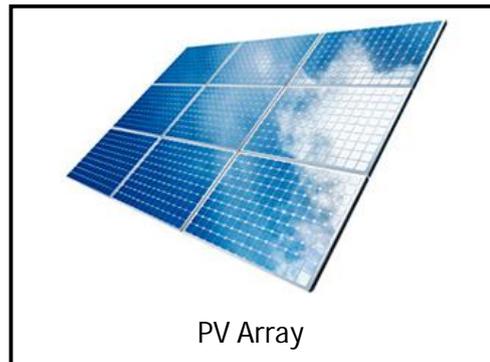
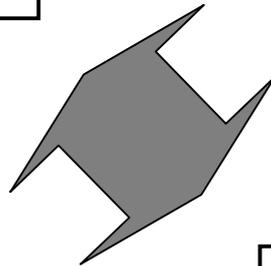
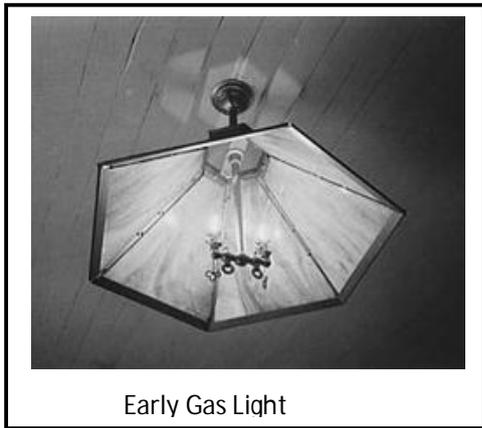


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**"Shaping the Future - Learning from the past"**



**By Ir. G. Richard Gibbons** BSc. (Hons), Dip BA, Cert Co Dir; FIET, C.Eng (UK); FIPENZ, CPEng (NZ); Int PE; Life M.EEA; FNZIM ; C.MInstD

**Managing Director, LineTech Consulting Ltd**



## 1. Introduction:

In the immediate past we have seen many articles, speeches and debate from the power industry on the disruptive technology the industry currently faces. Emotive claims (such as the poor will subsidise the rich) over the impact of photovoltaic's (PV's) and battery storage coupled with lobbying to maintain profitability on investments appear to assume that the present industry is structured in the most logical and efficient arrangement and is deserving of protection from new competition.

The term **disruptive technology** was coined by professor Clayton M. Christensen from Harvard Business School in his 1997 best-selling book, "The Innovator's Dilemma"<sup>1</sup>. Christensen separates new technology into two categories:

Sustaining technology - relies on incremental improvements to an already established technology. (LED Lighting could be put into this category).

Disruptive technology - lacks refinement, often has performance problems because it is new, appeals to a limited audience, and may not yet have a proven practical application (PV's fall into this category - although they do clearly have a practical application).

Christensen argues that large corporations are designed to work with sustaining technologies. Conversely, they have trouble capitalizing on the potential of disruptive technologies, because it does not reinforce current company goals.

This paper starts when Electricity was the disruptive technology and examines the structure of the industry from this time to the present against the prevailing political climate. In other words how society impacted on the electricity industry. From this it may be possible to project a better plan for the future. Examples are drawn from the UK, the USA and NZ.

## 2. In the beginning: - There was Gas!

The gas industry had started in the UK with the first house lit by gas in 1792. (This was gas produced by the reduction of coal to coke). The world's first public gas works opened in Westminster in 1813. Gas lighting quickly became very popular and within 15 years, almost every large town in Britain, Europe, North America and beyond, had a gas works. These were predominantly private capital ventures.

The main "product" sought by the buying public (including public institutions such as councils) was "light", the bright burning gas flame transforming everyday living. By 1826, almost every city and large town in Britain had a gas works for lighting the streets as well as public buildings, shops and larger houses. By the last quarter of the 19th century most urban working people could afford to light their homes with gas.

The gas companies behaved as the monopolists they were, the quality of the product was often poor and some charged penalties for daytime use as it upset their build-up of gas for the evening peak.

## 3. The coming of Electric Light

The gas infrastructure was in place, franchises had been granted, and manufacturing facilities for both gas and equipment were in profitable operation. Also, people had grown accustomed to the idea of lighting with gas. Into this, the new disruptive technology of electric light entered.

The first challenge was in public lighting with arc lamps - however it was not until the filament light bulb was available<sup>1</sup> there was a real threat to the Gas industry, however in the USA, gas stocks began to fall in price even before Edison demonstrated a working lamp!

The response to the electric challenge by gas companies in the USA was to consolidate and raise their prices. An article in Harper's Weekly entitled "The Tyranny of the Monopolies,"<sup>ii</sup> noted "They make just what gas they please, charge what they want for it, and slap the customer's face, so to speak, if he dares to protest against either the quality or the price." Customers responded by getting state intervention to reduce the tariffs.



Swan & Edison Demonstration lamps

However, whilst trying to preserve their revenues, gas companies did respond with two major advances. The first was better quality gas, the second was the incandescent mantle, both innovations resulted in brighter, more efficient light.

Over time the gas companies realised that they could not compete for Lighting, but diversified into home appliances-such as stoves, water heaters, and furnaces continuing to trade successfully.

#### 4. The Early Political Scene<sup>2</sup>:

It is interesting to look at the generally prevailing political mood of the countries at the time of the establishment of the early electrical supply companies.

In the UK in the late 1800's the Liberal party was in power, generally a reforming group, but run by the landed gentry and the well-off. Workers (Labour) were not yet organised.

Most of the early electrical supply companies in the UK were stock companies with private individuals and families investing in them. Joint stock companies dated back to the 1700's. i.e. Private enterprise established the UK supply industry.



Reefton Power Station 1904

In the USA during this period the Republican party held sway, with its support for free market capitalism, free enterprise, and business. Hence private enterprise was again the norm.

In NZ the liberal party was in power, However history indicates that it was more of a "Richard Seddon" party such was his influence and control. However, the first installations were again privately funded starting with the original Reefton hydro power station<sup>iii</sup>.

<sup>1</sup> Demonstrated by Swan(UK) and Edison(USA) in 1879

<sup>2</sup> Of necessity the comments on the political scene are fairly overarching and general. The interplay of political parties in most counties, requires volumes of books, not a few paragraphs!

## 5. Moving Forward:

The advantages of electricity were soon realised by the general public and installations grew rapidly. The establishment of the first power stations remote from the users (such as the Niagara falls hydro station in the USA and the Deptford Power Station in London) showed the way forward.

In the UK local supply was originally by private companies, but it soon attracted interest from the Municipal authorities. The first such undertaking appears to be the London Borough of Hampstead<sup>iv</sup>, opening a power station in 1894, supplying private consumers and the public street lamps.

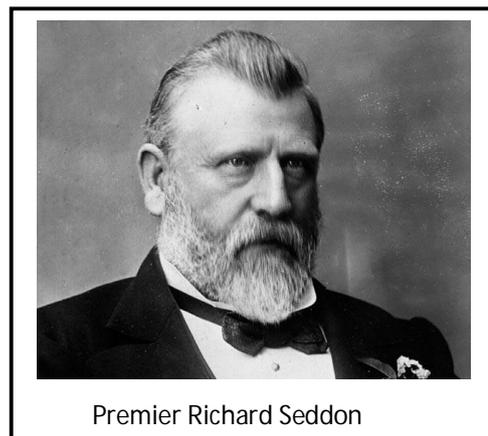
In the USA the private ownership model continued to generally hold sway

In New Zealand local government was quick to look at establishing their own supply arrangements, for example by 1903 the Christchurch City Council established a small scale public supply of electricity.

The major difference to the UK and the USA was the introduction by Premier Seddon in 1896 of legislation to prevent the development of electrical power generation without government permission<sup>3</sup>. This was followed by the passing of the Water Act 1903 which gave the Crown the right to use all water for generating electricity, with the establishment of the Hydro-Electric Branch of the Public Works Department in 1911<sup>4</sup>.

This served the country's energy needs well, as it encouraged the creation of a national system. In 1903 and 1904 detailed surveys of the total theoretical capacity that could be built in NZ were carried out this was several times our current peak demand<sup>v</sup>.

Richard Seddon was at the height of his reign and his political background had developed from his early representation of the miners, thus whilst he was nominally in the liberal camp, by the late 1890's he fully supported the idea of 'state socialism'. This political viewpoint can clearly be seen in the NZ power industry both then and in the future.



Premier Richard Seddon

In the USA the politics appear to have less impact on local reticulation although co-operative ventures became a popular way of getting power to remote farms<sup>5</sup>.

## 6. The first half of the 20th Century:

In the UK the rapidly growing demand for electricity was met by the mix of private enterprise and Municipal government. Before nationalisation in 1948 there were over 300 supply organisations in existence. At the national level the government realised in 1925, that Britain had an inefficient and fragmented electricity supply industry and after study passed the Electricity (Supply) Act 1926, which recommended that a "national gridiron" supply system

<sup>3</sup> Central government regarded water as a public resource. In the 1890s they prevented a private scheme for the Huka Falls.

<sup>4</sup> This became the State Hydro-Electric Department in 1946 and the New Zealand Electricity Department in 1958.

<sup>5</sup> Some were very co-operative - until the advent of remote read meters it was quite common for the farmers to read their own meters and send the data to the co-operative with no check readings for years.

be created. The 1926 Act created the Central Electricity Board, which set up the UK's first synchronised, nationwide AC grid, running at 132 kV, 50 Hz<sup>vi</sup>. At this time the UK government was a conservative one, but creating a national grid was seen as helping existing ventures, both public and private.

In the USA all ventures struggled to meet the rapidly rising demand and various transmission schemes were built to interconnect power plants and supply networks.



In New Zealand the path established at the turn of the century was firmly followed. To provide power outside of the immediate municipal areas the Electric Power Board Act of 1918, was passed.<sup>6vii</sup>. The political power at this time was the conservative reform party under William Ferguson Massey. It was a "farmers party" and the creation of the Power Boards would aid the rapid growth of distribution into farming areas.

The underlying philosophy continued into the Rural Electrification fund which saw a direct charge on existing customers (i.e. urban areas) to subsidise the installation of distribution to rural areas, the economics rarely entered consideration.

## 7. Mid 20th Century:

It is in the UK that this period is of greatest interest. The election of the labour party after WW2 saw the major push for nationalisation across many aspects of the UK. Whilst the underlying push was clearly philosophical it was also a very pragmatic solution to some of the leftover headaches from the war years. The government had effectively taken control of many industries - and faced huge levels of compensation for their use (and abuse) which, by nationalisation, was avoided.

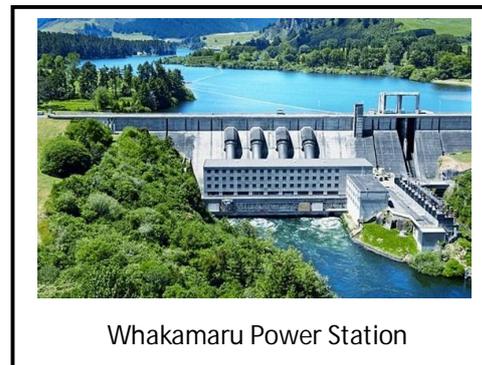
In the case of the supply industry there appeared to be strong public support to sort out the 300 plus companies involved. A single Generator and Grid owner (the GEGB) was established and distribution was placed into 12 geographically based areas. Support was particularly strong from the ETU (Electrical Trade Union) which represented nearly all "workers" in the industry as they were a strong communist body and saw nationalisation as part of their greater plan to take over the UK<sup>viii</sup>.

The USA continued much as before and will not be referenced any further.

In New Zealand the focus was on meeting the massive growth in demand after the delays caused by WW2 in constructing of new generating stations. It is of note that the UK settled on 12 boards, but New Zealand then had over 90<sup>ix</sup>.

## 8. Later 20th Century:

In the UK Conservative Party leader Margaret Thatcher came to power after many years of creeping nationalisation under Labour. As noted in her memoirs, Lady Thatcher saw

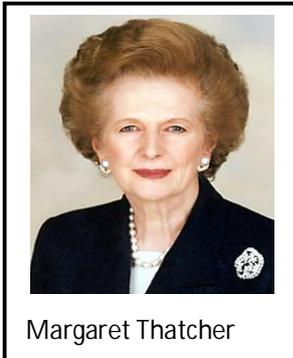


Whakamaru Power Station

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<sup>6</sup> NZ favoured creating special-purpose authorities including 32 harbour boards, 180 rabbit boards as well as for milk distribution, fire fighting, water supply, urban drainage and transport, soil conservation and rivers control, nassella tussock control, land drainage, and underground water usage.

privatisation as “fundamental to improving Britain’s economic performance”, which reflected her political ideology. “It was one of the central means of reversing the corrosive and corrupting effects of socialism,” she declared, adding: “Just as nationalisation was at the heart of the collectivist programme by which Labour governments sought to remodel British society, so privatisation is at the centre of any programme of reclaiming territory for freedom.”<sup>x</sup>



The boards were renamed Regional Electricity Companies (REC's) and privatised in December 1990, followed by the privatisation of the CEGB’s non-nuclear generation. The national grid followed later.

Privatisation spread throughout the world. In New Zealand this started under a Labour government. The reform of the power industry in NZ was more drawn out for the power boards with reform started by Labour Government and completed under National.

However, things did not rest there. In April 1998, the Minister for Energy Max Bradford announced a reform package for the electricity industry<sup>xi</sup>. The first change was to split up Electricity Corporation of New Zealand. The second was intended to increase retail competition by forcing local electricity companies to sell either their lines or their supply (generation or retail) businesses.

An academic analysis of this action states that "it concludes that the ownership split was a staggering mistake. The Government's reasoning was based on inconclusive evidence, inadequate research, and contained major logical flaws. The Government rejected unanimous policy advice warning against the split."<sup>xii</sup>

The industry has struggled under the new arrangements which had seen each part blaming the other for price increases, increasingly intrusive regulation of the "natural monopolies" and general public typically holding a (media fed) view that all of the industry is overpaid and solely interested in profits.

It is this splintered industry that is now trying to face the new disruptive technologies of small scale PV, local batteries and next - charging electric cars.

## 9. Considering the Past - Looking forward:

In some ways the electricity industry is in the position the Gas industry was when electric light was invented - and some of the early moves and rhetoric to protect monopoly profits seem to match the moves back then!

The present split of the industry, with each sector looking to protect its own position, will not help with presenting a logical and cohesive position to respond on a sound economic basis to the spread of domestic PV's - or any other threat or opportunity.

There are four main themes to extract from the above

- 9.1. Industry structure generally appears to follow the prevailing political thinking<sup>7</sup>. Thus trying to look ahead at how the New Zealand political landscape could develop should be part of every companies risk management process.

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<sup>7</sup> Recognising that once a change has been made, if there is little public complaint there will be no political gain to change matters, so that there is a significant inertia factor

- 9.2. In the immediate future there appears to be little political appetite to carry out significant industry reform, thus the existing industry players need to find ways to work together to address the issues. (Note this is not necessarily the case overseas - there is a proposal to re-nationalise the UK Electricity and Gas Industries<sup>xiii</sup>.)
- 9.3. The early battle with Gas was not about an electric bill against a gas bill - it was about the cost of lighting. In spite of the investment in "smart meters" the electricity industry is still trying to sell electricity - not lighting, comfort (heating/cooling), cooking, lifestyle (entertainment), etc. The focus on smart meters giving detailed usage information totally misses the point of what does the end customer actually want to know. Getting a bill identifying the monthly cost of each end use should be a priority for development.
- 9.4. Changing technology means that past decisions may no longer be correct - in fact it can be argued that line companies are no longer natural monopolies - even if they were previously<sup>xiv</sup>. The traditional arguments for cross-subsidies and averaging of costs need careful review.

The underlying basis for the future should be economically sound decision making and ensuring the best use of all resources from the NZ Inc. perspective. Thus all customers should face the true cost of their delivered electrical energy - this means true time of use for the energy component and a delivery charge reflecting the demand on the system and the quantity of the system used (i.e. peak and distance based charges<sup>8</sup>).

An associated issue is providing real time advice to customers regarding price. Customers are now very used to such information - the signs outside petrol stations - searching the web for major purchases, etc. A simple cell phone alert that prices are to go above a pre-set level would at least be a start to let customers make choices.

## 10. Conclusions:

Political ideology impacts on the structure of the power industry and not necessarily in a positive way.

Present billing for raw energy should be replaced with charging for the end use.

Pricing that hides the real price signals by averaging and cross-subsidising distort sound economic based decision making. This can be enhanced by providing real-time price signals to all customers.

The current industry lines company / marketing (Gentailer) company split is preventing a sensible national industry reaction to solar and other issues. Currently for solar each consumer is driven to put in their own solar storage which is ludicrously uneconomic and wasteful. There is a significant business opportunity in capturing exported daytime solar from

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<sup>8</sup> It is of note that at least one lines company is now charging domestic customers for the peak demand as identified by their smart meters - but only historically. It does not send a signal to advise that a peak is expected so the actual line charge remains a lottery. Whilst the claim is that this is fairer as it charges the customer for the amount of the network needed to supply them at that time, it does not address the fact that one customer may only use 0.5km of line to supply them but they are charged the same as someone using 50km of line and this difference in cost is probably greater.

each neighbourhood, storing it in commercial scale plants at local network level, then reselling back in the evening at a tidy profit.

This preserves and strengthens the use of the current networks and smart meters, increases revenue, and is a service the community needs. In some remote cases the economic solution will mean taking down lines.

Yet incredibly there seems to be no industry vision to fix this. It is proposed that this is due the current industry structure as currently neither side (lines or Genter) can win in this one alone.

Let us learn from the past.

### **Disclaimer:**

The views expressed in this paper are purely those of the author and not of their employer.

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<sup>xii</sup> <sup>xii</sup> Daniel Kalderimis\* PURE IDEOLOGY: THE "OWNERSHIP SPLIT" OF POWER COMPANIES IN THE 1998 ELECTRICITY REFORMS Victoria University

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