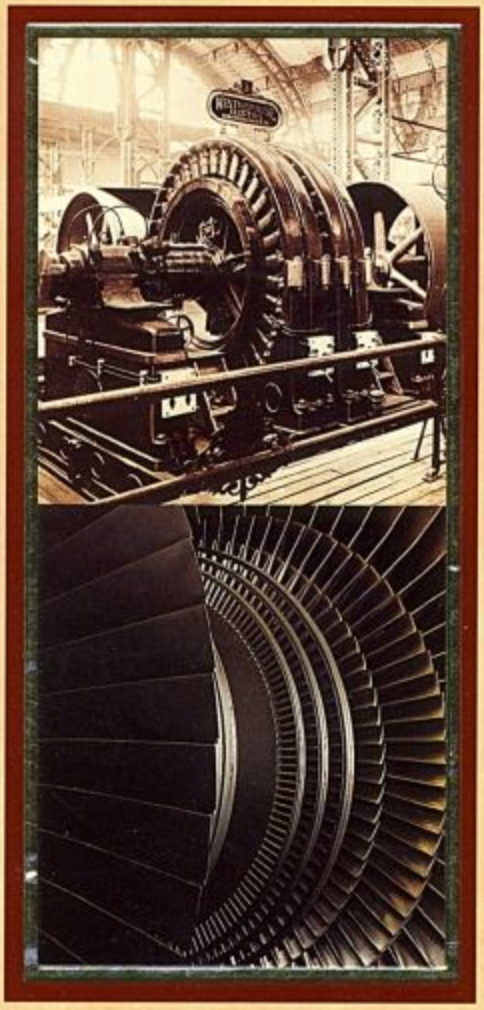
WESTINGHOUSE POWER GENERATION



A

rich and colorful

yesterday...

a commitment to

today's needs...

a promising

tomorrow.

George Westinghouse

1846-1914

On December 1, 1936, an extraordinary group of men gathered in New York to participate in a special forum. They were company presidents and chairmen, and distinguished engineers; one was the president of Yale University. Several were well advanced in age.

Their sole purpose was to commemorate the ninetieth birthday of the late George Westinghouse . . . to celebrate his life . . . and to reminisce about an old employer, friend and mentor who, before his passing 22 years previously, had forged his imprint on all their lives.

They spoke lovingly of a man crackling with energy and enthusiasm. They recalled a man of genius who balanced the urgency of discovery with a patient understanding of human nature. One thin fragile former employee, well into his eighties, recounted how Mr. Westinghouse had chartered a train and taken them all for a week of fun at the American Centennial Exposition in Philadelphia. The years fell away as they swapped stories about the gentle, unaffected giant they still referred to affectionately as "the Old Man."

Just as the spirit of George Westinghouse moved among that aging assemblage almost 60 years ago, it has molded and driven the company which has borne his name for more than a century. And much like those distinguished gentlemen in that long ago December, we seek in these pages to pause once again to celebrate the legacy of Mr. Westinghouse . . . and to confirm the fulfillment, every day around the world, of the simple wish he himself expressed:

"If someday they can say of me that in my work I have contributed something to the welfare and happiness of my fellow men, I shall be satisfied."

George Westinghouse

With the impetus provided by its founder, Westinghouse Electric Corporation went on to lead the rush into the Age of Electricity. Today, the company's Power Generation Business Unit is committed to helping the global power industry meet its current needs for electrical energy. And of equal importance, the Westinghouse Power Generation Business Unit is spearheading exploration in the emerging technologies which will generate more affordable and cleaner power, from more plentiful and varied sources, well into the next century.

A rich and colorful yesterday . . . a commitment to today's needs . . . a promising tomorrow. These are the elements of the long and continuing story of George Westinghouse and the company that carries his legacy.

The Man and the Beginning

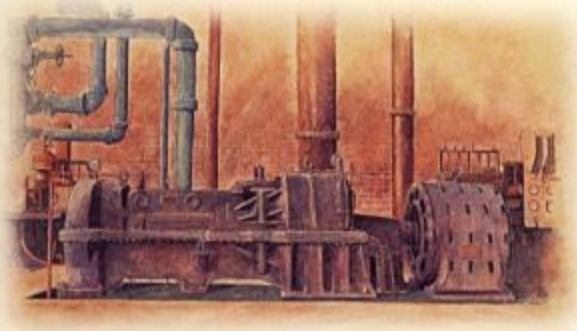
George Westinghouse was already a successful businessman in the mid-1880s. At the age of 22, he had invented the railroad air brake, and over the next 15 years, Westinghouse air brakes revolutionized the railway industry. In 1880, he had developed the first automatic railway switching and signaling system, and formed the Union Switch and Signal Company in Pittsburgh, Pennsylvania.

By 1885, Westinghouse was one of America's leading business entrepreneurs during the birth of American big business; and he was an insatiable inventor in the age of inventors. That year, Westinghouse turned his attention to a phenomenon which had intrigued scientists and inventors for years – the magic of electricity.

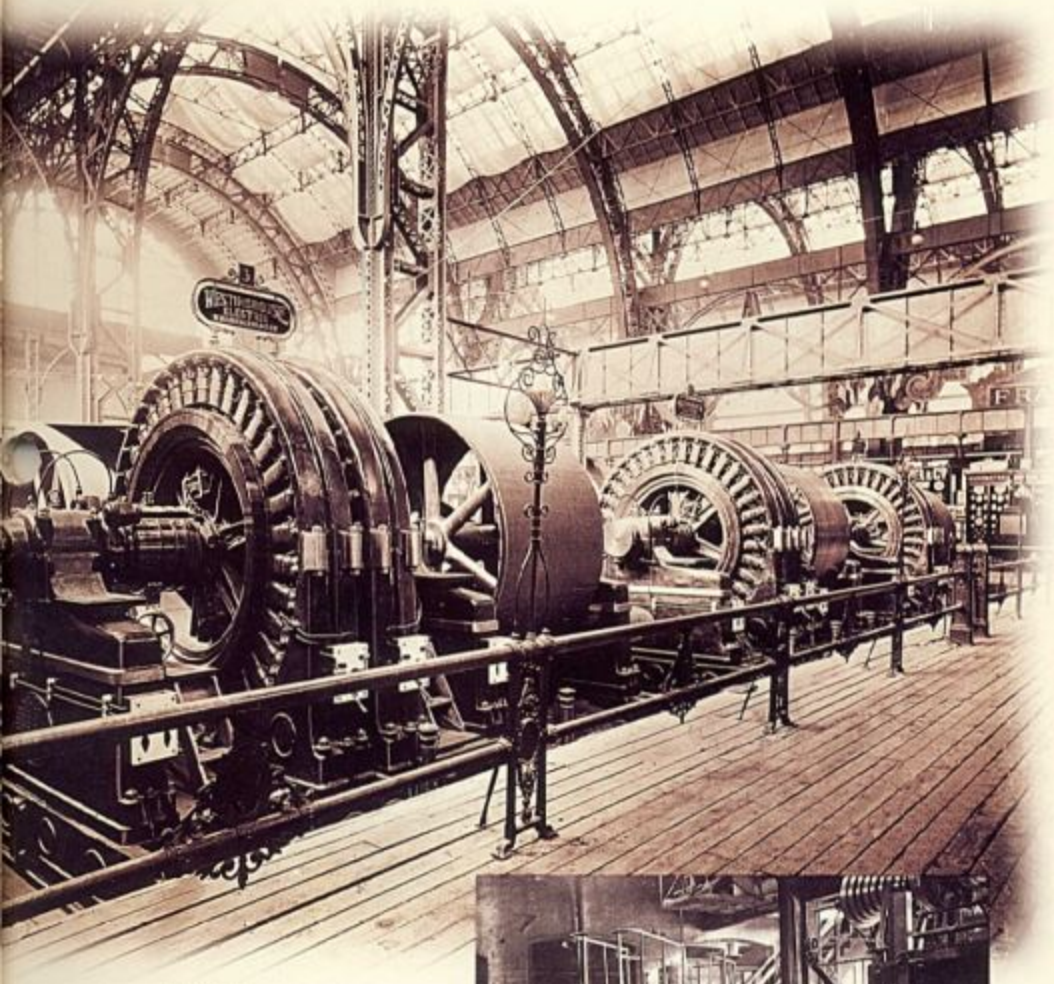
At that time, direct current (DC) was state-of-the-art in electric transmission. The drawback was that direct current could only move over short distances. The electricity produced by a DC generator might light up a neighborhood, but never a city. Yet no less than Thomas Edison, renowned as "the Wizard of Menlo Park," was convinced that DC was the path to lighting the world.

George Westinghouse thought otherwise. As a result of his experience with electricity in railway signaling, he was among several who became interested in the alternating current (AC) form of electricity. Early in '85, a talented, young, Italian engineer, Guido Pantaleoni, brought to the attention of George Westinghouse, a device called a "secondary generator," patented in England by Lucien Gaulard, a French electrician, and John Gibbs, a British engineer. One associate of Westinghouse, William Stanley, took the Europeans' design and developed the device with potential for commercial use. Today, this same device is called a transformer.

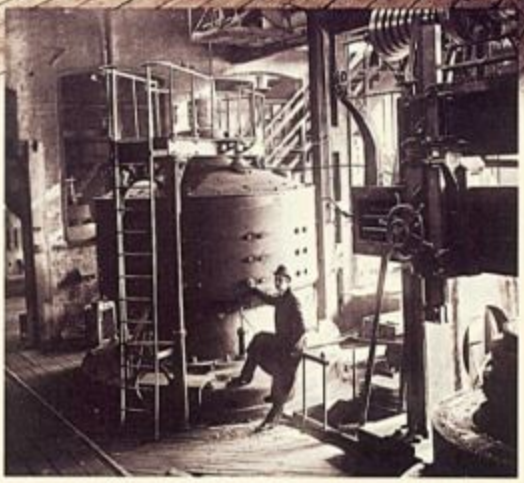
Westinghouse acted immediately. He bought the American rights to these patents and on January 8, 1886, a charter was granted for a new company to pursue the promise of electri-



First turbine-driven generator providing power from a central station – Hartford, Connecticut, 1901.



Westinghouse lights the Columbian Exposition – Chicago, Illinois, 1893.



5,000 horsepower AC generator – Niagara Falls, New York, 1885.

Document left: Charter and Letters Patent of the Westinghouse Electric Company – January 8, 1886.
Document right: Articles of Association and Application for Letters Patent – December 23, 1885.

cal power as a commercial product: Westinghouse Electric Company.

Unlike Edison, George Westinghouse put more of his trust in a brilliant team of researchers. He had no illusions that he held all the answers. In addition to continuing his own research, he readily sought the breakthroughs of other engineers and scientists, and bought patent rights to any idea or development which would accelerate his team's progress.

One of those from whom he purchased patents was a visionary Croatian named Nikola Tesla, who Edison had recently fired. Tesla invented and had patents for an induction motor and polyphase alternating current system which became the basis of Westinghouse Electric's early achievements in alternating current.

A series of tests over the next several years proved and improved

Guido Pantaleoni

William Stanley

Nikola Tesla

the Westinghouse system. By 1890, Westinghouse had installed more than 300 AC-driven central power stations. And in 1893, Westinghouse Electric made a convincing demonstration of the superiority of alternating current by providing light and power for the Columbian Exposition in Chicago, Illinois. It was the most spectacular display of lighting the world had ever seen.

In 1895, Westinghouse Electric completed a major milestone in its history – a 5,000 horsepower AC generator, five times larger than any previous generator at Niagara Falls, New York.

Blade ring for the 375 turbine – Lester, Pennsylvania, 1920.

Turbine blader – Lester, Pennsylvania, 1920.

The same year, Westinghouse purchased the patent for a steam turbine-generator developed in England by Charles Parsons. For four years, the Westinghouse team sought to perfect the details of a steam turbine-generator running on alternating current.

Then in 1900, a 1,500 kilowatt unit was purchased from Westinghouse Electric by the Hartford Electric Light Company, and began operating in 1901.

It seems fitting that here, near the beginning of a new century, the Age of Electricity was brought home to the American household . . . with a steam turbine-generator by Westinghouse Electric Company.

THE WESTINGHOUSE STEAM TURBINE

Prime Mover for Decades of Progress

As the first commercial Westinghouse steam turbine-generator began operation at Hartford Electric Light in 1901, it was watched closely by utility companies across the country. With each week of operation, the new turbine generated increased confidence throughout the emerging power industry.

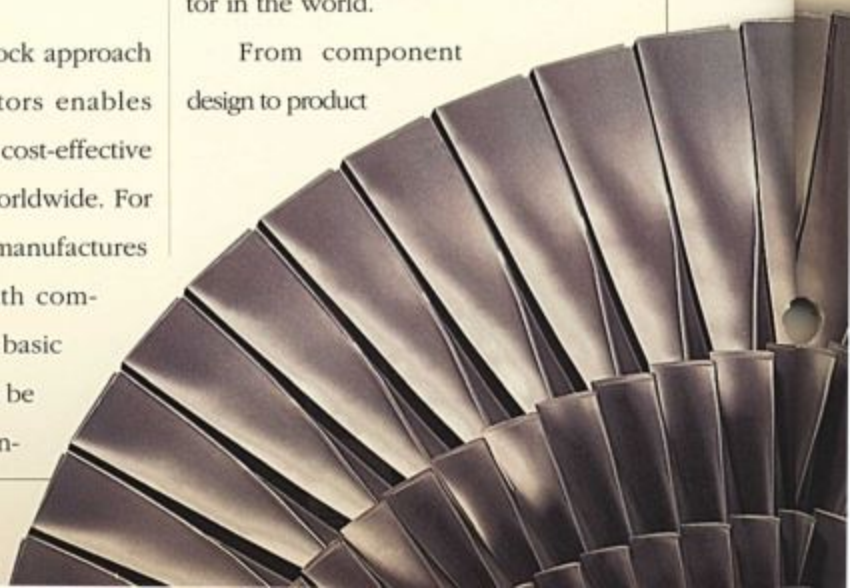
Today – almost 100 years later – Westinghouse offers a full spectrum of turbine-generator systems ranging between 10 and 1,500 megawatts. These turbines are designed for reheat, non-reheat, combined-cycle and cogeneration applications, and incorporate the latest technological advances to maximize efficiency and reliability.

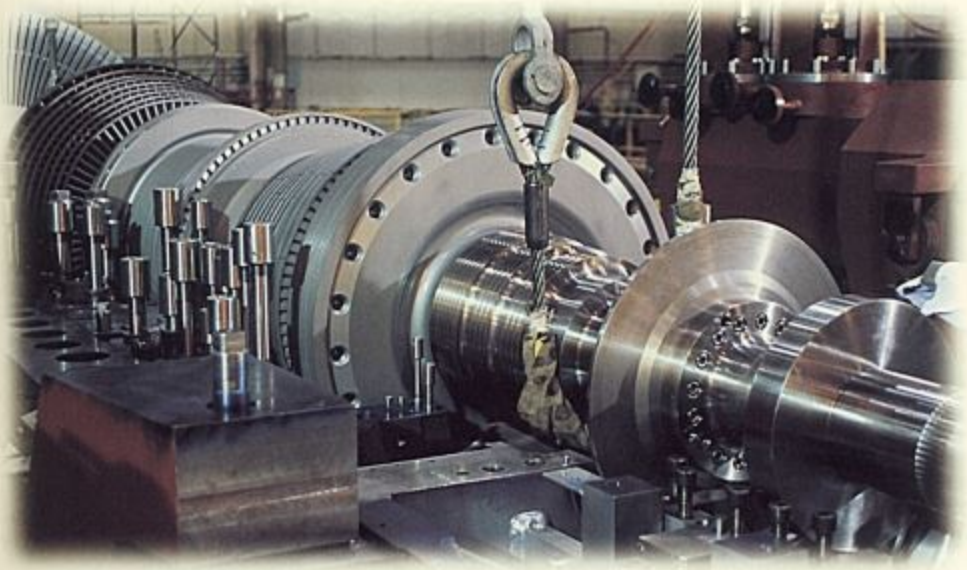
Ruggedized blading on the low-pressure turbine rotor improves reliability and increases thermal performance.

A unique building block approach to turbines and generators enables Westinghouse to provide cost-effective products for customers worldwide. For example, Westinghouse manufactures hydrogen generators with common core diameters and basic design features which can be customized by varying generator core lengths to meet specific requirements. The result is an individualized product with a proven design which can be delivered in a short cycle time – and performs more reliably with reduced maintenance requirements.

Westinghouse manufactures air-cooled generators for steam turbines up to 150 megawatts, offering simplified cooling and reduced maintenance; hydrogen-cooled generators designed to work in tandem with the 150 – 600 megawatt range of turbine configurations; and for applications above 600 megawatts – the technologically-advanced, water-cooled Rigi-Flex™ generator, the most reliable and maintainable, large generator in the world.

From component design to product



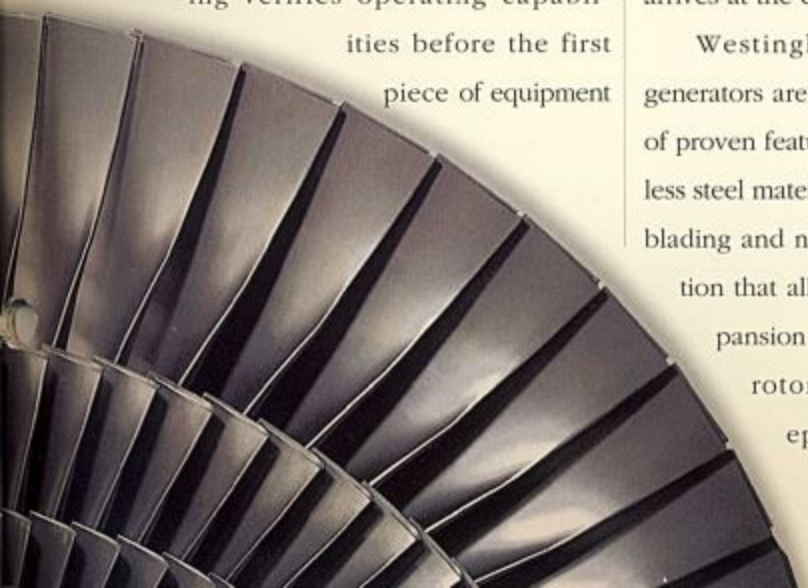


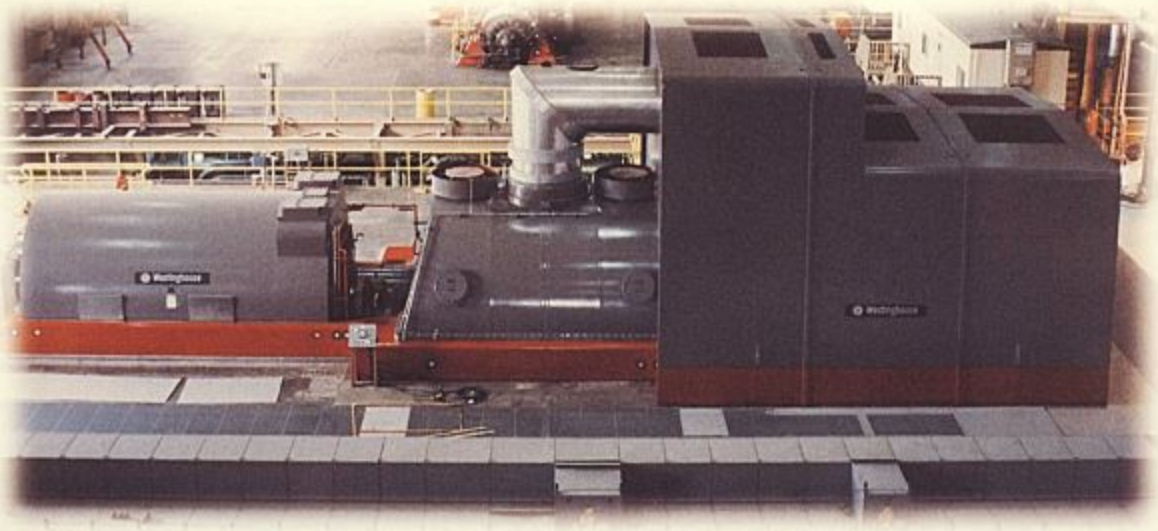
Installation of a state-of-the-art 180 MW high-pressure/intermediate-pressure rotor.

line enhancement to power block systems, Westinghouse engineers apply the same quality standard: "design by analysis; verification by test." Techniques such as three-dimensional finite element and flow field analysis, for example, have enabled engineers to incorporate innovation into the design process. And, intensive laboratory testing verifies operating capabilities before the first piece of equipment arrives at the customer's site.

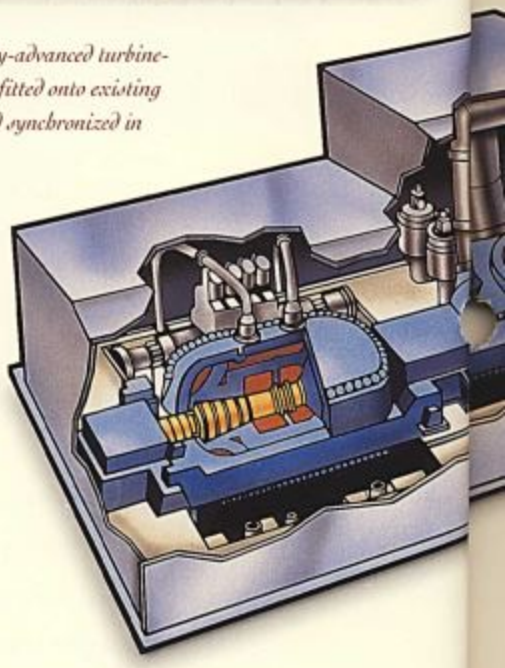
Over the past decade, Westinghouse technological innovations in rotor and blade design have improved low-pressure thermal performance by over 3 percent.

Westinghouse steam turbine-generators are available with a long list of proven features. From 17-4 PH stainless steel material used for low-pressure blading and nozzle chamber construction that allows for free thermal expansion – to monoblock boreless rotors and Thermalastic® epoxy insulation of the





Technologically-advanced turbine-generator retrofitted onto existing foundation and synchronized in 234 days.

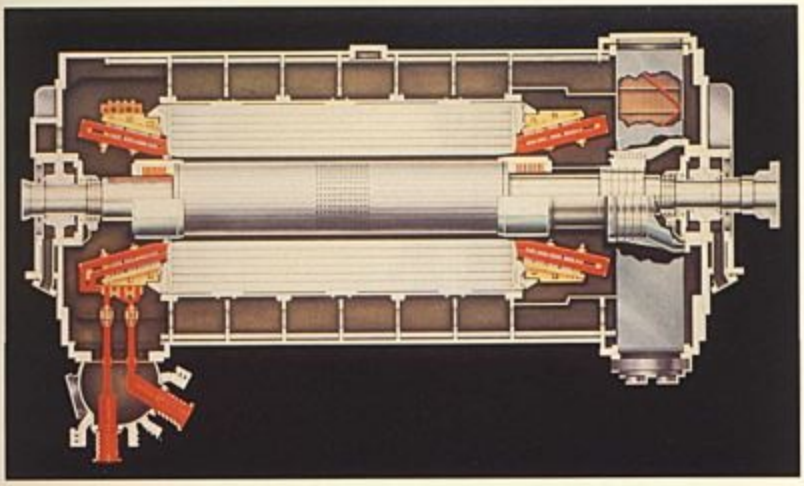


stator coil, these features and more, minimize maintenance requirements and extend operating periods.

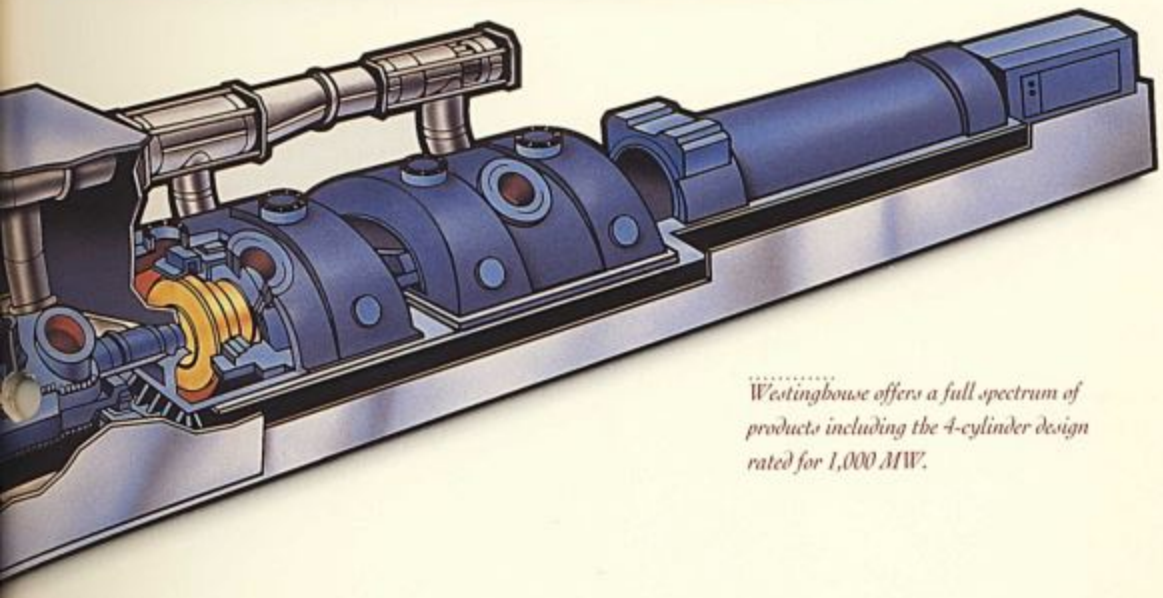
Today, over 50 percent of all turbine-generators operating in utility generating plants have accumulated more than 25 years of service. Westinghouse pledges its continued support to operating plant performance through parts services, blading, turbine and generator major service, including its generator Rapid Rotor Rewind and field Rigi-Flex™ programs.

At the same time, steam turbine power generation has begun to share its spotlight with combustion turbine systems. Today, one option for power producers is the combined-cycle power plant, where combustion turbine-generators produce steam to drive steam turbine-generators with system efficiency of greater than 50 percent.

Meanwhile, hundreds of steam turbine-generator systems continue to supply 90 percent of all electric power generated for millions of consumers around the world. And new steam turbine-generator applications remain



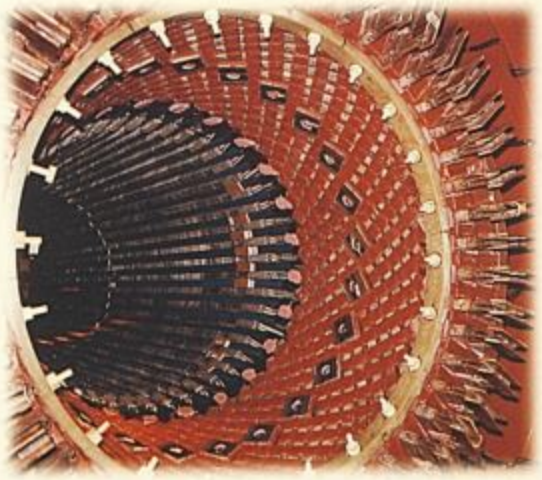
Proven hydrogen inner-cooled generators provide reliable power up to 600 MVA.



Westinghouse offers a full spectrum of products including the 4-cylinder design rated for 1,000 MW.

the most practical and cost-effective answer for many power users. For these reasons, Westinghouse is committed to ongoing steam turbine-generator research and development.

Even as the technology of power generation reaches out to new horizons, the story of steam turbine power generation, and the Westinghouse contribution to that story begun in Hartford almost a century ago – is a story still unfolding.



Advanced end turn bracing system eliminates maintenance and improves generator reliability.

The Next Generation of Turbine Power

The Westinghouse commitment to combustion turbine development was launched during World War II, fulfilling the need for more advanced pursuit planes in the Pacific theater. During this critical period in history, Westinghouse was in the forefront of engine development for the new jet planes. In 1948, this wartime turbine technology was converted to peacetime application as Westinghouse installed its first industrial application of the combustion turbine. Today, almost a half century later, more than 1,250 combustion turbine systems incorporating Westinghouse technology are installed worldwide.

Assembling vane segment into blade ring.

Westinghouse combustion turbines aid industry, electric utilities and independent power producers in meeting the challenges of higher fuel costs and greater environmental requirements – factors which were nonexistent during the earlier decades of this century.

Westinghouse combustion units are highly reliable and cost-effective. They also offer application flexibility and ease of site selection, as well as short lead times. And, combustion turbines offer one of the more efficient forms of power generation. The most sophisticated combined-cycle systems achieve over 50 percent thermal efficiency with significant reductions in emissions – a distinct environmental advantage.

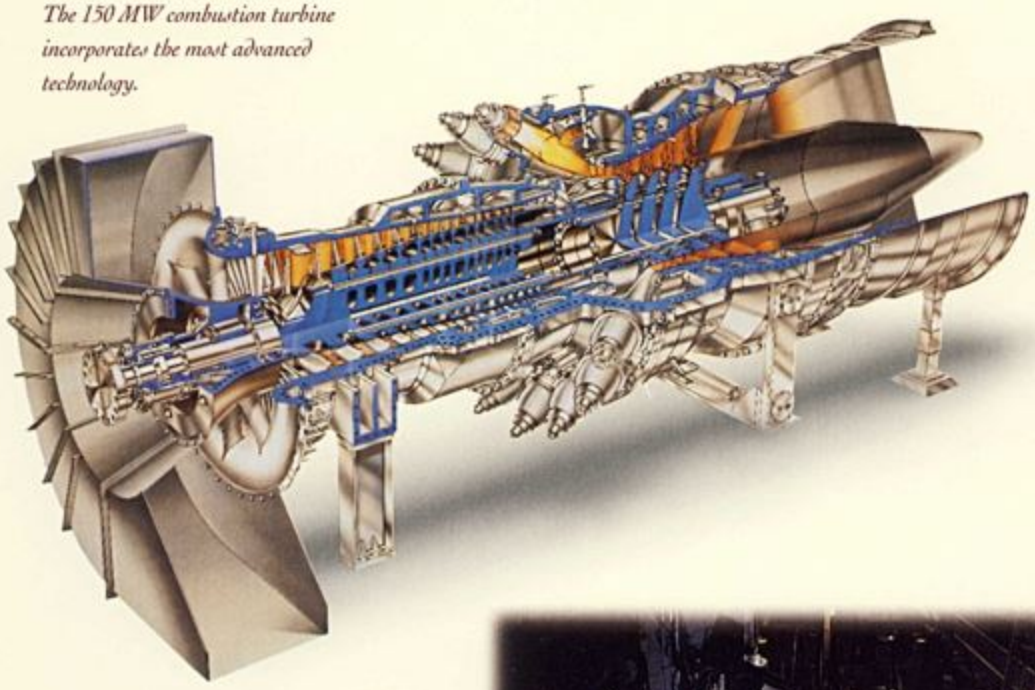
In order to meet ever-widening needs for cost-efficient power generation, Westinghouse offers a full range of combustion turbines. The model 501 turbine series, with various 60-hertz configurations, has continuously set new standards for performance in both simple-cycle and combined-cycle applications. For example, using two 501 turbines together with two heat recovery steam generators and a 100 megawatt steam turbine, Westinghouse achieves optimized combined-cycle performance.

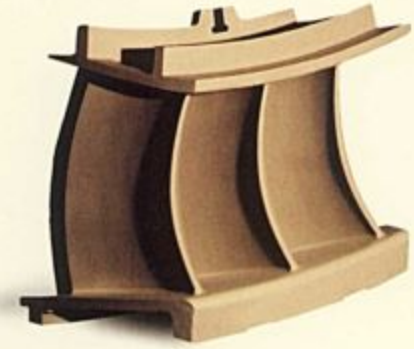
The model 701 is the 50-hertz derivative of the 60-hertz model 501.

Final assembly of 501D combustion turbine.

Combustion turbine model W21 with 1,800 horsepower, 1949.

The 150 MW combustion turbine incorporates the most advanced technology.



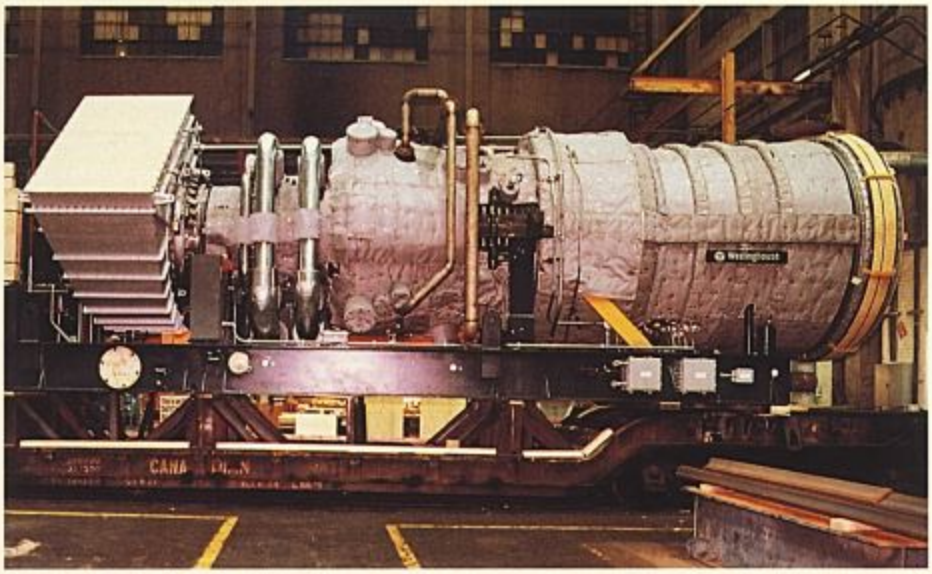


Right: 501D turbine cylinder.

Since the first 701 installation in 1975, the 701 has achieved a high reliability record.

The Westinghouse model 251 combustion turbine is the latest model of a successful series of heavy-duty, single-shaft engines designed for either 50- or 60-hertz applications. It has achieved one of the most reliable records in the history of combustion power generation technology.

In 1972, Westinghouse began working on syngas technology to fuel combustion turbine systems with synthetic gas derived from coal. Following earlier



251 combustion turbine ready for shipment.

developments from the '60s, a full-sized syngas combustor was demonstrated under laboratory conditions in 1986. And a year later, two 501D5 combustion turbine units at a Dow Chemical plant in Plaquemine, Louisiana, were converted to burn a medium BTU synthetic gas. This plant, with 160 megawatt capacity, is the largest integrated coal gasification combined-cycle power plant in the world.

As we enter the era of clean coal technology, the gasifier, atmospheric and pressurized fluidized bed combustor (PFBC), and direct and indirect coal-fired combustion turbines offer a variety of options for advanced combustion-based systems.

As a result of research and development efforts, Westinghouse continuously introduces new products for commercial use. The latest design of combustion turbines, rated at over 150 megawatts for 60-hertz applications and over 200 megawatts for 50-hertz applications, apply advanced, state-of-the-art cooling technologies comparable to the latest in aerojet engines. Emission controls are also being developed to satisfy more stringent environmental requirements worldwide.

Westinghouse 501D5 and 251 combustion turbines are totally manufactured and assembled in North America within the Westinghouse integrated Power Generation Factory. In addition, to meet demands more efficiently, Westinghouse has the capability to produce combustion turbine units in cooperation with its worldwide associates.

As the world's producers of electrical power turn to more highly efficient combustion turbine and combined-cycle systems for power generation, Westinghouse is prepared with the experience, resources and technology to meet those needs, wherever they develop, into the future.

Harnessing All the Power of Westinghouse Resources

A century ago, George Westinghouse, the visionary, was also a practical man. He understood the value of using all his company's resources – its skills and experience, its leverage and capital – to achieve his goals as expeditiously as possible.

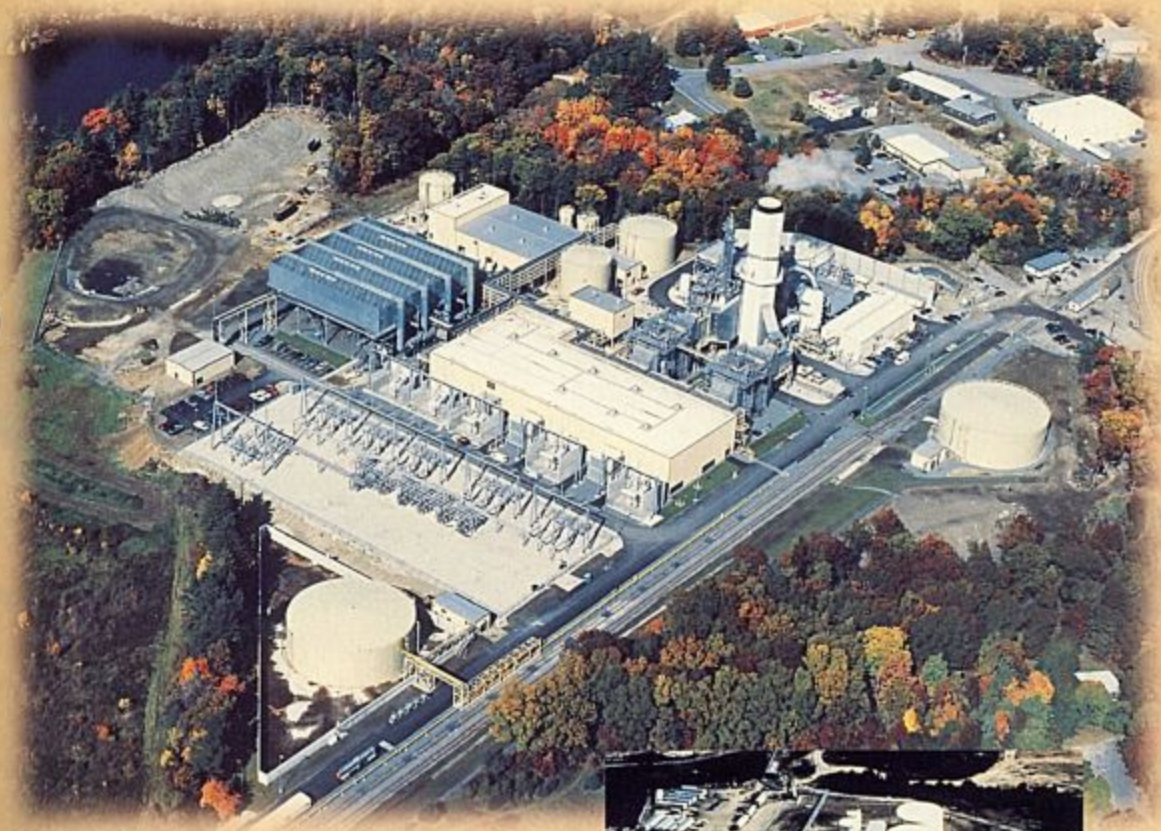
Today, the company he founded uses that same "get it done" approach, particularly in the area of power generation projects. Across North America and around the globe, Westinghouse works with industries, utilities, government agencies, cogeneration ventures and independent power producers to deliver reliable and efficient sources of new generation capacity.

The Power Generation Projects Division builds upon Westinghouse experience in power plant integration and complex project management. This group can provide a full range of power equipment and extended scope participation, from a turbine-generator to a power cycle – to a complete turnkey project. As an example, at Bellingham, Massachusetts and Sayreville, New Jersey, Westinghouse contracted to design, build, test and start-up two nearly identical 300 megawatt combined-cycle plants. Westinghouse is also responsible for long-term operation and maintenance of both plants.

To meet utility peaking requirements, such as at the Hagood Station of South Carolina Electric & Gas, and the Commonwealth Atlantic Limited Partnership plant in Chesapeake, Virginia, Westinghouse provided fast-track, simple-cycle peaking plants on a full turnkey basis.

When Enron Corporation began construction of the world's largest natural gas-fired cogeneration plant in England, Westinghouse was called upon to supply the equipment for the power island – eight 137 megawatt combustion turbine-generators and two 216 megawatt steam turbine-generators. In South Korea, Westinghouse was awarded the contract to provide all the major equipment and project management for the Ilsan and Puchon district heating combined-cycle plants. This project includes the installation of seven Westinghouse 501D5 combustion turbines.

Hagood Station of South Carolina Electric & Gas.



500 MW turnkey combined-cycle plant utilizing two 501D5 combustion turbines and a 100 MW steam turbine-generator – Bellingham, Massachusetts.

300 MW turnkey combined-cycle plant – Sayreville, New Jersey.

In the southwestern United States, Westinghouse participated in a construction consortium to design, supply and build two turnkey, 150 megawatt lignite-fired power plants for the Texas-New Mexico Power Company. These plants were designed to utilize Westinghouse steam turbine-generators, thermal cycle equipment, and plant electrics and controls. An innovative off-balance-sheet financing approach insulated the utility from the financial risks of construction.

The power of Westinghouse resources encompasses the full range of power plant design disciplines. By starting with well-proven reference design modules, Westinghouse engineers – experts in thermodynamics, fluid flow behavior, mechanical stress, materials, control systems, electrical properties and mechanical engineering – configure power plant systems to meet the economic, efficiency and reliability requirements of a dynamic global generation market – all with an integrated project approach.

Westinghouse has a proven track

55 MW turnkey Mojave cogeneration plant utilizing the Westinghouse 251 combustion turbine and a 15 MW steam turbine-generator – Boron, California.

Westinghouse trains plant operators on its advanced-design simulator system.

record of developing innovative project financing packages to meet the differing needs of its global customers. In many instances, this financial participation may extend to equity involvement in the revenue stream of the project.

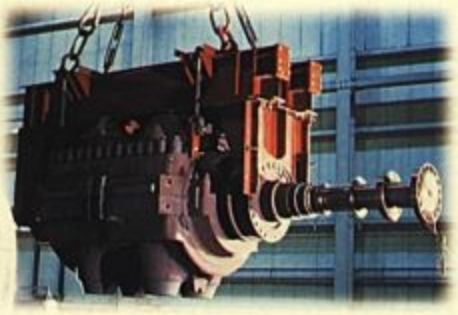
Plant operator training is another area which can be included in the scope of a Westinghouse project. Before operational start-up, Westinghouse can train plant operators on its advanced-design simulator system, creating a realistic operating environment and special situations which will prepare employees for "day one."

As the challenges in the worldwide power generation industry demand even greater innovation, the resources made available through the Westinghouse Power Generation Projects Division will increasingly become the cost-effective solutions to those challenges . . . with no two identical projects . . . just the way Mr. Westinghouse would have liked.

Innovative Worldwide Support for the Fleet

Since the installation of the first Westinghouse steam turbine almost a century ago, maintenance and technical support have been an essential part of every power generation system sold. Today, that support is the responsibility of the Power Generation Service Division – an integral part of the Westinghouse Power Generation Business Unit.

The Power Generation Service Division is an industry-unique, value-added supplier of service. Its business is to help customers be successful in their business by identifying the elements of their success, and then focus efforts and resources on achieving that success.

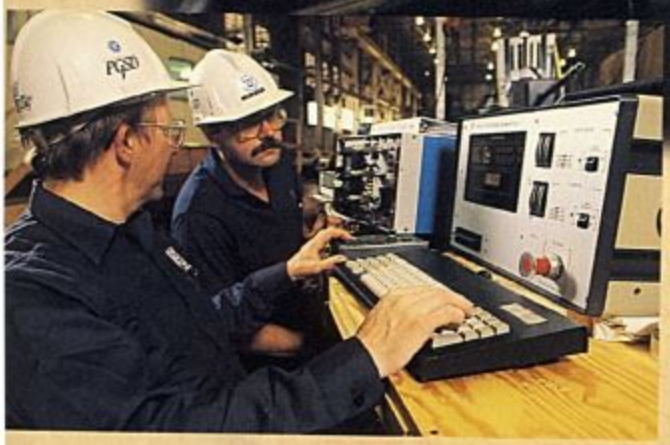


The unified lift makes it possible to assemble the high-pressure turbine in the factory, then ship and install the unit while maintaining critical alignment. This innovative method avoids the outage time required for on-site assembly, thus offering to customers significant savings.

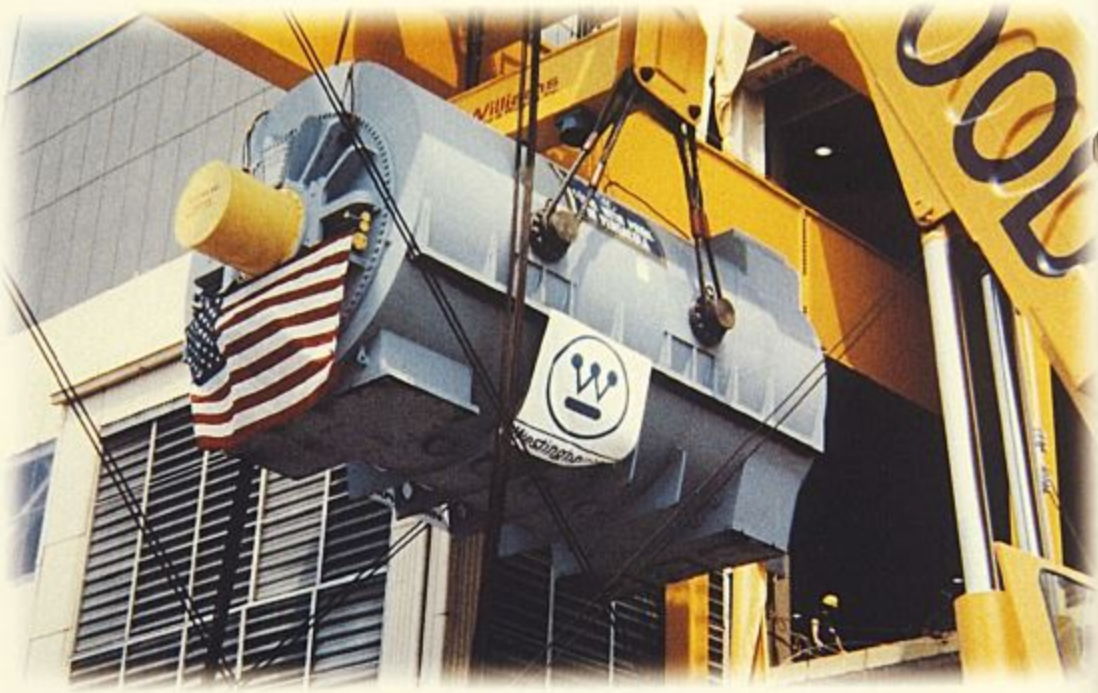
Within this division, hundreds of specialists can be deployed from dozens of locations around the world to install, maintain, repair, modernize and upgrade steam and combustion turbine-generator systems. Those specialists include some 350 service engineers and more than 200 field service technicians. Additionally, more than 2,500 skilled craftspeople are utilized on a project basis, and their capabilities are evaluated and maintained in a database providing unexcelled access to the most competent labor the industry has to offer.

With such a wealth of skills and experience from which to draw, the Power Generation Service Division can handle almost any service challenge directly in the field. Recognizing that it is often more efficient to bring Westinghouse expertise to the power plant than to ship major components to the Power Generation Factory, Westinghouse mobilizes – from four strategically located service centers – all the equipment and people necessary to perform virtually any evolution, from a routine inspection to a major modernization of any turbine-generator or associated system.

The Service Division provides Technical Field Assistance to existing power plant installations, and Technical Direction of Installation to new projects. It can also handle complete contract installation and maintenance services, including labor, technical and supervisory skills, planning and scheduling; and it can pro-



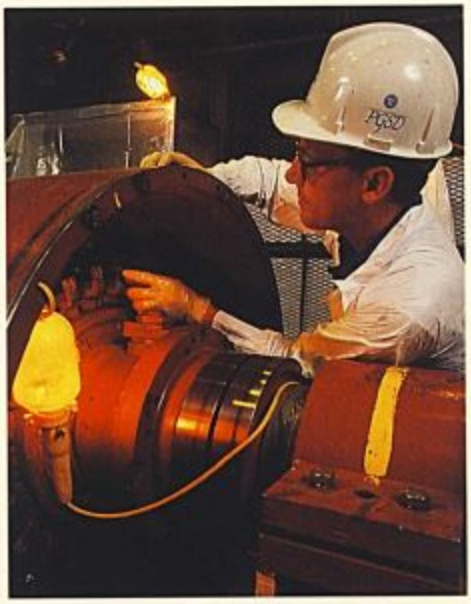
Periodic rotor bore examinations prove effective in mitigating risks, and extending reliability and rotor service.



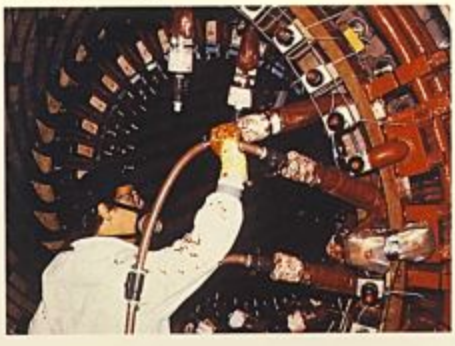
Fully assembled generator, weighing over 240,000 lbs., being lifted into position for 180 MW steam turbine installation project.

vide all services required for system start-up, modernization or any extent of repairs. Using sophisticated logistical management techniques, the Division completes dozens of major projects each year.

Several Westinghouse service programs typify the caliber of innovative support that Westinghouse customers can expect: the Rigi-Flex™ stator rewind program, turbine rotor gas tungsten arc welding, the unified lift process, rapid rotor rewind and non-destructive examination (NDE) services. Using such tech-

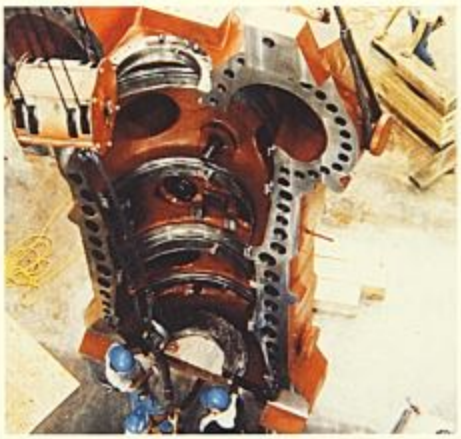


Above: Process-driven inspection and testing of the generator exciter in the field improves reliability and performance.



Right: Implementation of advanced Rigi-Flex™ stator winding technology reduces outage time to only 32 days.

High-pressure/intermediate-pressure turbine cylinder base repositioned for final installation on the foundation. This unit replaced a 35-year-old unit of another make. The total outage was less than five months.

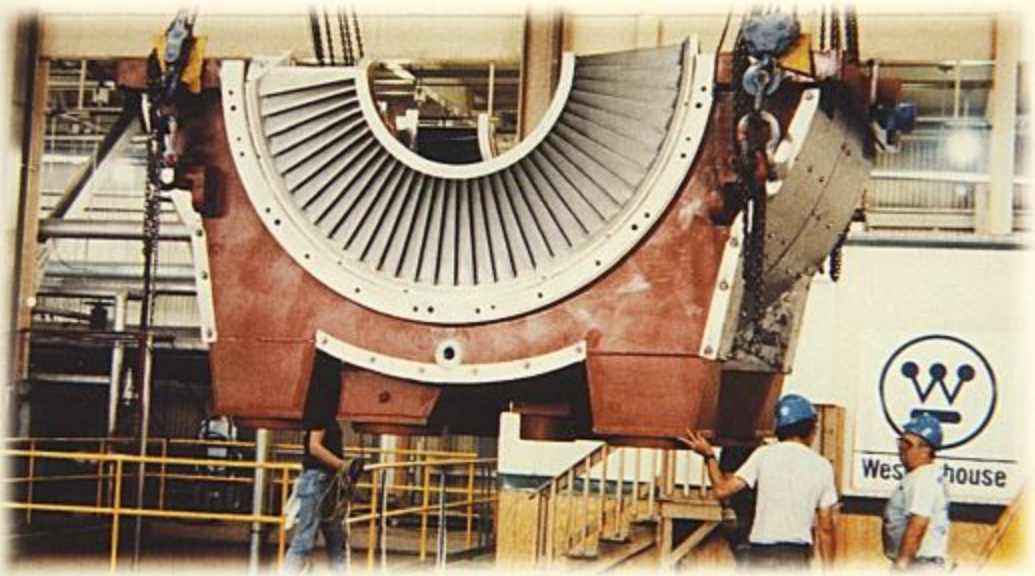


nology, Westinghouse has dramatically reduced the time required to perform major evolutions such as rewinding, inspecting and testing generators, and inspecting and modernizing turbines. This applied technology substantially improves unit availability and reduces maintenance costs.

Over the past few years, the Service organization has developed several unique partnering arrangements with power plant owners in which its compensation is directly tied to plant operating parameters such as forced outage rate, achievements in maintenance schedules, and unit reliability. The long-term relationships formed and integration of the customer and supplier process continue to be key elements assisting Westinghouse operating plant customers in achieving world-class results.

FAST Gen II – a state-of-the-art robotic process allowing remote inspection of the generator with minimum disassembly.

During the initial design process, Westinghouse teams interfaced to include details that would provide optimum safety and handling, and optimized interfaces with auxiliaries and other systems minimizing installation time and future maintenance.



Integrated Performance of Many Skills and Disciplines

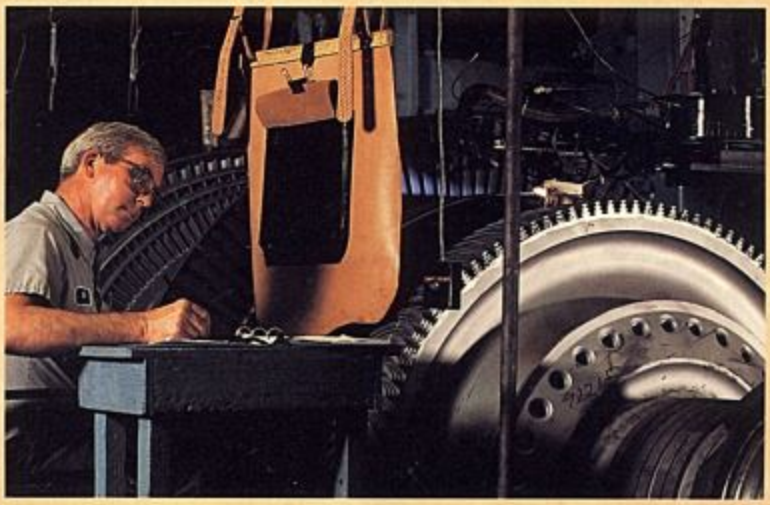
George Westinghouse might not easily recognize his manufacturing facility today. The Power Generation North American Factory is actually a network of horizontally-integrated factory sites, each one unique in its individual expertise, equipment and specialized facilities. Using this highly innovative method of operation, Westinghouse has eliminated the demands of the traditional vertically-integrated approach, and can provide a diverse product mix while meeting increased manufacturing and service demands.

Today, the Westinghouse plant sites are smaller in size than those of a decade ago, but are more streamlined, efficient, flexible, and responsive in their operations. And though each plant is self-reliant, all are connected by a sophisticated information management network which enables them to work as one "seamless" Factory. Its sites include:

- Turbine-Generator Manufacturing Plant – Charlotte, North Carolina
- Pensacola Manufacturing Plant – Pensacola, Florida
- Power Generation Canadian Division – Hamilton, Ontario
- Turbine Components Plant – Winston-Salem, North Carolina
- Electrical Components Plant – Fort Payne, Alabama
- Magnet Systems Division – Round Rock, Texas
- Power Generation Headquarters – Orlando, Florida

Westinghouse Power Generation Headquarters – Orlando, Florida.

Technicians prepare large steam turbine rotor for spin balance and testing in Vacuum Spin Chamber.



High strength gas tungsten arc welding on low-pressure turbine rotor.

Generator assembly bay area.

Computer-aided design and drafting (CADD) system for customer on-line ordering via PartsEXPRESS™.

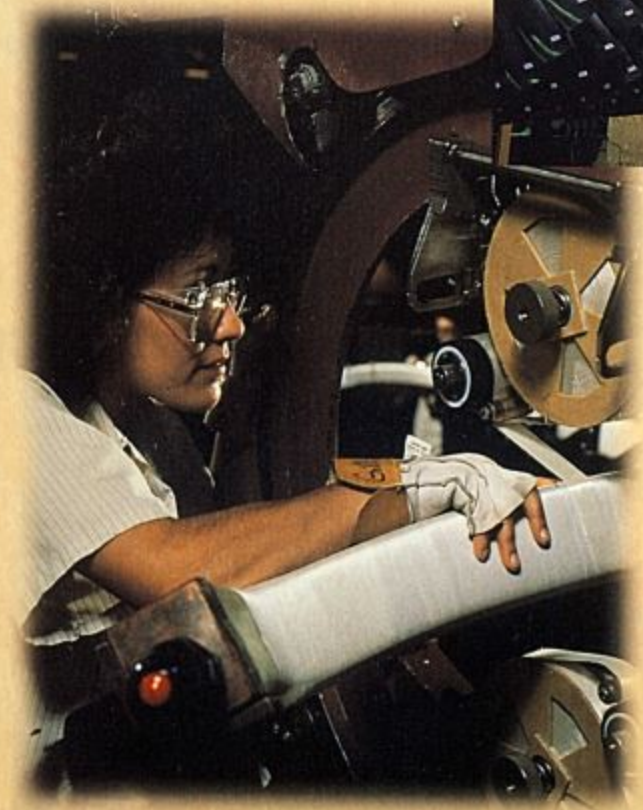
At Westinghouse Power Generation Headquarters, a host of key functions complement and support the Power Generation Factory including resource planning, purchasing, technical support, and renewal parts services – all of which comprise what is often referred to as the "extended Factory." Its F.A.S.T. Warehouse, or Field Availability Service Terminal, is also located in Orlando. This dedicated service facility provides a stock of key renewal parts and the ability to ship quickly in response to customer needs.

In a wider perspective, its global alliances strengthen the foundation for the horizontally-integrated approach to Westinghouse manufacturing and sourcing. They provide a source of materials, components and equipment which enables the Factory to meet customer cost, schedule and value requirements. As a result, Westinghouse delivers the latest technology and finest power generation products the world has to offer.

The integrated North American Factory plays a vital role in maintaining the corporation's leadership position, and meets manufacturing challenges presented by the industry's needs today.

Precision forging of turbine rotor blades on the counter blow forge.

501D combustion turbine rotor set for final blade tip grinding.



Automatic taping of water-cooled generator stator coil.

Westinghouse – at the Threshold of Tomorrow

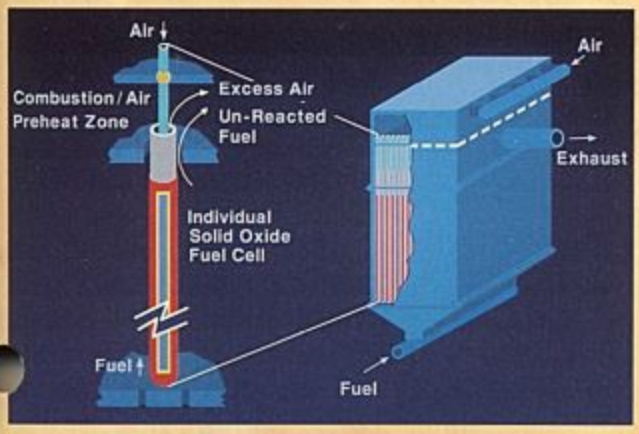
Nikola Tesla . . . William Stanley . . . Oliver Shallenberger. One hundred years after these men of uncommon genius wrought discovery in the sepia light of Garrison Alley, their successors at Westinghouse still probe the far reaches of science for new breakthroughs in energy conversion. The result of today's persistent hours at creative research are the emerging technologies which will empower the tomorrows of the next century, and enable them to dawn on a cleaner environment.

The Westinghouse history of pursuing new technologies has demonstrated its ability to move laboratory experiments to commercial applications. The world's most efficient steam turbine plant, largest hydroelectric generator and highest power density superconducting magnet, all mark successful transitions of technology. Tomorrow's energy conversion needs mean higher goals for operating efficiencies, maximum fuel utilization, low emissions, reliability of performance and commercial availability at competitive prices.

Since coal is the world's most abundant energy resource, research is being focused on clean coal technologies. A major thrust at Westinghouse has been advanced coal-fired, combined-cycle plants that offer improved efficiency and reduced emissions. Key technology development areas include coal gasification, fluidized bed combustion and direct coal-fired turbine cycles. In addition, Westinghouse has led the worldwide development of ceramic hot gas particulate clean-up systems which enable improved operating performance of all the advanced cycles. Building on a strong turbomachinery experience base, Westinghouse has completed conceptual plant designs and machinery applications that will yield positive changes in plant performance.

As an example, Westinghouse is also developing a direct coal-fueled gas turbine system rated at 200 megawatts in combined-cycle application. Unlike competing systems, Westinghouse technology uses dry pulverized coal or a coal-water slurry instead of expensive treated coals. Initial prototype testing has demonstrated carbon conversions well over 99 percent, indicating that direct

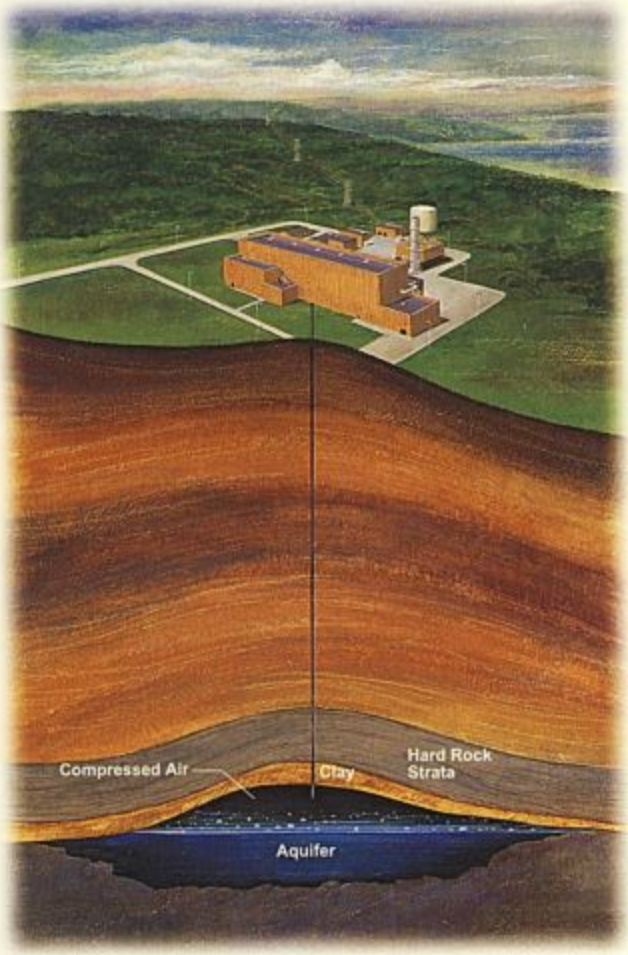
Quality check on solid oxide fuel cell bundles to be installed for a 25 KW unit demonstration on a utility system.



Process flow diagram of solid oxide fuel cells.

coal-fueled turbines have an encouraging future in the era of clean coal power generation.

Westinghouse is a world leader in the development of solid oxide fuel cells. Fuel cells can directly convert the chemical energy of coal-derived fuel gas, natural gas or distillate fuel to electrical energy. These highly efficient devices can operate at a wide range of pressures and at discharge temperatures exceeding 1,000°C with reduced emissions. In 1990, prototype solid oxide fuel cells surpassed

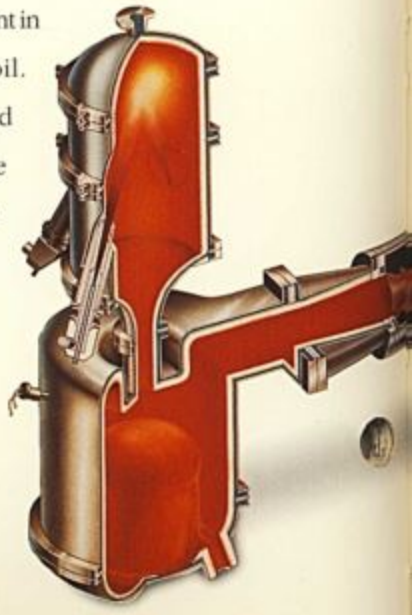


Compressed air energy storage (CAES) system currently under development to increase power plant performance.

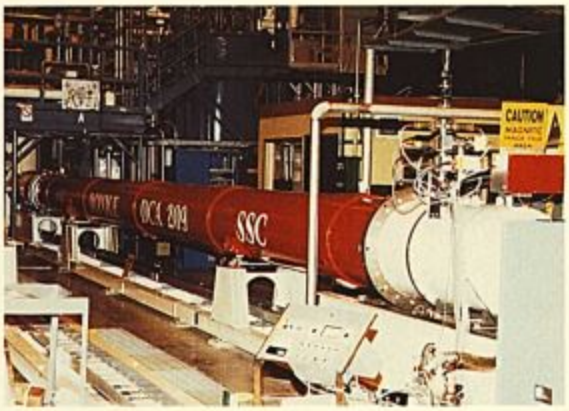
20,000 hours of operation, and became the longest such running cell in the world. Solid oxide fuel cells, with a vast range of possible applications, have the potential of providing clean, efficient energy in a way that will fundamentally change the nature of today's power systems for the future.

In addition to new power generation technologies, energy storage is expected to play an important role in future electrical systems. The most promising such technology is compressed air energy storage (CAES). This system is designed to store compressed air in a pressurized, underground cavern adjacent to a power plant. During peak demand periods, stored air is released to drive the turbine-generator using low cost, base load capacity which significantly reduces operating costs. During off-peak periods, the unit re-pressurizes the storage cavity for future power needs. Westinghouse is developing conceptual applications of modern combustion and steam turbomachinery to improve efficiency and increase maximum plant size.

Superconducting magnet systems technology also has the potential for energy storage. Superconducting magnetic energy storage reserves energy produced by a power plant in an underground coil. Like the compressed air energy storage system, magnetic energy storage is also designed to use



Slagging combustor for a coal-fired gas turbine.



First dipole magnet manufactured by Westinghouse at the Brookhaven National Laboratory – Upton, New York.

Dipole magnets for the U.S. Department of Energy Superconducting Super Collider Project.

low cost, base load capacity during peak periods. Researchers have designed superconducting magnetic energy storage coils with up to 1,200 megawatt-hours of energy.

Superconductivity has long been recognized as the next frontier in electrical power generation. The Superconducting Super Collider Project is the construction of the largest and most sophisticated scientific instrument in the world – and marks an important stepping stone for Westinghouse. Its participation in the construction of the Superconducting Super Collider in Waxahachie, Texas, continues pioneering research on emerging superconductivity technology which began over 40 years ago. Westinghouse is applying advanced manufacturing technology to the project making dipole magnets, each weighing 15 tons and measuring 52 feet in length.

Today's energy conversion systems have all had their origin in a sound, technological base. Advancing the level of technology by applying new materials and concepts is a Westinghouse goal. Research and development in clean coal, solid oxide fuel cells, compressed air energy storage, superconducting magnetic energy storage and superconductivity demonstrate the Westinghouse commitment to emerging technologies – and launches it as a leader in answering energy conversion needs of the world's next generation.

THE WESTINGHOUSE COMMITMENT

Total Quality for Today and Tomorrow

In the beginning, it was the Westinghouse commitment that propelled the world into the Age of Electricity. The history of power generation in the 20th century is filled with technological breakthroughs by Westinghouse engineers – innovations which have reduced the cost and boosted the productivity of providing power to countless millions for more than 100 years. The Westinghouse Power Generation tradition is one of continuing success.

Westinghouse treasures its tradition, but has never been limited by it. Instead, the Westinghouse Power Generation of the '90s is driven forward by renewed commitments to the goals of absolute Total Quality and Customer Satisfaction.

These present commitments, enriched by pride in past achievements, will push the horizon of progress further. And, here in the pre-dawn of a bold, new century, these commitments will enable Westinghouse to pioneer an exciting and promising future.

Striving to be the Supplier of Preference through Total Quality

Westinghouse Electric Corporation

Power Generation Business Unit

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