

**ECONOMICS AND
SECURITY**

151 ESC 06 E
Original: English



NATO Parliamentary Assembly

ECONOMICS AND SECURITY COMMITTEE

VISIT TO ARKANSAS AND SAN FRANCISCO

SECRETARIAT REPORT

26 – 30 JUNE 2006

International Secretariat

22 August 2006

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Assembly documents are available on its website, <http://www.nato-pa.int>

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I. MEETINGS WITH WAL-MART AND SUPPLIER REPRESENTATIVES AND WITH THE NORTH-WEST ARKANSAS BUSINESS COUNCIL

1. The visit began in North-West Arkansas which is the home district of Committee member U.S. Congressman John Boozman. Participating members had an opportunity to meet with a number of the civic, political and business leaders of this extraordinarily dynamic region and to learn more about the nature of its economic growth and its growing integration in the world economy.

2. North-West Arkansas is the home of three very large and important American companies: the retail giant Wal-Mart, the poultry company Tyson Foods and the transportation company, J.B. Hunt. There is also a fairly substantial military presence that has also been a source of growth in the region. Over the three days the Committee was in Arkansas, the sources of the region's dynamism began to become very clear. There is, for example an extraordinarily strong partnership between the region's local governments, the business and financial communities and those working with the Federal government. It became clear as well that the business community is well organized and collaborates to support a range of projects that benefit the broader community.

3. In a very interesting presentation former Wal-Mart executive Don Sonderquist noted how important strong leadership is to the initiation of change and economic development. He then traced the rise of Wal-Mart from a regional retail company with earnings of \$44 million in 1972 to a dominant force in global retail markets with sales of some \$312 billion in 2006. Mr. Sonderquist suggested that Wal-Mart had achieved this by making the customer the driving force of corporate strategy and by unifying its management and workers around the concept of driving costs out of prices and increasing the access of poorer people to products that had once been out of their reach. He suggested that the company's values were critical to its success. These included integrity, respect for the individual, justice, teamwork, communications, and collaboration. He suggested that the company had also long been open to shifting paradigms and constantly has reassessed and tested its long-term strategies for achieving success. Wal-Mart was also very open to putting new technologies to use even if this meant short-term financial sacrifices.

4. Wal-Mart's expansion also coincided with an ever-greater presence in international markets. At first, the company approached global markets as a source of supplies for itself and for its direct suppliers. The company took advantage of cost saving and quality opportunities in global markets and in 1991 set up an international division charged with building a Wal-Mart presence beyond US borders. Mr. Sonderquist suggested that this fruitful experience could be understood as a microcosm of the developmental benefits that the global economy holds out.

5. Wal-Mart's extraordinary success has certainly been one of the most important catalysts for economic growth in North-West Arkansas. Not only has this high earning retail power pumped a tremendous amount of capital into the region, but it has also attracted representative offices of a range of supplier companies that simply cannot afford not to be present in the region due to the vital role Wal-Mart plays in getting their products to the market. Their presence has further galvanized the region's economy. A recent a study conducted by the Milken Institute suggested that the North-West Arkansas economy was the highest performing in the country.

6. The region's growing population and the influx of Wal-Mart vendors has sparked a very dynamic local real estate market, and members reviewed plans for the construction of a large retail shopping centre close by the intersection of two important highway systems that link the region to the broader US economy and beyond. North-West Arkansas is also located near the centre of the United States and this has only facilitated the movement of people to the region and the flow of goods through and from it. The presence of a major university has also played a central role in the region's growth.

7. Rapid economic development has also generated urgent requirements for road and other infrastructure improvements. The regional airport has been upgraded in order to handle ever-growing demand. A very high percentage of the local taxes go to underwrite the school system which is seen as a vital investment for the region's future; regional leaders believe these schools must be of high quality to attract families to North-West Arkansas and to ensure that the school system provides the kind of skills the region needs to sustain its high level of growth. The University of Arkansas is also raising its profile and recently completed a \$1 billion funding drive. The degree of regional cooperation was made evident at a lunch meeting with the North-West Arkansas business council where a number of regional business and political leaders discussed the projects that have sparked regional integration and growth. It also became clear that many more projects are under discussion, particularly in the area of transportation, where local, regional, state and federal partnerships are clearly needed.

II. VISIT TO TYSON FOODS

8. The delegation visited the headquarters of Tyson Foods, one of the world's largest poultry companies. The company is following the Avian influenza issue very closely. A University of Arkansas professor noted that there have only been 224 confirmed human cases of H5N1 influenza and that these illnesses resulted in 127 deaths. Most of these individuals, in turn, had had direct contact with live infected poultry. There is no vaccine to protect humans against the virus although research is underway to develop one. Eating properly prepared poultry cannot transmit the virus. The United States is not importing poultry from any of the countries that have suffered outbreaks of Avian Influenza and there is a ban on imports from those countries. The United States is a net exporter of poultry and imports very little chicken. That said, bio-security remains a major priority for Tyson. All of its chickens are housed in modern enclosed facilities that restrict contact with waterfowl. Birds are closely monitored for disease.

9. Gregg Huet a Senior Vice President of Tyson noted how important exports are to Tyson's overall business, generating some 4 billion in revenue. 21% of its market is in Russia alone. Production platforms have also been established in many countries to meet local market demands. Mexico is particularly important in this regard, and Tyson has set up three joint ventures in China. Tyson has established very high standards for its plants in these countries, and generally its standards exceed those of the host country. Tyson is a strong supporter of trade liberalization.

10. Professor Eric Weils discussed rural China's economic conditions. This is not irrelevant to Arkansas which is an important food producer in the United States and which enjoys a burgeoning trade relationship with China.

11. He suggested that China's growth is extraordinary. The middle class now has swelled to some 200 million. This alone explains why Wal-Mart and Tyson are increasingly active in that market. But China's growth is also triggering serious rural-urban imbalances. Agriculture now generates only 14% of China's GDP but employs 49% of its work force, while industry is producing 53.1% of GDP while employing only 22% of the workers. The agricultural sector is further penalized by low water supplies, and drought is provoking rural crisis in several parts of China.

12. China's government is now seeking to rebalance China's economy, and this is made explicit in the 11th five year plan, which speaks of building a society characterized by thrift, lower pollution and institutional innovation which adopts a leading enterprise concept.

13. There are also efforts to bring in greener food production methods, but this is precipitating a bureaucratic struggle between environmentalists and those seeking to bolster food production. Organic production is booming, but China is also looking at biotechnological solutions to lower

fertilizer use. It is importing much of this technology from the United States but is also making its own genetic science advances. 3.3 million hectares are dedicated to genetically engineered crops.

14. At another meeting at the Airport with Wal-Mart executives, the logistics challenges of that huge company were discussed as well its growing presence in China. Wal-Mart has over 2500 stores and 100 distribution centres globally. These centres are very similar but are scaled to the size of the markets they serve. Their logistics function is to ensure that Wal-Mart stores are replenished in a timely and efficient fashion.

15. Wal-Mart has been operating in China for about ten years, and its operations have grown quickly. One of the initial problems the company confronted was China's poor infrastructure. This has improved significantly. The company also confronted a steep learning curve in terms of China's regulations and rules and it has always sought to comply fully with these. Government relations are thus very important to the company's Chinese operation.

16. Wal-Mart has been very impressed with the quality of its Chinese employees. The education level of these workers has improved and they have shown that they learn very fast. Not surprisingly, many local hires are moving up into management positions. These promotions are merit based and this is particularly appealing to the Chinese employees.

17. China is also a key supplier for Wal-Mart's stores in other countries including the United States. Wal-Mart, like Tyson Foods, is very much dedicated to the construction of a global free trade order, and it makes this case in its representations to the US government.

III. MEETING AT THE UNIVERSITY OF ARKANSAS

18. The University of Arkansas has established a centre - The Genesis Technology Incubator - to promote innovative partnerships with the private sector to develop commercial applications for some of the basic research conducted at the university. The centre hosts a number of small companies developing commercial applications in areas like chemical hazard protection, material science, ceramics, packing, electronics, transmission grids, bio-detection instruments, and sensor technology to name a few. The Genesis Technology Incubator has produced 15 companies that now employ over 800 employees. Many of the companies have received small federal business innovation grants to help them get started.

19. Delegation members also had an opportunity to discuss the regional economy with University of Arkansas economists. North-West Arkansas is currently creating 685 new jobs a month—a trend that is currently resistant to broader cyclical patterns in the national economy. The growth is linear.

20. That said, the state of Arkansas is losing manufacturing jobs. This paradoxically points to its dynamism although it also poses public policy challenges of transitioning manufacturing workers into other sectors. There is hidden poverty in Arkansas. Many jobs are for low skilled low paid workers, and the challenge to the region is to get workers trained to higher levels. This means inculcating immigrant groups and others in a sense that education is the key to economic advancement. Higher education standards are also the key to Arkansas' transition to a knowledge-based economy. In this sense, research advances are the proverbial canary in the mineshaft, and the goal in North-West Arkansas is to provide an environment for the emergence of a research cluster around the university. Given the economic dynamism of the region, this seems like a reasonable proposition to many of the region's leaders, but it will require very strong support for the university.

21. The delegation also had an opportunity to tour the campus of the University of Arkansas and met with retired football coach and Arkansas legend Coach Frank Broyles who generously gave a tour of the football stadium and explained the place of big time collegiate sports in American university life.

IV. ASIA FOUNDATION

22. The delegation also visited the Asia Foundation in San Francisco at the invitation of its President, Douglas Bereuter. Dr. Barnett Baron described the work of the foundation, which is a non-profit, non-governmental organization committed to the development of a peaceful, prosperous, just and open Asia-Pacific region. Virtually all the programs the foundation underwrites are located in Asia and the foundation maintains 18 resident offices in the region. Foundation grants are negotiated each year with partners.

23. The foundation has four core programs:

- Governance, Law and Civil Society;
- Economic Reform and Development;
- Women's Empowerment,
- and, International Relations.

24. Although American institutions and individuals provide most of the Foundation's funding, it is increasingly raising money beyond US shores in Australia, Canada, New Zealand, the United Kingdom and from institutions like the Asia Development Bank, the NDP and the World Bank.

25. China has been a major priority of the Foundation where it has worked on governance reform, strengthening the rule of law, migrant women worker issues, US-China relations and regional matters. One priority is to improve the legal environment for NGOs, urban and local government reform and assistance to village elections. Legal aid programs are a key Foundation priority in China, and there are efforts underway to help universities in these areas. The Foundation has worked to help China develop systems to give citizens legal recourse in cases where even the state may have certain liabilities. It is also developing judicial training programs designed to facilitate China's full participation in the WTO and its body of rules and regulations.

26. With some funding from US companies, the Foundation has worked with migrant women workers in China as well as with NGOs and local universities to provide basic training to some 250 thousand female factory workers. The program involves factory training on a broad array of issues including, HIV prevention, self-esteem, and fundamental workers' rights. The Foundation also administers a Give to Asia program which channels funds into educational, health, and poverty alleviation programs and distributes some 190 thousand books a year to Chinese libraries. Since the 1980's the Foundation has underwritten the costs of MA training in international relations for promising Chinese students. This has helped create a cadre of Chinese diplomats and professionals who know the United States intimately.

27. Linda Tsao Yang, a former Executive Director of the Asia Development Bank and Chairwomen of the Asian Corporate Governance Institution, suggested that China's equity and finance markets constitute a core impediment to growth. She noted that there are two very different ways to look at China's financial system. From the outside, it sometimes appears dysfunctional; its real vulnerabilities were made apparent during the stock market slide four years ago. Many of the state's regulatory commissions are not functioning properly, and the heavy hand of the governing party can sometimes obstruct needed reforms.

28. But from behind the bamboo curtain the view is very different. Indeed, in comparison to twenty years ago, the current situation is extremely positive. China has put all the essential building blocks in place including regulatory institutions, a functioning stock market, an effective central bank, and a securities regulatory body, none of which existed 25 years ago. If one compares this to the emergence of any market economy, the strides China has made look impressive indeed.

29. The priority now is to ensure that these structures and the reforms setting them are put to proper use. The Asian financial crisis provided a critical impetus to reform. One of the most important steps was to help relief banks of the non-performing loans on their accounts. One of the problems was that the state had been directing loans to create employment that is not a financially viable lending strategy. This has been changed. The government must now ensure that banks operate in a more commercially sustainable fashion. Another key decision was to bring foreign investors into the banking sector, a decision which while politically difficult has galvanized financial restructuring and reform. Strategic investors have injected all manner of change into the system and bolstered confidence in it. These outsiders impose a degree of discipline over the system. The Royal Bank of Scotland, for example, introduced risk and credit management concepts to the Chinese market that were heretofore unknown in China. Moreover, the boards of the larger banks increasingly include outsiders who reinforce the introduction of best practices across a range of functions. As long as the Chinese government perceives that such changes can be introduced without causing fundamental upheaval, they are willing to embrace reform.

30. All of this has boosted confidence in China's banking system. When the Bank of China launched an international IPO, it was 22 times oversubscribed and raised \$10 billion dollars. Still further reform is needed and it will take 7-10 years to affect a complete overhaul of the system.

31. China is a significant borrower from the Asia Development Bank, but it is now also a donor. It is also engaged in a network Asian central banks have put together to swap currencies and foster greater regional monetary stability. China has also set up an export-import bank to finance some development projects in Asia including a huge hydroelectric project in Vietnam.

32. China is just emerging as a regional and, indeed, a global player in financial markets, and this could trigger new tensions with the West. The United States, Europe and Japan will have to learn how to accommodate the financial rise of China or these tensions could become serious.

33. Dr. Sean Randolph from the Bay Area Economic Forum spoke to the delegation about how the region interacts with Asian markets. The Bay area itself is a nine-country area that includes San Francisco, Oakland Berkeley and Silicon Valley. In broad terms, San Francisco is an international service centre and Silicon Valley is largely a technology development centre with Stanford and Berkeley providing many of the region's highly skilled workers and basic research. The region has a large Asian population including people of Japanese, Chinese, Indian, Philippine, and Afghan descent. Although the Chinese first came to work on the railroads and gold fields in the 19th century the latest wave of immigrants have come to study particularly in the mathematics, computer and science fields. Many of these immigrants have remained in the region to work and they are assuming leadership roles. One half of the work force in Silicon Valley was not born in the United States. They are highly educated, and Chinese and Indians, in particular, are playing a key role in many of the start-up technology companies.

34. Half of the region's trade is with Asia as compared to 22% with Europe and 24% with NAFTA and the rest of the world. These patterns are largely determined by geography, hence the East Coast trades more with Europe, Miami with Latin America and Texas with Mexico. The region receives more direct investment from Europe than from China but more of the region's capital flows to Asia. Much of this is due to market seeking operations or efforts to lower costs for reexport back to the United States. Skill seeking is also driving these capital flows. This points to a

growing division of labour in which the region's economy engages in research and development while manufacturing is done in China and elsewhere in Asia. This has made it imperative to move the region's workers into new professions as their jobs are off-shored. There is a view that industry needs to work closer with universities to imbue the workforce with higher value-added skills. A growing amount of back room service work is being conducted in Asia. An increasing amount of important research and development is taking place in China, although most of this is applied and product based rather than highly innovative. Nevertheless, Chinese scholars are authoring an ever-growing share of articles in leading scientific journals.

35. During the discussion, it was suggested by one participant that China may be a predator state rather than one that seeks win-win solutions to international problems. But the view from many scholars is that China is a self-interested rather than an expressly predatory state. The key question concerns the degree to which it will be able to discern its interests in harmony with those of its trading partners. China is overcoming three centuries of humiliation and wants to assume its rightful place in the community of nations. Yet it will ultimately need a generation of leaders who fully understand the potential benefits associated with win-win diplomacy. Today, the dominant view among the leadership is simply that China is standing up. This makes it look predatory, and there is certainly a risk of dangerous miscalculation. In this regard, the 2002 US National Security Strategy speaks openly of holding China back. This is precisely the kind of Western approach that could further destabilize the situation. It is also true that China has 800 million people living in poverty and the uncertainty and political vulnerabilities that arise out of such mass poverty also shape China's approach to the international community. The Chinese leadership, not surprisingly, is very focused on stability, and this makes them extraordinarily prudent both domestically and internationally.

V. THE INSTITUTE OF EAST ASIAN STUDIES, THE UNIVERSITY OF CALIFORNIA, BERKELEY

36. T.J. Pempel, the Director of the Institute of East Asian Studies at Berkeley discussed the profound changes that have occurred in Asian regional relations. In the 1970's, 80's and 90's, these relations were bottom-up, corporate-driven, investment operations and were not government driven. Formal institutions, with only a few exceptions, were not part of the picture although ASEAN and APEC existed. Today these relations have become more dynamic and the region's trading relations are ever more sophisticated and integrated. Intra-Asian trade has increased 55% and production processes of highly sophisticated machinery and electronic products are increasingly integrated. Asian leaders will ultimately have to decide if this trading system will become a closed loop or will assume pan-Pacific or, indeed global proportions.

37. American interests in the region are significant. The United States remains a key security player and obviously maintains highly important commercial and financial links with many Asian countries. But these relations are evolving, and the United States is increasingly shut out of a range of Asian activities in ways that were once unthinkable. At the same time, Asian reserves have tripled in recent years and intra-Asian bank swaps are increasingly employed to manage exchange rates among throughout the region. There is also an emerging Asian bond market and all of this suggests that Asian players are interested in mobilizing development in ways that do not involve the United States.

38. There has been, in turn, a significant shift in US policy according to several speakers at Berkeley. The present administration is highly fixated on military and security matters and seems far less engaged in economic issues and the international institutional structures previous American governments helped erect. The Bush Administration came to power following what some have called an ABC policy—or Anything But Clinton, which meant an across the board repudiation

of many of the relations cultivated by the previous US administration. In the case of China, this meant that US policy moved hastily from strategic partnership to strategic rivalry. This shift proved short-lived as the 9/11 attacks demonstrated that there was indeed a range of common interests with China. Still the US is simply not showing a great deal of activism in the region as its focus has been turned elsewhere. George Bush ran for office as a foreign policy realist but he has evolved into a consummate moralist who sees international affairs in an extraordinarily Manichean manner. Within this framework, pre-emption and unilateralism have become leitmotifs of the American approach to international affairs and this approach has not generated many successes in Asia.

39. The Chinese-Japanese relationship, however, has worsened considerably and Japanese Prime Minister, Junichiro Koizumi, recently travelled to the United States to undertake a number of military initiatives with its partner designed to strengthen its own deterrent capacities vis-à-vis China. Japan's relations with China are economically very strong while the political relationship has been seriously degraded in recent years. China has now replaced the United States as Japan's most important export market but China's military build-up and the flap over Koizumi's visit to the Yasukuni shrine have embittered the political relationship.

40. As a partner in America's global war against terrorism, China has had a mixed record from the Administration's perspective. In South Asia they share common concerns about the rise of Muslim terrorist movements and have been cooperative on several fronts in this regard. But in North Korea the level of cooperation has not been as satisfactory due to the lack of shared strategic interests. The Chinese expressly reject any goal of regime change and do not want to define the Korean problem in absolute terms.

41. The situation in the Taiwan Straits has remained a serious concern for the United States, although it somewhat removed from the European radar screen. Political change in Taiwan has brought tensions to the surface. The nationalist forces that ruled Taiwan from 1949 and 2000, the so-called blue camp, never relinquished the dream of a reunited China under their leadership and never fully embraced a democratic order. The current government, led by the Democrat Progress Party or DPP (the so-called Green camp), essentially wants to establish an independent and democratic Taiwan, something that is anathema both to the blue camp and to China itself. The current government in Taiwan has been less inclined to establish working relations with the mainland based on these fundamental points of contact, and instead has incrementally pushed toward independence. The government, for example, recently announced that the National Unification Council on the island would cease to function, an announcement that neither pleased the United States nor China. Although Chinese leaders were once extraordinarily vocal in their opposition to these kinds of pronouncements, their approach has grown more subtle, and there is a sense in Beijing that the government party will be decisively defeated in the next elections. For its part, the United States is very concerned about the potential of Taiwanese provocation and wants no unilaterally imposed change of the current status quo. Although it enjoys a close security relationship with Taiwan, it hardly relishes the prospect of intervening in any scenario involving a military conflict. It thus strongly advocates caution and dialogue, particularly as its relationship with the mainland is so important and complex.

42. China-Taiwanese economic integration has proceeded at a rapid pace. As of April 2006, \$46 billion of Taiwanese funds were invested in mainland China, although this figure probably understates by \$50 billion the actual amount as most Taiwanese funds are pumped into China indirectly. Taiwan has established a manufacturing model in which it exports components to China for assembly and reexport. Mainland China is currently Taiwan's primary export market, and there is a significant number of Taiwanese currently living in cities like Shanghai. There are also several million Taiwanese visitors to China each year. Thus while the political and military situation between the mainland and Taiwan are in a state of paralysis, economic relations remains highly dynamic and indeed are integrating the two economic spaces.

43. Steve Weber, the Director of the Institute for International Studies at Berkeley offered a somewhat pessimistic view of the future of trans-Atlantic relations and suggested that relations with China were very much part of the problem. The United States and China have become intoxicated on mutual currency manipulation. The United States is importing deflation from China and has kept domestic prices low, in part, by keeping the dollar artificially higher vis-à-vis the Renminbi. China, in turn, is buying dollars to ensure continued American purchasing power and Chinese export surpluses. The problem is that these policies are creating growing liabilities. The dollar is simply overvalued and when it does finally fall, a number of dollar-denominated assets in China will plunge in value. Were the dollar to fall by 30% relative to the Renminbi, the Central Bank of China would lose the equivalent of 20% of China's national GDP. For currency speculators with a medium term outlook, this is a one-way bet. A depreciation is clearly on the cards given America's huge current account deficits, and when it does transpire, the Chinese will suffer unemployment shock and stagflation.

44. This scenario has global consequences. The currency problem, however, may be more immediate. Recently rising interest rates and gold prices are indications of underlying concern about the dollar. The Chinese are not only propping up the US dollar through the purchase of US Treasury Bills, they are also protecting their own dollar-denominated assets which are substantial. The Chinese must be somewhat confused by American demands to revalue the Renminbi as this would likely precipitate soaring interest rates in the United States. U.S. demands make some Chinese leaders very suspicious of American motives and at the extremes some might see American willingness to effectively sustain an interest rate induced recession as the price they are willing to pay for destabilizing the Chinese regime. China has become the Saudi Arabia of energy demand. Although energy economists are quick to stress the notion that oil is a fungible, globally traded commodity in which supply and demand conditions are global and not local, the Chinese do not subscribe to this and are using their capital to buy up as many energy assets as they possibly can. This will invariably bring them into the heart of Middle East diplomacy. This is very sensitive terrain for the United States and China's activism is likely to stoke new tensions.

45. China has also shown itself much more willing to deal with a range of countries considered pariah by other energy market players. The United States has made democratisation a central tenet of its recent foreign policy but Weber suggested that this has not been applied uniformly and is unsustainable given America's broad range of conflicting interests. That said, the United States continues to watch China's relations with countries like Somalia and Venezuela with deep suspicion. The Berkeley panel also indicated that there was very little dialogue between the academic community and the administration about the region.

46. Dr. Weber suggested that the United States is engaged in a kind of "property rights imperialism." Where land was once a much sought after commodity needed for production, today intellectual property rights are a source of great international rivalry. The United States is now asking other countries to organize property rights in such a way that they can instrumentalise them. As a large developing country, China has a very different view of property rights and finds itself frequently at loggerheads with the United States. This fundamental conflict seems slated to ratchet up.

47. Today, Europe is the most credible anti-inflation force in the world and the Europeans have not been positioned to exploit China's low prices. The European economy is far less leveraged than either the United States or China. Should the U.S.-Chinese bargain unwind, Europe may emerge far stronger in macro-economic terms than its American partner. This could thrust Europe into a new leadership role.

48. Weber suggested that the 2006 mid-term elections would be very important in shaping the American policy environment. Fiscal realities are going to weigh heavily on whichever party wins those elections. Fiscal imbalances are proving ever more burdensome and are not unrelated to the

war in Iraq where total American spending has now surpassed \$1 trillion. It might be reasonable to expect efforts to slow planned future tax cuts given the huge deficits the United States has been accumulating, but this will depend on the direction of U.S. politics.

49. In the discussion that followed it was noted that given the bankruptcy of the Chinese government's official communist ideology, there is effectively an ideological/spiritual vacuum in China. The state has sought to use nationalism and the quest for growth to fill this void. This has not been a totally effective tactic and chronic corruption, for one, has undermined the case.

VI. VISIT TO LAWRENCE BERKELEY NATIONAL LABORATORY

50. Lawrence Berkeley is a 75-year-old research centre that is government owned and contracted. But its employees are not considered civil servants and the laboratory and its employees enjoy a very close relationship with the University of California at Berkeley. Many graduate students and faculty members at Berkeley are also working on projects at the Laboratory. This large centre conducts research on a range of topics including nano science, advanced light sources, energy efficiency, climate change and energy security. The annual budget for the laboratory is \$524 million which helps cover the costs of institutes like the National Center for Electronic Microscopy, the Joint Genome Institution, the Molecular Foundry, the largest super computer in the world, a high speed data network and a large cyclotron. The laboratory's broad research agenda provides an ideal setting for dealing with scientific challenges that are cross disciplinary by nature including energy and environmental challenges. Some of the most consequential projects at the Laboratory are engaging scientists across disciplines. Members visited a project dedicated to developing more energy efficient windows and learned about advances made in this very applied area of research.

51. Nobel Lauriat and Berkeley National Laboratory Director Steve Chu gave the Committee a fascinating presentation on global warming. He suggested that global temperature rise is "off the scale" and that major civilisational disruption can be expected as a result. The correlation with industrialization is apparent as the rise of global temperatures clearly began in 1750 or roughly in tandem with the industrial revolution when CO₂ emissions began to become a factor in the global environment. The trend lines suggest that the planet could be heading to a climatic shift of greater intensity than that which occurred during the ice ages.

52. Moreover, reversing these trends poses enormous challenges. Even if CO₂ emissions were to be stopped today, existing high levels of CO₂ in the atmosphere and their heating effects would persist for 300 years. Conservative estimates suggests that with no more CO₂ in the atmosphere, ocean temperatures would nevertheless rise by another 0.8 degrees, which would have significant environment impacts. This could induce a significant shift in the Gulf Stream which is a global weather conveyor belt. The impact here would be irreparable. Another irreparable consequences could be the release of huge stores of methane currently lying in perma frost and ice in the world's artic climes. This release could have terrible environmental consequences and the problem could be far more dire than originally thought, particularly as the rate of glacial melt in artic regions is far outpacing expectations. There is obviously a broad range of geopolitical consequences associated with these developments. Within the next 20-25 years, oil production will peak. If we turn to tar sands, methane, coal, methane hydrate and shale oil, which can collectively fuel the world for the next 200-1000 years, we will essentially cook the planet.

53. This makes it very clear that alternative sources of energy are very much needed and that far more intelligent approaches to energy conservation are needed. Conservation and improvements in efficiency must be top priorities. The United States could reduce consumption dramatically without affecting a serious decline in its standard of living by implementing more

effective public policies. Coal is another still abundant energy source and here research and public investment is needed both to develop gasification and CO₂ sequestration technologies and to ensure that they are put to use.

54. Dr Chen suggested that fusion is not the panacea that some suggest and that nuclear energy simply will not solve the critical problems the world confronts.

55. Renewable energy remains largely untapped and we are beginning to see important successes in countries like Denmark where significant amounts of energy are being produced through renewable means. Biomass has great potential and there is important research being conducted on the Miscanthus weed which can produce a significant amount of bio fuel and could provide a vital new cash crop to western farmers who are producing too much food because of subsidies. Brazil is producing a significant amount of ethanol with sugar but Miscanthus can produce an even higher yield per acre. That need is far superior to Corn which many in the United States believe offers a solution particularly if one considers the carbon input needed to produce the crop. One problem is that a great deal of energy is used to break down cellulose in plants. Genetic research at the laboratory is focusing on manufacturing an enzyme that is naturally produced in the digestive systems of termites in order to accelerate and facilitate this process.

56. Jayant Sathaye picked up on energy conservation issues and specifically on energy intensity in certain sectors. He argued that this is a part of the energy solution that is often neglected but one where much can be done. Appliance standards can be dramatically upgraded in many countries but this is often neglected.
