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SHANGHAI MUNICIPAL ELECTRIC POWER ORIENTATION VISIT

JUNE 2-11, 2002

INITIAL REPORT

SPONSORED BY:
U.S. TRADE AND DEVELOPMENT AGENCY

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The U.S. Trade and Development Agency

The U.S. Trade and Development Agency (TDA) promotes American private sector participation in developing and middle-income countries, with special emphasis on economic sectors that represent significant U.S. export potential. Through the funding of feasibility studies, orientation visits, specialized training grants, business workshops, and various forms of technical assistance, we help U.S. businesses compete for infrastructure projects in emerging markets. We assist in building mutually beneficial partnerships between American companies and overseas project sponsors, which result in increased U.S. exports and jobs, and the completion of high quality, successful projects in host countries.

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June 2-11, 2002

U.S. Trade and Development Agency

The U.S. Trade and Development Agency's (TDA) mission is to promote American private sector participation in developing and middle-income countries by helping U.S. companies pursue overseas business opportunities. Through the funding of feasibility studies, orientation visits, training grants, conferences, and various forms of technical assistance, U.S. TDA enables American businesses to become involved in the planning stages of infrastructure and industrial projects in middle income and developing countries. Through these programs, U.S. TDA provides American firms with market entry, exposure, and information, thus helping them establish a position in markets that are otherwise difficult to penetrate. U.S. TDA aims to assist U.S. Companies in creating jobs here at home while simultaneously promoting economic growth in developing and middle income countries. U.S. TDA works closely with government officials and industry leaders in the host countries to ensure that U.S. TDA funded projects are of a high development priority for the countries where the projects are located.

Since the U.S. Trade and Development Agency's inception in 1981, U.S. TDA has been associated with approximately $16.8 billion in exports – or nearly $40 in exports for every dollar invested in U.S. TDA activities. In Fiscal Year 2000, U.S. TDA obligated $51.7 million for U.S firms in more than 63 strategically targeted developing and middle-income countries in the following regions: Africa/Middle East; Asia/Pacific; Central and Eastern Europe; Latin America and the Caribbean; and Eurasia. U.S. TDA is primarily involved in the following sectors: agriculture; energy; environment; health care; information technology manufacturing; mining and minerals development; telecommunications; transportation; and water resources.

U.S. TDA's success is often achieved through the cooperation and assistance of colleagues throughout the U.S. Government. U.S. TDA works closely with the Department of State, the Department of Commerce's U.S. Foreign Commercial Service, the Agency for International Development, the Department of Transportation's Federal Aviation Administration and Federal Railroad Administration, the Department of Energy and, most recently, the Federal Emergency Management Agency. U.S. TDA also works closely with the U.S. Export-Import Bank, and the Overseas Private Investment Corporation.

U.S. TDA funds project planning activities that directly influence the procurement decisions related to major industrial or infrastructure projects in developing and middle-income countries - projects that typically represent millions of dollars in U.S. export potential. From radar for airports in Asia to process controls for refineries in Latin America, hundreds of goods and services are required to implement a project. U.S. TDA works to ensure that the services and products provided by U.S. firms receive "equal access."

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Section I – Introduction

This initial report summarizes the Shanghai Municipal Electric Power Company's Orientation Visit undertaken during June 2-11, 2002. This orientation visit was implemented under U.S. TDA Contract Number IQC-1D00282, Task Order Number IQ2D00010 by Princeton Energy Resources International (PERI) of Rockville, Maryland.

A) Background

China is the world's most populous country, the largest energy consumer after the United States, and the production and consumption of its dominant fuel, coal, is the highest in the world. Broadly, China, like many other countries that are reforming their electricity industries, is looking to the United Kingdom's (UK) deregulation in the 1980s as a model. Thus, China plans to split power generation from transmission, and plans to let four or five generating companies compete to supply the grid, which itself will be split along geographic lines. China's largest state-run power producer, State Power Corporation (SPC), is a virtual monopoly. China, with an eye to foreign investment, will divide the power generating assets of SPC among several companies that will compete nationwide and the SPC will become the sole grid operator. The move, as part of the ongoing national power reform, is expected to break up SPC's virtual monopoly, which includes nearly half of the generation assets and all of the country's high-voltage assets.

Electric energy demand in China has been growing rapidly. Particularly in the metropolitan Shanghai city area, over the last decade, the average annual growth rate in energy consumption has been in the range of 6% to 10% range. Despite these high growth rates, electricity consumption in Shanghai area in 1999 was only 700 kilograms of oil equivalent (kgoe) per capita as compared to 5100 kgoe for the OECD countries. Electricity consumption per capita in China is 550 kwh/capita, far lower countries like Korea at 2150 kwh/capita, and the U.S. which in 1999 stood at 13,247 kwh/capita. Driven by rapid economic growth, population increase, industrialization, urbanization, and the competitive needs of the global market, electricity demand in China is projected to increase by an average of 7.3 % per annum over the next decade.

A detailed review of China's Electric Power Sector is provided in Section VI.

B) Shanghai Municipal Electric Power Company

The Shanghai Municipal Electric Power Company (SMEPC) provides electric power to the entire city of Shanghai. In order to keep pace with Shanghai's rapid development and to support the rising standard of living, SMEPC has become the most progressive utility in China. SMEPC hopes to build its power network into a first-class urbanized power grid built to international standards. It will do this by upgrading electric supply grid reliability and voltage quality.

According to the U.S. Department of Commerce Commercial Service, SMEPC's upgrading project offers significant opportunities for U.S. suppliers in areas related to management systems (EMS) and automatic generation (AGc) and power application software (PAS). Opportunities also exist for U.S. suppliers of distribution management systems (DMS). SMEPC plans to invest US$240 to US$300 million over the next five years to improve distribution, transmission and energy sales. Sixty to seventy percent of the budget will be used for the procurement of equipment, with the remainder for construction; less than one percent will be used for training. Internal funds and bank loans will be used to finance these projects and SMEPC describes its financial condition as healthy and it reports that it easily qualifies for bank loans.

The flexible and efficient operation and control of the electricity distribution network is essential to the commercial success of SMEPC as an electricity distributor. In practical terms, efficient operation and control must include not only the management of the physical distribution network, but also the interaction with support services, such as customer service, financial services, and metering. The need to provide greater productivity and efficiency has led SMEPC to examine in detail the interactions between the different parts of the business which support the operation and control of the distribution network. Specifically, SMEPC in near-term, the next 5 years, intends to invest in the following transmission and distribution areas to improve power supply quality and reliability:

a) An Integrated DMS Environment

A DMS is the key to the efficient management of a distribution company's principal asset, the network. Recent advances in the U.S. technology, particularly in the areas of communications, graphical workstations and open system standards, has meant that modern DMS are capable of being integrated with other computer systems already in use within a distribution business. This means that different parts of the business can obtain far more detailed, relevant, and up-to-date information, allowing them to function more effectively and efficiently and with the overall benefit that the distribution network can be managed in a more efficient and cost effective manner.

b) Distribution Supervisory Control and Data Acquisition (SCADA)

A SCADA system provides basic supervisory control and data acquisition functions, including remote control with interlocking and sequence control, data acquisition and handling of alarms and events. In addition, it maintains a connectivity model of the network and also provides the graphical interface to the system, supporting the display and the manipulation of geographic and schematic network diagrams, with background maps, diagram navigation and network coloring.

c) Work Order Management

Work Order Management contains all of the functionality required to prepare, check and execute work orders, producing all of the necessary hard-copy documentation. It can incorporate all of the required safety procedures of a utility, and help ensure that standard working practices are followed.

d) Distribution Operations Management

It consists of a suite of analysis tools, Distribution Operations Management can be used for the modeling and analysis of the distribution network. The tools enable load modeling and forecasting, short circuit calculations, voltage-var calculations and line loss minimization to be performed in a quick and efficient manner, producing optimal network reconfiguration strategies.

e) Distribution Outage Management and Restoration

Distribution Outage Management and Restoration systems embody all aspects of trouble call entry, not only allowing better response to customers' complaints and queries, but also allowing those calls to be used to aid outage analysis and prioritization of faults. The repair crew resource management facility ensures that the correct repair crews are dispatched to faults, and helps optimize repair crew utilization.

f) Demand-Side Management

Demand-Side Management systems provide the functionality necessary for the management of consumer loads. It includes peak load forecasting and the formulation and execution of load control strategies. With remote intelligent metering, readings can be performed as frequently as required, making flexible tariff switching and dynamic pricing possible. Also, remote earth fault detection and remote load voltage readings can be used both for planning and fault analysis purposes.

g) Substation Control and Protection

The capability to interface with substation control and protection systems allows remote operation and the setting of smart digital relays and protection equipment. It also helps in fault location by allowing the remote reading of fault recorders and protection equipment.

C) Results of SMEPC Orientation Visits

The SMEPC delegation's nine day intensive site visits included the on-site observation of high-voltage transmission and low-voltage distribution system management / automation at the following utilities:

- Pacific Gas and Electric Company (PG&E)
- Sacramento Municipal Utility District
- California Independent System Operator (ISO)
- Boston Edison Company
- PJM Interconnection (PJM)

The SMEPC team experienced, first hand, the U.S. technologies and man/machine interfaces for the automatic operation, control, and dispatch of the electric power systems in three different states. PG&E, California ISO, and PJM also provided the delegation with a number of fact sheets and other information packages, which are included in **Appendix A**.

In addition to the meetings, plant tours and site visits originally planned, several side trips were organized for the delegates in California and Boston. In California, on June 4th, after attending PG&E's Transmission and Distribution presentation, in the afternoon delegates visited PG&E's Energy Center for the promotion of energy conservation and demand side management. The Energy Center Director made one full hour presentation on various energy efficiency programs promoted by the PG&E, including, but not limited to the following:

- Lighting efficiency improvements
- Smart water and energy use programs in the PG&E system
- Day lighting initiatives for industrial and retail applications
- Efficient design for HVAC

On June 7th, after Boston Edison Company's Distribution and Dispatch Center visit, the delegates spent most of the afternoon in Boston Edison Company's Transmission and Distribution Training Center. Some of the delegation members were intrigued by the remote, radio control, breaker operation equipment at the training center.

Private meetings were also arranged with the executives of the following vendors, some of whom are currently providing equipment and consulting services in China:

a) EPRI Worldwide (Palo Alto, CA) - a subsidiary of Electric Power Research Institute (EPRI) is providing a wide-range of EPRI technologies to international electric utilities. Dr. Pei Zhang and Dr. Ashok Sundaram delivered a two-hour presentation on Grid Operations and Planning. A copy of their slide presentation is included in **Appendix B.**

b) APTECH Engineering (Sunnyvale, CA) **–** APTECH Engineering is an internationally recognized engineering consulting firm specializing in independent design and analysis, systems integration, materials engineering, reliability and risk analysis, failure analysis, and investigation of thermal power plants. APTECH is currently providing a wide range of consulting services to electric utilities in China in the following areas:

- Stress analysis and fracture mechanics
- Materials evaluation and laboratory testing
- Failure analysis
- Equipment life optimization
- Thermal-hydraulic analysis
- Risk and reliability analysis

Material provided by APTECH during this meeting is included in **Appendix C**.

c) Utility Consulting International (San Jose, CA) – Utility Consulting International (UCI) provides consulting services on a wide range of computer control systems, communication systems, and technical applications oriented to the automation of the electric utility including:

- SCADA Systems
- Distribution Automation (DA)
- DMS
- Bulk Power EMS
- Automated Meter Reading Systems
- Deregulated Electricity-Market ISO, Scheduling, Trading, Settlement Systems
- Residential and Industrial Load Control Systems

- Telecommunication Networks and Interfaces
- Utility Communication Architecture (UCA)

Particular services provided by UCI includes:

- Feasibility Studies
- Cost Benefit Analysis
- Master Plan and Definition/Requirement Studies including Implementation Plans
- Procurement Specification Preparation
- Evaluation of Bids from Vendors
- Work Statement Preparation
- Contract Negotiation
- Project Management including System Testing and Monitoring Contractor Performance

UCI is staffed entirely by engineering consultants with extensive experience in the above services. UCI's clients include many electric utilities, worldwide, EPRI and U.S. TDA.

d) KEMA Consulting (Fairfax, VA) – KEMA Consulting is an international corporation with more than 450 energy specialists. KEMA provides a full complement of electric utility distribution automation services to enable it's clients to implement the systems and processes necessary to achieve maximum reliability and improved customer satisfaction. From tactical procedures and technological issues to strategic and executive-level decisions, KEMA offers the energy industry a formidable partner to address the dynamic changes that are taking place. KEMA Consulting has assisted more than 500 clients in over 70 countries in achieving their strategic and operational goals. Applying global experience and regional insight, KEMA supports generation through the consumer side of the meter.

Today's EMS and SCADA systems are being recognized as important strategic assets in a utility's enterprise-wide information technology solution as the utility competes in the marketplace. KEMA Consulting has assisted electric utilities with the planning, procurement, and implementation of more than 200 EMS/SCADA systems for power systems ranging from 40 MW to 50,000 MW. KEMA is regarded as the proven leaders in developing and executing innovative approaches to the EMS procurement and implementation process.

KEMA Consulting:

- develops EMS strategies
- evaluates migration, phased replacement, and total replacement of existing EMS/ SCADA systems
- evaluates data and network security issues and needs
- develops a procurement process that best fits needs, time constraints, and budgetary considerations
- provides project management services

Appendix D provides additional information about KEMA and their capabilities.

e) BEACON Power (Wilmington, MA) - BEACON Power designs, develops and offers for sale flywheel-based power systems providing highly reliable, cost competitive, environmentally friendly, uninterruptible electric power for commercial facilities, communications, cable, computer networks, the internet and industrial manufacturing plants. BEACON currently sells two high-energy flywheel-based products and soon will be offering high-power uninterruptible power supply (UPS) flywheel based products. BEACON's current, high-energy products deliver a low amount of power over a long period of time, typically measured in hours, and the UPS products will be designed to deliver high amounts of power over a short period of time, typically measured in seconds.

Users of electricity can experience significant losses in their operations if their electricity supply is partially or wholly interrupted by events such as voltage sags and surges or power outages. When grid-supplied electricity is interrupted, these users must employ some means to replace it. Even if the utility industry were to undertake substantial upgrades and other investments to improve overall utility grid reliability, the grid's exposure to severe weather, accidents and other external events means that the absolute level of power quality required for today's sophisticated electronic and industrial applications remains difficult to achieve without local uninterrupted power protection close to the place of use.

BEACON Power believe that their flywheel systems provide significant advantages to potential customers due to the numerous problems associated with lead acid batteries, including:

- **Reliability** - Batteries are not only prone to heat buildup and acid leaks that lead to battery failure, but when they are repeatedly used at close to their maximum power output, their power output capacity can rapidly decrease, reducing the batteries'

effectiveness over time. Also, the amount of power available in battery systems may not readily be monitored and, therefore, the amount of energy cannot be assured.

- **Cost** - The use of batteries poses both direct and indirect costs. In addition to paying the initial purchase costs of the batteries, a user must allocate significant space to large battery arrays in space that could otherwise be allocated to revenue generating equipment, must inspect and test them on site every few months since their power output degrades over time, must cool them with costly air conditioning if the user wishes to avoid the rapid degradation in performance and life that results with temperature variations, and must replace them every two to six years, depending on type of use, environment and other factors.

- **Life** - In applications where discharges use all or most of the battery's available reserve, the life of batteries is significantly reduced.

- **Environmental** - Batteries contain toxic materials such as lead and sulfuric acid, are considered hazardous waste, and their disposal encounters rigorous and costly government environmental regulations. Facilities with spent batteries must make arrangements with hazardous waste handlers for disposal. Both the costs associated with disposal and the complexity of compliance for proper handling, permitting and regulatory requirements continue to increase and may accelerate sharply as the pressure to curb such hazardous wastes increases.

Presentation material provided by BEACON Power is included in **Appendix E**.

f) Reilly Associates (Philadelphia, PA) - Reilly Associates is an independent consulting firm to the electric utility and telecommunication industries. Areas of special interest are system reliability, power quality, information technology, and utility infrastructure development. Reilly Associates has participated in various U.S. TDA programs, including Desk Studies, Feasibility Studies, Technical Assistance, and Orientation Visits. Reilly Associates maintains direct contact with U.S. utilities, manufacturing companies and service providers, and promotes international projects and trade development.

The following companies co-sponsored this orientation visit by hosting the delegates:

- EPRI Worldwide – Lunch (Palo Alto)
- Utility Consulting International – Dinner (San Jose)
- PERI – Dinner (Sacramento, CA) and Lunch (Philadelphia, PA)
- PJM Interconnection – Lunch (Philadelphia, PA)

- Rielly Associates – Lunch (Philadelphia, PA)

Princeton Energy Resources International, based in Rockville, Maryland, planned, organized, scheduled, and reported results from the meetings. A follow-up survey of the participating companies will be conducted one year from now to determine results from the meetings.

Section II – Official Delegation

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Mr. Qian Wei Ming	Director, Department of Human Resources Shanghai Municipal Electric Power Company 181 Nanjing Road (E.) Shanghai, China 200002 Phone: 86-21-63291010-2502 Fax: 86-21-63291010 Email: jfqifq@sh163.net
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Mr. Zhou Xin Fu
Manager of President's Office
Shanghai Municipal Electric Power Company

Work Experience:
1984-1999: Manager, Shanghai Transmission and Transformation Engineering Company

- 500kV Nanqiao AC/DC Substation Project
- 500kV Yang Gao Substation Project
- 500kV Si Jing Substation Project
- 500kV YangHang Substation Project
- 35-220kV Transmission Lines Construction

2000-2001: General Manager, Shanghai Eastern Power Supply Company

2002-Present: Vice Chief Engineer, Shanghai Municipal Electric Power Company
Taking charge of Shanghai power grids construction and management.

Mr. Teng Le Tian
Deputy Manager of Department of Power Production & Technology
Shanghai Municipal Electric Power Company

Work Experience:

- Lead the preparation of the department of Dispatch Center of Shanghai Southern Power Supply Company (SSPSC)
- Lead the build up of the Dispatch Automation System covering 5 districts and 1 region in SSPSC;
- Lead the build up of the Transmission Automation System of SSPSC; drafted the AM/FM/GIS system scheme of SSPSC
- Developed the 'Ninth Five-Year Technology Plan' of SSPSC, 'Two Network Renovation Plan' and related technical principles.

Ms. Wang Xiao Jin
Deputy of Department of Financial Affairs
Shanghai Municipal Electric Power Company

Work Experience:
Ms. Wang is the Deputy of the Department of Financial Affairs for SMEPC. She is in charge of the capital management including annual budget, capital operation, and capital safety management. She also is the leader of the Real Asset and Under-Construction Project group.

Mr. Jiang Feng Qing
Section Chief, Department of Planning & Development
Shanghai Municipal Electric Power Company

Work Experience:

- During his tenure at the Dispatch Center of Shanghai Urban Power Supply Company, Mr. Jiang took charge of the operation management and safety of the 220kV, 110kv and 35kV power grids. He has been the leader for tens of 220kV substation projects and has handled several troubleshooting projects. He is also in charge of the R&D work of SCADA and PAS.
- He is in charge of the Load Estimate of Electricity Market and Power Grid Planning, analyzing the power demand for power grid investment. He is also in charge of the 220kV and 500kV power grid planning work.

Mr. Qian Wei Ming
Director, Department of Human Resources
Shanghai Municipal Electric Power Company

Work Experience:
1981 to Present: Human Resource Management on Labor Organization, Labor Performance, Statistics and Analysis, Information Management.
1984: Member of the working group on Labor Quota of Shanghai Urban Power Supply Company;
1996: Member of the development group on ‘ Personnel Information Management System’ of SMEPC
1998: Member of the working group on ‘Labour Quota Standard of Power Supply Enterprise’ of State Power;
2002: Member of the Investigation Group of ERP human resource module

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Mr. Jiang Ren
Foreign Affairs Division Engineer
Shanghai Municipal Electric Power Company

1984: Graduated from Shanghai Electric Power Institute

1984– 1994: I&C Engineer, Boiler Operator of Shanghai Zaibei Power Plant

1994: Interpreter, Project Officer of the Foreign Affairs Office of Shanghai Municipal Electric Power Company

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Mr. Shen Zhao Xin
General Manager, Senior Engineer
Shanghai Extra-High Voltage Power Transmission Company

Work Experience:
1983-1988: Leader of Line and Uninterrupted Work group of Shanghai Urban Power Supply Company (SUPSC).
1986-1989: Vice director of Lines Section of Shanghai Urban Power Supply Company
1989-1992: Assistant to Chief Engineer of Shanghai Urban Power Supply Company.
1992-1994: Vice Director of Transformation Section of Shanghai Urban Power Supply Company.
1994: Director of Product and Technology Section
1994-1997: Deputy Manager of SUPSC
1997-2000: Deputy General Manager of Shanghai Southern Power Supply Company.
2000-Present: General Manager of Shanghai Extra High Voltage Transmission and Transformation Company

Projects:
- 220kV 2244 Line Project;
- 220kV 2206/2215 Line Steel Pillar Base Boosting Project
- 220kV 2218 Line Lightning System
- 550kV Line, Huang Du Substation Project
- P13 Monitoring System of 550kV Nan Qiao Substation Project
- 220kV Tangzheng Substation Renovation Project
- 220kV Pudong Substation, Main Transformer Core Changing work;
- 35kV Busbar Troubleshooting
- APEC power supply work

Mr. Shen Zhao Xin worked as the leaders of several sections and companies throughout his career time and has published several essays in several technology publications. He is also the manager of several sub-companies of SMEPC.

Mr. Yu Yin
Vice General Manager
Shanghai Electric Power Design Institute Co., LTD

Work Experience:
Participant in the design of the following projects:

- Shanghai Electric Power Dispatch Center Building, primary design
- Wu Jin Power Plant Oil Silo and Oil Loading Station
- Training Center of Electric Power Bureau of Eastern China
- Training Center of Shanghai Municipal Electric Power Company
- 110kV Substation of Shanghai No.1 Metro, Shanghai Stadium Station
- 110kV Substations of Shanghai No.2 Metro, Center Park Station & Jin An Temple Station
- Shengneng Xinghuo Thermal Power Station
- 550kV Si Jing Substation
- 220kV Underground Substation of People's Square, 2nd Phase.
- Wu Jiang Fenhu Diesel Power Station
- 220kV Substations of Ruijin, Huashan, Dongchang, Zangjiang, Airport, Xuhang
- Baoxing, Hongqiao 110kV Substations of Shanghai Overhead railway Mingzhu Line

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Mr. Zhang Wei
Vice Chief Economist
Shanghai Urban Power Supply Company

1981: Graduated from Shanghai Electric Power Institute

1981– 1991: Engineer and Section Chief of Shanghai Hunan Power Supply Branch

1991– 1999: Vice Director of Shanghai Hunan Power Supply Branch

1999: Vice Chief Economist and Director of Planning Dept. of Shanghai Urban Power Supply Company

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Ms. Jiang Haiying
Deputy Director (U.S Affairs)
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Jiang Haiying has been with the Department of American and Oceanian Affairs at the Ministry of Foreign Trade and Economic Cooperation (MOFTEC) since 1989. She currently holds the position of Deputy Director at the U.S. Affairs Office. Her responsibilities include the handling and day-to-day management of government affairs related to the development of bilateral economic and trade relations between China and the U.S.

Ms. Jiang has been dedicated to the promotion of Sino-U.S. bilateral trade and economic cooperation over the past decade. She successfully organized a number of seminars sponsored by the two governments on Standards, Intellectual Property Protection and WTO-related training programs. She participated in the Market Access negotiations and textile consultations. She was frequently a member of high-ranking Chinese Government Trade Missions visiting the United States for the purchasing of U.S. airplanes, automobiles, fertilizers and other staple commodities. She was also directly involved in the organizing of major trade events between the two countries. In the mid-90's, Ms. Jiang was Office Manager of a NZ-based trading company under MOFTEC, where she obtained substantial commercial experience from her 3-year term of appointment.

Ms. Jiang is enthusiastic in promoting business cooperation between the SMEs of the two countries. She was awarded honorary citizenship of Alaska for her devotion and distinguished contribution to the business development in that region. With her coordination, many trade and investment disputes were successfully settled.

Ms. Jiang holds a Bachelors Degree in Economics from the Shanghai Institute of Foreign Trade. She is fluent in Mandarin Chinese and English.

Mr. Yao Dekang (Scott)
Senior Commercial Specialist
Foreign Commercial Service
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Mr. Scott Yao is a Senior Commercial Specialist with the U.S. Foreign Commercial Service (FCS), U.S. Consulate General Shanghai. His portfolio covers architectural, construction and engineering services, building materials, power generation, machinery, and the steel industry. In addition, he is also the office coordinator for WTO related activities and information.

Although Scott Yao has been with the FCS Shanghai for only one year, he has experienced the entire spectrum of Commercial Service activities and events. He has worked a Presidential visit last October for the APEC meetings, organized trade missions for 50+ companies, organized second-tier outreach WTO programs, as well as handled ordinary FCS programs such as Gold Keys, IPS and authored IMIs. He also has experience working with and promoting the U.S. TDA.

Prior to joining FCS Shanghai, he was a sales manager for Reynolds Metals Shanghai Co., Ltd. an American company in the private sector in Shanghai. Mr. Yao has a unique perspective on what it takes for American businesses to succeed in China's marketplace.

A graduate of the China Europe International Business School, Mr. Yao holds a MBA degree.

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Section V – Itinerary and Business Presentation Agendas

Day 1 – Sunday, June 2nd

Daytime	Arrived in San Francisco, California
Evening	Crown Plaza Union Square, San Francisco – Introduction and review of OV activities – Subjects to be covered included tour administrative matters, general orientation to U.S. culture, power sector specific issues and the OV tour agenda.

Day 2 – Monday, June 3rd

8:45 am	Departed for PG&E
9.30 am – 12:00 pm	Visited PG&E's Distribution System, Head Office. Review of the system operation and system reliability needs due to geographical constraints of San Francisco. Subjects to be addressed would include but are not limited to: Distribution SCADA, Distribution Operations Management, Distribution Outage Management and Restoration, Demand-Side Management, Substation Control and Protection, Effects of Capacitor Placement Variations, Switched Bank Capacitors, Voltage Control Considerations, Load Profile and Composition Modeling Using Programmable Logic Controller (PLC), and the Circuit Breaker Control Ladder-logic Software, etc.
11:30 am – 1:00 pm	Lunch Break
1:30 pm – 3:00 pm	Visited Pacific Energy Center
	Guided tour of the Pacific Energy Center

Day 3 – Tuesday, June 4th

8:30 am	Departed for Palo Alto Welcome and Opening remarks by EPRI
9:30 am – 12:00 pm	EPRI – Palo Alto Welcome and Opening remarks and EPRI's collaboration in China in the power sector control equipment and technologies Presentation of EPRI activities in Power Quality Control EPRI activities in Grid Operations and Planning
12:00 pm – 2:00 pm	Lunch hosted by EPRI
2.30 pm-3.30pm	Presentation by APTECH Engineering, Inc Sunnyvale, California Technical areas discussed are power supply reliability and efficiency improvement program and APTECH licensed products in China.
4.00 pm –6:00 pm	Visited Utilities Consultant International, Inc Presentation by UCI for their overseas services including activities in China, Philippines, Malaysia and Singapore, etc. in the areas of Power Quality Control.
7:00 pm-10.30pm	Dinner hosted by UCI

Day 4 – Wednesday, June 5th

8:00 am	Departed for Sacramento
9:30 am – 12:00 pm	Visited SMUD's Distribution Control Center. The SMEPC team were able to observe the Man-Machine Interface for: • Displaying both static and real-time information on CRT displays; • Entering data into the EMS database; • Handling of dispatcher control requests, etc.
12:00 pm – 1:00 pm	Traveled to Folsom – Lunch on the run

1:00 pm – 4:00 pm	Visited California ISO (Independent System Operator) center. California ISO is charged with managing the flow of electricity along the long-distance, high-voltage power lines that make up the bulk of California's transmission system. The mission of the California ISO is to safeguard the reliable delivery of electricity, facilitate markets and ensure equal access to a 12,500 circuit mile "electron highway".
7:00 pm	Dinner hosted by PERI
Night	Radisson Hotel, Sacramento

Day 5 – Thursday, June 6th

Morning	Traveled to Boston
Night	Radisson Hotel Woburn, Boston

Day 6 – Friday, June 7th

8:30 am	Departed for Boston Edison
9:30 am – 12:30 pm	Visited Distribution Control Center – Boston Edison Meeting with the Boston Edison Company for visiting their Distribution Control Center and Transmission and Distribution Training center and observation of various substation switching operations.
12:30 pm – 2:00 pm	Lunch
2:30 pm – 5:30 pm	Visited Beacon Power Manufacturing facility for Power Quality improvement equipment. Introduction to Beacon Power Flywheel Storage Technology Power Quality Issues and Applications for Shanghai Electric Equipment Demonstrations
7:00 pm	Dinner hosted by PERI
Night	Boston, Massachusetts (Hotel to be confirmed)

Day 7 – Saturday, June 8th

Am	Traveled to Philadelphia, Pennsylvania
1 pm	Meeting with Jim Reilly and Associates
Night	Crown Plaza Philadelphia Center, Philadelphia, PA

Day 8 – Sunday, June 9th

All-Day	Rest/Free time for sightseeing Lunch paid by PERI

Day 9 – Monday, June 10th

8:30 am	Departed for PJM Interconnection Center
10:00 am – 12:30 pm	Visited PJM Interconnection Center. PJM Interconnection LLC operates the largest wholesale electric market in the world. PJM's foremost responsibility is the safe and reliable operation of the electric transmission system to assure the reliable supply of electric energy from generation sources to wholesale customers.
12:30 pm – 2:00 pm	Lunch hosted by PJM
2:30 pm – 5:00 pm	KEMA Consulting, Inc 4377 County Line Road Chalfont, PA 18914 Presentation by KEMA in the areas of Distribution automation program, T & D real-time data management for switching operations.
7:00 pm	Dinner hosted by KEMA Consulting

Day 10 – Tuesday, June 11th

Daytime	Departed from Philadelphia for Los Angeles – End of official visit
June 11th through 13th	No U.S. TDA Planned activity
June 14th	Delegates Departed for Shanghai

Section VI: China Power Sector Overview [1]

Since 1994, China's electric power industry has seen a considerable transformation. An Electric Power Law was put in force April 1996, which was a major event in China's electric power history. The new law promotes the development of the electric power industry, protects the legal rights of investors, managers and consumers, and regulates generation, distribution and consumption.

Before, the electricity supply was managed by electric power bureaus of the provinces and cities and by administrative agents. Now utilities have been changed into companies outside of the administration. It is expected that the municipal electric power companies will be divided into electric power generation and electric power supply companies. A policy of competition between the different generators will be implemented in the next few years.

China's electric power industry continuously maintains a high growth rate. By the end of 2000, the total installed power was 315 GW, which means an increase of 16.5 GW or 5.5% compared to 1999. Hydropower amounted to 77 GW, accounting for 15%; thermal power amounted to 235 GW, accounting for 83%, nuclear power amounted to 2GW, accounting for 1% of installed capacity. Electricity generation reached 1400 TWh, 13.5% more than in the previous year. In 1999, the construction investment of the electric power industry reached 14 billion U.S. dollars, of which 49.3% were dedicated to thermal power, 12.5% to hydropower, 6.4% to nuclear, 26.1% to transmission lines and transformers, and 5.7% to other investments.

By the end of 2010, it is expected that the total installed capacity will reach 500 GW, and the annual generation of electricity will exceed 2040 TWh.

A) Electricity Demand and Supply [1]

In 2000, the total installed capacity of electric equipment for final use was over two times larger than the total generating capacity. The national electricity consumption was 1400 TWh of which, 166 TWh was consumed by households, accounting for 12%, an increase of 13% compared to the previous year; 1078 TWh was consumed by industry, accounting for 77%, an increase of 22%; 68 TWh was consumed by agriculture, accounting for 5%, an increase of 30%; and 87 TWh was consumed by the service industry, accounting for 6%, a decrease of 33%.

In 2000, the main features of electric demand and supply were as follows:

- Power demand growth rates were unbalanced in different regions and this led to great differences in power generation growth in different networks
- Load factor being decreased for some networks

[1] Zhou Jia Ping , Director of General Engineer Office Chongging Energy Conservation Technical Service Center, " The Current Situation of China's Electric Power Industry," November 2001

- Electricity quality being improved
- Investment for upgrading rural networks increasing by a large margin and a policy of identical electric prices for rural areas and cities being implemented
- Conflicts between power supply and demand being serious at peak period
- Electricity consumption per capita still being low. In 2000, the national installed capacity per person was only 0.24 kW, increasing by 0.003 kW over the previous year, consumption per capita was 1069 kWh, 90 kWh more than 1999

B) Development Direction of China's Electric Power Industry

1. China has prioritized the development of hydropower, especially in the southwest of China. Since the 1990's, newly added hydropower installed capacity has grown greatly. At present, there are many large sized hydropower stations under construction. At the end of 1999, 36 GW of hydropower were under construction, of which the Three Gorges was 18 GW. Other large sized hydropower projects amounted to 8 GW; medium and small hydropower projects amounted to 10 GW.
2. Thermal power plants will account for three-fourths of the newly added capacity in the future and coal will still be the major fuel source for these plants. A certain amount of imported fuel oil and liquefied natural gas will fuel thermal power stations in coastal areas with booming economic development.

   Future development goals are to construct a number of large thermal power plants near the coal mine areas.

   A number of large thermal power plants will also be constructed in the concentrated area along the coast, near the sea and/or at railway junctions. The low and medium pressure thermal power units, as well as the units beyond their normal service life, will be rehabilitated or substituted with large units, in order to reduce fuel consumption and to improve the environment. Research, development and demonstration of clean coal technology shall be carried out, including integrated gasification combined cycle generation, fluidized bed combustion, low NOx combustors and flue gas treatment techniques.

   Co-generation will be encouraged at places where concentrated thermal loads are located. A small number of gas turbines and gas-steam combined cycle units will be installed in the coastal areas.

3. China possesses nuclear fuel resources and nuclear technical forces. In east China, south China and the coastal area of northeast China, where serious energy shortages occur, nuclear power is considered an appropriate solution to improve the local energy supply.

   There are two nuclear power stations totaling 2.1GW in operation and 4 nuclear power stations totaling 6.6 GW under construction.

C) Rural Electrification

The Chinese government has prioritized rural electrification. At the beginning of 1990s, the government proclaimed the principle of "the power industry should serve for agriculture, the farm and for the rural economy". By the end of 1994, the former Ministry of Electric Power Industry (MOEP) made arrangements in order to improve the reliability of the rural power supply system.

By the end of 1996, the percentage of households with access of electricity amounted to 94.7%; 72 million residents throughout 11 countries remain with no electricity.

In June 1998, the Chinese government authorized the construction and upgrading of the rural networks for 2,400 counties, with a total investment of US$23 billion. It is expected that the project will be completed at the end of 2001. After the project is finished, 11 counties originally with no electricity will have access to electricity, and the percentage of households with access to electricity will amount to 98%.

For households with no electricity in remote regions, the government encourages farmers to exploit and use new and renewable energy technologies, such as micro hydropower, solar energy, wind energy, geothermal energy and biomass energy, giving subsidies and loans on favorable terms for the households in remote regions.

At present, there are 14 electric networks in China with a capacity of over 1 GW. The largest is the East China power system, with a system capacity of 31.67 GW; the Central China, North China and Northeast China electric networks each exceed 25 GW, have capacities of 27.60 GW, 27.15 GW, 26.53 GW respectively; the Guangdong, Shangdong, Northwest and Sichuan electric networks each exceed 10 GW and reach 19.0 GW, 11.25 GW, 11.48 GW and 10.9 GW of capacity respectively.

The total installed capacity of the 14 above mentioned power systems is 184.12 GW, and their annual generation is 890.2 TWh, accounting for 92% and 95% of the national total respectively. China's networks are not currently connected completely with each other. The State Electric Power Company has a plan to connect the networks in 2001; it will invest US$72.5 billion during 2000-2005, of which US$43.5 billion is networks construction and upgrading. At the end of 2005, China's networks will be integrated except for the Tibet, Hainan and Xinjiang networks.

D) Shanghai Municipal Electric Power Company

In 2000, SMEPC had 10 power plants possessing 9,160.2 MW of generation capacity and 479 35-500 KV substations possessing 40,174.3 MVA of transformer capacity. Annual power generation and power sales are 55,775 billion KWH and 39.569 billion KWH respectively.

Due to the construction of power plants over the past 10 years, Shanghai's balance of supply and demand changed from a power shortage to basic equilibrium, with only a small gap during peak load periods. By the year 2000, supply reliability had reached 99.91%, with a rate of qualified voltage of 99.06%. SMEPC hopes to increase the supply reliability to 99.99% by upgrading its grid.

SMEPC plans to invest US$240 to US$300 million over the next five years to improve distribution, transmission and energy sales. Sixty to seventy percent of the budget will be used for the procurement of equipment, with the remainder for construction. Less than one percent will be used for training. Internal funds and bank loans will be used to finance these projects. SMEPC describes its financial condition as healthy and it reports that it easily qualifies for bank loans.

SMEPC received a US$100 million loan from the World Bank last year. Of this amount, US$20 million was used for upgrades.

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Appendices

A. Materials Provided by the Utilities Visited

B. Electric Power Research Institute

C. APTECH Engineering

D. KEMA Consulting

E. Beacon Power

Appendix A: Materials Provided by the Utilities Visited

- Pacific Gas and Electric
- California ISO
- PJM Interconnection

(This material is not available in electronic format.)

Appendix B: Electric Power Research Institute

(This material is not available in electronic format.)

Appendix C: APTECH Engineering

(This material is not available in electronic format.)

Appendix D: KEMA Consulting

(This material is not available in electronic format.)

Appendix E: Beacon Power

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