

The Sons of Martha

Reshaping the Electric Industry

by William R. Gould

Ladies and Gentlemen,

As we inaugurate this new lecture series tonight I am immensely pleased to be here and share with you my thoughts on its subject matter. It is my fervent hope that the few words I speak here at the beginning of this venture will in retrospect prove to be less important and profound than those that will follow in future years. I would be most pleased if each successive speaker should set a new standard in the presentation of information and the infusion of stimulus on the subject of these lectures. It is indeed my belief that it is one whose importance will increase as society faces escalating environmental and other challenges in the coming years.

A word should be said about my co-sponsor of these lectures, namely my late wife, Erlyn Johnson Gould. To my great sorrow and staggering personal loss, she passed away in June of this year. If she were still among us and here tonight I would have her stand for the recognition she richly deserves. Over a half century ago we were sweethearts during our student years on this campus. Much of our courtship was conducted in and around the older buildings on the horseshoe - notably on the steps of the Park Building.

When we were married and went out to the far parts of the world and on to significant attainments in technology, she shared a partnership in every event and every adventure. She urged me on to ever higher plateaus in my professional life. Before her passing she shared fully my enthusiasm in establishing this lecture series. She was enamored of things scientific and technical. The CalTech trustees meetings were a field day for her. I am going to pause and ask you to observe with me a moment of silence in her memory.

In my discussion tonight I will endeavor to do two things. One will be to define the nature and purpose of this new lecture program. The other will be to present a case history to illustrate the principle of applying technology in improving the quality of life. I will use the electric utility industry as my model. Now for a moment let address the question, "Why this lecture series?"

THE LECTURE SERIES

My dear wife and I were always persuaded that preservation and enhancement of high standards in the quality of life on this planet will demand far greater technological effort and creativity in the future than has ever been the case in the past. While most environmental problems and life- deteriorating situations have a societal and political aspect, it will be in great measure the application of new technologies that will accomplish the healing, clean-up, and preservation of our communities as suitable places for the support of life as we know it.

It was our hope that these lectures would provide a forum for discussion of problems, issues, experiences, and hopefully successful case histories in this effort. We felt that an increased awareness of obligation in the publ trust would emerge among practitioners of my profession and their audiences as they addressed these very important problems. We though it possible in this process to bring engineering, technology, and those who practice them out of the backwaters of their workplace and into the full, swift-running stream of the cultural mileu of society. We desired interaction between technologists and opinion leaders in communities which are the benefactors of, or are otherwise impacted, by their efforts. This, we believe, will create a synergism that can greatly benefit society in the long-term future.

I have other reasons - perhaps personal, perhaps reflective of human weakness - that cause me to do this. Over those fifty years of engineering practice I have detected what I consider to be an adverse image of the engineer and scientist. Perhaps I have been overly sensitive to the situation, but my impression is that the general public has tended to blame engineers and scientists for things they dislike about the environment. They rarely give them credit for the effort they contribute to its clean-up and preservation. Conditions which are widely deplored are frequently associated with those creations of technology whose purposes contribute to the health and safety of the individual. I many cases they have become part of the life support system of his existence. I will have more to say on this point later on.

Another popular image of the engineer or scientist of concern to me is that they are frequently regarded as void of the sensitivities of those educated in the so-called humanities. I would like to dwell on this point for a moment. While some members of the profession may have a narrow focus that invites this perception, my experience indicates it simply is not true. It has been my good fortune to have known many scientists and engineers whose qualifications in the so-called humanities - the arts and letters - would equal or exceed that or erudite members of

academe and other professions. Moreover, it is in sharp contrast to how our profession in modern times began.

When the great engineering schools of our fledgling country were emerging in the early part of the nineteenth century, they generally drew as their students those sons of prominent families who had already obtained a classical education in the arts and letters. In 1802, the United States Military Academy at West Point was founded as a school to furnish a university-level education to engineer/officers in the armed forces. In 1817 General Sylvanus Thayer was appointed superintendent. He proceeded to model the academy's curriculum on those of the great university of Europe. A similar effort was made by B. Franklin Green in the founding of Rensselaer Polytechnic Institute in the 1840s.

The previously mentioned General Thayer in his late years endowed an engineering school at Dartmouth College. He conceived it as a two-year graduate program for students who had already completed a four-year graduate program for students who had already completed a four-year curriculum in the arts, letter, and sciences. I t was schools that were formed in this mold the furnished most of the engineers for our young nation in the 1800s. A strong implication that they would ply their skills and efforts in the public trust pervaded the profession.

Later on in the early part of this century, Albert Einstein was to give this counsel to engineers and scientists of a more mature industrial nation. The occasion was a 1931 address at the California Institute of Technology:

Concern for man himself and his fate must always for the chief interest of all technical endeavors...in order that the creations of our mind shall be a blessing and not a curse to mankind. Never forget this in the midst of your diagrams and equations.

Further, Arthus Henry Chamberlain, an early founding father of CalTech and its first dean of students when acting as the institute's president in 1907 offered this opinion:

A well trained engineer must be a man broad in his sympathies and possessing a knowledge of people and of things that shall give him place anywhere and always.

MARTHA'S SONS

Any treatment of our thesis here tonight, or any attempt to describe the role of the technologist, for me must begin with a reference to a bit of verse penned by one of my favorite poets - Rudyard Kipling.

I was fortunate to have had at Provo High School and English teacher who took an interest in my efforts to read widely and to write clearly. She was fully persuaded that I was destined for a classical education in the arts and letters. She was horrified to learn that from my experience of growing up in the Great Depression I was determined to pursue a career in engineering.

However, she did rise to the occasion. She informed me that if such was to be my lot I should be familiar, consistent with my literary interest, with the verse Kipling wrote to engineers and their like - "The Sons of Martha." For almost sixty years I have been indebted to her for this. I did read it. I enjoyed it thoroughly. It enriched my life, and over the years it has become part of the very fabric of my character. Most of it is now committed to memory.

These few lines eloquently reinforce the strong beliefs I have always nurtured about the service of the technologist in the public trust. You will easily see that this work borrow its theme from the biblical literature or what I choose to regard as Holy Writ. Specifically, it is the dialogue between Jesus of Nazareth and Mary and Martha, the sisters of Lazarus. We read of it in St. Luke, chapter 10, verses 38-42. The poem I have included to enrich our discussion here tonight:

THE SONS OF MARTHA

*The Sons of Mary seldom bother,
for they have inherited that good part;
But the Sons of Martha favour their mother
of the careful soul and the troubled heart.
And because she lost her temper once,
and because she was rude to the Lord her Guest,
Her Sons must wait upon Mary's Sons,
world without end, reprieve, or rest.*

*It is their care through all the ages
to take the buffet and cushion the shock.
It is their care that the gear engages;
it is their care that the switches lock.
It is their care that the wheel runs truly;
it their care to embark and entrain,
Talley, transport, and deliver duly
the Sons of Mary by land and main.*

*They say to the mountains, "Be ye removed."
They say to the lesser floods, "Be dry."
Under their rods are the rocks reproved-
they are not afraid of that which is high.
Then do the hill-tops shake to the summit-
then is the bed of the deep laid bare,
That the Sons of Mary may overcome it,
pleasantly sleeping and unaware.*

*They finger death at their gloves' end
where they piece and repiece the living wires.
He rears against the gates they tend:
they feed him hungry behind their fires.
Early at dawn, ere men see clear,
they stumble into his terrible stall,*

*And hale him forth like a haltered steer,
and goad and turn him till evenfall.*

*To these from birth is Belief forbidden;
from these till death is Relief afar.
They are concerned with matter hidden-
under the earthline their altars are-
The secret fountains to follow up,
waters withdrawn to restore to the mouth,
And gather the floods as in a cup,
and pour them again at a city's drouth.*

*They do not preach that their God will rouse them
a little before the nuts work loose.
They do not teach that his pity allows them
to drop their job when they damn'-well choose.
As in the thronged and lighted ways,
so in the dark and the desert they stand,
Wary and watchful all their days
that their brethren's days may be long in the land.*

*Raise ye the stone or cleave the wood
to make a path more fair or flat-
Lo, it is black already with blood
some Son of Martha spilled for that!
Not as a ladder from earth to heaven,
not as a witness to any creed,
But simple service simply given
to his own kind in their common need.*

*And the Sons of Mary smile and are blessed-
they know the angels are on their side.
They know in them is the Grace confessed,
and for them are the Mercies multiplied.
They sit at the Feet-they hear the Word-*

*they see how truly the Promise runs.
They have cast their burden upon the Lord,
and-the Lord He lays it on Martha's Sons!*

-Rudyard Kipling, 1907.

Now that I have indulged my whims and fancies in examining and perhaps even aggrandizing the role of the technologist, let proceed to look at what some of them have done to pursue this obligation in the public trust.

In an approach to this subject there is a strong temptation to roll back the calendar to ancient civilizations. There is an urge to comment upon the great works of antiquity such as early efforts in flood control in China and the diversion of those very flood waters to agriculture; to Classical Greece for the construction of structures of utility and beauty that in part endure today in the Parthenon and like buildings; to Imperial Rome where aqueducts conveyed the life support system of living waters to their cities; or to the pre-Columbian civilizations of the American continents with their great intellectual contributions in mathematics, astronomy, and like sciences which vastly enriched their societies as well as directed many everyday activities such as planting cycles in agriculture.

As illustrative as these important contributions are to our subject matter here tonight, I believe that technology, like any other benefactor, must answer that familiar question, "What have you done for me lately?" For this reason I choose to move forward to at least the mid-part of this current century.

Here I am also confronted by temptations which I must resist. It has been my good fortune to serve variously as trustee, director, or consultant to a number of corporations and institutions involved our space programs and other sophisticated scientific venture. This has been immensely exciting for the little boy from the wrong side of University Avenue in Provo. A boy who in the midst of the Great Depression had the impossible dream of growing up to become an engineer. But in my urge to discuss derivative technologies of these fields of endeavor and their contribution to the quality of life I have been dissuaded by my advisors in the lecture program.

It is their feeling that my greatest and best societal contribution was in service to the industry

in which I spent most of my working life - the serving of electricity to the general population at user voltages and frequencies. I will defer to their judgement even though for me it may tend to seem dull and commonplace.

I was somewhat dislodged from this feeling of the commonplace several days ago when I received a letter from the corporation I had earlier served as consultant and director. In this letter they recited two recent resolutions of their board. One was an expression of appreciation for my services, in testimony whereof they were making a contribution to this very lecture program in the name of my late wife. The other was an expression of gratitude for the technical leadership I had provided earlier in the field of alternate sources of power generation. This in effect created the opportunity for them to enter upon commercial activity as a corporation.

This letter came shortly after I learned of a similar action by the board of the corporation which I had long served as an employee, chief executive officer, and director - namely Southern California Edison Company. In this case they also cited me for the technical innovations which had made a lasting impact upon the industry and its customers. This they memorialized by the creation of a perpetual annual award, a medal, to be given in my name to the employee who in any given year was judged to have made the greatest contribution in related technical areas.

The Utilities Experience

So perhaps it is proper that I talk about what I know best - the electric utility enterprise and its impact upon the quality of life in society. As I begin let me make one point very clear. Many of the activities I will describe in this case history were indeed a group effort. Many fine, dedicated, and talented men and women with excellent credentials in engineering and science contributed immensely to what we were credited to have done. I only had the distinction of being their leader. Perhaps on one or two occasions I furnished some engineering or scientific judgments that were essential to our ventures, but for the most part my contribution was that of oversight and leadership. Often I was just running hard to stay out in front and keep out of their way.

An electric utility is an organization with a mission - a mission to furnish electric energy at user voltages to everyone who applies for the service. Our basic product has not changed in over a hundred years, but our method of producing and delivering it has undergone many mutations. Herein lie the opportunities for innovation and improvement.

We are perceived as a monopoly. If we do our job well everyone takes our service, and the perception becomes a fact. If we fail in our job there are many entities waiting in the wings to take over and do it for us. We enter every property in the community to deliver our service and therefore are constantly in the public eye. In this respect our opportunity to irritate is always present.

We require several very important ingredients to do our job well. Some of them we must obtain in competition with those whom we serve. They are air, land, water, and to a lesser degree, fuel. This characteristic of our business, together with the perception of monopoly, tends to raise hostile emotions in our constituencies. Some of our more unfortunate sister utilities have been referred to as "the company you love to hate."

Nonetheless, the service we render has become an essential ingredient to the life-support systems of our populous society. It pumps the water we drink. It is the prime mover in some aspects of transportation. It provides energy for food production and distribution. It renders possible and safe some vital medical procedures which must be provided on a continuous basis. It carries away the wastes of the common man's living. It pervades almost every aspect of our lives.

It cannot be inventoried but must be produced at the moment it is consumed. It must be furnished at the lowest cost and in the most reliable manner possible. In all of this, those of us who have set our hands, our heads, and our hearts to the task of providing it have dedicated ourselves to what I have previously referred to as "service in the public trust." We do not have the right to flag or fail.

All of these things I learned early in my career in this industry. I also learned that the demand for this product was growing at a frightening rate. On our system at one time we had a growth rate of 9.4 percent compounded annually. Nationally it was about 7.5 percent. This growth weighed heavily on me as I felt my responsibility to meet it. It came to be the first public issue I face when in 1967 I was serving as vice president and chief technical officer of my company.

At that time I was asked by the planning group in the General Electric Company to join a forum of some eighteen other people who were regarded as leaders in their respective fields of endeavor. It was our task to divine the future and opine on what our respective worlds would be

like in the coming years. We were to also identify what problems we would encounter. As I recall, this was the first time I expressed in public or on the printed page my concerns in continuing the patterns of utility growth we were experiencing.

I identified the limiting parameters as the finite supply of land, air, water, and fuel. This concern was to remain with me over the years. It grew and eventually culminated in October of 1980 in my announcement as chairman and chief executive of my company of our intent to seek to slow this growth and to meet what growth we must in a manner different than our previous practice. I little knew that this action would alter the course of the entire utility industry and create the utility of tomorrow in a completely different format.

The Way Stations

But there were way stations along the road to this momentous event of 1980. Way stations that we did not recognize at the time of their passing. Way stations that would prepare us to meet this watershed event. I will try to mention a few of them, because they illustrate the thesis of this lecture. In doing so I must pay tribute to two of my predecessors who taught me the business and schooled and prepared me to be chairman of my company's board. Both of them had served as chairman in their turn.

The earliest contact I had with this office of chairman was when it was occupied by a Mr. Harold Quinton. From him I learned many things, but principally, the importance of corporate integrity. Following him was my immediate predecessor, Mr Jack K. Horton, from whom I also learned much, principally that a great utility like ours did not do business in a vacuum or in the quiet of a closet. We were part of the world and what we did impacted the world.

We had grown up as a company whose operations were based upon hydroelectric generation with delivery to consumers over long transmission lines. Our beginnings went back to the late 1880s. We were not a late entry upon the utility scene. In those halcyon hydro years we learned our first lessons in corporate responsibility and sensitivity to the environment long before it was a popular issue in the press or elsewhere.

Way Station Number One: When I arrived on the scene it was our usual practice to reforest every scar we left on the hillside. This we did from our own tree farms. Moreover, if we turned the water in or out of a channel or reservoir, we restocked the affected waters with fish from our

own trout farms. This we did in a era before the U.S. Forest Service and other government agencies had developed such practices in their own operations. The benefits of such applications are of obvious and enduring worth to our many publics.

Way Station Number Two: This could have been our early and progressive abandonment of programs to promote increased use of electricity. By the time utility companies had adopted cooperative advertising programs of the "Live Better Electrically" era, we had already abandoned the promotion of lighting. Architects would do that for us and to a degree that exceeded our desires. Parenthetically, I have always regarded garish lighting, on the Las Vegas model, as the ultimate environmental insult. Electrical energy in my perspective is too precious to be used in the manner.

But I had my own little experience, almost of crisis proportions, with lighting, In the early 1960s while serving as manager of engineering, I was summoned post hast to the office of the chairman. As I entered the room I did not know the reason for my presence. But there I found the "Live Better Electrically" boys (the marketing department), assembled as minions around Mr. Quinton, the chairman, I was invited to take a seat - the hot seat.

"Bill," began Harold, "I understand from these people that in our new Long Beach office complex you are not providing the level of lighting that architects recommend to our customers."

There were the smiles of the predator on the faces of the sales staff around the room. The implication was clear. I was placing the marketing efforts of the company in jeopardy. I answered without hesitation.

"Yes, sir. That is correct."

Harold look puzzled. "Why is that, Bill?"

"Very simple," I replied, "I am providing the levels of illumination recommended by the several national institutes of eye hygiene. These people are selling levels in excess of that."

The chairman's face froze in hard lines. The smiles started to disappear from those who ringed the room.

"Do you mean to say we are promoting levels of lighting with the architects of our customers that they do not need?"

The "Live Better Electrically" boys started to stutter out their dogma and catechism of load growth for the benefit of the company's bottom line. The chairman interrupted them impatiently.

"I don't ever want to hear again that we are selling the customer something he doesn't need or does not want!" The meeting was about to end. I fired the last shot.

"In that case, Harold, you had better have them take a look at their promotional programs for air conditioning. We don't have to sell that service, the weather does it for us far more effectively than we can do it ourselves and sometimes in a volume that taxes our efforts to supply it."

A short while thereafter, air-conditioning promotion joined lighting on the scrap heap of corporate history. By 1972 our promotional efforts had all disappeared and "Live Better Electrically" had been replaced by a program called "Save a Watt!"

But in all of this Bill Gould had learned something - something that was a pearl of great price. I had learned from a chairman about integrity - that the so-called sacred bottom line was second to corporate responsibility in the public trust. I was to learn it again several times from my seniors who preceded me in that office.

Way Station Number Three: In the early 1960s we helped form a consortium and gave it some leadership in the construction of the transmission system which was to become known as the Pacific Intertie. This was to be a landmark system as far as length of line and the level of voltage of the direct current components were concerned. Nothing on this scale had been attempted before. While there was existing technology on which we could improvise, there was considerable risk in some of the unknown and untried factors. There were skeptics and detractors in the organizations of all the members of the consortium.

This transmission system would connect the large hydroelectric systems in the Northwest with the predominantly fuel-based systems in the Southwest. It would allow the surplus hydroenergy produced during the spring runoff in the northern river systems to be transmitted south to displace fuel burning. This it would partially clear the skies and freshen the atmosphere

in those locations. Later in the year when the runoff had passed its zenith, off-peak fuel generation, produced mostly at night, could be transmitted north to avoid the construction of fuel-based back-up generation in that area. It was a winner for both locations.

It required a herculean effort to forge new relationships in contract negotiation. But it also required an effort of equal proportion to bring new and not fully tried technologies to maturity to facilitate the construction and operation of the facilities. Happily, both of these tasks were accomplished successfully and residents of the Pacific states continue to enjoy these benefits o this day.

Way Station Number Four: In the middle 1960s we were reaching out for new generating sites. Sites that would be far removed from the land-hungry urban areas where millions of people lived and consumed our electricity. My chairman sent me out across the desert areas of the southwest to search for possible sites where we might accomplish the generation aspect of our business with minimal environmental impact. After two or three months I was again seated in Mr. Quinton's office. Jack Horton, who was president at that time, was also there.

I carefully briefed them on my findings. In the best tradition of the engineer I had maps, charts, and tables spread out on the conference table. I identified something in excess of six sites and ranked them in their order of economic viability - again giving deference to the bottom line. When I finished my presentation Harold asked the critical question.

"Good show, Bill! Now which do YOU consider the best site? On which one are you proposing to build?"

It should be noted that he did not leap to the most economic site on my list but rather left me in full control of my area of corporate accountability. He asked me on which site I would build. Just to be sure that he and Jack understood the economics involved, I put my pointer on a site contiguous to the head of Monument Valley in eastern Arizona. Looking at my seniors I started to reply.

"Without doubt this is the best site. It is favored by topography, soil mechanics, proximity to fuels, wind regime, water availability - everything. Moreover, it will deliver kilowatt-hours to our system at the lowest incremental cost."

"Is that where you are going to build?"

I hesitated for a moment, then, "No, It is not my choice. I do not choose to be the one who deteriorates the value of Monument Valley as a one-of-a-kind scenic attraction. I just could not build a generating station near the head of this national monument. If that station is built, someone else will have to do it."

Harold and Jack exchanged a quick glance. Then, without hesitation, Harold asked, "What is your second best site, Bill?"

Once again I had learned a lesson in corporate responsibility in the public trust from the two people who taught me most about the business of running a utility. As my friend Jack Horton taught me: "If you have no alternative, you have no problem."

Interestingly, another utility consortium later built a steam generating plant contiguous to the *lower* end of Monument Valley. We elected not to join them. They took their lumps in doing it. It could never be done today given the current sensitivity of the public to environmental impacts.

Way Station Number Five: Toward the end of the 1960s I was still the chief technical officer of the company, with the title of senior vice president. Some additional duties had been folded into my portfolio. By that time I was fully convinced that we would be able to meet our corporate responsibilities to our customers and other constituencies only by the application of new technology. The pressure of environmentalists and other special interest groups were making it increasingly difficult to build the facilities need to serve the growing load. We were still committed to serving with existing technology. This meant very large and very costly fuel-burning generating stations. I called it the "age of the dinosaurs."

Under these pressures many utilities were taking the position with their regulatory bodies that if they did not get the permits required they would no longer consider it mandatory to serve their loads. This was a tempting cop-out. But after some reflection we took a different position. I had told our operations people that our policy was to search out every available kilowatt of capacity regardless of source and we would serve the customer to our very last Kilowatt-hour of energy. We would make no idle threats of not serving.

In this atmosphere, with approval of my new chairman, Jack Horton, I established an in-

house research and development department. My charge to them was to carefully examine every emerging technology for producing, transmitting, and distributing power, including those of non-traditional methods. In short, we were on a full-scale search for new technology. I believe General Electric was credited with the slogan, "If you can dream it, you can build it." I needed a sprinkling of dreamers.

At that time most product improvement research was accomplished by large manufacturers of electrical equipment. However, there were possibly two other major utilities who had established research functions. There was also the newly formed Electric Power Research Institute which was a captive corporation of the combined utility industries. In most cases, research programs were oriented toward improving existing technology rather than a search for the new and untried. I felt we needed something more, and it must be under our own control. I would later have reason to be greatly pleased in what we were doing.

Way Station Number Six: By the early 1950s the smog situation was being identified as a problem of major proportions, particularly in the Los Angeles basin where our operations tended to concentrate. One of its principal investigators was a Dr. Arrie Hagen-Smit of the California Institute of Technology. Recognizing that our fuel-burning operations would come under scrutiny in the process of this research program, we did not wait for the pressures to be applied. Our company built a laboratory contiguous to one of our steam boilers and invited Dr. Hagen-Smit to pursue part of his research there. In this posture we were continually abreast of all progress made in the field. It was in this effort that Dr. Hagen-Smit received the Nobel Prize for identifying the photochemical nature of smog.

Our interest in this subject continued and does so to this day. As more was learned about smog, the state of the technology of combustion gas clean-up moved into new frontiers. By the mid 1970s it appeared that we were reaching the point of diminishing returns in approaching the problem from the standpoint of combustion gas clean-up. At that time I proposed to the cognizant state agencies, regulatory or otherwise, that we approach it from the position of fuel supply. Specifically, I volunteered the company's commitment to burn oils of 0.02 percent sulfur or less. This was regarded as a proposition of dubious value since at that time 0.02 percent was the threshold of our ability to measure sulfur content.

After some discussion we agreed to this approach. Because we had been working in the technology of fuel supply and contaminant measurement, we had the tools to carry out the

program successfully. Similar improvements were made in the reduction of the oxides of nitrogen through improved technology of combustion in the fuel oil or fuel-gas burner. The result was an incremental reduction in the total burden of contaminants in the airshed over the Los Angeles basin. This is a continuing problem today since it seeks moving targets in its solution.

Clearly there were other way stations along the road to environmental clean-up that I haven't mentioned. But I believe my examples clearly establish our thinking and effort in these matters. In this fashion we continued to operate the company and serve our customers. However, it was in a worsening business environment. The regulatory pressures were increasing, licensing of new plants was becoming more difficult, and criticism of the impact of our operations on the ecologies was intensifying.

The nuclear option was no longer available to us for new plants. Like many utilities, we had unfinished nuclear facilities that required large expenditures in order to complete and place them in an earning position. We also had projected plans for additional nuclear generation which would become large consumers of new capital. Shares of stock of almost all electric utilities, our own included, were selling well below book value. In this fashion we made out tortuous way toward the decade of the eighties.

A Monumental Change

By mid-1980 I had succeeded to the position of chairman and chief executive officer. In view of the difficult and discouraging condition of the industry as a whole and of our own company as a component thereof it would have been easy to have been greatly discouraged. Surprisingly, I was not. Experience I had gained at the way stations leading me to this point had reinforced my confidence. I still felt there were many things we could do. The new technologies and the improvements of the old we had been pursuing in the R&D effort gave me confidence.

In September of the year I convened an off-site planning meeting of the officers of the company. This was annual event in which we assessed our past performance, took an inventory of our current strengths and weaknesses, and projected our plans for the future. We were developing our plans on a ten-year horizon. At this meeting we gave special attention to the fundamentals of how we were conducting our business and to our on-going effort to respond to a dramatically changing operating environment.

After two days of exhaustive discussions of procedures and much massaging of numbers, it became patently clear that we simply could not continue to do business as we had done in the past. Even with the significant changes we had made over the past twenty years, status quo was just not good enough. To continue to try to meet even the reduced load growth we were experiencing - with the then current format of resource additions - would only lead to disaster. The very survival of the company was at stake. It was clearly time to turn a page.

I suggested to the assembled management that it was time to "call in our chips." It was time to capitalize on the ten years of research and development we had spent in improving existing technologies and creating new ones. The age of the dinosaurs was clearly over. We could no longer afford to build large, capital-intensive, fuel-burning plants as we had in the past. The time had come to deploy the new, but as yet unproven, technologies, with their promise of cost reductions and environmental benefits.

I told the group assembled that all of the past fears and skepticism we may have felt about plunging into this untried business format must be abandoned. I was weary of our being the whipping boy in the editorial pages of the national press - a press that characterized us as an industry incapable of managing change. For one brief shining moment, I wanted for myself and for them to be bold and daring, and therefore, "on the side of the angels."

Well, there was a stunned silence for a few moments. They really didn't think I was serious. After all, it had been Bill Gould, their current CEO, who in his younger days had built all those dinosaurs on our system. Certainly the fact that an old line CEO, with a track record in building on the old format, was proposing the scheme lent some credence to this madness. But could we pull it off? The question in everyone's mind was, "Do you really want to do it? Can we accept the risk?" We know that what we have now will work and work well, even though we'll have the devil's own time financing additions of that kind and defending their environmental impacts.

My reply was simple and direct. What worked well for us twenty years ago was no longer the answer - it was simply not good enough. The corporate creature was no different than the most elementary biological organism. If we failed to undergo the mutations necessary to adapt to a new environment, we would flounder and die - and we would deserve the fate. If you have no alternative you have no problem! The time for change, on a dramatic scale, was now!

Well, we wrangled about it for an hour or so. I let them have their full say. They asked for

further definition. I said that since our nuclear effort was well over ninety-percent complete, we would finish it. But all other *conventional* resource additions would be wiped off the slate. They would be replaced with the new *alternate* resources we had been researching, with special attention given to the so-called renewable sources of energy such as geothermal, solar, small hydro, and wind. I reiterated that we would find a kilowatt of capacity and a kilowatt hour of energy wherever we could! And we would serve the customer to our very last available kilowatt!

It was an interesting study in group dynamics. As we continued to talk about it our enthusiasm mounted. Soon it was unanimous and reaching a crescendo. We were very much like a losing football team in the locker room at half time. We even ended the meeting with old familiar benediction of "now let's get in there and fight!" We were clearly on the side of the angels!

I cautioned all hands to keep this plan as confidential as possible. We would do our foot work so the program would be on a good foundation with impeccable credence before we went public. We would meet again in two weeks to review progress and set a date for a press conference. If we were going to be on the side of the angels, the angels had to know what we were doing. It must be told fast, told completely, and told in an English that could not be misunderstood.

In a few days we met again and went over the program. In the interim I had discussed the general approach to our future with the board of directors. They were in concurrence. With a few changes we considered our program sound. I noted in my review that the planning people had left two coal-fired units in the plan for service in the early nineties. I looked at the vice president who had system planning in his portfolio. He and I had been together since we were both young, cub engineers in generating stations. We understood each other very well. He sensed the question my glance implied..

"Bill," he said, playing his last card, "they are only in the plan to hedge our bet. I can take them out of the next iteration."

When I delayed my answer he walked around to my side of the table and drew a heavy red line through them. The last of the dinosaurs had been removed from our resource plans. There has never been a subsequent issue of that plan in which they have reappeared. We had severed our last tie to the past.

We then addressed ourselves to that task of communicating our intent to our various constituencies. These included the general public, our shareholders, our ratepayers, the regulatory bodies in government, certain elected officials who had been interested in our affairs, our industry associations, and most importantly, our employees - the people who had to make this venture work. Each officer was assigned a list of contacts to be made the day before our press conference on October 17, 1980.

On October 16, I personally called the heads of the regulatory agencies and certain government officials. There was not one negative reaction in the group. I cautioned them not to break silence until we had our press conference the following day. I then prepared a letter to our employees and timed it to reach them at the close of business on October 16. I wanted them to be informed about the forthcoming announcement before the general public was. In this letter I sketched the situation that dictated this monumental change in the company's business plans. I outlined our future resource strategy based on the new technologies. I closed the letter with a statement to this effect:

"I now invite you to join me in a moment of high adventure as our company moves forward into a new and exciting period of its history!"

A curious thing about that letter. I am now retired to an emeritus situation. Twelve years have passed since that letter was issued, but it still lives on. People still stop me in the halls of our headquarters building and speak glowingly of those exciting times of "high adventure." The letter has become somewhat ubiquitous. I have found it in investment houses on Wall Street, among congressional staff in Washington, and with our sister utilities. It was more effective and had a greater longevity than our official press release.

The press conference went off without adverse incident. Our announcement was well received. But I was not prepared for the ground swell of support that followed in its wake. *The Los Angeles Times*, who in the past rarely had a good word to say of us, editorialized under the caption: "**Congratulations to a Courageous Maverick.**" *The Washington Post*, almost never found in our corner, opined: "**The Future is Now!**" Another periodical stated, "**Bill Gould Shapes the Utility of Tomorrow.**" And one element of the press with a deeply ingrained dislike for utilities in general paid us the best compliment of all. They grudgingly proclaimed us "**The Prettiest Hog at the Fair!**"

But the reaction of our sister utilities to our announcement was less than enthusiastic. We were regarded as a defector from the defense lines that were trying to preserve the status quo. The CEO of one of our nearby utilities called me and after expressing his disapproval said, "But don't expect us to follow you."

"Oh, but you will," I replied. "Either willingly as a hero or as a villain under the lash of public opinion." They followed us, as did the rest of the industry.

A day or so after the press release I was in Washington attending an industry meeting. The CEO of an eastern utility looked sneeringly across the table at me: "And what has the tooth fairy brought you this morning, Billy Boy?"

I smiled back, "It is as yet a little early in the day."

One year later in a similar meeting, a security analyst was reviewing for the same group of CEOs the performance of utility securities and the general situation on Wall Street. It seems that in his report we had the happy situation of being the jewel in the crown. We led all the rest in the long climb out of the financial cellar. Released from that great burden of debt associated with the building of the dinosaurs, we were performing well. We were, indeed, the prettiest hog at the financial fair.

My antagonist and critic of a year ago was seated in front of me. I took great delight in poking him in the ribs and saying, "That, my friend, is what the tooth fairy brought me this morning!"

Although at that time I did not know it, a year or so later when our progress was continuing unabated and the industry was clearly falling into line, I would be named the man of the year for our industry. The utility business was changed forever to the great benefit of its ratepayers, its shareholders, its employees, and the general public. I felt humbled to have had the opportunity to play a role in the monumental exercise.

The Engineer and the Environment

Now, in summary, what had we actually done? Succinctly stated, we had made dramatic changes in the way the electric utility service was to be offered in the future. The changes had

been to some degree institutional and political. But primarily they were technological. And all of this was done at lesser cost and with reduced impact on the environment that had been the situation with earlier procedures.

How had we done it? To begin with, we stopped some wasteful practices. Conservation was urged on the customer. Sophisticated computer-based, use-control programs were devised and applied.

In the area of production, we seized upon unused opportunities to generate power. For example: in a technology as old as hydro-generation we developed small, hydraulic turbine generators. These were used in water deliver systems where it was common to have small amounts of water discharged at significant velocities. In past practice this energy was absorbed in direct impact since the increment was thought to be insignificant for power generation. We now thought otherwise and installed small turbine generators to capture these kilowatts. This was consistent with our effort to find every kilowatt available, including those that had previously escaped us. A general upgrade of existing hydro-generation resources was pursued.

We developed geothermal resources at sites where heat resources deep in the earth were used to produce steam to operate a turbine generator. This made it unnecessary to burn large amounts of fossil fuels and thereby eliminated the burden of products of combustion (smog, if you will) on the atmosphere in areas where we would otherwise have built fuel-burning generating stations.

We pursued with good effect the production of electric power from solar energy. In this we used two systems. One was the direct absorption of heat from the sun's rays into a steam-boiler turbine-generator system. Another was through the use of photovoltaic cells which produced the energy directly. These projects were both in cooperation with the Federal Department of Energy and with individual entrepreneurs in the private sector. Again the effect was to reduce the amount of fuel burned. Cleaner air was the prize.

We stimulated and developed co-generation projects wherein steam required for a given industrial process was also used to produce electric power. This is popularly known as the utilization of waste heat in process industries for power production. Industries that were candidates for this type of energy partnership included petroleum production, petroleum refining, primary steel production, steel fabrication, paper manufacturing, and many other.

Again the effect was a reduce consumption of fossil fuels.

Our research conducted in the area of wind turbine generators was made available to private entrepreneurs who installed wind machines from which we purchased the output.

We led a consortium which build a successful coal gasification and combined-cycle power-producing facility. In this process, the environmental impact, particularly in the burden of products of combustion on clean air resources, was much lower than with the conventional combustion of coal.

There were many more sources of power production that we pursued. Some were fruitful and some await further development. At one time we were obtaining power from nine different categories of production. This was more than any other utility in the world utilized at that time. All had the effect of reducing the demands that our earlier format operation made on the air, water, land, and fuel resources of this planet.

These programs were not pursued without some difficulties. Problems of significant magnitude were encountered, primarily of a legal, contractual, and political (regulatory) nature. Some of these problems still plague us. However, on balance we were and are doing our job considerably better than it had been done before. The industry in general was following us. The genie was out of his bottle and would never return. In spite of the new set of problems we continue to confront, the energy world is considerably better than it was under the old system. We have made a distinct contribution to the quality of life in doing our business in the public trust.

As time went along we accrued other accolades for our pioneering efforts in this field of new and alternate energy resources. To the company as a corporate entity there came almost every recognition that we could expect. They came from government, industry associations, professional societies, and the like. Perhaps the crowning event of this nature was the awarding of the prestigious John and Alice Tyler Energy/Ecology Prize. This was the first and only time a corporation had been named a Tyler Laureate. Some recognitions came to me personally as the leader of our company team. Most of the founder societies in the engineering progression took note of what we had done.

The Challenge . . .

We should not for a moment believe that all has been done in our industry that can reasonably be expected to improve its performance in its chosen mission. Let me offer an observation and a challenge to those who will pursue its problems in the future. The observation first: all we have done to date is but a small beginning. I hope that future analysis will show it to be but another way station on the road to further and greater developments. I mentioned that what we have done thus far has left in its wake some institutional problems with which the industry is wrestling. I am confident they will be solved by careful and competent people. But more importantly, our efforts have opened many areas of opportunity for further technological change and improvement.

And herein lies the challenge. I fervently hope that power engineers of the future will forever be dissatisfied with the status quo of their art and science. Our discussion here tonight has focused primarily on the many improvements we have made in the means by which we produce electric power. There are still frontiers to be pushed back in this phase of our business. But there are also other aspects to the power industry.

Electrical transmission and its related impacts on the environment is a field of endeavor burgeoning with opportunity. A similar situation exists in distribution. While we have made considerable progress in this field, such as the undergrounding of service lines and the like, there are still many places where our means of serving the customer is an eyesore and an affront to the sensibilities. True, this area is fraught with considerable expense that must be born in the cost of service, but I am firmly convinced that significant progress can be made.

These are some of the problems that I would hope engineers will earnestly address. I am sure that similar problems await solution in many industries and fields of scientific endeavor. It was the hope of my late wife and I that these problems would be met, solved, and discussed in a forum such as this. It was for this purpose that this lecture series was established.

Conclusion

Now, at the risk of repetition I would like to return to the spirit and the note on which I opened this lecture. What have we in the utility business and engineers and scientists in many other diverse fields been doing? In the public trust we have continued to pursue our chosen tasks and mission. When we do our basic job well we usually produce many direct and ancillary

benefits to the quality of life for society in general.

Why do we do it? Let us return to one of the verses from Kipling's "Son's of Martha:"

*Not as a ladder from earth to heaven,
not as a witness to any creed,
But simple service simply given
to his own kind in their common need.*

And further . . . , with some paraphrase:

*"They have cast their burdens (environmental)
upon the Lord.
And - the Lord He lays it on Martha's Sons!"*

Thank you . . . ,

. . . and good night!

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