Indian Institute of Technology 2007 Global Alumni Conference
Symposium on Energy and Avenues for Collaboration with IIT Bombay
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Congratulations to the organizers of this year's Indian Institute of Technology Global Alumni Conference. You have done a superb job of highlighting the role of technology in transforming the world and emphasizing the special role of the Indian Institute of Technology (IIT) in bringing about this transformation.

This afternoon's symposium is particularly interesting because one of the University of California's goals is to increase its collaborations with India and with the IITs in particular. I strongly support this goal and I will work with you to make it a success. And the topic you have chosen, energy, is one in which the University of California has special expertise. This expertise was underscored by British Petroleum's decision to award the $500 million Energy Biosciences Institute to UC Berkeley, Lawrence Berkeley National Laboratory, and the University of Illinois. More recently, the Department of Energy made the decision to award a $125 million bio-fuels grant to a consortium of universities led by Lawrence Berkeley Lab and UC Berkeley. Our faculty and researchers have expertise in energy

conservation, a wide range of energy sources, transportation, new materials, global climate change, and many other areas. Since a number of them have already spoken to you today, I won't elaborate further. I know that our faculty will have already done so with eloquence.

Recent trips to India and China have focused my attention on the pace of technological change occurring throughout the world. A publication by the National Science Foundation, entitled *Science and Engineering Indicators 2006*, provides a wealth of statistical information that documents the key role that science and engineering have had in shaping our world. For instance, over the past twenty-four years, the world's output from high technology manufacturing industries has grown at an average annual rate of 6.4 percent.[1] By comparison, the output of other manufacturing industries has grown at a rate of only 2.4 percent.[2] So, on average, technology industries have been growing at an annual rate two-and-a-half times faster than other manufacturing industries. While this rate of growth is impressive, it has taxed the science and engineering workforce and unleashed a global flow of highly educated human capital to the world's technology centers.

[1] Science and Engineering Indicators 2006. Chapter 6, page 6-4.
[2] Ibid.

In the U.S. from 1980 to 2000, science and engineering occupations grew at an annual rate of 4.2 percent.[3] This was more than triple the rate of growth of other occupations. Yet, the number of science and engineering degrees granted in the U.S. grew at an annual rate of only 1.5 percent.[4] American universities have not been able to meet our economy's need for more scientists and engineers. This explains, in simple terms, why 2,400 IIT graduates are gathering in the Silicon Valley tonight.

The result of this imbalance is that 25 percent of scientists and engineers with at least a bachelor's degree working in the U.S. in 2003 were born outside the United States, and 40 percent of all doctoral degree recipients in science and engineering were born outside the U.S.[5] More specifically, fourteen percent of foreign-born scientists and engineers with at least a bachelor's degree were born in India and 9 percent were born in China.[6] At the doctoral level, 21 percent of foreign-born scientists and engineers with doctoral degrees were born in China and 14 percent were born in India.[7] As these data make clear, China and India produce a greater share of the more highly educated foreign-born scientists and engineers working in this country. Overall, the United States relies to a significant extent on Chinese, Indian and other foreign-born individuals to make up

[3] Ibid. Chapter 3, page 3-4.
[4] Ibid.
[5] Ibid.
[6] Ibid.
[7] Ibid.

its science and engineering workforce. And we thank you for your contributions to our economy and to our society.

This American dependence on foreign-born scientists and engineers is even more pronounced in some fields, where more than half of the doctoral degree recipients working in the U.S. were born abroad: 57 percent in Computer Sciences, 57 percent in Electrical Engineering, 54 percent in Civil Engineering, and 52 percent in Mechanical Engineering.[8] Perhaps this should not surprise us, since 78 percent of the world's science and engineering doctoral degrees were granted outside of the U.S.[9] At the same time, a growing share of science and engineering doctorates granted by U.S. universities are being awarded to individuals born outside of the U.S. Forty percent of those doctoral degrees were awarded to students born in three countries: China (20%), Taiwan (11%), and India (10%).[10] Indians received the largest number of U.S. doctorates in Computer Science (1,399 from 1983 to 2003).[11]

Imagine where the U.S. would be as an actor on the global economic stage without the talent you and your fellow Indians bring to American businesses and universities. For example, I was told recently that there are

[8] Ibid. Chapter 3, Table 3-20.
[9] Ibid. Chapter 2, Page 2-6.
[10] Ibid. Chapter 2, Table 2-3.
[11] Ibid. Chapter 2, Table 2-4.

300,000 Indians living in the Silicon Valley who earn more than $200,000 per year.[12] That represents more than $60 billion in income generated here in the Valley and spent largely within California. Additionally, I have been told that 25 percent of the companies in the Silicon Valley have at least one Indian founder or co-founder. And, although I am not able to quantify the impact of these individuals and companies on California's economy, it is clearly significant.

During recent visits to India and China, President Abdul Kalam and Chinese leaders each emphasized that one of their national goals was to improve higher education. The leadership in both countries expressed the goal of developing fifty distinguished national universities and committed to increase the percentage of gross national product devoted to research and development. What was most astonishing was the pace at which China is implementing this vision. We visited one Chinese university with 15,000 students that had been transformed from raw land to a fully-developed campus in only eighteen months. We were concerned, by contrast, with the state of physical facilities and scientific instrumentation at a number of the universities we visited in India.

[12] Conversation with R.A. Mashelkar, Mumbai, India, February 25, 2007.

Some of the greatest challenges facing the world, such as energy, do not recognize national boundaries. Universities are uniquely positioned to address these challenges. They possess the scientific, engineering and scholarly expertise that can offer practical solutions to the world's critical problems. They can involve students in these efforts, thereby ensuring that future leaders in our societies carry these solutions forward to fruition. And, universities have the convening power to bring together representatives of government, the private sector, and non-governmental organizations – all of whom are needed to address the grand challenges facing us. The University of California wants to work with the Indian Institutes of Technology to address these grand challenges. I look forward to the dialogue about how we can best do so. Thank you.