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FISCAL INSTRUMENTS FOR CLIMATE FRIENDLY INDUSTRIAL DEVELOPMENT IN TAMIL NADU

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Preface

This study was carried out by Madras School of Economics as part of a project, 'Development of Fiscal Instruments for Climate Friendly Industrial Development in the State of Tamil Nadu' undertaken by Confederation of Indian Industry with funding from the British High Commission under the Prosperity Fund. The study was initiated by the then Director of MSE, Dr. D.K. Srivastava with support from Dr. K.S. Kavi Kumar and Dr. Madhuri Saripalle. The study coordination was taken over subsequently by the current Director of MSE, Dr. K.R. Shanmugam.

The study benefited from active support provided by Mr. K.S. Ventakagiri, Ms. Gargi Mitra, Ms. Nisha Jayaram and Mr. S. Karthikeyan of Confederation of Indian Industry. The study team would like to thank all of them. The study team would also like to acknowledge the support provided by the project consortium including Jadavapur University and Eunomia Research & Consulting.

The MSE team also gratefully acknowledges the support received from a number of officials from the Government of Tamil Nadu during the course of this study. The authors would like to place on record the help extended by Dr. C.Rangarajan, Chairman, Madras School of Economics in facilitating successful completion of the project. The authors would also to like to acknowledge able secretarial assistance provided by Ms. Sudha, Ms. Jyothi and Ms. Geetha in preparing this report.

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MSE Study Team

Fiscal Instruments for Climate Friendly Industrial Development in Tamil Nadu

Abstract

There is increasing scientific consensus linking greenhouse gas (GHG) emissions from developmental activities to global climate change. In response to this, many Governments globally have started looking towards various actions to reduce GHG emissions. India too has pledged its support to contribute to climate change mitigation, with a voluntary commitment by the Prime Minister of India at the World Stage to reduce the country's carbon intensity by 20-25 percent of 2005 levels by 2020. In view of this, it has become imperative for all the states to individually chalk out their action plan to achieve the set target within their boundaries so as to facilitate the nation to achieve the target.

Being one of the industrialized states in the country, Tamil Nadu has a significant carbon footprint already and is reported to have emitted 111.86 million tons of carbon dioxide (CO2) during 2009-10 at 1.59 tons of CO2 per person. Government of Tamil Nadu in its "VISION 2023: Strategic Plan for Infrastructure Development in Tamil Nadu" proposed 12.3 percent industrial growth in Tamil Nadu and 13.8 percent growth for manufacturing. Such aggressive growth strategies could aggravate the climate change issues unless appropriate policy interventions are made. Against this background, this study examines the scope of using fiscal instruments for climate friendly industrial development in Tamil Nadu. Specifically the study attempts to design fiscal instruments at the state level that encourage a switch from higher carbon intensity activities (and fuels) to low carbon intensity ones.

To maximize impact all instruments suggested in this study are designed as two part instruments. The first part is a tax and the second part is a subsidy. This strategy addresses several aspects of the design simultaneously. The salient features of the

suggested instruments include: maximizing environmental impact; financing subsidy; endogenizing administrative costs; and minimizing revenue risks. The instruments selected in consultation with different stakeholders including the policy makers and industry representatives cover four broad sectors: energy, transport, cement and construction. A summary of suggested fiscal instruments aimed at interventions meant for the Tamil Nadu economy along with their basic features is given below:

a. *Energy sector related instruments*
    1. *Coal cess or limiting input tax rebate of statevat to finance a green fund used to subside use of cleaner substitutes for energy production*
    2. *Green cess to finance the green fund*
b. *Transport sector related instruments*
    3. *Green motor vehicle tax to subsidise use of less polluting vehicles*
    4. *Congestion tax to finance a city road maintenance fund to reduce use of diesel and petrol per km of use by vehicles*
c. *Construction sector related instruments*
    5. *Reducing VAT on energy saving materials accompanied by higher state VAT on high energy using materials used in construction*
    6. *Reducing property tax on green buildings accompanied by higher rate on high energy consuming properties (like malls, etc.)*
    7. *Cess on solid waste accompanied by subsidy for burning waste in cement producing firms.*

From a longer term perspective there is a now a move to subsume a number of central and state taxes on goods and services in a comprehensive Goods and Services Tax (GST). The GST may involve constitutional changes affecting the powers and flexibility of the states in using the tax instrument for environmental purposes. It is important for the states to have autonomy in levying cesses and surcharges or differentially higher rates for identified polluting goods and services. In a GST framework, since the idea is to tax all goods and services in a rate structure that has either just a single rate or few rates, there must be scope at state-level for rate differentiation for environmental purposes.

Keywords: *Climate change, Fiscal Instruments; Carbon Emissions*
JEL Code: *H23; Q38; Q53*

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Chapter 1

INTRODUCTION

Tamil Nadu is one of the industrialized states in the county. It ranks first in number of factories and third in industrial output, contributing 9.1 percent of industry GDP (at 2004-05 prices in 2011-12) of the country.[1] While Tamil Nadu's growth is driven by services, industry is the second dominant sector, accounting for about 30 percent of total GSDP of the state. It is a leading manufacturer in automobiles, textiles, hosiery, pharma, leather, IT and ITES.

Tamil Nadu is also the most urbanized state in the country. Nearly 50 percent of its people live in urban areas. Rapid urbanization creates pressure on urban amenities like housing, water supply, sanitation, solid waste management etc. One of the immediate manifestations of urbanization can be seen in terms of increase in the vehicular population. With about 11 percent of the total registered vehicle in India (as of March 2011), Tamil Nadu ranks second next only to Maharashtra in terms of the vehicle population.

Other manifestation of urbanization is solid waste. Over 1000 tons solid waste is generated in Tamil Nadu per day in all municipalities and municipal corporations, with average generation ranging from 13 tons/day (in Grade II and III municipalities) to 3500 tons/day (in Chennai corporation).

While Tamil Nadu is a power (electricity) deficit state, it ranks sixth in per capita energy consumption among the major states. In fact, the Tamil Nadu Electricity Board (TNEB) ranks third in operation size, gauged by generation capacity and volume of energy sold and the size of the energy consumers.

Thus, Tamil Nadu is one of the comparatively developed states in the country. Obviously its development activities can have significant environmental consequences. According to a recent study on Tamil Nadu Carbon footprint by the Confederation of Indian Industry (CII), the total Greenhouse Gas (GHG) emissions from the state in 2009-10 were 111.86 million tons, which amounted to the state per capita GHG emission of 1.59 tons of CO_2 per citizen. The study further estimated that the energy sector

[1] Industry comprises (i) mining and quarrying, (ii) manufacturing, (iii) construction and (iv) electricity, gas and water supply.

accounted for 75 percent of the total CO_2 emissions and within energy sector, the power generation alone contributed nearly 46 percent. While the industrial sector accounted for 16 percent of the total emissions in the state, the transport sector accounted for 18 percent and waste accounted for 2 percent (CII, 2012).

At the national level, the energy sector contributes 58 percent of total GHG emission and the industry accounts for 22 percent (Ghoshal and Bhattacharya, 2007).[2] Within the industry, cement (31.7 percent) and iron and steel (28.4 percent) are the major contributors of GHGs (in 2000). Vehicular emissions account for 60 percent of GHG emissions from various activities (in 2003-04), of which 94.5 percent by road transport (Ramachandra and Shwetmala, 2009). According to the Economic Survey 2011-12, the GHG emissions grew at an average rate of 3 percent per annum during 1994-2007. India is the fourth largest CO_2 emitter in the world.

There is increasing scientific consensus linking GHG emissions from developmental activities to global climate change. In response to this, many Governments globally have started looking towards various actions to reduce GHG emissions. India too has pledged its support to contribute to climate change mitigation, with a voluntary commitment by the Prime Minister of India at the World Stage to reduce the country's carbon intensity by 20-25 percent of 2005 levels by 2020. In view of this, it has become imperative for all the states to individually chalk out their action plan to achieve the set target within their boundaries so as to facilitate the nation to achieve the target.

Government of Tamil Nadu has recently brought out "VISION 2023: Strategic Plan for Infrastructure Development in Tamil Nadu" to identify thrust areas for growth and bottlenecks in such areas. It has proposed 12.3 percent industrial growth in Tamil Nadu and 13.8 percent growth for manufacturing. It has also proposed many new industrial corridors, industrial parks/towns, manufacturing investment zones, aerospace and logistic parks. New power projects are proposed to add 11258 MW additional capacity of thermal and 10000 MW of renewal. A total investment of Rs. 1.5 million crore is proposed in the document (Rs. 0.45 million crore on energy, Rs. 0.37 million crore on transport, Rs. 0.16 million crore on industry, and Rs. 0.28 million crore on urban infrastructure. These activities would aggravate the climate change issues unless appropriate policy interventions are made.

[2] Globally, the energy contributes 26 percent of total GHG emissions while the industry accounts for 19 percent.

Against this background, this study examines the scope of using fiscal instruments for climate friendly industrial development in Tamil Nadu. Climate friendly development is likely to demand actions in respect of both mitigation and adaptation. But this study focuses on mitigation. That is, the recommendations made in this study do not contribute towards the adaptive response. The major objective here is to design fiscal policy or instrument at the state level such that it encourages a switch from higher carbon intensity activities to low carbon intensity ones.

The approach adopted in this study is to design policies which seek to target as far as possible the source of the GHG emissions. Climate change is at most basic level an externality. The GHG emitters today contribute towards changes in climate and thereby impose external costs on the world and on future generations. However, the GHG emitters do face directly neither via markets nor in other ways, the full consequences of the costs of their actions. In such cases, the social welfare can be improved by adjusting the workings of the market to ensure that pollution is abated or to encourage greater provision of the positive externality. This can be done by (i) a tax or subsidy that seeks to reflect the nature of externality directly within market prices (see Pigou, 1920), (ii) a system of tradable allowances/credits that uses a combination of market trading and a pre-determined level of abatement to allow a price for the allowances or credits to be formed through the interplay of supply and demand (see Coase, 1960), and (iii) regulations and standards to ensure a reduction in pollution or an increase in the provision of the positive externality.

Instead of targeting the pollution directly, one may also consider targeting polluting inputs and outputs for environmental management. The present study adopts such approach for facilitating low carbon growth path in Tamil Nadu. Specifically, this study considers four sectors - power[3], cement industry, transport and construction and identifies appropriate instruments for pollution control across these sectors. The choice of instruments depends on either cost benefit analysis, cost effective analysis or environmental effectiveness analysis. Keeping in view the India's move soon towards the Goods and Services Tax (GST) regime, the study also explores the potential means to integrate environmental considerations in the context of indirect tax reforms unfolding in India.

[3] As low carbon industrial development will rely upon initiatives being taken in each of the following areas: (i) improving the efficiency with which energy is used, (ii) creating shifts in demand for energy and (iii) switching the source of power and heat/cooling supply towards sources with a lower GHG intensity per unit of energy demand, the study included the power sector in the analysis.

The rest of the report is structured as follows: The second and third chapters provide the profile of the economy and environment of Tamil Nadu. The fourth chapter discusses the industrial policy scenario in Tamil Nadu with special attention to the environmental dimensions and also provides a brief discussion on the international experience with regard to use of economic instruments for environmental management. The fifth chapter outlines the potential industries and sectors that could facilitate climate friendly development in Tamil Nadu. The next chapter describes the selected fiscal instruments along with the national and international experience with regard to implementation of such instruments. The seventh chapter describes the design features of the selected fiscal instruments for climate friendly development in Tamil Nadu and illustrates the effectiveness of some of the instruments. The last chapter discusses the implementation strategies and provides policy conclusions.

Chapter 2

TAMIL NADU ECONOMY: AN OVERVIEW

Introduction

This Chapter highlights the key features of the economy of Tamil Nadu. While it makes up only 4 percent of India's land area, it accounts for almost 5.96 percent of the India's population of 1210 million as enumerated in the 2011 census. Tamil Nadu, one of the comparatively developed states in the country, ranks first in credit deposit ratio, second in competitiveness index, third in industrial development and fourth in terms of per capita income[4] among the major Indian states. Its gross state domestic product (GSDP) comes largely from the non-agricultural sector. Tamil Nadu has also done well in terms of human development indicators.[5] Three key features of the Tamil Nadu economy are (i) growing share of services sector, (ii) volatility of its GSDP and its vulnerability to global shocks; and (iii) growing urbanization and urbanization of poverty. The central challenge is to absorb population migrating from rural to urban areas into productive activities by devoting much larger resources to education and ensuing high, sustained and inclusive growth.

Structure of GSDP

Like in many other Indian States, the structure of GSDP in Tamil Nadu has been shifting away from agriculture towards non-agriculture, particularly services. The share of primary sector in total GSDP (in 1999-00 prices) of Tamil Nadu in 1993-94 was about 23 percent and the shares of secondary and tertiary sectors were 33.7 and 41.5 percent respectively (not shown). As indicated in Table 2.1, the share of primary declined to about 12 percent in 2004-05 (at 2004-05 prices) and further to 8.8 percent in 2011-12. During 2004-05 to 2011-12, the share of secondary sector declined marginally from 30.9 percent to 30.2 percent and the contribution of tertiary sector increased from 57.2 percent to 61 percent. At all India level too, the share primary in GDP factor cost declined from 21.9 percent in 2004-05 to 16.1 percent in 2011-12. The share of secondary sector remained at 25 percent while the share of tertiary sector increased from 53 percent to 59 percent. Thus, the major portion of GSDP comes from services (about 61 percent). Industries contribute nearly 30 percent of GSDP. The share of agriculture is only about 7 percent.

[4] Next only to Maharashtra, Haryana and Gujarat..

[5] It ranks fourth in terms of literacy rate and female literacy in 2011 and third in infant mortality rate. It also ranks fourth in life expectancy at birth.

Table 2.1: Share of GSDP (GDP) in Tamil Nadu (India) at 2004-05 Prices

(Percent)

Sectors	2004-05	2005-06	2006-07	2007-08	2008-09	2009-10	2010-11	2011-12
Tamil Nadu								
Primary *of which*	11.9	11.7	11.4	10.3	9.6	9.3	8.8	8.8
Agriculture	9.6	9.4	9.4	8.5	7.8	7.6	7.2	7.2
Secondary *of which*	30.9	31.1	30.6	30.0	28.0	30.7	30.6	30.2
Manufacturing	19.8	20.0	20.6	19.6	18.4	21.6	21.5	20.7
Construction	9.0	9.2	8.3	9.3	9.3	8.9	8.5	8.6
Tertiary *of which*	57.2	57.3	57.9	59.7	62.4	60.0	60.6	61.0
Transport, Storage & Communication	9.3	9.1	9.0	9.3	9.7	9.6	9.5	9.7
Trade, Hotels and Restaurants	17.1	17.4	18.2	17.9	17.7	16.8	16.5	15.9
Real Estate, Ownership of Dwellings	10.5	10.6	10.7	11.8	12.8	12.3	12.4	13.1
Other Services	20.4	20.1	20.0	20.7	22.2	21.3	22.2	22.3
GSDP	100	100	100	100	100	100	100	100
India								
Primary *of which*	21.9	20.9	20.0	19.3	18.1	17.0	16.8	16.1
Agriculture	16.0	15.5	14.7	14.3	13.4	12.4	12.3	n.a
Secondary *of which*	25.1	25.3	26.1	26.3	25.8	25.8	25.6	24.9
Manufacture	15.3	15.3	16.0	16.1	15.8	16.0	15.8	15.3
Construction	7.7	7.9	8.0	8.1	8.0	7.9	7.9	7.8
Tertiary *of which*	53.0	53.7	54.0	54.4	56.1	57.2	57.7	59.0
Transport, Storage & Communication	8.4	8.6	8.8	9.1	9.4	10.0	10.6	10.7
Trade, Hotels & Restaurant	16.1	16.5	16.7	16.8	16.6	16.6	16.6	17.4
Real Estate, Ownership of Dwellings	9.0	9.0	9.0	9.0	9.3	9.2	9.1	n.a
Other Services	19.6	19.6	19.4	19.6	20.7	21.4	21.3	n.a
GDP at factor cost	100	100	100	100	100	100	100	100

Source (Basic Data): Government of India, Central Statistical Organisation. n.a means not available.

Table 2.2 indicates the sectoral shares of employment and corresponding growth rates in recent years. Comparing the share of workforce in different sectors with those in GSDP, it is noted that the primary sector has a share in employment (43.8 percent in 2007-08) that is far exceeding its share in output (11.85 percent in 2007-08). Correspondingly, the services sector employs far less than its share in GSDP. It is only the secondary sector that contributes to a share in employment at 28.7 percent in 2007-08 and is comparable with its share in GSDP at 30 percent.

Table 2.2: Composition and Growth of Sectoral Employment

Sectors	1993-94	1999-00	2004-05	2007-08*
Composition of Work Force (in Lakh)				
Primary	154.81	145.65	127.42	122.16
Secondary	62.43	68.53	84.87	80.05
Tertiary	68.36	75.56	94.37	76.70
Total	285.6	289.74	306.66	278.91
Sectoral Shares (percent)				
Primary	54.21	50.27	41.55	43.80
Secondary	21.86	23.65	27.68	28.70
Tertiary	23.94	26.08	30.77	27.50
Total	100	100	100	100
Growth Rates (percent)				
Primary		-5.92	-12.52	-4.13
Secondary		9.77	23.84	-5.68
Tertiary		10.53	24.89	-18.72
Total		1.45	5.84	-9.05

Source: Government of Tamil Nadu (2007), Eleventh Five Year Plan 2007-2012. * NSS 64th Round (2010), Employment and Unemployment Situation in India: 2007-08.

It can be seen from Table 2.2 that the growth rates in agriculture employment during 1993-94 to 1999-00, 1999-00 to 2004-05 and 2004-05 to 2007-08 were negative. Between these periods, the agriculture share in total employment had progressively come down. Correspondingly, shares of other sectors had gone up (except the tertiary between 2004-05 and 2007-08). The employment pattern indicates that there will be a growing number of job-seekers moving towards the non-agricultural sectors and urban areas, putting pressure on the urban services and urban infrastructure.

Sectoral Growth Pattern

Table 2.3 shows the sectoral growth pattern during 2005-06 to 2011-12. The 7-year average annual growth in the primary sector (including agriculture) was 5.2 percent. In 2007-08 and 2008-09, growth rates of the primary sector and agriculture have been negative due to bad monsoon. The growth rates of manufacturing and tertiary sectors also declined significantly in those years due to global slowdown. As a result, the overall GSDP growth also declined significantly. In 2009-10, the growth rates of agriculture and manufacturing improved. After that manufacturing growth declined significantly due to global slowdown again (due to Euro crisis) and power supply. It is noted that among the services, the sector comprising the trade, hotels and restaurant registered a slow pace of growth in the recent years. This may be due to the impact of global slowdown.

Table 2.3: Annual Growth Rates: GSDP and GDPfc at 2004-05 Prices

(Percent)

Sectors	2005-06	2006-07	2007-08	2008-09	2009-10	2010-11	2011-12	7 year Aver-age	5 year Aver-age (XI Plan)
Tamil Nadu									
Primary *of which*	12.1	12.8	-4.1	-2.3	6.3	4.4	6.9	5.2	2.2
Agriculture	11.5	15.4	-4.7	-2.7	6.3	4.2	8.0	5.4	2.2
Secondary *of which*	14.5	13.6	3.9	-2.1	21.1	9.3	6.2	9.5	7.7
Manufacture	15.1	18.8	0.6	-1.3	29.2	9.7	3.5	10.8	8.3
Construction	16.2	4.4	18.6	5.3	5.2	5.1	9.2	9.1	8.7
Tertiary *of which*	14.0	16.6	9.3	9.6	6.1	11.0	8.0	10.7	8.8
Transport, Storage & Communication	12.4	13.6	9.3	9.5	9.4	9.0	8.9	10.3	9.2
Trade, Hotels and Restaurants	16.3	20.6	4.3	3.7	4.5	7.9	3.7	8.7	4.8
Real Estate, Ownership of Dwellings	15.2	16.5	16.7	13.4	6.8	10.6	13.1	13.2	12.1
Other Services	12.3	14.5	9.9	12.7	5.6	14.4	8.1	11.1	10.2
GSDP	14.0	15.2	6.1	4.9	10.4	9.8	7.4	9.7	7.7
India									
Primary *of which*	4.6	4.6	5.5	0.4	1.7	6.8	2.3	3.7	3.3
Agriculture	5.5	4.1	6.3	-0.3	0.7	7.8		4.0	3.6
Secondary *of which*	10.7	12.7	10.3	4.7	8.6	7.4	3.8	8.3	6.9
Manufacture	10.1	14.3	10.3	4.3	9.7	7.6	2.5	8.4	6.9
Construction	12.8	10.3	10.8	5.3	7.0	8.0	5.3	8.5	7.3
Tertiary *of which*	10.9	10.1	10.3	10.0	10.5	9.3	8.9	10.0	9.8
Transport, Storage & Communication	11.8	12.6	12.5	10.8	14.8	14.7	7.8	12.1	12.1
Trade, Hotels & Restaurant	12.2	11.1	10.1	5.7	7.8	9.0	11.3	9.6	8.8
Real Estate, Ownership of Dwellings	10.6	9.5	8.4	10.4	7.8	6.9		9.0	8.4
Other Services	9.6	8.3	10.3	13.1	11.8	8.2		10.2	10.8
GDP at factor cost	9.5	9.6	9.3	6.7	8.4	8.4	6.5	8.3	7.9

Source (Basic Data): Government of India, Central Statistical Organisation.

Chart 2.1 clearly shows that after 2006-07, agriculture, manufacture and the sector comprising the trade, hotels and restaurant registered a slow pace of growth. As a result the average growth in the Eleventh Plan declined to 7.7 percent from its 7 year average of 9.7 percent.

Chart 2.1: Growth of Selective Sectors in Tamil Nadu

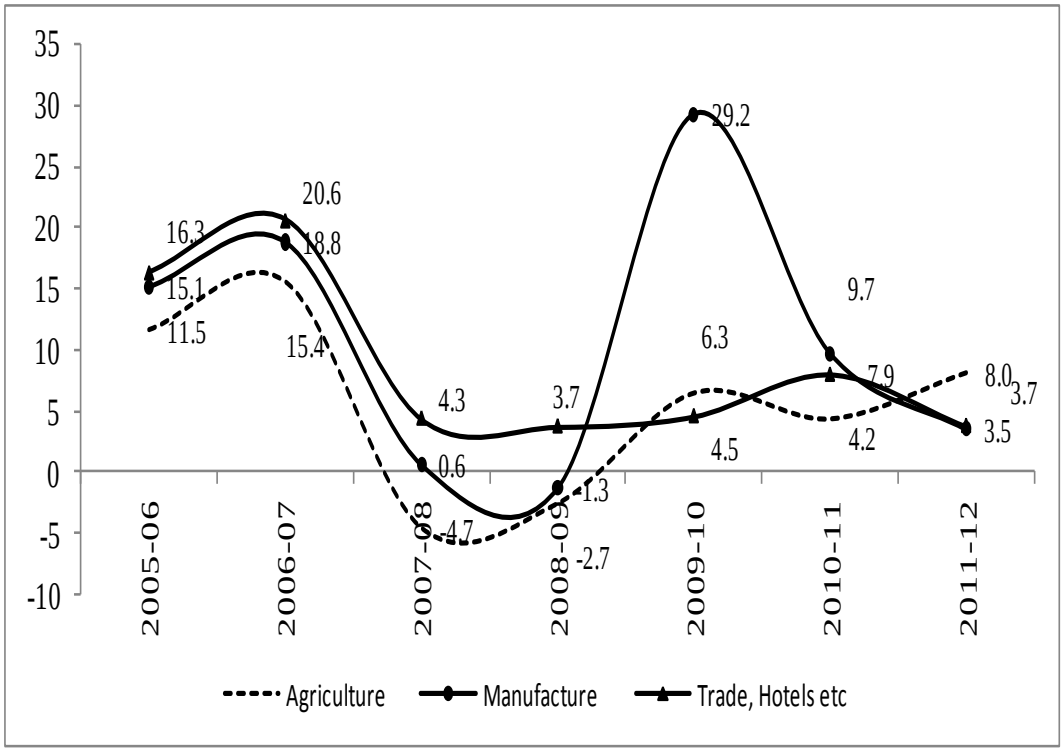


Table 2.4 shows the likely sectoral structure of the Tamil Nadu economy with alternative assumptions regarding growth rates during 2011-12 and 2021-22. In the first case, the historical growth rates (during 2000-01 to 2011-12) are used while in the Scenario 2 the target growth rates suggested in Twelfth Plan are used. In both cases, the share of agriculture may shrink to about 5 percent in 2021-22. The shares of industry and services may be about 29 percent and 66 percent respectively. Table 2.5 shows the likely values of GSDP in both the scenarios.

Table 2.4: Changing Structure of GSDP in Tamil Nadu: 2011-12 and 2021-22 (Alternative Scenarios and Sectoral Shares)

(Percent)

Sectors	Growth Matrix	2011-12	2012-13	2013-14	2014-15	2015-16	2016-17	2017-18	2018-19	2019-20	2020-21	2021-22
Scenario 1												
Primary	3.0	8.8	8.4	8.0	7.6	7.3	6.9	6.6	6.3	6.0	5.7	5.4
Secondary	7.6	30.2	30.1	30.0	29.9	29.8	29.7	29.6	29.5	29.3	29.2	29.1
Tertiary	8.8	61.0	61.5	62.0	62.4	62.9	63.4	63.8	64.2	64.7	65.1	65.5
GSDP	8.0	100	100	100	100	100	100	100	100	100	100	100
Scenario 2												
Primary	5.0	8.8	8.3	7.9	7.4	7.0	6.6	6.3	5.9	5.6	5.3	5.0
Secondary	10.5	30.2	30.1	30.0	29.9	29.7	29.6	29.4	29.2	29.1	28.9	28.7
Tertiary	12.0	61.0	61.6	62.2	62.7	63.3	63.8	64.3	64.8	65.3	65.8	66.3
GSDP	11.0	100	100	100	100	100	100	100	100	100	100	100

Source: Computed by authors.

Table 2.5: Projected Values of GSDP: 2011-12 to 2021-22

(Rs. Crore)

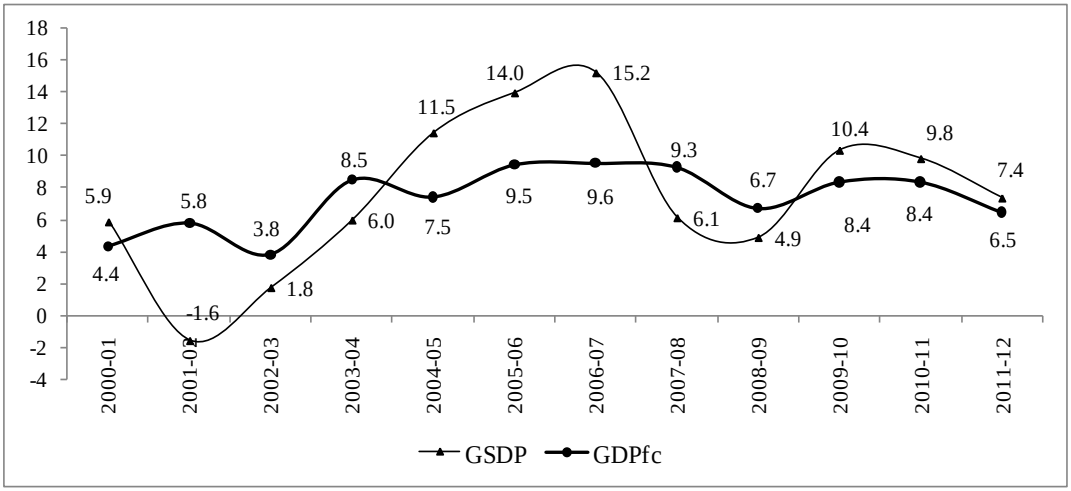
Sectors	2011-12	2012-13	2013-14	2014-15	2015-16	2016-17	2017-18	2018-19	2019-20	2020-21	2021 22
2004-05 Prices											
Scenario 1	416549	449576	485330	524042	565960	611355	660518	713768	771451	833939	901640
Scenario 2	416549	462089	512768	569175	631967	701878	779728	866430	963004	1070588	1190451
2011-12 Prices											
Scenario 1	581635	628166	678419	732693	791308	854613	922982	996820	1076566	1162691	1255706
Scenario 2	581635	645615	716632	795462	882963	980089	1087899	1207567	1340400	1487844	1651507

Source: Computed by authors.

Comparing Tamil Nadu Growth with Growth in India

Comparing the growth performance Tamil Nadu (at constant prices) with growth of the country during 2000-01 to 2011-12, three features stand out: (a) Tamil Nadu growth is highly vulnerable to external shocks in recent years; (b) there is a greater volatility in Tamil Nadu's growth rate as compared to the GDP growth rate; and (c) GSDP growth in Tamil Nadu roughly follows the path of GDP growth. When GDP rises, the GSDP of Tamil Nadu rises faster and when GDP falls, it declines even faster (Chart 2.2). During 2000-01 to 2011-12, Tamil Nadu economy grew at an average rate of 7.6 percent while the Indian economy grew at 7.4 percent.

Chart 2.2: Growth Rate of Tamil Nadu GSDP and the Overall GDP Growth of the Economy



The market size as indicated by the Tamil Nadu's share of GSDP increased from 7.37 of GDP in 2004-05 to 8.07 percent in 2006-07. Then it declined to 7.7 in 2008-09 as a result of global slowdown and then started increasing and reached 8.01 percent level in 2011-12 (Table 2.6).

Table 2.6: Tamil Nadu's Share of GDP (at 2004-05 prices)

Details	2004 -05	2005 -06	2006 -07	2007 -08	2008 -09	2009 -10	2010 -11	2011 -12
TNGSDP	219003	249567	287530	305157	320085	353237	387973	416549
GDP	2971464	3253073	3564364	3896636	4158676	4507637	4885954	5202514
TN Share(%)	7.37	7.67	8.07	7.83	7.70	7.84	7.94	8.01

Source: As in Table 2.3.

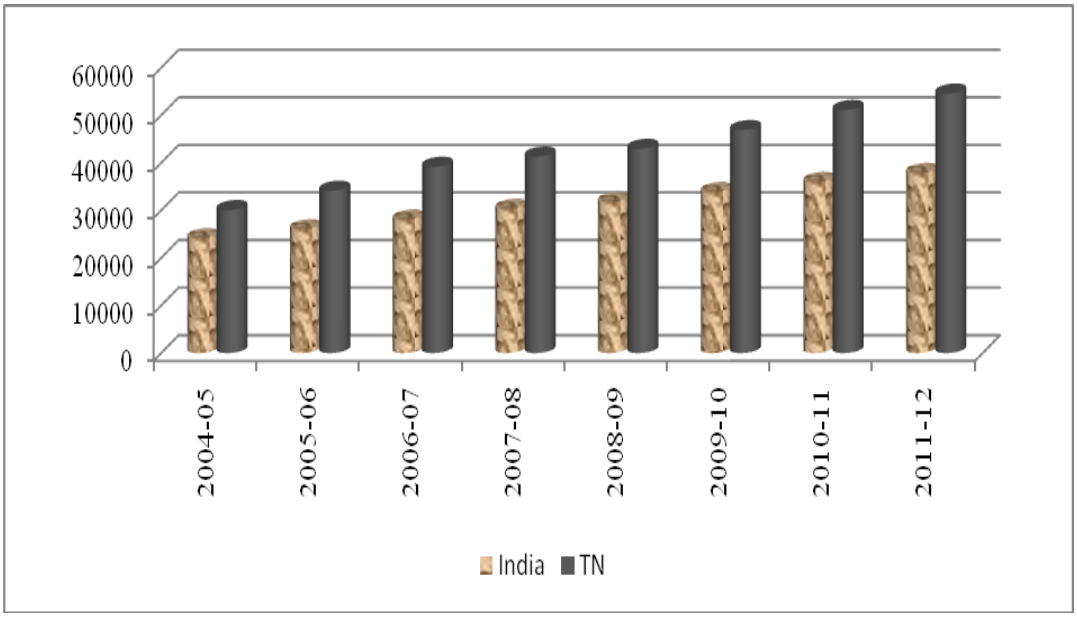
During 2005-06 to 2011-12, the average growth of per capita income of Tamil Nadu in 2004-05 prices (measured in Net State Domestic Product) was 8.95 percent and that of all India was 6.64 percent. During this period, the per capita income of the state was always higher than that of the nation (Table 2.7 and Chart 2.3). In 2011-12, the per capita income (in 2004-05 prices) of Tamil Nadu was Rs. 54550 while the per capita income the country was Rs. 37851.

Table 2.7: Growth of Per Capita Income (in 2004-05 Prices)

Details	2004 -05	2005 -06	2006 -07	2007 -08	2008 -09	2009 -10	2010 -11	2011 -12
India	24143	26015	28067	30332	31754	33843	35993	37851
		(7.75)	(7.89)	(8.07)	(4.69)	(6.58)	(6.35)	(5.16)
TN	30062	34126	39166	41314	42936	46886	51117	54550
		(13.52)	(14.77)	(5.48)	(3.93)	(9.20)	(9.02)	(6.72)

Source (Basic Data): Government of India, Central Statistical Organisation. Figures in parentheses are annual growth rates.

Chart 2.3: Per Capita Income: Tamil Nadu and All India (2005-05 Prices)



Poverty in Tamil Nadu

Tamil Nadu has been very successful in reducing poverty. During the period 1973-74 to 2009-10, the number of total poor decreased from 2.4 crore to nearly 1.22 crore (not shown). However, all of this reduction in the number of poor comes from rural areas. The number of urban poor actually increased over time in absolute terms reaching a peak of 80.4 lakh in 1993-94. After 1993-94, there was a reduction in the number of urban poor but even in 2009-10 the absolute number of urban poor was 43.5 lakh.

Chart 2.4: Head Count Ratio in Tamil Nadu and Urban Poor as % of Total Poor

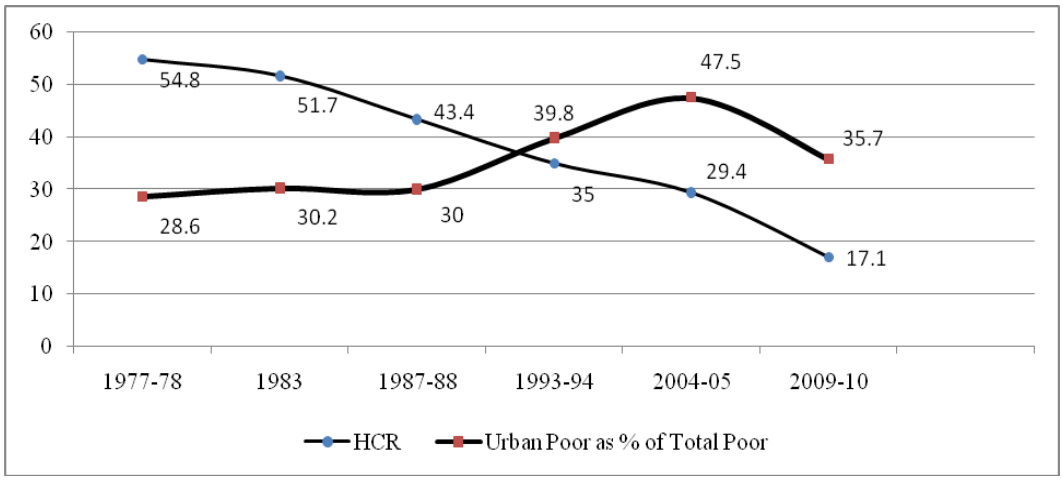


Chart 2.4 indicates the progress in reducing the head count ratio in Tamil Nadu. The share of urban poor in total poor increased significantly from 30 percent in 1987-88 to 47.5 percent in 2004-05. But it declined to 35.7 percent in 2009-10. These figures are only indicative, as people debate on comparing the poverty estimates from different years.

Urbanization

Tamil Nadu is the most urbanized state in the country. Nearly 50 percent people live in urban areas. Rapid urbanization creates pressure on urban amenities like housing, water supply, sanitation, solid waste management etc. The government has established an 'Urban Development Mission' for all cities and towns to improve urban amenities. Two new special programmes viz., "Chennai Mega City Development Mission" for Chennai and its sub urban areas, and the "Integrated Urban Development Mission" for all other urban area are proposed to achieve the objective of developing urban areas into sustainable cities and ensure equitable benefits to all the sections of the society. The government has also proposed to develop ten world class cities, thereby facilitating regional and balanced development across the state. 25 lakh affordable houses are proposed to build in order to create hut free and slum free cities.

Inter State Comparison

An interstate comparison reveals that Tamil Nadu ranks fourth in per capita income (in 2004-05 prices) among the major Indian states (Table 2.8). During 2005-12, its average annual GSDP growth was 9.68 percent which is higher than all India GDP growth of 8.34

percent and GSDP growth of any of the southern states. But Uttarkhand's ranked first with its GSDP growth of 13.75 percent. Interestingly, the poor state -Bihar recorded a double digit growth during this period and obtained the second rank. Tamil Nadu ranked sixth in agriculture growth (5.37 percent). It ranked ninth in industry growth and eight in services growth.

Table 2.8: 7 Year Average Annual Growth of GSDP and Sectors of Major States (2005-06 to 2011-12) in 2004-05 prices

(Percent)

States	Agri.& Allied	Rank	Indus-try	Rank	Servi-ces	Rank	GSDP	Rank	PCI 2011-12
Maharashtra	4.69	10	10.76	5	10.46	10	9.97	4	64951
Haryana	4.15	11	7.43	13	12.90	2	9.39	6	62825
Gujarat	6.47	2	10.90	4	11.10	5	9.98	3	56398
Tamil Nadu	5.37	6	9.36	9	10.67	8	9.68	5	54550
Kerala	-0.22	20	6.58	16	10.77	7	8.31	12	53427
Uttarakhand	2.31	16	18.25	1	14.77	1	13.75	1	52125
Himachal Pradesh	1.55	18	9.00	11	11.44	4	8.29	13	49817
Punjab	1.73	17	11.08	3	8.13	20	7.11	15	46788
Andhra Pradesh	4.96	9	9.74	7	10.25	12	8.90	8	42685
Karnataka	5.12	8	7.42	14	10.02	13	8.37	11	40410
West Bengal	2.56	15	5.34	17	9.14	16	6.94	17	33470
Chhattisgarh	7.27	1	9.37	8	10.53	9	9.15	7	29635
Jammu & Kashmir	1.30	19	4.73	18	9.12	17	5.97	20	29195
Rajasthan	5.86	5	7.48	12	9.20	15	7.78	14	27421
Odisha	3.15	13	9.35	10	10.45	11	8.52	10	26900
Jharkhand	6.32	4	2.68	19	11.93	3	6.53	18	24974
Madhya Pradesh	6.42	3	9.91	6	9.51	14	8.77	9	24598
Assam	4.08	12	2.67	20	8.68	19	6.05	19	22956
Uttar Pradesh	3.01	14	7.35	15	9.10	18	7.04	16	18099
Bihar	5.36	7	15.79	2	11.05	6	10.17	2	13971
India	**3.72**		**7.85**		**9.99**		**8.34**		**37851**

Source (Basic Data): Government of India, Central Statistical Organisation; States are arranged according to descending order of per capita income.

Table 2.9 provides the details of selective indicators of development in major Indian states in India. Tamil Nadu ranks first in bank credit-deposit ratio, third in infant mortality rate (IMR), and fourth in literacy rate and life expectancy at birth. In terms of competitiveness index, Tamil Nadu ranks second. This index was prepared based on a methodology developed by the Institute of Competitiveness by Mann and Kapur and published in Business World (April 5, 2010). This aggregate index made up four

constituents, viz., factor conditions, demand conditions, strategic context and supporting conditions. Tamil Nadu ranks first in terms of both strategic context and supporting conditions. It ranks third in factor conditions and sixth in demand conditions (not shown).

Table 2.9: State Wise Selective Indicators of Development

States	IMR (2010)	Rank	Credit-Deposit Ratio (2011)	Rank	Life Expectancy at Birth (2002/6)	Rank	Literacy Rate (2011)	Rank	Competi-tiveness Index (2010)
Maharashtra	20	2	87.0	4	67.2	3	82.9	3	59.5
Tamil Nadu	22	3	117.2	1	66.2	4	80.3	4	56.4
Andhra Pradesh	33	12	114.9	2	64.4	8	67.7	17	53.9
Gujarat	30	8	64.3	9	64.1	9	79.3	6	53.5
Punjab	28	7	76.9	6	69.4	2	76.7	8	53.1
Karnataka	28	6	74.6	8	65.3	6	75.6	10	52.3
Haryana	38	15	83.2	5	66.2	5	76.6	9	51.3
Himachal Pradesh	40	16	40.0	15	na	na	83.8	2	49.7
Kerala	10	1	75.9	7	74	1	93.9	1	49.2
Uttarakhand	25	5	32.9	18	na	na	79.6	5	48.9
Uttar Pradesh	44	20	41.9	14	60	12	69.7	15	48.5
Rajasthan	31	10	96.4	3	62	10	67.1	19	47.5
West Bengal	25	4	57.2	11	64.9	7	77.1	7	47.1
Madhya Pradesh	42	17	59.3	10	58	15	70.6	14	47.0
Odisha	43	18	50.2	13	59.6	13	73.5	11	45.0
Assam	36	13	34.0	16	58.9	14	73.2	12	44.0
Bihar	38	14	26.9	20	61.6	11	63.8	20	42.9
Jharkhand	30	9	33.6	17	na	na	67.6	18	42.5
Chhattisgarh	44	19	50.8	12	na	na	71.0	13	42.0
Jammu & Kashmir	32	11	27.7	19	na	na	68.7	16	na
India	31		74.6		63.5		74.0		

Source: For IMR the SRS Bulletin; For Competitiveness Index, Business World (April 5, 2010), and for others, Economic Survey of India. States are arranged according their performance in competitiveness index.

Recent Initiatives by the Government of Tamil Nadu

As the growth in the Eleventh Plan (7.7 percent) has declined as compared to the Tenth Plan (9.7 percent), the newly elected Government in June 2011 identified the need for formulating a succinct strategy for rejuvenation of economic and social growth and to

reclaim the top position. It has also come out with "Vision 2023: Strategic Plan for Infrastructure Development in Tamil Nadu" to identify thrust areas for growth and bottlenecks in such areas. The Vision 2023 document has identified Ten themes: (i) Economic prosperity, (ii) Inclusive growth, (iii) Health for all, (iv) World class infrastructure, (v) Healthy investment climate, (vi) Innovation hub and knowledge capital of India, (vii) Creating conducive environment for human development, (viii) Nurturing a rich heritage and preserving the ecology, (ix) Protecting against vulnerability and (x) Improving the quality of Institutions and Governance. The details of these themes are given below.

The Ten Vision Themes

1. Tamil Nadu will be amongst India's most economically prosperous states by 2023, achieving a six-fold growth in per capita income (in real terms) over the next 11 years to be on par with the Upper Middle Income countries globally (including Argentina, Brazil, China, Costa Rica, Mauritius, Mexico, South Africa, and Turkey);
2. Tamil Nadu will exhibit a highly inclusive growth pattern – it will largely be a poverty free state with opportunities for gainful and productive employment for all those who seek it, and will provide care for the disadvantaged, vulnerable and the destitute in the state.
3. Tamil Nadu will be India's leading state in social development and will have the highest Human Development Index (HDI) amongst all Indian states.
4. Tamil Nadu will provide the best infrastructure services in India in terms of universal access to Housing, Water & Sanitation, Energy, Transportation, Irrigation, Connectivity, Healthcare, and Education.
5. Tamil Nadu will be one of the top three preferred investment destinations in Asia and the most preferred in India with a reputation for efficiency and competitiveness.
6. Tamil Nadu will be known as the innovation hub and knowledge capital of India, on the strength of world class institutions in various fields and the best human talent.
7. Tamil Nadu will ensure Peace, Security and Prosperity for all citizens and business, enabling free movement and exchange of ideas, people and trade with other Indian states and rest of the world.
8. Tamil Nadu will preserve and care for its ecology and heritage.

9. Tamil Nadu will actively address the causes of vulnerability of the state and its people due to uncertainties arising from natural causes, economic downturns, and other man-made reasons and mitigate the adverse effects.
10. Tamil Nadu will nurture a culture of responsive and transparent Governance that ensures progress, security, and equal opportunity to all stakeholders.

The VISION document estimates that the expenditure on infrastructure creation in Tamil Nadu (by Government and private sector) is 5 percent of GSDP. As the Twelfth Plan is targeting an infrastructure creation at the all India level at 10 percent of India's GDP, the VISION document assumes progressive investment plan. The total investment in infrastructure for the Twelfth Plan period is estimated at Rs. 3.96 lakh crore in VISION 2023 and that for the whole period is estimated at Rs. 15 lakh crore (Table 2.10).

Table 2.10: Projected Infrastructure Investment in VISION 2023

(Rs. Crore)

Year	**2012 -13**	**2013 -14**	**2014 -15**	**2015 -16**	**2016 -17**	**2017 -18**
Investment	41670	61394	84801	93705	114413	126999
Year	**2018-19**	**2019-20**	**2020-21**	**2021-22**	**2022-23**	***Total***
Investment	147376	164325	191188	213175	237690	***1502129***

Source: Vision Tamil Nadu 2023.

Power Sector in Tamil Nadu

Power is one of the key inputs for the overall economic development of any economy. Tamil Nadu ranks sixth in per capita electricity consumption among the major states. The Tamil Nadu Electricity Board (TNEB) ranks third in operation size, gauged by generation capacity and volume of energy sold and size of the consumers. As stated earlier power sector is a major contributor of CO_2 emissions. According to the CII Study to estimate Carbon Footprints for Tamil Nadu, the energy accounts for 75 percent of the total CO_2 emissions of 111862,292 MT (in 2009-10). Within energy sector, the power generation alone contributes nearly 46 percent (CII, 2012).

Power Development

The installed power generation capacity (from conventional sources) of the state was 7924 MW in 2001-02 (end of Ninth Plan). It increased to 10098 MW at the end of the Tenth Plan (i.e., 2006-07) and to 10256 MW in 2011-12. The total generation capacity of

renewable energy was 7572 MW in 2011-12, representing 42.5 percent of the grid capacity of TNEB (Table 2.11).

Table 2.11: Power Generation Capacity in Tamil Nadu

Sources	2002-03	2006-07	2009-10	2011-12
1. States Own	5308	5597	5690	5696
(i) Hydro	1996	2184	2187	2191
(ii) Thermal	2970	2970	2970	2970
(iii) Wind Mill	19	19	18	19
(iv) Gas	323	424	516	516
2. Central Sector	1903	2837	2825	2861
3. External Assistance	0	0	305	305
4. Private	988	1664	1180	1180
5. Captive Plants	70	0	215	214
A. Conventional Sources	8268	10098	10215	10256
6. Wind Mill Private	na	na	4890	6697
7. Bio Mass*	na	na	697	771
8. Solar	na	na	0	10
9. Other	na	na	0	94
B. Renewable Sources			5586	7572
Total			**15801**	**17828**

Source: Policy Note, Energy Department, Government of Tamil Nadu (various issues).

The state purchases power from central sector projects and independent power producers. The own power generation and power purchases forms the gross power availability in the state. The gross power availability increased from 41764 MU in 2000-01 to 77218 MU in 2011-12 (Table 2.12). The share of purchases continuously increased during this period from 40 percent to 64 percent. However, it is noted that the net power availability (after selling power to other states) has been less than gross power availability. Therefore, the power produced within the state is still higher than the net purchase (=purchased minus sold).

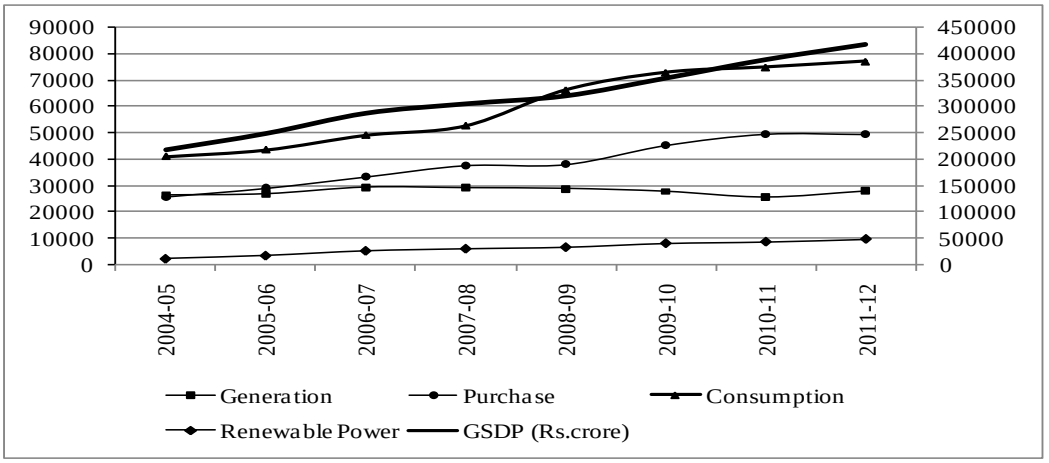
Table 2.12: Power Development in Tamil Nadu

Year	Install-ed cap (MW)	Power Generation (MU)	Power Purchase (MU)	Gross Power Availability (MU)	Net Power Availability (Consump-tion)	Power from Renewable (MU)	Share of Purchases
2000-01	7513	25147	16617	41764	33418	1094	40%
2001-02	7924	25562	18358	43920	35202	1257	42%
2002-03	8268	24929	21263	46192	36077	1306	46%
2003-04	9319	24114	25384	49498	38374	1714	51%
2004-05	9531	26450	25895	52345	41,200	2261	49%
2005-06	10031	26915	29091	56006	43,710	3444	52%
2006-07	10098	29481	33357	62838	49,263	5269	53%
2007-08	10122	29241	37607	66848	52,849	6067	56%
2008-09	10214	28983	37984	66967	66391	6655	57%
2009-10	10214	27862	45125	72987	72987	8146	62%
2010-11	10237	25639	49351	74990	74990	8720	66%
2011-12	10365	27941	49277	77218	77,218	9763	64%

Source: Statistics at a Glance, TNEB (various issues).

Chart 2.5 shows the growth of GSDP (in 2004-05 prices), power generation (in MU) from conventional sources, power purchase, and power consumption in Tamil Nadu from 2004-05 to 2011-12. Until 2007-08, all of them move at almost the same speed. After that the power generation stared decreasing while the consumption and the purchases shifted upward. Chart 2.5 also shows the power from renewable sources. It has been continuously increasing over the years.

Chart 2.5: Demand and Supply of Power in Tamil Nadu



Demand and Supply Elasticity Values

Table 2.13 present the annual growth and elasticity of installed capacity, power generation and power consumption in Tamil Nadu with respect to GSDP real. During 2004-05 to 2011-12, the installed capacity elasticity was 0.1 while the generation elasticity was 0.2. At the same time, the purchase elasticity and consumption elasticity were 0.9 and 1.2 respectively.

Table 2.13: Annual Growth Rates and Elasticity Values of Capacity, Power Generation and Power Consumption

	GSDP	Capacity		Generation		Purchase		Renew.Power		Consumption	
Year	Growth (%)	Growth (%)	Elast-icity	Growth (%)	Elasti-city	Growth (%)	Elasti-city	Growth (%)	Elasti-city	Growth (%)	Elast-icity
2001-02	-1.6	5.5	-3.5	1.7	-1.1	10.5	-6.7	14.9	-9.5	5.3	-3.4
2002-03	1.8	4.3	2.5	-2.5	-1.4	15.8	9.0	3.9	2.2	2.5	1.4
2003-04	6.0	12.7	2.1	-3.3	-0.5	19.4	3.2	31.3	5.2	6.4	1.1
2004-05	11.5	2.3	0.2	9.7	0.8	2.0	0.2	31.9	2.8	7.4	0.6
2005-06	14.0	5.2	0.4	1.8	0.1	12.3	0.9	52.4	3.8	6.1	0.4
2006-07	15.2	0.7	0.0	9.5	0.6	14.7	1.0	53.0	3.5	12.7	0.8
2007-08	6.1	0.2	0.0	-0.8	-0.1	12.7	2.1	15.1	2.5	7.3	1.2
2008-09	4.9	0.9	0.2	-0.9	-0.2	1.0	0.2	9.7	2.0	25.6	5.2
2009-10	10.4	0.0	0.0	-3.9	-0.4	18.8	1.8	22.4	2.2	9.9	1.0
2010-11	9.8	0.2	0.0	-8.0	-0.8	9.4	1.0	7.1	0.7	2.7	0.3
2011-12	7.4	1.2	0.2	9.0	1.2	-0.1	0.0	12.0	1.6	3.0	0.4
Average											
Since 2001-02	7.8	3.0	0.2	1.1	-0.2	10.6	1.1	23.0	1.5	8.1	0.8
Since 2004-05	9.9	1.4	0.1	2.1	0.2	8.8	0.9	25.4	2.4	9.3	1.2

Source: Computed by authors.

Projections of Demand and Supply of Power

Table 2.14 presents the estimated power generation by the conventional and renewable sources and demand for power during 2012-13 to 2021-22. These projections are based on the average elasticity of respective variables with respect to GSDP during 2004-05 to 2011-12 (as given in Table 2.3) and assumed GSDP growth of 8 percent (long term growth rate) and 11 percent (target growth rate). With historical rate of growth of GSDP of 8 percent per annum (Scenario 1), the power generation from conventional sources is likely to be 32748 MU in 2021-22 (from 27941 MU in 2011-12) and the from renewable sources is likely to be 56539 MU. With the target growth of 11 percent (Scenario 2), they are likely to reach 34734 MU and 101638 MU.

Table 2.14: Baseline Projections of Power Generation in Tamil Nadu

Year	Power Generation (MU)	Power Purchase (MU)	Gross Power Availability (MU)	Net Power (Consumption) (MU)	Power from Renewable (MU)
Scenario 1: Average Elasticity Values Since 2004-05 and GSDP Growth of 8%					
2012-13	28388	52825	81213	84631	11638
2013-14	28842	56628	85471	92755	13872
2014-15	29304	60706	90009	101660	16535
2015-16	29773	65076	94849	111419	19710
2016-17	30249	69762	100011	122116	23495
2017-18	30733	74785	105518	133839	28005
2018-19	31225	80169	111394	146687	33383
2019-20	31724	85941	117666	160769	39792
2020-21	32232	92129	124361	176203	47432
2021-22	32748	98763	131510	193119	56539
Scenario 2: Average Elasticity Values Since 2004-05 and GSDP Growth of 11%					
2012-13	28556	54155	82711	87411	12340
2013-14	29184	59517	88701	98949	15598
2014-15	29826	65409	95235	112010	19716
2015-16	30482	71884	102367	126796	24921
2016-17	31153	79001	110154	143533	31501
2017-18	31838	86822	118660	162479	39817
2018-19	32539	95418	127956	183926	50329
2019-20	33254	104864	138118	208204	63615
2020-21	33986	115245	149231	235687	80410
2021-22	34734	126655	161388	266798	101638

Source: Computed by authors.

Comparison with State Finance Commission Estimates

Table 2.15 compares the estimates of power availability and power demand reported here with the estimates provided by the State Finance Commission up to 2016-17 (end of the Twelfth Plan). To compute the power availability, the gross power availability is combined with power from renewable sources. Projections in Scenario 1 are closer to the Finance Commission values.

Table 2.15: Comparison with State Finance Commission Estimates of Power Situation

	Finance Commission Estimates (in MW)		Projections Reported in this Study (in MW)			
Year	**Total Power Availability**	**Demand**	**Gross Power +Renewal Power (Scenario 1)**	**Demand (Scenario 1)**	**Gross Power +Renewal Power (Scenario 2)**	**Demand (Scenario 2)**
2012-13	11888	13459	14133	12881	14468	13305
2013-14	11775	14536	15121	14118	15875	15061
2014-15	11371	15699	16217	15473	17496	17049
2015-16	11856	16955	17437	16959	19374	19299
2016-17	19740	18311	18798	18587	21561	21847

Source: Computed by authors.

State Finances: A Brief Review

Tamil Nadu has managed its finances in a fiscally prudent manner. Like all other state governments, Tamil Nadu had also witnessed a serious deterioration in various indicators of fiscal balance towards the end of the nineties and the early years of the current decade including large revenue deficits, and large fiscal deficit relative to GSDP. But these imbalances were brought under prudent limits in the framework of Fiscal Responsibility and Budget Management Act (FRBMA), which was enacted in 2003, making Tamil Nadu one of the first states to enact such legislation even prior to the recommendation of the Twelfth Finance Commission.

Since 2005-06, the revenue account in Tamil Nadu showed surplus except in two years 2009-10 and 2010-11 (Table 2.16). However, in those years also it was less than 1 percent of GSDP. The fiscal deficit relative to GSDP kept below 3 percent in all years except in 2010-11. In 2010-11, it was 3.21 percent. This could be mainly because of a sudden 0.6 percentage point increase of capital outlay-GSDP ratio in that year over the previous year. The accumulation of primary deficit that remains un-neutralized by the excess of growth over interest rate results in an increase in outstanding liabilities of the government. In Tamil Nadu, the outstanding liabilities relative GSDP was 22.75 percent in 2004-05. After this year, it started decreasing and reached 18.4 percent level in 2007-08. Then it started increasing marginally and was slated to be 21.67 percent in 2011-12. This may be an acceptable level as the Twelfth Finance Commission suggested an overall target of 28 percent for the states as whole.

Table 2.16: Tamil Nadu State Finances: Selected Fiscal Aggregates

Fiscal Indicators	2004 -05	2005 -06	2006 -07	2007 -08	2008- 09	2009- 10	2010 -11	2011 -12RE
			Rs. crore					
Own Tax Revenues	19357	23326	27771	29619	33684	36547	47782	59932
Own Non-tax Revenues	2208	2601	3423	3304	5712	5027	4651	5543
State's Own Revenue	21565	25926	31193	32923	39396	41574	52434	65475
Total Central Transfers	6886	8033	9720	14597	15646	14270	17754	20078
Share in Taxes and Duties	4236	5013	6394	8065	8511	8756	10914	12715
Grants	2650	3020	3326	6532	7135	5514	6840	7363
Total Revenue Receipts	28452	33960	40913	47521	55042	55844	70188	85553
Total Revenue Expenditure	29155	32009	38265	42975	53590	59375	72916	85016
Revenue Surplus/Deficit	-703	1951	2648	4545	1452	-3531	-2729	537
Fiscal surplus/deficit	-5570	-2251	-3956	-3686	-8548	-11807	-16647	-16597
Capital Outlay	4564	4055	5952	7462	9104	8573	12436	16388
Outstanding Liabilities	49819	57457	60170	64655	74858	88883	111657	126062
GSDP (current price)	219003	257833	310526	350819	401336	473519	518576	581635
			As Percent of GSDP					
Own Tax Revenues	8.84	9.05	8.94	8.44	8.39	7.72	9.21	10.3
Own Non-tax Revenues	1.01	1.01	1.10	0.94	1.42	1.06	0.9	0.95
State's Own Revenue	9.85	10.06	10.05	9.38	9.82	8.78	10.11	11.26
Total Central Transfers	3.14	3.12	3.13	4.16	3.9	3.01	3.42	3.45
Share in Taxes and Duties	1.93	1.94	2.06	2.3	2.12	1.85	2.1	2.19
Grants	1.21	1.17	1.07	1.86	1.78	1.16	1.32	1.27
Total Revenue Receipts	12.99	13.17	13.18	13.55	13.71	11.79	13.53	14.71
Total Revenue Expenditure	13.31	12.41	12.32	12.25	13.35	12.54	14.06	14.62
Revenue Surplus/Deficit	-0.32	0.76	0.85	1.3	0.36	-0.75	-0.53	0.09
Fiscal surplus/deficit	-2.54	-0.87	-1.27	-1.05	-2.13	-2.49	-3.21	-2.85
Capital Outlay	2.08	1.57	1.92	2.13	2.27	1.81	2.4	2.82
Outstanding Liabilities	22.75	22.28	19.38	18.43	18.65	18.77	21.53	21.67

Source (Basic Data): State Budget Documents of Tamil Nadu, various years.

Relative to GSDP, own tax revenues in Tamil Nadu have historically been one of the highest among states for many years. It is slated to be at 10.3 percent in 2011-12. The slightly lower figure for own tax revenue relative to GSDP in 2009-10 reflects consensus of the revenue impact of introduction of State VAT which the state has recently implemented. Own non tax revenues relative to GSDP is just 1 percent. Tamil Nadu ranks low in non tax revenues among major Indian States. Part of the reason is that some user charges (such as bus fares) do not go directly to the state's treasury but

are collected by state-owned enterprises. There is some potential for the state to increase the non-tax revenues.

Fiscal transfers to Tamil Nadu come from Finance Commission transfers, Plan grants, and grants under various centrally sponsored schemes. In the aggregate, the transfers remained around 3-4 per cent during the Eleventh Plan period except in 2007-08 (Table 2.16). In that year, it was about 4.2 per cent. The Thirteenth Finance Commission has fixed Tamil Nadu's share in total divisible pool of central taxes at 4.969 per cent (5.047 per cent in the case of services tax) as opposed to 5.305 per cent recommended by the Twelfth Finance Commission. However, the Thirteenth Finance Commission has recommended a total grant of Rs. 11366.9 crore for the five year period for maintenance of roads and bridges, improving delivery of justice, issuing UIDS, forests, water sector, elementary education etc. A grant of comparable magnitude has never been given to Tamil Nadu by earlier Commissions.

Summary

In this Chapter, we have briefly reviewed the key features of Tamil Nadu economy. Tamil Nadu is one of the fastest growing states in the country. During 2005-06 to 201-12, the real growth of its economy was 9.7 percent per annum as against the All-India average rate of growth of 8.3 percent. Its GSDP has come mainly from services, which grow at about 11 percent per annum. Tamil Nadu has the potential to grow at 11 percent per annum. The per capita income of Tamil Nadu has been higher than that of the Nation. However, the inter district distribution of income is much skewed.

Tamil Nadu compares well with other major states in many development parameters. It ranks first in bank credit-deposit ratio, second in competitiveness index, third in IMR, and fourth in both literacy rate and life expectancy at birth. Tamil Nadu has managed its finances in a fiscally prudent manner. Its revenue deficit, fiscal deficit and debt are kept within the norms prescribed in its FRBM act. Rapid urbanization and increasing proportion of urban poor creates pressure on urban amenities like housing, water supply, sanitation, solid waste management etc. However, the Government of Tamil Nadu has recently unveiled a VISION TAMIL NADU 2023 document which indentifies 10 major themes or thrust areas for growth and bottleneck in such areas. It has also spelled out its investment plan. These efforts will be expected to bring Tamil Nadu to top position in near future.

Given that the share of secondary and tertiary sectors in Tamil Nadu are higher than that in the all-India GDP, and since these are the high growth sectors, it is desirable for Tamil Nadu to aim at a growth rate that is at least 1.5 to 2.0 percentage points higher than the National GDP growth rate on a sustained basis. If the real GDP growth rate is likely to average at about 9 percent, the Tamil Nadu GSDP should be targeted to grow to 11 percent per annum in the medium term.

Chapter 3

ENVIRONMENTAL PROFILE OF TAMIL NADU

Introduction

It is in general argued that growth is the principal panacea for environmental issues. Evidence indicates that Tamil Nadu registered higher economic growth (during the nineties) at the cost of environmental quality (Mukherjee and Kathuria, 2006). Tamil Nadu ranks seventh in terms of GHG emission from energy and industry sectors (based on figures in 2000), next to Uttar Pradesh, Madhya Pradesh, Maharashtra, Andhra Pradesh, West Bengal, and Gujarat (Goshal and Bhattacharya, 2007). It also ranks second next only to Maharashtra in CO_2 emissions from road transport. The major concern is to address the environment challenges posed by key industries, energy sector and transport in Tamil Nadu.

As industrial sector is a major contributor to pollution and is subject to various environmental laws and regulations, it is difficult to specify the impact of environmental regulations on industrial performance. However, recent studies show that firms in the organized manufacturing sector have become more energy efficient over a period of time. For example, Goldar (2010) show that (i) the energy intensity (defined as the ratio of energy cost to the value of output) of organized manufacturing industries declined during 1994-2002; (ii) technology, use of IT and location of industries were the significant determinants of energy intensity; (iii) energy productivity or energy use efficiency is relatively higher in Maharashtra, Madhya Pradesh, West Bengal and Delhi (the index is less than one); (iv) energy productivity is relatively lower in Chattisgarh, Jharkhand, Kerala, Punjab, Uttar Pradesh and Uttaranchal; and (v) inter-state variation in energy intensity of plants belonging to an industry could be attributed to differences in plant size, technology, vintage, product composition and energy prices.

Environmental considerations in India have not been carbon (or climate) centric, reflecting the urgent need to address local pollution problems. There have been many studies on health and economic impacts due to pollution. For example, World Bank (1995) for the first time provided an aggregate economy-wide estimate of cost due to environmental pollution in India. The study estimated the health impact of water pollution to be $5,710 million and the agricultural output loss due to soil degradation as $1,942 million. The health impacts of air pollution were assessed as $1,310 million and the loss of live-stock carrying capacity due to rangeland degradation was found to be

$328 million. The cost of deforestation was $214million while the loss of international tourism was $213 million. The total environmental damage was $9.7 billion per year, or 4.5 percent of GDP in 1992 values.

In a subsequent estimate, the World Bank (2005) assessed that the annual economic cost of damage to public health from increased air pollution alone based on RSPM measurements for 50 cities with the total population of 110 million was close to US$ 3 billion in 2004. Recently Mani et al. (2012) provided an estimate of social and financial costs of environmental damage in India by focusing on urban air pollution, indoor air pollution and inadequate water supply, poor sanitation and hygiene. This study estimated the total annual cost of environmental degradation in India at 3.75 trillion rupees, equivalent to 5.7 percent of gross domestic product in 2009.

Deteriorating conditions of certain hot-spot areas further highlight the need for urgent policy intervention. The Blacksmith Institute of New York started a new initiative to identify the worst polluted places of the world in 2006. The top ten worst polluted places are selected on the basis of size of affected population, severity of the toxin involved, impact on children's health and development, evidence of a clear pathway of contamination, and existing and reliable evidence of health impact.

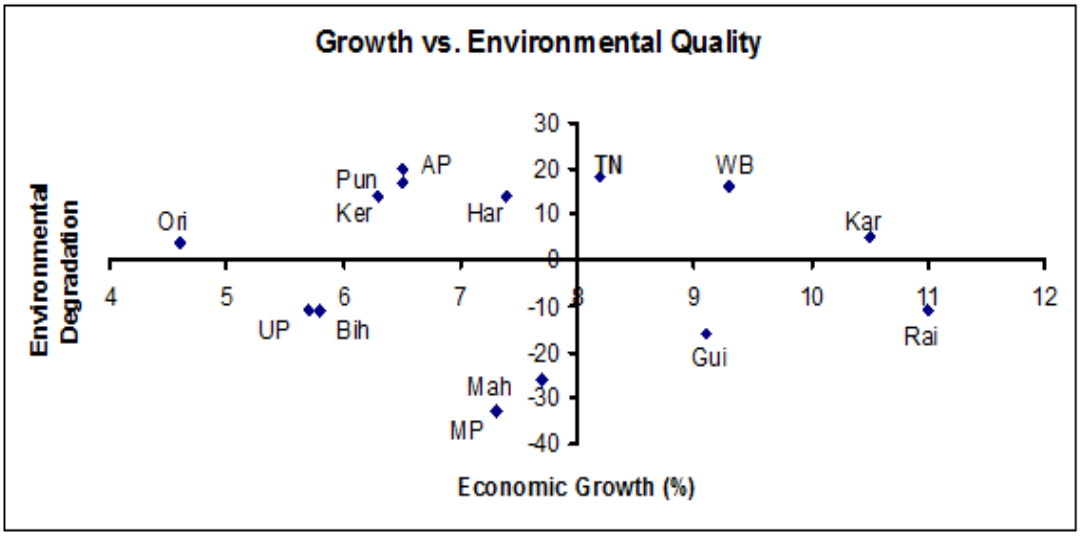
In the 2006 report, Ranipet in Tamil Nadu featured among the top ten worst polluted places (Blacksmith Institute, 2006). While the state government has ordered the closure of Tamil Nadu Chromates and Chemicals Limited a decade ago, the legacy of the same still continues with no solution still in sight for the safe disposal of 1,500,000 tons of solid waste generated by the factory over two decades before its closure.

Blacksmith Institute and Asian Development Bank estimate 3.5 million people as potentially affected people due to ground and surface water contamination. Within five kilometer distance around 68 tanneries operate in Dindigul leading to severe ground water pollution. Tannery-effluents reported to have left only 16 out of 56 wells in Kamatchipuram village uncontaminated forcing people to walk long distances for water. The water and soil pollution from the tannery effluents has the potential to affect about 450,000 people.

Mukherjee and Kathuria (2006) compared the economic growth in major states of India against the observed environmental degradation. The environmental quality is captured through integration of some fourteen indicators and the environmental

degradation in each state is assessed in terms of the change in the environmental quality over 1990s. Chart 3.1 shows the trade-off between the economic growth and the environmental quality across the Indian states. It is observed that along with West Bengal and Karnataka, Tamil Nadu registered higher economic growth during 1990s at the cost of environmental quality.

Chart 3.1: Economic Growth *vs*. Environmental Degradation



Source: Mukherjee and Kathuria, 2006

Given this background, this Chapter provides a brief overview of the state of environment in Tamil Nadu. The next section discusses the some broad environmental concerns in Tamil Nadu including the environmental challenges posed by key industries in Tamil Nadu.

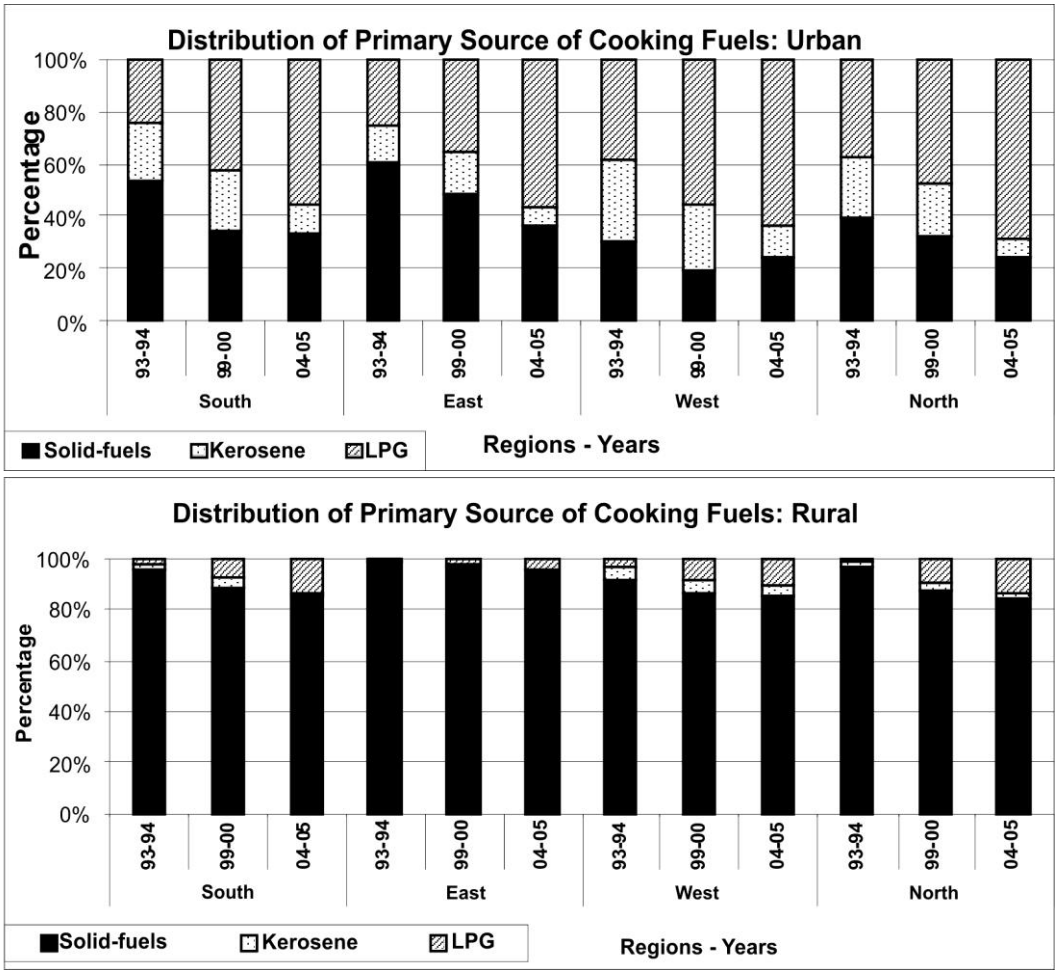
Environmental Issues: Tamil Nadu

Indoor Air Pollution

Large numbers of rural households in Tamil Nadu and in other states of India continue to depend on bio-fuels for cooking. A number of inherent disadvantages of the traditional fuels are widely reported, and these include arduous and time-consuming nature of fuel collection, difficult to control combustion process, and inefficient heat exchange. For instance, cooking with firewood on open fire captures only 15 per cent of thermal energy, while cooking with LPG captures about 60 per cent of energy.

Further the traditional fuels pose serious health threat for persons involved in cooking. Cooking with bio fuels on an open fire within a confined space can lead to acute respiratory problems, particularly for women and children. Studies in India show that about 500,000 premature deaths of children under five and women per annum could be attributable to the indoor pollution caused by the use of bio fuels (Smith, 1998). Smith et al. (2004) observed that most common health problems associated with exposure to indoor air pollution include (a) acute lower respiratory infections (pneumonia) in children, (b) chronic obstructive pulmonary disease, and (c) to lesser extent, lung cancer. Health risks associated with indoor air pollution now considered as one of top ten risk factors in the world – with countries like India and China experiencing the maximum impact due to such risks.

Chart 3.2: Distribution of Cooking Fuels across Zones and Years – Rural and Urban India



Source: Kumar and Viswanathan (2011)

Note: South Zone: Andhra Pradesh, Karnataka, Kerala, Tamil Nadu; East Zone: Bihar, Orissa, Assam, West Bengal; West Zone: Gujarat, Maharashtra, Rajasthan; North Zone: Haryana, Punjab, Madhya Pradesh, Uttar Pradesh.

There are significant regional differences in India in terms of the consumption of solid fuels. Chart 3.2 shows the percentage of households using solid fuels (including firewood, coal/coke, dung cake etc.), kerosene and LPG as primary source for cooking in different geographical zones for four different years in the past several years for rural and urban India, respectively.

In rural India, barring the Eastern Indian states, the rest of the states showed some penetration of LPG with about 10 to 14 percent of households reporting this fuel as primary source for cooking in the year 2009-10. The Western Indian states showed a dramatic shift towards LPG largely from firewood in the period between 2004-05 and 2009-10. The Southern states including Tamil Nadu have not made significant progress towards cleaner fuels.

In urban India, penetration of LPG has been very impressive with all the regions having more than 55 percent of the households consuming LPG as primary cooking fuel in the year 2009-10. Further, in all the regions, kerosene served as transition fuel. In terms of the solid fuels, the Southern states (that include Tamil Nadu) have registered impressive reduction relative to other geographic zones during 2004-05 to 2009-10.

Solid Waste

Table 3.1 provides an overall picture of the solid waste generation in Tamil Nadu. Over 10000 tons of solid waste is generated in Tamil Nadu per day across all municipalities and corporations, with average generation ranging from 13 tons/day to 3500 tons/day. Such wide range of solid waste generation throws significant number of challenges for management, as no one management strategy would fit for all.

Table 3.1: Solid Waste Generation in Tamil Nadu - Overview

Category	Type of City/Town	No.	Quantity (Tonnes/day)	Percentage of total	Average per City (Tonnes/day)
Corporations	Mega City (Chennai)	1	3500	34	3500
	Metro Cities	2	1421	14	710
	Other Corporations	3	948	9	316
Municipalities	Special Grade	13	1366	13	105
	Selection Grade	26	1260	12	48
	Grade – I	38	900	9	24
	Grade – II & III	75	1000	10	13
Total		**158**	**10395**	**100**	

Source: Reports of the Department of Municipal Administration, Govt. of Tamil Nadu.

The solid waste management in Tamil Nadu faces similar challenges as faced in other Indian states (cities) and these include:

- Due to absence of segregation and mixed storage of waste at source, primary collection system is ad-hoc and disorganized;
- Insufficient number and inadequately equipped primary collection points prompts waste dumping along roadsides and in open space;
- Multiple handling of waste at different stages and irregular street sweeping results in inefficient waste transfer and littering;
- Uncovered transportation of waste in tractors and conventional trucks results in littering en route the disposal site;
- Inadequate and ill designed vehicles, under-utilisation of existing vehicles due to frequent break downs coupled with delay in repairs adds to inefficiency; and
- Crude waste dumping in land fill site provides breeding ground for pests and rodents apart from soil and groundwater contamination.

In addition, weak institutional structure and inadequate technical skills and expertise, together with public apathy due to poor community participation make solid waste management one of the pressing issues of urban governance in Tamil Nadu.

Vehicular Pollution

One of the immediate manifestations of urbanization can be seen in terms of increase in vehicular population. With 11 percent share of the total registered vehicles in India (as of March 2011), Tamil Nadu ranks second, next only to Maharashtra in terms of vehicle population. Tamil Nadu registered the highest annual growth of vehicle population of 11.7 percent during 2001 to 2011 (GoI, 2012). Major cities like Chennai, Coimbatore, Salem, Madurai, Tiruchirapalli, Tirunelveli etc., have accounted for almost half of the total vehicles in the state. Chennai itself has a quarter of all the registered vehicles in the state. The registered vehicular population has increased more than two fold during 1996 to 2004.

The ambient levels of major pollutants like Suspended Particulate Matter (SPM), Respirable Suspended Particulate Matter (RSPM), oxides of nitrogen and sulphur are regularly monitored in several cities but concentration levels of toxic chemicals like benzene and lead are not monitored. Among the monitored pollutants, SPM and RSPM levels are often found to be in excess of the standard in Chennai and Madurai cities mainly due to increased vehicular population. Epidemiological studies have shown serious health effects due to this pollution and have advocated regular monitoring of toxics such as lead and benzene.

Industrial Pollution

Industrial activity in Tamil Nadu has traditionally been among the top in India. Five main industrial complexes having chemical, petro-chemical and other industries in Tamil Nadu are: Manali/Ennore, Ranipet. Cuddalore, Mettur and Tuticorin. More than 3000 industrial units in Tamil Nadu have been classified under the highly polluting or 'red' category. The total effluent generated is about 6 lakh liters per day. Of which, large industries generate more than 5 lakh liters (85 percent). About 400 units discharge directly into the rivers. The challenges posed by specific industries in the state are discussed below.

(i) Cement

In the non-metallic mineral segment, Tamil Nadu is the third largest producer of cement in India with its share of 9.77 per cent of annual installed capacity and 10.48 per cent of cement production of the nation (in 2008-09). Tamil Nadu has 16 major plants and 4 mini plants, with an annual installed capacity of 32.27 million tones. In 2008-09, the industry as a whole consumed 35 million tonnes of fly-ash and 7.5 million tonnes of slag. According to the Ministry of Commerce and Industry a continuous increase in the production of blended cement is expected to reduce the problem of waste disposal, improve energy efficiency and reduce carbon footprint. Recently the cement industry has started consuming 75 percent of the fly ash recycled in the country, a hazardous waste posing problems of disposal by thermal power plants. Similarly, the cement Industry has also helped in providing a clean environment by consuming blast furnace slag, which also poses a problem of disposal.[6]

(ii) Thermal Power Plants

Thermal power plants are among the most pollution intensive industries and there are five thermal power stations in the state at Ennore, North Chennai, Mettur, Neyveli and Tuticorin. Table 3.2 shows the level and intensity of emissions from these five power plants. Wide divergence exists among these plants, indicating significant potential for efficiency improvements.

[6] Based on 95th report on Performance of Cement Industry, Rajya Sabha, February 2011, www.rajyasabha.nic.in).

Table 3.2: Thermal Power Plant Emissions in Tamilnadu

Emissions	Ennore	Mettur	Neyvelli	North Chennai	Tuticorn
CO2 Emission per day (Thousand Tons)	4282	19635	10710	14994	23919
CO2 Emission (Kg / KWH)	12.852	10.2812	8.711	10.282	10.139
SO2 Emission per day (Thousand Tons)	0.0304	0.1304	0.2347	0.0999	0.1565
SO2 Emission (Kg / KWH)	0.0086	0.005	0.019	0.0069	0.0066
HO Emission per day (Thousand Tons)	0.039	0.168	0.087	0.116	0.205
NO Emission (Kg / KWH)	0.0101	0.0081	0.0065	0.0082	0.0078
Soot Emission per day (Thousand Tons)	0.00027	0.00123	0.00068	0.00093	0.00139
Soot Emission (Kg / KWH)	0.000077	0.000062	0.000054	0.000063	0.000061
SPM Emission per day (Thousand Tons)	0.01	0.04	0.007	0.03	0.05
SPM Emission (Kg / KWH)	0.003	0.002	0.0006	0.002	0.002

Source: Central Electrical Authority (CEA) Annual Report, 2007-08.

(iii) Leather

Presently, Tamil Nadu accounts for 70 per cent of tanning capacity of India and meets 6 percent of Global Leather requirement. The state has over 9000 registered small and medium firms in the leather sector, about 70 large scale firms and about 40 composite firms. Most of them are concentrated in a handful of locations dominated by the Palar valley in Vellore district and the Cauvery river basin. Spatially, the industry is marked by distinct agglomerations near river basins—a feature that adds to the negative externalities associated with environmentally damaging effects of effluents generated by the industry.

Nearly 1000 tanneries are located in Vellore, Kancheepuram, Dindigul and Erode districts. The effluents have caused serious problems in the Palar basin. Loss of Ecology Authority, Government of India analyzed the impact of tannery pollution on agricultural land and identified bout thirty six thousand individuals for paying compensation to the tune of Rs. 35 crore by the tanneries.

(iv) Textiles

Textile mills in Tamil Nadu are predominantly spinning oriented and provide mass employment. Of 3069 large, medium and small spinning mills in India, 1889 mills (61.55 percent) are located in Tamil Nadu and provide employment to 2.40 lakh persons. is a major knitwear centre in India with more than 9000 small scale units, contributing to 56 percent of knitwear exports from India.

There are large numbers of textile bleaching and dyeing units in Tiruppur, Erode, and Karur, which contaminate the Noyyal, Amaravathy and other water bodies. Due to the continuous discharge of effluents by the processing units for over a decade, the magnitude of pollution has increased in the Tiruppur area resulting in environmental degradation.[7] In 1997, following the Order of the High Court issued an Order that industries which did not have effluent treatment facilities had to close and the remaining units decided to construct effluent treatment plants. Of the 702 units, 278 units are treating their effluents through eight CETPs while 424 units have individual effluent treatment plants.

Due to strict directives from the High Court, it has become somewhat common practice to use the treated and semi-treated water for irrigation purposes. This has resulted in not only th agricultural output loss but also contamination of ground water that is unsuitable for drinking purposes (Mukherjee and Nelliyat, 2006). Amarnath and Krishnamoorthy (2001) have estimated the loss in yield of paddy and sugarcane crops in Vellore district and attributed more than 90 percent of these losses to water pollution.

(v) Paper

The Government of Tamil Nadu established the Tamil Nadu Newsprint and Papers Limited (TNPL) in 1979. The TNPL has emerged as the largest paper mill in India in a single location and the second largest in terms of paper production in the country. To convert some of the waste materials namely, lime sludge and fly ash generated in the process of manufacture of paper into high grade cement, the TNPL is setting up a 600 tons per day cement plant at a capital outlay Rs 69 crore.

[7] Madras School of Economics analyzed in several studies the impact of pollution from textile units on agricultural production and reported significant losses.

(vi) Sugar

Within the food and beverages subgroup, the state contributed to 11 percent of total sugar production in the country. Bagasse, molasses and press mud are the three by products of sugar industry which cause industrial pollution. The by-product bagasse is used as fuel to generate steam and power for operation of the mill. In the Tamil Nadu cooperative sector, 3 co-generation plants are functioning with an installed capacity of 7.50 MW each. According to the recent industrial policy initiative, it has been decided to set up co-generation plants in 12 sugar mills with a capacity of 183 MW to reduce the power and steam consumption in sugar manufacturing process and also to increase the quantity of power for export to State Grid. To meet with the requirement of 5 percent blending with petrol, 8 Ethanol plants having production capacity of 9.60 crore litres per annum were established in Tamil Nadu.

(vii) Automobiles

Tamil Nadu accounts for 35 percent of the total auto component production. Tamil Nadu's current annual output in the automotive sector is estimated to be $3-3.5 billion with an estimated share of 25 per ent in the Indian automotive Industry and its contribution to the State's Gross State Domestic Product is 7-8 percent. Automobile industry is highly energy intensive and a major contributor to GHG emissions across its entire value chain from production to consumption.

Table 3.3 provides an overview of the compliance of the industries to the environmental norms.

Greenhouse Gas Emissions – Tamil Nadu

India is the fourth largest CO_2 emitter of the world. According to Ghoshal and Bhattacharya (2007), coal is one of the most significant sources from which CO_2 is emitted. Liquid fuel is other major source. Uttar Pradesh leads the Indian states as far as mean CO_2 emissions between 1980 and 2000 is concerned. The state-wide trend in emissions during 1980-2000 shows that the growth rate of West Bengal was the lowest at 3.66 percent while that of Himachal Pradesh was the highest at 11.63 percent. Tamil Nadu ranked eighth in the growth of emissions at 6.72 percent. All-India average growth was 5.86 percent. Consumption pattern of solid and liquid fuel by states shows that the consumption of petroleum products was relatively high in Maharashtra, Gujarat, Uttar Pradesh, Andhra Pradesh and Tamil Nadu while the consumption of coal was relatively high in Uttar Pradesh, Madhya Pradesh, West Bengal, Bihar and Andhra Pradesh. As mentioned above, the total GHG Emission from Tamil Nadu during the year 2009-10 has

been estimated as 111.86 million tons. With a population of 70.3 million, the state per capita GHG emission stands as 1.59 Tons of CO2 per citizen of Tamil Nadu (CII, 2012).

Table 3.3: Highly Polluting Industries – Environmental Compliance Status

Polluting Industries	No. of units	Complying	Defaulting	Closed
Aluminium Smelting	1	0	0	1
Basic Drugs & Pharmaceuticals Manufacturing	27	22	2	3
Chlor Alkali/Caustic Soda	3	3	0	0
Cement(200 TPD and above)	19	12	0	1
Copper Smelting	1	1	0	0
Dyes and Dye Intermediate	1	1	0	0
Fermentation(Distillery)	17	15	0	2
Fertilizer	6	6	0	0
Integrated Iron & Steel	2	2	0	0
Leather Processing including Tanneries	55	54	6	1
Oil Refinery	3	3	0	0
Pesticide Formulation & Manufacturing	1	1	0	0
Pulp and paper(30 TPD and above)	3	3	0	0
Petrochemical	12	12	0	0
Sugar	41	40	0	1
Thermal Power Plants	41	40	1	0
Zinc Smelting	0	0	0	0
Total	**233**	**215**	**9**	**9**

Source: TNPCB; data as on March 2010.

Chapter 4

CLIMATE FRIENDLY INDUSTRIAL POLICIES IN TAMIL NADU

Introduction

The purpose of this Chapter is to review climate friendly industrial policies in Tamil Nadu. Identifying policies and measures that exclusively target GHG emissions is neither feasible nor desirable. However, policies directed towards achieving sustainable development goals could inter alia lead to GHG emission reductions besides addressing local environmental concerns. Therefore, we review the environmental policies in general rather than climate related policies.

Type of Policies

Broadly, two types of policies-sanction-based vis-à-vis compliance based-are used to enforce the environmental regulations. The sanction-based approaches aim to enforce regulation by compulsion and coercion, with a penal approach to dealing with deviant activity, given that regulations are in place. For example, judicial orders being used to close down polluting industries. The compliance-based approaches begin by recognizing that the detection of a deviant activity is the first step towards prevention, rather than prosecuting the deviance (Lane et al., 1999). The stress is on shared responsibility where the environmental agencies work with the polluters to reduce pollution with least social and economic costs. These policies are often referred in the literature as Command and Control (CAC) policies and market based policies.

(i) CAC Instruments

Regulatory instruments (also called as CAC instruments) involve state regulation of activities where the state prescribes emission or effluent standards, limits the production of certain goods beyond a prescribed limit, prohibits the use of polluting inputs, and restricts location of polluting industries. Non-compliance to these standards results in punishment in the form of fine or other legal measures. Regulations could also take the form of performance standards where the state dictates a certain level of performance or work practice standards where it imposes the use of a technique known to reduce pollution.

All environmental legislations in India come under criminal laws.[8] In implementation of the laws as well as in judicial decisions, the issue is on compliance or non-compliance, and not on the extent of compliance. The penalties for non-compliance are unrelated to the compliance costs. This type of pollution control regime creates an opportunity for corruption and rent-seeking. The present standards and control regimes – particularly based on technology standards and input usage norms, provide no incentive for polluters to search for and adopt environmentally sound cost minimizing technologies/practices. Economic instruments like taxation and subsidies, on the other hand, use incentives and disincentives to affect the decisions of producers and consumers. These are self-administered and allow the possibility of affecting the extent of pollution.

The main criticism against the CAC instruments is the high cost of emission reduction and government implementation failures. Given that all industries do not have the same abatement cost, it is the cost efficient for some industries to abate more and others to abate less than required. However, regulations require all industries to adhere to similar standards irrespective of their cost of abatement which increases the overall cost of abatement. Regulation is also more difficult to implement as they require considerable information and involve significant administrative costs for implementation and monitoring. Further, the penalty for non-compliance does not depend on the extent of non-compliance. In case of non-compliance, everyone pays the same fine irrespective of the difference in their level compliance.

(ii) Market Based Economic Instruments

Market based Economic Instruments are intended to internalize environmental costs and externalities and hence influence decisions of agents by sending signals through price and other variables. These provide financial incentives to make environment friendly decisions. It is in the economic interest of the polluter or the consumer to reduce pollution voluntarily by using better inputs and techniques or consume less polluting goods by conservation or substitution.

The main strength of economic instruments is the flexibility they allow leading to a reduction in the overall cost of abatement in comparison to other regulatory approaches. The economic Instruments call for an overall level of environmental

[8]National Environmental Policy 2006 notes that, 'Civil law offers flexibility and its sanctions can be more effectively tailored to particular situations. The evidentiary burdens of civil proceedings are less daunting than those of criminal laws. It also allows for preventive policing through orders and injunctions' (GoI, 2006; p. 17).

performance in the economy. The private players, depending on their relative costs, can decide their respective levels of abatement. This ensures that industries with lower abatement cost abate more than those with higher abatement costs. Broadly, there are three types of market based instruments, namely (a) price-based, (b) quantity-based and (c) informational-policy instruments.

In India, the market-based instruments have largely been price-based. The price-based instruments can be either taxes or subsidies. A pigouvian tax is a typical price-instrument used when the output produced of a 'bad' is at the point where the marginal cost of the firm meets the price. The socially optimum output should have been lesser if the social marginal cost (which is higher than the firm's private cost) had been considered. Since the firm ignores this externality, a tax imposed on it to the extent that its private cost equals the social cost internalizing the externality and inducing the firm to produce at the socially optimum level. In such cases, resources and emissions become more expensive and consumers and producers have an incentive to consume lesser or pollute lesser. It works out to be more efficient than CAC regulations as firms which have a lower marginal abatement cost than the marginal tax rate will do so and those who do not will simply pay the tax. Subsidies for environmental 'goods' which are generally under-produced or consumed, to encourage more production and consumption are also a price instrument.

The following sections focus on policy initiatives of the Government of India and Government of Tamil Nadu that fall either under the category of command-and-control or fiscal initiatives.

Environmental Policies at the Center

Non-fiscal (Command and Control) Policies at the Center

India is the first country to provide for environmental protection explicitly in its constitution (Mallik and Dutta, 2004). The government of India relies mostly on command and control policies. The foremost regulation consisted of the Water Act of 1974 which laid down penalties for non-compliance of the regulation. This was followed by the Environment (protection) Rules, 1986; the Hazardous Waste (management and handling) Rules, 1989; the Manufacture, Storage and Import of Hazardous Chemicals Rules, 1989; the Manufacture, Use, Import, Export and Storage of Hazardous Microorganisms or Cells Rules, 1989; the Public Liability Insurance Act, 1991; the National Environmental Tribunals Act, 1995 and the National Appellate Authority Act, 1997.

The energy conservation bill was passed in September 2001 which stressed on the energy consumption norms and required the industrial establishments to adhere to these. Subsequently, the Bureau of Energy Efficiency launched a number of initiatives targeted at various sectors. Two major barriers to the implementation of the bill were (a) energy pricing and (b) informational asymmetry with respect to opportunities available for improved energy efficiency.

There are various centrally sponsored and central sector schemes for pollution abatement. Approximately 12 percent of total outlay in the 11th Plan was on environmental governance, monitoring, education, research and development, and pollution abatement (Table 4.1). The major objectives of these schemes are to ensure pollution abatement through various means such as assessment and monitoring of air and water quality, introduction of cleaner technologies for resource conservation, setting up of Common Effluent Treatment Plant (CETPs) in cluster of small scale units, research and development, up gradation of laboratories etc.

Table 4.1: Eleventh Plan Outlays on Schemes for Pollution Abatement

(Rs. Crore)

	Programmes	11th Plan Outlay	2007–09 Exp.	2009–10 Outlay	2010–12 Bal.
1	Environment Monitoring and Governance	216	84.64	40.8	90.56
2	Pollution Abatement	235	41.15	32.07	161.78
3	R&D for Conservation & Development	250	104.83	59.21	85.96
4	Conservation of Natural Resources & Eco-systems	600	165.43	75	359.57
5	Environment Information & Education	295	146.18	94.82	54
6	Taj Protection	0.01	0	0.01	0.01
7	International Cooperation Activities	80	29.09	19.01	31.9
8	National Coastal Management Program	10	1.63	15.5	–7.51
9	National River Conservation Plan	2,100.00	538.97	532.33	1,028.70
10	Grants in aid to Forestry & Wildlife	450	202	117.28	130.72
11	Capacity Building in Forestry Sector	110	21.31	19.51	69.18
12	Gregarious Flowering of Multi-Bamboo	37	35.71	0	1.29
13	Intensification of Forest Management	600	143.35	76	380.65
14	Strengthening Forestry Division	100	32.59	19.63	47.78
15	Strengthening Wildlife Division	150	43.75	22.58	83.67
16	Integrated Devt of Wildlife Habitats(IDWH)	800	143.14	80	576.86
17	Project Tiger	615	222.75	243.13	149.12
18	Project Elephant	81.99	37.79	21.5	22.7
19	National Afforestation & Eco-Dev.Board	250	54.46	31	164.54
20	National Afforestation Programme	2,000.00	738.54	345.62	915.84
21	Panchayat/GramVanYojana	900	0	10	890
	Total	10,000.00	2,833.37	1,880.00	5,286.64

Source: www.planningcommission.nic.in/aboutus/committee/wrkgrp11/wg_envtal.pdf

During the 11th Plan, the activities initiated by the central pollution control board include preparation of air quality management plan for sixteen cities and source apportionment studies for six identified cities, creation of environmental data bank, performance evaluation of CETPs and programmes for capacity building and awareness. The preventive strategies scheme consists of three components namely; Environmental Audit, Adoption of Clean Technology in Small Scale Industries and Environmental Statistics. Under the establishment of Environment Protection Authorities (EPA) and Environment Commission and Tribunal (ECT) Act, various authorities have been constituted for environment compliance and enforcement of various activities. At the state level, many cities have introduced Bharat Stage II norms for motor vehicles and industries have been asked to install necessary pollution control equipment.

The CAC measures for abatement of industrial pollution and environment friendly industrial development have been met with limited success for various reasons. One of the major reasons being that in India, the unorganized sector accounts for 80 percent of the total employment and 32 percent of the gross domestic product of the manufacturing sector. Majority of the units in the unorganized sector are micro and small industrial units. Environmental problems in the small industries are complex and, multi-dimensional. The experience in Delhi (Dasgupta, 2000) with respect to small industries showed that the environmental policy of command and control had no discernible impact on Delhi's environment and the strategy to impose factory closures, relocation of units and construction of central effluent treatment plants (CETPs) through court orders and deadlines did not work.

Fiscal Initiatives for the Promotion of Energy from Renewable Resources

There is a high potential for the generation of renewable energy from various sources such as wind, solar, biomass, hydro and cogen bagasse. The geographic distribution of estimated renewable power generation across states shows that Karnataka has the highest potential followed by Gujarat and Andhra Pradesh, mainly on account of wind power. The provisions in the new Electricity act 2003 to procure a minimum percentage of power from renewable energy sources signify a major landmark in the move toward adoption of cleaner technologies. Some of the incentives include:

- Concession on import duty on wind turbines
- Accelerated depreciation up to 80 percent allowed for first year
- Sales/excise relief
- Soft loan from IREDA
- Income tax holiday for first five years
- 5 percent annual escalation in tariff as a guideline
- Financial assistance of 60 percent of the cost of wind turbine equipment, up to a specified limit for demonstration projects.

(i) Eco-cess on Coal Producers

Based on the recommendations by many studies including Chelliah et al. (2007), an eco-cess to provide for suitable incentives for reducing the ash content in coal to improve its thermal efficiency and reduce the operational cost of the thermal power plants was introduced by the Government of India in the Union Budget 2010-11. Revenues

generated from the eco-cess are earmarked to set up a clean coal fund that will be used to set up infrastructure for coal washing, selective mining and R&D.

(ii) Rebate on Water Cess

The cess rate is specified by the Government of India and the same rate applies to all the states. It varies from Re. 0.5 per m^3 to Rs. 3 per m^3 depending on the purpose of water use and the presence of biodegradable or toxic pollutants in the eventual effluent. Industries that comply with effluent standards are connected to a wastewater treatment plant. Industries that do not consume water in excess of the prescribed limit are entitled to a 25 percent rebate in the water cess.

(iii) Subsidies

Under the Credit Linked Capital Subsidy Scheme, the Ministry of Small Scale Industry provides assistance to small industrial units for adoption of cleaner production technologies and installation of pollution controls. In order to facilitate fuel conversion from coal to oil or gas in small boilers and ceramic kilns, the Pollution Control Board (PCB) launched a project in 2001 to provide financial assistance to small industries with support of the India-Canada Environment Facility (ICEF). By December 2004, a total of 228 small boilers and 18 ceramic kilns were converted to cleaner fuel, resulting in a drastic reduction of emissions of particulate matter from these industrial units.

(iv) Cogen Schemes

Approximately 3500MW of additional power would be produced if all sugar mills (>400 in number) switched to modern techniques of cogeneration, benefitting both the sugar mills and cane growers. In Tamil Nadu, there are 16 cogeneration plants with 274.6 MW and their contribution to TNEB grid is 155 MW in season and 168 MW during off season.

(v) Emissions Trading Scheme

More recently, the Ministry of Finance has launched a concept note on the possibility of establishing a local emission trading scheme for air pollution- to reduce emission of some conventional air pollutants such as SO_2, NO_x or SPM to reduce compliance cost. This might serve as a model for future environmental regulation in India and also position industry to benefit from potential tie-ups under global emissions trading schemes. The government has selected two states: Tamil Nadu and Gujarat for the implementation of the pilot scheme.

Industrial Regulations in Tamil Nadu to Promote Climate Friendly Development

a. State Industrial Profile

The secondary sector accounts for 30.2 percent of GSDP in Tamil Nadu and the manufacturing sector's share alone 20.7 percent (in 2011-12). During 2005-06 to 2011-12, the manufacturing sector grew at annual rate of 10.8 percent. In fact, Tamil Nadu ranks first in number of factories (in 2009-10) and factor employment in the country (Table 4.2).

Table 4.2: Industrial Scenario in Tamil Nadu vis-à-vis India

Indicators	All India		Tamil Nadu		Rank of Tamil Nadu
	2005-06	2009-10	2005-06	2009-10	
No. of factories	140160	158877	21265	26790	1
Fixed capital (Rs. Lakh)	60694028	135218367	6034229	13289599	3
Total persons engaged	9111680	11792055	1355789	1890149	1
Net Value Added (Rs. Lakh)	31186419	59211387	2798101	5914310	3

Source: Annual Survey of Industries, 2009-10.

Within manufacturing, there are 22 sub groups. Of these, textiles, motor vehicles, food and beverages, machinery and equipment, fabricated metal, other transport equipment, electrical machinery, rubber and plastics, and Medical, optical and precision instruments grew at more than 10 percent in 2010. Chemicals, basic metals, paper and paper products, coke and refined petroleum, publishing and printing industry registered a negative growth (Table 4.3).

Table 4.3: Key Manufacturing Industries in Tamil Nadu

Industry	Weight in the state index of industrial production (Manufacturing =811.37)	Year on year growth (April-July 2010 over Apr-July 2009)
Chemicals	168.02	-8.3
Textiles	138.01	11.5
Motor vehicles	82.25	20.9
Food and beverages	75.97	19.4
Machinery and equipment	53.89	38.4
Other non-metallic minerals	40.42	8.1
Fabricated metal	34.97	26.6
Apparel, dyes	32.6	2.4
Basic metal	30.28	-5.1
Tanning & dressing of Leather	28.75	0.1
Rubber and Plastics	23.6	11.1
Paper& paper products	19.78	-0.6
Coke, refined petroleum and nuclear fuel	18.77	-13.7
Other transport equipment	14.23	30.5
Electrical machinery & apparatus	13.60	20.5
Publishing, printing & reproduction of recording media	10.91	-11.0
Medical, precision & optical instruments	10.44	28.9
Wood & wood products	1.26	5.8
Others (radio, television & communication, accounting, electrical machinery, furniture)	13.62	negative

Source: Department of Economics and Statistics, Chennai.

b. Policy Environment

In the Governor's address of June 2011, the Government's priority for industrial growth was states as follows:-

"*It will be the endeavour of this Government to attract top industrial houses for investment in key sectors like automobile and auto parts, IT, ITES, textiles, leather,*

engineering goods etc., and make the State a hub of the manufacturing sector. This Government will lay special emphasis on the newly emerging sectors like bio-technology, nanotechnology and pharmaceuticals"

Vision 2023: The VISION 2023 document lays special emphasis on manufacturing industry. Its sets a target rate of growth of GSDP of 11 percent per annum up to 2023, 14 percent for manufacturing, 11 percent for services and 5 percent for agriculture. Such high emphasis on manufacturing growth is bound to increase pressure on local environment and will contribute substantially to the greenhouse gas emissions unless appropriate measures are put in place to usher-in clean energy options and promote clean technologies.

The vision document also proposes to provide access to safe sanitation including open defecation free and garbage environment, 25 lakh affordable housing, increased capacity of ports, roads, highways and airports, and a system of integrated multimodal transport in the urban sector. It also discusses about the key *strategic initiatives* within specific sectors as:

(a) **Manufacturing sector:** (i) Encourage greater depth in existing industries and target investment in related industries such as aerospace, medical equipment, heavy engineering goods, defence goods and sunrise sectors such as biotechnology, solar and clean energy and (ii) Incentivise and mandate recycling of waste water for industrial and non-consumption purposes; and

(b) **Energy:** (i) Selective thrust for green power by maximizing investments in wind and solar power and (ii) Establishment of a smart grid system to help lower the cost of energy for consumers.

Table 4.4 provides the aggregate value of investments proposed in VISION 2023 over the period 2012-23 under the key heads of infrastructure. Energy gets Rs. 4.5 lakh crore while transport gets Rs. 3.7 lakh crore. Investment proposed for urban infrastructure is Rs. 2.75 lakh crore and for industry and commercial is Rs. 1.6 lakh crore.

Table 4.4: Key Investments Proposed in VISION 2023

(Rs. Crore)

Sector	Investments
Energy	450,000
Transport	370,000
Industrial & Commercial	160,000
Urban Infrastructure	275,000
Agriculture	40,000
Human Development	30,000
Subtotal	*13,25,000*
General & Social Infrastructure Projects	100,000
Capital Improvements to existing Projects	75,000
Subtotal	*175,000*
Grand Total	**15,00,000**

Source: Vision Tamil Nadu 2023, March 2012. http://www.spc.tn.gov.in/pdfs/TN_Vision_2023.pdf

The vision document also envisages setting up of centers of excellence in areas such as automotive technology, solar and clean energy technologies to name a few. To reduce the cost of power to the industry, the government plans to bring major reforms in the TNEB. The government of Tamil Nadu will set up a cell that will assess the situation with respect to environmental issues (mainly climate change related issues) that impact Tamil Nadu and suggest policy inputs to Government so that industry and society are able to move forward in a responsible and efficient manner.

c. Non-fiscal (Command and Control) Policies in Tamil Nadu

As per the Industrial Policy (2008) for effective monitoring, industries are categorized as Ultra Red, Red, Orange, and Green according to their pollution potential. The field engineers in the Tamil Nadu pollution control board's (TNPCB) district office inspect the large scale ultra red industries every month and ordinary red category units once in three months. Vehicles transporting perishables, on the other hand, are labeled "green transport" for speedy clearances at the check posts. The TNPCB has implemented various laws to promote environment friendly industrial development. They are summarized below:

The Tamil Nadu Water (Prevention and Control of Pollution) Rules, 1983.
The Water (Prevention and Control of Pollution) Cess Act, 1977 as amended in 1991.
The Water (Prevention and Control of Pollution) Cess Rules, 1978. as amended in 1992
The Air (Prevention and Control of Pollution) Act, 1981 as amended in 1987.
The Tamil Nadu Air (Prevention and Control of Pollution) Rules, 1983.
The Environment (Protection) Act, 1986.
The Environment (Protection) Rules, 1986.
The Hazardous Waste (Management and Handling) Rules, 1989 as amended in 2000 and 2003
The Manufacture, Storage and Import of Hazardous Chemical Rules, 1989.
Manufacture, Use, Import, Export and Storage of Hazardous Mirco -organism Genetically Engineered Organisms or Cell Rules, 1989.
The Chemical Accidents (Emergency Planning, Preparedness and Response) Rules, 1996.
The Bio-Medical Waste (Management and Handling) Rules, 1998 as amended in 2000.
The Recycled Plastics Manufacture and Usage Rules, 1999 as amended in 2003
The Noise Pollution (Regulation and Control) Rules, 2000
The Municipal Solid Wastes (Management & Handling) Rules, 2000
The Batteries (Management & Handling) Rules, 2001
The Public Liability Insurance Act, 1991 (No.6 of 1991). as amended in 1992
The Public Liability Insurance Rules, 1991.
The National Environment Tribunal Act, 1995 (No.27 of 1995)
The Environmental Impact Assessment Notifications, 2006 (Now notification inforce) (At present not applicable)
The National Environment Appellate Authority Act, 1997
The National Environment Appellate Authority (Appeal) Rules, 1997
Coastal Regulation Zone Notification, 1994
The Ozone Depleting(Regulation and Control) Substance Rules, 2000

Some of the initiatives under these laws are described below.

- The TNPCB plays an important role in the establishment of ***Common Effluent Treatment Plants*** **(CETPs)** for clusters of small-scale industries in various parts of the State.[9] There are cement units, distilleries, sugar, sago, paper, dairying, electroplating, chemical and fertilizers (Agro chemicals), mining industries, ores/mineral processing industries and a variety of other industries which are water consuming and also generate large quantities of effluent. Some

[9] According to PCB (2005) the number CETPs that are operational are 14 (out of 24 formed) in Tanneries, 18 (out of 25) in textiles and dying, and 1 in hotel/lodging in Tamil Nadu.

of the industries have also provided the treated effluent for irrigation with some degree of success.

- The government is planning to set up a ***Hazardous Waste Treatment, Storage and Disposal Facility*** **(HWTSDF)** at Gummidi Poondi, Oragadam, Perundurai, Cuddalore, Karur and Tiruppur. The TNPCB is taking effective steps in handling and management of hazardous chemicals. To adopt recycling and reuse principles, cement industries are encouraged to utilize the sludge from CETPs as raw materials and a trial run has also been taken in Chettinad Cements at Puliyur. Similarly, the cement industries such as A.C.C, Madukarai and Grasim Industries, have taken trial runs for utilizing paint sludge, Tar waste, Petroleum refinery sludge as incineration material. Moreover, action is being taken to establish a common hazardous waste treatment storage and disposal facility at SIPCOT, and treatment and disposal of hazardous wastes in an environmentally safe manner.
- **Recycling of Waste:** The Ministry of Environment and Forests, Government of India vide notification dated 4.2.2011 notified 'Plastic Waste (Management and Handling) Rules, 2011'. As per this notification, no person shall manufacture, stock, distribute or sell any carry bag made of virgin or recycled or compostable plastic, which is less than 40 microns in thickness;
- ***Co-Incineration of Plastic Waste in Cement kilns*****:** the Board is directing the cement industries to co-incinerate the plastic waste as an alternate fuel in the cement kiln.
- ***Recycling of E-waste*****:** TNPCB has issued consent to 10 E-waste recyclers for segregation and recovery of Printed Circuit Board (PCB), Integrated Circuit (IC), Iron, Copper, Rubber, and Glass etc. PCB/IC wastes are exported to foreign countries such as USA, Singapore and Malaysia to recover the heavy metal present in the said wastes.

d. Fiscal Initiatives for Environment Friendly Industrial Development in Tamil Nadu

The Government of Tamil Nadu has taken the following fiscal initiatives for climate friendly industrial development.

- **Free Electricity for Micro-Irrigation Systems**: Primary producers who commit to install micro-irrigation systems will be given priority in provision of free electricity connections. Overriding priority for free electricity connection will be given to small and marginal farmers if they join together to form a cluster of 20

hectares and above and undertake to jointly set up, own and manage the common irrigation systems using micro-irrigation technology.

- **Subsidy Schemes on Capital Invested**: (i) 25 percent additional capital subsidy on the value of eligible plant and machinery installed to promote cleaner and environment friendly technologies subject to a maximum of Rs. 3 lakhs and certification by the Tamil Nadu Pollution Control Board and (ii) Subsidy schemes to promote investments in environment friendly plant and machinery for micro, small and medium manufacturing enterprises established in industrially backward blocks and agro based enterprises in all blocks in the State.
- **Subsidy for Biofuels**: Government provides 50 percent subsidy on planting material for jatropha and other biofuel crops and extend the subsidy available to agro-processing industry to bio-fuel and bio-diesel extraction plants. Further, jatropha seed will be exempted from purchase tax and jatropha oil will be exempted from VAT for a period of 10 years from the date of commercial production.
- **Promotion of Renewable Energy:** The installed capacity of power generation in Tamil Nadu from the Renewable Energy sources reached 7527.2 MW and the power generation from them increased to 9763 MU in 2011-12. TNEB buys surplus energy at the rate of Rs.2.75 per unit from the existing wind mills commissioned before 15.5.2006 from the date of renegotiation of the existing agreement and Rs.2.90 per unit from the Wind Mills Commissioned after 15.5.2006 as per the new tariff order issued by the Tamil Nadu Electricity Regulatory Commission.
- A new tax called **'Green tax'** under section 3-A of Tamil Nadu Motor Vehicles Taxation act was levied in 2003. This amounted to an additional tax in respect of vehicles specified in the fourth schedule of the Act. For motor cycles of age exceeding 15 years, a sum of Rs. 500 is charged and for other vehicles, a sum of Rs. 1000 is charged.
- **Municipal Solid Waste Generation:** Government of Tamil Nadu has started municipal waste generation schemes on build-own operate basis at Perungudi with a buy-back rate of 2.73 per unit, escalated at 5 percent..
- **Energy Conservation Building Code** (ECBC) is applicable to commercial buildings or building complexes that have a connected load of 100 kW or greater or a contract demand of 120 kVA or greater or having conditioned area of 1000 m2 or more. Chennai is home to 42 of the 212 structures in India that are certified as eco-friendly by the Indian Green Building Council (IGBC).

Various issues have emerged with respect to designing an appropriate tariff rate for electricity from renewable sources, especially, the duration of agreement, wheeling/banking charges and the need to factor in government subsidies while devising the tariff rate.

Market based Instruments for Climate Friendly Industrial Development: International Experience

Market based instruments like environmental taxes can be effective in reducing pollution and energy use. Fuel taxes are the single most powerful climate policy instrument implemented to date. Sterner (2007) concludes that, *'Had Europe not followed a policy of high fuel taxation but had low U.S. taxes, then fuel demand would have been twice as large'.* Ekins (2009) estimates the price elasticity of energy demand in the UK at about (-) 0.64, which implies that a 10 percent increase in the energy price will reduce energy consumption by 6.4 percent). Other things being equal, this means that if a sector (or by implication the economy as a whole) is growing, its energy use will be growing too, unless it is restrained by a rising energy price.

Eco-tax is a broad term used to denote a variety of negative price incentives including not just taxes that directly tax pollution but also other indirect taxes which discourage the consumption of polluting outputs and the use of polluting inputs in production. Existing eco-taxes have targeted three main areas that are major contributors to pollution:

- transport, in the form of differential taxation on vehicles based on fuel efficiency and congestion charges such as the one in place in London;
- energy, where fuels which feed into energy generation are taxed; and
- waste and use of natural resources, where pollution, waste disposed and exploitation of natural resources is taxed so that an industry that is more polluting or is more natural resource intensive ends up paying a higher amount in taxes.

Table 4.5 provides a summary of eco-taxes used in recent years in various countries. Available evidence indicates that nearly 8 to 10 per cent of total tax revenues are being raised by eco-taxes in countries that have implemented such taxes.

Industry Stake-holder Perspective

The main industries that can be supported for encouraging innovations and substitution of cleaner inputs are: energy, particularly thermal energy, iron and steel, cement, construction and automobiles. In this section, we describe the industry stake holders' perspectives on target industries and potential fiscal instruments that can be used for encouraging a climate friendly industrial development in Tamil Nadu.

Energy

- State support required to adopt a range of advanced, more efficient, and cleaner technologies for producing electricity using coal. Importance to availability of good technology, access to good quality of raw materials.
- Cogeneration to be encouraged and incentives for coal/bio mass based cogeneration equipment. Government should encourage Casuarina plantation for bio mass. Incentives for Equipments like Electrostatic precipitator (ESP) / bag filter for bio mass based boilers and key environment control equipments.
- Washing of coal at the mine heads will reduce the weight to be transported to the power plants and reduce pollution from transport vehicles.

Table 4.5: International Experience on Eco-taxes

Country	Tax	Objective	Description
Taxes on Energy			
UK	Climate Change Levy (CCL)	To encourage energy efficiency	Charged on business use of energy such as natural gas, electricity, LPG and solid fuels. Different rates for different fuels.
	Fuel Duty	To reduce number of trips made by car	Tax levied on fuels based on emissions.
Germany	Energy Tax	To encourage energy efficiency	Tax charged on tax rate on mineral oil for fuel, gas and heating oil, coal and electricity.
Sweden	Carbon Tax	To reduce carbon emissions	Levied on oil, coal, natural gas, liquefied petroleum gas, petrol and aviation fuel in domestic traffic.
	Sulphur Tax	To reduce sulphur emissions	Levied on liquid fuels, coal and fuel oil according to the sulphur content.
Canada	Fuel Tax	To encourage use of efficient fuels	Fuel is subject to the GST/HST, the federal excise tax, provincial taxes and provincial sales taxes. Hence, tax rates differ among provinces.
	British Columbia's Carbon Tax	To reduce emissions of CO_2, methane and nitrous oxide	Levied on the purchase and use of fossil fuels such as gasoline, diesel, natural gas, heating fuel, propane, coal, etc based on emissions of CO_2 equivalent.
Taxes on Waste and Natural Resources			
UK	Landfill Tax	To reduce externalities associated with waste disposal	Charge levied on landfill site owners and can be passed on to consumers via higher prices
	Aggregates Levy	To reduce externalities associated with aggregates extraction	Tax levied on quarry operators and other organizations that commercially exploit aggregates. Different rates for active and inactive wastes.
	Water Abstraction Charge	To cover the costs they incur in water resource management	Levied on businesses that extract and use over ground, underground or tidal water sources

(Contd.. Table 4.5)

(Table 4.5 contd…)

Country	Tax	Objective	Description
Transport Taxes			
UK	Vehicle Excise Duty (VED)	To encourage purchase of low emission cars	Annual tax on road vehicles based on the emissions rating of the vehicles.
	Air Passenger Duty (APD)	To reduce the number of times a person flies	Levied on airlines based on the number of passengers flying domestically or internationally from UK airports.
	London Congestion Charge	To reduce level of congestion in Central London	Charged on any vehicle entering or parking in the charging zone between 7 am and 6.30 pm on a weekday.
	Taxation of Company Cars	To reduce emissions by company cars	Company cars are allocated a cash value on which company car drivers are liable to pay income tax and employers are liable to pay Class 1A National Insurance Contributions (NICs).
Germany	Vehicle Tax	To reduce CO_2 emissions from road traffic	Tax based on cylinder capacity of vehicle, over which EURO 2 per gram of CO_2 emissions per kilometre (g/km) is charged if those exceed a threshold of 120 g/km.
Sweden	Vehicle Excise Duty (VED)	To reduce CO_2 emissions from road traffic	Duty comprises of a base charge of 360 SKR plus a CO_2 charge of 15 SKR per gram of CO_2 exceeding 100 grams per kilometre (g/km).
Canada	Vehicle Tax	To encourage purchase of low emission cars	Federal excise tax on automobiles based on the weighted average fuel consumption rating of the vehicle.

Source: Compiled by authors.

Renewable Energy

- Off grid application of renewable energy should be encouraged. Presently only accelerated depreciation is available.
- Income tax benefits should be available for investing in renewable energy.
- Currently the VAT for solar power is 14% against 5% for wind. Both need to be at par to encourage solar power investment.
- Smart metering should be encouraged in residential houses.

Transport

- Exhaust of automobiles can be used for air conditioning. Use of fly ash bricks would solve the issue of fly ash waste disposal.
- Emission from transport should be regulated. Fiscal incentives should be provided for vehicles running on cleaner fuels.
- SME sectors should be incentivized through fiscal measures to use environment friendly technology. Technology up gradation fund (TUF) was a success for textile sector and should be extended to other sectors too.

Iron and Steel

- Cleaner technologies must start from the mining of iron ore itself.
- Innovative technology of micro addition of more earth (RE) to liquid steel and the use of Energy optimizing furnace (EOF) is being advocated for the production of cleaner steel.

Textiles

The textile industry is intensive in the use and discharge of chemical substances in various stages of production.

- cultivation of organic cotton,
- waste water recycling,
- effluent treatment plants,
- recycling of plastic, polyester and polyester yarn to produce fiber and packaging materials.

Paper and Pulp

Effluent treatment plants are a major source of saving on freshwater consumption by paper mills. Major players are targeting zero effluent discharge in their mills. Being energy intensive, some players have also invested in wind farms for generation of renewable energy.

Potential Fiscal Instruments

- Statewide sharing of central coal cess, which can be used to subsidize the incentives: In the Union Budget of 2010-11, for the first time the central government has taken the initiative of levying a cess of Rs. 50 per tonne on domestically produced and imported coal. The revenue of this cess will form the resource pool for a _clean coal fund'.

- Non-rebatable excise/cess on heavy polluters (as per GHG emissions): Treatment of polluting inputs and outputs for effective environmental management is very important as these inputs and output create negative externalities. Industries can be categorized based on the amount of GHG emissions and a non-rebatable excise/cess can be implemented subsequently. Potential industries include petroleum products, alcohol and tobacco industry.
- Congestion charges in heavily urbanized areas: In the automobile sector, fiscal instruments can be identified for the entire chain of activities from production to consumption. Differential taxes on vehicles based on fuel efficiency and congestion can be levied, similar to the one implemented in the U.K.
- Subsidies on production, to introduce new technology modify input usage. Subsidies can be of two types: input focused and technology focused. Similarly consumption focused
- Instruments can also be introduced which include taxing/subsidizing goods that are environment unfriendly/friendly.
- Implementation of Green building code in construction industry would be an important step towards energy conservation and reduction in greenhouse gas emissions as well.

A Note on Industrial Policies in Tamil Nadu

- **Emphasis of Infrastructure Planning and Development:** As per the industrial policy note 2011**,** Tamil Nadu Infrastructure Development Board will be created to attract private investment into infrastructure.
- **Dispersal of Growth:** creation of industrial corridors, extension of special packages, and creation of new infrastructure in less developed regions will be given importance.
- **Proposal for Petroleum, Chemicals and Petrochemicals Investment Region** in Cuddalore and NagapattinamDistricts.Nagarjuna Oil Corporation Limited (NOCL), a Joint Venture of TIDCO is implementing a 6 million tonnes per annum capacity Petroleum Refinery Project at Thiruchopuram in Cuddalore District at a total investment of about Rs 7,160 crores. A world-class Shipyard cum Minor Port Complex is under construction in Kattupallivillage, PonneriTaluk of Tiruvallur District through a Joint Venture company of TIDCO and M/s. Larsen & Toubro Limited viz. L&T Shipbuilding Limited.
- **LNG Import Terminal Project at Kattupalli Village of Tiruvallur District:** To meet the State's growing demand for energy especially the Natural Gas which is an efficient and environment friendly fuel, it is essential to position a firm

source for natural gas in the long term. The State Government has granted a package of incentives for the proposed LNG Terminal project.

- **TRIL Info-park Limited (TIDEL – III)** To encourage and attract further investments in the IT-ITES Sector, TICEL Bio Park Ltd, a Joint Venture of TIDCO and TIDEL has established a state-of the- art Biotechnology Park-I at Chennai, which are all functioning. TICEL is constructing Biotechnology Park II for catering to the needs of Biotech Research & Development For supporting the growth of aerospace industries, an Aero Space Park project is planned.
- **Free Trade Warehousing Zone in Tiruvallur District:** SIPCOT has actively promoted seven Sector Specific Special Economic Zones in its Industrial Complexes / Parks, each for a specific sector, A Sector Specific SEZ for Granite processing industry was established at Bargur with an extent of 379.96 acres, which is first of its kind in India and approval and Notification from the Government of India
- **A novel scheme to convert secondary treated sewage** through TT-RO process for the usage of industrial units located at Oragadam, Sriperumbudur and Irungattukottai Industrial Parks is to be executed through a private operator by Chennai Metropolitan Water Supply & Sewerage Board (CMWSSB)
- **SIPCOT has been focusing on providing world class infrastructure** in its industrial complexes in order to attract more investors. During the year 2010-11, works relating to roads, water supply, street lights, sewerage system, buildings, etc. were taken up in a total outlay of ` 200 crores.
- **Tamil Nadu Industrial Investment Corporation Limited (TIIC)** is the pioneer among State Financial Corporations in the country.Some of the important schemes operated by TIIC:

1. Micro/Small Enterprises Fund Scheme.
2. Bill Finance Scheme for TNEB/Working Capital Term Loan for Rice Mill units / for manufacturing units / for certain Service Sector units.
3. Wind Power Projects.
4. Technology Upgradation Fund (TUF) – Scheme for Textile Industry.
5. Equipment Finance Scheme.
6. Transport Operators Scheme.

- **Raising Energy Efficiency** and upgrading technology are ways of cranking up firm-level competitiveness. There is also a need to promote cleaner technologies. A Tamil Nadu Technology and Efficiency Upgradation Initiative will be launched

primarily through a fund to be administered by TIIC. This fund would be available as a soft loan for SMEs.

- **Incentives for Manufacturing Sector (Industrial policy 2007)**
- **List of Industries ineligible for Incentives include** Sugar mills, Mineral water and aerated soft drinks, Alcoholic beverages, Ice cream and confectionery, Fertiliser and animal feed, manufacture, Mining and beneficiation, Steel re-rolling, steel fabrication, stainless steel utensils, Tobacco processing, cigarette or beedi manufacture, Timber or wood processing, Servicing or repair facilities, Services sector, Any other industries as may be notified by Government.
- A back-ended State Capital Subsidy and Electricity tax exemption on power purchased from TNEB or generated and consumed from captive sources would be sanctioned for all manufacturing units, based on employment and investment in eligible fixed assets made within 3 years, irrespective of location.
- Dedicated Effluent Treatment Plants (ETP) and/or Hazardous Treatment Storage and Disposal Facility (HWTSDF) set up by individual manufacturing units would be eligible for an Environment Protection Infrastructure subsidy of Rs 30 lakhs or 25% of capital cost of setting up such ETP/HWTSDF, whichever is less.

Incentives for the Infrastructure Sector

- An *Industrial Infrastructure Subsidy* of Rs 2 crores would be given for approved infrastructure projects involving investment of Rs 300 crores in 3 years.
- Developers of approved industrial infrastructure projects would be eligible for 100% exemption from entry tax, tax on works contract and input taxes from the date of notifying it as an approved infrastructure project till the project is commissioned.
- *Single window clearance* would be available for all industrial infrastructure projects. GUIDANCE Bureau, on application, will provide single window clearance as a fee based service.

Sector Specific Policies

i. Automotive Industry

- In order to attract large investments in the automobile manufacturing sector, the State Government has already announced an *ultra-mega integrated automobile projects policy.* This policy is applicable to automobile projects investing Rs 4000 crores or more in eligible fixed assets
- *A Special Economic Zone for auto-components will* be set up near Chennai in about 300 acres. Facilities for training in high technology in auto-components

would also be set up in this SEZ. Polytechnics and ITIs around Chennai, Hosur and Coimbatore would be oriented for automotive sector.

ii. Engineering Industry

- To further strengthen exports, an Engineering Goods Special Economic Zone in about 250 acres for pumps, motors and foundry would be promoted near Coimbatore as a PPP project with the local industry by SIPCOT.

iii. Semiconductor, Electronic Hardware & Nanotechnology Industry

- *A Centre of excellence in chip and electronic hardware design* will be promoted in Anna University in collaboration with the electronic industry and Government. A Nano-Technology Research Centre is being set up in Bharathiar University and will be supported by State Government for promoting Research and Development.

iv. Leather Industry

- *A footwear SEZ,* with design centre and training facilities, is being set up in Sriperumbudur by SIPCOT in 150 acres of land. In addition, a *Leather Products SEZ* would be set up in the Chennai-Ranipet corridor by SIPCOT.
- A high technology environment-friendly *Leather Processing Complex* of international standards would be setup at a suitable location.

v. Chemicals, Petrochemicals and Fertiliser Industry

- Steps would be taken to make Natural Gas available from Krishna-Godavari basin and also from the Cochin LNG terminal through TIDCO and other private gas suppliers.
- Restrictions in use of methanol as a feedstock in chemical industries are hampering its regular and wider use. Necessary deregulation to enable chemical industries to freely use methanol would be considered.
- Petrochemical Projects Investment Region (PCPIR) at Ennore or Cuddalore will be set up using PCPIR policy recently announced by Government of India.

vi. Cement Industry

- Government would take all steps to enable effective use of fly ash by the cement industry from all sources, including TNEB. Clinker grinding units would be encouraged in the State.
- Exploration of new limestone resources would be given special thrust.

vii. Agro and Agro-processing Industry

- Support for this sector will comprise of promotion of agro processing, agro infrastructure development such as cold chains in the PPP mode covering agriculture, meat, fisheries, poultry, etc., while also enabling improvement of quality of processed foods to world standards. This
- Standalone SME cold storages for agro processing will be provided power tariff subsidy of 30%, 20% and 10% in the first, second and third year of commercial operation.
- 100% exemption from payment of Electricity Tax would be provided for all new agro-processing units for a period of 5 years from the date of commercial production.
- Government will give 50% subsidy on planting material for jatropha and other biofuel crops and extend the subsidy available to agro-processing industry to bio-fuel and bio-diesel extraction plants. Further, jatropha seed will be exempted from purchase tax and jatropha oil will be ex exempted from VAT for a period of 10 years from the date of commercial production.

viii. Sugar Industry

- State Government has issued guidelines for establishment of Integrated Sugar Complexes consisting of sugar mills, co-generation plants and distilleries in all future projects.
- Existing sugar mills will be encouraged to put up such facilities in their complexes.
- Establishment of ethanol units in sugar mills would be encouraged.

ix. Bio-fuel industry

- Government of India have launched Ethanol blended petrol (EBP) scheme. Oil Companies would be encouraged to effectively implement this scheme, leading to better returns for farmers and profitability of sugar mills. State Government will also encourage use of ethanol as fuel and increase of blending ratio of ethanol to petrol.

x. Construction Industry

- A fee-based *single window clearance mechanism* would be put in place, like GUIDANCE bureau, for all major construction projects covering clearances

required from several Government departments. An e-governance package would be evolved for this single window clearance mechanism for construction industry.

xi. Environmental Clearances

- An *E-governance package* would be implemented by TNPCB for speedy processing of environment clearances. TNPCB will grant clearance for "red' category industries on compliance of relevant norms within 60 days. Consent for *"orange"* and *"green"* categories will be given in 15 days from date of application. An online application and clearance mechanism will be developed for green and orange categories.

xii. Cluster Based Facilities

- Dyeing, leather tanning and industries that pollute would be encouraged to locate only within approved clusters with common environment management facilities.

xiii. Hazardous Waste Management

- Hazardous Waste Treatment, Storage and Disposal Facility (HWTSDF) will be set up at Gummidipoondi, Oragadam, Perundurai, Cuddalore, Karur and Tiruppur.

xiv. Carbon Credit System

- TNPCB and TIIC will encourage industries from Tamil Nadu to benefit from Joint Implementation, Clean Development Mechanism and Emissions Trading mechanisms through active dissemination and facilitation.

Chapter 5

SELECTION OF INDUSTRY SPECIFIC INSTRUMENTS FOR CLIMATE FRIENDLY DEVELOPMENT IN TAMIL NADU

Introduction

As the state is aiming at 14 percent growth for the industrial sector up to 2023, the GHG emission from this sector is likely to further increase unless appropriate policy interventions are made. To facilitate low carbon economic growth and industrial growth in the state, it is imperative that appropriate policy instruments are identified and implemented in the important sectors contributing to the GHG emissions in the state.

This study focuses on four sectors – power, cement, transport, and construction. This Chapter provides a brief discussion of fiscal versus non-fiscal approaches to environmental management and describes potential instruments for pollution control across the four sectors. It also discusses the fiscal scenario of Tamil Nadu in the context of emerging Goods and Services Tax (GST) regime and explores the potential means to integrate environmental considerations in the indirect tax reforms unfolding in India. Finally, it provides a brief comment on choice of approach for selecting appropriate policy instruments.

Classification of Policy Instruments for Environmental Management

World over a number of direct and indirect instruments are typically used for environmental management. Eskeland and Jimenez (1992) provide a useful classification of various policy instruments used for reducing pollution (see Table 5.1). The classification can also be in terms of fiscal and non-fiscal instruments. The fiscal instruments broadly include taxes, subsidies and grants. Further classification can be done in terms of the fiscal instruments under the jurisdiction of the Central government and State government. Since most taxes for environmental management with the exception of few local taxes such as congestion tax come under the Central government's jurisdiction, the fiscal instruments in the purview of State government will mostly be subsidies that promote efficiency improving practices etc. For financing of course the States will have to either get the resources from their indirect tax revenue or get the share of revenue from eco-taxes such as coal cess from the Centre (see below for further discussion on eco-taxes).

Table 5.1: A Taxonomy of Policy Instruments to Reduce Pollution

Policies	Direct Instruments	Indirect Instruments
Market-based incentives	Effluent charges; tradable permits; deposit refund systems	Input/output taxes and subsidies; subsidies for substitutes and abatement inputs
Command and control measures	Emission regulations (Source-specific, nontransferable quotas)	Regulation of equipment, processes, inputs, and outputs
Government production or expenditure	Regulatory agency expenditures for purification, cleanup, waste disposal, and enforcement	Development of "clean" technologies

Source: Eskeland and Jimenez (1992).

Industry Specific Instruments

As stated above, the main industries that can be targeted for environment friendly development through fiscal incentives are energy, cement, transport and construction. We can look at briefly the status of these industries and describes the potential fiscal instruments that can be used for encouraging a climate friendly industrial development in Tamil Nadu.

(i) Cement

At present India is the second largest producer of cement in the world with an installed capacity of 226.88 MT and produced 166.74 million tonnes (MT) in 2010 (CMA, annual report 2009-10). Tamil Nadu is the 3rd largest producer of cement in the country. As per CII's report on estimation of Tamil Nadu' s carbon footprint during 2009-10, the cement industry accounted for 12 Million tonnes of CO_2, which is 66 percent of the total emissions by the industrial sector.

Limiting carbon dioxide emissions fall broadly under process modification[10] and product modification. This would require usage of cleaner inputs, raw materials including renewable energy sources and environment friendly products. Voluntary schemes by companies can also be encouraged. Noteworthy of mention is afforestation and planting of trees in the plants' environs by many cement plants; these act like a "sink" for GHG's.

Some of the non-fiscal policies targeted towards climate friendly development in the cement industry include (i) recycling of waste through co-incineration of plastic waste as an alternate fuel in the cement kilns; and (ii) encouraging cement industries to utilize the sludge from the common effluent treatment plants (CETPs) as raw materials. Cement industries (such as A.C.C, Madukarai and Grasim Industries) have taken trial runs for utilizing paint sludge, tar waste, Petroleum refinery sludge as incineration material. The industrial policy (2007) of Tamil Nadu also proposes to take all steps to enable effective use of fly ash by the cement industry from all sources, including Tamil Nadu electricity Board (TNEB).

Fiscal measures

- **Emission Tax**: Cement is one of the major contributors to GHG emissions. British Columbia introduced a carbon tax on fuel use in 2008 which includes fuel used in industrial processes such as cement (Eunomia, research and consulting, 2012). At the same time, presumptive emission taxes on fuel should be differentiated if possible. For example, the cement industry does not discharge the sulphur of its fuels and should be ideally refunded presumptive sulphur taxes on fuel (Eskeland and Jimenex, 1992).
- **Subsidies for Use of Cleaner Inputs**. Subsidies can be of two types: input focused and technology focused.
- **Combinations of Fiscal and Voluntary Approaches**: The use of voluntary approaches (VAs) as a tool to reduce emissions from industry is widespread, and has been used as a tool to reduce GHG emissions since the early 1990s in some countries. For example, 100 percent of aluminium and cement producers, 98 percent of electricity generation and distribution and 98 percent of oil and gas

[10] Process modification measures include substitution of coal by lower carbon fuels like lignite and natural gas, use of washed coal, improved kilns, multiple-stage preheater, precalciners, cogeneration, etc. Use of renewable sources of energy like solar, wind energy also comes under this category. Product modification includes blended cement manufacture and increased use of pozzolana in concrete. This is recognized as the most cost effective emission reduction method. Each tonne of pozzolana or cementitious material used reduces CO_2 emissions by one tonne. Because clinker making accounts for the most energy consumed in the cement making process (about 90%), reducing the ratio of clinker to final cement produced by mixing clinker with additives can greatly reduce the energy used for manufacture of cement.

extraction have signed up to the Australian "Greenhouse Challenge" (AGO 2002, Shevlin, 2002). Voluntary environmental agreements negotiated by government and industry where industry aims to meet a specific energy-efficiency or emissions performance standard may be binding once entered into, and may also involve regulatory or fiscal sanctions in the case of non-compliance, e.g. in the Danish agreement on industrial energy efficiency. Entering into a voluntary agreement can also lead to tax exemptions in some countries, e.g. In Denmark, there is a reduction in the energy tax rate from 2 to 0.4 Euro/ton of CO_2 for entities participating in voluntary agreement (Danish Energy Agency 2000). This exemption has to be repaid in the VA has not been met.

- **Emission Trading Scheme:** The EU ETS works on the principle of cap and trade that puts a cap on the amount of GHGs that can be emitted by installations such as factories and power stations. At the end of each calendar year, each company must surrender sufficient allowances to cover its emissions, otherwise fines are imposed. If a company lowers its emissions, it can keep the spare allowances or trade with another firm which is short of allowances. Since its launch in 2005, the scheme has covered various energy intensive industries including cement.

(ii) Transport/ Automobile Industry

The automobile industry affects the environment throughout its entire value chain—right from the usage of raw materials and scrap in the manufacturing process to the usage of final product by the end user/consumer. Major environmental concerns in the production process relate to the volatile organic compounds contained in the emissions from painting of car/body parts. Paint solvents like primers, lacquers are concentrated in assembly and paint shops where processes like cleaning and adhesion are performed. Some options available for reducing these emissions include:

- Use of water-based paints and powder coating techniques
- Installation of systems to treat the air in painting booths
- Use of aluminium castings in place of steel castings

In the year 2008, Tamil Nadu had over 16 million 2 and 4-wheeled vehicle registrations. Chennai is the base of 30 percent of India's automobile industry and 35 percent of its automobile component industry. Chennai is now the most polluted of the four metropolitans in the country in terms of air quality. The major pollutants emitted by motor vehicles include CO_2, NO_x, sulphur oxides (SOx), HC, lead (Pb) and suspended

particulate matter (SPM). Congestion, poor quality roads, too many traffic lights affect the traffic flow adversely. Poor traffic flow causes frequent speed cycle changes which increase the average emission rates significantly. There are only very few vehicles going for regular emission check-ups every six months and the maintenance of the vehicles are also poor. Some of fiscal measures by Tamil Nadu government are listed below:

- In 2003, a **'Green Tax'** under section 3-A of Tamil Nadu Motor Vehicles Taxation act was introduced. This amounted to an additional tax in respect of vehicles specified in the fourth schedule of the Act. For motor cycles of age exceeding 15 years, a sum of Rs. 500 is charged and for other vehicles, a sum of Rs. 1000 is charged.
- **Subsidy for Battery Operated Vehicles**: MNRE is providing a subsidy of up to 33 percent of the cost of indigenously manufactured 4/6/8 seater passenger vehicle exclusive of excise duty, sales tax etc, subject to a maximum amount and to specific beneficiaries that includes Government organisations, undertakings, autonomous bodies, Public/Private limited companies, Registered Voluntary Institutions and Professional associations of Repute under Societies Registration Act.

Some of the policies that can help in the reduction of GHG emissions are:

- **Energy Taxes**: In Sweden, energy taxes on transport fuels were introduced as early as in 1924 for gasoline and extended to diesel in 1937. Since gasoline taxes were very high, comprising 68.5 percent of gasoline price, the government distinguished between industry and consumers and subsequently treated them separately in the new tax regime. Energy taxes further gave way to carbon taxes which were not uniform across industries and not successful for various reasons, primary of them being unable to distinguish between various types of fuels.
- **Congestion Tax:** In London, a congestion tax was levied on any vehicle entering or parking in the charging zone between 7 am and 6.30 pm on a weekday. Similarly, in Germany a vehicle tax is imposed to reduce CO_2 emissions from traffic. This tax is based on cylinder capacity of vehicle, over which EURO 2 per gram of CO_2 emissions per kilometre (g/km) is charged if those exceed a threshold of 120 g/km.
- **Compressed Natural Gas (CNG):** The use of compressed natural gas as fuel for public transport vehicles could drastically bring down the pollution levels. The use of CNG is a grand success in Delhi, which will serve as the model for the state government to have a look at the CNG.
- **Subsidize Public Transport**: More number of public transport vehicles should

be made available during the peak hours, so that people will reduce using their own vehicles, in order to travel to their work places.

- **Subsidies/ Exemptions for Hybrid Vehicles (Electric/battery powered) and Low Emissions Vehicles**: Exemptions from taxes and excise duties for the hybrid cars and battery powered two-wheelers could bring down pollution levels. Many countries worldwide offer subsidy programs and tax relief for Electric Vehicles that might encourage higher production and compensate purchasing prices. Most countries within the EU and beyond have introduced CO_2 based car taxes. For example, in U.K and Canada, a federal excise tax on new automobiles is based on the weighted average fuel consumption rating of the vehicle. In July 2010, the government of India announced an incentive scheme for Electric Vehicles in India. As per this scheme the manufacturers of Electric Vehicles will receive financial incentive for each Electric Vehicle sold in India. The scheme envisages incentives of up to 20 percent on the ex-factory prices of the vehicles, subject to a maximum limit. The scheme was discontinued in April 2012.

  The effectiveness of subsidies on EVs is under debate. Hahn (1995) discussed the cost effectiveness of various measures to improve the environment quality in transport sector and concluded that tighter pollution standards and improved fuel qualities were the more cost effective compared to introduction of EVs. Carlsson and Stenman (2002) undertake a social cost benefit analysis of increasing Electric vehicles in Swedish transport sector by 2010 and find that battery cars are socially unprofitable even through their private life cycle costs and external costs are lower compared to petrol cars. This is because of the high subsidies on EVs compared to the low taxes on fossil fuels.

(iii) Energy/ Power Sector

At present Tamil Nadu suffers from a power deficit. Own generation of TNEB is relatively low as compared to Maharashtra, Andhra Pradesh and Rajasthan. Thermal power stations generate majority of the energy, but with aging technology and infrastructure produces excessive pollution and greenhouse gases. Some of the reasons for the continued growth in CO_2 emissions stem from the weak monitoring and enforcement frameworks. It is estimated for Tamil Nadu that GHG emissions by energy sector amounted to 84.72 million tonnes of CO_2 equivalent, of which power sector generated 51.42 million tonnes (CII, 2012).

Tamil Nadu is the only State in India which gets 42.5 percent of its installed capacity coming from renewable source of energy (in 2011-12). Of the total installed capacity of 10256 MW from conventional sources, the thermal plants have the capacity of 2970 MW. The hydel projects have the capacity of 2191 MW. The state has the wind energy capacity of 6697 MW. It has a very good solar potential with almost 300 clear sunny days as it receives very high solar radiation. But currently its capacity is only 10 MW. To meet the ever growing needs of energy, the State Government has to tap the solar energy, which is the single biggest source of renewable energy and offers unlimited potential.

The state government has enacted various policies in order to promote renewable energy sources. These are:

- **Subsidy for Biofuels**: Government will give 50 percent subsidy on planting material for Jatropha and other bio-fuel crops and extend the subsidy available to agro-processing industry to bio-fuel and bio-diesel extraction plants. Further, Jatropha seed will be exempted from purchase tax and Jatropha oil will be exempted from VAT for a period of 10 years from the date of commercial production.
- **Promotion of Renewable Energy Sources through Soft Leans and Subsidies**: Soft loans at 2 percent to domestic users and capital subsidies for solar power generation;
    - MNRE, Government of India subsidy for Street lighting system is 50 percent of the actual cost or a maximum of Rs.9600/- (whichever is less) is applicable for non-profit organisations in rural areas;
    - Subsidy for solar photovoltaic (SPV) power plants: MNRE Government of India provides subsidy of 50 percent of the actual cost or Rs.1.25 lakhs / KWp for up to 10 KWp plant and Rs.1.50 lakhs / KWp for more than 10 KWp plant with distribution line.
- **Other Fiscal Measures:**
    - **Energy Taxes**: These taxes are based on the carbon content of the fuel. Finland was the first country to introduce carbon tax in 1990. Its current tax structure divides tax rates between liquid fuels used in transport and heating and those for other fuels and electricity. While the tax on liquid fuel and coal takes account of both the energy content and CO_2, electricity tax has no CO_2 component. U.K charges climate change levy tax on business use of energy such as natural gas, electricity, LPG and solid fuels with different rates for different fuels. Sweden charges sulphur tax on liquid fuels, coal and fuel oil

according to the sulphur content, in addition to carbon tax. British Columbia levies carbon tax on the purchase and use of fossil fuels such as gasoline, diesel, natural gas, heating fuel, propane, coal, etc based on emissions of CO_2 equivalent. A noteworthy aspect of Denmark's carbon-energy taxation program was the earmarking of twenty percent of the revenues to co-finance energy-efficiency measures and upgrade production technology which had marked impacts on energy productivity.

- **Accelerated Depreciation:** The Netherlands uses carbon tax revenues to reduce the general tax burden for individuals and businesses as well as to provide programs to reduce greenhouse gases. Part of the revenue is "recycled" to businesses in the form of accelerated depreciation for environmental equipment and tax-deductibility of energy investments.
- **Subsidies for Emerging Technologies such as Photovoltaic (PV)** have the potential to solve some of the drawbacks of the fossil fuel based energy system as well as meet other development challenges such as rural electrification, energy provision and more generally poverty alleviation. Those who generate with roof top systems can consume the power so generated and also feed the surplus to the grid. Under the Rooftop Power and Stand alone Small Grid-connected Power scheme, seven SPV projects, of each 1 MW capacity have been sanctioned for the Tamil Nadu state (TEDA, 2010).
- **Feed-in Tariffs** for supporting renewable energy. These provide a guaranteed price to the producer for the power they feed into the grid;
- **Feed-in Premium** for renewable energy producers that provides a premium, in addition to the electricity market price (that fluctuates based on changes in market conditions);
- **Green Certificates** where the government issues certificates to producers of renewable energy and imposes obligation on consumers to a specific percentage of energy from renewable sources. This system allows competition between renewable producers as the certificate price will depend on demand and supply of green certificates.
- **Grants and Subsidies** can be used to promote use of energy efficient technologies. For example, Scotland has a biomass heat scheme that has provided grants to businesses to install biomass heating systems and district heating systems in small businesses. U.S. has the Tribal Energy Program, which promotes tribal energy sufficiency, and fosters economic development

and employment on tribal lands through the use of renewable energy and energy efficiency technologies.

- **Grants and Subsidies to SMEs**: Important lessons can be learnt from Norway's Industrial Energy Efficiency Network (IEEN) program which was set up to encourage uptake of energy efficiency measures. Between 1996 and 2006, approximately 600 of the 900 members of the network had received information and/or financial support for lowering their energy consumption. Most of these were SMEs.
- **Accelerated Depreciation for use of Smart Meters, Electric Grid Systems and Renewable Energy Sources**: There are a number of general difficulties with regard to accelerated depreciation. For example they tend to favour large businesses since they tend to be administratively complex, unattractive to profit-oriented firms as they have an impact on business profitability. However, several countries have adopted such measures with varied degrees of success. For example, the Brazilian scheme of accelerated depreciation to encourage energy efficient investment is costly to government, yet induced technological advancement by increasing the expansion of combined heat and power plants (CHPs) by 24% (Koowattanatianchai et al, 2009). In Japan an accelerated depreciation allowance equal to 30% of the acquisition cost for specific energy efficient and renewable technologies as well as other environmentally beneficial products led to increased investment in energy-efficient products from 300 billion yen in 1990 to 800 million yen in 1993.
- In the United States, the Emergency Economic Stabilization Act 2008 contains a number of depreciation incentives for increasing energy efficiency. The Act permits accelerated depreciation for smart electric meters and smart electric grid systems. Taxpayers are allowed to recover the cost of this property over 10 years. The Modified Accelerated Cost Recovery System (MACRS) allows tangible property to be depreciated on an accelerated basis according to a schedule specified by the Internal Revenue Service (IRS). Wind, solar and geothermal projects, for example, are classified as five-year property and depreciated at a set rate over the course of six years.

(iv) Construction

Energy Conservation Building Code (ECBC) is currently applicable to commercial buildings or building complexes in Tamil Nadu that have a connected load of 100 kW or greater or a contract demand of 120 kVA or greater or having conditioned area of 1000 m2 or

more. Chennai is home to 42 of the 212 structures in India that are certified as eco-friendly by the Indian Green Building Council; the residential sector accounts for 7.2 percent of total carbon dioxide emissions in the energy sector in Tamil Nadu (CII, 2012). Energy use (and resulting GHG emissions) can be greatly influenced by building design or renovation. For example, Passive solar and adequate insulation can make an important contribution towards reducing energy required for heating. The choice of materials used during the construction and renovation of a home are a key area of sustainable design as materials extraction and production can have both environmental and social impacts.

- **Tax exemptions, subsidies and grants** can be used to improve energy efficiency of the construction sector.
    - **Reduced VAT** on installation of energy saving materials: In the U.K, a 5 percent reduced VAT rate is applied to grant-funded installations of energy saving materials (for insulation, draught stripping, central heating system controls, including thermostatic radiator valves, hot water system controls, solar panels and renewable heating power systems)
    - **Property Tax Exemptions on the use of Renewable Energy Sources**: Arizona's property tax exemption was established in June 2006 and originally applied only to "solar energy devices and any other device or system designed for the production of solar energy for on-site consumption".
    - **Tax Credit for High Performance Buildings**: In addition to the tax credit for renewable energy, local governments can also provide a tax credit for high performance buildings. The credit is applied as a credit against the property tax for buildings so long as they achieve at least a silver rating according to the U.S. Green Building Council's LEED standards, or which meet other comparable green building guidelines or standards approved by the State.
    - **Increase Relative Cost of Resident Parking Permit,** e.g. by granting stamp duty exemptions on new developments close to public transport/ and or without designated parking space. Subsidized housing projects can be promoted so as to reduce the need to travel and promote increased use of public transport.
    - **Reduced VAT Rates for Accredited Supplies:** As per the recommendations of WWF, UK, a reduced VAT rate of five per cent is applied to accredited 'sustainable' supplies. These supplies would have to be defined by Government but could include for example: rainwater harvesting

systems, low solvent paints and other certified material including primary resources such as Timber.

- **Aggregates (sand, gravel and rock) Levy**: In the U.K, over the last few years there has been a substantial increase in the amount of construction and demolition waste used as aggregate. An Aggregates Levy (introduced in April 2002) has been set at £1.60 per tonne of aggregates produced. Some of the revenue is recycled to business through national insurance contribution reductions of 0.1 percent. Some of the money (£35 million for the UK for the next 2 years) will be spent on reducing the environmental impact of quarrying through a number of measures.

Eco-taxes and Goods and Services Tax Regime

Any discussion on low carbon growth cannot be made without the reference to the emerging Goods and Services Tax (GST) regime. The proposed GST is required for strengthening India's economic growth. It will correct the existing distortions resulting from segmentation of an economically common space of taxation of value added in the production and sale of goods and services into jurisdictional separation between the Centre and the States. Te existing system has given rise to distortions and created avoidable barriers in inter-state trade. However, the sales tax/State VAT has over time become the mainstay of state tax revenues, which has provided much needed autonomy to the states whereby they can jointly decide their expenditure and revenue budgets.

State economies, demographic and geographical features are different from each other. States' revenue autonomy has allowed them to develop their own expenditure priorities according to their specific needs. Some states are relatively more industrialized, some continue to be more dependent on agriculture and some are dominated by the service sector. In many states, the structure of production is such that considerable pollution affects the quality of air, water, and soil in their states.

The Indian tax system pertaining to goods and services has evolved in a manner where the value added tax principles are now applied. But the system remains segmented because taxation of goods is not integrated with that of services and central sales tax still constitutes a barrier on free movement of goods across states. One final step in indirect tax reforms can be taken in the form of a comprehensive GST.

Two precautions must be taken by the states. One, they should not fully write-off their revenue autonomy which includes autonomy to fix tax rates and select goods that

may be given exemptions or subjected to lower tax rate. Secondly, producing states like Tamil Nadu must ensure that part of the tax revenue is recovered from the consumers even if they are located in other states or countries to meet the costs that need to be incurred in mitigating the adverse effect of localized pollution and for providing environmental public goods to restore the quality of air, water, and soil and meet costs of providing additional health services. As growth increases, these considerations would become more and more important. Pollution is a stock variable and as time passes the problem becomes more and more serious. This is because pollution accumulates over time and subject to some absorption or cleaning up by nature, pollution of different years only accumulates. All past polluters who have remained untaxed have already escaped taxation.

Future environmental cleaning up or health costs will have to be met only by current producers/consumers of goods and services, which will be both unfair and inadequate. States should not give up any taxation power in the name of growth, which will tie their hands in future, when additional revenues will be needed and polluters, many on them in other states or abroad would already have escaped their responsibility of paying for the environmental damage. It is always the final consumer who is the ultimate polluter and must pay for the damage under the 'polluter pays principle'.

There are four ways in which environmental taxes can be implemented: as non-rebatable excise, non-rebatable cess, non-rebatable surcharge, and a higher rate for polluting goods and services. In the last case, probably the tax paid on inputs will have to be rebated within the intra-state valued added chain. An excise is relevant if the pollution is at the production stage. A cess is relevant if the government wants to earmark the revenues for environmental purposes specific to industries. A surcharge can be used more generally. States should not give up any of these powers.

In addition, there is now a move toward direct taxation of pollution such as the carbon tax or SO_2 tax etc. These emissions cannot constitute 'supply' or sale in the GST framework, because emission is into the atmosphere and not supplied to any dealer of consumer and certainly not supplied for a consideration. Under the present constitutional scheme, pollution cannot be taxed. At best, the central government can levy such taxes under its residuary powers. However, states will not have access to such powers unless these are listed in the State list.

It is doubly important for the states to have autonomy in levying cesses and surcharges or differentially higher rates for identified polluting goods and services. These can be administered by the same authority that administers the GST. This can be achieved by agreeing to only floor rates for GST and take steps to lower tax rates or exempt goods from GST on distributional considerations. The international experience shows that many countries including the EU do provide this kind of flexibility.

There are at least two alternative GST models that are currently under discussion: the model proposed by the Empowered Committee and that by the Thirteenth Finance Commission (ThFC). The Central government has not proposed its own model but has proposed constitutional amendments which will eventually define the contours within which the GST can evolve. The ThFC has linked its grant scheme to a full-scale acceptance of the model proposed by the Commission. The chances of accepting the ThFC seems remote as the differences between the EC Model and the ThFC model are considerable.

All the alternative models of GST under discussion do have a discussion of environmental taxes in relation to demerit goods or sin goods which make reference to the issue of negative externalities. The move towards GST will have significant implications for the scope of environmental taxation, which needs to be integrally considered at this stage rather than leaving it for the future. Most countries across the world are working out strategies to impart a green shift to their system of taxation of goods and services and India at this juncture should not by-pass the issue but leave space for environmental taxation both at the central and state levels.

As long as GST is planned to be revenue-neutral for the centre and states taken together, there is bound to be some revenue losing states and some states which will experience a positive impact. It is the so called 'producing' states which will lose revenue in relative terms, particularly because of the loss of revenue from the central sales tax as the taxation principle moves to a destination principle. Tamil Nadu will be one of the losing states. Losses will be additional if the Tamil Nadu included more goods in the exempted and/or low rate categories. The proposed grant of Rs.50,000 crore by the ThFC is full of conditionalities that may be difficult to meet.

The Central government will have to devise its own grant mechanism. However, any scheme for compensation will be for a finite time horizon, extending at best from 3 to 5 years. The relative revenue losses will have a longer term impact. The state

governments should primarily focus on retaining revenue autonomy and the long term interest of the state and its citizens including the environment and pollution related perspective rather than short term compensation.

The issues involved in the integration of eco-taxes in the GST regime can be summarized as:

In a modern growth-oriented economy like India, there is a clear case for integrating the taxation of goods and services and avoid cascading as well as segmentation of the taxation space between goods and services, inter-state boundaries, and value added up to manufacturing vis-vis value added up to the final consumer.

1. This will require that states get power to tax services and the Centre the power to tax value added beyond manufacturing up to final retail sale.
2. The destination principle should be followed in general, which would involve zer-rating exports outside the state, whether to out of country or to another state.
3. The only exception to this should be with respect to polluting goods and services where the pollution affecting the soil, water, and air is largely localized and the state in question needs to recover taxes from the consumers of such polluting goods and services whether located in other states or other countries.
4. This exception should be made with respect to only a limited number of polluting inputs and outputs by way of a non-rebatable excise so that the overall GST chain is not broken.
5. Determination of destination of consumption of services will pose particular problems and some working rules need to be evolved.
6. The changeover to GST needs to be done in a manner that does not disturb the basic feature of India's federal structure where states should retain autonomy to decide on the rate structure and exemptions taking into consideration their specific features.
7. If the overall GST rate structure is determined such that for states taken together and for the centre, revenue under GST are broadly equal to the revenues under the present system in a bench mark year, then some states are bound to lose relative eto others. A state like Tamil Nadu, being a manufacturing state, is likely to lose revenue in a transitional period. Furthermore, it has to incur expenditure for the maintenance of the infrastructure that it has developed to cater to the needs of the industry. Its citizens will also suffer on account of localized pollution around the factories. Such states need to be compensated adequately.

Approaches for Selecting Appropriate Policy Instruments

While multiple instruments can be used to reduce pollution, the choice of 'appropriate' instrument(s) could depend on either, (a) Cost Benefit analysis; (b) Cost Effectiveness analysis; or (c) Environmental Effectiveness analysis.

(a) Cost Benefit Analysis (CBA) requires careful examination of all costs and benefits involved with the implementation of the policy instrument over a chosen time horizon along with appropriate discount rate. When applied to greenhouse gas emissions, due to long time horizons involved the choice of discount rate becomes quite complex. Further, identifying and valuing all the benefits – including the indirect/secondary benefits – may not be an easy exercise, especially due to paucity of reliable estimates of WTP/WTA in developing countries.

(b) Cost Effectiveness Analysis on the other hand requires careful examination of the costs of implementing various policy instruments to meet a specified environmental objective and choosing the intervention with least cost. Though costs are aggregated over time in this approach also, the relatively small time horizons involved pose relatively less difficulty in the choice of discount rate.

(c) Environmental effectiveness attempts to simply compare the environmental outcome(s) under different policy instruments with reference to the business as usual scenario and chooses the one that assures maximum environmental benefit. In the context of global pollution such as carbon dioxide the environmental effectiveness could be simple and appropriate to apply especially due to the uniformly mixed nature of such pollution.

Chapter 6

FISCAL INSTRUMENTS FOR SELECTED INDUSTRIES: NATIONAL AND INTERNATIONAL EXPERIENCES

Introduction

The purpose of this Chapter is to discuss the objectives and benefits of introducing fiscal instruments identified for selective industries and to highlight experiences of other nations and other states of India or government of India levying/utilizing similar fiscal instruments in managing environmental issues. The sectors identified for Tamil Nadu are: cement industry, waste disposal, energy, and transport and construction industry.

Cement Industry

Fiscal Instrument: Subsidies for waste derived fuel through co-incineration in the cement industry

Objective: Reduce carbon emissions emitted through coal consumption by integrating cement kilns with an overall waste management strategy that promotes use of alternate fuels like blast furnace slag, coal ashes, by product gypsum, waste oil, wood chips, waste plastics and waste tires. Currently the government of India gives a capital subsidy for WTE programs but not for co-incineration in cement plants. Further, subsidy should be based on the energy efficiency of the program.

Benefits: Utilization of 1 kg of waste plastics in cement kilns, displacing an equivalent amount of fossil fuel in thermal units results in avoiding emissions relating to the mining, handling, transportation and use of coal at the kiln; Specialist waste incinerators are very inefficient converters of the heat content of wastes, whereas a cement kiln approaches 100 percent efficiency. A net decrease in the quantity of CO_2 released, relative to a scenario in which waste is combusted in a dedicated incinerator, reduces the environmental impact of the greenhouse effect during the combustion of wastes.

International Experience: In Europe and USA, the cement industry has been using alternative fuels prepared from waste materials for more than 20 years, and high substitution rates are being achieved. The share of alternate fuels in total fuel consumption for cement production is 17.9 percent in the EU-27 countries (CEMBUREAU, 2008). Secondary fuels processed from industrial waste are commonly co-incinerated in cement kilns across Europe. About 105 kilns are reported to co-incinerate more than 2.5

million tpa of secondary fuels, mainly hazardous waste such as spent solvents, used oils and tires. Use of Refuse Driven Fuel in coal power plants and cement plants, due to the effective substitution of primary fossil fuels, shows a large number of ecological advantages when they are compared with the alternative combustion in an incinerator as long as the plants comply with the New Waste Incineration Directive 2000/76.

The waste derived fuel (WDF) projects are driven by: (a) high conventional fuel prices, (b) high landfill tax charges on waste deposits and on fossil (c) CO_2 savings in emission trading schemes and (d) subsidy scheme for sustainable energy production. Cement plants are often paid to accept alternative fuels; other times the fuels are acquired for free, or at a much lower cost than the energy equivalent in coal. Thus, the lower cost of fuel can offset the cost of installing new equipment for handling the alternative fuels. Energy normally accounts for 30-40 percent of the operating costs of cement manufacturing; thus, any opportunity to save on these costs can provide a competitive edge over cement plants using traditional fuels (Mokrzycki and Uliasz-Bochenczyk, 2003).

An important EC Directive which has an impact on Refuse Derived Fuel market is the Landfill Directive 1999/31/EC which requires diversion from landfill of biodegradable fraction of MSW and used tires. The other important piece of EC legislation that will impact on co-incineration of waste is the new Waste Incineration Directive 2000/76/EC which aims to bring closer the requirements for incineration and co-incineration. The decision for a municipality or waste management company to produce Refuse Derived Fuel through Mechanical Biological Treatment (MBT) or to rely on MSW incineration to comply with the Landfill Directive will depend on whether the costs of the MBT process are less than that of incineration or thermal treatment.

Netherlands has a subsidy scheme for sustainable energy production ('Stimulering Duurzame Energieproductie', SDE) which compensates the difference in production costs between fossil and sustainable energy. Among the types of sustainable energy for which SDE subsidy is available are electricity from waste incineration and biogas from the digestion of organic waste. For waste incineration plants the subsidy amount is dependent on the energetic efficiency, which should be at least 22 percent. For energy from organic waste the basic subsidy amount is EUR 0.12 per kWh. The actual electricity price (to be determined annually) is subtracted from the basic amount.

In the United States, approximately 5 percent of fuel used in the cement industry comes from renewable and non-renewable waste fuels such as wood, tires and other

non-hazardous and hazardous materials. In the U.S.A legislations vary with respect to co-incineration in the various states.

Some states like Montana do not allow co-incineration of tires in cement kilns. The California Portland Cement in Colton is a long dry kiln that is permitted to use coal, petroleum coke; natural gas, fuel oil and whole scrap tires. The Colton plant gets paid to use the scrap tires, and thus gets paid to use the energy thus generated. Also, the use of scrap tires reduces the NOx emissions from the plant, and scrap tires are therefore categorized as a NOx control strategy.

Geo-cycle is a wholly owned subsidiary of Holcim and is responsible for sourcing and processing alternative fuel and raw material feed stocks and supplying the Holcim cement plants with alternative fuels and raw materials. The plant based in Oklahama is primarily a coal-fired plant and includes two wet process kilns. The current plant fuel mix includes: Petroleum coke 25 percent, alternative fuels 20 percent (almost all tires) and remainder coal primarily. Oklahoma runs the tire program, under the Oklahoma Department of Environmental quality (DEQ). Post consumer tires pay $1 per tire; this funds the Oklahoma Tire Fund. The processors, end users, and transporters of tires are all covered by the program, but very confusing legislation and implementation. At the end of each month each tire transporter and tire processor/user sends a report to state and applies to state for funds for tires handled. The State pays out money every month.

Central Government/other State Policies and Applicability to Tamil Nadu:

- **Government of India Financial Assistance to Waste to Energy Programs:** Currently the central government gives a subsidy of Rs.50 lakh to Rs.1 crore/ MW for industrial waste to energy programs, depending on the technology (20 percent higher subsidy for Special Category States).
- **Industrial Waste to Biogas (biomethanation):** Capital subsidy of Rs. 0.5 crore to Rs. 1crore/MW.
- **Power Generation from Biogas**: Rs. 0.8 crore- Rs. 1 crore /MW
  - 8 Sago waste based bio gas Projects have been established in the Tamil Nadu by availing CFA from MNRE to a tune of Rs.79 lakh, during the year 2011-12. CFA sanction for Rs.55 lakh has been obtained for establishing another 5 Sago waste based projects. 6 captive biogas based power projects in Agro farms for 3 MW are being commissioned with the financial assistance of MNRE.

- **Power Generation from Solid Industrial Waste**: Rs 0.8 crore/MW
    - The CPCB has initiated the implementation of co-processing of incinerable hazardous and non-hazardous waste including plastic waste in cement kilns, thermal power and steel plants. The Tamil Nadu Pollution Control Board is directing the cement industries to co-incinerate the plastic waste as an alternate fuel in the cement kiln. The cement industry at Tirunelveli is utilizing the plastic wastes in the cement kiln regularly. A subsidy for co-incineration will alter the incentives for incineration of wastes vis-à-vis co-incineration in cement plants. The Ultra-tech plant in Tamil Nadu experimented with waste to energy for material such as rubber tire chips, agro wastes and hazardous high calorific materials such as paint sludge from automobile industry and achieved successful safe disposal.
- **Energy Recovery from Municipal Solid Waste**: Financial assistance for setting up of five Pilot projects at a flat rate of Rs. 2 crore per MW, subject to ceiling of 20 percent of project cost and Rs. 10 crore per project, whichever is less. Administrative charge of 1 percent of the MNRE's financial assistance with an upper limit of Rs 5 lakh per project shall be payable to the State Nodal Agencies (SNA) to facilitate the development and implementation of the projects and monitoring for a period of one year after commissioning. The scheme is to be implemented by involving the State Nodal Agencies, Urban Local Bodies / Municipal Corporations. The projects will be taken up by urban local bodies and other Government organizations in Public Private Partnership mode.
- **Emission Trading**: The Ministry of Finance has launched a concept note on the possibility of establishing a local emission trading scheme for air pollution that might serve as a model for future environmental regulation in India and also position industry to benefit for potential tie-ups to global emissions trading schemes. The government has selected two states: Tamil Nadu and Gujarat for the implementation of the pilot scheme. These schemes would further encourage the production of alternate fuels from waste at the state level.

Waste Disposal

Fiscal Instrument: Cess on Waste Disposal

Objective: The mail objective is to incentivize safe disposal and recycling of hazardous/non-hazardous waste. In many countries, there are heavy "polluter pays" taxes and high duties for dumping wastes. Many prefer industries such as cement for disposing the waste safely than pay taxes. Even after facilities have become operational

in some states, illegal dumping persists as it avoids the cost of transportation, treatment and disposal. A cess will ensure that companies dispose waste in a safe manner and also ensure a continuous supply of waste to the integrated waste management facilities. In addition to subsidies to recycle waste, a cess can be levied on companies that do not dispose waste in an efficient manner. The MOEF should formulate guidelines for Implementing the principle of 'Polluter to pay' for disposal of wastes (DIPP, 2011).

Benefits: Tax on waste needs to be introduced along with other economic instruments to be effective. A study by the ministry of housing, planning and environment, Netherlands, analyzed the impact of economic instruments for waste disposal and found that an increase in the tax on land filling and the introduction of a non-zero tax rate on incineration will be effective if simultaneous measures are taken which transfer the incentives of the tax on to the producers of waste (i.e. households and the service sector). This can be achieved, for example, by introducing unit-based pricing such as differential and variable rates and stimulating separate collection of waste streams.

International Experience: In EU member states, the Landfill Directive 1999/31/EC (CEC 1999) imposes a phased reduction of biodegradable waste going to landfill from 2006. It also imposes a progressive ban on the disposal of tires to landfill. Since 1995 the Netherlands has a tax on the final disposal of waste which is collected by the local municipal body. This tax is based upon article 23 of the Environmental Taxes Act ('Wet belastingen op milieugrondslag'). Until now, the area of application has been limited to land filling, as the rate for incineration is nil. In 2008, the rate for land filling amounts to €88.21 per tonne, which is relatively high compared to other EU countries that apply a landfill tax. A limited number of waste categories, including waste with a density of more than 1,100 kg per m3, are subject to a reduced rate of €14.56 per tonne. Revenues from waste taxes generally accrue to the general budget, but several countries earmark them for specific waste related or other environmental purposes. This is common practice in the new Central and Eastern European Member States, but waste tax revenues are also earmarked in Austria, Ireland, Italy and Spain (Catalonia).

Central Government/other State Policies and Applicability to Tamil Nadu: The 74th Constitutional Amendment (1992) transferred the responsibility for collection, treatment and disposal of MSW from State Governments to the Urban Local Bodies (ULBs). As per the National policy on hazardous waste (CPCB), there is a need for development of an "environment clean-up fund" at the state/national level for which industries and municipalities have to make mandatory annual contributions. The contributions may be

collected on the lines of water cess following some norms as to be decided by the government. The water cess is collected by state pollution control boards.

The cess rate is specified based on for what the water is consumed and varies from 10 to 15 paise per kilo liter based on extent of bio-degradable pollution in the water. Out of the cess collected and credited to consolidated fund of India (CFI), 80 percent of cess is reimbursed to state pollution control boards to augment the resources of boards. Cess reimbursement to state pollution control boards is also utilized to execute pollution abatement programmes. Industries that comply with effluent standards, are connected to a wastewater treatment plant, and do not consume water in excess of the prescribed limit are entitled to a 25 percent rebate in the water cess. The rebate scheme thereby encourages compliance.

In the same way the process can be extended for levying tax on emissions from cement industries. At the state level, a waste management cess can levied upon industries based on the bio-degradability of the waste.

Waste Collection Charges in Tamil Nadu: In Namakkal, Tamil Nadu, the Municipal Commissioner in the year 2003 initiated a project especially for solid waste management wherein collection charges and penalties are being introduced. The Tamil Nadu government has prepared a manual on urban municipal solid waste generation based on the Municipal Solid Waste (Management and Handling) Rules 2000.

According to the manual, a garbage collection fee may be collected on need and affordability basis and therefore initially the domestic households and slums are not suggested for garbage collection fee. The garbage collection fee as fixed by the ULB should be collected from the bulk garbage producers while simultaneously ensuring 100% collection of garbage by the Municipal staff / Authorized agency. But council can take a decision to levy garbage collection fee from individual household through bye laws.

Private Public Partnership (PPP) Model in Gujarat: Rajkot Municipal Corporation in the State of Gujarat has developed a model which follows Public Private Partnership (PPP) mode. The Corporation has many primary collection points for collecting waste from various generation points, from where it reaches the secondary collection points and to transfer stations. Half of the city area is privatized for lifting from the collection points (RCC bins) and transportation of the waste. In the other half of the city area, RMC

vehicles are used for the purpose of collection, lifting and transportation of the waste. The private operator has invested about Rs.22 Crores for developing the project. The Corporation has made 'tipping fee' payment to the operator for the quantity of rejects and inert supplied at the landfill site (about 20% of the total waste generation).

Currently a solid waste management cess is levied by the Bangalore civic body for solid waste management in the city and disposing them scientifically. According to the municipal authority (BBMP) Bangalore, it spends Rs 200 crore annually for solid waste management in the city. To manage the financial implications for the same, BBMP introduced a Solid Waste Management Cess along with BBMP property tax for property owners in Bangalore.

Energy Generation

Fiscal Instrument: Green Cess

Objective: The mail objective is to encourage generation of electricity from renewable sources, green cess could be levied on all generating units excluding those based on renewable energy sources and on electricity consumed for commercial and industrial purposes.

International Experience: Finland was the first country to introduce carbon tax in 1990. Its current tax structure divides tax rates between liquid fuels used in transport and heating and those for other fuels and electricity. While the tax on liquid fuel and coal takes account of both the energy content and CO_2, electricity tax has no CO_2 component. The Netherlands uses carbon tax revenues to reduce the general tax burden for individuals and businesses as well as to provide programs to reduce greenhouse gases. Part of the revenue is "recycled" to businesses in the form of accelerated depreciation for environmental equipment and tax-deductibility of energy investments.

Central Government/Other State Policies and Applicability to Tamil Nadu: Based on the recommendations made by the MSE (2007) study, the government implemented a levy of an eco-cess to provide for suitable incentives for reducing the ash content in coal to improve its thermal efficiency and reduce the operational cost of the thermal power plants (GOI, 2007; Annual Report, Ministry of Coal, http://coal.nic.in). Revenues generated from the eco-cess may be used to set up a clean coal fund, which could be used to setting up infrastructure for coal washing, selective mining and R&D.

State Government Initiatives-Gujarat & Maharashtra: Gujarat recently passed an act (March 2011) that provides for levy of cess on generation of electricity for creation of a fund for the protection of environment and promoting the generation of electricity through renewable sources. The tax is levied at a rate not exceeding 2 paise per unit of the electricity generated irrespective of whether the electricity is consumed in the state or not. The funds will be credited to the consolidated fund of the state and transferred to Green energy fund after deducting collection charges. The state government may exempt units having capacity of not more than 1000 kw.

Maharashtra has levied Rs. 0.08 (eight paise) per kWh on energy consumption by commercial and industrial units. This cess generates around Rs.200 crore annually. The state government has formed the Urjankur Nidhi trust and appointed M/s IL & FS as fund manager for proper utilization of the funds. The funds are being utilized for providing equity capital for bagasse co-generation projects and for funding power evacuation infrastructure required for evacuation of power generated from non-conventional energy generation projects. [11]

Transport

Fiscal Instrument: 1. Congestion Tax

Objective: To facilitate a smooth traffic movement during peak hours of traffic and reduce GHG emissions, a cess may be levied on vehicles in urban centers to facility smooth traffic movement.

Benefits: Time savings to vehicle occupants who continue to travel on the roads; improved journey time reliability, over and above direct time savings; reduced fuel and other vehicle costs.

International Experience: In 1999, the Greater London Authority (GLA) Act was passed to create a unique form of strategic citywide government in London. [12] The GLA Act (as amended by the Transport Act 2000) is also the legislative instrument which gives the Mayor the powers to introduce congestion charging schemes in London. For at least ten years all net proceeds from a scheme must be spent upon improving transport in accordance with the Mayor's transport strategy.

[11] Karnataka has planned to impose Rs.0.05 (five paise) per kWh as green cess on commercial and industrial consumers to generate about Rs.50 to Rs.60 crore annually.

[12] This Act formed the Greater London Authority (GLA) which is made up of an elected Mayor who has an executive role, making decisions on behalf of the GLA and a separately elected London Assembly which has a scrutiny role.

In Sweden, the congestion pricing system is implemented as a tax on most vehicles entering and exiting the central Stockholm, Sweden. The Road Administration worked with the federal tax Authority to manage the payment and fee structure, and overall administration. It was proposed that the revenue raised from the reintroduced congestion charge would partly fund a new bypass road and inner city traffic improvements.

In Germany, this tax is based on cylinder capacity of vehicle, over which EURO 2 per gram of CO_2 emissions per kilometre (g/km) is charged if those exceed a threshold of 120 g/km.

Central Government/Other State Policies and Applicability to Tamil Nadu: Delhi is the first city in the country that plans to impose congestion tax on motorists. A task force constituted by Delhi High Court had also favored introduction of congestion tax to minimize vehicular traffic. The Government, in the document, said 'disincentives' for use of personal vehicles may include introduction of congestion charges for entry into certain areas of the city and higher parking fees. The Municipal Corporation of Delhi, the authority charged with providing civic services to the city, hopes to introduce a system to levy a 150-rupee (£2) fee on cars, motorbikes and even rickshaws entering central areas during the day.

Of the four metropolitan cities in the country, Chennai is the most polluted city with the GHG gases and particulate emissions entering the air exceeding the tolerance limits in many parts of the city. Poor traffic flow causes frequent speed cycle changes which increase the average emission rates significantly. Therefore this tax is relevant.

Fiscal Instrument: 2. Subsidies/ exemptions for Hybrid Vehicles (Electric/battery powered) and Low Emissions Vehicles

Objective: Exemptions from taxes and excise duties for the hybrid cars and battery powered two-wheelers could bring down pollution levels.

International Experience: An increasing number of countries worldwide offer subsidy programs and tax relief for Electric Vehicles that might encourage higher production and compensate purchasing prices. However, implementing such a policy requires investment

in appropriate supporting infrastructure (eg. charging stations) and this may be considered as a medium term proposition.

Central Government/other State Policies and Applicability to Tamil Nadu: Currently, the Motor Vehicle Tax is being levied in all States and Union Territories (UT) except in the UT of Lakshadweep on the basis of engine capacity, or, unladen weight and cost of vehicle. The purpose of motor vehicle tax (MVT) is to defray the costs of road maintenance out of the revenue realized from user charges. In July 2010, the government of India announced an incentive scheme for Electric Vehicles in India. As per this scheme the manufacturers of Electric Vehicles will receive financial incentive for each Electric Vehicle sold in India. The scheme envisages incentives of up to 20 percent on the ex-factory prices of the vehicles, subject to a maximum limit. The scheme was discontinued in April 2012 and has been re-introduced recently by MNRE. Under the MNRE's subsidy scheme announced in November 2010, the government had set up a Rs 95-crore corpus to provide incentives of up to 20 percent on ex-factory prices of vehicles, subject to a maximum limit. The cap on the incentive stood at Rs 4,000 for low-speed electric two-wheelers, Rs 5,000 for high-speed electric two-wheelers and Rs 1,00,000 for electric cars.

MNRE, GOI announced for the implementation of Alternate Fuels for Surface Transportation Programme (AFSTP) for Battery Operated Vehicles (BOVs) with CFA of Rs.4000/- or 20 percent of the cost of the vehicle for low Speed vehicle and Rs.5000/- or 20 percent of the cost of the vehicle for high Speed vehicles. TEDA has promoted 1427 BOVs - two wheelers under the above scheme so far. In 2003, a **'Green tax'** under section 3-A of Tamil Nadu Motor Vehicles Taxation act was introduced. This amounted to an additional tax in respect of vehicles specified in the fourth schedule of the Act. For motor cycles of age exceeding 15 years, a sum of Rs. 500 is charged and for other vehicles, a sum of Rs. 1000 is charged.

Construction/Building

Fiscal Instrument: 1. Reduced VAT on installation of energy saving materials.

Objectives: To encourage energy saving materials in order to reduce energy consumption. Some of the energy efficient products are: innovative lighting controls, photovoltaic solar electricity, solar resistant glass, energy recovery ventilators, energy efficient air conditioners, solar roofing membranes, and light pipe day lighting (capturing the sunlight from rooftops and piping it down through reflective tubing). Other green

innovations include horizontally perforated clay hollow blocks (which besides giving excellent sound and thermal insulation save on structural costs); autoclaved aerated concrete blocks, wall form system (a construction system comprising of lightweight panels), cellular lightweight concrete (which reduces consumption of reinforcing and cement and saves energy); heat resistant terrace tiles (replicating the benefits of conventional cool roofing); thermal insulation boards; porous pavement system and Sky ceilings. Green materials also include fly ash cement, fly ash blocks, recycled aluminium, recycled steel, recycled tiles, low VOC paints and bamboo-based products.

International Experience: In the U.K, a 5 percent reduced VAT rate is applied to grant-funded installations of energy saving materials (for insulation, draught stripping, central heating system controls, including thermostatic radiator valves, hot water system controls, solar panels and renewable heating power systems. In China, VAT is exempt on sale of self-produced goods including recycled water, qualified powdered rubber made out of obsolete tires, retrodden tires, and certain construction material made of waste.

Central Government/other State Policies and Applicability to Tamil Nadu: The Bureau of Energy efficiency (BEE) has introduced "The Bachat Lamp Yojana", a programme under which households may exchange incandescent lamps for CFLs (compact fluorescent lamps) using clean development mechanism (CDM) credits to equate purchase price. Some states have made mandatory the installation of solar water heaters in hospitals, hotels and large government and commercial buildings. Subsidy is provided for installation of solar water heaters in residential buildings.

The Standards and labeling programme launched by the BEE insists assigning of star rating to the appliances depending upon their efficiency. Labeling is made mandatory for four appliances (refrigerators, air conditioners, tube lights and distribution transformers) for which anything below star one cannot be manufactured or sold as per Section 14 (c) of the Energy Conservation Act, 2001. Energy efficient home lights SPV, is a fixed indoor lighting system available in five configurations under MNRE subsidy scheme. The lights used in the above systems are Compact Fluorescent Lamps (CFL), consuming less energy but equivalent to 25/40/60 W of conventional lamp. MNRE provides subsidy equivalent to 50 percent of actual cost. In addition MNRE gives subsidies for SPV power plants, water pumps and solar street lights.

Fiscal Instrument: 2. Property tax exemptions on the use of renewable energy sources. Such exemption could apply to both new and old constructions.

International Experience: Arizona's property tax exemption was established in June 2006 and originally applied only to "solar energy devices and any other device or system designed for the production of solar energy for on-site consumption.

Central Government/other State Policies and Applicability to Tamil Nadu: The central government has announced the GRIHA Scheme for promoting implementation of energy efficient solar/ green building programme. The incentives are:

- *To encourage Architects and Consultants* to design buildings on Green Architectural concepts and get them rated under GRIHA, and incentive as per below will be available from MNRE.
    - Rs. 2.5 lakh for projects up to 5000 sq.m. built-up area with minimum 3 star rating
    - Rs. 5 lakh for projects > 5000 sq.m. built-up area with minimum 4 star rating
- *Capital Subsidy for SPV Installations*: One of the criteria under GRIHA is to meet 1 percent of total connected load for interior lighting and space conditioning through solar photo voltaics.
- *Incentives to Urban Local bodies*: A one-time incentive of Rs. 50 lakh to Municipal Corporations and Rs. 25 lakh to other Urban Local Bodies will be available to those who i) announce rebate in property tax for energy efficient solar/green buildings rated under GRIHA, ii) make it compulsory to get the new buildings under Govt. & Public Sector rated under GRIHA and iii) sign an MOU with GRIHA Secretariat in presence of MNRE for large scale promotion of Green Buildings in their area.
- *Institution of Awards/ Incentive*: Annual awards to green buildings rated 5 Star under GRIHA will be given away by the Ministry in the form of Shields/ Certificates. Cash incentive of Rs. 50 lacs to Municipal corporations and Rs.25 lakh to municipalities/other Urban Local Bodies (one each to them) will also be given away that perform the best in promoting Green Buildings in their areas from 2011-12 onwards.

State Government Initiatives-Andhra Pradesh: Government of Andhra Pradesh has announced a rebate of 10 percent in property tax on use of solar heating and lighting system, on recycling of waste water and rain harvesting. Tamil Nadu government can also introduce a property tax on green buildings to take advantage of the fiscal incentives available from the central government.

Chapter 7

DESIGN AND EFFECTIVENESS OF FISCAL INSTRUMENTS

This Chapter discusses the broad design features of the select fiscal instruments for facilitating climate friendly industrial development in Tamil Nadu. The environmental and cost effectiveness of some of the identified fiscal instruments is also described in this chapter.

Fiscal Instruments – Design Features

Broadly, the two sets of fiscal instruments used for environmental management are environmental taxes and environmental subsidies. Both are indirect instruments that operate by affecting the market prices. Taxes increase the price while subsidies reduce these. There are a number of critical differences in these two instruments. Some of these are mentioned below.

a. Taxes work as disincentives while subsidies provide incentives;
b. Taxes raise revenues while subsidies draw upon fiscal resources;
c. Taxes can generally be broad based; subsidies allow fine distinctions to be made. Although the more refined the target, the costlier it is to administer a subsidy. Very fine distinctions in tax rates according to different attributes of goods lead to a variety of classification disputes. In general, there is a preference for common tax rates for all goods and services or very broad distinctions.
d. Both taxes and subsidies require additional administrative costs.
e. Viewed individually, in the case of taxes, the costs (reduced output, reduced employment) and benefits (environmental benefits, revenue benefits) may both be spread over a long period of time requiring detailed cost-benefit analysis. In the case of subsidies, generally costs are front-loaded (support for purchase of new machinery) and benefits (better environment) are spread over time. By using the two instruments jointly, some of the associated assessment risks can be minimized if not altogether neutralized.

With a view to maximizing their impact, all instruments in this study are designed as two part instruments. The first part is a tax and the second part is a subsidy. This strategy addresses several aspects of the design simultaneously. Its basic features are as follows:

Maximizing Environmental Impact

Taxation has a disincentive effect and it acts as a disincentive to an environment damaging activity. But taxation raises revenue, which may become part of the general budget of the government. In order to ensure that this revenue is also used for promoting environment, we develop a counterpart of the tax instrument so that a subsidy can promote environment. This two-part strategy will therefore have maximum positive impact on environment both by introducing a disincentive and an incentive.

In India, two of the most significant contributors to pollution are coal and iron and steel. Both of these are part of a list under the central sales tax act (CST Act) called 'declared goods' and referred to as goods of special importance. States cannot increase the tax beyond the limit prescribed by the central government under the CST Act. This limit was fixed at 4 percent[13], which has recently been increased to 5 percent. At the same time unless these inputs are taxed relatively more heavily and alongside the use of substitutes for producing energy in the case of coal and shift in the usage of iron and steel to substitutes like cleaner plastics is encouraged, a tangible dent on pollution cannot be made. The options available for this purpose are discussed in further detail later in this chapter.

Financing of Subsidy

One of the major problems in using environmental subsidies is to ensure its financing. Generally, if it is to be financed by the general budgetary resources, it gets under financed and the funding is also not ensured. In the suggestions given in this study, the subsidy is financed automatically from within the sector by raising additional revenue from the environmental tax within the sector. It also ensures sectoral fairness as the funding for the subsidy comes from within the sector. This is not to suggest that general budgetary sources should not be relied on for financing environmental subsidies.

[13] The rate was increased from 4 to 5 percent in the Union Budget of 2011-12. The relevant notes on clause 74 runs as:: "Clause 74 of the bill seeks to amend section 15 of Central Sales Tax Act, 1956, so as to increase the ceiling imposed through the Central sales tax on the power of the States to levy VAT on the "declared goods" from 4 per cent to 5 per cent."

Endogenizing Administrative Costs

Another important aspect is that there are additional administrative costs of administering both a tax and a subsidy that requires to be provided for. In the suggestions that are made here, a part of the additional tax revenue is earmarked for meeting additional administrative costs so that this cost is also met by design.

Minimising Revenue Risks

The success of an environmental fiscal intervention depends on the decision making authority agreeing to assessments of additional revenues that can be raised in the case of taxation. In all such assessments, there are revenue risks as revenues depend on market conditions. However, if programs can be designed such that the revenue risks are minimized, it is easier for decision-makers to accept such decisions. A variety of strategies can be used to minimize revenue risks. Thus, a subsidy program can be scaled down in economic slow-down years when revenues fall; a separate fund can be created to neutralize cyclical variations in revenue; and suitable borrowing strategies can be put in place where the subsidy program requires a lumpy investment in the beginning.

Strategy for Cost-Benefit Analysis

Decisions regarding accepting a fiscal intervention are often based on cost-benefit analysis. Such fiscal interventions that can be shown to have a positive net present value (NPV) have positive chances of being accepted if the NPV is positive. But the cost-benefit analyses often require a variety of assumptions that relate to the future and are characterized by obvious uncertainties. Here, the cost benefit analysis is meant to cover both instruments.

Suggested Fiscal Instruments

A summary of suggested environmental instruments aimed at interventions meant for the Tamil Nadu economy along with their basic features is given in Table 7.1.

Table 7.1: Summary of Suggested Fiscal Instruments for Tamil Nadu

Instrument	Counterpart	Implemented by
Uplifting to higher State VAT rates of identified polluting goods	Applying lower State VAT rates to environment promoting goods	State government (under statevat regime)
Alternate under GST Non-rebatable excise/cess on identified polluting goods	Placing under exempt category identified environment promoting goods and services	State government (under GST Regime)
Cess on electricity duty for generation of electricity using polluting inputs (coal)	Subsidy to electricity producers using non-conventional inputs	State government
Congestion tax on traffic in identified cities (city-centres; specified hours)	Inner city road development fund	Local government
Property tax concession on green commercial buildings	Property tax cess on conventional commercial buildings	Local government
Green motor vehicle tax	Augmenting financing of road building and maintenance using green materials	State government

Source: Compiled by authors

Effectiveness of Fiscal Instruments

While multiple instruments can be used to reduce pollution, the choice of 'appropriate' instrument(s) could depend on either, (a) Cost Benefit analysis, (b) Cost Effectiveness analysis, or (c) Environmental Effectiveness analysis.

Cost Benefit Analysis (CBA) requires careful examination of all costs and benefits involved with the implementation of the policy instrument over a chosen time horizon along with appropriate discount rate. When applied to greenhouse gas emissions, due to long time horizons involved the choice of discount rate becomes quite complex. Further, identifying and valuing all the benefits – including the indirect/secondary benefits – may not be an easy exercise, especially due to paucity of reliable estimates of WTP/WTA in developing countries.

Cost Effectiveness Analysis on the other hand requires careful examination of the costs of implementing various policy instruments to meet a specified environmental objective and choosing the intervention with least cost. While costs are aggregated over

time in this approach also, the relatively small time horizons involved pose relatively less difficulty in the choice of discount rate.

Environmental effectiveness attempts to simply compare the environmental outcome(s) under different policy instruments with reference to the business as usual scenario and chooses the one that assures maximum environmental benefit. In the context of global pollution such as carbon dioxide the environmental effectiveness could be simple and appropriate to apply especially due to the uniformly mixed nature of such pollution.

Given the design of the instruments for Tamil Nadu outlined above, the costs of implementation are negligible. The instruments are likely to reduce carbon dioxide equivalent emissions significantly. Given high social costs associated with carbon dioxide equivalent emissions, the emission reductions will lead to substantial social benefits. Thus, on one hand, the costs of intervention are negligible by design and on the other hand the benefits of intervention are high due to avoided greenhouse gas (GHG) emissions. Therefore, the cost-benefit and cost-effectiveness analyses under these circumstances will overwhelmingly support the intervention. Hence, it would suffice to assess the avoided GHG emissions under various policy interventions. If the intervention could generate significant GHG emission reduction then the intervention under consideration could be justified. The rest of this chapter illustrates the effectiveness analysis of some select fiscal instruments – namely, green cess on electricity generation, coal cess (limiting input tax rebate on coal)[14], and rebate on property tax for green buildings.

Effectiveness Analysis of Green Cess on Electricity

The methodology adopted for carrying out cost-benefit analysis and environmental effectiveness analysis of the proposed fiscal instrument-green cess on electricity is described here. The basic approach involves the following steps:

- To project various plausible future scenarios of electricity production in Tamil Nadu over the period 2011-12 to 2030-31. This includes assumptions about the future grid-mix in Tamil Nadu that takes into account the state policies on renewable electricity generation such as wind based electricity.
- To estimate the baseline coal consumption under various future scenarios and baseline GHG emissions (in CO_2 equivalent terms).

[14] This instrument is discussed further in the next chapter.

- To assess the potential fund generated through the green cess and the costs associated with its administration.
- To project potential implications of the green fund on, (a) increase in plant efficiency; and (b) greater penetration of renewable in electricity generation, and re-estimate the coal consumption with green-cess in place along with the CO_2eq emissions.
- To estimate the present value of the cost of implementation of the green cess and the present value of avoided damage costs associated with reduced GHG emissions resulting from the lower coal consumption.
- To assess the effectiveness of the fiscal intervention by, (a) estimating the overall GHG emission reductions, (b) calculating the ratio of costs to the avoided GHG emissions (cost-effectiveness), and (c) calculating the ratio of the present-value of costs of implementing the fiscal measure to the present-value of the benefits of implementing the fiscal measure (cost-benefit analysis).

Projecting Future Electricity Demand in Tamil Nadu

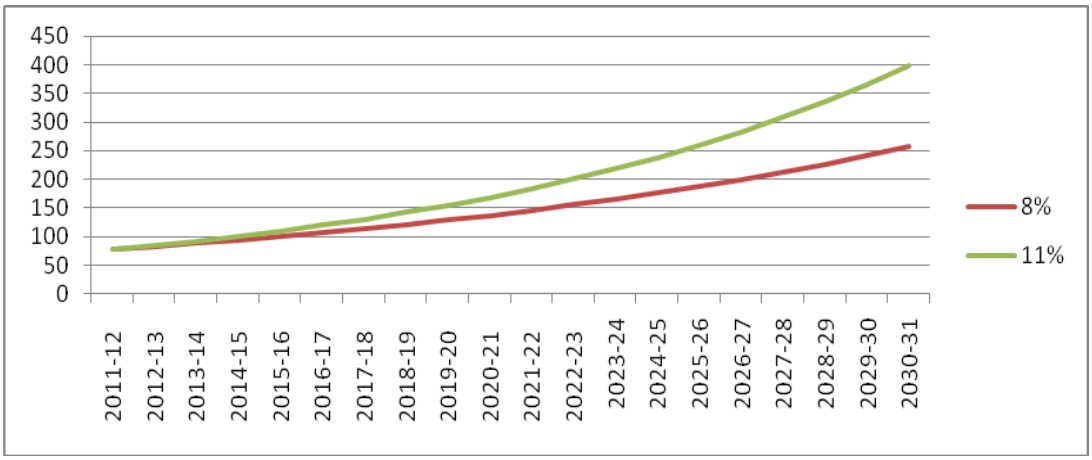
For the purpose of projecting electricity demand in Tamil Nadu, the elasticity of electricity demand to GSDP has been taken as 0.82 for the entire analysis period. Using the elasticity and the future projections about the GSDP in Tamil Nadu the electricity demand has been estimated. The GSDP projections are based on two possibilities – 8 percent growth (Scenario 1) consistent with the approach adopted by the Integrated Energy Policy Report of the Government of India; and Tamil Nadu State Vision-2023 document, which amounts to 11 percent growth rate (Scenario 2); see chapter 2 for further details. Table 7.2 provides the projected electricity demand in TWh (tera watt hour) for several years under two different scenarios. Chart 7.1 shows these projections graphically.

Table 7.2: Electricity Demand Projections for Tamil Nadu (in TWh)

Year	Scenario -1 (8 percent GSDP Growth)	Scenario - 2 (11 percent GSDP Growth)
2011-12	77.2	77.2
2015-16	99.5	109.1
2020-21	136.8	167.9
2025-26	187.9	258.6
2030-31	258.2	398.3

Source: Compiled by authors.

Chart 7.1: Electricity Demand Projections, Tamil Nadu



Source: Authors estimates.

Assessing Electricity Grid-mix in Tamil Nadu

As per the Energy Policy Note of the Government of Tamil Nadu, the grid-mix as on June 2012 is: total generation capacity of the state is 7656.22 MW. Of this the thermal capacity is 7617.33 MW, representing 43.14 percent of the grid capacity of Tamil Nadu (Table 7.3).

Table 7.3: Grid-mix of Capacity in Tamil Nadu, 2012 (in MW)

Source	Coal	Gas	Diesel	Total Thermal	Nuclear	Hydro	Re newable	Total
State	2970	523.2	0	3493.2	0	2122.2	118.55	5733.95
Private	250	503.1	411.66	1164.76	0	0	7274.14	8438.9
Central	2959.37	0	0	2959.37	524	0		3483.37
Total	6179.37	1026.3	411.66	7617.33	524	2122.2	7392.69	17656.22

Source: Policy Note, Energy Department, Government of Tamil Nadu.

Given the grid mix of capacity and with plausible load factors for various power plants using different fuels, the percentage share of various fuels in the electricity generation is estimated and shown in Table 7.4.

Table 7.4: Fuel-mix in Electricity Generation in Tamil Nadu

Share	Coal	Gas	Diesel	Nuclear	Hydro	Renewable*
%	53	9	4	3	11	21

Note: Renewable sources mainly include wind based electricity generation.

Future Scenarios of Electricity Generation in Tamil Nadu

Various future scenarios of electricity generation in Tamil Nadu are assessed with following assumptions:

(1) High Coal Mix Scenarios:

a. 8 percent GSDP growth
b. 11 percent GSDP growth

(2) High Renewable Scenarios:

a. 8 percent GSDP growth
b. 11 percent GSDP growth

For the high-coal mix scenario, the following assumptions are made:

- Gas, Diesel, Hydro capacity stays at the 2011-12 level through-out
- Nuclear capacity increases to reach a capacity of about 1750 MW by 2030
- Renewable increase by 1000 MW per year up to 2015-16 as per the Tamil Nadu Wind Energy Policy; after that the capacity stays at that level
- The balance of the demand is met through coal-based thermal power

For the high-renewable scenario, the following assumptions are made:

- Gas, Diesel, Hydro capacity stays at the 2011-12 level through-out
- Nuclear capacity increases to reach a capacity of about 1750MW by 2030
- Renewable capacity increases by 1000 MW per year through-out the period
- The balance of the demand is met through coal-based thermal power

The BAU scenarios so worked out are shown in Table 7.5. In the scenario with high coal and 8 percent GSDP growth, the coal power generation capacity is likely to be 205.62 TWh in 2030-31 and the renewable capacity is likely to reach 25 TWh. In the scenario with high coal mix and 11 percent GSDP growth, the coal power generation capacity is likely to reach 346. 95 TWh while the renewable capacity is likely to reach 25 TWh in 2030-31. In high renewable scenarios, the coal power generation is likely to be 172. 61 TWh when GSDP grows at 8 percent. It is likely to be 262.05 TWh when GSDP grows at 11 percent. At the same time, the renewable capacity is likely to reach 58.01 TWh.

Table 7.5: BAU Scenarios of Future Power Generation in Tamil Nadu

(a) High Coal Mix: 8 Percent GSDP Growth (in TWh)

Year	Coal	Gas	Diesel	Nuclear	Hydro	Renewable
2015-16	54.27	6.74	2.70	3.34	8.37	25.01
2020-21	92.10	6.74	2.70	4.65	8.37	25.00
2025-26	140.75	6.74	2.70	6.32	8.37	25.00
2030-31	205.62	6.74	2.70	8.56	8.37	25.00

(b) High Coal Mix: 11 Percent GSDP Growth (in TWh)

Year	Coal	Gas	Diesel	Nuclear	Hydro	Renewable
2015-16	62.88	6.74	2.70	3.34	8.37	25.01
2020-21	120.49	6.74	2.70	4.65	8.37	25.00
2025-26	209.51	6.74	2.70	6.32	8.37	25.00
2030-31	346.95	6.74	2.70	8.56	8.37	25.00

(c) High Renewable: 8 Percent GSDP Growth (in TWh)

Year	Coal	Gas	Diesel	Nuclear	Hydro	Renewable
2015-16	54.27	6.74	2.70	3.34	8.37	25.01
2020-21	81.09	6.74	2.70	4.65	8.37	36.01
2025-26	118.73	6.74	2.70	6.32	8.37	47.01
2030-31	172.61	6.74	2.70	8.56	8.37	58.01

(d) High Renewable: 11 Percent GSDP Growth (in TWh)

Year	Coal	Gas	Diesel	Nuclear	Hydro	Renewable
2015-16	58.41	6.74	2.70	3.34	8.37	25.01
2020-21	99.21	6.74	2.70	4.65	8.37	36.01
2025-26	164.14	6.74	2.70	6.32	8.37	47.01
2030-31	262.05	6.74	2.70	8.56	8.37	58.01

Source: Calculated by authors.

Social Damage Costs of Carbon

Various studies estimated the social damages costs associated with greenhouse gas emissions and the associated climate change. These costs are highly uncertain. For the purpose of our analysis, we have considered the figures shown in Table 7.6, which have been sourced from the literature and these figures are in line with those utilized in studies on West Bengal and Orissa carried out by Eunomia consultants (Hogg et al., 2012).

Table 7.6: CO_2 Damage Costs, 2011-12 Prices, INR per ton CO_2eq

Year	Upper	Central	Lower
2015-16	4341	1725	1070
2020-21	4877	1903	1189
2025-26	5531	2141	1368
2030-31	6185	2379	1546
2030-31	6185	2379	1546

Source: Compiled by authors.

The emission of the local pollutants such as particulate matter, sulfur dioxide and nitrous oxides also decreases with the lower consumption of conventional fuels such as coal. The analysis does not explicitly quantify the health benefits associated with the reduction in local pollutants. If accounted the fiscal intervention would be further favored.

Green Cess on Electricity – Quantity and Fund Generated

The green cess on electricity generation is proposed to collect Re. 0.02 per kwh of electricity generated through conventional fuels such as coal, gas and diesel. This will be equivalent to Rs. 50 per ton of coal. The green fund is estimated as shown in Table 7.7. The estimates shown here and in the rest of the analysis are for high-coal mix and 8 percent growth rate scenario.

Table 7.7: Green Fund Generated in Tamil Nadu

Year	Green Fund, in Rs.Crore
2015-16	127
2020-21	203
2025-26	300
2030-31	430

Source: Calculated by authors.

GHG Emission Savings through Plant Efficiency Improvement

For the purpose of assessing GHG emissions, we have used certain assumptions with reference to various hydro-carbon fuels. These are shown in Table 7.8.

Table 7.8: Fuel Parameters Used for the Analysis

Details	Coal	Gas	Diesel
Energy content, MJ/kg	20	40	40
Net plant efficiency (%)	32	50	40
Fuel required, kg/kwh	0.57	0.18	0.22

Source: Compiled by authors.

The green cess could boost the plant efficiency and would lead to reduction in coal consumption. With Green Cess, the Net Plant efficiency is assumed to increase by 2 percent for coal plants in 2030-31; for the intermediate years, the efficiency improvements are linearly interpolated. The associated CO_2eq emission reduction savings estimated for High Coal-mix, 8 percent GSDP growth scenario are shown in Table 7.9.

Table 7.9: CO_2eq Emission Reductions through Plant Efficiency Improvement: High Coal-mix and 8 Percent GSDP Scenario (in million metric tons)

Year	CO_2eq Emission Reductions
2015-16	0.7
2020-21	2.8
2025-26	6.6
2030-31	13.0
Cumulative Emission Reduction, 2012-13 to 2030-31	86.2

Source: Compiled by authors.

GHG Emission Savings through Higher Share of Renewable Resources

The green fund generated through the green cess would be utilized for promoting greater penetration of renewable resources in electricity generation. This can be facilitated through appropriate design of subsidies. Since the BAU scenarios assume capacity additions for renewable resources for the first four years, no additional capacity has been considered till 2015-16. For the period starting from 2016-17 to 2030-31, an additional capacity of 200MW of other renewable resources has been assumed to be added every year. Table 7.10 illustrates the GHG emission reductions estimated for high coal-mix, 8 percent GSDP scenario.

Table 7.10: CO_2eq Emission Reductions through Greater Penetration of Renewable Resources: High Coal-mix and 8 Percent GSDP Scenario

(in million metric tons)

Year	CO_2eq Emission Reductions
2016-17	0.5
2020-21	2.4
2025-26	4.7
2030-31	7.1
Cumulative Emission Reduction, 2012-13 to 2030-31	56.9

Source: Calculated by authors.

Social Damages Avoided

Using the social damage costs of carbon discussed in Table 7.6 and the CO_2eq emission reductions estimated in Tables 7.9 and 7.10, the social damages avoided are calculated. Table 7.11 shows the net-present value of the damage costs avoided over the period 2012-13 to 2030-31 in Tamil Nadu due to the introduction of the Green Cess on electricity generation from the conventional resources. For the purpose of calculating the net-present value, we use 8 percent discount rate.

Table 7.11: Net Present Value of Damage Costs Avoided, 2012-13 to 2030-31 (INR Million)

Costs Avoided	Upper Estimate	Central Estimate	Lower Estimate
Through Plant Efficiency Improvement	173788	67400	42989
Through Greater Penetration of Renewable Resources	115750	44874	28602

Source: Calculated by authors.

Costs Associated with Green Cess Administration

The costs associated with the administration of the Green Cess are estimated at 0.1 percent of the green fund generated. The net-present value of the administration costs over the period 2012-13 to 2030-31 is estimated as Rs. 20.5 millions.

Cost Effectiveness and Cost-Benefit Analysis

Using the above information on costs and benefits of intervention and the GHG emission reductions achieved the effectiveness of the intervention (namely, Green Cess) are illustrated in Table 7.12.

Table 7.12: Effectiveness of Fiscal Intervention, Green Cess: 2012-13 to 2030-31, High Coal-mix and 8 Percent GSDP Scenario

Details	Upper Estimate	Central Estimate	Lower Estimate
NPV of Costs (Rs. Crore)	2.05	2.05	2.05
NPV of Benefits (Rs. Crore)	28953	11227	7159
NPV of net benefits (Rs. Crore)	28932	11206	7138
Total GHG Emission Reduction, (Million Tons of CO_2eq)	146.1	146.1	146.1
Cost effectiveness (Rs/ton CO_2eq)	0.14	0.14	0.14

Source: Calculated by authors.

Effectiveness Analysis of Coal Cess (or Limiting Input Tax Rebate on Coal)

The estimates will be very similar to another proposed instrument, namely coal cess. The coal cess as argued in the next Chapter could involve reduction of input tax rebate from existing 5 percent to about 2 percent. Such reduction in the rebate of state-VAT will result in additional funds to the state government, which in turn can be used to facilitate improvement in the plant efficiency of thermal power plants and greater penetration of renewable in the overall energy mix.

Since coal cess will influence coal fired thermal power plants more directly, the plant efficiency improvements are considered to be higher than those modeled in case of Green Cess. With about 3 percent improvement in plant efficiency induced by the coal cess, the CO_2eq emission reductions and net-present value of social damages avoided (or, benefits) are shown in Table 7.13.

Table 7.13: Effectiveness of Fiscal Intervention, Coal Cess: 2012-13 to 2030-31

Details	Upper Estimate	Central estimate	Lower Estimate
NPV of Benefits (Rs. Crore)	25323	9821	6264
Total GHG Emission Reduction, (Million Tons of CO_2eq)	125.6	125.6	125.6
Cost effectiveness (Rs/ton CO_2eq)*	0.16	0.16	0.16

*considering similar administrative costs as Green Cess.

Source: Calculated by authors.

Effectiveness Analysis of Rebate on Property Tax for Green buildings

The real estate sector is a major consumer of energy. This sector is the end user of energy as well as consumer of various raw materials that influence the usage of energy. The contribution of construction sector to GDP is 10%, and is a significant contributor to the growth of the economy. However, a higher growth is not favorable unless the composition of the growth is environmentally sustainable. The increasing rate of urbanization poses serious challenges in energy conservation and emission of GHGs. Based on secondary sources, it is estimated that during 2008-12, 80 percent of projected demand in real estate space will come from seven major cities including Delhi, Banagalore, Bombay, Pune, Chennai, Hyderabad and Kolkata. Although the residential sector accounts for 37 percent of energy usage, industry and services together account for 40 percent of primary energy use. According to BEE, most commercial buildings in India have Energy Performance Index (EPI) of 200 kwh/sqm/year or higher. The BEE considers 180 kwh/sqm/year as the typical national average and states that the buildings in North America and Europe have EPI of less than 150 kwh/sqm/year due to overall efficiency gains.

One of the recent McKinsey estimates shows that the national power demand can be reduced by as much as 25 percent in 2030 by improving energy efficiency of buildings and operations. With improved and optimized insulation, highest efficiency electric appliances energy consumption for heating, ventilation and air conditioning, energy consumption can be reduced by 55 per cent – this can cut 150 million tonnes of CO_2 by 2030.

For the construction sector, this study suggest a policy instrument that includes a rebate of 10 percent on property tax paid by existing as well as new operational units incorporating 'green' measures. The state government would receive lesser revenue from property tax. For the policy to be revenue neutral, it is suggested that a green fund be created that can be used to subsidize the green buildings. This can be generated by specifying a threshold energy consumption level and charging a higher tax rate for highly polluting buildings that exceed the threshold energy consumption baseline. Thus revenue is raised by determining a threshold level of energy consumption per square feet and charging a higher tax on buildings exceeding these norms. The mechanism will only operate for the first 5 years of operation of the new building, as the principle aim is to give businesses the financial incentive to invest in new 'green' measures at the design and build stage of the unit, not to provide continuous funding for what could be 20/30 years of operation of an industrial or commercial unit.

The potential list of eligible green / energy efficiency measures could include use of energy efficient lighting throughout the unit; use of rated energy efficient motors, with a rating of EFF1 (as per the rating of the Bureau of Indian Standards, BIS) or higher; use of solar PV for lighting in common areas; use of solar thermal for heating water for non-process use; use of energy efficient equipment; and use of BEE 5-star rated appliances throughout the unit.

Methodology

The effectiveness of the policy intervention would follow the steps outlined below:

1. Implications of reduced revenue from property tax;
2. Estimation of stock of green and polluting buildings in Chennai; calculation of amount of green fund generated assuming that the percentage of highly polluting buildings reduces from 30 percent to 10 percent during 2012-20 and stays at that level up to 2030. We also assume that percentage of buildings adopting green measures increases from 10 percent to 35 percent during this time period and proportion of other buildings decreases from 60 percent to 55 percent;
3. Estimation of administrative costs for implementing the rebate;
4. Assuming energy savings of green measures up to 40 percent, reduction in total GHG emission intensity is estimated if 35 percent of buildings adopt green measures by 2015 and remain at that level upto 2030; and
5. Estimation of environmental benefits from increased energy efficiency stemming from the green measures.

Estimating the Commercial Floor Space and Energy Consumption in Tamil Nadu[15]

As the database on real estate in India is not available, various secondary sources are used to estimate commercial floor space in India, including McKinsey (2009), USAID, ECO –III and climate works foundation. The estimates of commercial floor space in India are then used to arrive at the commercial floor space in Tamil Nadu by multiplying it with the state's GDP share (Table 7.14).

[15] This section uses the approach followed by Hogg et al. (2012) for estimating commercial floor space in Orissa and West Bengal.

Table 7.14: Commercial Floor Space Projections in Tamil Nadu, million m2

Projection	2011-12	2020-21	2030-31
Upper	86	179	405
Central	63	112	213
Lower	42	54	73

Source: Calculated by authors.

An average Energy Use Intensity (EUI) of 70 kWh / m^2 was used to estimate the energy consumed by the commercial buildings in Tamil Nadu (Table 7.15).

Table 7.15: Energy Consumption Baseline for Commercial Buildings in Tamil Nadu, MWh / year

Projection	2011-12	2020-21	2030-31
Upper	6	12	26
Central	4	7	13
Lower	3	4	5

Source: Calculated by authors.

Rebate on Green Buildings

To estimate the green fund that can be generated to subsidize the buildings adopting green measures, we estimate the stock of commercial buildings in the capital city of Tamil Nadu, Chennai. In this study, we arrive at estimates of the stock of commercial buildings, green fund generated and administration costs in the following way:

1. The property tax is levied half yearly at the rate of 12.4 percent on the annual value of the property (Table 7.16). We estimate the yearly property tax revenue for 2012-2030 @ 10 percent p.a. (see Chart 7.2).

Table 7.16: Calculation of Property Tax (Per Half Year)

Grade	Annual Value	Total
I	Rs.1 to 500	6.62 %
II	Rs501 to 1000	9.92 %
III	Rs.1001 to 5000	11.02 %
IV	Rs.5001 and above	12.40 %

Source: Corporation of Chennai.
http://www.chennaicorporation.gov.in/departments/revenue/methodOfProIndex.htm

Method of Fixing Annual Value: Example

- Plinth Area x Basic Rate per sq.ft. = Monthly Rental Value (M.R.V.) Rs.100 p.m. Annual Rental Value Rs.100 x 12 = Rs.1,200.00 Less 10% for Land Value (Rs. 120.00)

- Annual rental value = 1080 Less 10% depreciation on the building (Rs.108.00)
- Depreciated value of the building = Rs.972.00
- Add :10% of the land value arrived earlier = Rs.120.00
- Annual Value for land and Building = Rs.1,092.00
- For working Annual Value use the factor 10.92; Annual Value = M.R.V x 10.92

2. Estimate the share of taxes attributed by commercial properties @ 19% of total property tax revenue, assuming that property tax revenue is proportional to size of commercial floor space in total floor space available for residential, commercial and retail.

   For Non-Residential Properties, basic rental rate ranges from minimum of Rs.4.00 to maximum of Rs.12.00 per Sq.ft. At an average size of 2000 sq. feet for commercial buildings in Chennai and an average rental rate of 8 per square feet, the rental value works out to Rs. 16000. After deducting the depreciation, the value is Rs.12000. After applying the factor of 10.92, the annual value is Rs.131040[16].

3. Assuming the average annual value of a commercial property in Chennai to be Rs.1,20,000, estimate the number of commercial buildings by dividing (2) by 1.2.We get an approximate figure of 26815 commercial buildings in Chennai for 2011-12, which is close to the estimates by independent studies mentioned in the following paragraph.

4. Next we estimate the green fund @ 10 percent tax rebate assuming the number of green buildings progressively increases from 10 percent to 35 percent in 2020 and stays at that level up to 2030-31.

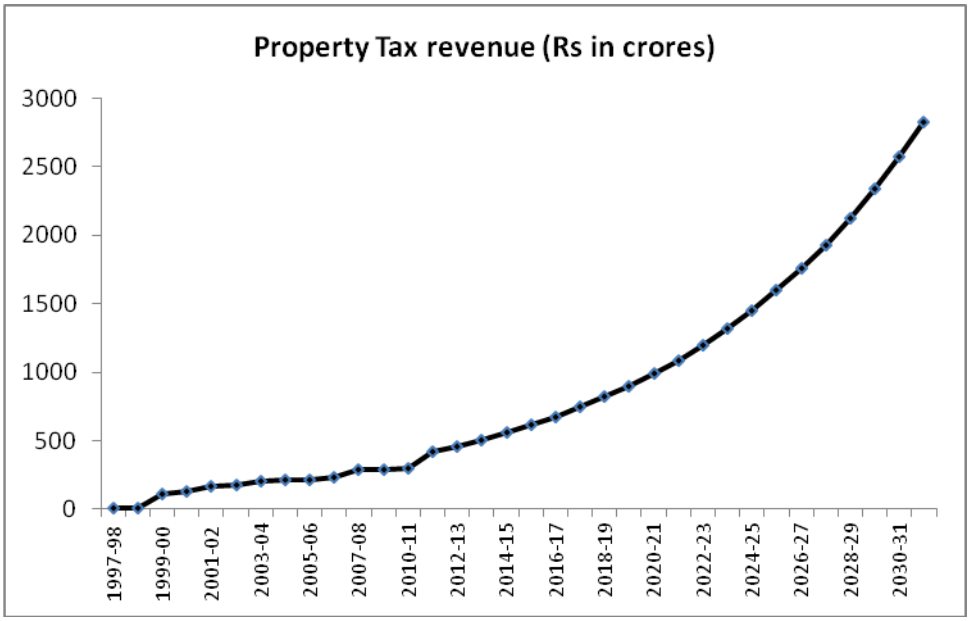
5. The administration cost of implementing the rebate is assumed to be 1 percent of the rebate. The present value of the administration cost at a social discount of 8 percent p.a., comes to Rs. 3.2 crores for the period 2012-13 to 2030-31.

6. In order for the policy instrument to be revenue neutral, the property tax on buildings that are highly polluting is estimated to increase by 4 percent in 2012-13.

[16] http://www.chennaicorporation.gov.in/departments/revenue/methodOfProIndex.htm#nonresident

As more buildings adopt green measures, the tax is expected to increase by 35 percent by 2020-21 and stay at that level.

Chart 7.2: Estimated Property Tax Revenue in Chennai

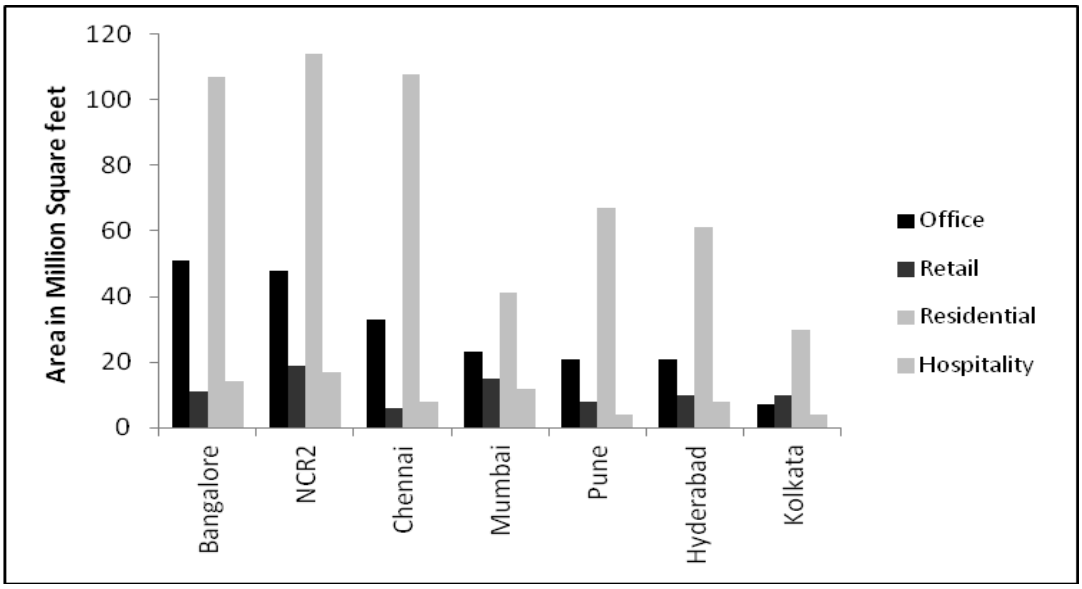


Source: Own estimates based on National Institute of Urban Affairs (2011).

The Stock of Commercial Buildings

A study by the Center for Science and Environment (2011) estimates that, of the total real estate demand in Chennai for 2012, 60 percent is for residential, 19 percent is for commercial and 21 percent for retail and hospitality (Chart 7.3).

Chart 7.3: Cumulative Real Estate Demand by Sectors (2008-12)



Source: Cushman & Wakefield Research (2008).

The Chennai office market has witnessed remarkable growth from nearly 10 million sq ft in 4Q05 to 45 million sq ft in 2Q11. Every 13 quarters, Chennai has added 20 million sq ft of office space since 2006. The growth has been mainly led by offices built for the IT industry (as IT Parks or IT Special Economic Zones), which constitute 86 percent of the operational office stock in Chennai. As per this study, residential properties will increase to 70000 units by 2014, making the stock of commercial properties to 22000(Jones Lang LaSalle, 2012). Another study (Arijit Maji, 2011) estimates the number of residential properties for sale in Chennai to be more than approximately 45142 during 2010, which puts the total number of buildings in Chennai, roughly at 57500 (including old as well as new properties in 2010) and commercial properties at 15000.

The urban land buildings (ULBs) in TN have been following the Annual Value Method of property taxation. The annual value is deemed to be the gross annual rent at which they may reasonably be expected from month to month or from year to year less a deduction from the cost of building of 10 percent for maintenance. In case of buildings not ordinarily let, the annual value is deemed to be of the total estimated value of land and the estimated present cost of erecting the building less 10 percent depreciation.

Estimated Benefits

Based on the assumptions above, the savings in total GHG emission intensity, externalities in terms of damage costs and admin costs at 1 percent of green fund generated are given in table 7.17. The three scenarios refer to the proportion of buildings adopting the green measures at 35 percent in the upper scenario, 25 percent in the central scenario and 10 percent in the lower scenario.

Table 7.17: Estimated Benefits

Parameter	Upper	Central	Lower
Total GHG Reduction, kt CO2 eq	-46,233	-26,189	-7487
NPV Net Cost of Green Measures, Rs. Crore	0	0	0
NPV Administration Costs, Rs. Crore	3.2	3.2	3.2
NPV Externalities, Rs. Crore	-8,920	-791	-154
NPV Net Costs, Rs. Crore	-8,920	-791	-154
Cost Effectiveness, Rs. / tonne CO2 eq	0.19	0.03	0.02

Source: calculated by authors.

Chapter 8
FISCAL INTERVENTION FOR CLIMATE FRIENDLY INDUSTRIAL DEVELOPMENT OF TAMIL NADU – PROSPECTS

Introduction

The process of economic growth entails myriad activities that generate pollution affecting the quality of air, water, and land. There are two groups of policy instruments that can stem the flow of pollution: regulatory and economic. The main economic instruments are fiscal instruments encompassing both taxation and subsidies. In India, consideration of the fiscal instruments is particularly important at the present juncture as we are in the process of bringing in comprehensive reforms in the system of taxation of goods and services. In particular, the idea is to integrate central excises and service tax as well as sales tax and state VAT and a number other state levies into a comprehensive goods and services tax (GST). Any design of environmental taxes should take into account not only the present taxes but also how the environmental taxes can be positioned into the GST framework.

There are two ways in which environmental taxes can be implemented: first through additional taxation like a non-rebatable excise or sales tax on goods and services whose production and/or consumption leads to pollution; and secondly, by taxation of pollution directly such as a carbon tax. In the first case, the intervention is indirect. It is aimed at producers or consumers who may reduce the use of polluting inputs or outputs that intensively use polluting inputs. In the Indian federal context, environmental taxes can be divided into two groups: Group A consisting of state taxes where the relevant central provisions may have to be taken into account; and Group B, where the fiscal instrument can be decided by the state government. In the context of the instruments under Group A account has also to be taken of present transitional position where efforts are being made to move to a comprehensive GST from the present system of domestic indirect taxes consisting of cenvat, statevat and service tax. For example, the following instruments can be considered as belonging to Group A or B.

1. A sales tax or excise tax can be levied by a state at the first point of sale. Under the present constitutional arrangements, states can levy a sales tax or statevat on all goods including polluting goods. For such a tax to have any effect, it should not be rebated at a later stage. However, this is subject to considerations like whether

the good belongs to the list of declared goods, which is a central provision. The following two, however, are examples of instruments that belong to Group B instruments:

2. (a) a cess or a surcharge, which can be levied on an existing tax but on selected polluting goods only and (b) local levies like property tax and congestion tax.

In the present system of statevat, taxes paid on inputs are rebated at later stages of sales. Any excise duty or additional sales tax on polluting goods can only be effective if it is not rebated at later stages of sales. An excise is relevant if the pollution is at the production stage. A cess is relevant if the government wants to earmark the revenues for environmental purposes specific to industries. A surcharge can be used more generally.

In addition, there is now a move toward direct taxation of pollution such as the carbon tax or SO_2 tax etc. These taxes are now being used extensively in many countries but in India such taxes are not specified in the Constitution and state governments cannot levy such taxes. The central government can levy a tax like this under its residuary powers.

From a longer term perspective, as already mentioned, there is a now a move to subsume a number of central and state taxes on goods and services in a comprehensive GST. The GST may involve constitutional changes affecting the powers and flexibility of the states in using the tax instrument for environmental purposes. It is important for the states to have autonomy in levying cesses and surcharges or differentially higher rates for identified polluting goods and services. In a GST framework, the idea is to tax all goods and services in a rate structure that has either just a single rate or few rates. Scope for differentiation for environmental purposes will need to be separately provided for.

Apart from taxation, subsidies can also be used to promote environment. One example is subsidy for clean energy that is energy that is produced by relatively less polluting inputs. These subsidies can be used to encourage introduction of new technology or substitution of polluting inputs by cleaner inputs. Subsidies can be of two types: input focused and technology focused. There can be consumption focused subsidies to encourage consumption of cleaner fuels like ethanol or products like the CFL bulbs.

Implementation of Environment-promoting Fiscal Instruments[17]

Electricity: Green Cess

A green cess on the generation of electricity can be implemented by the state government of Tamil Nadu, along the lines of the Gujarat government. The subsequent hike in the price of electricity for commercial and industrial consumption has to be worked out by the electricity regulatory authority and does not fall under the purview of the state government.

Gujarat has implemented a producer based green cess on the generation of all kinds of electrical energy including captive energy but excluding solar, wind, hydel, geo-thermal, bio energy and tidel energy. The tax is levied by the state government, at a rate not exceeding 2 paisa per unit of the electricity generated. The funds are credited to the consolidated fund of the state and transferred to Green energy fund after deducting collection charges; and used for the protection of environment and promoting the generation of electricity through renewable sources. Maharashtra has implemented a green cess of 8 paise per unit on commercial and industrial users of energy.

The green cess serves as a resource kept as a common pool (like a Green Fund) that can be used to subsidize energy from renewable sources, providing equity capital for bagasse co-generation projects and other non-conventional energy generation projects. The subsidy can be producer or consumer based.

The charging sections in the The Tamil Nadu Tax on Consumption or Sale of Electricity Act, 2003 under clause 3 provide enough flexibility for the levy of such a cess. The provisions in the sub-clauses provide a range within which the overall tax rate should lie. Some of the relevant provisions are given below.

Under clause 3 of the Act:

> (1) Save as otherwise provided in this Act, every licensee and every person other than a licensee shall pay every month to the Government in the prescribed manner, a tax on the electricity sold or consumed during the previous month at the rates specified hereunder:

[17] See Annexure I for a detailed discussion on implementation strategies for some of the fiscal instruments and the lessons to be learned from other state experiences.

(a) In the case of licensees other than captive generating plants, the rate shall be not less than 5 percent and not more than 10 percent of the net charge, as may be notified by the Government; Provided that no tax shall be paid on sale of electricity for agricultural purposes and hut service connections;

(b) In the case of licensees who are captive generating plants, the rate shall be not less than 10 paise and not more than 20 paise per unit of electricity on the consumption for own use; and shall be not less than 5 percent and not more than 10 percent on the net charge on the sale of surplus electricity as may be notified by the Government.

Cess on Waste Disposal: Integrating Cess on Waste Disposal with Subsidies for Co-incineration of Waste in Cement Kilns

Such cess can be charged by the local municipal body on specific wastes that can be used to generate alternate fuel in cement kilns. A cess by the local municipal body will result in the disposal of waste in a safe manner and also ensure a continuous supply of waste to the integrated waste management facilities. By adopting the polluter-pay principle, companies prefer to pay a lesser amount to industries such as cement for disposing the waste safely than pay taxes. The contributions may be collected on the lines of water cess for hazardous waste disposal.

The revenue generated from the cess can be used to subsidize cement plants to install specialist waste incinerators for generating energy. The collection and transportation of wastes to the cement plants can be enforced by a PPP model. This can be developed along the lines of State of Gujarat which follows Public Private Partnership (PPP) mode that takes care of the collection, segregation and delivery of waste at the waste incinerators in Rajkot Municipal Corporation.

Reduced VAT on Use of Energy Saving Materials

A reduced VAT incentivizes usage of energy saving material, thus promoting the objective of reduced carbon footprint. A green building uses building materials that will reduce energy consumption, and can minimise waste in manufacturing industry. Currently, subsidies are available at the state level for installation of solar power equipment in the residential units[18]. Most construction activities are carried out under 'works contract' arrangements wherein compounding rate facilities are given. A differentiation will need to

[18] See Annexure II for a discussion on energy efficient material and relevant VAT structure in Tamil Nadu.

be made in the compounding rate where the works contract specifies use of energy saving materials to a minimum extent.

Rebate on Property Tax

A rebate on property tax is an incentive for new buildings to use sustainable energy saving materials. The central government has announced fiscal incentives for municipal governments if they adopt the Griha program for promoting green buildings through the use of renewable energy. The Government of Andhra Pradesh has announced a rebate of 10 percent in property tax on use of solar heating and lighting system, on recycling of waste water and rain harvesting. There may be an additional cost to the state government in implementing this policy but it can be compensated through provisions in the state finance commission.

Congestion Tax

Of the four metropolitan cities in the country, Chennai is the most polluted city with the GHG gases and particulate emissions entering the air exceeding the tolerance limits in many parts of the city. A congestion tax can be implemented in ten municipal corporations in the state of Tamil Nadu where vehicle density is the highest, with partial exemptions as an additional incentive to promote car pooling during peak hours of traffic.

The proceeds from congestion tax may be used to develop the transport infrastructure, similar to the scheme followed in London. The Municipal Corporation of Delhi also has plans to implement a congestion tax on cars, motorbikes and even rickshaws entering central areas during the day.

London congestion charge was imposed in early 2003 a daily charge for driving or parking a vehicle on public roads within central London between the hours of 7:00 a.m. and 6:30 p.m. on workdays. Traffic congestion is reported to have declined substantially, and the program is largely popular. It is often cited as an example of successful economic intervention to correct an important negative externality.

Differential VAT Based on Carbon Content of Fuel

The state of Tamil Nadu can charge reduced VAT (lower VAT rate) on vehicles using alternate fuels like LPG or Hybrid fuels vis-à-vis those using Petrol.

Green Motor Vehicle Tax

The green tax on old vehicles can be revised. Currently Tamil Nadu charges a green tax

on vehicles older than 15 years. For motor cycles of age exceeding 15 years, a sum of Rs. 500 is charged and for other vehicles, a sum of Rs. 1000 is charged. Himachal Pradesh and Andhra Pradesh are the foremost states to introduce this tax. In Himachal, the green motor vehicle tax is Rs 100 for two-wheelers, Rs 200 for cars and jeeps, Rs 300 for utility vehicles and Rs 500 for buses and trucks. The tax collection has been subcontracted to an outside contractor. In Andhra Pradesh, transport vehicles which have completed seven years from the date of their registration have to pay Rs.5000 per annum. Motor vehicles other than Transport vehicles that have completed 15 years from the date of their registration have to pay tax of 1000 for motorcycles and 5000 per annum for other vehicles.

Uplifting of State VAT Rate

(a) Coal

Coal is taxed at 5 percent in Tamil Nadu. It falls under the list of declared goods under the CST Act. As such this instrument is subject to central constraints (Group A). The relevant items under the rate list are listed in Table 8.1. In Tamil Nadu, most power plants are thermal and intensively use coal. Coal is almost entirely imported from other states or countries and used as an input and any taxes paid on it are likely to be rebated at later stages. In spite of the constraint placed by the provision of declared goods, states can still utilize the instrument by limiting or disallowing the rebate of input tax paid at later stages in the value added process. An initiative like this has been taken by Government of Odisha (see, Annexure I). The environmental effectiveness of coal cess has already been demonstrated in the previous chapter alongside the discussion on 'Green Cess' on electricity generation.

Table 8.1: Taxation of Coal

Commodity Code	Description of Goods	Rate of Tax
2050	Coal ash of all kinds	5
2029	Coal tar	5
2041	Coal, including coke in all its forms, but excluding charcoal	5

(b) Iron and Steel

Iron and steel is also taxed at 5 percent under the state VAT act. This is also a declared good. Iron and steel are identified as one of the most polluting inputs. It is used in the construction industry and motor vehicle industry. Tamil Nadu has a significant presence of the automobile industry and other industries where iron and steel may be used as input. In most cases the taxes paid on iron and steel would be rebated at later stages.

State governments have to keep the rate at 5 percent because it is notified under the 'declared goods' by the central government. Some of the options that may be considered are as follows.

1. Introduce a non-rebatable cess on iron and steel;
2. ITC on use of iron and steel in subsequent uses may be discontinued;
3. Central government may take it out of the list of declared list goods. The whole idea of declared goods may be discontinued as we move to GST.

(c) Non-ferrous Metals and Alloys

Non-ferrous metals and alloys are also taxed at the lower rate of 5 percent. These metals are also polluting goods but these are not part of declared goods. These may be taxed at the higher rate of 14.5 percent but the issue of input rebate needs to be reconsidered until GST is introduced.

a. Plastic bags and plastic dyes and most other plastic categories and PVC sheets and pipes: These are also polluting goods and taxed at the lower rate of 5 percent. This rate should be increased to 14.5 percent.

b. Unbranded Steel Furniture: This is also taxed at 5 percent. This only encourages shift from branded steel to unbranded production in unorganised sector but it is equally polluting.

c. Cement is another major polluter. It is mainly used in the construction industry. However, it is taxed at 14.5 percent. The issue is that since it is mostly used as input, any tax paid as an input would be washed out at later stages.

In all these cases, the strategy for environmental taxation should be thought of in the context first under the state VAT and secondly under the GST. Since the GST is being considered, the use of these instruments may be postponed until GST takes effect.

One option is to levy a sales tax up to permissible limit if the goods are declared goods or at the higher rate of state VAT and either allow no input tax credit or limit it to 2 percent, just as in the case of goods that come from other states having paid the central sales tax. It would be best to treat these polluting goods similar to the treatment of petroleum products where no ITC is provided.

The option under GST is considered later in this chapter. In each case, a corresponding subsidy can be introduced. In the case of coal, the revenue may be used to finance subsidy for non-conventional energy from wind, solar, bio-mass and ethanol. In the case of iron and steel, a subsidy can focus on supporting alternative technologies for developing substitutes. In the case of cement, use of newer type of bricks (fly-ash based) and windows and other energy saving materials used in the construction industry can be supported.

Climate Friendly Taxation under GST

Except for petroleum products and demerit goods like tobacco and alcohol, states now levy state VAT on goods, which was initially under an agreed rate structure as recommended by the Empowered Committee of State Finance Ministers.

Features of the Constitution Amendment Bill

The Constitution Amendment Bill introduces the concept of concurrent powers of taxation to central and state governments as compared with the existing scheme where the powers are exclusive for the centre and the states in their respective domains. The centre has power to levy excise duties on all goods and separately levy a service tax. The states have power to levy sales taxes on goods. They also levy entry tax or Octroi, motor vehicle tax, entertainment tax, purchase taxes, and luxury taxes. In addition, the central sales tax on inter-state trade is levied by the central government but administered by the state governments, who also retain the revenue collected.

The key features of the Constitution Amendment Bill are:

- The Constitution Amendment Bill maintains the revenue powers given in the Union List and the State List but gives concurrent powers to tax goods as well as services to both the central and state governments through amendments proposed in these two lists. It does not use the Concurrent List where no taxes are mentioned. The central and state components are to be called respectively, CGST and SGST.
- For handling inter-state trade in goods and services, it gives the central government the power to levy and collect and integrated goods and services tax (IGST).
- It proposes the setting up of two bodies: a GST Council where the central and all the state governments are represented and a Dispute Settlement Authority.
- The GST Council has the power to decide the tax rates, list of exemptions, etc.

- The GST Council is proposed to follow the 'unanimity' rule with respect to all members present and voting.

Non-rebatable Levy on Selected Polluting Goods

The only way in which a differentiation can be made between taxation of polluting and non-polluting goods in a GST framework is to introduce a non-rebatable levy (as excise tax/sales tax) on selected polluting goods over and above the standard GST rate. The variants of GST currently under consideration emanate respectively from, (a) the Empowered Committee of State Finance Ministers (see, Empowered Committee, 2009), (b) the Thirteenth Finance Commission (Task Force on Goods and Services Tax, 2009), and (c) the model implicit in Central Government's proposed constitutional amendment (GoI, 2011). A major achievement is that the basic features of GST, namely, that it will be a concurrent GST, consistent with India's federal structure has been agreed upon. In all the three versions, the GST consists of central and state GST components (CGST and SGST) with the following main features:

i. The basic features of law such as chargeability, definition of taxable event and taxable person, measure of levy including valuation provisions, basis of classification etc. would be uniform across central and state statutes as far as practicable.
ii. The CGST and SGST would be applicable to all transactions of goods and services made for a consideration except for the exempted goods and services, goods which are outside the purview of GST and the transactions which are below the prescribed threshold limits.
iii. The CGST and SGST are to be paid to the accounts of the Centre and the States separately. Taxes paid against the CGST and SGST will get input tax credit (ITC) within the CGST and SGST chains respectively but cross utilization of ITC between CGST and SGST would not be allowed.
iv. The administration of the CGST will be with the centre and that of SGST with the States. The GST will be based on the destination principle. This requires that inter-state sales of goods and services and exports are zero-rated.

As discussed above, there are also issues concerning whether the proposed GST will have adverse environmental implications and what can be done to bring environmental considerations in the GST framework. Treatment of polluting inputs and outputs for effective environmental management is of critical importance in the context of GST as these inputs and output create negative externalities. Thus, a select number of polluting goods should be subjected to either a non-rebatable excise/sales tax over and above the GST.

The following are some of the notable features:

- The core GST rate is kept at 14 percent.
- Without changing the core rate, and compliance rate, the desired buoyancy comes from the petroleum taxes.
- The core rate can be further reduced if higher rate is charged on polluting goods/petroleum products or if the compliance rate improves.

Selected Goods for Non-rebatable Levy

Given Tamil Nadu's production structure, the polluting goods used within Tamil Nadu and outside of Tamil Nadu including exports, where the cost of pollution will have to be suffered by the producing state, the following goods may be taken up for a non-rebatable levy over and above the standard GST rate.

1. Coal
2. Cement
3. Iron and steel
4. Leather
5. Textiles
6. Electricity
7. Petroleum products (if taxation of these is integrated into GST; if not they will taxed under the present sales tax regime and the tax will be allowed to cascade as at present).

In addition, since the motor vehicle tax will continue even with GST, a green motor vehicle tax component and local congestion tax can complement the Green GST.
The present discussions around GST are characterized by a number of concerns.

- First, the states fear loss autonomy. Sales taxes and 'state-vat' are their main revenue sources. With these merged in GST, states fear that they will completely lose autonomy in determining tax rates and raising more or less revenues according to their needs.
- Second, many states fear that with the central sales tax abolished, they will lose revenue in the long run. While the central government may compensate them for a few years, eventually this compensation will dry up. This concern is particularly true of the so-called 'producing' states.

- Thirdly, in a destination-based system, the tax revenue will accrue to the consuming states, while considerable amount of pollution will remain in the producing states.
- Fourth, states are talking about dual rates for goods: one lower rate for goods of mass consumption and the other, the core rate for all other goods. This would necessitate having two rates for goods and possibly a third rate for services. This will bring back classification disputes amongst goods and between goods and service.
- Fifth, the GST as presently envisaged is environmentally perverse, since it will tax polluting and non-polluting goods and services at the same rate.
- Sixth, in spite of the reforms, taxation of petroleum products, is still being kept out of the purview of GST where cascading is allowed to continue.

Concluding Remarks

Our prioritized list of instruments relate to four sectors: energy, transport, cement and construction.

d. Energy sector related instruments
    1. Coal cess or limiting input tax rebate of statevat to finance a green fund used to subside use of cleaner substitutes for energy production
    2. Green cess to finance the green fund
e. Transport sector related instruments
    1. Green motor vehicle tax to subsidise use of less polluting vehicles
    2. Congestion tax to finance a city road maintenance fund to reduce use of diesel and petrol per km of use by vehicles
f. Construction sector related instruments
    1. Reducing VAT on energy saving materials accompanied by higher state VAT on high energy using materials used in construction
    2. Reducing property tax on green buildings accompanied by higher rate on high energy consuming properties (like malls, etc.)
    3. Cess on solid waste accompanied by subsidy for burning waste in cement producing firms

As argued here, if environmental taxes are integrated in the GST, almost all of the above mentioned concerns can be effectively addressed. The environmental taxes can be introduced in the form of non-rebatable excises or cesses on polluting goods and services. With respect to these non-rebatable excises, the states can be given autonomy to select the goods from within a list approved by the Goods and Services Tax Council.

The rates may also be fixed by them subject to bands approved by the GST Council. Second, the revenue from environmental taxes can be used to bring the overall GST rate down to say 14 percent, divided between centre and states, at 7 percent each. Third, the producing states will get a long term source of additional revenue enabling them to cope with the problems of localized pollution. Fourth, the 7 percent rate is low enough obviating the need to have dual rates for goods. We can then have a single rate for goods and services. Fifth, we will then have an environmental friendly taxation regime. Sixth, the provision of non-rebatable excise will allow petroleum products also to be brought under GST. All in all a Green GST (GGST) will be far more welfare improving and acceptable than the narrowly formulated GST.

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Annexure I

IMPLEMENTATION STRATEGIES FOR SELECT FISCAL INSTRUMENTS

Green Cess

Legislative and Regulatory Setup

The Seventh Schedule of the Constitution of India defines the distribution of legislative powers between the state and the central government. According to this schedule, "Electricity" is listed as Entry 38 of List III, thereby vesting the central and the state government with legislative powers on the subject. Besides this, "Taxes on the consumption or sale of electricity" also features in the seventh schedule as Entry 53 under List II. Therefore levy of any cess on Electricity should abide by the aforesaid legislative setup as dictated by the Constitution of India.

The most important act which governs the power sector in India is the Electricity Act, 2003 which came into force on June 10, 2003. The Electricity Act of 2003 supersedes the Indian Electricity Act, 1910, Electricity (Supply) Act, 1948 and Regulatory Commissions Act, 1998 which governed the power sector prior to its enactment. The objective of the act is;

"*to consolidate the laws relating to generation, transmission, distribution, trading and use of electricity and generally for taking measures conducive to development of electricity industry, promoting competition therein, protecting interest of consumers and supply of electricity to all areas, rationalisation of electricity tariff, ensuring transparent policies regarding subsidies, promotion of efficient and environmentally benign policies constitution of Central Electricity Authority, Regulatory Commissions and establishment of Appellate Tribunal and for matters connected therewith or incidental thereto*"

The Electricity Act, 2003 promotes renewable energy sources in a number of ways:

(i) Part II - Section 3 of the EA mandates that Central Government in consultation with the states, prepare national electricity policy and tariff policy for development of the power system based on optimal utilisation of non renewable resources or hydro and renewable sources of energy.

(ii) Part II - Section 4 of the EA mandates the Central Government in consultation with the states prepare and notify a national policy, permitting stand alone

systems (including those based on renewable sources of energy and non-conventional sources of energy) for rural areas.

(iii) Part VII - Section 61 of the EA provides guidelines and principles based on which tariff shall be determined among which it states that the tariff should reward efficiency in performance(61 – e) , promote of co-generation and generation of electricity from renewable sources of energy(61 – h) and be guided by the National Electricity Policy and tariff policy(61 - i).

(iv) Part X of EA stipulated the institution of Central Regulatory Commission and respective State Regulatory commissions. Part X – Section 86 of the EA, listing the functions of the State commission states that promotion of cogeneration and generation of electricity from renewable sources of energy is one among them.

Also, the National Tariff Policy, 2006 mandate that a minimum percentage of purchase of energy should be from renewable sources of energy. Section 6.4 of the NTP, 2006 reads as follows,

"*Pursuant to provisions of section 86(1)(e) of the Act, the Appropriate Commission shall fix a minimum percentage for purchase of energy from such sources taking into account availability of such resources in the region and its impact on retail tariffs. Such percentage for purchase of energy should be made applicable for the tariffs to be determined by the SERCs latest by April 1, 2006"*

It will take some time before non-conventional technologies can compete with conventional sources in terms of cost of electricity. Therefore, procurement by distribution companies shall be done at preferential tariffs determined by the Appropriate Commission. Further on June 2008, India's first National Action Plan on Climate Change was released which among many other National Missions included the National Solar Mission that promoted the generation and use of solar power. Subsequently, in line with the National Solar Mission, the National Tariff Policy was amended in 2011 to include a solar specific RPO. The amendment stated that the solar power purchase obligation for States may start with 0.25% in Phase I (by 2013) and go up to 3% by 2022 This will be complemented by solar specific Renewable Energy Certificate (REC) mechanism to allow solar power generation companies to sell certificates to the utilities to meet their solar power purchase obligations.

Following the aforementioned provisions the CERC and the SERCs promote RE through various RE policies, RPO, REC and Feed in Tariff mechanisms.

Green cess as a fiscal instrument to promote renewable energy has been implemented in the states of Maharashtra and Gujarat in India. The studies of green cess levied in these states provide an insight into the implementation strategy.

Maharashtra Tax on Sale of Electricity, 1963

The purpose of the Maharashtra Tax on Sale of Electricity is to levy a tax on the sale of electricity in the State of Maharashtra and to provide for the creation of a Fund there from for the improvement and development of power supply in the State. The state government of Maharashtra amended the Maharashtra Tax on Sale of Electricity in 2004 and subsequently through a notification dated 19th May 2004 the rates were specified and deemed effective retrospectively from the 6th April 2004. The act mandates,

Every power utility shall pay to the State Government at the time or times and in the manner prescribed the amount of tax payable under this Act.

(1) The proceeds of the tax (together with interest payable under section 9) recovered under this Act, shall first be credited to the Consolidated Fund of the State, and under appropriation duly made by law on this behalf-

(a) An amount of tax four Paise per unit paid by power utility to the State Government in respect of sale of electricity to commercial and industrial consumers shall be transferred to the Maharashtra Energy Development Agency established under the Societies Registration Act, 1860 or its successor, for executing schemes of generation of renewable and non-conventional source of energy, and

(b) the remaining amount be entered in, and transferred to a separate fund called the state electricity fund.

(2) Any amount transferred to the Maharashtra Energy Development Agency and the state electricity fund under sub-section (1) shall be charged on the consolidated fund of the State.

The fund may be expended for executing schemes for development and improvement of power supply, in the state and for operating rural electrification schemes therein and in furtherance of this purpose, the State Government shall, form and out of the fund, gives subsidies or loans or ways and means advances of power utility and the board.

According to the above notification dated 19th May 2004, the MSEB issued a circular dated 22nd September, 2004 with regard to implementation of the GoM

Notification retrospectively from 6th April, 2004, i.e. by levying an amount of 4 paise per unit consumed from industrial and commercial consumers.

However, in a petition dated 19th January, 2005 to MERC, the Vidarbha Industries Association (VIA) contested the levy of this tax on consumers by the MSEB. A summary of the case is as follow: VIA has pointed out that, as per Section 4 of the Maharashtra Tax on Sale of Electricity Act, every bulk licensee / power utility engaged in distributing electricity, "shall pay to the State Government at the time or times and in the manner prescribed the amount of tax payable under this Act." Thus, under the Act, TOSE is to be paid, in this case by MSEB, and cannot be collected from the consumers automatically on a one-to-one basis. However if, because of the consequent increase in MSEB's cost of supplying electricity, MSEB want to recover the burden from consumers, they can only do so by approaching the Commission for review of tariff. Section 62(6) of the Electricity Act (EA), 2003 stipulates that if any Licensee recovers a price or charge exceeding the tariff determined under that Section, the excess amount shall be recoverable by the person who has paid such price or charge, along with interest. The contention was resolved by the MERC stating that the tax incidence was on the MSE and not the consumer. The TOSE paid by MSEB to the GoM should be accommodated in future tariff determination. However since TOSE paid by MSEB to GoM is a substantial amount and postponement of recovery will result in consumers having to pay past burden, 2 choices were proposed, (1) MSEB can recover TOSE from all consumers and not just industrial and commercial consumers using the prevailing formula (due to the lack of a distinct of FAC formula) and refunds made to the industrial and commercial consumers to the extent required and arrears recovered from other category of consumers; (2) Alternatively, MSEB could the entire burden of TOSE payments until the tariff is revised following due process, and refund the amounts recovered from industrial and commercial consumers on this account.

Through the notification dated 15th May, 2008 Government of Maharashtra, with effect from the 1st May 2008, revised the rate to 8 paise per unit.

Gujarat Green Cess Act, 2011

The purpose of the Gujarat Green Cess Act, 2011 is

"*to provide for levy of cess on generation of electricity other than renewable energy for creation of a, fund for protecting environment and promoting the generation of electricity through renewable sources in the State of Gujarat and for the matters connected therewith and incidental thereto*"

The Act stipulates the levy and collection of a cess on generation of electricity except on generation of renewable energy by the generating company at the generation station or at the captive generating plant or the stand by generating plant. The Act also states that the cess shall be levied irrespective of whether the electricity is consumed within the state or not. The proceeds of the cess at a rate of 20 paise per unit electricity are first credited into the Consolidated Fund of the state and after deduction of the expenses of collection and recovery there from shall, under appropriation duly made by law in this behalf, be entered in and transferred to a separate fund called the Green Energy Fund, for being utilized exclusively for the purposes of this Act.

However a number of industrial players of the state have challenged the constitutional validity of the levy of such a cess in Gujarat High Court. A number of companies have challenged the provisions contained in Gujarat Green Cess Act, 2011 and the Gujarat Green Cess Rules, 2011 as ultra vires the Constitution of India. In view of these petitions, the Gujarat High Court has restrained recovery of any amount by way of cess on generation of electricity under the provisions of the Gujarat Green Cess Act, 2011 and the Gujarat Green Cess Rules, 2011.

Implementation of Green Cess in Tamil Nadu

In view of the implementation of the Green Cess in Tamil Nadu, the following can be learnt from the examples of Maharashtra and Gujarat:

The levy of the cess needs to be passed as a bill in the legislative assembly before it can be enacted. The power to levy such a cess lie with the Government of Tamil Nadu and no other body such as the TNERC will have the powers to do so. In concordance with the legislative set up, such a cess can be levied on the sale or consumption of electricity however there is still contention on levy of such a cess on the production of electricity as in the case of Gujarat Green Cess Act, 2011. The Tamil Nadu Tax on Consumption or Sale of Electricity, 2003 can be amended to include the levy of a green cess towards a Green Energy Fund. According to Section 3(1) of the Tamil Nadu Tax on Consumption or Sale of Electricity, 2003

> *"every licensee and every person other than a licensee shall pay every month to the Government in the prescribed manner, a tax on the electricity sold or consumed during the previous month at the rates specified hereunder".*

Therefore amendment of this section shall allow imposition of green cess. Also with the powers conferred by Section 15(1) of the Tamil Nadu Tax on Consumption or Sale of Electricity, 2003, the State may amend the Tamil Nadu Tax on Consumption or Sale of Electricity Rules, 2003. The cess may be targeted at industrial and commercial consumers as in the case of Maharashtra or generators of electricity other than renewable energy sources as with the Gujarat Green Cess Act. Also, as far as passing on the burden of the cess is concerned, the levy of the green cess should be accompanied by relevant changes to the tariff as approved by the TNERC on request of the TNEB and other generation licensee.

Change of Input Tax Credit for Coal

Legislative and Regulatory Setup

Article 286(3) (a) of the Constitution of India empowers the parliament to impose restrictions and conditions on the levy of taxes by the States on the goods declared to be of special importance.

CST is tax on sales or purchase of goods in inter-State trade or commerce. However it is to be noted that CST is not applicable for imports and exports. In concordance with the above mentioned powers, the Central Sales Tax Act, 1956 lists some goods as of special importance. According to the CST Act, 1956 "declared goods" means goods declared under Section 14 of the act to be of special in inter-state trade or commerce. Coal, including coke in all forms, but excluding charcoal is declared as a good of special importance in inter-state trade or commerce. Section 15 of the CST Act, 1956 lists the restrictions and conditions with regard to tax on sale or purchase of declared goods within a State. According to Section 15(a), the tax payable on the sale or purchase of declared goods inside the State should not exceed 5%. Therefore levy of state VAT is bound by the 5% limit for the declared goods.

Also there is a Clean Energy Cess which imposed a duty of excise on coal, lignite and peat. This was enacted as part of the Finance Bill, 2010. Through a Notification No. 1/2010-CEC (Clean Energy Cess) dated 22.06.2010; the cess came into force from 1st July, 2010.

Orissa - Denial of Input Tax Credit for Coal

The Orissa Government through a notification S.R.O. No.34/2009 dated 27th January, 2009 denied the input tax credit for items listed in the schedule as part of the notification

which included coal, furnace oil, kerosene, all automobiles including commercial vehicles/ two wheeler/three wheeler, air conditioning units etc.

However a number of companies challenged the above notification in the Orissa High Court on two main grounds. (1) Disallowing input tax credit is in contrary to the Orissa VAT Act as coal and furnace oil are used as inputs. (2) Clause (m) of sub-section (8) of Section 20 of the OVAT Act does not vest the Finance department of Government of Orissa with the powers to issue such notification in general and specific circumstances needs to be mentioned.

The Orissa High Court passed a ruling that clause (m) of sub-section (8) of Section 20 of the OVAT Act does not give plenary power and therefore it is ultra vires of the subsection and specific circumstances similar to those contained in Section 20(8)(a-l) of the OVAT Act must be specified and Coal and Furnace Oil cannot be denied input tax credit altogether.

With regard to contradiction of whether coal and furnace oil can be treated as input in the manufacturing process and the hence input tax credit cannot be denied, the court concluded as follows;

> *"input comprises of two types of commodities, i.e. (i) those commodities which directly go into the composition of finished product and (ii) the consumables used in the manufacturing process for production of finished product and concluded that for 'consumable' to qualify as an 'input' it is not at all necessary that in order for consumable to qualify as 'input' should directly go into the composition of the finished product. What is required is that consumable should be directly used in the manufacturing process for production of the finished product. In that view of the matter Court concluded that 'furnace oil' used by the petitioner in the process of manufacturing of PSF was to be treated as 'input' as defined under Section 2(25) of the OVAT Act and the credit for input tax which has been paid by the dealer on the purchase of furnace oil can be claimed under Section 2(27) of the OVAT Act against the tax payable on finished product"*

The final order passed by the Orissa High Court is as follows;

> *"We are of the considered view that the impugned notification SRO No.34/2009 dated 27.1.2009 in all the writ petitions declaring 'coal' and 'furnace oil' as goods is illegal and therefore the impugned notification is liable to be quashed to the aforesaid extent and is accordingly quashed."*

While the above notification was quashed, it should be noted that Electrical

Energy is listed under Schedule A of Orissa Vat Act, and hence exempted.

But later the OVAT was amended through a bill which was passed and a notification was issued on the 27th June, 2012. Through this amendment Section 20 of the OVAT was amended to include the following sub-section;

"(1-a) Notwithstanding anything to the contrary contained in this Act, a dealer shall not be entitled for input tax credit in respect of purchase of the following taxable goods' subject to the circumstances mentioned against each such goods.

1. *Coal when used for generation of electricity for sale and captive use.*
2. *Furnace oil except when purchased for resale.*
3. *Kerosel1e except-when purchased, for resale.*
4. *AU automobiles including commercial vehicle, two wheelers and three wheelers required to be registered under the Motor Vehicles Act, 1988 except when purchased for resale and including tyres and tubes, spare parts and accessories for the repair and maintenance thereof.*
5. *Earth moving equipment such as dozers, loaders and excavators; and poclain, dumpers and tippers except when purchased for resale.*
6. *Machinery and equipments including accessories and component parts thereof purchased for use in mining.*
7. *Machinery and equipments including accessories and component parts thereof purchased for use in construction activities such as mixer, road roller, paver, vibrator.*
8. *Fuels used for automobiles or used for captive power generation or used in power plants.*
9. *Natural Gas except when purchased for resale."*

The above amendment came into force on 1st August 2012, through a notification S.R.O. No. 438/2012 dated 30th July, 2012. These goods for which input tax credit is denied are commonly called the "negative list". The APVAT Rules 2005 specify a list of 11 goods under Rules 20(2) for which input tax credit cannot be claimed. The state of Punjab, denies input tax credit on all Goods used in generation and distribution of electrical energy among other things.

Implementation of Change in Input Tax Credit for Coal in Tamil Nadu

In the case of Tamil Nadu, as per the section 15 of the TN VAT Act goods specified in the Fourth Schedule of the Act and the goods exempted by notification of the Government by any dealer is exempted from VAT. Section 19 of the TNVAT Act provides details on the input tax credit under the TN VAT Act. According to subsection 19(1), input tax credit can be claimed by the registered dealer to the seller on purchase of goods specified under First Schedule provided that the registered dealer, who claims input tax credit, shall establish that the tax due on such purchases has been paid by him in the manner prescribed. Section 19(5) lists the cases where input tax credit claim is denied.

1. *No input tax credit shall be allowed in respect of sale of goods exempted under section 15*
2. *No input tax credit shall be allowed on tax paid or payable in other States or Union Territories on goods brought into this State from outside the State.*
3. *No input tax credit shall be allowed on the purchase of goods sold as such or used in the manufacture of other goods and sold in the course of inter-State trade or commerce falling under sub-section (2) of section 8 of the Central Sales Tax Act, 1956.*
4. *No input tax credit shall be allowed on purchase of capital goods, which are used exclusively in the manufacture of goods exempted under section 15.*
5. *No registered dealer shall be entitled to input tax credit in respect of-*

    a. *goods purchased and accounted for in business but utilised for the purpose of providing facility to the proprietor or partner or director including employees and in any residential accommodation; or*
    b. *purchase of all automobiles including commercial vehicles, two wheelers and three wheelers and spare parts for repair and maintenance thereof, unless the registered dealer is in the business of dealing in such automobiles or spare parts; or*
    c. *purchase of air-conditioning units unless the registered dealer is in the business of dealing in such units.*
6. *No input tax credit shall be allowed to any registered dealer in respect of any goods purchased by him for sale but given away by him by way of free sample or gift or goods consumed for personal use.*
7. *No input tax credit shall be available to a registered dealer for tax paid or payable at the time of purchase of goods, if such-*
    a. *goods are not sold because of any theft, loss or destruction, for any reason, including natural calamity. If a dealer has already availed input*

tax credit against purchase of such goods, there shall be reversal of tax credit; or

b. *inputs destroyed in fire accident or lost while in storage even before use in the manufacture of final products; or*
c. *inputs damaged in transit or destroyed at some intermediary stage of manufacture.*

However Electrical Energy is listed as item no. 25 in part B of Schedule 4 in the TN VAT Schedule and hence exempted from VAT. According to the G.O.Ms.No.42 dated 20.03.2012 the Government of Tamil Nadu exempted VAT on all sales of goods effected by the following dealers and their branches in the State of Tamil Nadu 1. Tamil Nadu Electricity Board Limited (TNEB); 2. Tamil Nadu Generation and Distribution Corporation Limited (TANGEDCO); 3. Tamil Nadu Transmission Corporation Limited (TANTRANSCO) effective 1st November 2010.

Besides this, in the same order the Government of Tamil Nadu makes a reduction in respect of tax payable by any dealer to four percent on the sale of any goods except petrol, diesel and cement to the following, for use in generation, transmission and distribution of electrical energy:-

1. Tamil Nadu Electricity Board Limited (TNEB);
2. Tamil Nadu Generation and Distribution Corporation Limited (TANGEDCO);
3. Tamil Nadu Transmission Corporation Limited (TANTRANSCO).

Although Electrical Energy is exempted from tax, input tax credit for Coal used in the generation of Electricity is not denied in the Section 19 of the TN VAT Act and hence may be added to the existing list in Section 19(7) of the TN VAT.

Property Tax Rebate for Solar Energy

Legislative and Regulatory Setup

Property tax is an urban tax on building and the appurtenant land imposed on the owners. The Seventh Schedule of the constitution empowers the state to levy property tax by listing it as Entry 49 in the List II – State List. However, the 74th amendment to the Constitution Act, 1992, was a crucial effort to empower the urban local bodies. Article 243W of the amendment authorises the State Legislature to endow power and authority

to the municipalities as listed in the Twelfth schedule. Article 243X of the 74the amendment details the powers to impose taxes by the municipalities;

> *243X. Power to impose taxes by, and Funds of, the Municipalities.-The Legislature of a State may, by law,-*
> *(a) authorise a Municipality to levy, collect and appropriate such taxes, duties, tolls and fees in accordance with such procedure and subject to such limits;*
> *(b) assign to a Municipality such taxes, duties, tolls and fees levied and collected by the State Government for such purposes and subject to such conditions and limits;*

Rebate on Property Tax for use of Solar Energy – Andhra Pradesh

The levy of Property Tax comes under the Municipal Administration and Urban Development department of the Government of Andhra Pradesh. By the powers conferred by the Hyderabad Municipal Corporation Act, 1955 and the Andhra Pradesh Urban Areas Development Act 1975, the Government of Andhra Pradesh issued a set of Revised Building Rules through G.O. Ms.No. 86 dated 3rd March, 2006. According to Section 18 of G.O. Ms.No. 86, incentives were given to the property owners for usage of solar heating / lighting system and recycling of waste water in terms of rebate on property tax. However, initially these Building Rules were applicable only to Municipal Corporation of Hyderabad area, rest of Hyderabad Urban Development Authority area, Cyberabad Development Authority area and Buddha Purnima Project Authority area. Later through G.O.Ms.No.678 dated 07-09-2007 was revised and extended to Visakhapatnam Urban Development Authority area and Vijayawada-Guntur-Tenali-Mangalagiri Urban Development Authority area. Further, through G.O.Ms.No.302 dated 15-04-2008, the Hyderabad Building Rules, 2006 was extended to Tirupati Urban Development Authority, Kakatiya Urban Development Authority, Puttaparti Urban Development Authority, Basar Special Development Authority and Rishi Valley Special Development Authority and to all other Municipal Corporations areas of the State upon suitable modifications. This was called the Andhra Pradesh Revise Building Rules, 2008. Subsequently in 2012, in order to bring about uniformity in the state, the Government of Andhra Pradesh issued a comprehensive set of rules called the "The Andhra Pradesh Building Rules -2012" through G.O.Ms.No. 168 dated 07.04.2012.

The clause with respect to property tax rebate on solar heating / lighting system and recycling of waste water is still part of the Andhra Pradesh Building Rules – 2012 under Section 22, read as follows;

> *"INCENTIVES FOR OWNERS LEAVING MORE SETBACKS / INSTALLING SOLAR HEATING SYSTEM / LIGHTING / RAIN WATER HARVESTING / RECYCLING OF WASTE WATER:*
>
> *The following incentives in terms of rebate in Property Tax will be given by the local authority for owners or their successors-in-interest who: (i) Install and use solar heating and lighting system: 10% rebate. (ii) Undertake both recycling of waste water and rain water harvesting structures: 10% rebate"*

Implementation of Rebate on Property Tax for use of Solar Energy in Tamil Nadu

In Tamil Nadu the urban areas are governed by the urban local bodies which are classified as Municipal Corporations, Municipalities and Town Panchayats. There are 10 Municipal Corporations, 125 Municipalities and 611 Town Panchayats in Tamil Nadu.

The administration of these urban local bodies comes under the purview of the Municipal Administration and Water Supply department. Each of the municipal corporations is governed by their respective Act and Building Rules. The Chennai Municipal Corporation is governed by the Chennai City Municipal Corporation Act, 1919 and the Chennai City Corporation Building Rules, 1972. As far as the Municipalities are concerned they are governed by the Tamil Nadu District Municipalities Act, 1920 and the Tamil Nadu District Municipalities Building Rules, 1972. The Town Panchayat which were earlier governed by Tamil Nadu Panchayat Act, 1958 was brought under the Tamil Nadu District Municipalities Act, 1920 after the 74th amendment to the constitution.

In so far as Chennai City Municipal Corporation Act, 1919 is concerned, Section 98 empowers the corporation to levy taxes which includes property tax. Similarly Section 81 of the Tamil Nadu District Municipalities Act, 1920 empowers the Municipalities to levy property tax.

In order to provide incentives for the use of solar energy, the respective Corporation Acts and the Tamil Nadu District Municipalities, 1920 Act needs to be amended. With the powers vested in the Sections 230, 347 and 348 of the Chennai City Municipal Corporation Act, 1919 any rules can be made by the State government to carry out any or all of the purposes said in the Act. The above mentioned sections allow the

amendment of Chennai City Corporation Building Rules, 1972 and Special Rules for the Multi-storied and Public Buildings, 1974. Similar powers are vested by section 191 and section 303 of the Tamil Nadu District Municipalities Act, 1920 to make amendments to the amendment to the Tamil Nadu District Municipalities Building Rules, 1972. Section 191 and section 303 of the District Municipalities Act, 1920 also allows for changes to the Multi-storied and Public Building Rules, 1973. Also it is worthy to mention that the District Municipalities Building Rules, 1972 was amended to specify that if a building is intended to be used as hospital, nursing homes, hotels, lodges, guest house, hostels, colleges, marriage halls etc. in which there is an installation for supplying hot water, a provision should be made for an auxiliary solar assisted water heating system fitted according to the prescribed rules.

Annexure II

REDUCED VAT ON ENERGY EFFICIENCY MATERIALS

As discussed in the main text a list of energy saving materials that are used in constructing green buildings can be identified and a rebate in VAT on those materials can be proposed. The revenue loss from the rebate can be made up by marginally increasing the VAT on polluting material, ensuring a zero cost in the movement within the VAT structure. For example, a reduced VAT can be suggested on energy saving air conditioners. Currently, the difference in the purchase price of a two-star and a five-star rated air-conditioner is around Rs 9,000 - 10,000 for a 1.5 tonne air-conditioner. VAT rate is the same. However it is expected that the higher initial outlay can be recovered from savings on power cost during the lifetime of the air-conditioner.

Energy efficient products are listed as:

- innovative lighting controls,
- photovoltaic solar electricity,
- solar resistant glass, solar roofing membranes,
- energy recovery ventilators,
- energy efficient air conditioners,
- light pipe day lighting (capturing the sunlight from rooftops and piping it down through reflective tubing) exist.
- Other green innovations include horizontally perforated clay hollow blocks (which besides giving excellent sound and thermal insulation save on structural costs);
- autoclaved aerated concrete blocks, wall form system (a construction system comprising of lightweight panels),
- cellular lightweight concrete (which reduces consumption of reinforcing and cement and saves energy); heat resistant terrace tiles (replicating the benefits of conventional cool roofing);
- thermal insulation boards; porous pavement system and Sky ceilings.

Green materials also include fly ash cement, fly ash blocks, recycled aluminium, recycled steel, recycled tiles, low VOC paints and bamboo-based products. Table AII.1 shows the current VAT structure on the energy efficient materials.

Table AII.1 Current VAT Structure on Energy Efficient Materials

Energy Efficiency Material	VAT (%)
Innovative Lighting Controls	
Bed room lights burning on oil Parts and accessories including wicks and chimneys	0
Cycle dynamo lights	5
Flash light apparatus	14.5
Hurricane lights burning on oil Parts and accessories including wicks and chimneys	
Kerosene lamps (other than gas lights and petromax lights)	0
Lighting control reflectors	14.5
Petromax lights	5
Photovoltaic Solar Electricity	
Solar cells of all kinds parts and accessories thereof	14.5
Solar cookers	0
Solar Resistant Glass	
Glass -other than those specified elsewhere in the schedule	14.5
Opera glasses	14.5
Energy saving choolas	0
Solar cookers	0
Municipal waste conversion devices for producing energy	
Renewable energy devices and spare parts other than those specified in the Fourth Schedule.	5
Ventilators made of any materials other than those specified in the schedule	14.5
Ventilators armoured or reinforced safes	14.5

The following energy saving materials carry a reduced VAT rate of only 5% (not 17½%)	
1. Central heating and hot water system controls	
2. Draught Stripping	
3. Insulation	
4. Solar panels	
5. Wind turbines	
6. Water turbines	
7. Ground source heat pumps	
8. Air source heat pumps	
9. Micro combined heat and power units	
10. Wood-fuelled boilers	
Air Conditioners	14.5
The Bureau of Energy Efficiency (BEE), a statutory body under the Union Ministry of Power, has upgraded the requirements for star rating of split type room air-conditioners. This regulation, which came into effect in January this year and raised the energy efficiency standards by about 8% for split air-conditioners for the same rating band, is intended to help raise consumer awareness on saving energy and creating more energy efficient appliances across the spectrum for this industry.	
Star rating is a system initiated by BEE (Bureau of Energy Efficiency) to determine the energy efficiency of an appliance, like air-conditioners. Depending on their energy efficiency they are rated on a scale of 1 - 5 stars. Higher the number of stars, better is their energy efficiency.	
The energy efficiency of an AC depends on two factors :	
a) Cooling capacity (in watts)	
b) Power consumption (in watts)	
Examples Of Energy Efficient Air Conditioners	
The star rated Hitachi Split Air Conditioners	14.5
energy efficient air-conditioning solutions from Daikin	14.5

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