India's Energy Security

Edited by
Ligia Noronha and
Anant Sudarshan

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India's Energy Security

This book explores the multifaceted aspects of India's energy security concerns. Bringing together a set of opinions and analysis from experts and policymakers, it sheds light on the context of India's energy insecurity and explores its various dimensions, its nature and extent. Contributors examine the role that trade, foreign and security policy should play in enhancing India's energy security. It is argued that the key challenge for India is to increase economic growth while at the same time keeping energy demands low. This is especially challenging with the transition from biomass to fossil fuels, the growth of motorized private transport, and rising incomes, aspirations and changing lifestyles. The book suggests that at this time there are strong arguments to lessen India's fossil fuel dependence and it argues for a need to engage with all the key sources of this dependence to implement a process of energy change.

India's Energy Security is a timely contribution given the national and international interest in the issue of energy security and the possibility that energy concerns could become the cause of serious international conflicts. It will be of interest to academics and policy makers working in the field of Asian Studies, Energy Policy, International Relations and Security Studies.

Ligia Noronha is a Senior Fellow and Director of the Resources and Global Security Division of The Energy and Resources Institute (TERI), New Delhi, India.

Anant Sudarshan is a PhD student in the Management Science and Engineering department at Stanford University, US and a visiting Research Associate at the Centre for Research on Energy Security at The Energy and Resources Institute (TERI), New Delhi, India.

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Contributors

Talmiz Ahmad is currently Ambassador of India to the UAE. Mr Ahmad has been the Indian Ambassador to Saudi Arabia (2000–03) and Oman (2003–4), and Additional Secretary in the Ministry of Petroleum and Natural Gas. His book, *Reform in the Arab World – External Influences and Regional Debates*, was published in July 2005. He writes and lectures regularly on resurgent Islam, West Asian politics and energy security.

Ravi Kumar Batra is a Distinguished Fellow at The Energy and Resources Institute (TERI), New Delhi. He has 35 years' experience in the petroleum industry, beginning his career in Burmah Shell in 1957 and retiring as Marketing Director of Bharat Petroleum, a Fortune 500 company. He is currently on the Board of Directors of the Energy Institute, India, a chapter of the Energy Institute, London.

Koshy Cherail is Senior Consultant – Business Development with Conzerv Systems Pvt Ltd, India. Dr Cherail has more than 20 years of experience in programme implementation, policy analysis and consulting with various bilateral and multi-lateral agencies, including World Bank, USAID and GTZ. He has been associated with the various efforts to organize the ESCOs and EE business in India. He has represented Indian ESCO and EE businesses at various international fora.

Pradeep Kumar Dadhich is a Senior Fellow at TERI. He has a Ph.D (IIT Bombay) in Energy Systems Engineering and over 27 years of experience. He has also been a member of the International Energy Agency's Greenhouse Gas RD&D Executive Committee since 1998. He was one of the lead authors in the IPCC's special report on carbon dioxide capture and sequestration. He is currently the Head of the Centre for Policy and Regulatory Studies at TERI University, New Delhi.

Mitali Das Gupta is Associate Fellow with the AEI and also with the Centre for Research on Energy Security at TERI. She has completed her doctoral thesis from Jadavpur University, Calcutta. She was selected for the International Association for Energy Economics (IAEE) student award for the year 2001. Presently she coordinates the activities of AEI. At TERI she is working on energy security, climate change and trade and environmental issues.

Ravi B. Grover is a nuclear engineer and is concurrently working as Director, Homi Bhabha National Institute (HBNI), Director, Strategic Planning Group (SPG), Department of Atomic Energy (DAE), and Director, Knowledge Management Group, Bhabha Atomic Research Centre (BARC), DAE, India. Grover is a Fellow of the Indian National Academy of Engineering. He studied mechanical engineering at Delhi College of Engineering, nuclear engineering at BARC Training School and received a Ph.D from the Indian Institute of Science, Bangalore.

Eshita Gupta has been working as a Research Associate at The Energy and Resources Institute, TERI, India since February 2006. She is an economist with a postgraduate degree in economics from Delhi School of Economics. She has a number of publications in refereed journals and proceedings of international and national conferences. She has worked extensively in the areas of energy, with a major focus being work related to energy-security indicators, energy-market risks and energy-access issues.

Commander Gurpreet Singh Khurana was commissioned into the Indian Navy in 1988 and is a Missile Warfare specialist. Before joining IDSA as Research Fellow in 2003, he commissioned the Fast Attack Craft INS *Tarmugli* at Port Blair as its first Commanding Officer. His research interests include maritime security, strategic and defence issues. He has authored more than 25 journal papers and made presentations at many international maritime conferences in India and abroad. He is the author of *Maritime Forces in Pursuit of National Security: Policy Imperatives for India* (2008) published by IDSA and Shipra Publications. He is presently involved in a study of China's maritime strategy and naval modernization.

Sudha Mahalingam is currently Member, Petroleum and Natural Gas Regulatory Board of India. She is also a member of India's National Security Advisory Board, advising the Prime Minister on security-related issues. In 2007, Sudha Mahalingam was awarded the first K Subrahmanyam award for Excellence in Strategic Studies. Prior to her current assignments, she held the prestigious Nehru Fellowship at Nehru Memorial Museum and Library. An economist and lawyer by training, she specializes in reforms and energy security. Her focus areas are energy regulation, tariff setting and the geopolitics of energy security.

Deepti Mahajan is Research Associate at The Energy and Resources Institute, New Delhi. Here she is part of the Centre for Research on Energy Security. She has a graduate degree in International Relations from the University of Nottingham, UK, and an undergraduate degree in Journalism from Lady Shri Ram College, University of Delhi. She was earlier with Women in Security, Conflict Management and Peace (WISCOMP), New Delhi, where she worked on multi-track diplomacy, and issues at the interface of gender, security and peace building.

Ajay Mathur is Director General of the Bureau of Energy Efficiency, Government of India, and a Member of the Prime Minister's Council on Climate Change. As Director General of BEE, he coordinates national programmes and policies

to enhance end-use energy efficiency in the country. Prior to joining the Bureau, he was President of Suzlon Energy Limited; and has headed the World Bank Climate Change Team in Washington, as well as the Energy Technology Division of TERI in New Delhi. Dr Mathur received his Ph.D from the University of Illinois. Dr Mathur is the co-author of three books, including the IPCC Special Report on Technology Transfer.

C. Raja Mohan is currently a Professor at the S Rajaratnam School of International Studies, Nanyang Technological University, Singapore. Raja Mohan was the Strategic Affairs Editor of the *Indian Express* in New Delhi, and the Diplomatic Editor and Washington Correspondent of *The Hindu*. He has a Masters degree in Nuclear Physics and a Ph.D in international relations. He was a member of India's National Security Advisory Board during 1998–2000 and 2004–06. His recent books include *Crossing the Rubicon: The Shaping of India's New Foreign Policy* (New York: Palgrave, 2004) and *Impossible Allies: Nuclear India, United States and the Global Order* (New Delhi: India Research Press, 2006).

Nitya Nanda is a Fellow with the Centre for Global Agreements, Legislations and Trade at The Energy and Resources Institute (TERI), New Delhi. He has published several articles and papers on issues of trade, investment and competition, in professional journals, edited volumes and newspapers. His recent work includes *Expanding Frontiers of Global Trade Rules: The Political Economy Dynamics of the International Trading System*, published in 2008 by Routledge, London.

Ligia Noronha is a Senior Fellow and Director of the Resources and Global Security Division of The Energy and Resources Institute (TERI), New Delhi, India. She has been Secretary of the Asian Energy Institute since 2005 and coordinator of REEEP South Asia. She has a Ph.D from the London School of Economics. She is a member of the GOI's Expert Committee on Climate Change, is on the External Review Committee for Shell International's Sustainability Reporting and on the Task Force (natural resources, environment, land and agriculture) of the Commission on Centre State Relations of the Government of India.

M. V. Ramana, a physicist by training, is currently Senior Fellow, Centre for Interdisciplinary Studies in Environment and Development (CISED) at the Institute for Social and Economic Change, Bangalore. He obtained his Ph.D from Boston University, USA. Over the last few years he has been studying the Indian nuclear energy programme, focusing on economics, safety, and environmental impacts. He is co-editor of *Prisoners of the Nuclear Dream* (New Delhi: Orient Longman, 2003).

Surya Sethi is Principal Advisor (Energy) to the Planning Commission, Government of India, and part of India's negotiating team on climate change at the UNFCCC. He has worked in some 30 countries worldwide in the field of infrastructure, capital markets and industrial enterprises across a variety of sectors. Most recently, as Chief Investment Officer at the International Finance

Corporation (IFC) Mr Sethi's Energy Portfolio included power, hydrocarbons, energy efficiency, renewables and climate change initiatives.

J. Y. Suchitra has a Masters in Economics from the University of Hyderabad and has been examining the economics of nuclear power for four years. She is at the Institute for Social and Economic Change, Bangalore.

Anant Sudarshan is a Ph.D student in the Management Science and Engineering department at Stanford University and a visiting Research Associate at the Centre for Research on Energy Security at The Energy and Resources Institute. He holds degrees in mechanical engineering from the Indian Institute of Technology, Delhi and Stanford University. His present research focuses on the economics of energy and environment policies.

Foreword

The issue of India's energy security is not a new subject – it has been discussed ever since the first oil price shock took place in 1973–74. The Indian economy at that time was in a precarious condition, and therefore the quadrupling of oil prices led to inflation in double digits and, at some stage, inflation rose to well over 20 percent. The political fallout of those developments proved to be terribly expensive, and one could even say that Ms Indira Gandhi's imposition of emergency in 1975 was in some ways the outcome of what happened in the energy sector over the 1973–74 period. This historical fact only establishes the reality that the concept of energy security is very much part of a larger socio-economic and political construct. Currently, the Indian economy is in a fairly strong position, and therefore the spike in oil prices that has taken place in recent months has not in any way destabilized the economic progress of the country, even though growth is expected to be lower this year than in the previous three.

Dependence on specific sources of energy is a function of access to different forms of energy, their prices and the stock of capital which may constrain substitution between one form and the other. For instance, the Indian Railways having gone in for large-scale use of diesel locomotives cannot in a short period of time switch over to, say, electricity that would be based on an indigenous source of energy – coal. Similarly, given the problems associated with inadequate and unreliable supply of electric power, the country has seen a proliferation of captive power generating units, which are heavily dependent on the use of diesel oil. The recent increase in automobiles and their extensive usage has also led to an increase in consumption of oil. With the capital stock existing and the inertia in the system, India's dependence on oil would continue to grow in the foreseeable future. This would certainly raise questions relating to the country's energy security in several respects. Firstly, upward fluctuations in oil prices could prove disruptive to steady economic progress. Also, if on the basis of geopolitical changes the physical supply of oil were to be disrupted for a short period of time, the reserves of oil available in the country at any point of time would not be enough to withstand disruptions in oil-dependent activities. Finally, with growing imports and high oil prices, increasing consumption could prove to be an unbearable burden for the Indian economy, which may result in lower economic growth and loss of welfare.

One particular dimension of energy security which does not receive the attention

it deserves is the issue of energy security for the poor sections of society in India. This is a subject that is of relevance not only to India, but to several other developing countries as well. There are today about 2.5 billion people in the world who are still dependent on the use of biomass energy. At the same time there are 1.6 billion people who have no access to electricity. For people who do not have a proper energy supply for cooking, and, therefore, have to depend on poor quality biomass, energy security takes on a very different dimension than what would be experienced in the modern sectors of the economy.

As yet the global community has not found satisfactory answers to this large-scale problem. Some limited efforts have been made, such as supply of LPG at highly subsidized prices to the population in some of the mountain states of India. This has proved very effective in providing a clean and modern fuel for cooking in some of these regions and has also helped arrest deforestation, which took place earlier in these locations for supply of fuel-wood. In respect of lack of access to electricity, at least the basic needs of people in rural areas for lighting can be taken care of through the promotion of solar lanterns and solar torches, which is exactly what TERI is attempting to do in its campaign for Lighting a Billion Lives (LaBL). But the task at hand is gigantic and the resources available have made the energy security objective of poor populations across the world clearly insurmountable under current conditions. This dimension of energy security has been covered in the book, but clearly much greater work is justified if this challenge is to be met on a large scale in different parts of the world. In my view, this book would be of great value for policymakers and citizens of the world who now need to ponder the direction of developments in the supply and use of energy, where changes are due to take place for various reasons, but most importantly also as a response to the problem of climate change. If any sectors in any economic system are likely to undergo major changes because of climate change, it is those involved in the supply and use of energy. The drive to ensure secure supply of energy would be a major factor in this change.

R. K. Pachauri
Director-General, The Energy and Resources Institute (TERI)
Chairman, Intergovernmental Panel on Climate Change (IPCC)
September 2008

Preface

This volume originated in a conference on **India's Energy Security: Foreign, Trade, and Security Policy Contexts** organized by TERI, and the Konrad-Adenauer-Stiftung, New Delhi on 29–30 September 2006. Given the growing concerns on the energy front, it was felt that there was a need to understand the factors that could enhance India's energy insecurity, to explore various dimensions of energy security in relation to India, and to examine the role, if any, that trade, foreign policy and overall security measures policy should play in enhancing it. The Conference had both Indian and foreign participants from Germany, Japan and China. The contents of the book, however, go beyond that conference. We include some of the papers from that conference that focussed on India, revised and updated, and we add new material in order to ensure that the debate reflects a concern not just with the external dimensions and security of supply issues, but more frontally with issues of energy access, increasing energy consumption of certain groups, the provision of clean energy and available technologies, and the environmental sustainability of energy choices. The purpose of this book is therefore to bring together a set of opinions and analysis, from experts and policymakers, with a view to crystallizing the assessment of challenges and opportunities before the nation on a subject that will remain central for some time to come.

India's energy concerns are really in the midst of a perfect storm: growing import dependency and rising prices of the fuels that the country needs to import; the complex geopolitics around energy supply sources and the growing pressures of the global community to make emerging economies, including India, accept commitments to limit the emissions of greenhouse gases. In many ways, these forces should create a movement away from current energy paths. But such change cannot come easily, and India is locked into a path dependency that will require it to engage actively with long standing compulsions of domestic energy pricing, technology choices, institutions and perceptions. The key objective of this volume then is to highlight the internal and external dimensions of India's energy security scenario, the choices it is consciously making, and the room to manoeuvre that it possesses in which to address these concerns.

We are very grateful to the Konrad-Adenauer-Stiftung for its financial support for the 2006 conference, particularly to Jörg Wolff, its Resident Representative at New Delhi. We would also like to thank him and the Foundation for permission to

use some of the material that has appeared in an earlier summary of the conference proceedings. Some of the material in this volume draws from research being done under the project 'Building an Energy Secure Future for India' supported by the Nand and Jeet Khemka Foundation and we would like to thank them for their financial support. We thank the Director General of TERI, R K Pachauri, for his guidance on energy security policy issues and support with this project. Dorothea Schaefter, Associate Editor, Asian Studies, Routledge, has been very supportive of this book project, and this volume would not have taken shape but for her encouragement. We would like to acknowledge her role in this. Our thanks to Kate Moriarty for copyediting the manuscript and to Saroj Nair who helped with formatting the manuscript and other formalities. And last, and most importantly, to the contributors who attended the conference in 2006 and have since revised their papers despite their many other very pressing commitments, and to the new authors for their contributions that have together shaped this volume.

Ligia Noronha
Anant Sudarshan

Part I

Understanding India's energy security concerns

1 Contextualizing India's energy security[1]

Anant Sudarshan and Ligia Noronha

In the last couple of decades, energy-related policy challenges have grown increasingly prominent in India. On the back of a number of driving factors, (population growth, economic growth and lifestyle changes, among others) energy consumption has risen and its concomitant concerns have grown steadily. The forces that have shaped the development of the Indian state and the Indian economy over the last two decades, and that have led to the recent years of high growth, have also changed the paradigms within which energy policy decisions are taken.

There are two overarching forces influencing the country's energy policy decisions and creating the challenges confronting policy makers. These are *energy and growth* concerns and *energy and poverty* concerns. The first set of problems includes the need to supply enough commercial energy to drive growth, tackle unsustainable consumption, and improve our ability to cope with high energy prices. The second set of forces arises from the pressures generated due to large energy inequities, the need to manage the transition from traditional fuel sources to cleaner fuels, and the provision of lifeline energy required to eliminate poverty and provide a basic minimum standard of living to all citizens. This duality of challenges that is before large developing nations such as India contrasts sharply with the situation in both developed countries, and the least developed nations. India's large and growing middle class[2] has energy-related concerns that bear a much closer relationship to those in the developed nations than to those of the very poor. At the same time, the majority of the country's population remains poor and predominantly rural, with no access to clean and modern energy, and little ability to pay for such.

The spread of issues arising from energy and growth concerns spans both internal and external dimensions of national policymaking. Arising out of the need to spur economic growth is the task of increasing domestic production of different fuels, and of dealing with environmental challenges – both local and global. There is also the challenge of walking the geopolitical tightrope that an increasingly import-dependent India finds itself on. There are perceptions of high risk, fuelled by growing dependence on oil imports and high oil prices. The heavily politicized nature of the international oil trade also adds to risk. In recent years geopolitics has become a central concern in energy trade, characterized by a rising resource nationalism; the concerns of an increasingly volatile West Asia; the responses that

India's emerging energy ties create among countries of the West; and potential threats to energy infrastructure and transit routes. Energy issues are becoming the lens through which many foreign and trade policy initiatives are being viewed, and part of the language of new diplomacy. On the environmental side, concerns about fossil fuel use have been tightly linked with climate change and international pressures for a cleaner energy path. India's room to manoeuvre is thus increasingly being framed by these developments (Noronha 2007).

Yet alongside the concerns we have just mentioned (which in many ways are just as important for developed nations), there is a different set of challenges specifically posed by energy poverty. Energy access is a huge problem in rural India, where traditional biomass fuels still dominate the energy mix. The 55th round of the National Sample Survey of India (1999–2000) found that 86 per cent of rural households continued to use biomass in the form of dung cakes, firewood or wood chips for cooking. Even today only 5 per cent of rural households use LPG, and only about 43 per cent are electrified (TERI 2005). While the penetration of modern energy sources was greater in urban households, over 20 per cent continued to rely on firewood and wood chips, and fewer than half used LPG for cooking. The total contribution of traditional fuels to the primary energy mix remains very significant (Figure 1.1). The presence of energy inequities in India also leads to the question of how to manage the transition from biomass to electricity and cleaner fuels (probably fossil fuels). Such a transition, given India's vast rural population, poses a major challenge from the point of view of ensuring supplies.

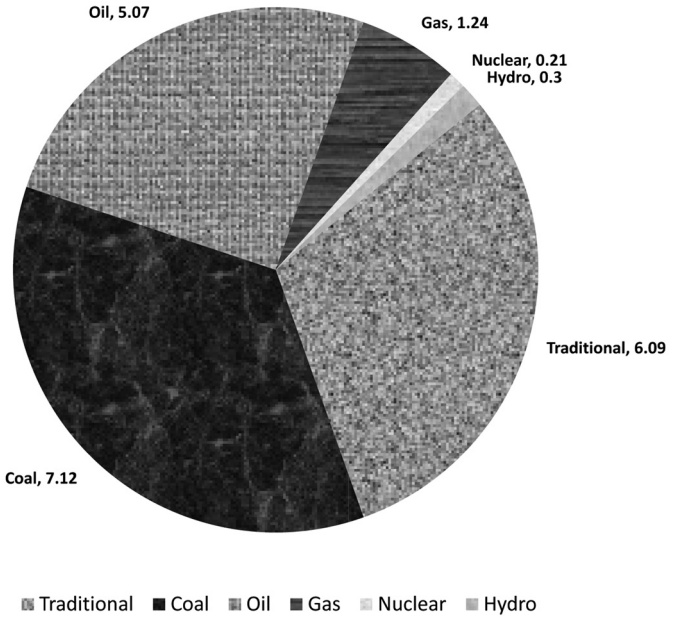

Figure 1.1 India's primary energy supply 2003–04 (in EJ).
(Source: Integrated Energy Policy Report (Planning Commission, 2006a.))

In this context, it is unsurprising that a number of energy-related concerns have arisen, for Indian people and policymakers. The term 'energy security' has become increasingly common, and defining an energy policy for India that takes us towards an 'energy secure' future has become an important goal today. Yet, for such an oft-used phrase, energy security has a somewhat ambiguous meaning. The sense in which the term is used has changed with time and so has its meaning in different parts of the world.

The concept of energy security

In April 1912, as Germany and Britain prepared to go to war, Winston Churchill – then the First Lord of the Admiralty – made the decision to switch the fuel used by the British Navy, from coal to oil. In doing so, he sought a crucial edge on the naval front, yet simultaneously committed the national security of Great Britain to oil supplies from Iran instead of coal from Wales. The company supplying oil to Britain – then called Anglo-Iranian oil and later becoming British Petroleum – became the object of investments by the British government and the rationale for an increased British military presence in the Persian Gulf.

The idea that energy policy, foreign policy and national security are all linked is therefore not new. Over the years however, conceptions of 'energy security' have evolved and grown rather more complicated. After the oil crisis of the 70s, as prices rose and a scarcity of affordable supplies became a real and pressing concern for countries in different parts of the world, ensuring energy supplies became a constant concern for all governments. Since then, energy security has been seen primarily as a problem of supplies and costs. In 1999, the United Nations defined energy security as requiring 'the continuous availability of energy in various forms and in sufficient quantities at reasonable prices'. Other organizations such as the Energy Information Administration of the US Department of Energy and the World Coal Institute use similar, supply centric definitions of energy security[3]. Along with an emphasis on supplies and costs, have come debates on issues such as the geopolitics of energy, the links between energy and foreign policy, maritime safety of energy supplies, play-offs between strategic energy investments and the development of free global energy markets, the nationalization of energy resources and the value of increased energy self sufficiency.

While all of these issues are certainly important, it has become increasingly clear in the last ten years that they provide only part of the picture. If the 'security' in 'energy security' is understood in the context of protection from energy-related threats, then the issues relevant to 'energy security' suddenly appear much broader. One way to understand this is to look at threats due to energy use as falling into the two categories mentioned above – those affecting economic growth and those that are unique to conditions of poverty. The traditional threats that form a part of energy security definitions – supply constraints, costs, import dependency, geopolitical tensions – all of these may be called energy and growth threats because they directly affect economic growth and the normal functioning of the economy. Other problems such as energy inequity, and the use of dirty, traditional

biomass fuels with their associated health risks, could be treated as energy poverty threats.

Added to these challenges is the very major threat posed by global climate change. It is increasingly becoming clear that climate change is not only real and in large part caused by our dependence on fossil fuels (IPCC 2007a), but that its consequences will also pose a serious development challenge, particularly to the more vulnerable developing world (IPCC 2007b). It is still the case that energy security and climate change are normally regarded as distinct, sometimes competing, objectives. In recent years however the world has moved towards the realization that policies that focus on only one of those two aspects are probably doomed to being severely suboptimal. As such (and in line with the idea that energy security is best approached by first asking what the causes of insecurity are), it makes sense to speak of environmental threats as energy security threats. Not to do so is to miss the central fact that nations can have only one energy policy, and we might as well look to identify what is optimal across multiple attributes, rather than create separate policy goals (in this case 'reducing GHG emissions' and increasing 'energy security') that often conflict with each other.

It is in this context that India's 2006 Integrated Energy Policy report defines energy security as follows:

> The country is energy secure when we can supply lifeline energy to all our citizens as well as meet their effective demand for safe and convenient energy to satisfy various needs at affordable costs at all times with a prescribed confidence level considering shocks and disruptions that can be reasonably expected.
>
> (Planning Commission, 2006a)

This definition includes within it key aspects of energy security: those related to poverty and those related to growth. It may therefore be adopted as a reasonable definition for India with the understanding that the word 'costs' needs to be read as referring to not just monetary costs, but also externalities such as local and global environmental costs.

This understanding of energy security as being a broad concept is useful for researchers and policy analysts seeking to appreciate developing country priorities and energy policy decisions. For a country such as India for example, it is necessary to assess the marginal benefits involved in addressing any particular aspect of this broad definition and the opportunity costs involved in placing an alternative issue on the backburner. For example, addressing the issue of climate change must be played off against the need to tackle other threats – low energy access, poverty and disease (alleviating which requires development and increasing energy use), insufficient access to modern technology and consumer products (implying the need for industrialization) and so on. In some situations it might be felt that the marginal benefits from growth, energy access, cost reductions or mitigating local socio-environmental damages might dominate those obtained from addressing a climate change concern. In other cases, the reverse might be true. These kinds of tradeoffs should be the central concern of policymakers looking to create an

energy secure policy for India. In addition, for energy policy analysts both within and outside the country, appreciating the existence of these tradeoffs and the fact that priorities will necessarily differ for the developed and developing world, is essential to evaluating the current situation and suggesting the measures most urgently needed.

Drivers of energy concerns in India

The last two decades have been, for India, a time of change and growth along many dimensions (Table 1.1). Many, if not all, of the changes have strongly affected our energy needs and certainly contributed to energy security concerns. Economic changes have probably received the most attention – both economic growth rates as well as structural shifts in the economy. Yet there have been other important drivers of change. These include demographic effects – population growth, urbanization, changing kinship structures and the demographic transition. There have also been strong increases in energy demand from the transport sector – linked to growing ownership of private vehicles and increasing travel distances. Finally, domestic energy use has seen a slow transition from traditional, biomass energy to commercial fuels. Managing this transition is likely going to be one of the country's greater challenges in the medium term.

There are also a number of external factors that contribute today to energy insecurity in India. These include high risk perceptions, fuelled by the extent of energy imports, the price of fuels in the world market, and geopolitical realities. Taken together, these factors influence perceptions of space in an international context and the urgency with which foreign dependence is sought to be reduced.

The factors highlighted in Table 1.1 have played and continue to play a large part in India's growing energy security concerns. Much can be said about each of these, but we will turn at this stage to an examination of the constraints that have held back the formulation of effective policy responses to these and other problems.

Our primary concern is that India is currently heavily 'fossil fuel' or 'carbon' dependent, seemingly committed to a 'traditional' path of development and energy use. Figure 1.1 illustrates this quite starkly. Virtually the entire primary energy mix is carbon based and, except for the significant share of energy that still comes from traditional biomass fuels, the remainder is almost entirely from coal, oil and natural gas.

Of greater concern than the country's current energy use patterns though, is its projected energy use. Not only are the fossil fuels likely to remain important in the commercial energy mix, but also, as traditional biomass use declines, the demand for electricity and fuels such as LPG will rise sharply in the residential sector. A number of energy models exist that seek to project future energy use, including those in the National Energy Map report (TERI 2006) and the Integrated Energy Policy report (Planning Commission, 2006a). While different models and projections have differed in their details, there seems to be uniform agreement among energy analysts that India's future in the next three to five decades is inextricably linked to high fossil fuel use. As an example, the Integrated Energy Policy report

Table 1.1 Factors aggravating the rise of energy security concerns in India

Factors increasing energy demand	*As indicated by*
Economic growth	Annual growth in real national income in India at a rate of 6 to 7%. Economic growth of over 6 % in the last decade and future targeted growth rates of 8 to 10% (Planning Commission, 2006b).
Changes in the nature of the economy	Economic reforms post 1991, accompanied by structural shifts away from agriculture and towards the services sector. Strong demand for infrastructure, housing, retail, media and entertainment services and IT.
Demographic factors	Annual rate of population increase of about 1.9% p.a. over the last two decades. Percentage of urban population is projected to rise from 25.5% in 1990 to over 40% by 2030 (United Nations, 2006). Changing kinship structures with smaller households.
Growing transport sector	Demand for petrol and diesel between 1980–81 and 2003–04 grew 7.4% and 5.7% p.a. respectively (Integrated Energy Policy, 2006). Rising share of road haulage in freight transport and rapid increases in personal vehicle ownership. Nearly 50% of oil demand comes from the transport sector (a share set to grow).
Incomplete energy transition	Biomass still the major cooking fuel in rural India, and less than 50% of rural households are currently electrified. In 2003–04 the domestic sector accounted for 25% of total electricity consumption, a share that is rising as fuel choices change.
Supply side pressures	India has 17% of the world's population, but only 0.8% of known oil and gas resources. Environmental concerns, inaccuracies in reserve estimates and coal quality concerns have led to constraints on domestic coal use, leading to rising import dependencies for all the fossil fuels.
External security concerns	Crude oil import dependency is projected to rise from 35% in 2001 to 78% by 2031 (TERI 2006). Imports of natural gas and coal are also expected to grow. India has been heavily dependent on West Asia for its oil and gas needs. More recently the focus of attention has shifted to sourcing from Africa. The growing oil import bill, as well as the projected increased dependency on imports for coal, oil and gas, is creating pressures for change in the way India engages energy-rich countries.

projects a maximum share of 4.5 per cent for renewable sources of energy, even if the country succeeds in developing 100,000 MW of renewable capacity over the next 25 years (which is estimated as an upper-bound on the feasible potential). Similarly, Figure 1.2 is a projection of India's commercial energy demand in a business-as-usual scenario and it illustrates both a sharp increase in expected energy demand, as well as a continuing dependence on fossil fuels.

Evidently there are serious concerns about both the environmental sustainability of this path and the degree of security it can provide in an energy stressed world. Therefore, for India to address energy security concerns, the country must

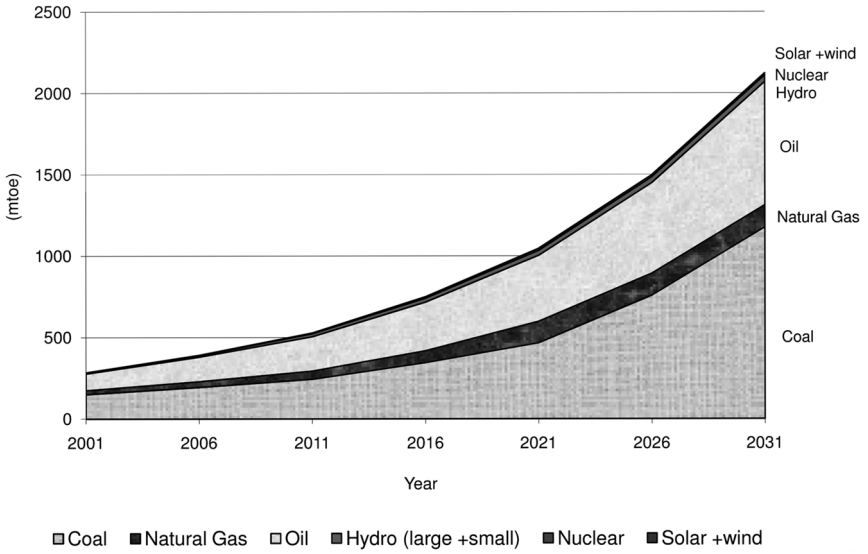

Figure 1.2 Rising commercial energy consumption in a BAU scenario.
(Source: National Energy Map for India: Technology Vision 2030 (TERI 2006.))

understand and tackle the underlying causes of this path dependence internally, while navigating the opportunities and risks that exist externally. To make our position on path dependence clear we quote here from North (2006):

> Path dependence is not 'inertia' rather it is the constraints on the choice set in the present that are derived from historical experiences in the past. Understanding the process of change entails confronting the nature of path dependence in order to determine the nature of the limits of change that it imposes in various settings.

Following North, we suggest that to understand what it would take to bring about change in India's energy sector, we need to focus on the sources of this path dependence.[4] We suggest that there are four key sources of path dependence in India's energy sector: *beliefs and perceptions*, *institutions and organizations*, *technology*, and *relative prices*.

Beliefs and perceptions are key to ordering mindsets and influencing choices. In the energy context, the beliefs that are important are those that relate to perceptions of resource availability, to what constitutes energy security, to the external 'symbols' of prosperity. If for example, both from the point of view of the state, as well as the consumer, energy security is perceived to be only a problem of *supplying* a minimal amount of energy, and of avoiding shocks and disruptions in that supply; then large parts of rural India are in fact reasonably secure as they are dependent on non-commercial biomass. If energy security is linked to the quality of the fuel