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Cogeneration, District Heating and District Cooling: 
A Century of District Energy in Indianapolis

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Abstract-

In 1888, the proprietors of the Grand Opera House in Indianapolis requested electric light and steam heating service from the new Marmon-Perry Lighting Company, which the following year installed a small plant nearby to light several buildings and also heat the Opera House with exhaust steam piped through 250 feet of four-inch pipe.

Indianapolis soon turned to natural gas for its heating needs, but the depletion of local gas fields at the turn of the century led to installation of several new low pressure steam and hot water district heating systems in the Indiana capital. These combined heat and power systems were finally merged together in 1927 to form Indianapolis Power and Light, which recently became a subsidiary of IPALCO Enterprises and is now the second-largest district energy utility in the United States.

Mid-America Energy Resources, an unregulated subsidiary of IPALCO Enterprises formed in 1989, operates a 20,000 ton (70.4 mW) chilled water plant serving seventeen customers in downtown Indianapolis and also owns another district heating and cooling system serving downtown Cleveland.

Keywords - History, cogeneration, district heating, district cooling, waste-to-energy
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A Century of District Energy in Indianapolis

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**First District Heating**

Nordyke & Marmon, Inc. of Indianapolis was the largest manufacturer of flour mill machinery in the United States in 1885 when its owners, Addison H. Nordyke and Daniel W. Marmon, decided to start manufacturing machinery for the new electric light industry. They hired electrician Charles D. Jenney and formed the Jenny Electric Company, which manufactured generators and other apparatus at the Nordyke & Marmon works, and in addition installed and operated an arc street lighting system in the nearby town of West Indianapolis. In 1886 Marmon hired Charles C. Perry, a struggling 28-year-old telegraph operator, as a “sort of utility man,” and two years later the two men formed the Marmon-Perry Light Company to install the Edison system of incandescent lighting in Indianapolis.

They received a contract to light the Park Theater, the Sentinel Printing Company, and other nearby properties and installed a 35 kW Jenny generator powered by steam purchased from the printing company's boiler. The installation proved satisfactory and the theater's managers contracted with Marmon-Perry for light in the English Opera House and light as well as heat in the Grand Opera House. Marmon-Perry built a second plant in a leased barn near the two opera houses, ran wires for the lights and a four-inch (102 mm) steam line to carry exhaust steam 250 feet (76 m) to warm the Grand. The Marmon-Perry Company thus joined at least eight other Edison companies that were offering exhaust steam heating service that year.

Although service in Indianapolis was somewhat unique by being delivered from a barn, business was good and in 1892 the Indianapolis Light and Power Company was incorporated to consolidate the entire electric business in that city. A new generating plant was built at West Street and Kentucky Avenue and began service in 1893 with substantial fuel resources. Not only did it have condensing water, rail access and enough coal storage capacity for two months' operation, but also was served by two of Indiana's new natural gas companies. The new plant had condensing engines with no provisions for heating service, so when the wires from it reached the customers of the original plants, they, along with the initial district heating service, were abandoned. This inglorious end of district heating turned out to be only temporary, however, as the heating marketplace in Indianapolis took a dramatic turn when the twentieth century arrived.

**Failure of Natural Gas**

Indianapolis Power and Light was not alone in using natural gas, which had been discovered in Ohio
in 1884 and Indiana two years later, creating an entirely new industry virtually overnight, not unlike the early
days of oil fever in Pennsylvania. Gas was sold in Indianapolis at flat rates for each stove and furnace
connected, or in some cases by meter at about 7¢ per 1000 cubic feet (6.6¢ per GJ). Many switched to this
marvelous fuel for heating and lighting, not only freeing themselves from the nuisance of burning coal, but
the low cost gave them little incentive to conserve the gas. The Indiana Legislature outlawed egregiously
wasteful flambeau lights in 1891, but even when gas fields started running dry and leaving communities
without fuel little was done to stem the overall euphoria. In the late 1890s, a few cooler heads prevailed and
thoroughly examined the matter. The Indiana State Inspector of Gas, Mr. Leach, addressed the Indianapolis
City Council in late 1899 and reported that “A good deal of the gas brought to Indianapolis is wasted, and
consequently more gas is used. As to how long the gas will last, is mere speculation. I estimate that the pipe
lines will furnish gas for four years, and after that what little gas remains will be consumed in the locality
of the wells.”

While not welcome news, Indianapolis businessmen took steps to provide new heat and power
systems before the gas ran out. After carefully exploring available technologies, many communities in the
natural gas regions chose to install combination heat and power plants to serve their homes and businesses.
Steam cogeneration had been utilized as early as 1784 and was commonly used in industrial applications
throughout the nineteenth century. The first utility company applied it in 1881 when the Citizens Steam
Company of Lynn, Massachusetts installed a dual-pipe steam system: one provided high pressure steam for
power and then second collected the low pressure engine exhaust and resold it to other customers. Similar
systems operated in New Haven, Connecticut and San Francisco, but the greatest market came from the new
electric light companies. The New York Steam Company sold exhaust steam from its uptown steam-electric
plant in 1886, the same year that Albany Edison received a charter to provide steam and electricity to its
customers. At least thirty electric companies throughout the United States were providing such service
before the natural gas crisis started in the late 1890s.

Home Heating and Lighting Company

The first company to jump into the Indianapolis market was the Home Heating and Lighting
company, which was incorporated 5 September 1900 with Samuel E. Rauh as president and John F. Wild
as secretary and treasurer. Exactly one month later they received a franchise to provide hot water, steam,
and electricity throughout the city. The franchise territory “followed the flag,” automatically including any
territory annexed to the city. Another provision, however, gave the City’s Board of Public Works power to
select a territory for the company’s first plant, such territory not to exceed one mile square and to contain at
least 800 residence buildings. Within ninety days after this territory had been laid out, the company was to
commence plant construction and place it in operation by 1 September 1901. The company would be
required to establish additional heating plants, or extend existing lines, only “upon the petition of owners of
property requiring 50,000 square feet of radiation or more within a territory of not more than one-half of one mile square, and who with such petition shall submit contract to become consumers of such heat from said company to the extend of such radiation.” The franchise was for a period of twenty-five years and the company was required to pay five percent of its gross receipts to the city. Rates were set at ten cents per kilowatt hour for electricity and a flat annual rate of 17 cents per square foot of radiation (44 W) of connected radiation.

The Home company's plant at 16th and Alabama was built by a Toledo construction company and placed into service in late 1901, as required by the franchise. Indianapolis capitalist W. K. Eldridge, who installed nine such plants one year, described the Home company plant in a 1903 paper. Covering an area of 2¼ square miles, the plant furnished hot water through nine miles of double piping, supplying 325,000 square feet of radiation (14.3 mW). The plant was taxed “to its fullest capacity in the severest weather, so that large additions are being considered.” The boiler capacity was 1,800 horsepower (17.7 mW) and the hot water was heated with steam exhausting from a 250 kW engine-generator. The plant was reported to be “the largest for hot water heating yet installed in the United States.”

The Toledo company that installed this plant was almost certainly the Toledo Heating and Lighting Company, which was managed by Homer Taylor Yaryan. He studied law and became chief of the United States Revenue Service in 1875, where he unearthed the famous St. Louis whiskey frauds, pursuing the scofflaws with great vigor until President Ulysses S. Grant removed him from office, allegedly to protect his political cronies. Yaryan then turned to inventing and installed the first of more than thirty-five hot water systems in Toledo in 1894. Several of his inventions improved refrigeration and some were used in early district cooling stations. Although a detailed description of the Home Heating plant has not been located, Yaryan did write about several others he installed of similar design.

Yaryan's hot water system came on the market shortly after several electric companies had installed exhaust steam district heating systems, some of which were very extensive. These systems distributed steam at pressures generally below 5 psig (34.5 kPa) and many utilized vacuum condensate systems of Paul and Webster designs. Even under the best of circumstances, however, the use of low pressure steam limited the service area, and Yaryan decided that hot water was a much better distribution medium. Low temperature hot water had been used for comfort heating as early as 1777 and by the 1890s was widely used in individual buildings. An extensive low temperature hot water system had been installed in 1876 to serve nearly forty buildings at the Banstead Downs Asylum in England. The engineer for that project, Sir Frederick Bramwell, pointed out that such a system could be used to supply hot water for heating and washing to groups of buildings, such as “streets of workmen's dwellings.”

Several high temperature hot water district heating systems were proposed in the United States in the 1880s and at least three were installed: Washington, D.C., New York City, and the largest in Boston. Low temperature water was apparently first used for district heating in this country in Idaho, where the Boise
Artesian Hot and Cold Water Company, Ltd. in 1890 began distributing 170°F (77°C) geothermal hot water through a gravity piping system, after which it was drained to the sewer. The fundamental parameters of Yaryan's system, which he patented in 1893, are contained in his 1900 description of his Floyd Street station in Toledo, which served 90,000 square feet of radiation (3.9 mW). The variable-temperature and variable-flow apparatus was designed to maintain 70°F (21°C) inside a building when the outdoor temperature was at freezing, with 160°F (71°C) supply water entering the house. The supply water temperature was raised one degree for each degree drop in the outside temperature, and vice versa. A maximum of 212°F (100°C) could be delivered in the coldest weather and in moderate weather 130°F (54°C) was maintained. Tests in Toledo during the coldest weather showed the temperature at the farthest end of the three-quarter mile (1.2 km) supply line was 12°F (7°C) lower than at the station, and the water returned to the plant 35°F (19°F) cooler than the plant supply temperature. The pressure maintained on the supply was 60 psig (414 kPa) during cold weather and 40 psig (276 kPa) during moderate weather. A 75,000 gallon (284 m³) thermal storage tank was used to store excess heat generated when electric production peaked and to supplement heat generation when electric production was low. The supply and return pipes were installed in a wooden duct constructed with three layers of one-inch (25 mm) boards with one-half-inch (13 mm) air spaces between them.7

The advantages of this system did not please everyone. In early 1901, Indianapolis City Engineer Jeup examined the plans of the several heating and lighting companies which had requested hot-water and electric-light franchises for particular districts of the city. He believed that their main purpose was to furnish electric light, and thought that the Indianapolis Light and Power company, which held the existing street-lighting contract, would enter a vigorous protest.8

Marion County Hot Water Heating Company

Rather than fight the newcomers, the owners of Indianapolis Light and Power chose to join them, incorporating the Marion County Hot Water Heating Company on 7 January 1902. This company received a 25-year franchise similar to Home's, with some different provisions making it easier to expand. Termination procedures were also more thoroughly elaborated.9

This company did not begin construction of their plant at 18th and Mill Streets until 1903. A short description of this plant notes that it would cost about $250,000, have two of 1,500 kW Curtis vertical steam turbines (among the first installed) and have 5,000 horsepower (49 mW) of boilers installed. The plant was to distribute hot water or steam heat within a ½-mile radius and would provide electric service in March 1904 and heating the following November.10

Merchants' Heat and Light Company

The downtown Merchants' Association appointed a committee in early 1902 to investigate and report
on the best replacement for gas in their buildings. The committee was also charged with reducing electric cost, if possible, and to deal with the smoke nuisance, since the limited reintroduction of coal had already caused a pall of smoke to appear over the city. The committee called in Chicago engineer William H. Schott, who presented plans and estimates for a cogeneration plant to provide heat and power to the members of the Association. The Association's members incorporated the Merchants' Heat and Light Company on 1 July 1902 with $150,000 capital stock and with authorization to issue $500,000 of twenty-five year bonds. The Board of Public Works, however, refused to grant a franchise limiting service to Association members, so the parties agreed on a twenty-five year general franchise covering the entire city, with terms similar to the Marion County Hot Water Heating Company except that a maximum annual heating rate for steam heat was set at 30 cents per square foot of radiation (70.3 W). The Merchants' Association received the franchise on 29 July 1902 and contracted with Schott to build the plant at South New Jersey and Pearl Streets. He delivered heat five months later, 1 January 1903, and electricity a month later.¹¹

A year after it opened, the company was serving 127 customers with a total of nearly 200,000 square feet of steam radiation (14 mW), not including cooling coils that extracted the last bits of heat from the steam before discharging it into sewers at about 150°F (66°C). These condensate cooling coils were used to warm basements, temper outside ventilation air, or heat domestic hot water, as had been proposed by Birdsell Holly twenty-five years earlier. The steam was generated in seven boilers totalling 1750 horsepower (17.2 mW) and used to generate 1100 kW of electricity before being distributed through a network of underground pipes between 8 and 20 inches (203 mm to 508 mm) in diameter. The street mains were designed to supply 500,000 square feet of radiation (35 mW) with 5 psig (34 kPa) backpressure on the engines, adjustable from 1 to 7 psig (7 and 48 kPa) as conditions warranted. The engines were also designed to run condensing in the summer, using a 2000 horsepower (19.6 mW) Worthington jet condenser and cooling tower. According to the plant's manager, F. B. Hofft, the most important operating feature of the heating operation was the automatic temperature control system incorporated into the plant's design. A pneumatic thermostat in each building controlled a valve on the steam line serving the building, regulating the space temperature within 2°F (1.1°C). The steam valve was not allowed to completely close for a long period and was kept slightly cracked to slightly warm the pipes, keep air out of the system, and produce a more rapid circulation of steam when heat was required. A separate three-inch (76 mm) pipe provided 15 psig (103 kPa) pneumatic control air from the plant's air compressor to each customer to power the thermostat and valve.¹²

Hofft calculated that generating an average of 750 kW of electricity for 24 hours would require 538,080 pounds of steam (567 GJ). Adding a heating load of 200,000 square feet of radiation (14 mW) required raising the engine backpressure and heating additional feed water, raising the total steam required to 769,720 pounds per day (811 GJ), a difference of 271,650 pounds (286 GJ), only a fraction of the 1.2 million pounds (1266 GJ) that a separate heating boiler would have had to supply to provide the same heat. The Merchants' Association appears to have done rather well and their customers seem to have agreed, for
in 1904 four more boilers and two 750 kW Westinghouse-Parsons turbo-generators were installed to raise the plant's electric capacity to 2600 kW. A 1904 article includes a map of the steam distribution system and a more detailed account of the temperature regulation in a typical building.13

Another district heating system operated by John E. Christian supplied heat to a number of rental houses he owned, and was awarded a franchise to furnish steam to other nearby houses. He was charged $1 a year for the franchise and could not charge more than 35 cents per square foot of radiating surface.14

Although dire predictions of vanishing energy sources have been made for at least two thousand years, the investors in the Indianapolis heating plants were not surprised by new or hidden supplies of gas. On 1 June 1903 a circuit judge permitted one company to shut off gas to about 5,000 patrons, as it had no gas left. The company had tried to shut down the supply the previous December, but the city of Indianapolis had obtained a restraining order forbidding it.15

**Competition and Combination**

While some residents of Indianapolis were undoubtedly pleased by the presence of four electric companies, few outside the downtown area had a choice of companies. Those who did, however, aggressively played one against the other in seeking lower prices. While electric rates slowly dropped as new technology such as steam turbines were introduced, the expenses of the heating operation remained constant or even rose. Wages and fuel prices, the majority of a heating company's expenses, started an inflationary spiral in 1903, while the prices that the companies charged had been fixed in the franchise, making them difficult, if not impossible, to raise. The first casualty was the Home Heating and Lighting Company, which was placed in the hands of a receiver on 30 April 1904. Their audit showed that the company had receipts for the year of $70,700 and had the following assets and liabilities:

| Plant and hot water pipe lines          | $384,640 |
| Accounts receivable                   | $1,830   |
| Furniture                             | $250     |
| Total assets                          | $287,728 |
| Bonds (issued to Indiana Pipeline & Const Co.) | $250,000 |
| Money (borrowed and secured by an additional $100,000 bond) | $95,000 |
| Due for supplies                      | $25,684  |
| Advances for Rauh & Wild              | $33,964  |
| Total liabilities                     | $404,467 |

President S.E. Rauh reported in a circular “that the business of supplying hot water for heating had proved less profitable than was expected, and suggests that either the plant be dismantled and disposed of in payment of debts and liens, or a new corporation be organized to take over the property and to issue a new
mortgage, the patrons to take the new stock and bonds on a basis to be agreed upon and the plant thereafter to be owned and operated as a mutual enterprise.” How he and his treasurer justified advancing themselves nearly half of a year's receipts is not recorded.16

The first receiver, Union Trust, had petitioned the city council for a rate increase to 25¢, but was opposed by the Indianapolis Commercial Club, who had hired a consulting engineer, C. Brown, to gather statistics from 50 hot water plants. Brown's report showed that a 17¢ rate was sufficient “for the well-constructed and well-managed combined plant.”17 Union Trust resigned as receiver in July and was replaced by the Marion Trust Company, which ran the plant the following winter and in the spring petitioned the bankruptcy court for permission to raise heating rates to 25¢, stating that the plant had lost $20,000 the previous season.18 Further details of the court proceedings are not known, but the company was reorganized as the People's Light and Heat Company on 18 July 1905 and continued in operation under the same management.

The Marion County Hot Water Heating Company, which had never installed a heating system or made any hot water, was next in line. As was mentioned above, it had been organized by the same group that ran Indianapolis Light and Power, probably for reasons involving more favorable franchise terms and street lighting contracts. Shortly after the older company received the new street lighting contract in late 1904 it merged with its newer “rival” and assumed the franchise of the newer firm, including the right to provide heating. The new organization, incorporated on 31 December 1904, was known as the Indianapolis Light and Heat Company.

The Mill Street plant had both rail access and condensing water, and over the next several years became the principal electric generation station for Indianapolis Light and Heat. A 5 mW turbine was added in 1909 and another 5.5 mW set two years later. Meanwhile, 3 mW of engine-generators at the Kentucky Avenue plant were modified in 1905 to provide exhaust steam for a new district heating system “of large proportion,” competing not only with the Merchants' company but with the very popular “isolated plants” that many larger buildings used to cogenerate their own heat and power. The Claypool Hotel and the Marion
County building complex had installed such systems around 1900, and the new Post Office and Custom House did so in 1906. While many utility executives undoubtedly preferred to sell only electricity, building owners forced to make their own heat often found that they could make their own power for less than the utility could sell it to them. District steam service enabled a building owner to discard the plant altogether.

**District Steam Competition in Downtown Indianapolis**

Demands for service from the Merchants' Heat and Light Company continued to grow beyond all expectations, but expansion opportunities at the plant were limited by a lack of condensing water and rail access. The cooling towers were of marginal utility, while using wagons and trucks to deliver coal was very expensive. The company began searching for a site that solved these problems, and also made a deliberate decision to locate the plant near the downtown area so that it would also provide steam to their district heating system.

They found such a site just four blocks west of the State Capitol on a Washington Avenue site formerly owned by the Chandler & Taylor Company. The New York firm of J.G. White & Company was hired to engineer and construct the new plant and connect it to the existing steam and electric networks. Two 1000 kW Allis-Chalmers backpressure turbines were installed to provide power during the heating season and three 750 kW Westinghouse-Parsons turbines from the old station were rebuilt as condensing units to meet summer needs. The plant began operating in early 1910 and shortly thereafter an additional 4,000 kW generator was installed, driven, surprisingly, by a large Corliss engine.

The exhaust steam from the new Washington Street, or West, station was delivered through a new 30-inch (762 mm) pipe installed in a reinforced concrete tunnel. This line delivered 8 psig (55 kPa) steam to Senate Avenue, where it connected with the existing 20-inch (508 mm) line from the East plant and a new 24-inch (610 mm) line for new steam customers. By April 1911 nearly 1 million square feet of radiation (70 mW) was connected and the company was proud to report that “not one customer has ever left the lines because of dissatisfaction.” Approximately ninety percent of the larger buildings in the downtown area were
using district steam and "hundreds of smokestacks are now smokeless, the result being a cleaner and brighter
city." The company required each customer to install either Powers pneumatic control or a "Sylphon
Regithem" mechanical control valve to close the steam valve when the space temperature reaches 70°F
(21°F).

Coal for the plant cost $1.20 per ton and steam production costs were 12.2¢ per thousand pounds
(11.6¢ per GJ). Adding in distribution, insurance, depreciation and interest raised the total unit cost to 26.9¢.
A daily output of 45,000 kWh (162 GJ) while operating condensing required 900,000 pounds of steam (950
GJ) and produced $1,800 of revenue at the average price of 4¢ per kWh (1.1¢ per GJ). Generating the same
amount of electricity at a 5 psig (34 kPa) backpressure required 2,025,000 pounds of steam (2136 GJ) and
produced $1,012.50 in steam sales at the average price of 50¢ per thousand pounds, for a total of $2,812.50.
Since the total cost of the added steam necessary for backpressure operation was only 26.9¢ per thousand
pounds (25.5¢ per GJ), a net profit of 23.1¢ was realized. Considered from a total plant perspective,
revenues from steam sales paid for the entire annual fuel cost of the plant (electric included), plus all plant
maintenance and labor, and still returned ten percent on the investment in the street piping and service. More
importantly, steam service permitted expansion of the electric system to serve buildings that would otherwise
have made their own power.21

One of these buildings was the Claypool Hotel, mentioned earlier. Around 1913 the company took
over the operation of the hotel's 1,050 boiler horsepower (10.3 mW) steam plant and in 1916 constructed a
new 190 psig (1.3 mPa) six-inch (152 mm) steam line 3,600 feet (1097 m) from the West plant to the hotel
plant, allowing the hotel plant to be shut down at a net annual savings of $15,000.22 The National District
Heating Association held its fifth convention at the Claypool Hotel in May, 1913, opening with an address
by former Indianapolis mayor Charles A. Bookwalter, who noted that as a young man he had worked in a
central heating station for five months. Bookwalter advised the district heating men that "the trouble with
the average heating plant has been heretofore that the matter of heating the building has been left entirely
to the architect, who provided spacious and commodious accommodations for the office, and ample floor
space for the manufacturing processes of the business, or the mechanical necessities of the business; and then when he reached the end of the proposition apparently he marked off some little hole down in the corner, and there he located the heating plant.” The Association's secretary responded that the he “was not unmindful of the fact that Indianapolis contains the largest District Heating Company in the world.”

**Battle of the Holding Companies**

The new West station had been profitable enough to permit the Merchants' organization to form a holding company, the Merchants' Public Utility Company of Indianapolis, incorporated 17 September 1912 with $4 million in capital stock. This was at the start of the great age of utility holding companies, so it is not surprising that a short time later, on 7 December 1912, both Merchants' and the People's Light and Heat Company were purchased by the American Public Utility Company of Grand Rapids, Michigan. People's was consolidated into the Merchants' Heat and Light Company and its plant at 16th and Alabama became known as the North plant, which continued to serve the hot water system, which was thoroughly examined in 1915 and found to be in good operating condition. A number of tests showed that the circulation and pressure drop showed “conclusively that almost the entire system is in good operating condition, although the lines were laid fourteen years ago and, according to some theories of depreciation, should now be ready for replacement.”

Despite expansion of the West plant until 1918 when it had 23 mW of electric capacity, Merchants' load continued to grow and it soon had to purchase a large amount of power from elsewhere. The Indianapolis Light and Heat Company had responded to Merchants' new West station by greatly expanding their own downtown steam system in 1910, which continued to be served by the Kentucky Avenue plant. Indianapolis Light and Heat continued to add capacity to both of its plants, completely renovating the Kentucky Avenue plant in 1916. By the early 1920s it surpassed the Merchants' company in sales and continued to experience substantial electric and steam load growth. By 1927 they had 243 customers, while Merchants' served 440 on its downtown steam system and 475, mostly residential, on the North plant hot
American Public Utilities had attempted to merge its Indiana holdings in 1921, but was thwarted by legal opposition from the cities of Indianapolis and Kokomo. The Indiana Electric Company, another subsidiary and intended owner of the Indiana properties, nevertheless started construction on a large 100 mW "super-power" plant 70 miles (113 km) west of Indianapolis on the Wabash River near Terre Haute, marking the end of investment in Merchants' Indianapolis plants. Another attempt to unify the various companies came in 1923, when Samuel Insull and Randall Morgan, who controlled two of the largest utility holding companies, sat down to "rationalize the utility business in Indiana." Although the transactions were very complex, the two men, "in the manner of a pair of European monarchs partitioning Poland, simply agreed upon how it should come out and instructed their lawyers and directors to take the necessary steps."

The Merchants' holding company became the Central Indiana Power Company, which was sold in 1924 to the Insull organization. Insull, no friend of district heating, also obtained control of 28½% of Indianapolis Light and Heat's stock and tried to merge it into the Merchants' company, but Harley L. Clarke, whose own holding company controlled the remaining Indianapolis Light and Heat stock, blocked Insull's takeover and formed the Indianapolis Power and Light Corporation, which bought the Merchants' company and Insull's share of Indianapolis Light and Heat and merged them into the new corporation. While the machinations of the various holding companies may seem inconsequential seven decades later, the thwarting of Insull's plans to take over electric service in Indianapolis very simply meant the survival of district heating in that city. Although Insull used district heating where necessary to fight isolated plants, he favored construction of large, "efficient" plants located in the countryside. One need look no farther than Chicago to consider what Insull would have done to cogeneration and district heating in Indianapolis.

Steam Systems Merge and Expand

After the brutal fight, which included calls for building a municipal electric system, the steam and electric systems were quickly merged. The downtown systems essentially overlapped in several places and
were connected together in the summer of 1927. The West plant became the base plant for steam service and the Kentucky Avenue facility became a reserve and peaking plant. The hapless East plant, without rail access or condensing water, was shut down. The hot water system at the North plant presented more difficulties. The load on the hot water system had decreased by 20% since the end of World War One and, more importantly, the nature of the district itself had changed. When the system was first installed in 1901 it was the best residential district of the city, but in recent years many of the houses had been torn down and replaced with businesses and high-rise apartment houses.

The new corporation first attempted to abandon the hot water system, but the Indiana Public Service Commission refused permission and service continued. It was then decided to replace the entire hot water system with a new steam system. Although the pipe itself was generally in good shape, years of shoddy operating practices had allowed many of the service connections and radiators to become filled with oil and sediment. Many well-run Yaryan systems lasted for several decades, with the longest lived one in Perry, Iowa running from 1900 well into the 1980s.

With a massive effort, the steam department of Indianapolis Power and Light replaced the entire hot water system in the summer of 1929, the majority of work accomplished in 81 days. Including a new service from the Mill Street plant and a tie-line to the downtown steam system, 59,000 feet (18 kM) of mains were installed and 370 service connections made. Customers were also converted from flat hot water rates to metered steam rates, causing every heating contractor, oil burner dealer, and boiler manufacturer for miles around to descend on the neighborhood, but only ten customers left the system while another ten joined, along with several new business and apartment customers. The company's managers certainly did not lack confidence, for they began this massive project without a single customer having signed up for the new steam service. The old North plant itself, a rather nice building, was turned into Ipalco Hall, an employee activities center.28

With corporate management committed to district heating, steam service continued to expand. In 1930, steam output was 1.5 thousand million pounds of steam (1.6 PJ). The following year, Eli Lilly, a large
pharmaceutical enterprise, contracted for steam service. The company aggressively marketed steam during the depression to replace revenues from declining electric sales and increasing taxation and regulation of the utility industry. The steam system was reinforced in 1936 by connecting the Kentucky Avenue (Perry K) and Washington Avenue, or West plant (Perry W) with a 245 psig (1.7 mPa) steam line. Lilly and several other customers used high pressure steam to generate on-site electricity before tapping its heating value.

By 1940, annual steam output was 2.8 thousand million pounds of steam (3.0 PJ) and growth in the northern portion of Indianapolis led to installation of new lines to serve the area and the 1961 shutdown of the old Mill Street plant. Expansion continued unabated into the 1970s, with annual output for 1972 reaching 3.7 thousand million pounds (3.9 PJ). The highest peak hourly system demand was 1,515,000 pounds per hour (430 mW) delivered on 18 January 1994. About six thousand million pounds of steam (6.3 PJ) are now produced each year, with 49% purchased from the city-owned Indianapolis Resource Recovery Facilities. More than 98% of the remainder is generated by coal at the Perry K plant, which has 20 mW of electricity capacity and 1,990,000 pounds per hour (565 mW) of steam capacity, and the Perry W plant, which has an electricity capacity of 11 mW and a steam capacity of 300,000 pounds per hour (85 mW).39

The New Energy Marketplace

New opportunities and markets appeared in the 1980s and the company responded by forming a new holding company, IPALCO Enterprises, Inc., with subsidiary Indianapolis Power and Light providing regulated steam and electric service, while the newly formed Mid-America Energy Resources pursues new markets. These include a new 20,000 ton (70 mW) steam-driven chilled water system that already serves ten customers in downtown Indianapolis.30 Mid-America in 1991 also purchased the steam heating company in Cleveland and has since built a 10,000 Ton (35 mW) district cooling plant there.

District heating and cooling in Indianapolis has provided the Indiana capital with environmentally beneficial and economically affordable energy. The history of these services shows that an electricity utility
with a clear vision and commitment to customer service can profitably incorporate district heating and cooling into its corporate structure. At a time when many electric utilities could not wait to be rid of district heating, Indianapolis Power and Light not only recognized its advantages to them but also to their city. They aggressively marketed, supported, and expanded their steam system and invested in a district cooling facility. And to provide more evidence of their faith in district heating and cooling, they purchased another district heating system in Cleveland and added district cooling there as well. Electric utilities wondering how to compete and thrive in the new energy marketplace may well look to the thriving example in Indianapolis for a profitable lesson.
References


3. Laws and Ordinances, City of Indianapolis, Revision of 1904 (Indianapolis, 1904), 505.


9. Laws and Ordinances, City of Indianapolis, Revision of 1904 (Indianapolis, 1904), 513.

10. Engineering News 50 (5 November 1903): 419. Different sizes for these turbines are reported in various accounts, but Engineering News 58 (11 November 1911): 1185-8 appears most authoritative.

11. Laws and Ordinances, City of Indianapolis, Revision of 1904 (Indianapolis, 1904), 522.


14. Laws and Ordinances, City of Indianapolis, Revision of 1904, 500; Eldridge, "Central Heating Plants at Indianapolis," 420.


27. See series of articles in *Electrical World* 87, 88 & 89 (1926-7).

