Project Objective:

We, the Shanghai Bus Company (SBC) are seeking international partners for the design and manufacturing of fuel cell equipped buses, in order to alleviate the serious air pollution in China’s urban centers, and also acquire a new and promising technology for the future of our country. The goal of this project is to create a joint-venture company to produce 1000 fuel cell powered urban transportation buses per year, by the fifth year of the plant operation. The buses will be introduced into the highly populated, greater Shanghai area, and other densely populated urban areas of China. They could also be exported to other countries interested in this new technology.

Due to China’s large and growing population, and its rapidly expanding economy, the projected damage to the environment caused by current transportation methods is overwhelming. Using clean burning fuel cells for large scale mass transit systems, and introducing policies that strongly encourage the use of public transportation, we will be able to substantially cut down the air pollution created by the combustion engine powered buses and automobiles in the major urban areas. We are also very interested to introduce to China a new, cutting edge technology, which will help our work force learn new skills and be competitive in the world market.

With this Request for Proposals (RFP) we invite all qualified foreign entities, in the fuel cell used transportation field, to submit their full proposals for this joint-venture project by November 24, 2000. By becoming a partner with SBC they will have the opportunity to participate in the rapid growth of China’s industrial might in the 21st century.

Project Scope:

1. Information about Shanghai Bus Co. (SBC):

   We are a recently privatized company, manufacturing for more than 40 years combustion engine powered buses for the greater Shanghai area and other urban centers in China. Our current production is in the range of 10,000 buses per year. We are seeking to form a fuel cell bus production joint-venture company as above mentioned.

   Our company’s technological assets and our years of experience in bus manufacturing include:
   • A complete bus manufacturing assembly line
   • Available space for manufacturing fuel cells and other systems required for the new type of buses
   • An experienced managerial, engineering, and workers staff
   • Deep knowledge of the transportation industry, laws, operations, etc. in China.

   We are particularly interested to gain the following technology through a joint venture with a foreign partner:
- Fuel cell manufacturing
- Design, assembly, operation, and maintenance of fuel cell buses
- Building and operation of methanol fuel stations.

**Personnel expertise needed:**
We hope to attract the following expertise through a joint venture:
- Electrochemical engineers familiar with fuel cells
- Mechanical design engineers for the redesign of combustion-engine to fuel cell buses
- Chemical engineers and other specialists to help with the methanol production and distribution stations’ construction and operation

We plan to implement a five-year training program, in which local workers will be taught the design, construction, operation and maintenance of fuel cell buses, methanol production, and fuel station operations. At the end of the fifth year, we expect that Chinese workers will be able to fill most of the positions related to this project.

**Our Team:**

_Gigi Chen_ - General manager, Financial Advisor
_Russel Lamb_ – Operation Manager
_Elaine Lee_ – Environmental Advisor
_Chris Man_ – Technology Manager
_Andrew Simmonds_ – Human Resources Manager
_Keith Vuono_ – Expert in the People’s Republic of China

**2. General Background on China:**

**2.1. China’s Population:**
With a total population of 1,261,832,482, and a relatively high population density and uneven population distribution, China utilizes family planning to aid in the controlling of possible overpopulation. The Chinese population demographic is also of importance and can be seen through the following facts and figures:
- **Age structure:**
  - 0 to 14yrs: 25%
  - 15 to 64yrs: 68%
  - 65yrs and over: 7%
- **Population growth rate:** 0.9%
- **Birth rate:** 16.12 births/1,000 population
- **Death rate:** 6.73 deaths/1,000 population
- **Infant mortality rate:** 28.92 deaths/1,000 live births
- **Life expectancy:**
  - Total population: 71.38yrs
  - Male: 69.6yrs
  - Female: 73.33yrs
• Total fertility rate: 1.82 children born/woman

2.2. China’s Economy:
The Chinese economy has moved from a Soviet-style centrally planned economy to a more market-oriented one within the framework of our political system. Recently, authorities have switched to a system of household responsibility in agriculture, increased the authority of local officials in industry, permitted a wide variety of small-scale enterprise in services and manufacturing, and opened the economy to increased foreign trade and investment. These changes and modern changes in the management of the economy have resulted in the quadrupling of the GDP since 1978, causing China to become the second largest economy in the world, after the United States. In addition, tighter monetary policies and stronger measures to control food prices produced sharp inflation drops from 1995-1999, and the doubling of agricultural output. The presence of foreign investment aided in the growth of China’s economy and the growth of Chinese industry. Unfortunately, in recent days, there have been numerous threats to this economic growth, as a result of China’s weakened population control program, the deterioration in the environment as a result of air pollution, and the loss of arable land because of erosion and economic development.

Facts and Figures: (as of 1999)
• GDP: $4.8 trillion
• GDP growth rate: 7% (1999 est.)
• GDP per capita: $3,800
• GDP composition by sector:
  o agriculture: 15%
  o industry: 35%
  o services: 50%
• Inflation rate: -1.3% (1999 est.)
• Labor force: 700 million
• Labor force by occupation:
  o agriculture: 50%
  o industry: 24%
  o services: 26%
• Unemployment rate: 10%
• Exports: $194.9 billion/year
  o Commodities: machinery, equipment, textiles, clothing, footwear, toys, fuels, and chemicals
  o Main partners: United States, Hong Kong, Japan, Germany, South Korea, Netherlands, UK, Singapore, Taiwan
• Imports: $165.8 billion/year
  o Commodities: machinery, equipment, plastics, chemicals, iron, steel, and fuels
Main partners: Japan, United States, Taiwan, South Korea, Germany, Hong Kong, Russia, Singapore

External debt: $159 billion

### 3 China’s Environment:

#### 3.1 Severe pollution in China

With the incredibly rapid economic growth in China, air pollution is becoming an overwhelming problem. According to the 1998 World Health Organization’s (WHO) air quality study of 272 cities, seven out of the ten most severely polluted cities were in China. The following charts show the ambient concentrations of two air pollutants measured in 1995. All six of the top pollutant production cities were in China, and almost all six of the Chinese cities exceeded the WHO guideline for the two pollutants.

![Total Suspended Particulates Chart](image1)

![Sulfur Dioxide Chart](image2)


#### 3.2 Major pollution contributor: automobile exhausts

One of the main sources of pollution is from vehicle exhausts. The number of automobiles in China is increasing 15% every year. Within ten years, from 1984 to 1994, there was a 300% increase in the number of vehicles from 2.4 million to 9.4 million. Aside from the incredible numbers, the automobiles themselves are built with 1970’s technology. These vehicles emit 2.5 to 7.5 times more hydrocarbons, 2 to 7 times more nitrous oxides (N2O), and 6 to 12 times more carbon monoxide (CO) than foreign automobiles. The following chart lists the percentage of pollutant emissions from vehicle exhausts in some of the major Chinese cities.

<table>
<thead>
<tr>
<th>CITY</th>
<th>CARBON MONOXIDE</th>
<th>HYDROCARBONS</th>
<th>NITROUS OXIDES</th>
<th>CATEGORIES</th>
</tr>
</thead>
<tbody>
<tr>
<td>Beijing</td>
<td>48-64</td>
<td>60-74</td>
<td>10-22</td>
<td>District</td>
</tr>
<tr>
<td>Shanghai</td>
<td>69</td>
<td>37</td>
<td>---</td>
<td>District</td>
</tr>
</tbody>
</table>

PERCENTAGE ATTRIBUTABLE TO MOTOR VEHICLES
3.3 Chinese environmental legislation

In recognizing the environmental problems, the Chinese government took many measures to prevent pollution from worsening. Government administrative agencies such as the National Environmental Protection Agency, the Environmental Protection Committee, and the Environment and Resources Protection Committee to draw up environmental protection regulations and to enforce them. Under these agencies, standards were created for environmentally harmful substances. Fines were set for polluting companies.

The 1987 Air Pollution Control law was established and was amended twice, once in 1995 and once in 2000. The final amendment took effect this September. In particular, the newly amended law required that all newly manufactured and imported cars must meet national emissions standards. Cars already in use must meet those standards with alteration. There will be an annual emission-checking requirement for all vehicles, and random inspections will take place in parking lots. In addition, the law promises to support the manufacturing and the use of clean, renewable energy. Yet, the details of the supporting method are to be determined.

4. Financial Regulations for the SBC-Foreign Joint Venture:

A joint venture trading company shall be a company of limited liabilities. The shares of the Chinese company in the registered capital of a joint venture trading company shall be no less than fifty-one percent (51%), and that of the foreign company shall be at least twenty-five percent (25%). A joint venture trading company shall have a registered capital of no less than 100 million Yuan, have its own name and organization, and have its own operational venue, professionals and other necessary physical conditions compatible with its foreign trade operations.
4.1 Capital Breakdown:

The above graph of capital breakdown represents the ownership of the partners in this joint venture. Thirty percent of the total required capital will be in equity, issued as stocks, and seventy percent will be comprised of debt, borrowed from international banks, investment firms or private investors issued in bonds.

The two graphs above show the total capital split in to Foreign, Domestic Equity and Debt at minimum foreign ownership of the joint venture at twenty-five percent, and at maximum foreign ownership of the joint venture at forty-nine percent. These terms will be negotiated with our future partners, upon submission of their proposals.
4.2 Managerial Structure of the Joint-Venture:
The stakeholder model of corporate governance has been selected for the board of directors, due to the following reasons:

- China’s legal, economic, managerial, and political environment will demand significant involvement in any JV related to public transportation.
- The JV will be involved in manufacturing a product utilized as part of the local transportation infrastructure, and it will be appropriate to involve local government.
- The potential major differences between the structure of the parent company (SBC) and the other JV participants, will call for a managerial structure, which will be effective in balancing the conflicting interests of all constituencies having important stakes in the success of this project.

The Board of Directors will be organized according to the following:

- All constituencies that have a direct stake in the performance of the corporation will be represented in the governance of the SFBC.
- Control and governance will be negotiated between SBC and our foreign partner.
- The partner with the largest capital involvement will have the leadership role in the SFBC.
- If and when capital involvement ratios change so will the leadership change.
- The chair should be Chinese nationals. Each partner will be able to nominate BOD majority of the members will be from the SFBC. The remaining members will come from the involved JV foreign company, the local government (Offices of Transportation and Economic Development), the local workers’ union, and impartial observers and specialists from Shanghai academia, accounting and law firms, etc.

The BOD will nominate the CEO, and will be comprised of 10-15 individuals. Of these 10-15 individuals, one will become the head of the Board, as the result of an internal Board vote. The CEO and BOD members for the negotiated number of seats available to him. The initial investors will determine this level. Nominations for the third party seats will be made by the organizations invited to participate. The principal investors in the JV will retain the right to approve or reject the BOD nominations.

4.3 Technical Considerations:
4.3.1. Fuel Cell Types:
The most likely candidates of fuel cell to be utilized in the fuel cell-powered transit buses are either phosphoric acid fuel cells (PAFC) or proton exchange membranes (PEM), due to their energy efficiencies, size, and operating temperatures. Compared to internal combustion engines (ICE) and battery-powered engines (BPE), fuel cells provide maximum power for fuel input.

- ICEs - Internal combustion engines operate by burning fossil fuels – such as coal or petroleum – to generate heat, which is then converted to mechanical energy regulated by a generator to produce power. Burning fuels creates waste heat, which decreases the overall efficiency (~25%) of the ICE, not to mention the noxious fumes left in its wake.
- BPEs - Battery-powered engines recharge their power supply by conventional means (plugging it in) and act not unlike a capacitor. However, the drawbacks include a
substantial charging time, moderate efficiency, and a limited quantity of power. Thankfully, BPEs produce little to no byproducts, like carbon monoxide, that harm the environment.

- **Fuel Cells** - In general, fuel cells generate electricity by first extracting hydrogen from a hydrogen-rich fuel source; storing hydrogen gas is hazardous at best, so alternatives, like methanol, are being considered. The hydrogen atoms are exposed to an anode (negative electrode), and oxygen from the air is charged at a cathode (positive electrode) in an electrochemical reaction to create water molecules and electricity as products. Therefore, the only byproducts of the entire process, other than the much sought-after electricity, include water, some waste heat, practically no harmful hydrocarbons, greenhouse gases, and barely a whisper.

- **PEMs** - Photon exchange membrane fuel cells are currently the most widely used in fuel cell-powered automobiles. Operating at roughly 200 degrees Fahrenheit, PEMs operate at a high power density, providing for sufficient energy for shifts in power demand. DaimlerChrysler and Toyota have manufactured methanol PEMs, among others, with an impressive conversion of input-to-output efficiency (~30%).

- **PAFCs** - Phosphoric acid fuel cells utilize that acidic catalyst to excite the hydrogen and oxygen into their electrolytic reaction. With an operating temperature ranging from 200 to 400 degrees Fahrenheit, their purposes had previously been limited to larger environments – such as buildings and power plants – but have recently made the move to automotive buses, courtesy of Nova Bus Corporation and Georgetown University. They have tested efficiency up to 40% (and possibly 80% if cogeneration ensues with its steam byproduct).

- **Others** - Currently, direct methanol fuel cells (DMFC) have been in development and are in prototype stages. Unlike the two mentioned, the DMFC catalyst at the anode draws the hydrogen from the liquid methanol fuel itself, without a reformer, generating 40% efficiency at roughly 160 degrees Fahrenheit, with higher efficiencies possible at higher temperatures. Also, regenerative fuel cells are being researched. The possibility of a closed-loop, power-generating device would require the installation of a solar-powered electrolyser to separate the water molecule byproduct back into hydrogen and oxygen. This would, of course, be fed back into the electric process.

### 4.3.2. Technical Infrastructure:

- **Fuel** - Refueling stations would be required to carry liquid methanol for fuel into the fuel cell-powered buses.

- **Stations** - Refueling stations would typically be located adjacent to ICE bus stations: out of the way of heavy traffic flow, easy access to major streets or lanes, and well within the range of their supported buses. These stations, in turn, shall be refueled not unlike ICE bus stations (i.e. via tanker truck into under-station pumps, regularly and upon demand).

### 4.3.3. Our Corporation’s current bus specifications:

**CHASSIS**
Proven, heavy-duty Blue Bird Chassis. Tested by more than 200 million miles of actual fleet operations. Utilizes 50,000-PSI frame rails and 14 cross members, with Dana/Spicer drive axles and Ross steering. Combined axle capacity of 31,000-35,000 lbs.

New Optional Air-Ride Suspension. 14,600 lb. rated front and up to 23,000 lb. rated rear, heavy-duty gas charged shocks and three zero delay self-leveling valves assure a stable and level ride.

Eaton "S-Cam" Transit Air Brakes. Features non-asbestos brake lining and emergency spring brake system with dash panel mounted valve for parking. Standard brake sizes: 16.5" x 5" front, with 16.5" x 7" rear; or optional 16.5" x 6" front with 16.5" x 8.62" rear.

Frame. 9.625" high channel with 3.0" flanges; a 50,000-PSI yield; 34.0" frame width with stamped cross members. Special insert doubles frame thickness in high-stress areas.

Steering. Integral power steering with tilt-telescopic steering column.

Tires/Wheels. 10R 22.5-G tubeless radials: 2 front, 4 rears. Disc type wheels. Stainless steel wheel covers or polished aluminum wheels available. Optional 11R 22.5-G tubeless radials.

Electrical. 12-volt/160-amp alternator system. Optional 200 or 240 amp alternators available.

Batteries. Roll-out tray features one 8D lead-acid 225 amp battery with 1020 cold cranking amps; second 8D available.

DIMENSIONS & WEIGHTS

- Exterior Length 35.1'
  - Width 96.0" 
  - Height 124.0"
- Wheel base 221"
- Overhang Front 81.5"
  - Rear 118.5"
- Angles Approach 8.5 degrees
  - Departure 7.6 degrees 
  - Breakover 10 degrees
Turning Radius Curb 36.4'
  - Wall 40.6'
- Interior Height 76.0"
  - Width 90.5"
- Floor Height 37.6"
- Step Height Front 13.0"
  - Rear 14.3"
- Passenger Capacity To 35
- Weight GVWR 30,000 lbs.*
  - FAWR 12,000 lbs.
  - RAWR 21,000 lbs.

*32,500 lbs. GVWR using MT643 transmission and 11R 22.5 tires.

4.3.4. Our Corporation’s current Engine options:

DIESEL ENGINE
- Cummins Electronic Diesel Engine. An all-electronic turbo-charged rear-engine with horsepower ratings from 190 to 300.

NATURAL GAS ENGINES USED
John Deere 8.1 Liter Natural Gas Engine
- 8.1 Liters, 496 Cu. In.
- Bore 4.56", Stroke 5.06"
- 6 Cylinders
- Wet-Type Cylinder Liners
- 250HP @ 2200 RPM
- 806 lbs. ft. @ 1300 RPM
- Electronically Controlled Fuel System
- Lean Burn Engine Technology
• Available Transmissions: B300, B300R
• Available Axle Ratios: 5.29, 5.38, 6.14
• Available in QBRE and CSRE

John Deere 6.8* Liter Natural Gas Engine
• 6.8 Liters, 414 Cu. In.
• Bore 4.19", Stroke 5"
• 6 Cylinders
• Wet-Type Cylinder Liners
• 225HP @ 2400 RPM
• 600 lbs. ft. @ 1450 RPM
• Electronically Controlled Fuel System
• Available Transmissions: B300, B300R
• Available Axle Ratios: 5.29, 5.38, 6.14
• Available in QBRE and CSRE

Cummins 5.9 Liter Natural Gas Engine
• 5.9 Liters, 359 Cu. In.
• Bore 4.02", Stroke 4.72"
• 6 Cylinders
• 230HP @ 2800 RPM
• 420 lbs. ft. @ 1600 RPM
• Lean Burn Engine Technology
• Available Transmissions: MT643, B300, B300R
• Available Axle Ratios: 4.78, 5.38, 6.14
• Available in CSFE, CSRE, QBRE
• Limited to 30,000 lbs. GVWR

4.3.5. What our corporation wants from the JV:
We want a fuel cell engine that can deliver a safe, environmentally friendly, cost-effective, and design compatible alternative to our current selection of Diesel and Natural Gas Engines.

5. **JV Dissolution Terms:**
   We propose that should any of the following conditions be met, the prospects and terms negotiated in this proposal can be considered null and void:
   - The joint venture is pending or facing financially catastrophic litigation.
   - One or more of the partners involved is facing an other legal or financial matters which the joint venture would not want to be associated with
   - Costs-to-return ratio proves the impracticality of the joint venture.
   - Supplies cannot be manufactured in timely fashion for implementation. Or
   - Extreme political, economical, social, and/or environmental interests are jeopardized.
   Note that these conditions may not be exhaustive, and we invite your input in this area.

6. **Proposal Submission Information:**
The Proposals’ submission date is no later than November 24, 2000, 5:00 PM EST-USA. The interested companies are requested to submit, as a minimum, the following information:
   - Clear, detailed information about their goals and interests in this JV
   - Their technical experience and expertise as it relates to this project
   - Their financial and managerial resources to be dedicated to the project
   - Their proposal for technology transfer and training of the Chinese work force
   - The total estimated capital costs required for the first 8 to 10 years of operation of the JV
   - Any further ideas or concerns that they might consider relevant to this project.

SBC is thanking you for your attention to this RFP and invite you to give your outmost attention to this project. We will thoroughly examine and consider all the proposals submitted on time, and we invite your questions for clarification, and future pre-award negotiations to reach the best possible agreement for all parties involved.