Ethical Analysis of the Global Climate Dilemma

S. L. Rao

1 What is an Ethical Analysis

Prof MV Nadkarni in 'Ethics for our Times' says that ethical propositions apply to everyone. Ethics like Economics, involves choice between different kinds of life. It promotes the welfare of all. Ethics is not meant only for individuals acting in isolation. It is in the 21st century that people have realized the true interdependence of all people in the world. Carbon emissions and climate change have led to understanding that development in one part of the world can harm others and in the future as well.

2 Developed Countries: Lifestyles and Carbon Emissions

The real crisis in the developed world, exemplified by the USA, is about the unwillingness of the American people and their Leaders to take the measures that will change the psychology and behaviours that have led to the crisis of the new millennium.

For at least the last decade, the USA (many developed countries have followed suit) has taught its citizens that saving is unimportant, that there need be no limits to household or government borrowing, and that otherwise unaffordable luxuries

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can be had today. This was a transformation from the thrifty American pioneers who made the United States. Brilliant minds in New York created financial products that nobody quite understood. Sub-prime packages, options and derivatives, and many other products built by packaging and repackaging the original debt instruments, ultimately led to the collapse in 2008. It was government money that stopped the collapse from going further and to some stability among banks and financial firms. But the American economy took a bad hit.

Manufacturing had already migrated largely overseas, especially to China. Imports were a major portion of American household consumption, especially from China, paid for by China accumulating (in 2011) over 3 trillion dollars of American Treasury bonds. It helped make China the second largest economy in the world and soon to overtake the USA. The USA was, and remains, a vibrant, highly productive and very innovative economy. It also has a substantial government or employer funded social security system. That combined with easy access to credit, has led to almost zero household savings. Government also spent massively on keeping peace in the world and spreading democracy under force of arms. In addition, the USA has always kept energy prices low under a regime of low taxes, encouraging gas guzzling cars, excessive air conditioning, powerful lighting, etc.

American household debt in annual disposable personal income was 127 % in end 2007, versus 77 % in 1990. The US home mortgage debt to gross domestic product (GDP) rose from an average of 46 %, during the 1990s, to 73 % during 2008. In 1981, US private debt was 123 % of GDP; by the third quarter of 2008, it was 290 %. (Much higher later year figures were not easily available). The USA is a debtor economy.

Low interest rates stimulated the economy, and also reduced government interest payments. Budgeted net interest on the public debt was approximately $240 billion in 2007 and 2008, 9.5 % of government spending. Interest was the fourth largest single budgeted disbursement category, after defence. Despite higher debt levels, this declined to $189 billion in 2009 or approximately 5 % of spending, as average interest rates declined from 1.6 % in 2008 to 0.3 % in 2009.

In January 2011, foreigners owned $4.45 trillion of U.S. debt, approximately 32 % of the total debt of $14.1 trillion, largest holders being the central banks of China, Japan, United Kingdom and Brazil. The share held by foreign governments has grown from 25 % of public debt in 2007 and 13 % in 1988. Not surprisingly, these creditor countries are flabbergasted at the American economic decline since it will result in a decline the American dollar value and in the value of their American holdings.

The Laffer curve was the Bible for Reagan and the Bush junior. It focused on reducing tax rates but without controlling expenditures. Reagan and Bush junior greatly increased government deficits, but also cut taxes. Clinton balanced the budget, and left a budget surplus that was squandered by the junior Bush. The conservative ‘Tea Party’ Republicans want government expenditures to fall sharply, mainly on measures that help the poor and the aged, but tax loopholes and rates for the rich should be untouched. Obama would like to cut defence expenditures, collect more from the rich, and save on social expenditures with more

efficiency. But he had squandered two years when Democrats controlled both Houses. Instead of pushing ahead with his programme, he tried for bipartisan support, and failed.

If the Americans are to emerge from this crisis of overspending, there must be sacrifices in spending, both at the household and the government levels. This will mean a reduction in living standards and some social benefits. Overseas, the USA can no longer be the unilateral superpower, and must develop allies that it listens to and who participate in sharing the cost of keeping the peace. Grand ideas of spreading democracy must be given up. Energy and carbon taxes must be introduced as well as incentives for improving productivity and innovations. A more insular inward-looking USA is inevitable. America's demographic composition and vibrancy will raise the American economy as past bad economic habits of households and governments are abandoned. Before these happen, there will be considerable political and economic disruption.

The USA's economic policies ignored their effects on the rest of the world. It also ignored the vast additions its policies have made to the carbon stock in the environment. One can say that American economic policies have been unethical. The same comment can be made about all developed countries. It could also be made of the imitation of their lifestyles in developing countries, in the sure knowledge that they will further increase the prospects for severe climate change.

Developed countries have to move towards maximum efficiency in energy use, making maximum use of renewable energy instead of carbon emitting energy, and to make technologies available easily and cheaply to developing countries as well so that their development is with least addition to the carbon stock in the atmosphere.

3 India

In this Section we consider the developments in the Indian economy and the directions in which they will affect accelerated climate change.

4 Global (Climate Change) Adaptation Index

The Global Adaptation Index (GaIn) summarizes a country's Vulnerability to climate change and other global challenges on the one hand and its Readiness to improve resilience on the other hand. It aims to help businesses and the public sector better prioritize investments for a more efficient response to the immediate global challenges ahead (Table 1).

Table 1 Global adaptation index country rankings (higher scores are better)

Country	Score	Rank	Country	Score	Rank
Top 5 countries			*Bottom 5 countries*		
Denmark	85.3	1	Ethiopia	40.3	157
Switzerland	83.5	2	Chad	38.4	158
Ireland	82.2	3	Burundi	38.1	159
Australia	82.0	4	Zimbabwe	38.0	160
New Zealand	81.6	5	Central African Republic	37.6	161
Position of China and India					
China	60.3	96	–	–	–
India	53.6	117	–	–	–
Vulnerability			*Readiness*		
China	0.262[a]	70	China	0.470	17
India	0.480[a]	59	India	0.480	18

Source India and China like the developed countries are in between. Except for the five most adapting countries mentioned above, developed countries have yet to go a long way. They have yet to resolve the ethical dilemma of doing something to mitigate the acceleration of carbon emissions and climate change created by them

Note [a] indicates time series vulnerability scores showing upward trend

5 India: Growth and Inflation

India has shown high but erratic growth except in transport, storage, and communication, which have been consistently high since the liberalization of the economy in the 1980s. However, inflation has invariably and periodically stunted growth. Indian policy-makers have been in search of the growth rate that does not create unacceptable levels of inflation. Since the turn of the century, this level has been rising as can be seen from the Charts. Between 2005 and 2008 when growth was 8.6, 8, 7 and 8.0 %, respectively, inflation was moderate at or below 6 %. Inflation spurted from 2007 to 2008 and with the global recession, in 2008, growth declined in 2008–2009 to 6.7 %. Inflation has remained high and growth moderate. Inflation, especially of food products, hurts the poor and there is a major dilemma in allowing persistent inflation in order to maintain high economic growth (Fig. 1).

The proximate causes of inflation have been energy prices, food prices, capacity utilization, investment activity, and business and consumer confidence in the economy and government policies, energy imports of petroleum, oil and lubricants, account for 30 % of total imports. Because the retail prices of petroleum diesel, kerosene, are controlled by government, their prices have not always changed with prices of crude. Instead, the government has absorbed the higher costs because of higher crude prices in its budgets or as a loss to the public enterprises that refine and are principal suppliers domestically. This obviously has pushed up government's fiscal deficits and maintained a strong underlying pressure on overall prices in the economy. The rise in crude prices is largely due to relatively inelastic supplies and growing demand, especially because developing

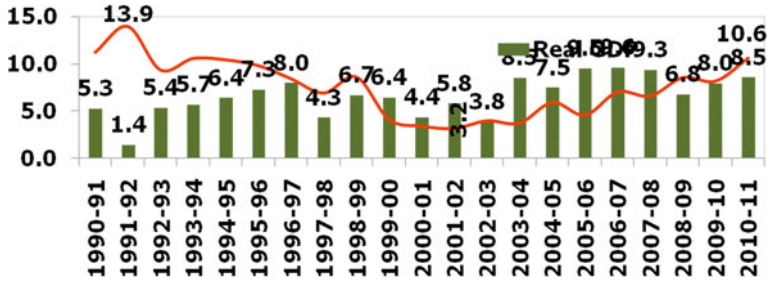

Fig. 1 Overall performance of Indian economy—year to year changes in real GDP and inflation rate: 1990–1991 to 2010–2011. *Note* Based on figures from handbook of statistics on Indian economy 2010–2011, RBI. Real GDP at 2004–2005 constant prices

countries were increasing consumption, while developed countries kept their consumption at extremely high levels (Fig. 2).

Food prices have been another cause of inflation. Productivity of agriculture has generally been declining in India and particularly so in food grains. However, dramatic changes in Indian diets at all income levels have put pressure on demand

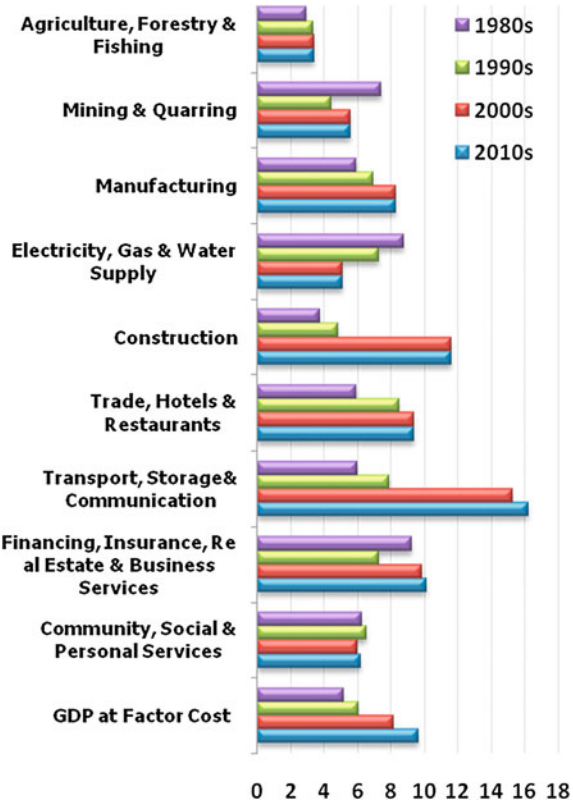

Fig. 2 Decade-wise GDP growth of India (Based on data from Annual Economic Surveys, Government of India)

for pulses, vegetables and, particularly, staples like onions, and sugar, and the erratic behaviour of their prices have reflected this. They have been affected also by exports and speculation. There are some doubts about the motives for allowing exports even when prices were rising. During 2011, when onion prices rose sharply with exports and government stopped exports, producers and intermediaries held on to stocks in the knowledge that government could be pressed to resume exports.

India had the great advantage in the new century of a sharp rise in domestic savings rates, mainly due to high corporate savings due to high corporate profits. This also led to high rates of investment which stimulated growth. Since much of this high profitability was in services, especially the information technology sector, considerable investment went there.

Indian growth has been skewed towards services and not to the 'real' economy of agriculture and industry, particularly manufacturing. Agriculture growth rates have been lower than the overall average GDP growth, erratic from year to year, and lower than industry and services. Industry has shown lower growth than services, and has been inconsistent from year to year. Service sectors in infrastructure like transport, and construction have shown better growth, largely driven by public investment. The relatively high capacity utilization in consumer products also meant that a surge in demand would raise their prices (Table 2).

With further and continuing massive investments in infrastructure, transport, and manufacturing, India can expect demand for manufactured goods to zoom and the contribution of industry, including manufacturing, to GDP to rise. Inevitably, this will require much more carbon intensive products. Low carbon emissions by India are mainly a reflection of the manufacturing capacities of consumer goods not having risen very fast. Similarly, the output of agricultural products has also not risen fast. This has meant that any supply constraint is quickly transmitted to prices since there is little excess capacity to meet demand. As the capacity rises, as it should, carbon emissions will also rise sharply.

6 Employment and Poverty

The pattern of growth in past years has resulted in employment growth being concentrated in the service and infrastructure sectors, and not in agriculture which has over 60 % of the population dependent on it. This has led to wide inequalities in income distribution. While overall poverty levels defined in calorie consumption terms have declined, there are still over 300 million extremely poor people in India. With limitations on cultivable land availability, agricultural growth must come from significant improvements in productivity which will need more water, fertilizers, pesticides, etc., all of which require substantial additional energy.

Table 2 Sector-wise GDP growth rates (%) at 2004–2005 constant prices

Item	2005–2006	2006–2007	2007–2008	2008–2009	2009–2010[a]	2010–2011[b]
Agriculture, forestry and fishing	*5.1*	*4.2*	*5.8*	*−0.1*	*0.4*	*6.6*
Industry	*9.7*	*12.2*	*9.7*	*4.4*	*8.0*	*7.9*
Mining and quarrying	1.3	7.5	3.7	1.3	6.9	5.8
Manufacturing	10.1	14.3	10.3	4.2	8.8	8.3
Electricity, gas and water supply	7.1	9.3	8.3	4.9	6.4	5.7
Construction	12.8	10.3	10.7	5.4	7.0	8.1
Service	*11.0*	*10.1*	*10.3*	*10.1*	*10.1*	*9.4*
Trade, hotels, transport and communication	12.2	11.6	11.0	7.5	9.7	10.3
Financing, insurance, real estate and business services	12.7	14.0	11.9	12.5	9.2	9.9
Community, social and personal services	7.7	2.9	6.9	12.7	11.8	7.0
GDP at factor cost	*9.5*	*9.6*	*9.3*	*6.8*	*8.0*	*8.5*

[a] Quick estimates

[b] Revised estimates

Source Economic outlook 2011–2012, Economic advisor council to prime minister, New Delhi—GoI

Table 3 Water requirements for different uses in India (Qty in billion cubic meter)

Different uses of water	1990	2000	2010[a]	2025[a]	2050[a]
Domestic	32 (6.4)	42 (6.6)	56 (6.9)	73 (6.7)	102 (7.0)
Irrigation	437 (87.1)	541 (85.3)	688 (84.6)	910 (83.3)	1072 (74.1)
Industry	–	8 (1.3)	12 (1.5)	23 (2.1)	63 (4.4)
Energy	–	2 (0.3)	5 (0.6)	15 (1.4)	130 (9.0)
Others	33 (6.6)	41 (6.5)	52 (6.4)	72 (6.6)	80 (5.5)
Total	*502*	*634*	*813*	*1093*	*1447*

Note Figures in parenthesis are percentages to total and [a] Forecasted estimates. Figures from Government of India (2002), Compendium of Environment Statistics, 2002, Ministry of Statistics and Programme Implementation

7 Ground Water Use

India has the highest usage of ground water in the world with an estimated use of 230 cubic kilometres of groundwater every year—more than a quarter of the global total. In fact, groundwater use has been steadily increasing in India over the last 4–5 decades. Today, groundwater supports approximately 60 % of irrigated agriculture and more than 80 % of rural and urban water supplies (World Bank). However, groundwater resources are being depleted at an alarming rate. Today, 29 % of groundwater blocks are semi-critical, critical, or overexploited, and the situation is deteriorating rapidly. By 2025, an estimated 60 % of India's groundwater blocks will be in a critical condition, while overall water usage will rise by 25 %. As poverty reduces, the real economy of agricultural and industrial products must show greater growth. This will further accelerate energy usage and carbon emissions. Most ground water extraction uses electricity which is supplied either below cost or free for the purpose. Climate change will further strain ground water resources (Table 3).

8 The Burden of Traditional Fuels in Rural India

Over 500 million people are not connected to electricity and burn dry leaves, twigs and branches in squalid and unventilated huts. This adversely impacts on the health of women and children. India has the highest incidence of tuberculosis in the world. Respiratory symptoms are prevalent among 24 million adults of which 17 million have serious symptoms. 5 % of adults suffer from bronchial asthma, 16 % from Bronchitis, 8.2 % from Pulmonary TB and 7 % from chest infection. India has the highest incidence of tuberculosis in the world (138 per 100,000 households versus 99.7 for the world. The risk of contracting respiratory diseases and eye diseases increase with longer duration of use of bio-fuels.

Forests contribute 39 % of the fuel wood needs and 314 Mt of bio-fuels are gathered annually. About 85 million households spend 30 billion hours annually in

fuel wood gathering. The total economic burden of dirty biomass fuel was estimated to be Rs 299 billion. Obviously, depletion of forests is also a factor in climate change and must be reduced.

Biomass added 577 million tonnes to emissions. Women and girls bear the drudgery of collecting biomass, and the health impact of burning biomass is on women and children, who are usually indoors. The lack of safe and convenient energy leads directly or indirectly to illiteracy, gender inequality, disempowerment, high infant and maternal mortality. To eradicate such abysmal poverty of so many, India needs consistent and inclusive GDP growth of 8 % per annum over the next 25 years and must improve access to modern commercial energy for all (*Source survey of a Sample of 15,293 rural households from 148 villages in three states of rural North India and one state in South India*).

9 Economic Growth and Requirements of Commercial Energy

It will be seen from the table below that at 9 % annual growth of GDP, the installed capacity of commercial energy, assuming a declining elasticity of use, will rise from 155 GW in 2006–2007 to 960 GW in 2031–2032 (Studies by TERI-The Energy and Resources Institute, New Delhi). Even this growth will leave per capita consumption far behind that of many other countries. Energy consumption in 2003 and that projected for India in 2031 by TERI are compared with some others in Table 4.

The present ratios between different energy sources are given in the next diagram. A sharp increase in manufacturing to 40 % of GDP will change the energy requirements considerably upwards. Among the electricity sources, the potential

Table 4 Per capita energy consumption by country—2010

	TPES (Kgoe)	Electricity consumption (KWh)	Oil (Kgoe)	Gas (Cu.m.)	Coal (Kg)	Nuclear (KWh)	Hydro (KWh)
India	447	786	133	53	237	20	95
India[a]	1250	2471	331	149	925	256	273
China	1829	3162	322	82	1288	56	542
Japan	3950	9032	1590	745	976	2306	671
OECD	4534	8880	1721	1259	899	1875	1114
U.S.A.	7368	13944	2740	2203	1691	2738	837
South Korea	5242	10223	2171	882	1563	3039	77
World Av.	*1751*	*3112*	*588*	*462*	*519*	*404*	*500*

Note [a] for year 1931–1932 projected at 8 % GDP growth. Per capita coal consumption of India has been estimated based on cabrific value of lard coal used internationally (6,000 kcal/kg) to maintain uniformity

Source Integrated Energy Policy—Report of Expert Committee Pg. 32, BP Statistical Review of World Energy 2011, International Energy Statistics, IEA database

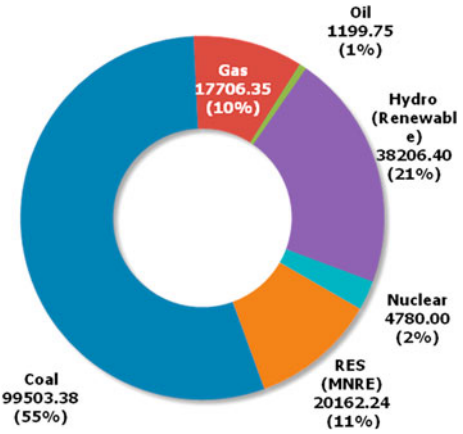

Fig. 3 Energy sources—installed capacity—as on August 31, 2011 (figures in MW) (*Source* Ministry of power, government of India)

growth for hydro is limited by land shortages, environmental considerations, geological, political, and resettlement and rehabilitation problems. Flexibility in supplies is possible from the use of coal, gas, nuclear and renewable energy. Of these, coal is the highest carbon emitter and India will need considerable quantities of coal in the coming years (Fig. 3).

The chief fuel for India's power needs is coal. Uranium could contribute a large quantity. It is 3 % now because India has been a loner, shunned by the nuclear suppliers' group for some years, depending on the Soviets for some technology and India's scientists for developing technologies. Financing nuclear generation is expensive and India has not allowed private sector entry into this sector. This has been another limitation on expanding capacity. The agreement with the Bush Administration brought India out of the cold. There are plans now to add substantially to nuclear power capacity. After the Fukushima accident in Japan, additional safety features are expected to add significantly to costs of nuclear power, adding the fresh dilemma of high cost electricity in a country where electricity costs are already unaffordable to a large number (Table 5).

Table 5 possible development of nuclear installed capacity—2010 to 2050 (In Giga watts of electricity)

Years	Optimistic	Pessimistic
2010	11	9
2020	29	21
2030	63	48
2040	131	104
2050	275	208

Note It is assumed that (a) Successful Fast Breeder Reactor (FBR) Technology by 2011, (b) 8 Giga watts of Light Water Reactor acquired through imports by 2017, and (c) Developed Advanced Heavy Water Reactor using Thorium by 2020
Source Department of Atomic Energy, Govt. of India

Projections of Energy Requirements

This increase in energy requirements will still leave India as a relatively energy efficient economy. But, while it will use less energy in relation to output growth, it will still add to the carbon stock (Fig. 4, Tables 6, 7).

The fuel sources required for the purpose are given in the next slide. But from the slide above it is clear that India will not become an energy intensive economic power in the coming decade. India's GDP in 2019–2020 would be about 4.5 times what it was in 2001. However, total energy requirement would have barely doubled since then. Endemic lack of energy has created an economy that is not as energy dependent as (say) China. India's growth relies more on services that are typically less energy intensive than manufacturing (Table 8).

Coal (from domestic sources and imports) will continue to dominate. Gas might grow a little faster because of large gas discoveries on and offshore in India. Nuclear energy will continue to be a small fraction of our needs because of the high cost of equipment and technology, as well as the anticipated rise in uranium prices. While India does not have uranium in any quantity, its gas reserves have increased recently but can meet only some of the additional demand, most of which will continue to have to be met from coal, which is going to be in short supply domestically. Uranium, coal, gas, will all have to be imported, leaving the economy at the mercy of international market prices and India's ability to export its goods and services to earn the foreign exchange needed.

India has substantial indigenous capability in nuclear energy developed over the last 60 years, strong research and scientific institutions, and a growing team of well trained research scientists and engineers in the field. India has been unable to make nuclear energy its best alternative to increasing use of coal and, thus, limit carbon emissions. Until the agreement during the Bush Administration, this was

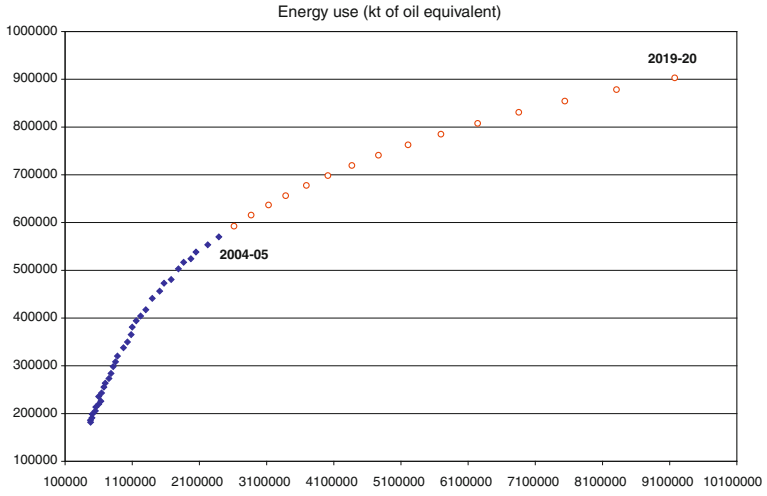

Fig. 4 Expected energy demand *Source* Analytics Pvt. Ltd

Table 6 Economic growth and energy requirements: projected commercial primary energy requirements (based on falling elasticities)

	Total energy requirement (BkWh) @ GDP growth rate		Energy required at bus bar (BkWh) @ GDP growth rate		Projected peak demand (GW) @ GDP growth rate		Installed capacity required (GW) @ GDP growth rate	
	8 %	9 %	8 %	9 %	8 %	9 %	8 %	9 %
2003–2004	633	633	592	592	89	89	131	131
2006–2007	761	774	712	724	107	109	153	155
2011–2012	1,097	1,167	1,026	1,091	158	168	220	233
2016–2017	1,524	1,687	1,425	1,577	226	250	306	337
2021–2022	2,118	2,438	1,980	2,280	323	372	425	488
2026–2027	2,866	3,423	2,680	3,201	437	522	575	685
2031–2032	3,880	4,806	3,628	4,493	592	733	778	960

Note Electricity generation and peak demand in 2003–2004 is the total of utilities and non-utilities above 1 MW size. Energy demand at bus bar is estimated assuming 6.5 % auxiliary consumption. Peak demand is estimated assuming system load factor of 76 % up to 2010, 74 % for 2011–2012 to 2015–2016, 72 % for 2016–2017 to 2020–2021 and 70 % for 2021–2022 and beyond. The installed capacity has been estimated keeping the ratio between total installed capacity and total energy required constant at the 2003–2004 level. This assumes optimal utilisation of resources bringing down the ratio between installed capacities required to peak demand from 1.47 in 2003–2004 to 1.31 in 2031–2032

Source Integrated Energy Policy—Report of Expert Committee Pg. 30

Table 7 Expected growth in GDP and energy

Years	GDP[a]	Energy use[b]
1971	478,918	181,983
1981	678,033	255,362
1991	1,099,072	381,117
2001	1,972,605	524,257
2009	3,691,518	677,641
2019	9,176,341	902,960

[a] at factor cost (constant prices) ….. in Rs.crores

[b] Kt of oil equivalent

Source The Energy and Resources Institute (TERI), New Delhi

due to strict curbs on India's imports of uranium and limited access to nuclear technology. It is now planning significant additions to nuclear energy capacity.

India will, in coming years, add substantially to nuclear power capacities but will continue its high dependence on coal. This is necessary since using coal as a dominant fuel for economic growth will make India's carbon emissions unacceptably high to the developed countries. To combat climate change, India requires substantial nuclear energy capacity. India expects to raise nuclear generation capacity from 4,120 to 20,000 MW by 2020, to 63,000 MWe by 2032, and aims to supply 25 % of its electricity from nuclear power by 2050. India bases its projections not merely on imported technologies and uranium, but hopes in a decade or so to breakthrough in using its large reserves of thorium (Table 9).

Table 8 Commercial energy requirements: one scenario—coal dominates; Oil next; Gas could rise (figures in MToe)[a]

	Hydro	Nu-Clear	Coal		Oil		Natural Gas		TPCES	
			8 %	9 %	8 %	9 %	8 %	9 %	8 %	9 %
2011–2012	12	17	257	283	166	186	44	48	496	546
2016–2017	18	31	338	375	214	241	64	74	665	739
2021–2022	23	45	464	521	278	311	97	111	907	1011
2026–2027	29	71	622	706	365	410	135	162	1222	1378
2031–2032	35	98	835	937	486	548	197	240	1651	1858
CAGR[b] (per cent)	*5.9*	*11.2*	*5.9*	*6.3*	*5.1*	*5.6*	*7.2*	*8.0*	*6.0*	*6.4*
PC[c] in 2032	24	67	569	638	331	373	134	163	1124	1266
PC[c] in 2004	6.5	4.6	157	157	111	111	27	27	306	306
Ratio 2032/2004	*3.7*	*14.6*	*4.1*	*2.9*	*2.9*	*3.4*	*5.2*	*6.3*	*3.7*	*4.1*

Note a = Million Tonnes oil equivalent
[b] CAGR = Compound Annual Growth Rate
[c] PC = Per Capita Consumption in Kg
Source Integrated Energy Policy: Report of the Expert Committee: 28

Table 9 Maximum values of domestic coal availability—not enough for needs (in million tonnes) Source National Energy Map for India: Technology Vision 2030

Fuel	2001–2002	2036–2037
Coking coal	27	50
Non-coking coal	299	550
Lignite	25	50

10 Indian Emissions

The table below shows Indian emissions as of now and as projected. The Hybrid scenario assumes lower energy requirements due to higher efficiencies. Indian emissions must be seen in relation to emissions in other countries, including China. India's emissions today and in future years will remain a fraction of the others (Table 10).

Figure 5 shows the per capita carbon emissions by India as compared to some developed countries. The contrast even by 2020 is stark. The nature of the ethical dilemma is clear. A better life for many hundreds of millions will not get them anywhere near that of the people in developed countries. But it will require a reduction in emissions by them and in their use of energy that produces carbon emissions.

Table 10 CO_2 emission profile (in million tonnes)

Sectors	2001	2011	2021	2031
BAU (business as usual)	917	1663	3332	7267
Hybrid	917	1479	2443	4774
Sectors in 2031	*BAU*	–	*HYB*	–
Power	2879	–	1329	–
Industry	2830	–	2510	–
Transport	1377	–	759	–
Others	181	–	176	–
Total	*7267*	–	*4774*	–

Source The Energy and Resources Institute (TERI), New Delhi

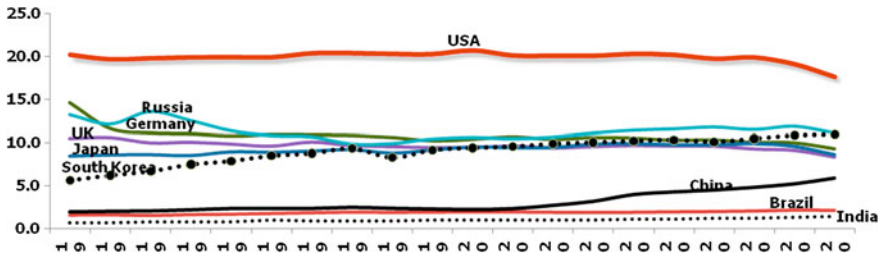

Fig. 5 Per capita of CO_2 emission from consumption of energy (in metric tonnes per person) (*Source* Based on international energy database)

11 Domestic Political Concerns

The large number of poor in India will need to be supplied electricity at prices affordable to them, if not free. The farmer community in India has for long suffered lower prices for agricultural output as compared to international prices, principally to protect the urban industrial working class who would get cheaper food. This has led to farmers being supported by the government with fertilizers supplied at lower than market prices, and electricity free or below cost to extract ground water. This has made electricity distribution entities mostly owned by state governments, suffer massive losses (estimated at Rs 100,000 crores in 2011) that are supported from state government budgets at the sacrifice of investment in physical and social infrastructure. An increase in manufacturing to GDP will also affect energy requirements.

The retail prices for electricity have, thus, been un-remunerative and have for long kept private investors out of the generation business, which is dominated by central and state governments (34, 52 % and the rest with private generators). In recent years, a set of pricing and market options as a result of imaginative government policies have allowed private investors to invest in energy for trading purposes and also for supplies to government distribution enterprises at acceptable prices. Payments have been ensured by letters of credit and escrow accounts.

All fuel prices the world over have been rising in sympathy with those of oil and gas. As the country moves to protect its energy security, more expensive sources of fuels, like imported coal, LNG, uranium, etc., are inevitable. This will raise input costs further, along with the rising costs of equipment. Thus, the tariff subsidies that are eating big holes into the state government budgets will have to come down. At the same time, more precise targeting of beneficiaries is inevitable, to limit the subsidy costs to vulnerable consumer groups. This will become easier with the project to provide unique identity numbers to all Indians. Higher tariffs will make investment more attractive for the private investor.

Energy consumption is unlikely to fall despite higher tariffs. The poor and vulnerable groups will need to be subsidized and government budgets must provide for it. In contrast with wasteful energy use in developed countries, many in India have either no access or cannot afford the cost of clean energy.

The Indian concern with energy security will also lead to a scramble for overseas assets in coal, oil, gas and uranium (if that were possible). This will also add to the pressure on tariffs domestically.

12 Renewable Energy

The following table shows the potential availability and present exploitation of renewable energy sources in India. It must be recalled that renewable energy capacity is always much larger than how much it can actually deliver. It is variable in supply as far as wind and solar are concerned (because of wind speed and the sun rays being available only in the day) and there is yet no inexpensive way to store and use the energy later. At present, all renewable energy is expensive as compared to the present ones. It is unlikely, in the foreseeable future, that renewable energy can meet the vast additional needs of energy in India. It can only supplement supplies (Table 11).

The central government has announced a national renewable energy policy which envisages 10 % of additional grid power from renewable energy generation capacity. The installed capacity from grid-interactive renewable power, which stood at 3,500 MW in 2005, has now risen to around 6,050 MW. As much as 18 %

Table 11 Renewable energy source: potential/availability and exploited

Source/technology	Units	Potential/availability	Potential exploited
Biogas plants	Million	12	3.22
Biomass—based power	MW	19,500	384.00
Efficient wood stoves	Million	120	33.86
Solar energy	MW/km^2	20	1.74
Small hydro	MW	15,000	1398.00
Wind energy	MW	45,000	1367.00
Energy recovery from wastes	MW	1,700	16.20

Source The Energy and Resources Institute (TERI), New Delhi

of the additional grid interactive renewable power capacity, i.e., 2,602 MW that was commissioned during the first 3 years of the 10th Plan came from renewables. Of this, 13.5 % has come from wind power with the balance 4.5 % coming from small hydro power (2 %) and bio energy (2.5 %). The constraints are that the actual energy available is around 30 % of capacity in wind and solar, there is an erratic availability, no storage is possible, and the costs are high. Despite this, the state regulators have imposed a requirement on distribution companies to buy specified proportions as renewable and this of course raises costs. The central regulator is also making it possible for states with low renewable energy potential to buy the performance of other states and offer that as their contribution.

A more certain way to enhance renewable energy supplies is to use waste heat recovery and co-generation. India has also the possibility of using the hydro resources available in Bhutan and Nepal. While Bhutan is already supplying power to India and benefitting its economy and the living standards of its people, any possible Nepal supplies are mired in Nepal politics. But this is a source that might be useful to reduce India's use of carbon emitting energy. However, the water in these countries is from Himalayan Rivers and will be affected by melting glaciers due to global warming.

13 Green House Gas Mitigation

Industry can also do a lot to reduce emissions. Targeted industries that are high emitters can be taught to bring it down and also be given incentives for the purpose. The principal industries that are being targeted under the PAT scheme are: Power, Fertilizer, Chlor-Alkali, Iron & Steel, Cement, Textile, Pulp & Paper, Aluminium and Railways.

Energy efficiency improvement can also make for more power becoming available by using less for the same output. The Bureau of Energy Efficiency (BEE) has launched the Perform Achieve and Trade (PAT) initiative, under the National Mission for Enhanced Energy Efficiency, which is a market based mechanism to enhance cost effectiveness of improvements in energy efficiency in energy-intensive large industries and facilities, through certification of energy savings that could be traded. This scheme is part of the National Action Plan on Climate Change (NAPCC) which was introduced on June 30, 2008 to outline India's strategy to meet the challenge of Climate Change. The BEE is setting targets for efficiency and there is a proposal to enable it to impose stringent penalties for non-performance.

14 Technology

If India is to accelerate economic growth and also mitigate carbon emissions, it will require cheap and quick access to technologies for reducing costs of solar and wind power, access to new and efficient storage technologies, efficient power generation equipment, nuclear technology with safeguards and insurance against accidents, and also at affordable costs, as well as other technologies to improve the efficient use of energy. These must come from developed countries and will also require their financial support.

15 Conclusion

A democracy with many poor people, economic growth as a paramount consideration, consequent need for substantially more energy, severe limits on domestic fuel resources, and constraints on foreign exchange for importing fuels, gives little choice to India except to use coal as the major fuel. Reducing and mitigating emissions, while enabling a better life for its people, requires a high economic growth rate to lift people out of poverty, and coal as the only fuel that can produce enough energy for its needs. Nuclear, gas, etc., are supplementary, not replacements for coal. India has many policies to mitigate carbon emissions. It is getting ready to charge higher tariffs to the consumer, politically a great challenge. At best, India can maintain its carbon emission levels in relation to GDP, but they will certainly not reduce. It would be unethical to deprive so many millions from a better life.

Developed countries face a monstrous ethical dilemma. Their people have to make drastic changes in lifestyles. A carbon tax on exports from India and China would be very unfair, making these countries pay for perpetuating lifestyles of the rich. India could be more efficient in its use of electricity and it's pricing. However, the gap between need and usage is extremely wide and policy changes will make little difference to India's carbon emissions. One way that countries like India can reduce carbon emissions in relation to GDP is by developing more modest lifestyles, not imitating the rich countries. Whether this is possible in an increasingly integrated world, is doubtful.

It is the lifestyles of the rich countries, the enormous energy and emissions required to sustain them that stand out in comparison. If carbon emissions are to be controlled, it is the rich that have to do most of the running since developing economies will only consume more over the years as their poor improve their living standards.