

The book cover features a composite image of renewable energy sources. In the upper left, several wind turbines are shown against a clear blue sky. Below them, a large array of solar panels is visible, with a bright sunburst effect emanating from behind them. In the bottom left corner, a portion of the Earth's globe is shown, highlighting the Americas. The background also includes a body of water and a cloudy sky. The title is prominently displayed in the upper right quadrant.

THE
GREEN STOCKS
INVESTMENT
BOOK

**The Inspiring Stories of
20 Earth Friendly Companies
that Prosper as the Green
Movement Gains Momentum**

Michael Caldwell

FUEL TECH, INC.

(NASDAQ: FTEK)

Coal has been one of the world's main sources of energy for hundreds of years, and promises to remain so for a long time. Relatively cheap as an energy source, and widely available, coal is used to provide over 25 percent of the world's total energy, and much of its electricity. According to the latest figures (2005) from the U.S. DOE's Energy Information Administration, over 41 percent of the world's 17,300 Terrawatt hours (TWh) in electrical generation came from coal-fired power plants. In 2015, coal is projected to account for nearly 44 percent of the world's electrical generation and, despite intensified efforts to find replacement energy sources, that number is expected to rise to over 46 percent by 2030.

Clearly, although burning coal to create electricity has always been a dirty business, it is a fuel source the planet cannot do without. To be sure, coal combustion releases fly ash and heavy metals, such as mercury and arsenic, as well as a variety of air-borne pollutants such as nitrogen oxide, sulfur dioxide, sulfur trioxide and carbon dioxide, the latter a greenhouse gas that may contribute to global warming. However, coal is not immune to the green wave spreading throughout the world -- an increasing demand that the environmental footprint from all forms of energy production grow progressively smaller. So new technologies from companies such as Fuel Tech are highly prized in their ability to enable coal to be used in a more environmentally acceptable manner.

In the United States, the Clean Air Act requires states to achieve certain air quality standards in all their areas. States are required to submit their plans to implement pollution reductions in sulfur dioxide, nitrogen dioxide and particulates to achieve those air quality standards.

A growing number of states are enacting laws to go beyond the Federal standards, especially for mercury and certain other heavy metals. In addition, legislation to limit greenhouse gas emissions is currently being debated in the U.S. Congress.

Coal combustion not only creates noxious emissions that are released to the atmosphere, it fouls internally – within a power plant’s combustion chambers themselves. Coal combustion creates a by-product, known as slag, which reduces efficiency in coal-burning power plants. This slag, composed of metals and ash, clings to walls and burners in thermal towers, hardens – sometimes to rocks the size of Volkswagens, reducing efficiency and sometimes falling down causing major damage to the plant. Therefore, all coal-fired power plants have to periodically shut down, at enormous cost, while the slag is scraped, chipped, blasted, or air-hammered off the interior surfaces of combustion towers.

This double threat to coal combustion is the bane of the industry, but forms a wide and growing market for Fuel Tech, a growing Warrenville, Illinois-based company that has combined advanced computer modeling with chemical engineering knowledge to inject chemicals into combustion units to reduce atmospheric emissions and eliminate slag that covers surfaces within the combustion towers themselves. Fuel Tech operates as one integrated company but reports its results along two major business lines. The first is a capital projects line that includes its Nitrogen Oxide (NOx) reduction technologies, which reduce emissions from boilers, incinerators, furnaces and other stationary combustion sources before going into the air. The second is its FUEL CHEM® segment, which provides technology to remove the slag mentioned previously, as well as dramatically reducing sulphur trioxide (SO₃) emissions, which are a major health problem. Together, the two business segments provide utilities boiler optimization, air pollution reduction and cleaning solutions.

Fuel Tech began in the 1980’s as a company that designed air pollution control equipment for paper mills and other big manufacturers. But the industry wasn’t particularly interested in pollution control at the time,

and Fuel Tech, partially owned at that time by the Illinois based water-treatment company Nalco, was losing millions. In 1998, Ralph Bailey, a retired oil and chemical executive, offered to invest in the company and paid \$3.3 million to help buy out NALCO and secure a 27 percent stake in Fuel Tech. Bailey had a long history in the chemical industry – he was Chairman and CEO of Conoco and later Vice Chairman of DuPont – and bet that U.S. industry would eventually face pressure to clean up the pollution it was sending into the atmosphere. He also believed the next energy crisis would force power generators to be far more efficient in their production of energy. Bailey’s Fuel Tech team focused on U.S. utilities, which produced half the nation’s electricity from coal (U.S. utilities use nearly a billion tons of coal a year to generate electricity) and were under increasing regulatory pressure to clean up their act. When the energy crisis hit in the early part of this century, and combined with increasing pollution regulations, Fuel Tech found its sweet spot.

“The board wanted to grow this company fast because its time had come,” explained President and CEO John Norris, 59, an industry veteran who came aboard in 2005 after running Duke Engineering & Services, a unit of utility giant Duke Energy, and later as Senior VP at American Electric Power (AEP), where he ran the largest fleet of coal-fired units in the country. During his tenure at Duke Engineering, Norris had built the unit into an engineering powerhouse with a global clientele. “To grow rapidly, you need a large addressable market and you need something to take to that market – you need a quiver full of arrows. When I got here we had two products, now we have quite a list of technologies.”

Norris expanded the company’s product line by instituting a modern, aggressive innovation program that threw the Research and Development team together with the Sales and Marketing people to create products the market was demanding. Every week, R&D, sales, and execution teams would meet to move the innovation program forward quickly. “We’re an entrepreneurial company, and so we’re all in it together,” Norris explains. “You have to do it that way. If you want 10 percent growth you can do it

the old way, but if you want to ratchet up quickly you need to move. Now we have over a hundred patents and 450 installations all over the world. We have the right stuff just as the world is getting greener, so we have to be there first.”

To drive growth in its business segments, Fuel Tech has formed these patented technology innovations into focused enabling technologies that help customers produce energy in a cleaner and more cost-effective manner. These are primarily based on sophisticated computer models that help gain critical understanding of the dynamic environments in which combustion units operate and how they can be altered to optimize performance. In particular, the use of process modeling and high-end visualization software has enabled the company to build and maintain leadership positions in air pollution control and specialty chemical treatment technologies, while allowing new product development to satisfy anticipated marketing demands. At the heart of Fuel Tech’s enabling technologies are its computational fluid dynamic (CFD) modeling capabilities, which are used to create unique process design methods that rely on chemical injections to furnaces. Every Fuel Tech product installation has a custom process model supporting it.

Models begin with a CFD simulation of the conditions under which a particular product will operate. The model then generates predictions of gas flow characteristics, such as operating temperatures and velocities, from a virtual replication of real-world geometry and operating inputs. In the case of its proprietary NOxOUT processes, as well as its FUEL CHEM applications incorporating TIFI™ Targeted In-Furnace Injection™ technology, the model generates a 3-D geometry of the combustion unit, including temperature profiles, to facilitate efforts to position the injectors for maximum effectiveness. NOxOUT CASCADE® models additionally include the distribution of ammonia slip entering a selective catalytic reduction catalyst. The NOxOUT ULTRA® models are based on the geometry and dynamics of a urea decomposition chamber and its connection to the customer’s ductwork.

Data output from the CFD models are then visualized using Fuel Tech's internally developed, virtual reality based visualization software. This software is designed to reveal the complex process behaviours of combustion flows, while enabling company engineers to explore the model from multiple perspectives throughout the process design phase. Nitrogen oxide reduction applications are further analyzed with detailed chemical kinetics modeling (CKM). This predicts NO_x reduction by simulating relevant chemical reactions along gas temperature profiles derived from the CFD models in the presence of anticipated chemical dosage and key flue gas compositions. FUEL CHEM applications are screened for ash composition effects based on fuel and ash sample analyses. In both cases, a complete understanding of conditions leads to the next step – to optimize a chemical injection strategy.

Fuel Tech has developed and validated numerous chemical spray models specific to boiler and duct conditions. These models are coupled to the predicted CFD velocities and temperatures to predict droplet evaporation and subsequent chemical distribution. Visualization software is then used to reposition sprays dynamically and gauge the effect on desired performance. Fuel Tech's modeling results are usually shared with customers so they can benefit in other ways to improve their operations.

Fuel Tech's oldest product line is its platform of air pollution control (APC) technologies, which are currently installed on over 450 combustion units worldwide, including utility, industrial and municipal solid waste applications. Fuel Tech's APC technology segment is a capital projects business that generates revenues primarily through the sale of NO_x reduction systems.

Product offerings include customized nitrogen oxide (NO_x) control systems, which can reduce emissions by 30 percent to 85 percent, and patented urea-to-ammonia conversion technology. Underpinning the NO_x control suite of technologies is the urea-based NO_xOUT process, a selective non-catalytic reduction (SNCR) approach that can be used for both new and retrofit applications at costs as low as \$5 per kilowatt. This technology

can be deployed either on a stand-alone basis, to achieve typical NO_x reductions of 25 percent to 30 percent or higher, or in conjunction with complementary technologies such as Rich Reagent Injection (RRI) and NO_xOUT CASCADE for deeper NO_x reductions. RRI involves the injection of urea into a lower furnace with staged combustion for a combined SNCR/RRI NO_x reduction of 50 percent. The NO_xOUT CASCADE process is a multi-stage system, integrating a special urea based SNCR process with a compact SCR module for NO_x reduction up to 80 percent. In addition, the NO_xOUT-SCR® process is available to reduce NO_x emissions by as much as 85 percent from industrial power generation equipment.

The NO_xOUT family of products is relatively low in capital cost, ranging from \$5 to \$75 per kilowatt, compared with approximately \$150 - \$400 per kilowatt for a full-scale SCR system, which is capable of NO_x reduction of up to 90 percent. This lower-cost approach is being enhanced by recent price escalation of components in most SCR systems such as concrete, steel and labor. Further, the NO_xOUT ULTRA process, which provides for the safe and cost-effective on-site conversion of urea to ammonia for use as a reagent in the SCR process, eliminates the hazards and costs involved in the transport, storage and handling of ammonia, and is especially suited for crowded urban situations.

Fuel Tech's other and newer FUEL CHEM business segment is gaining much attention and achieving rapid growth because it makes combustion-based power plants operate more efficiently and therefore achieve significant cost savings. The technology platform revolves around the unique application of specialty chemicals to improve the efficiency, reliability and environmental status of boilers of all types, including electric utility, industrial, waste-to-energy and university heating units. FUEL CHEM programs are currently used to treat a wide variety of solid and liquid fuels including coal, heavy oil, biomass and municipal waste, the combustion of which results in ash and burner-fouling slag. Central to the FUEL CHEM approach is the introduction of chemical reagents, such as magnesium hydroxide, via in-body fuel application or via direct

injection, into the boiler using Fuel Tech's patented TIFI Targeted In-Furnace Injection technology.

By attacking performance-hindering problems such as slagging, fouling, corrosion, and loss on ignition, as well as the formation of SO₃, ammonium bisulfate, carbon dioxide (CO₂) and nitrogen oxide (NO_x), the Fuel Tech approach provides numerous operational, financial and environmental benefits to owners of boilers, furnaces and other combustion units. These include improved efficiency, availability and reliability, which enables plants to generate more electricity per unit of fuel input; enhanced fuel flexibility, which permits plants to burn lower cost fuels, such as lower cost coal; maintenance cost reductions, which reflect reduced operating and equipment replacement costs; and environmental improvements, which stem from the mitigation of SO₃, NO_x and CO₂.

Depending upon the problem at hand and the particular unit being treated, TIFI applications can reduce NO_x emissions by 5 percent to 10 percent and slash SO₃ emissions by 75 percent. In addition, some small reductions in CO₂ emissions can be achieved because of increased energy efficiency improvements that lessen the amount of fuel required for combustion.

The fuel treatment chemicals segment generates revenues primarily through the ongoing sale of specialty chemicals that are a part of the FUEL CHEM programs. But utilities are notoriously slow to change processes, despite strong value propositions and regulatory prodding, so Fuel Tech has devised an innovative model to market the newer FUEL CHEM line. In essence, it's a "try-before-you-buy" approach that offers utility executives a no-risk trial of the slag-removal technology. Jimmy Blakley was one such utility manager who helps operate the Western Farmer's Electrical Co-op plant near Paris, Texas and wasn't too keen on the technology until he tried it. Blakley's boiler was suffering severe slagging problems and had to be shut down for as many as 10 days a year so the slag could manually be cleaned out, usually at a cost of about \$800,000 a day. "I told the folks (at Fuel Tech) nobody's drilling any holes in my boiler, and nobody's spraying

any chemicals in there either!" But Blakley agreed to try Fuel Tech's no-risk demonstration, and today, the Co-op pays Fuel Tech \$1 million a year to save \$4.5 million annually in costs. It also reduces emissions by 10 percent and has boosted power production by more than 5 percent.

The FUEL CHEM product line has also attracted considerable interest in the press because of its attractive business model, untapped market potential, and relatively light competition. Fuel Tech has routinely been voted a top pick by several analysts, such as Morningstar and Fortune Small Business, where it placed #12 on the magazine's top 100 list of the fastest growing small public companies, and a company to watch because of the large market potential for the new efficiency and pollution mitigation technology. "Our FUEL CHEM program gets people excited because of its business model, which is more like a utility in that it provides ongoing annuity-like revenue," John Norris explains. "But we're the best in the world at SO₃ mitigation and that's also generating a lot of interest." Norris says the SO₃ mitigation – emissions can be slashed by as much as 75 percent – is particularly exciting to buyers concerned with this air pollution issue because SO₃ is a severe local health hazard that must be handled or the plant must cease operation. This really came into the limelight when the first large Selective Catalytic Reduction (SCR) system went into service in 2004 as SO₂ to SO₃ conversion is an unintended consequence of the SCR system. Fuel Tech's FUEL CHEM program can solve this problem and can save utilities money in the process.

Attention has also been gathered because of awards given to Fuel Tech's technology. For example, in December 2007, Fuel Tech was bestowed the Innovative Technology Award for 2007 by the Mexican National Utility, Comision Federal de Electricidad (CFE). Fuel Tech, which shared the award with Double V Holding, S.A. de C.V., a general contractor, was named in recognition of technology incorporated in sulphur trioxide (SO₃) abatement equipment installed at CFE's Punta Prieta thermoelectric power plant in La Paz, Mexico. Fuel Tech, which earlier began demonstrating its TIFI technology on a pilot scale oil-fired boiler in a government-run facility,

supplied Double V with a FUEL CHEM program to mitigate the effects of the plant's use of heavy fuel oils, which resulted in SO₃ emissions and slagging problems at these CFE units.

Another reason for the excitement is Fuel Tech's growing presence internationally. Already, TIFI technology is successfully treating combustion units burning low-quality foreign coals as well as biomass (wood and olive pits) in Italy, while other European opportunities are being pursued vigorously. (All fuels except natural gas cause slag problems.) A potentially large SO₃ abatement market exists in Mexico, where heavy fuel oils containing vanadium and nickel are the primary source for electricity production, including an estimated 17,000 megawatts generated by CFE. The presence of these metallic constituents promotes slag build-up, and the fuel properties result in SO₃ emissions in local combustion units. As noted above, Fuel Tech has successfully treated such units with its TIFI technology.

A particularly appealing market is China, which is adding the equivalent of two new power plants a week as it increases industrial production. China, which is expected to burn three times the amount of coal as the U.S. (or about 3 billion tons annually) by 2010, already has a poor reputation in the world as a polluter, largely because it uses low-grade coal in its power plants and has eschewed pollution reduction technology until recently. According to European Space Agency satellite images, China has the planet's worst levels of air pollution. The World Bank says China is home to 16 of the planet's 20 most air-polluted cities. So, especially as was evident at the Beijing Olympics, the country is trying to clean up quickly, not only by making new plants more environmentally friendly, but also to retrofit many of its plants over the next decade.

China provides attractive business opportunities for Fuel Tech, both short term and long term. As new power plants are constructed with NO_x-reducing SCR systems during the next several years, the Company's NO_xOUT ULTRA process is the leading candidate for the safe delivery of ammonia, particularly near densely populated cities, major waterways,

harbors or islands, or where the transport of hazardous anhydrous ammonia is a safety concern. Longer term (beginning in 2014), environmental regulations are anticipated to create opportunities for some 4,000 retrofit units utilizing the Company's low capital cost NOxOUT Selective Non-Catalytic Reduction (SNCR) and NOxOUT CASCADE systems. To help penetrate this vast market, Fuel Tech has opened an office in Beijing and has also signed a teaming agreement with a subsidiary of ITOCHU Corporation to pursue FUEL CHEM opportunities.

Other APC targets are being actively pursued in the Asia-Pacific region, including Taiwan, Thailand and Korea. The company is also expanding its efforts in the European market, where NOx reduction systems are in demand for municipal solid waste and cement plants and where applications for urea-to-ammonia conversion systems are expected to grow. In addition, Eastern European nations that are admitted to the European Union will be required to take concrete steps to reduce NOx emissions.

New market opportunities for FUEL CHEM are also being pursued in the Asia-Pacific region, including China and India, where high-slugging coals are fueling a large and growing fleet of power plants. In particular, TIFI initiatives in these markets are focusing on energy efficiency improvements to reduce the amount of expensive imported coal used to produce electricity in those countries. During 2008, Fuel Tech signed its first FUEL CHEM customers in both countries, where TIFI programs are now installed on large coal-fired units.

"The next decade will be the cleaning up decade around the world, and we're in the right place to help that," says Norris of the company's international thrust. "China recognizes that it has a bad image in the world that has been intensified by the focus put on the country by the Beijing Olympics. So they plan to really address the problem. And India wants to increase power production to help industrialization without creating harmful pollution."

Part of Fuel Tech's rapid growth strategy is the building of a creative

and industry knowledgeable team that understands implicitly the dynamic nature and pressures on companies involved in power production.

The team is led by Executive Chairman Ralph Bailey, who continues to hold a large ownership position in Fuel Tech. Mr. Bailey is also currently a director of Fuel Tech and Great Northern Properties Management Corporation, and a member of the Advisory Council of J.P. Morgan. Past directorships include Conoco, Inc., J.P. Morgan, General Signal Corporation, IC Industries, Abex Corporation, DuPont, The Williams Companies, Rowan Companies, Inc., Clean Diesel Technologies, Inc., and the National Forest Foundation. He was former Chairman of the National Petroleum Council and the American Mining Congress.

John F. Norris Jr., President and Chief Executive Officer and a director of Fuel Tech, is a former football star from North Carolina State University, who graduated with a B.S. degree in Nuclear Engineering in 1971. A former fighter pilot in the U.S. Air Force, he joined Duke Power Company in 1982 as an Assistant Engineer, progressing to Engineering Manager by 1988. He became President and CEO of Duke Engineering & Services in 1989 and in 1998 was named Senior Vice President of Duke Energy Corporation and Chairman and CEO of Duke Energy Global Asset Development. After stints as the President & COO of the American Bureau of Shipping Group and as Senior Vice President of Operations & Technical Services at American Electric Power, where he was responsible for all non-nuclear power generation, coal mines, and engineering and construction, he became a consultant to companies in energy-related industries, including Fuel Tech. He has been Chairman of the North Carolina Zoological Society and is a member of the National Coal Council. He became President and CEO of Fuel Tech in 2006.

John P. Graham, Senior Vice President, Chief Financial Officer and Treasurer, joined Fuel Tech in June 2008. Previously, he served as Vice President and Chief Financial Officer of Hub International Limited, a \$500 million North American insurance brokerage. From 2002 through 2006, he was Senior Vice President of Finance, Treasurer and Assistant

Secretary of Career Education Corporation. Prior positions include Vice President of Investor Relations and Financial Reporting for Newell Rubbermaid, Manager of Financial Planning at Kraft General Foods and an Audit Supervisor with Deloitte Haskins & Sells. Mr. Graham holds a B.S. degree in Accounting from Indiana University and an MBA from DePaul University. He is a Certified Public Accountant and a Certified Management Accountant.

Vincent M. Albanese, Senior Vice President, Regulatory Affairs, represents Fuel Tech for liaison with federal, state and regional environmental agencies. Previously, he was Senior Vice President, Regulatory Affairs and Advanced Technology, Senior Vice President, Air Pollution Control, Vice President, Air Pollution Control, and Vice President, Sales and Marketing, with Nalco Fuel Tech. Mr. Albanese was a member of EPA's Acid Rain Advisory Committee, and currently serves as a Managing Director and Treasurer of the Institute of Clean Air Companies, while also serving as chairman of its NOx Division.

Stephen P. Brady, Senior Vice President, Sales and Marketing, spent two years with Johnson & Johnson and 48 years with Nalco Chemical Company in a variety of sales and management positions, primarily focused on the electric utility, steel, paper and refining industries. Among his industry experiences were managing growth in water treatment applications and the early introduction of fuel treatment technologies.

M. Linda Lin, Senior Vice President, China Pacific Rim, has been with Fuel Tech since the inception of Nalco Fuel Tech in 1990 where she held a dual position of Marketing Manager for Asia and Research Manager. Prior to that, Dr. Lin was at Nalco Company for 28 years. Born in Nanjing, P.R. China, Dr. Lin grew up in Taiwan where she graduated with a B.S. degree in Chemical Engineering from the top-notch Taiwan University. She earned a Ph.D. degree in Catalysis from Texas A&M University and was an Adjunct Professor in the MBA curriculum at the Illinois Institute of Technology's (IIT) Stewart Business School in Chicago. She is the inventor

or co-inventor of over twenty U.S. patents and approximately one hundred publications in water and air pollution control.

Michael P. Maley, Senior Vice President, International Business Development and Project Execution, has 25 years of experience developing, designing, constructing and operating power generation facilities. He began his career at Sargent & Lundy LLC, a global engineering services provider for the electric power industry, and also worked for Cogentrix Energy Inc., a pioneer in the coal-fired independent power industry, spending considerable time in the Far East, especially in India. Prior to joining Fuel Tech, he was President and Chief Operating Officer of Alliant Energy Generation, a subsidiary of Alliant Energy.

In the company's annual report issued in March 2008, John Norris observed, "Today we are in the midst of one of the most rapid global environmental transformations in history, a "green" revolution, where nations, industries and individuals are demanding cleaner and more efficient energy production." Overlaying this general heightened environmental concern are industry trends such as a rapid escalation in global energy demand and increasing demand for coal to satisfy this demand. But this increased demand drives up coal prices and drives energy power generators to seek lower cost fuels, typically lower quality coal, which is also "dirtier" in the combustion process. This driver, combined with resistance to the building of new, more efficient coal-fired generation plants, is forcing power generators to seek ways to squeeze more production from their existing plants, while at the same time making them cleaner.

These pressures all combine to drive these power producers into the arms of innovative and dynamic companies like Fuel Tech, which anticipated these trends and developed products to meet those demands. By applying the latest computer modeling methods to innovative engineering approaches, the company has developed a suite of technologies that is helping to facilitate the movement to cleaner and more efficient energy production using the world's oldest energy source. Customers have

responded with double-digit growth in the company's revenue line, and promise to increase the growth rate even more in the years ahead.

FUEL TECH, INC.

STOCK SYMBOL: NASDAQ: FTEK

*Inserting a lance to provide
chemical feed to a boiler
utilizing TIFI™ technology*



*Stack emissions without a
Targeted In-Furnace Injection
application*



*Stack emissions with a
Targeted In-Furnace Injection
application*



*This virtual reality image
of a computational fluid
dynamic model enables Fuel
Tech engineers to optimize
urea injection for nitrogen
oxide control in a cyclone
boiler*

