



Prof. C. S. Deshpande Memorial Lecture

Low Carbon Strategy for Inclusive Growth

By

Padma Bhushan Dr. Kirit Parikh

Chairman, Integrated Research and
Action for Development (IRADe), New Delhi

Mumbai, 19 May 2017



Dr. Kirit Parikh delivering Memorial Lecture



Shri Vishwas Deshpande, Managing Trustee felicitating Dr. Kirit Parikh



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Opening Remarks by

Dr. V. N. Gupchup

Educationist &

Member of Governing Board, Vidyalankar Institute of Technology

Dr. Kirit Parikh, Dr. Rohini Kelkar, ladies and gentlemen. May I join Prof. Asif Rampurawala, in welcoming Dr. Kirit Parikh and all of you, to this second lecture of the Prof. C. S. Deshpande, Memorial Lecture Series. We have just seen a documentary, showing in brief Prof. Deshpande's achievements as a student and later as the founder of Vidyalankar. A brilliant student in his college days, never letting the first rank slipping out of his grip, in the University examinations as well as in the National Competitive Examinations. A scholar of his capability would normally be engaged in research activities and we saw that he did have joined at the TIFR or having an engineering design which he tried to at Indian Railways. Yet, as we have seen, he gave up those avenues and got himself to lost in the field of teaching engineering students, with particular emphasis on his first love, the subject of mathematics. Thus, he brought up the institute of Vidyalankar.

Today his institute which started at modest degree, has grown and expanded into a huge complex with excellent coaching classes for the competitive examinations, an engineering college, a polytechnic and a school of information technology. There are many other places in Maharashtra, the name Vidyalankar is associated with quality.

This is indeed my pleasure to acknowledge Prof. C. S. Deshpande's task of educating people. One can never overemphasize the need to keep in mind the founder's dream. Hence the Vidyalankar Dnyanpeeth Trust and the Deshpande family wished to carry out some activity of organizing a memorial lecture series in a public nature, delivered on Prof. Deshpande's Birthday, 19th May every year. The plan is to invite eminent speakers, from within the country and outside, to deliver these lectures on general topics. These would include Education, Finance, Social Economic Issues, National Development and so on. It is told, that these lectures will provide

an opportunity to friends, colleagues and well-wishers of late Prof. Deshpande viz a viz Vidyalankar, to remember the Founder in affection. They will also inspire the younger generation to believe in the pursuit of excellence and having dreams. The memorial lecture that was delivered last year by Dr. Narendra Jadhav, Former Member of Planning Commission and now a member of the Rajya Sabha. Dr. Jadhav spoke on the subject of Making Indian and Higher Education Globally Well Known. To deliver the second lecture we have amongst us, a renowned scholar, Padma Bhushan Dr. Kirit Parikh. He will speak to us on the subject of Low Carbon Strategy for Inclusive Growth.

Let me introduce Dr. Parikh briefly. Dr. Parikh is a civil engineer. He took the Degree of Doctorate of Science from the Massachusetts's Institute of Technology, United States and a Master's degree in Economics from MIT. He has been a professor of Economics since 1967 and is a Fellow of the National Academy of Sciences, India. Dr. Parikh is currently the Chairman of IRADe, Integrated Research and Action for Development, an autonomous advanced research Institute in New Delhi which was established by Dr. Parikh and Mrs. Jyoti Parikh in 2002. It aims to conduct research and policy enhances and connects various stakeholders including the Government, NGOs, Corporations and Academic and Financial Institutions. His areas of research include energy and power systems, sustainable urban development, Climate Change & Environment, Poverty Alleviation and Gender and Agriculture and Food Security. Dr. Parikh was the Founder, Director And Vice Chancellor of the Indira Gandhi Institute of Development Research (IGIDR), An advanced Research Institute setup in Mumbai and is promoted by the Reserve Bank of India, from 1986. A former member of the Planning Commission, Dr. Parikh was also a member of Economic Advisory Council of the Prime Ministers of India, Atal Bihari Vajpayee, P.V. Narasimha Rao, Chandra Shekhar, V.P.Singh and Rajiv Gandhi. In the past he had also been a member of the National Committee for Environmental Planning and Co-ordination, the National Committee on Science and Technology and the Fuel Policy Committee. He has also been a member of the Board of Directors of the Indian Petro-Chemicals Limited, Life Insurance Corporation, Industrial Development Bank of India and State Bank of India. Dr. Parikh's various activities during his long and lustrous career include being a Special Economic

Advisor to the Administrator, United Nations Development Programme New York. In the year 1997 – 98 he was on sabbatical leave from the IGIDR. Program Leader of the Food and Agricultural Program of the International Institute for Applied Systems Analysis (IIASA), Austria. Professor of Economics (and sometimes Head) of the Indian Statistical Institute, New Delhi. Director of Program Analysis Group , Department of Atomic Energy in Mumbai. Infact during that time, Kirit and I had an opportunity of working on the very first Dynamic Analysis of a Nuclear Reactor founded in Europe.

Dr. Parikh has authored and co-authored 29 books on various topics such as planning, engineering, energy systems and policy, natural resources accounting, national and international food policies etc. He has also published numerous research papers and is a recipient of many prestigious awards. He was honoured the Padma Bhushan award in 2009. Ladies and gentlemen, it is a great pleasure for me to invite Dr. Kirit Parikh and deliver his lecture, Thank you.



Low Carbon Strategy for Inclusive Growth

Padma Bhushan Dr. Kirit Parikh

I must say I am deeply honoured and touched to come and give this lecture in the memory of C. S. Deshpande. I did my B.Sc. in Structural Engineering and decided to give that up and I decided to go for economics. My father was very upset but then later he understood this is what I wanted to do and I have been in that area, working in research, policy and education. I feel emotionally touched by C. S. Deshpande in setting up this wonderful centre of institutes and I was very impressed when I was greeted this afternoon. So first I thought I would take up the topic India's Low Carbon Strategy, then I thought we should know why we need low carbon strategy, why climate change is important and what is India's strategy in these areas. Why a low carbon inclusive growth strategy is required in a sense we are in an unequal world which is afflicted by poverty and it will create problems if we don't address these problems of climate change. Ten years ago, people used to think climate change is something that will take place. 50 years down the line, even today people think so but what is happening is that we can see that climate change is here. We see many extreme events like flooding for instance what occurred in Chennai or Sri Lanka and other places; the intensity and the frequency of the extreme events have found to be increasing significantly all over the world in the recent years. So that we need to emerge with a climate change remedy. When any of these extreme events take place, the poor suffer the most, so we should think about how to make them resilient so that we can better the future generations.

Global warming takes place because there is lots of greenhouse gases, carbon dioxide and other gases in the atmosphere and they act like a greenhouse, the infrared rays when they enter earth they bounce back but they don't go back up in because these gases trap them and the earth keeps getting warmer and warmer. If there is no generation of carbon dioxide the U.V. rays will go out and the earth will not get warmer. And this is caused

by everyone's activities hence the responsibility must be on everyone. A convention was agreed in 1992- one of the principle was CBDR that is common but differenced responsibility. It is a common responsibility for the countries but are differentiated by its abilities and responsibilities and so on. The responsibility is on the basis of how much the country contributes to the stock of carbon dioxide in the global atmosphere because it's the stock that creates warming. There are two policies that are the government tax and the second is through the government quota. You can also buy and sell additional stock from someone who has surplus, but for that to work - just allocation of global commons is required, the allocation is on per capita income but the Americans say it should be on basis of per GDP basis, but by large everybody thinks per capita is the most ethical way. Per capita basis is ethically the most defensible thing because your constitution say it as self-evident. I think that next thing is to worry about the contribution of Green House Gases (GHG) emissions. It is not just carbon dioxide but also other gases like nitrous oxide, carbon oxide and methane etc. They all are considered as greenhouse gases. Each gas has different kind of impact or ability to reflect that are equivalent to carbon dioxide - that is how we measure the emissions. We can say that in GHG emission, India's contribution is very small even in the terms of per capita basis it is very small. Even from 1990, when UN preparation of convention of 1992 started, everybody knew that there is a problem for GHG emissions but nobody can take the defensive approach that this is the problem that persists; therefore, it is reasonable to start at least from that day as to ascertain the responsibility and here we can see that India's emission is very low.

Then I think, we see that why we should measure historical accountability based on cumulated emission. There is stock that leads to warming and there is pollution pays principle, if somebody is charged and he is responsible for that and equal right for global commons. Commons is earth atmospheric holding capacity, which is considered as global commons. Quality of air in Mumbai should be considered commons and city's commons. And all the citizen should have same right, one cannot blame as say after 1990 that the per capita emission is really right thing to do.

Ethical and equitable emission quota is what usually such cities evolve

rules for, for the use of commons. People say we can only grasp, say x number of animals in x no. of days and used during raising is not allowed. Common bond is there then also usually societies also evolve that kind of rule for the use of commons to be neatly evolved with the rapid growth of incomes and population. It has become urgent to do so. Ethically no one should emit more than what is substantial. Now what is substantial? Well one can say that nature has absorbing capacity. How much can we absorb than how much we emit carbon dioxide gases. Some of it is absorbed by ocean, flood and carbon dioxide, plants and forests.

Nature absorbing capacity: say nature absorbing capacity is x tons that there will be further build-up of GHG emissions into the atmosphere is slightly more than 100 years in environment and what is not there is disintegrated and dissipated that has been absorbed by the atmosphere. So if you look at the absorbing capacity and this is the diagram of intergovernmental panel on climate change. And see above the horizontal line in the middle of transmissions and below where they have gone. Above you see that brown area is the fuel and cement from energy things and you can see that is rising dramatically since 1950 and still growing fast. But if you see the bottom part, it is -that this thing has really gone, there is a green, i.e.- residual land sink, there is light blue is addition to atmosphere and dark blue which is ocean sink and light sky blue which is where it is accumulated.

So roughly we can say that addition/ emission is 40-50 % or 60% on maximum is being dissipated so probably to allocate the cumulative analysis of absorption, we can see the contribution of different countries and India's contribution is virtually zero if you take the total amount of absorption that takes place and allocated to the citizens of the earth. We have never emitted more but nonetheless we are growing and we are emitting more so we would have some overall responsibility. Now one would say that you can really put a tax on how much stock of GHG emission you emit in the atmosphere and collect at the parking space you could have parked and for every hour you could give some money that kind of rental on parking of GHG emission to the atmospheric change and then redistribute it to the other holders of the earth and you can get a huge amount of money that can take care of low carbon growth and take care of the dualism like many who are responsible for that and those who are

refused to pay and don't have world government to be able to do that, but it is good idea to keep in mind that there are some possible ways of giving and someday we may become wise enough to do that. Now doing this has a certain advantages and rationale because stock is the culprit so instead of carbon tax one could have tax on the stock. It will be warning and rewards negative emissions. What do we mean by negative emissions? If a country emits a low amount of e.g. suppose they generate all their energy burnt electricity by biomass and then capture the carbon and put it in a storage underground then there is really taken out carbon di oxide from the atmosphere and put it back. So anyone who have done that kind of negative emission can take it. It incentivises delaying emission because it saves and postpone the emission and I think it is easy to implement.

What is India's approach? India is not much responsible for carbon emission or global warming. However, it is highly vulnerable to climate change (CC). We need to ensure that the growth is low. We took lead in Paris conference held in 2015 and announced an ambitious target as our intended nationally determined contribution- INDC and this is the target to reduce our emission intensity by 30 to 35% by 2030 compared to 2005. GTP analysis for emission test and can say that fossil power capacity would be 40% by 2030 and non-fossil power generation capacity that includes hydro, solar, wind, and biomass and nuclear and fossil would be obviously coal, gas, and oil. And finally, we are said to improve our green cover to absorb upto 2.5 to 3.0 GT of carbon dioxide by 2030.

And I think that is the target you make but that is the question-Can you do this or how can you do this? And experts explore policies and implications and IRDA developed a multi-sectoral, inter-temporal, optimizing activity analysis model. This model maximizes 30-35% applicate but present discounted value of consumption over 2011 to 2050 and its top-down bottom-up model. Top-down in a sense that it covers the whole economy - 25 different sectors covering the economy and it is bottom-up because many of its goods can be produced by more than one activity e.g. electricity is produced by solar, wind and we also have coal temperature plants etc., select good kind of activity we should have so that we can reach some of the targets, etc. in a sense GT objective is to have increased private consumption. The model does this with cumulative balance that all commodities demanded should be equal to commodity savings and the

balance of payments should be balanced. The investment should not exceed the savings. Now it is the endogenous income distribution - 10 rural and 10 rural-urban classes - each with a demand system that allocates consumption to different goods/ commodities so that what it does with this kind of model, we explore the number of options. We make three scenarios - one is called dynamics as usual - that some of the policies that low carbon would continue- we determine actions and say that it will take lot of activities to make sure that carbon emissions are reduced and we say this are the ambitious actions. And we also say that for countries like India improving the growth or improving human welfare should be the first priority much above carbon reduction and that we will do it for that expenditure required for human welfare. So we set number of policies that will be set for 2030. India's human welfare indicators would be comparable to high income countries. The idea is income transfer- i.e. Rs. 3000/- per person per year at 2007-2008 prices given as cash transfer to 70% of the people beginning 2015. Every family should be given pucca house by 2030. Beyond Indira Awas Yojana and Rajiv Awas Yojana government builds 2015-2025 0.7 million houses for the poor. The next is drinking water- the government will provide clean drinking water to all by 2016-17. The issue of sanitation will be sorted out by providing education to women and increased demand for sanitation will lead to end open defecation by 2021-2022. Government expenditure on education and health is increased to be 7.3% of GDP in 2015 and stays at that level after that. We have to ensure to provide electricity. All households consume 1 kWhr per day of electricity by 2015. The deficit from the households' normal consumption is made up by the government. In respect to cooking gas – the poor households' expenditure on energy is supplemented by government so that they can have six cylinders of LPG per year. In respect to growth, real GDP growth of 8% is realized from 2007 to 2031. The improvement in health, education, access to water and sanitation will result in lower immortality rate (IMR) and fertility.

So we can say, what kind of policies do we follow for low carbon growth scenario. The energy requirement is changing over the time, you can just see from last 15 to 20 years. You look that intensity is also growing out. So one might say that we have autonomous energy efficiency- the inputs of these are to various things would be down by 1% to 1.5% per year. However, we assume that not all these are available free of cost. To turn on

or switch off the lights which are without investment. But beyond a certain amount, we need to make some investments like energy efficient fans or need to buy more expensive fans so additional investment is required. So you need to put some energy saving devices, we require upfront investment so that you can get investment efficiency. If you look at the most of its technical progress to better management to learning by doing is also decreasing in reference to capital or input required. So the total factor productivity growth is 1% for agricultural sectors and 1.5% for non-agricultural sectors. Many power technologies have been introduced. These include solar PV, solar CSP and wind, all with and without storage based plants. Hydro and nuclear power development is accelerated and all new coal plants from 2011 onwards are super critical plants with 20% higher fuel efficiency and 25% higher capital cost.

So, we also have assumed that a minimum penetration rate for renewable power is prescribed so that the share of renewables in total generation increases every year by 0.18 to meet plan targets. For transport sector, the share of railways in freight movement is stipulated to increase by 2.5% for each sector. The other assumption is that the fleet efficiency norms on motorized vehicle manufacturers will be double fuel efficiency by 2030. Energy efficient appliances are very critical. Fortunately, if you look at the data, consumers in India, all are buying Star-rated appliances. So to improve this efficiency certain policies can be made by implementing subsidies or incentives can be provided. Today even without subsidies star-rated appliances are in demand. And that is why it looks possible to reflect use of energy efficient appliances, the marginal demand for coal and electricity are assumed to fall by 1% per year.

The greater use of public and non-motorized transport by households assumed by changing the demand system parameters by reducing marginal budget shares for petroleum products by 1.5% per year. All cars and vehicles should be replaced by CNG or electricity. This is the most stipulated scenario but move to subsequent in this regard. Alternative fuels in transport sector stipulated by reducing petroleum products inputs in the transport sector by 2% per year and replacing this by increasing inputs of CNG and electricity in the ratio of 60% and 40% respectively. I think this is the most ambitious target but I think may be possible. The share of energy conservation building code (ECBC) compliant building

increases. Finally, to reflect the Green India Mission that targets to increase green cover in India, CO₂ sequestration rate of future years is specified.

INDC and IRAD model scenarios depict the targets stipulated in this regard. Population and urban population has been estimated and reduction in emission intensity of GDP is estimated to be reduced by 33 to 35% from 2005 level and 38% to 46% has been specified from 2007 level by IRADe. Electricity demand has gone down marginally. Renewable target has been claimed 175 GW by 2022 but if we don't take any specific action it will be 71 GW by 2030, if we take moderate action it will be 143 GW by 2030 whereas if we take strong actions, it will be 190 GW by 2030. And the cumulative electric power installed capacity non-fossil estimation is there for 2030. The next is CO₂ emission in Kg/\$GDP (PPP 2007). And then the renewable electricity generation – technology wise targets are there which are growing too high. The chart depicts that the generation of these resources are quite high. This is the summarization of the situation. All these come free of cost. Solar power is free of cost in some sense as to set up one megawatt solar capacity we need to invest six crores of rupees. Recent assessment indicates that it has been reduced to 2.5 crore. But it was estimated to be six crores for the instalment of 1 mw solar plant. 1 mw coal base plant cost around 3.5 to 4 crores. But replacing them may cost 16 crores to 20 crores and that's the problem. And hence GDP rates growth rate falls down in comparison to PPP. This is the loss compared to the reference scenario and it can be much higher by 2050. This indicates the cost to the economy compared to a reference scenario with no specific measures for low carbon growth. Cumulated GDP loss, cumulative investment increase, cumulated consumption loss cumulated energy investment increase from 2010 is estimated for 2030 and 2050. You can see the reference in the slide. And that's why I would have to say that we have to think about the policies to do that. We can take some actions. India is vulnerable to take some actions and we can do it in such a way that we can ensure the inclusive growth and still India's target is to be seen – what are the specific policies we should implement or how can we implement, what measures should one take, e.g., energy efficient appliances are required. Private sectors are buying energy efficient products but government officials are not buying considering it costly and they buy the products with cheaper rates till 2005 but now they are mandated to buy

star-rated products. Promoting new products with subsidy can lead to market development, e.g. LCD. Government has instructed to distribute LCD free of cost. So this kind of vast procurement of the policies would be very effective. Same thing has been initiated for super-efficient fans that can save large amount of electricity. But before this, it is important to select carefully what should be promoted. The energy efficiency guidelines also include: labelling with informed consumer works and extension of labelling to more appliances and products. It is important to empower public sector and government procurement officers to purchase on life cycle cost basis through simple guidelines. And it is also important to tighten the standards periodically to make the updated and relevant. In respect to commercial building it is important to promote uptake of green and energy efficient building standards requires. The various ways are: property tax rebate may be offered, there should be implementation of ECBC code in the municipal bye-laws. There should be training and knowledge dissemination about green building technologies, materials and advantages, that includes e.g. electric metres that indicates how much energy it is consuming or supply materials- whether they are energy efficient or not? And we should ensure to strengthen the supply chain of green building materials. For retrofitting and small sector buildings we should offer loans to ESCOs and owners for retrofitting of building. We should set up an agency that prepares project reports and finances retrofitting and energy efficiency in small commercial buildings. Residential building is an incentive for the builder as well as owner. builder wants to make the flats and want to sell the flats as soon as possible. And he knows the owner will buy cheap flats. And the builder has not any incentive to make energy efficient buildings as it requires some more expense to make it and he will not do that unless he is incentivised. One way to promote is to incentivise the developers, reduce property tax and reduce stamp duty and reduce interest on loans for green energy efficient buildings. All of this is an important device to develop a mechanism. The other thing which is my favourite is that you know temperature in hotels, cinemas and malls are so cold which is almost shivering, that should be mandated to a certain degree as Japanese have done at least 24 degrees. All the public buildings should be mandated to set the minimum temperature. And industry also requires a huge amount of opportunity also exist for doing this... one of the thing that is recognised is that the industrial capital

stocks will double in every 7-8 years. And then therefore future should concentrate on new industries to set up energy-efficient plants. Promotion of this labelling for industrial equipment, such as variable speed drives, can be effective if energy prices are competitively determined. In this continuation to fully realize the potential energy prices must reflect their true cost. A carbon tax would be an effective way to contain emission from small and large industries.

How can we promote renewable energy? To promote it, it is important to have a uniform RPO across states. We have to ensure the floor price that should be prescribed as minimum FIT. Not only this, but a forbearance price, an upper bound should also be set. There should also be provision of penalty who do not meet the RPO. To implement it effectively, banking of RECs for a period of three years should be permitted. The obligation, whether on DISCOM or on the plant operator, to build the needed transmission line should be clearly spelt out. If you do some of the things a robust grid is required to absorb intermittent power from renewable power plants.

Similarly, in the case of transport also we must do lot of things here. Certainly that can refuse accelerate development of DFTCs. One of the problem why people prefer to move goods by truck rather than train even though the cost is much higher is that truck provide door to door reach whereas railways cannot and I think railway should provide on-schedule delivery and I think you would be delighted to know the railway minister Suresh Prabhu started two scheduled goods trains. Invest in faster intercity trains to attract passenger traffic. Push energy efficiency of vehicles with fleet efficiency norms. Invest in urban public transport. Provide cycle lanes and footpaths even if it means reducing a lane for motor vehicles. Impose parking fees and congestion charges to reflect opportunity cost of road space.

To conclude I think attending to human development should be the highest priority in this unequal world. Historical responsibility and rational allocation of Global carbon space on a per capita basis will be the ideal solution to do this. India can meet its INDC goals. However, it is not costless. Financial help or dramatic fall in costs of renewable technologies and storage and access to them are critical to avoid the cost.



Vote of Thanks

Dr. Rohini Kelkar

Principal, Vidyalankar School of Information Technology

Honourable Chief Guest, Dr. Kirit Parikh, Respected Dr. Gupchup Sir, our most valued invitees, ladies and gentlemen. On behalf of Vidyalankar Group of Educational Institutes, it's my privilege to propose vote of thanks on this occasion.

Low carbon economy is perhaps the most important objective of all wise economies of the world. About this scenario, Dr. Parikh has presented before us a module of how growth with low carbon strategies can go hand in hand with other economic and social objectives. Sir we are extremely thankful for providing non-technical insight into this most discussed issue of climate change.

As an outcome of this lecture, we can join the Green India Mission mainly by two ways, One – by following the green practices ourselves, many green practices have been told to us by our guests and Two – by doing research to find some technological solutions to these environment related problems.

Our thanks are due to our mentor Dr. Gupchup Sir, who has been guiding us through right from inception, planning and execution of Prof. C.S.D memorial lecture series and special thanks to him for inviting an eminent personality like Dr. Parikh on our campus.

I am also thankful to special invitees which include friends and family members of Prof. C.S. Deshpande, members of Statutory bodies of all the three institutions on the campus, professors and officials of the prestigious institution in Mumbai. Students and Researchers of various institutions in Mumbai.

Last but not the least, I am thankful to the entire Vidyalankar family for putting their souls together in a successful organization of the programme. Thank you.



About Prof. C. S. Deshpande (1932-2005)

Endowed with a good academic career, C. S. Deshpande stood FIRST at the Inter Science Exam winning all the University prizes. Then after completing B.E. (Electronics and Telecom.) from the College of Engineering, Pune, he joined the prestigious T.I.F.R. He appeared at the I.E.S. (Indian Engineering Services) Examination and again stood FIRST in this All India examination.

He discovered his intrinsic interest was in the field of teaching and writing Mathematics and in Mathematical Engineering Subjects. This pursuit of his passion and an urge of dedicating himself to sincere academic pursuit led him to establish Vidyalankar. His basic objective was to guide eager young students. He worked at it with a missionary zeal to enhance their worthiness and imbibe nobler values of life in their receptive minds not through empty words alone but through his own example.



About Padma Bhushan Dr. Kirit Parikh

An **Emeritus Professor and Founder Director** of Indira Gandhi Institute of Development Research (IGIDR), Mumbai, India. He has served as **Senior Economic Advisor** to United Nations Development Programme from October 1997 to September 1998. He has been a **member of the Economic Advisory Council (EAC)** of the Prime Minister of India, Atal Bihari Vajpayee, and had been a member of EAC of Prime Ministers Rajiv Gandhi, V.P.Singh, Chandra Shekhar and P. V. Narasimha Rao. The Government of India awarded him with **Padma Bhushan, in 2009**, for his contributions to public affairs, culture and social work.



August gathering for the Memorial Lecture



