not been designed for the low quality coal mined from the northern

regions of South Australia. AESCo asserted that this coal was uneconomic; Playford argued that its utilisation was essential to South Australia's post-war survival and subsequent independent development.

By 1942, in the midst of a painful and debilitating world war, AESCo and Playford were locked in a power struggle of their own. Playford, maintaining his belief that there was a need for a central electricity supply and generation authority, established the South Australian Electricity Commission in 1943. Within a year, this fledgling organisation, under the guidance of Jim Harrod, proved active and influential in the State Government planning process.

Although AESCo was determined to survive as an independent private entity, a Royal Commission into its corporate affairs was initiated by an also determined State Government. Restrictive Government Bills were threatened and strong public sentiment was in favour of Playford. All these factors counted against the company at a time when the community was experiencing many electricity disruptions caused by a shortage of coal supplies from New South Wales.[1] Consequently, it was not to be long before Playford was able to achieve one of his main objectives to assist the State's future development.

On 1 September 1946, the Playford Government, through an Act of Parliament, created a new entity named the Electricity Trust of South Australia (ETSA), to co-ordinate, control and operate the electricity processes in South Australia for the benefit of the State. This manoeuvre effectively put into the hands of Government, all of AESCo's assets and staff.[2] A bold move on every front, it anticipated and then paved the way for an amazing period of growth in generation, transmission and in the sophistication of power system control and planning. The formation of ETSA was seen at that time as the opening of a window of opportunity for South Australians – the herald of a frontier of post-war change and growth.

Empowerment of ETSA

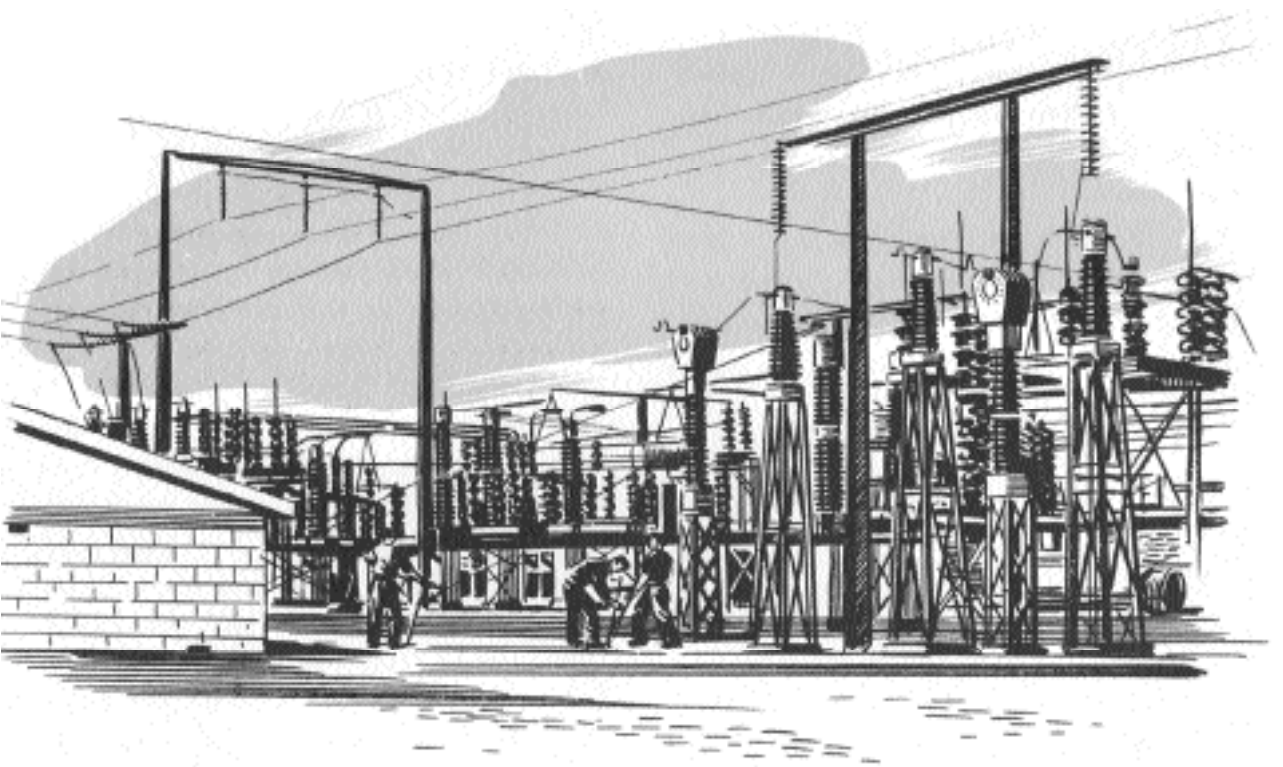
At the time of the launch of the Electricity Trust of South Australia in September 1946, the South Australian transmission network had already

By December 1946, the transmission system had already moved into a large number of rural areas and was planned to spread at a much greater pace and intensity. A comparison with the earlier map will clearly show the developments achieved
Adelect Magazine

etched its away across countryside from Booleroo Centre in the north, to Rapid Bay in the south, and from Port Wakefield in the west, to Morgan in the east. This network had effectively addressed the electricity requirements for the Fleurieu Peninsula, the Adelaide metropolitan area and the prosperous farming communities of the mid-north. However, it had not progressed nor expanded into the rural and mining areas at a rate satisfactory to the State Government, anxious to see South Australia move rapidly from a concentration on the war effort, into development as a successful agricultural and industrial producer.

By taking over AESCo and retaining its staff, Playford gained an effective team with a determined organisation that, under State Government arrangements, had access to the necessary financial resources to back the planned rapid expansion of the electricity system, and which could cut through any frustrating bureaucratic delays.

Hence, at the time of ETSA's first annual report in 1947, the members of the Electricity Trust could already report that electricity

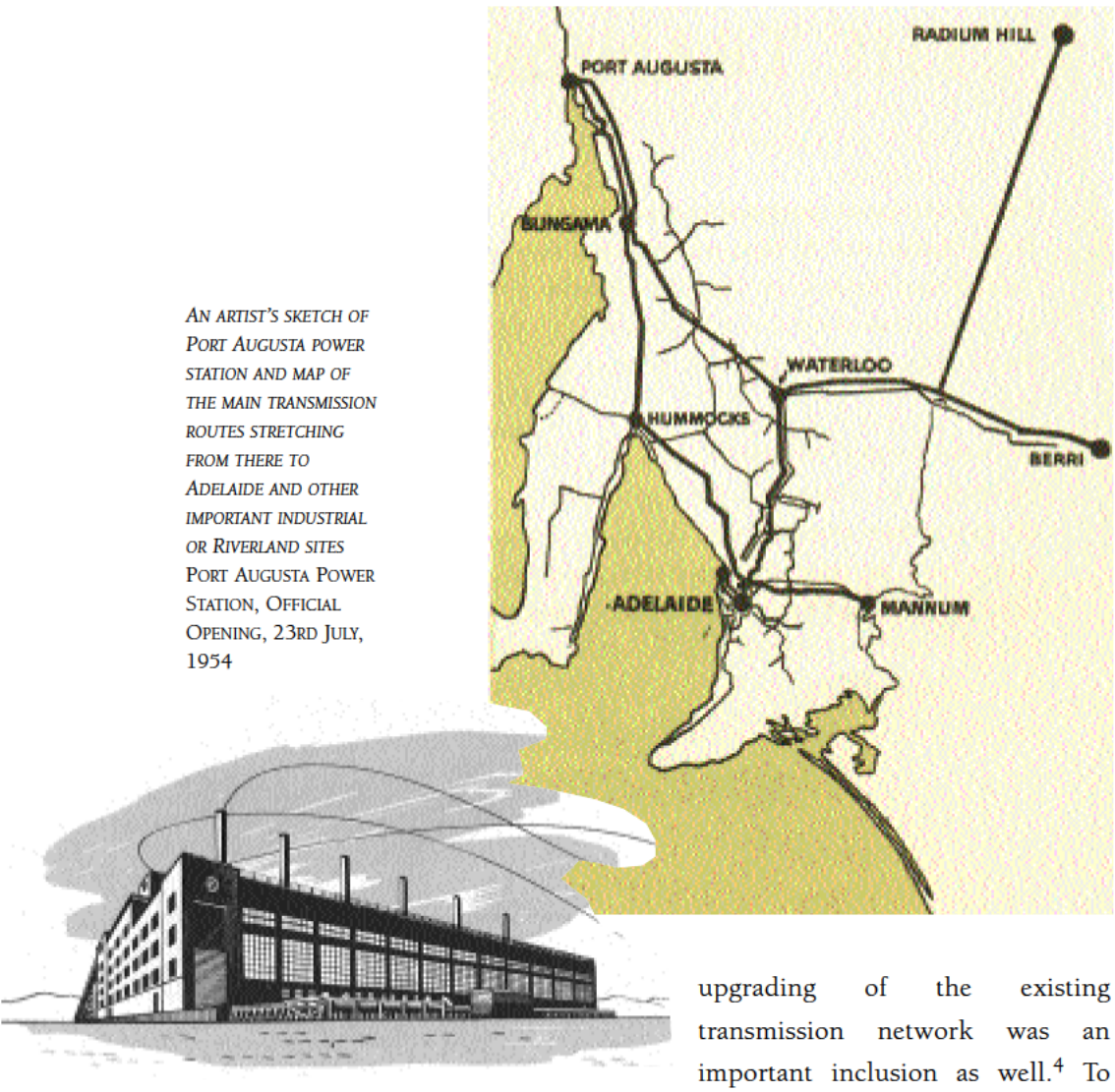


An artist's sketch of one of the substations en route from the Port Augusta power station
Port Augusta Power Station, Official Opening, 23rd July, 1954

supply had been extended to a number of new areas and that 13.3 kilometres of 66kV, 35.4 kilometres of 33kV and 19.3 kilometres of 7.6kV transmission and distribution lines had been erected in the previous nine months.[3] This was a significant achievement in itself; during a period of post-war rationing and restriction, the very scale of ETSA's new forward planning was daunting. At the insistence of the State Government, local and regional electricity supply companies in many of the country areas were being progressively purchased and placed under ETSA's control; and, being rapidly extended into all rural areas, were the high voltage transmission lines which, in time, would dispense with the need for small rural power generation and supply systems located in the main country towns. Indeed, the enhanced transmission network was very quickly developing throughout the State, under central control and with an advanced communications system already being established to service all corners of the main network.

Rural and urban expansion during the 1950s to early 1960s

Just over a year after ETSA's first annual report had outlined the magnitude of the power system expansion that was planned, the Electricity Trust announced that many of its major projects were already under way and they even advised the community when these projects would be completed. This project list was testimony to the drive of those people involved. By the end of 1948, a substation at Clarence Gardens would be built; and a host of projects would be completed in the Riverland irrigation area, including a 33kV line between Loxton and Berri. In addition, by the end of the first quarter in 1949, there would be a new 33kV substation at Kilburn, a further transmission line from the Osborne Power Station, and 33kV lines from Blyth to Clare, from Kilburn to Croydon, and from Port Wakefield to Ardrossan on Yorke Peninsula. On and on went the project list, with completion dates for projects provided up to the end of 1952: a Kilburn to Northfield 66kV line; Bungama to Port Pirie 33kV line; new substations; new Mains Control supervisory systems; and a host of other initiatives. The continuance of the maintenance and



An artist's sketch of Port Augusta power station and map of the main transmission routes stretching from there to Adelaide and other important industrial or Riverland sites
Port Augusta Power Station, Official Opening, 23rd July, 1954

upgrading of the existing transmission network was an important inclusion as well.[4] To provide new generation to be connected to this planned enhanced network, and to meet the needs of all the new customers, there would be an Osborne "B" Power Station, with a fourth boiler designed to burn Leigh Creek coal, and a major regional power station at Port Augusta, whose boilers would exclusively burn Leigh Creek coal.[5] With even further foresight, in December 1950, ETSA announced another future power station was being planned for the North Arm of the Port River, with a huge 500MW capacity to meet the expected growth in South Australian electricity demand in the 1960s and 1970s.[6]

The spread of the electricity transmission network throughout the late 1940s and 1950s was a time of vitality, camaraderie and accomplishment for those involved. Of great interest was the progress of the first 132kV high voltage transmission line between Adelaide and Port Pirie, which was to be further enhanced by another 132kV transmission line from Northfield to Waterloo and then on to Berri. In due course, it was planned that the new Port Augusta Power Station would re-link into this new backbone 132kV transmission system.[7]

The construction of these transmission lines provided employment for many people in South Australia. Construction teams working in remote rural areas were housed in prefabricated, transportable huts.[8] Although conditions on these major construction sites could be trying, those involved felt a certain pride in the undertaking. In 1955, when a major transmission line was extended from the North West Bend substation near Morgan, to the uranium mining centre at Radium Hill in the State's north, it had to pass through some very inhospitable country. Yet, the spirit of the team there was excellent. Lloyd Bannister, who witnessed it first hand, wrote:

> All associated with the transmission power line construction could feel the task of blazing this new trail across country, explored by few in the past, was related to the Atomic Age. A pioneering spirit was strongly evident and this created strong teamwork which carried the difficult project through.[9]

Others associated with these ventures agreed. Ex-employees Keith Shrubsole and Peter Burgess recall the many events that shaped the construction of the early 132kV transmission lines in South Australia's mid-north and Yorke Peninsula. There was an incident near Maitland, for example, when the twenty-three-metre-long 'Stobie' poles used for the line were not properly supported, and an entire stretch of electricity cable and poles fell like dominoes. There were tales of trying to raise the cables over 'stinking swamps', of seeing farmers' valuable sheep disappearing down the holes bored ready for the poles, and of battling the elements and

Four scenes showing the spread of the transmission system through the Mid North and Yorke Peninsula in the early 1950s. An ETSA crew at Ardrossan, 1950; erecting poles for the transmission line; and two views of the movable transmission camps – one on board trucks ready for the journey and the other erected at Crystal Brook in 1955
Keith Shrubsole

the shortage of time to achieve the ambitious project goals.[10] Keith Shrubsole embellishes:

> From the day you joined you were a team – you all worked together. There was much pride in doing a job well and in the amount of work that could actually be completed. With this teamwork, it was only a matter of time before the whole system started to fall into place. The 132kV transmission system *really* opened the whole State up, especially the north, and particularly when the Port Augusta Power Station first came on line … You had two transmission lines – one going through near Port Wakefield meeting up at Crystal Brook and then up to Port Augusta. The other line was over Waterloo side, coming in again at Port Pirie – what we call Bungama – and headed up to Port Augusta … The transmission circuit that went to Waterloo supplied the entire upper Murray region. That was the start of the real major development in this State – the 132kV transmission system going in.[11]

Keith Shrubsole
ElectraNet SA

Peter Burgess
ElectraNet SA

The rural community welcomed the ETSA teams and contractors with open arms and saw the advent of electricity in their region as a major sign of progress.[12] The presence of 66kV and 132kV transmission systems was seen as ample evidence of the actual dawn of a new era. Not only was life being simplified, but the entire fabric of rural households, farm management and urban living was forever changed. It is Keith Shrubsole, again, who puts the situation succinctly:

> There were seldom any problems. People wanted us. People wanted electricity. I think we were very good with our public relations too. We didn't upset people … If we wanted to cross a person's property we made sure that we had their permission, that we did the right thing, because, after all,

you might be sent to Riverton to work, and those people would become your neighbours and your friends. Everything was growing fast within South Australia. Nothing was standing still. Everything seemed to be pushing ahead. There was plenty of work.[13]

Between June 1952 and June 1962, 596 kilometres of 275kV transmission line, 1285 kilometres of 132kV transmission lines, 625 kilometres of 66kV and 2314 kilometres of 33kV distribution line had been completed. These figures do not take into account the vast distance of SWER lines and 11kV and 7.6kV distribution lines that had also been installed.[14]

Late 1960s & 1970s: New Pathways

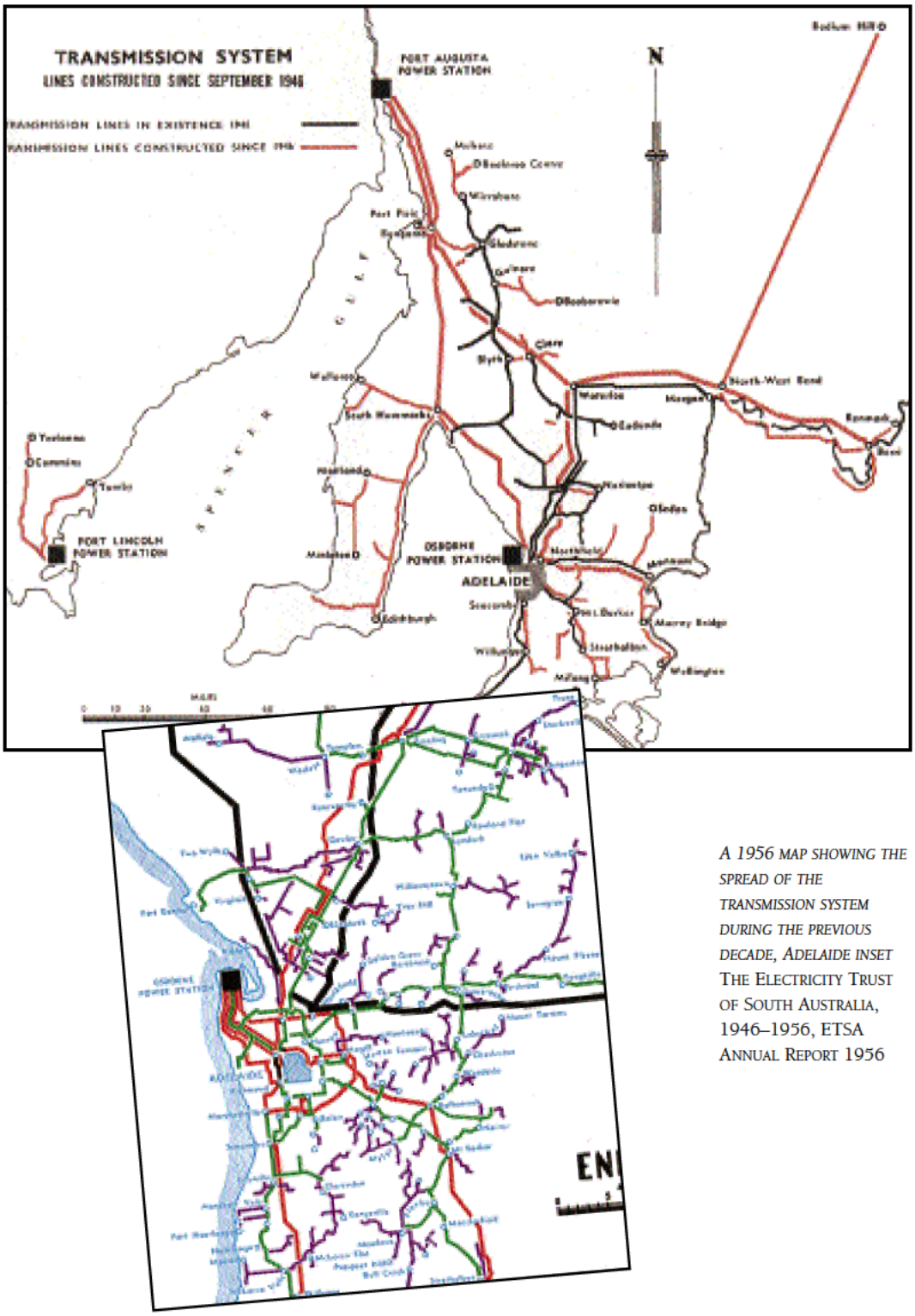
Thomas Playford's dream of a State, whose economy was sparked by industrial growth and agricultural wealth – supported by an extensive State-wide electricity network – was gradually being achieved.

By 1966, when a twenty-year comparison of ETSA's operations was undertaken, it was calculated that power consumption and transmission infrastructure had grown at the cumulative rate of 11% per annum.[15] By that time, a total of 24,150 kilometres of high voltage lines had been built, a figure, noted one writer, that would take a transmission line from South Australia to the United Kingdom and then twice around Scotland.[16]

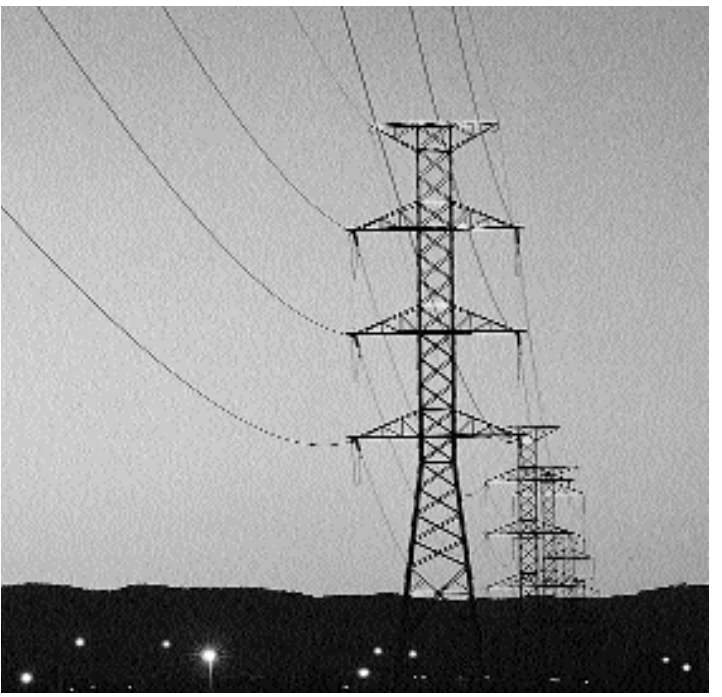
A live line working party on call ElectraNet SA

The early 1960s had seen the major development of the 275kV transmission system, including the Para substation, necessary to transmit power from the new, large, gas fired Torrens Island Power Station, which commissioned its first unit in 1967 and the eighth in 1980.

Incredibly, more developments were to come. By this time, though, the attitudes



A 1956 MAP SHOWING THE SPREAD OF THE TRANSMISSION SYSTEM DURING THE PREVIOUS DECADE, ADELAIDE INSET
THE ELECTRICITY TRUST OF SOUTH AUSTRALIA, 1946–1956, ETSA ANNUAL REPORT 1956

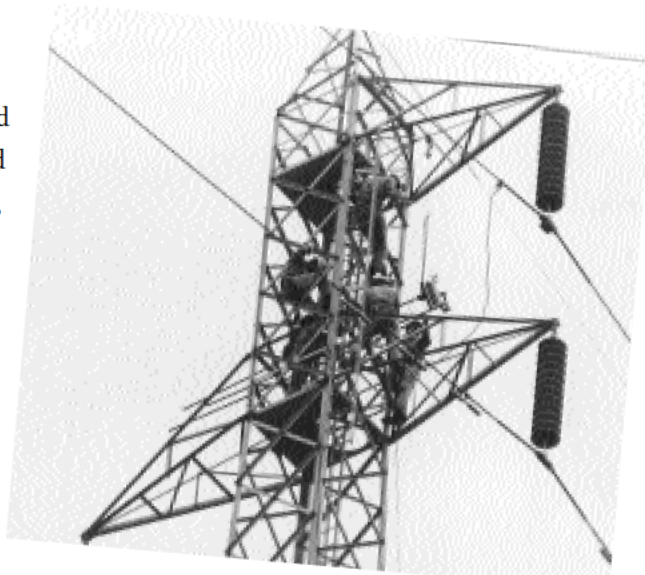


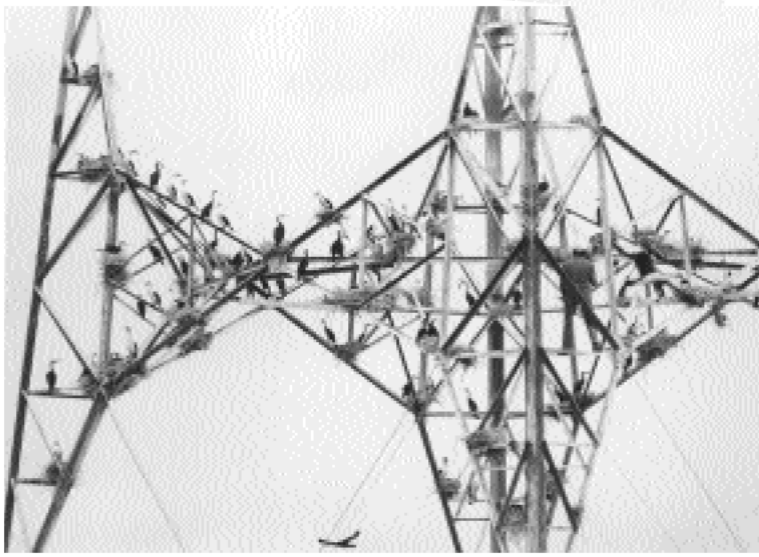
Double circuit 275kV transmission lines at sunrise, near Salisbury Highway
ElectraNet SA

of the South Australian community, originally welcoming the introduction and subsequent development of electricity, had undergone some revision. Although the community generally was still convinced of the need for transmission lines to be taken from Whyalla to Port Lincoln, undersea to Kangaroo Island and to the site of the ill-fated Chowilla Dam on the River Murray above Renmark, there were disagreements about which routes these lines should span. With urban spread on the increase, much debate had occurred between ETSA and the affected communities, regarding the necessary new transmission routes. Although a Transmission Aesthetics Committee had been set up within ETSA to advise on matters that would affect public perception of ETSA's policies, there was a steady growth in public opposition to transmission easements. During the 1960s, the fate of a line through the well populated Para Valley was much influenced by public protest.[17] From this point on, the planning, survey and construction of transmission lines proceeded with a far greater amount of public consultation, which was a precursor to subsequent environmental impact studies. Without doubt, it was a time of rapid development and dramatic change in ETSA's approach to development, as the following excerpt notes:

> In the 1970s the actual transmission line construction work was fairly quiet, but there was a lot of ground work being done for new lines for the new Northern Power Station at Port Augusta. Certainly [this was the time of] the beginnings of the environmental studies which were initially done in-house.[18]

There was little doubt that ETSA had set high standards for the design and construction of transmission lines. As well, techniques for maintaining these lines were continually upgraded and updated. So, in 1969, for example, an innovation of helicopter contracting was used to string conductors between pylons over a deep gorge in the Adelaide Hills.[19] Interestingly, a cartoon in an issue of ETSA's internal *Adelect Magazine,* some twenty-five years earlier, had predicted such an occurrence.





In 1972, after a study tour to the USA, Keith Shrubsole brought back new equipment to all linesmen to carry out work on live high voltage wires. The main part of this equipment was a range of epoxy-glass insulated operating sticks – or 'hot sticks' as the Americans called them, for working and manipulating the live high voltage lines. Crews were soon trained in the use of this equipment.[20] Then in 1978, when the 66kV transmission lines between Osborne and Torrens Island required sophisticated radiography, to measure the effect of conductor vibration in the wind, some amazing innovative work occurred on these wires stretched some 100 metres above the ground.[21] Also, in the late 1970s, a technique for using high pressure water hoses to clean dirty insulators on live transmission lines was devised and proved exceptionally successful (and is still used).[22]

Installing Ontario recorders, to measure aeolian vibration – the cormorants had established nests on the tower. Woe betide the first linesmen who jumped on to the tower from the boat, for the birds left their mark
ElectraNet SA

In all phases of transmission – from design to survey, from construction to maintenance, from substation work to the control of the network – it seemed that there was nothing too difficult for ETSA to tackle.

Between 1969 and 1979, an additional 44,000 kilometres of high voltage transmission and distribution lines had been constructed, although an unexpected freak storm in the mid-north, in November 1979, caused major destruction of transmission lines and towers in that area, and created the need for extensive repairs.

Communications systems development

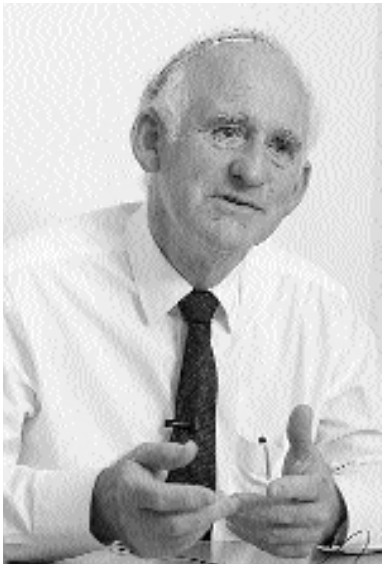
The planning and the designs for attaining the goals of the expansion of the transmission system were well thought out. Often there was a significant degree of creative innovation involved. The way in which the communication system was initially established, then developed across ETSA's transmission network, was one example of this inventive practice.

From the birth of ETSA in 1946, there had been an awareness of the need to communicate between field officers, construction and maintenance teams, Mains Control and headquarters. In those early days, there were people like Maurie Phillips and John Bulling who actually built ETSA's radio equipment for mobile radio trucks. The objective was to provide a State-wide radio network of these vehicles with radio systems. Their innovative work was pioneering and preceded even the creation of a police radio network in South Australia. During the early 1960s, the existing mobile radio system was gradually superseded by plant of commercial manufacture, because the early frequencies used by ETSA landed right in the middle of those subsequently allocated for the development of television.

There were only three places in South Australia where mobile radio towers were located in those early days. One was at Mount Lofty to service ETSA's radios in the metropolitan area, one on the historical centenary tower at Mount Gambier, and one up on the hill at the rear of Port Lincoln. In comparison, today's radio communication network covers and

permits a person to communicate from a car in Adelaide to almost anywhere in the State.[23]

Ex-employee Graham Vincent (previously ElectraNet SA's Manager Telecommunications) spent his early years with ETSA assisting with the upgrade of ETSA's original mobile radio network, into a widespread, modern system. Within about twelve years, on extremely tight budgets, nearly all of the working areas of ETSA were covered by this enhanced radio network. It was an absolutely essential part of ETSA's work; for line construction and maintenance gangs needed to be able to converse with their supervisors and those controlling the transmission network to enhance safety, time management and resources. Graham Vincent stresses, 'We were in this business of trying to spread the radio coverage as far as possible. We were utilising some very innovative techniques that, by and large, other people in Australia had not used.'[24]



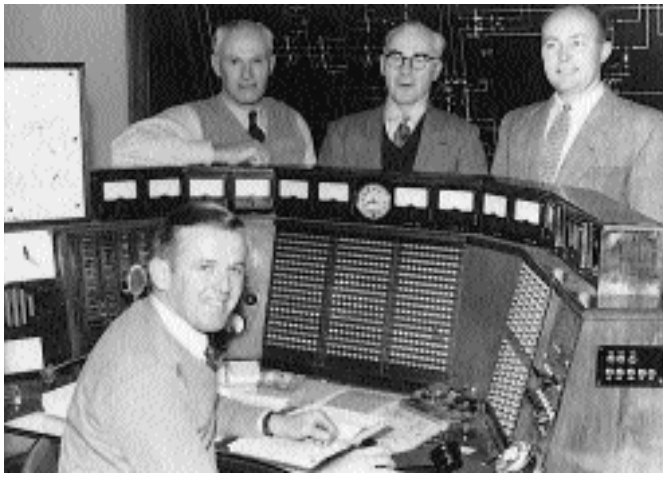
Graham Vincent
ElectraNet SA

The second part of ETSA's communication network, and one that preceded the mobile radio system, was the development and use of the internal ETSA telephone exchange. From the days of AESCo, there had been limited use of this telephone system, to guide either those controlling generation or those engaged in line maintenance. Of course, a more expensive option than mobile radio, the telephone system was nevertheless a major component of a communication system that depended on the ability of individuals to keep in constant touch anywhere in the State. While it was updated on a regular basis, it was not until 1984, with the introduction of a state-of-the-art Ericsson system, that the telephone system within ETSA underwent an innovative change to directly link all physical operation locations.[25]

The third phase of the communication system development within ETSA was the introduction of the specialist Power Line Carrier (PLC) communications equipment in the mid-1950s. At the time that ETSA was building its first 132kV network from the Playford Power Station at Port Augusta, there was a great need to provide a form of communication,

Three means of communication for ETSA maintenance and transmission crews over the years. The first shows a linesman using radio telephone; the second shows Colin Buckley manning a Flying Doctor radio during work on the Radium Hill line; and the third shows more up-to-date radio communication with Tony Sochel, Cyril Rumbelow, Peter Doley, Bill Williams and Mal Richter as part of the team repairing conductors on the Number 1, 275kV line from Port Augusta to Magill
Keith Shrubsole, ElectraNet SA, ETSA Museum

along the transmission line itself, that could assist in the automatic protection of the line. (PLC is a means of integrating a path for communication along the actual transmission line conductor. So, unlike a separate telephone system, the communications devices were actually linked to the physical transmission line itself). An efficient form of communication that had at that time been used overseas for just over a decade, PLC proved to be a success here in South Australia, also.



Mains Control, East Terrace, 1955 – G. Chambers, J. Vincent, C. Barnett, F. Richardson – the main control panel had been moved to this site from the Kelvin Building. Mains Control Officers were an integral part of the ETSA communications network
ElectraNet SA

Used for the first time on 18 April 1955, to relay a conversation between Jim Burfield at Northfield substation and Max Wills at Port Augusta, the PLC system also enabled Mains Control, by this time situated at East Terrace, to remotely operate transmission line circuit-breakers at distant and remote substations.[26] It was during these years that ETSA expanded its drive towards developing and implementing state-of-the-art telecommunication and remote Supervisory Control and Data Acquisition (SCADA) systems, that brought the business much success and a reputation as a leader in the specialised area of power system control. Indeed, ETSA's transmission and distribution line crews had the utmost respect for the achievements of the original PLC radio and telephone communication processes managed by Mains Control. Keith Shrubsole and Peter Burgess again comment:

> When you were in a small district with a large substation like Waterloo, events could become pretty interesting. Mains Control Officers would provide regular training – but linesmen can't become expert substation operators in half a day. We depended entirely on our communications with Mains Control, who effectively led us around by the hand

remotely, sometimes during tumultuous storms.

We have always had tremendous respect for the Mains Control Officers. We don't think the general community or even much of ETSA realised how good they were. Howard Marriott (Supervisor Mains Control), with his crew of operators. Names like Cliff Barnett, Merv Dingle and Jack Bond. Then there were the 'newer' staff like Geoff Chambers and Ted Whelan. They were all the backbone of the network operations and control activities.[27]

Such obvious praise highlights how far the work of a communications system, with the guidance of Mains Control Officers, could provide assistance for the day-to-day occurrences in the widespread transmission and distribution system of South Australia.[28]

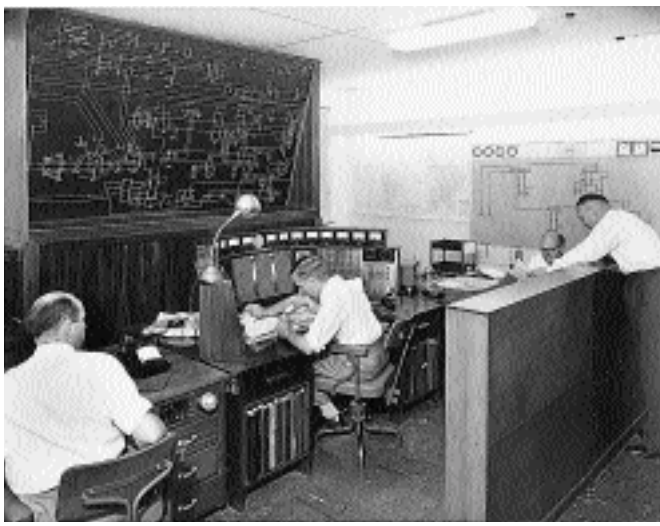
Below: Jan Carroll, Communications Officer, East Tce, Mains Control. opposite Page: The other views are of the Mains Control centre, East Tce, fifteen years apart, 1955 and 1969
ElectraNet SA, ETSA Museum

Mains Control to System Control – handling growth with technology

For some years after ETSA's inception, Mains Control remained in the Kelvin Building. In July 1949, at the height of severe electricity shortages in South Australia, Adelaide's Sunday newspaper, the *Mail*, wrote a feature article on the crucial work undertaken by Mains Control Officers.[29] As demand for power increased with the rapid growth in population, coal supply shortages for the Osborne Power Station occurred, resulting in a number of 'black outs'. In order to explain how this situation developed, the *Mail*'s journalist explained that when the power was cut, 'An efficient behind the scenes load shedding plan is operated by Electricity Trust officials. One minute after the black-out order is given at Osborne powerhouse, power is cut off in selected districts.

Areas to be blacked out are pre-determined on a roster system'.[30] Photographs in the article depicted Mains Control Officers sitting in front of the massive system board entitled 'The Organ', and carrying out the necessary substation and line switching. Although a positive article, it was somewhat simplistic, especially as the Mains Control activity was becoming an increasingly sophisticated application.

By 1952, ETSA reports were noting that 'With the growth of our system over the years, the problem of restoration of supply and the control of switching has progressively become more complicated'.[31] As the Port Augusta (Playford) Power Station came on line, and was then expanded in the late 1950s, and as the web of transmission lines spread across the State, the complexity of Mains Control was further increased.



The demand for electricity more than doubled in the 1950s and again during the 1960s. The accompanying diversity of fuel supplies and sizes of generating units, and the complexity of high voltage transmission, were to lead to a rapid evolution in the processes for the monitoring and control of the supply of power from generators, to match the demands of the customers and the transmission and distribution delivery systems.

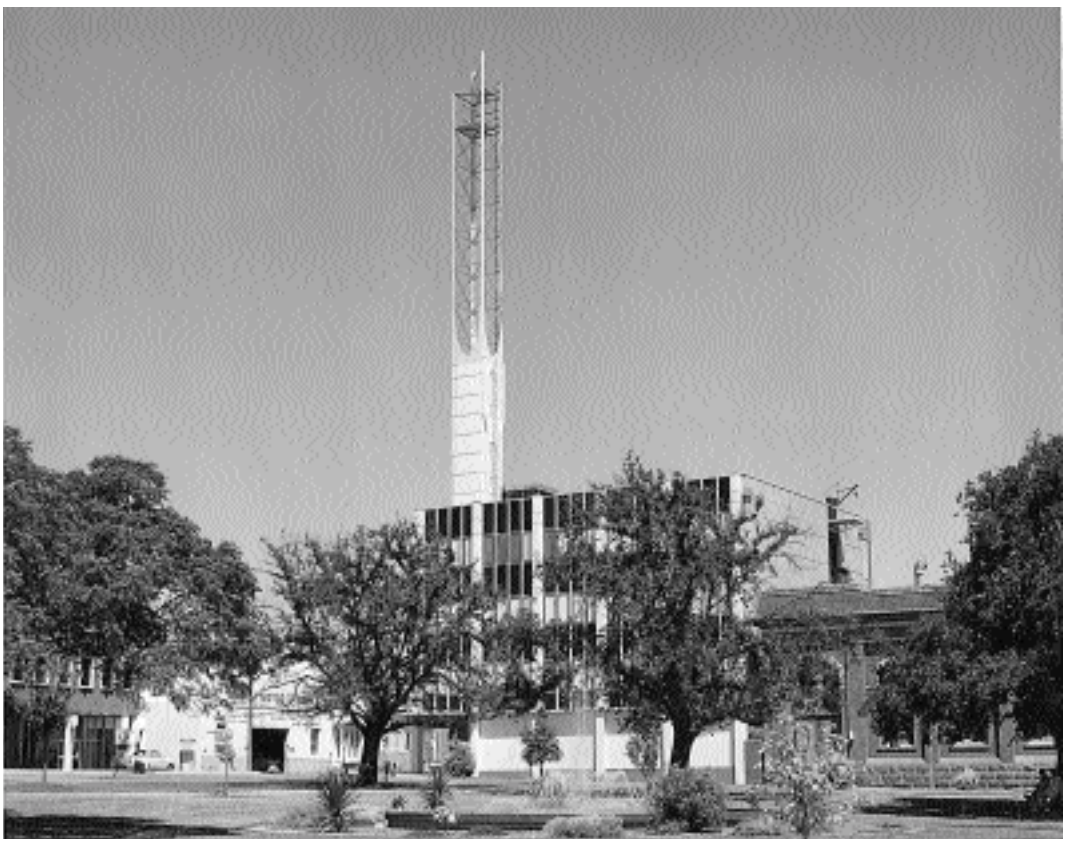
Ex-employee Ern Broughton describes the evolution that he witnessed:

> Mains Control was originally a part-time job for two or three people in the Kelvin Building on North Terrace, because the actual electrical power system at that time was not particularly large. Originally a lot of the work in dispatching the generating plant was co-ordinated at the power stations. Mains Control Officers worked part time for five days a week, with one Officer required for each of the two shifts. If overtime was required, Officers were often contacted at home from where they would resolve any problems. As the workload and electricity network increased, two full-time Mains Control Officers were appointed on day shift and one on night duty, and were all subsequently moved to the East Terrace substation backyard during 1955. A third shift was then added to the original two, ensuring around the clock continuous oversight and management of the South Australian transmission and distribution network.[32]

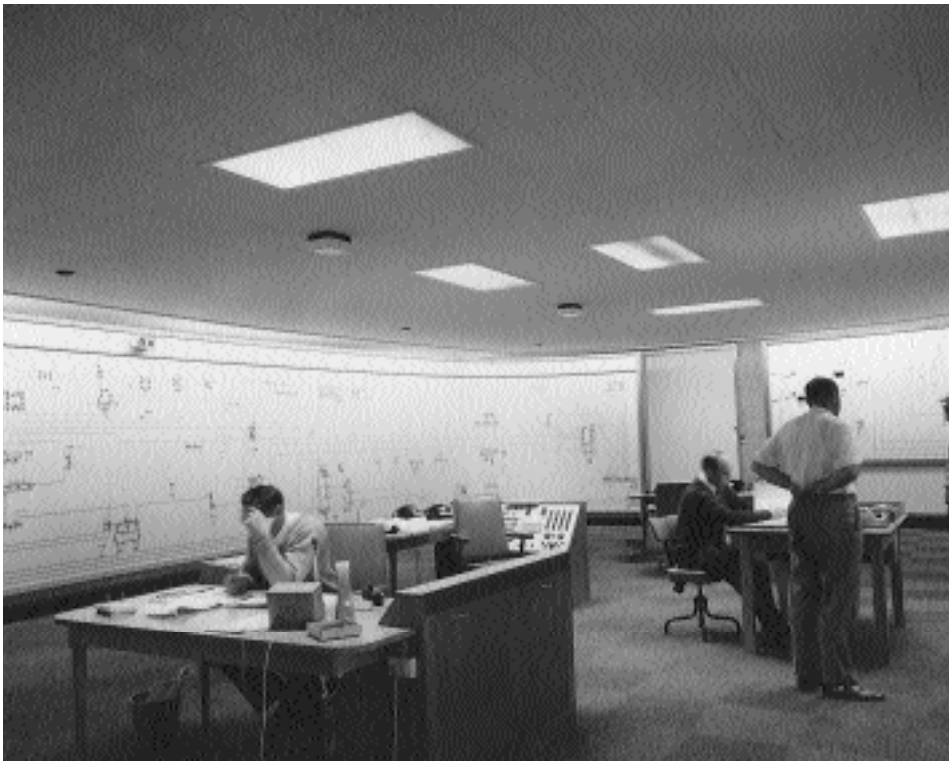
Remote supervisory control technology was to take a major step forward, when, during the mid-1960s, the Para substation began to assume a major role in the high voltage transmission system (being connected directly to both Playford Power Station at Port Augusta and the new Torrens Island Power Station). An innovative electronic remote supervisory system was installed to monitor and control the Para substation and commissioned in 1968. This highly effective monitoring and supervisory system was the foundation for the technology used to

interface substation equipment to the Control Centre and enable the development of the complex system control capabilities needed for the operation of a modern power system.

In early 1969, Mains Control moved to a new, purpose-built facility at Pirie Street, Adelaide. Later that year, the generator load despatch, production planning and co-ordination and power system security functions that had previously been attached to the Osborne Power Station, also came within the ambit of Mains Control. With this change, Mains Control effectively became the System Control Centre for the whole of the South Australian power system. System Control Officers were recruited from across the entire ETSA organisation, mostly with experience in power station plant operation and/or substation



THE NEW, PURPOSE-BUILT SYSTEM CONTROL FACILITY, IN ADELAIDE – AN INTERIOR VIEW (PAGE 50) SHOWS GEORGE BURGESS, FRANK RICHARDSON AND JACK BOND AT WORK
ELECTRANET SA



maintenance. Training programmes were initiated, including site visits to supplement experience and maintain a working knowledge of all new equipment installed on the power system. New recruits were closely supervised for up to twelve months and spent extensive periods in the field interfacing with maintenance and operations personnel, or co-ordinating network outages. System Control Officers were also providing training for ETSA's regional line workers in the methods of safe switching of field equipment. This led to social interaction and friendship, and in times of crisis, these personal contacts meant that people could go into potentially dangerous situations with confidence in the capabilities of all involved.[33]

Ex-employee John Thomson, and Ern Broughton mentioned earlier, who were involved with ETSA's System Control Centre operations for many years, insist that its function was all about 'co-ordination'[34] –

co-ordination of a power system running from Leigh Creek coal production, through steam generated electricity production at the power stations, and on to the remainder of the South Australian transmission and distribution systems. Almost the only part of ETSA that wasn't touched or co-ordinated by System Control, they claim, was the team of people who read the electricity meters! They recall the move of Mains Control from the Kelvin Building, to a small two-storey building at the rear of the East Terrace substation in Adelaide during 1955, and finally to its present site with the creation of System Control in 1969. Moreover, they consider that Laurie Ellison, the original System Control Engineer, was the person who, through the 1950s and 1960s, was responsible for the initiative to establish world-class processes, involving extensive remote control of substations from a centralised Control Centre. Current ElectraNet SA employees Barry Foster (previously Executive Manager Transmission Operations) and Phillip Webb (Executive Manager Operations) agree that Laurie's 'vision for a centralised co-ordination of operations, combined with remote monitoring and control capability', was really on the leading edge for the whole of Australia.[35]

Left to right: Ern Broughton and John Thomson
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Both Thomson and Broughton again comment that the 1970s was, probably, the 'finest hour' of the System Control Centre. At that time, as summer demand for electricity grew rapidly, through increased numbers of airconditioning units being introduced into households, control of the power system required all equipment to be operating at maximum efficiency, with generation and transmission outages being kept to a minimum.

As the South Australian electricity demand growth continued, additional high voltage transmission lines were built and other substations were considered for supervisory control installations during the period 1969 to 1974. These state-of-the-art supervisory systems were installed at approximately fifty-five Adelaide metropolitan substations and others in

the Adelaide Hills and country areas including Cherry Gardens, Mount Barker, Templers, Kincraig, Blanchetown, Tailem Bend, Mount Gambier – as well as in the Playford Power Station switchyard, to increase power system reliability performance.

Also in this period, the slide rule and the comptometrist machines employed in the early days in the power station load despatch section of System Control, were replaced with the first generation of desktop computers. In addition, specialist computer programmers were employed to develop production planning software, as the ETSA power station fuel budget began to exceed $100 million per annum. The installation of a new generation of control interfacing facilities at the System Control Centre, during the latter part of the 1970s, allowed the System Control Centre to effectively monitor and remotely control most of the South Australian main transmission and distribution substations, including the remotely operated Dry Creek Power Station gas turbines, commissioned in the mid-1970s. Three new gas turbine powered generators at Snuggery in the south-east also came under remote control by the System Control Centre. At the furthermost ends of the network, at Port Lincoln and Mount Gambier, the System Control Operations were assisted by local operating facilities, known as Zone Control centres. These centres continued to provide local assistance in co-ordination of the high voltage distribution system, until driven by cost efficiency measures to close, during the reform and restructuring of the industry at the beginning of the 1990s.

The 1970s, however, saw a number of unforgettable power system disturbances in South Australia: outback floods which affected coal and natural gas fuel supplies to the power stations; commissioning tests and delays of major new power station generators; industrial action which almost shut down the entire Torrens Island Power Station; severe storms which severed the 275kV connections to Adelaide from the Playford Power Station; and a poplar tree which had grown into a 275kV line from Torrens Island, which almost blacked out the State. However, most concede that the day that really tested System Control occurred on 30 June 1980, when all generation at the huge Torrens Island Power Station

suddenly stopped, because there was no natural gas fuel to fire the Torrens Island boilers. The natural gas pipelines supplying the Power Station were both shut off through a mistake during a routine test by the gas supplier. Without this supply System Control Officers were thus forced to disconnect almost all of the State's electricity customers, as the remaining generation at Port Augusta could not meet the huge customer demand shortfall. This scenario is aptly named a 'black start'.

The Torrens Island Power Station had come on line in early 1968 and in some ways provided the confirmation of that early planning of ETSA in its first few years of existence. This Power Station was considered the most important at that time for providing for South Australia's growing electricity needs during the late 1960s and 1970s. While there had been initial problems switching the fuel for the steam generating boilers, from oil to natural gas (after large quantities of gas had been found at Moomba), this Power Station was ultimately very successful. The day of the 1980 'black start' was, however, a frightening scenario, and as John Thomson recalls, was the longest day of his life:

> It was horrible. Operations to bring the 1,280MW Torrens Island Power Station back on line and to reconnect supply to customers after the total shutdown occupied several hours, with huge media attention and public outcry. This disaster tested ETSA employees right to the utmost rivet of their ability, in terms of contingency planning and ensuring backup systems were in place.
>
> In hindsight, it is considered that ETSA personnel managed the situation extremely well, and the experience was pivotal to the life of System Control.[36]

Barry Foster agrees:

> that the outstanding performance of ETSA during the black start incident was a reflection of the quality of ETSA's employees and a testimony to their competence. From a State blackout condition occurring at about 10.00am, System Control had co-ordinated the recovery of most of the

State's power supply and delivery systems within four hours, with full restoration achieved later that same afternoon.[37]

By the early 1980s, the System Control Centre had become a unit capable of maintaining the balance within a complex and diverse network of electricity supply, with transmission and distribution elements. At the forefront of technological advance and with the ability to guide those working throughout the whole electrical power system, System Control Officers made an important contribution to the success of the South Australian electricity industry.

This claim was realised in part when, on Good Friday 1985, a serious cable tunnel fire at Torrens Island shut down the whole of the newest section of that Power Station, damaging important control equipment and some of the major turbine plant. This disaster could have had a very serious impact on the availability of electricity to South Australian consumers. As it eventuated, the full power demands of the community were met over that Easter period, and urgent repairs were completed to allow some of the affected generating plant to be brought back into service a few days later, just in time to meet the electricity demands of the customers when everyone returned to work after the Easter break.

The 1980s and planning for interconnection with Victoria

The growth of electricity demand in the thriving Adelaide business district, during the 1980s, was addressed by the construction of an underground 275kV cable from the Magill substation in the eastern foothills at the edge of the metropolitan area, to a newly constructed 275kV section of an East Terrace substation, adjacent to the main business district. This major work was completed in 1984.

Major reinforcement of the 275kV transmission system between Adelaide and Port Augusta then occurred in the early 1980s, in preparation for the new Leigh Creek coal fired Northern Power Station, due to be commissioned in 1985 and 1986.

This Power Station included a significant number of new features. As normal, in the commissioning of power station plant, a number of

major teething problems occurred with the Northern Power Station, which, during 1985 and early 1986, caused significant challenges in managing production planning and power system security, and resulted in frequent load shedding of Adelaide electricity customers. The impact of the loss of either of the large Northern generating units on the power system was a new experience in ETSA and often a second generating unit would trip in sympathy, causing widespread customer disruption. Of course, all of the problems were systematically addressed by ETSA during the testing phase, and the Northern Power Station subsequently became one of Australia's most reliable coal fired power stations.

During the mid-1980s, another major focus for transmission personnel was in developing the proposals for an interconnection between the two separate electricity transmission systems of Victoria and South Australia. The 1980 Zeidler Committee of Inquiry into 'Electricity Generation and Sharing of Power Resources in Southern Eastern Australia' had recommended that electricity providers in New South Wales, Victoria and South Australia place a premium on the provision of an interconnection to the latter State.[38]

The first phase of this interconnection commenced with the planning of particulars for individual State electricity systems, to allow the import of a maximum of 500MW of power into South Australia and to export up to 250MW back to Victoria if required. Although the culmination of this project was years away, many saw its benefits. It was seen as a positive step towards the future; a harbinger of those who claimed that Australia needed to see its energy resources and power supply systems more from a national point of view.

During the 1980s, ETSA, particularly in relation to the cost of producing electricity in South Australia, had been profoundly affected by circumstances largely beyond control. The spiralling cost of fuel supplies for the South Australian power stations, and the effects of the disastrous 1983 bushfires (to name but two of the major challenges), were coupled with the more active involvement of the State Government in ETSA activities. Even the interconnection project, itself, was being eagerly

promoted by the Commonwealth Government, as a way to reduce costs to electricity customers in South Australia. The latter period of the 1980s began to look like yet another time of challenge and change.

~ *Change Upon Change* ~ *1986–1996*

Interconnection – the bringing of change

In 1986, the various public utilities and supply companies that made up the Australian electricity supply business were really at a significant turning point. In retrospect, it was a time of reckoning.[1] It was as though the industry was perched on top of a dormant volcano – about to be thrust apart by the explosive pressure of social and economic rationalist change.

For many at ETSA, the previous decades had seen the development of an impressive public utility, full of engineering expertise and with a fine track record of achievement. Some contemporary commentators noted

THE BEGINNING OF THE INTERCONNECTION PROJECT – WORKING WITH TRIPLE CONDUCTORS AT THE TAILEM BEND SUBSTATION, 1983
ELECTRANET SA

John Welford
ElectraNet SA

that ETSA was in an extremely good financial state, thanks to its sound management practices and the quality of its infrastructure.[2] Yet the State Government, at that time, apparently perceived the organisation as uncompromising and inflexible – the relic of an era of unimpeded and unfettered development, that had now passed. There was, moreover, a strong national push for structural reform and even privatisation of the electricity industry, to better utilise the spare electricity resources available to customers from the surpluses in the larger eastern States. This was in part due to the eastern States' excess generating capacity, which had been installed through their zealous over-estimation of the growth of electricity demand expected during the early 1980s.[3] This push towards a nation-wide electricity industry, and the creation of a more efficient management and workforce in the public electricity utilities, started the dormant volcano rumbling.[4]

Ex-employee John Welford (previously ElectraNet SA's Project Manager Market Design) had earlier been involved in the planning of ETSA's generating capacity and, during the 1990s, had contributed significantly to the planning for a National Electricity Market. John recalls the impact of this time:

> During the 1970s, the Federal Government had been pushing the concept of a resources boom and promoting the development of new aluminium smelters and other energy-intensive industry. Both Victoria and New South Wales had embarked on major programmes of building new power stations. South Australia looked at these, and certainly considered the potential for a new power station in the south-east (and perhaps elsewhere), but really, the State economics for the use of indigenous coal in South Australia's own power stations were not that supportive of such a

massive expansion of the State's power generation capability. Other States however, with their easy access to cheap good quality coal, were building power generating stations like there was no tomorrow.

The Commonwealth Government became concerned about the drain on capital resources in building all this new generating plant, so considered it was desirable to look at whether there was some potential for integrating these efforts and sharing spare generating resources between the States. It set up the Zeidler Committee to investigate the possibility for the greater role of interconnectors between each of the States. Victoria, New South Wales and South Australia agreed to participate, but Queensland did not.

Both Victoria and New South Wales came to that particular Commission in an environment where they were rapidly progressing their own power station developments which they did not wish to jeopardise. Subsequently they were very cautious about the Commission endorsing any project that would interfere with what they considered their potential for more development and employment growth within their own States. It was very much a stand-alone approach. The Zeidler investigation, in which a number of ETSA personnel indirectly participated, finally came to a majority conclusion. In another environment, the conclusion may have differed, but each of the States (and their Governments) satisfied themselves that there was no real case for any more large scale transmission interconnectors – that is, no further opportunity for major power flows between the large States. They did however conclude that there was some potential for a limited electricity interconnector to South Australia, based on so-called opportunity energy transfers, which they suggested deserved to be investigated further. (Opportunity exchange assumes that participants are able to generate their

Major substations associated with the interconnection system – from left to right: South East Substation (SA), Heywood Substation (VIC) and Kemps Creek Substation (NSW)
Interconnection of South Australia, Victoria and New South Wales

own electricity independently, but decide to reduce or increase their own output, sharing the saving in fuel costs between the participating States.) In such an arrangement, each of the States could still maintain all the power stations needed to service their own electricity demands, but use any surpluses to generate cheaper electricity for another State, with their agreement to share the savings.

Although this was not a particularly bold outcome, Zeidler had nevertheless, identified the potential for an opportunity energy interchange process, to assist in the reduction of the cost of electricity in South Australia, through a small sized electricity transmission interconnector.[5]

In one sense, ETSA had unwittingly begun the process of providing and satisfying the prerequisites for the establishment of a National Electricity Market. The South Australian–Victorian transmission interconnection project, first spawned from the recommendations of the report from the Zeidler Committee of Inquiry, paved the way for a massive rethinking of power generation and transmission in south-eastern Australia.

In September 1985, a background paper on the South Australian, Victorian and New South Wales interconnection was issued. Following political agreement, construction began on the project in 1986, with the transmission interconnection between South Australia and Victoria planned to be in use by early 1990. At the beginning of the task, ETSA's main transmission network was made up of 275kV and 132kV

transmission lines servicing the power stations and the main South Australian distribution loads. The 275kV system had also been extended to Tailem Bend and, from there, a 132kV network provided electricity to Mount Gambier. With the interconnection, it was proposed that a second 275kV transmission line would be built from Adelaide to Tailem Bend, with a new 275kV double circuit transmission line to be constructed from there to a new south-east terminal substation near Mount Gambier. Additionally, a double circuit 275kV line was to be constructed from the south-east to meet up with the Victorian 500kV network at Heywood (in western Victoria). Thus a double circuit 275kV transmission line with a capability of 500MW became accepted as the desired outcome of the proposed interconnection project. This expansion would also require other 275kV reinforcement work and additional substation development, including the installation of sophisticated state-of-the-art equipment to help stabilise the power system, known as static var compensators (SVCs).

The benefits of sharing costs and transferring energy were such that South Australia stood to gain a good deal from this arrangement. Even the associated projects – including transmission lines into the Cherry Gardens

substation in the Adelaide Hills from the main south-east line, brought additional benefits. The first interconnection project of its type attempted in Australia, it was a common sense approach to the transmission and sharing of electrical power resources.[6]

Local media greeted news of the planned transmission interconnection with acclaim.[7] By July 1987, the route of the transmission line network had been approved and survey work started in the following month.[8] ETSA was careful that every landowner affected by the siting of the new line was visited and there was extensive consultation with public bodies and community groups.[9] By October 1987, major construction work was under way.[10] A year later, with the south-east stage of the network in progress, tenders were called for the construction of lines nearer Adelaide.[11]

ETSA and its contractors were under intense pressure to have the transmission interconnection up and running on schedule. Unfortunately, work was affected by the extremely wet winter of 1988. The heavy vehicles used for shifting equipment and materials for the transmission line cut their way across farmers' soggy paddocks, leaving a trail of damage in their wake. However, compensation to these farmers was swift.[12] Ex-employee Peter Bottroff recalls something of ETSA's endeavour at the time:

> The new transmission line was constructed in some of the worst conditions ever encountered. It was very wet through the Adelaide Hills, with landslides of black mud, which seriously delayed construction. To meet the deadline, some of the tower steelwork was taken into properties with two or three D8's (large caterpillar tractors) pushing the steel trucks into place. This caused unavoidable damage, which was subsequently rectified through ETSA funding, with a result that generally most of the property owners were very happy with. It was a good example of what could be done, and ultimately saved a lot of money.[13]

On 30 March 1990, the interconnection project was officially opened by the Premier of South Australia, John Bannon, bringing to a

At the official opening of the interconnection in March 1990 – from left to right: Don Gellard, Ron Barnes, Premier's press secretary, John Bannon MP, Kym Tothill, Robin Marrett, John Klunder MP
ElectraNetSA

conclusion the $140 million project that had involved twenty-five ETSA departments.[14] The main south-east newspaper wrote of the project as an enormous achievement in which much of the local community had been involved.[15] More than this, the project actually became an enormous financial benefit to the State. Cost savings on expensive South Australian fuels, and the sharing of generating reserve capacity from the eastern States greatly assisted the cost of electricity to South Australian consumers during the early to mid-nineties.[16]

One matter that did not surface in the press, though, was the story about the day on which the first test of the interconnection occurred. John Thomson, who at that time was in charge of System Control, was given the task of closing up the final circuit breaker to connect the power system of South Australia, with that of Victoria, for the first time. At the precise moment that John threw the switch to energise the line, a System Control Officer flicked another switch nearby, that immediately doused the Control Centre lights. One can only imagine the impact that that would have had on John's recollection of the moment. It was a typical example of the light-hearted camaraderie that existed within the ETSA family.[17]

The control of power flow across the interconnection was critical for economic performance and power system security. The responsibility for implementation of systems for the management of power flows nested in System Control. During preparations for the interconnection with Victoria, the System Control Centre was enlarged and refitted to accommodate computer-based control facilities, and a project was commenced to interface all main and sub-transmission substations, at a total cost of about $10 million. Software applications were developed in-house to facilitate interstate and intrastate energy production, trading and settlement processes, linking data for the first time, from the real time control, business systems and operational planning computer systems. The installation of the leading edge computerised Supervisory Control and Data Acquisition System (SCADA), replacing the hard-wired systems of the 1950s and 1960s, and 1980s generation control, was to provide the basis for unlimited expansion and real-time network analysis tools, maintaining the business' previously attained reputation for innovative power system control capabilities. It was a time of considerable duress for System Control Officers, who were required to undertake extensive training in the technical features of interconnected system operations and the commercial aspects of interstate energy trading. As well, System Control Officers were also managing ongoing power system control operations and network switching, at times surrounded in plastic sheeting to reduce construction noise and dust levels, in the period leading up to the commissioning of the interconnector.

Commencement of ETSA restructuring

While the commissioning of the interconnection marked an important phase in the growth of ETSA's skills in the delivery of transmission services, there were enormous changes occurring behind the scenes. In May 1988, Leon Sykes retired as ETSA's General Manager and in his place was appointed Robin Marrett. For the first time, a person with no history in either ETSA or the electricity supply business became the Electricity Trust's Chief Executive. Marrett, whose own managerial experience had

taken him around the globe with a major oil company, had a fervent belief that public utilities had to walk in step with their customers and to constantly monitor the demands of their market.[18] To achieve these aims, Marrett instigated a major reform programme designed to increase efficiency within the business and reduce costs. Marrett found at ETSA 'a typical public sector, technical product oriented organisation'.[19] Although ETSA carried little debt, Marrett perceived other problems: a lack of forward planning; high electricity tariffs; financial returns on assets were low; the organisation was highly centralised, and management performance was never adequately assessed.[20] He, therefore, saw his task as guiding the organisation into a new, vibrant era of reform, with a focus on the 'light on the hill'.[21]

Part of this reform of ETSA involved a change in the manner of organising the activities of the enterprise, as well as achieving a significant reduction in staff numbers. The latter caused consternation to many long-term employees; but the re-arrangement of activities really assisted in preparing ETSA for a changing world. Ex-employee John Burgess believes that:

> … with the introduction of this new culture, one really had no choice but to change, especially as our business process knowledge was ageing. I mean, I know that's a very negative way of looking at the reforms, but for many, the old ETSA culture was so deeply ingrained, it was difficult to move ahead and push into new unexplored realms.
>
> Robin Marrett was the first 'imported' General Manager that we had and many found this hard to accept, as all our General Managers had grown up in the organisation. It didn't matter whether one was a junior power station engineer or the General Manager, there was always a common bond in

John Burgess
ElectraNet SA

> completing a job well. I never found it difficult to talk to the General Manager or any of our senior managers, because we had shared parallel paths, and often worked in the same areas together. But when the reforms came, it was really unsettling to some of us.[22]

Despite the difficulties with acceptance by some of ETSA's older staff, Marrett's job was to prepare the Electricity Trust for the obvious changing nature of the Australian electricity supply environment.

Barry Foster
ElectraNet SA

By 1989, after an extensive business effectiveness study by external consultants, the first phase of the reorganisation was completed and the notion of a 'supply' section of the business incorporating transmission, interconnection and power system development was put into practice.[23] It was merely one small step. By 1991, the emphasis had changed and customer services and supply (retail and wires) were bundled together.[24] Then, during 1992, a 'generation and transmission' division was established under Don Gellard, and Kym Tothill was appointed to manage the power grid, the System Control Centre and the 275kV transmission network assets. Marrett termed this a simplification of the organisation, as it was the initial attempt to create a separation between components of the electricity industry that were being identified as the major business units, or building blocks, of the future electricity supply activity.[25] Two years later, the transmission business had been established as a separate division, which was responsible for the 275kV and 132kV network, in addition to electricity production planning and System Control.[26]

As Barry Foster (previously Executive Manager Transmission Operations) recalls:

> The fire at Torrens Island in 1985 and commissioning of the Northern Power Station in the mid-1980s, followed by the development and implementation of the interconnection operation and trading arrangements with the eastern States, was an extensive period of challenge and change for System

> Control. No sooner had we made the transition, than here we were totally reorganising the place, and really changing the values and direction of our business and the industry.[27]

Barry Foster and Phillip Webb (Executive Manager Operations) agree that through 1989 and 1990, a significant amount of restructuring of ETSA occurred, which laid the foundation for reform of the electricity supply industry in South Australia. Phillip Webb continues:

> The main change was the pursuit of self-contained business units, purchasing and selling services to achieve a viable commercial financial outcome for each entity. With this concept of asset ownership being introduced, each part of the business required an owner whether it was a power station, a transmission line, or part of the distribution system. Up until that time, we were all operating the electricity supply business together.[28]

Bob Stam (ElectraNet SA's Executive Manager Customer Development and Regulation) notes that it was the interconnection with the transmission system of the eastern states, that drew ETSA into the concept of a National Electricity Market. By 1992, he states, ETSA's power system operations and planning people were heavily involved with equivalent groups from New South Wales and Victoria, as part of the combined management of the interconnectors and energy transfers between each of those States. It was from this base that the national grid management strategy was developed. 'As soon as they started developing the Code of Practice', says Stam:

> … the electricity industry structures were being formulated. In 1992 four basic building blocks were clearly identified – there would be a generator, a transmitter, a distributor and a retailer … perhaps ETSA may have been slower than those in the eastern States to completely understand the speed that the industry was being re-shaped within Australia.[29]

Bob Stam
ElectraNet SA

Pages 68,69 and 70: Transmission crews at work – their skills entail using state-of-the-art equipment and techniques
ElectraNet SA

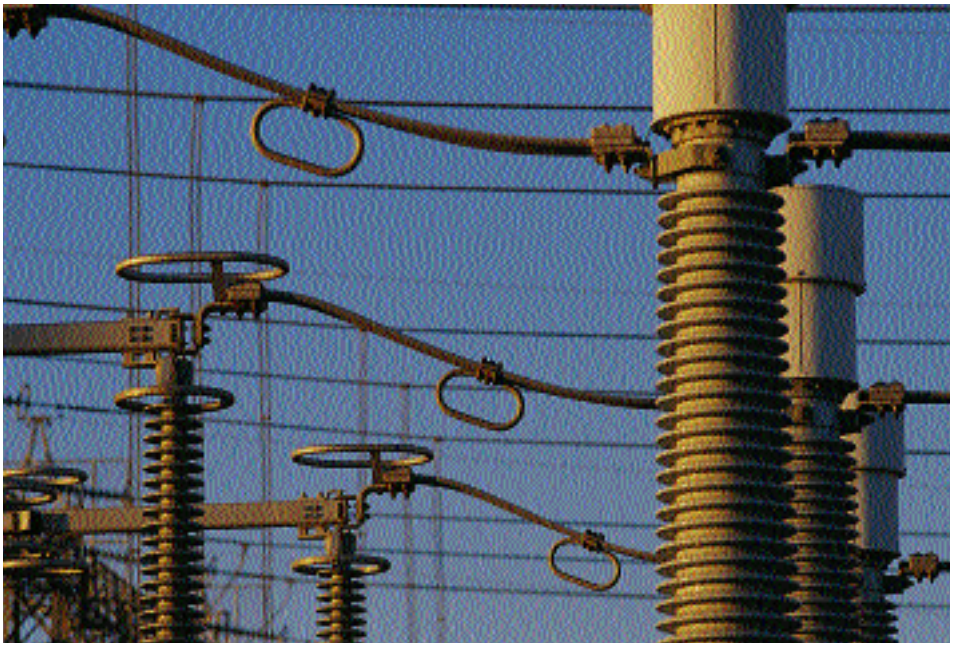
It was really not until after the corporatisation of ETSA in 1995 – following the arrival of a new external ETSA General Manager appointment (Clive Armour) – that a clearer picture of the impact of the proposed National Electricity Market emerged.

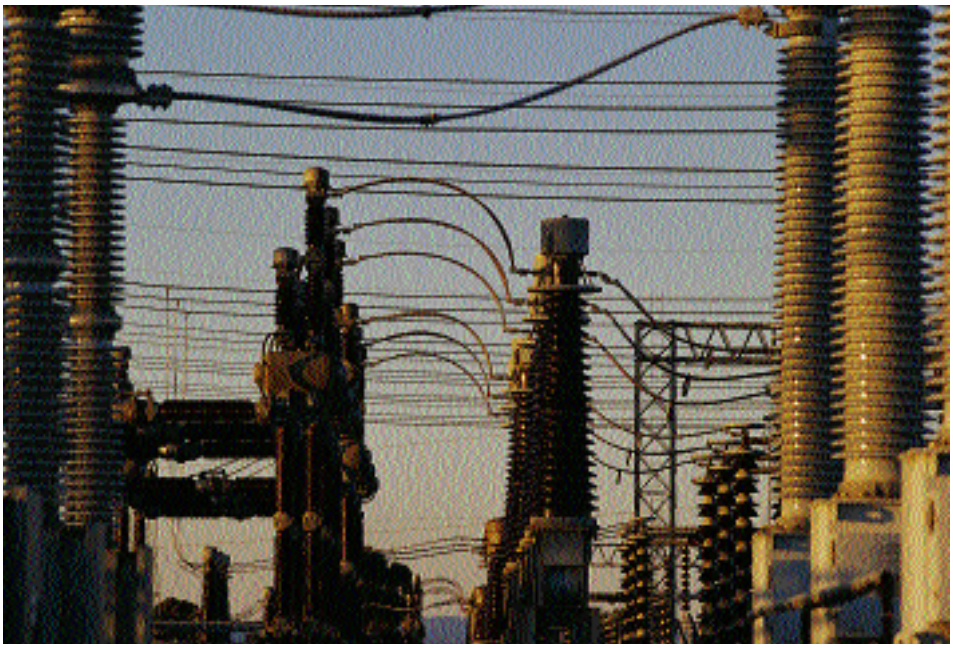
National Electricity Market

The move towards a stand-alone division of ETSA devoted only to transmission was directly linked to the evolution of a National Electricity Market (NEM). First, as has been described, came the Zeidler Report and its recommendations. Then, in 1983, Australian Premiers had discussed the notion of a national electricity grid.[30]

While most of these discussions were overridden by the politics of the time, the one sustainable project that eventuated was the interconnector between South Australia and Victoria.

In 1991, a National Industry Commission Report proposed the reformation of the State-based electricity industry to a competitive National Electricity Market. It recommended that the Government-owned electricity industry be made more commercially focused and that it take on a corporate structure with the view to eventually being privatised – a notion that had been anathema to the industry and the incumbent State Government for years. Other sweeping reforms (such as corporatisation) – in line with those adopted by former Government agencies such as Qantas, Australia Post and





PAGES 71 AND 72: THE FUTURISTIC SHAPES OF HIGH VOLTAGE TRANSFORMER BUSHINGS AND CIRCUIT BREAKERS – PART OF THE SUBSTATION NETWORK THAT 'STEPS DOWN' VOLTAGE FOR DISTRIBUTION TO CUSTOMERS
ELECTRANET SA

Telstra – were also mooted. A wide ranging report, it pushed the concept of a privately owned electricity market to new limits.[31]

At a Premiers' Conference in July 1991, this reformist agenda was taken one step further. At that meeting, two crucial issues were decided – the reform of the electricity industry and the introduction of national performance monitoring of Government Trading Enterprises, of which ETSA was one. Also, it was agreed that a National Grid Management Council (NGMC) be created to 'encourage and co-ordinate the most efficient, economic and environmentally sound development of the electricity industry in eastern and southern Australia'.[32]

Step by step, the reformation of the electricity industry proceeded. Pushed by Prime Minister Paul Keating's desire to achieve significant industry reform, 'the restructuring continued', as one commentator put it. It was certainly a time of upheaval and uncertainty.[33] By 1993, consultative public forums were being held to inform electricity consumers and businesses of the industry reform progress and to gauge responses.[34] In June of that year, the States agreed to support the Federal Government's acceleration of the reform process.[35] There was now no doubting the impetus for the move towards a competitive National Electricity Market. John Welford, an active participant in ETSA's planning for the proposed market, along with the likes of Don Gellard, Colin Taylor (Power System Planning) and Kym Tothill, described the development path:

> The National Grid Management Council was subsequently established to oversee the development of a process for a more co-ordinated electricity reform approach between States. The Commonwealth had always been keen on actually promoting a market-driven approach, and they increasingly successfully managed to influence this agenda. A national working party was convened to investigate the arrangements for transmission and whether there should be independently owned transmission systems or whether there should be a single national grid and how it should function. The eventual report made clear that the owners of the grids

should be required to operate in a manner which made it, effectively, a single grid, but with a range of separate owners. The National Grid Management Council then decided that the use of the grid, and the pricing for the use of the grid, was a fundamental component of any competitive electricity market arrangement. There was another national working party set up to look at how the costs for using the actual transmission system should be developed. A range of possibilities were considered and a solution reflecting a user pays system was endorsed.

Similar consultation resulted in the endorsement of a real-time pricing market for electrical energy, and the unique concept of a National Electricity Market Management Company (NEMMCO), to act as both the electricity market manager, and also, to be the independent system operator to manage both the energy trading and the security of the power system. As soon as NEMMCO was in position to take over the co-ordination of the preparations for the National Electricity Market, the National Grid Management Council was to be phased out.[36]

However, in South Australia in 1995, there was still a degree of uncertainty about how far ETSA should be divided up, so the Industry Commission was invited by the State Government to conduct a full review of the future directions for South Australian electricity industry. The Review concluded that there was a clear need to establish a completely disaggregated transmission and distribution business, and have at least two or three generators in this State promote supply-side competition. The State Government at that time was not fully convinced, and decided not to immediately adopt fully the recommendations of that Review. A minor restructuring to promote a more efficient and competitive environment in South Australia was implemented nevertheless. As a further compromise, from 1 January 1997, the generation entities were totally separated out from ETSA and placed into one company – the South

Australian Generation Corporation. As time progressed, even that was not seen by customers outside ETSA to be adequate for the promotion of effective competition in the South Australian electricity sector. In order to satisfy the National Competition Commission framework for the impending National Electricity Market, a structure providing for the clear definition of three separate generators, a separate transmission entity, separate distribution entity with a potentially separate electricity retail entity, and a separate gas trading business was eventually proposed by the South Australian State Government.[37]

By early 1997, a critical phase of the National Electricity Market was implemented with limited electricity trading between Victoria and New South Wales, which saw the entire Australian electricity industry positioning and restructuring to ensure their place in this new national electricity marketplace.

Transmission and independence

On reflection, ETSA had effectively been undergoing preparation for the proposed new national competitive market for some years. Robin Marrett's emphasis on a customer-oriented organisation with a commercial outlook was very much in keeping with the reforms envisaged by the Commonwealth Government. As Marrett was fond of stating, 'If you don't do it yourself [change into a more efficient organisation] you'll have it done to you'.[38] A change of Government in South Australia in 1993, an Audit Commission Report, and the passing of the Electricity Corporations Act in 1994 began the next move towards the establishment of the ETSA Corporation, which was, itself, to be broken down into a number of business units, one of which was the Transmission business.[39]

At the time of its fiftieth anniversary in 1996, ETSA was still at a stage of responding to the forces of change, along with the rest of the Australian electricity supply system, pushed along by Governments and the major electricity consumers who had expectations of significant price reductions arising from the structural changes. Already, ETSA had passed through the refiner's fire, had witnessed massive reductions in staff

Transmission Corporation Management Team, 3 July 1995: Kym Tothill (General Manager Transmission); Joe Juchniewicz (Transmission Assets Manager); Barry Foster (Manager Market Operations); Paul Muller (Manager Business Services); Greg Rice (Manager Transmission Service); Graham Vincent (Manager Special Projects); Phillip Webb (Manager System Operations); Bob Stam [not in picture] (Manager Transmission Planning)
ElectraNet SA

numbers, the complete breaking up of the old organisation, and the establishment of a new corporate identity.

Bob Stam looks back at the break-up of ETSA from 1995 and the move towards separate business corporations and notes:

> The transmission business was basically set up during 1995 and we all started working towards what it was going to be: an independent transmission authority in accord with the National Electricity Code requirements. In 1995 Kym Tothill had selected a core group of people, with very similar views. Their central objective was to create a responsive and cohesive transmission authority capable of operating successfully in the impending National Electricity Market.[40]

From 1 July 1996, ETSA Transmission Corporation, as a separate subsidiary of ETSA Corporation, stood at the verge of yet another new era of challenge.

~ *Into the Future* ~
1996 – 2000

From Electricity Trust to ETSA Corporation

At the beginning of 1996, ETSA had just passed through what seemed to be the most tumultuous phase of its fifty-year history. The inevitable onset of the National Electricity Market (NEM), the major internal reforms, and the external pressures of the State and Federal Governments had seen the development of an entirely new, commercially focused entity. ETSA Corporation, created through a Government Act of 1994, was now the umbrella for a group of separate business organisations that included ETSA Transmission Corporation.

Transmission towers blend into a foreground of rural beauty, near Birdwood, in the Adelaide Hills
ElectraNet SA

An important change that the re-appraisal of ETSA Corporation's structure had brought about, as a result of the approaching NEM, was that ETSA Transmission had taken over direct financial responsibility for the management of assets and liabilities for the 275kV and 132kV networks. Additionally, it was responsible for the power station 66kV switchyards and any 66kV interconnections between those switchyards and the main transmission network. The South Australian commitment to the onset of

Anthony Smith
ElectraNet SA

the new electricity market was demonstrated in a $10 million project for new metering arrangements to track customers and measure energy movement on the electricity transmission network for the competitive market.[1] The activities of the transmission business had at this stage been transferred to the ETSA buildings at East Terrace and Pirie Street.

Those involved with ETSA Transmission during this time of 'disaggregation' – that is, of the establishment of discrete companies without the old contacts of ETSA – saw important changes. Ex-employee Anthony Smith (previously Transmission Assets Auditor) and Roland Schulz noted that ETSA Transmission actually evolved in a climate of political necessity.[2] Barry Foster (previously Executive Manager Transmissions Operations) and Phillip Webb (Executive Manager Operations) agree that the biggest change in the move from ETSA to ETSA Transmission was the creation of those enterprises as external companies that owned different parts of the power system.[3] It was, they conclude, 'a cultural shift from stewardship to ownership'.[4] As a result, System Control was ring fenced within ETSA Transmission as the independent market and power system operator to manage formal commercial agreements, and electricity trading processes were established to replace the previous co-operative arrangements.

Greg Rice
ElectraNet SA

Greg Rice (Executive Manager Engineering and Construction) and Alex Wyschnja (Project Manager) commented that ETSA Transmission still managed to keep much of the personal, human touch of the previous ETSA. They argue that the new organisation was full of people with a 'can do' attitude: 'we had a business to establish and being pro-active was a key focus'.[5] There was a sense, they contend, in which the creation of ETSA

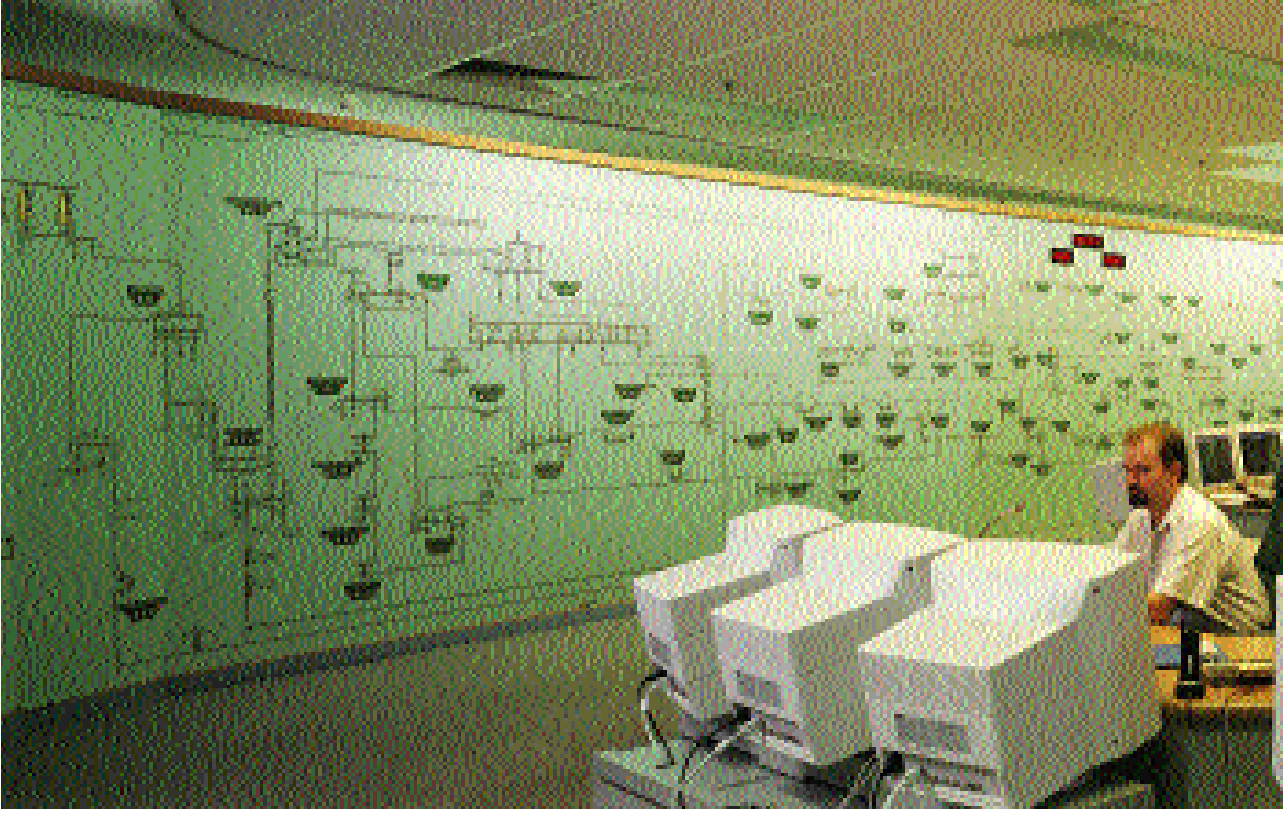
Transmission provided the 'freedom' to investigate new ideas and new approaches for the business.[6]

By 1997–98, ETSA Transmission had become a tight-knit unit. A 'regulated monopoly business', it was 'responsible for the management and development of the high voltage network assets and for service delivery to directly connected customers in South Australia'.[7] The company was involved in an international benchmarking study to analyse costs for operations and maintenance – research that concluded that its maintenance management practices were amongst the best in the world. The development of the transmission network was further expanded as customer demand in South Australia continued to grow, with the establishment of major new substations and lines. The onset of the NEM and associated transmission access arrangements effectively blocked an agreement for ElectraNet SA to be involved in the construction of a 275kV interconnection system with New South Wales in 1998; however, additional major transmission work was constructed by ElectraNet SA during this period to connect new generating plant at Port Lincoln, Ladbroke Grove (Penola West) and Pelican Point (LeFevre Peninsula), to satisfy the ever increasing demands of the South Australian electricity customers.

Alex Wyschnja
ElectraNet SA

NEMMCO and the start-up of the National Electricity Market

The origins of the NEM were much to do with the political necessities of the age. It was planned that the Market would 'introduce competition in the wholesale supply and purchase of electricity … [that would, in turn] promote a more flexible, cost effective and efficient electricity industry with the ultimate objective of delivering lower electricity prices to business and the general community'.[8] ETSA Transmission management had anticipated the steady move from State to Federal regulation of the NEM and were ready for its inception.



System Control Officers watch over the workings of South Australia's electricity supply network
ElectraNet SA

Barry Foster and Phillip Webb describe the lengthy process in the early days of the NEM, following the break-up of ETSA and the formation of ETSA Transmission:

> After the decision to implement a competitive wholesale electricity market the development of a National Electricity Code was required to support the proposed network access and electricity trading arrangements. The NEM was a long time in coming. Development started in earnest, in 1992. In 1994 the NEM 'paper trial' was undertaken to test the impact of the new rules and the official national competitive electricity market start occurred on 13 December 1998. The advent of the NEM had tremendous impact from the point of view of the control of the South Australian power system. Previously System Control was relatively autonomous and had overall control of the power system in South Australia. Under the NEM, the market operations, generation dispatch and power system security were to be undertaken by

NEMMCO in accordance with the National Electricity Code. The role of the System Control Centre has since changed, to focus on the management of operational risks for ElectraNet SA in meeting contractual and regulatory obligations for the delivery of transmission services. Many of the previous power system operational activities are now undertaken as an agent to, or in response to, NEMMCO requirements, or in accordance with the arrangements for contracted services that are provided for the various other asset owners (generators or distributors). These organisational authority changes require a change in culture, and the traditional engineering oriented skills need to be supplemented with skills in the areas of commercial, legal, risk management, liabilities and contracting – to cope with the deregulated, competitive market environment, while still being capable of handling any emergency situation on the power system in South Australia.[9]

Kym Tothill
ElectraNet SA

In August 1998, Kym Tothill, who had been General Manager of ETSA Transmission Corporation, was subsequently appointed Chief Executive of the 'separated' transmission organisation in preparation for its launch into the NEM. Then, in October 1998, ETSA Corporation effectively ceased operating as a centralised entity and its disaggregated business units (transmission, distribution and electricity retailing) took over its previous accountabilities. At that time, ETSA Transmission Corporation became known as ElectraNet SA.[10] A Board was appointed to oversee the operation and management of the ElectraNet SA business, comprising David Lindh as Chairman, and David McNeil, Clive Hall and Kym Tothill as Directors. On 13 December 1998, ElectraNet SA commenced operation as a 'regulated monopoly transmission network owner and operator in the new competitive National Electricity Market environment'.[11]

Innovation

From its inception, and partly because of the foresight of its management, ElectraNet SA had a penchant for innovative solutions to complex business, maintenance and construction problems. Having come to grips with its competitive environment, ElectraNet SA very quickly took on the concept of 'managing the assets and bringing in the services' necessary to maintain them.[12] The business has taken this notion a step further. Through its programme of strategic alliances for major capital works, it has pioneered an approach to new electricity infrastructure developments.[13]

ElectraNet SA staff are enthusiastic about these initiatives. Greg Rice and Alex Wyschnja comment again on how well the new structure

Four views of the ElectraNet SA team – (above): Tony Billett (Senior Field Officer) briefing Rachael Tomlins (Media and Communications Officer) on line maintenance issues on the 275kV transmission system; (page 84 top): Meredith Murdy, left (CEO's Executive Assistant) and Mandy Evans (Receptionist) in the foyer of ElectraNet SA's Corporate Headquarters; (page 84 bottom): Kathrine Hinze, left (Technical Support Engineer) and Carolyn Wilson (Substation Management Support Officer) conducting a routine substation maintenance check; (page 85): Matthew Napolitano (Graduate Engineer) Conducting transformer gas-in-oil diagnostic testing through an on-line monitoring system installed by ElectraNet SA
ElectraNet SA

has worked and how it has provided creative results in a number of areas:

> An innovative approach for ElectraNet SA operations has been adopted whereby all of our construction maintenance services are contracted. There is no other electricity transmission organisation in Australia at the moment that has adopted this model, but ElectraNet SA's success will undoubtedly change that.


Elect
Net SA
transmission network

Anthony Smith, left, (Transmission System Auditor) and Maria Christou (Environmental Co-ordinator) inspecting a substation storm water retention facility
ElectraNet SA

ElectraNet SA has established an alliance contract with a construction and engineering company for carrying out some of its construction works – the first that has been performed by any part of the electricity industry in Australia, or indeed by any Government enterprise in South Australia. ElectraNet SA is searching for and pinpointing new technologies and application developments which provide the freedom to canvass broader industry to select the most cost effective organisation that embraces best practice and efficient methodology.[14]

Others at ElectraNet SA speak equally enthusiastically of the organisation's ability to initiate new approaches. Anthony Smith, for

Sunrise at Mount Barker, South Australia, covering a section of ElectraNet SA's triple circuit transmission system
ElectraNet SA

instance, notes the advances made in the installation of high quality metering equipment.[15] Others recall the introduction of a computer-based system to handle emergency call-out numbers,[16] and to implement the most up-to-date methods of radio telecommunications.[17] ElectraNet SA is recognised as an industry leader in South Australia for the implementation of market and operational information systems to support technical and commercial operations in the NEM. Additionally, ElectraNet SA's Technology Services Division provides a range of state-of-the-art specialist laboratory and field testing services for companies with high voltage systems and plant. Indeed, optimisation of asset life and providing early warning of impending failure of high voltage plant is a high priority. Nevertheless, even with all the changes in its approach to the management

ElectraNet SA, Board of Directors. Left to right: David McNeil, Kym Tothill, Clive Hall and David Lindh (Chairman)
ElectraNet SA

of its business, personnel safety is still the highest priority.

In relation to its transmission network, ElectraNet SA continues to deal with the inevitable environmental influences that are beyond its control. Just as it happened 20 years earlier, a severe wind storm passing through the mid-north of South Australia, in early December 1999, demolished four 275kV transmission towers and flattened 22 poles of one of the 132kV transmission lines. The impact on the electricity consumers was negligible and the repairs were completed before the peak of summer electricity demand.

A world of private ownership

The outcome of the disaggregation of ETSA Corporation had been the preparation of the subsidiaries, like ElectraNet SA, for sale or leasing into







ElectraNet SA, executive management team: Gavin Brennan (Executive Manager Asset Maintenance); Greg Rice (Executive Manager Engineering and Construction); Bob Stam (Executive Manager Customer Development and Regulation); Vicki Brown (Executive Manager Corporate Affairs); Phillip Webb (Executive Manager Operations); Ian Stirling (Executive Manager Finance and Administration) and Barry Foster (previously Executive Manager Transmission Operations); Kay Nolte, not pictured, (Executive Manager Information Systems)
ElectraNet SA

the private sector by the South Australian Government. This followed the privatisation announcement by the State Premier, John Olsen, on 17 February 1998. Barry Foster and Phillip Webb believe that leasing of the business provides a unique opportunity to show the staff's 'innovative skills' and the ability to adapt. Any new owner will readily see a well-structured business, with valuable people who have quality systems implemented for managing and operating the South Australian transmission assets.[18]

Greg Rice and Alex Wyschnja also have the sense of impending challenge. They describe the future in the following terms:

> The move to new ownership will bring new challenges. It is an exciting time. Part of our agenda will be to deliver our new infrastructure projects at the best possible price – given the appropriate quality and standards – so that it really enhances the value of the business in the future. That is where the business is already heading. ElectraNet SA's major asset is its people, who are of a very high calibre and extremely competent. They are much sought after in the electricity industry.[19]

ElectraNet SA is entering another phase of major change – perhaps the most important turning point in the history of South Australia's electricity supply industry. Just as the pioneers of AESCo struggled to establish a reliable electricity supply network around Adelaide, and later, in the post-Second World War boom, when ETSA set out to rapidly extend the electricity supply across the vast expanse of South Australia, so now, too, ElectraNet SA is primed to pioneer new ways of managing the South Australian transmission network as a private business in a new competitive environment. Its people are part of a strong, enduring heritage, and remain extremely capable of planning for, and contributing to, the future growth and prosperity of South Australia.

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[5] Linn, *ETSA*, pp. 77–80.

[6] *Adelect Magazine*, December 1950, p. 2.

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[8] ibid., August 1953, pp. 15–16.

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[10] L. Francis interview with P. Burgess and K. Shrubsole, 29 November 1999.

[11] R. Linn interview with K. Shrubsole, 20 March 1996.

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[21] ibid., April 1978, p. 13.

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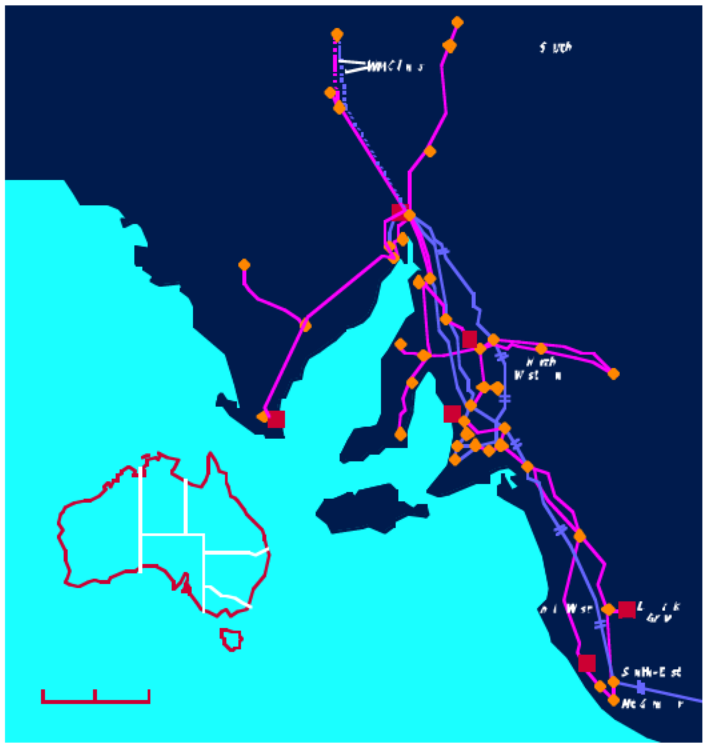

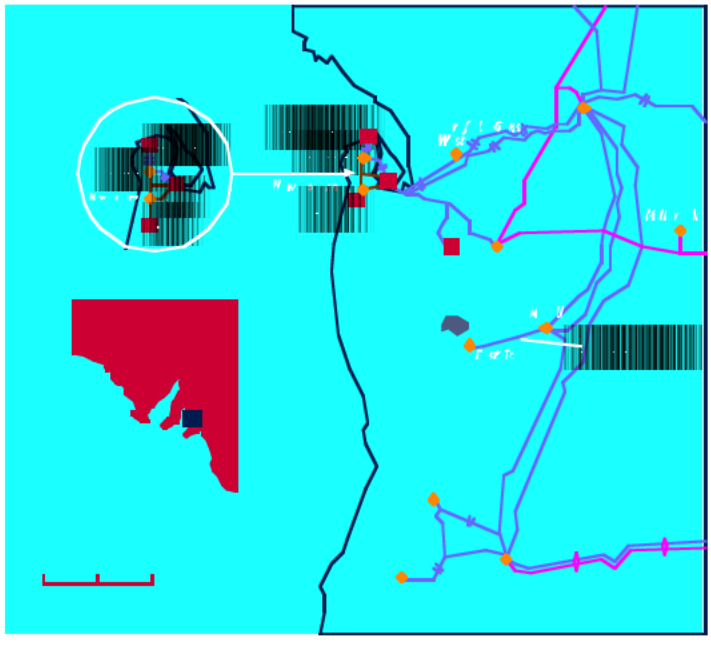

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Bob Stam.
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