My observations
on
Gujarat's Green Initiatives

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While the Infrastructure necessary to meet development needs are being planned, designed and built in each sector – it is very crucial that such design investments are being made with climate change considerations, for controlling GHG emissions during the infrastructure life-time.

The huge potential offered by the modern technologies (ICT, automation etc) innovations for controlling GHG and enhancing productivity remains un-utilized in most of the states.

My close association with Gujarat revels some of the unique and far-sighted initiatives taken by Gujarat state for accelerating economic growth and at the same time controlling Green House Gases. The description given below is based on my personal observation, perception and understanding.

Major Carbon emission Contributors:

Major GHG (Green House gases) contributors and distribution of their share in developing countries and their states are:

1. the share of emissions from electricity and heat related sources, from transportation and other fuel combustion is lower, while
2. Emissions from manufacturing and construction, land-use change and forestry (LUCF) and agriculture related activities are significantly higher (see Figure 1 and Figure 2 below).

The **"Manufacturing & Construction"** subsector includes emissions from fossil fuel combustion in activities such as iron and steel, chemicals and petrochemicals, mining and quarrying, food and tobacco, wood and wood products, and construction operations.

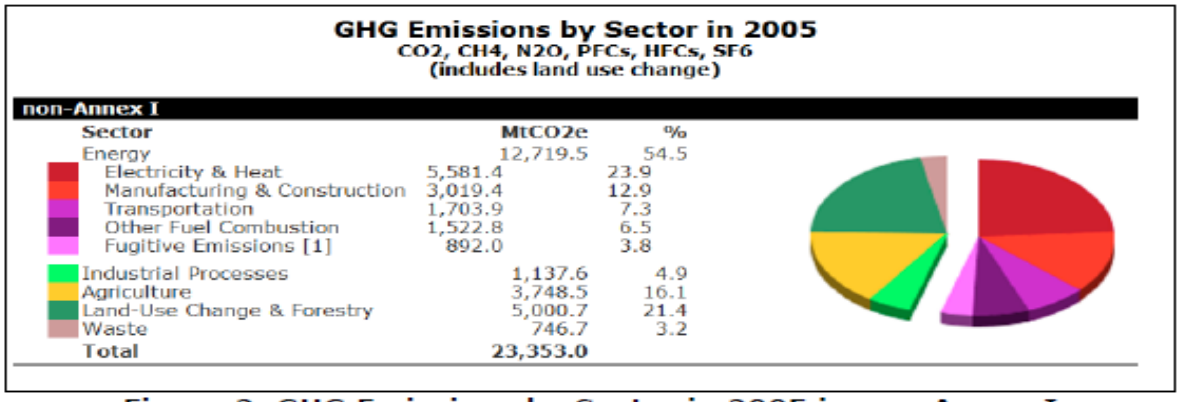
GHG Emissions by Sector in 2005
CO2, CH4, N2O, PFCs, HFCs, SF6
(includes land use change)

Annex I

Sector	MtCO2e	%
Energy	15,120.4	85.0
Electricity & Heat	6,520.4	36.6
Manufacturing & Construction	2,123.3	11.9
Transportation	3,572.1	20.1
Other Fuel Combustion	2,156.3	12.1
Fugitive Emissions [1]	748.3	4.2
Industrial Processes	710.0	4.0
Agriculture	1,467.2	8.2
Land-Use Change & Forestry	39.5	0.2
Waste	459.6	2.6
Total	17,796.7	

Figure 1: GHG Emissions by Sector in 2005 in Annex I (industrialised) Countries.

The "Agriculture" sector includes emissions from enteric fermentation (livestock), livestock manure management, rice cultivation, agricultural soils, and other agricultural sources.



GHG Emissions by Sector in 2005
CO2, CH4, N2O, PFCs, HFCs, SF6
(includes land use change)

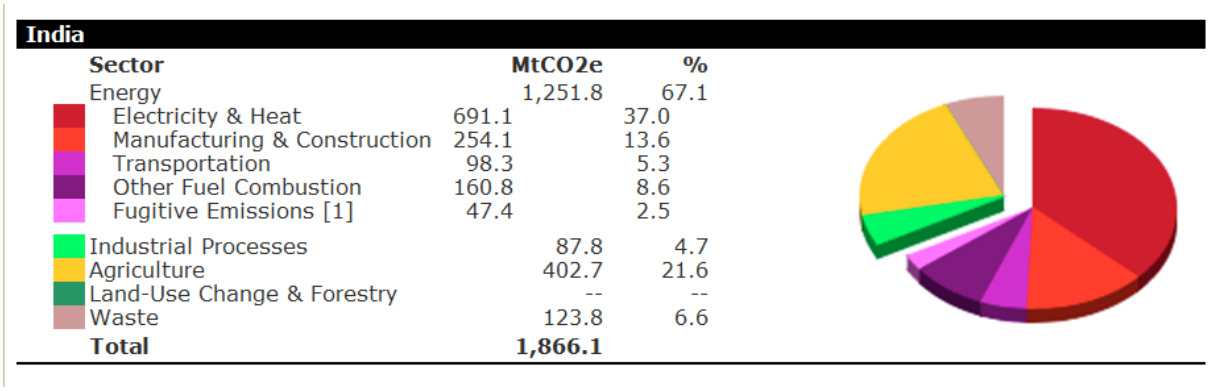
non-Annex I

Sector		MtCO2e	%
Energy		12,719.5	54.5
	Electricity & Heat	5,581.4	23.9
	Manufacturing & Construction	3,019.4	12.9
	Transportation	1,703.9	7.3
	Other Fuel Combustion	1,522.8	6.5
	Fugitive Emissions [1]	892.0	3.8
Industrial Processes		1,137.6	4.9
Agriculture		3,748.5	16.1
Land-Use Change & Forestry		5,000.7	21.4
Waste		746.7	3.2
Total		**23,353.0**	

Figure 2: GHG Emissions by Sector in 2005 in non-Annex I (Developing/Emerging) Countries.
Source: Climate Analysis Indicators Tool Version 7.0., World Resources Institute, 2010.

The "Land-Use Change and Forestry" (LUCF) subsector includes emissions from deforestation and conversion of land from forested to agricultural land. Deforestation is the largest source of CO2 emissions in this category, releasing sequestered carbon into the atmosphere from the burning and loss of biomass.

In India - the largest sources of GHG emissions in 2005 came from sources related to electricity and heat, manufacturing and construction, and agriculture (See figure below)



India

Sector		MtCO2e	%
Energy		1,251.8	67.1
	Electricity & Heat	691.1	37.0
	Manufacturing & Construction	254.1	13.6
	Transportation	98.3	5.3
	Other Fuel Combustion	160.8	8.6
	Fugitive Emissions [1]	47.4	2.5
Industrial Processes		87.8	4.7
Agriculture		402.7	21.6
Land-Use Change & Forestry		--	--
Waste		123.8	6.6
Total		**1,866.1**	

Figure – 3 – India GHG emission by Sector 2005

Gujarat - Harnessing ICT for GHG Mitigation:

Technology plays a fundamental role in advancing efforts to address climate Change and the areas listed above indicate potentially significant opportunities for Technology-enabled mitigation options. Gujarat state is considered one of the fastest state as far as adoption and deployment of technology in general is

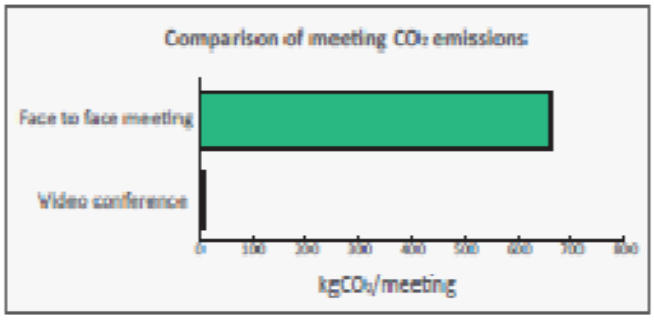
concerned. Some of the most widely used ICT applications helping reduce GHG emissions in the state include:

Gujarat Smart Governance:

Dematerialisation by replacing physical goods, processes or travel with 'virtual' alternatives, such as video-conferencing or e-commerce (online business in all spheres i.e. G-G, G-C and G-B).

With its mega eGovernance network (GSWAN, eGram, HIMS etc), Gujarat is the leading state where majority of G-G, G-C and G-B businesses are conducted using state's ICT infrastructures. Travel requirements – both for Government officials and public at large could be minimized due to "virtual presence of services" either at the door steps of user or in near proximity.

Video conference has become major vehicle for bringing officials to locations physically apart Which has proved very useful in enhancing productivity and reducing GHG emissions.



Above are the results of a business meeting scenario (described overleaf) in order to compare the emissions associated with video conferencing versus a face to face meeting published in a research study.

Table- 2: Emissions from business travel

Mode of transport	Return distance travelled per trip (km)	Emissions factor ($kgCO_2$/pass.km)	No. of people	Total CO_2 emissions (kg)
Taxi	30	0.172	3	15.5
Plane (domestic)	1,108	0.191	3	635
Underground	50	0.065	3	9.8
Total for 1 return trip	1,188	-	-	660
Total for 12 return trips	14,256	-	-	7,924

Table – 3: Emissions from video conferencing equipment use

Equipment	Power (W)	Use per month (hours)	Emissions factor ($kgCO_2$/ kWh)	Total CO_2 emissions (kg)
2 x Polycom VSX7000e*	2 X 72	7.5	0.537	0.6
4 x 42" Plasma screen	4 x 300	7.5	0.537	4.8
Total for 1 meeting	-	-	-	5.4
Total for 12 meetings	-	-	-	63

The calculations show that choosing high quality video-conferencing over business travel in the scenario outlined above would result in emissions savings of approximately 7.9 tonnes of CO2 annually. In reality the emissions reductions associated with avoided business travel are likely to increase with company size, and reduce additional emissions sources such as overnight accommodation on longer business trips.

It is very clear from the above tables that - the effective use of egovernance applications associated with the Judiciary, Jail, agriculture, educations, civil supply, health etc. can produce immense positive impact on aggregate productivity as well as controlling GHG. Gujarat has done remarkably well in this direction compared to other state. *SWAGAT – a ICT based grievance redressal system used by Chief Minister of state has acclaimed national and international recognition.*

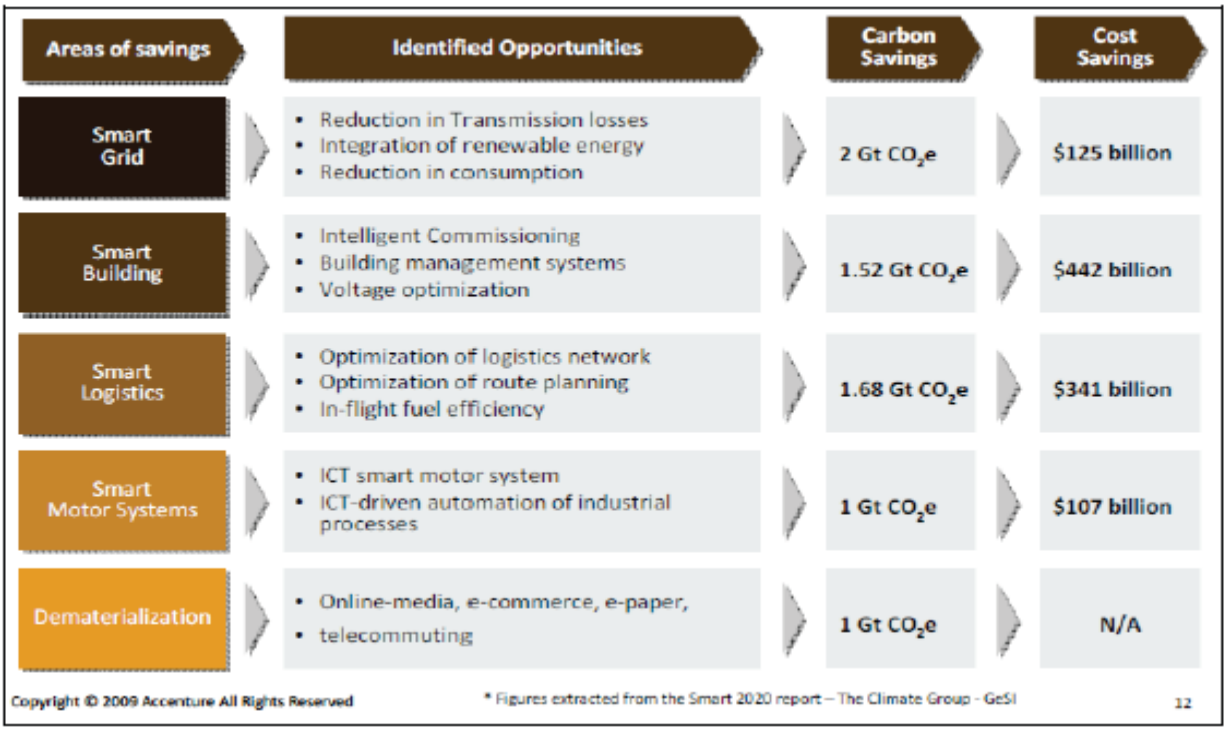
Gujarat Smart Grid System:

Machine-to-machine (M2M) communication, which enables a large share of GHG emission savings by means of process optimisation.

These include for example smart grids, smart logistics, smart buildings, or smart motor systems. Initiatives taken by Gujarat state for establishing smart grid, reducing transmission losses and electricity theft management has not only improved productivity and reliability of electricity (domestic, agricultural and industrial) but also has reduced GHG emissions. Gujarat state is concentrating on technological investments included an Outage Management System which allows the control room to pinpoint the location of a failure and trigger a repair operation - a solution that allows faster restoration of power.

The Climate Group and GESI (2008) argue that T&D losses in India's power sector can be reduced by 30 percent through better monitoring and management of electricity grids, first with smart meters and then by integrating more advanced ICTs into the so-called "energy internet". This will lead to significant financial savings and emissions reductions from prevented T&D losses; creating a potential economic and environmental win-win situation.

Table 1: ICT-based Carbon Solutions (Source: Accenture, 2009)



Areas of savings	Identified Opportunities	Carbon Savings	Cost Savings
Smart Grid	• Reduction in Transmission losses • Integration of renewable energy • Reduction in consumption	2 Gt CO_2e	$125 billion
Smart Building	• Intelligent Commissioning • Building management systems • Voltage optimization	1.52 Gt CO_2e	$442 billion
Smart Logistics	• Optimization of logistics network • Optimization of route planning • In-flight fuel efficiency	1.68 Gt CO_2e	$341 billion
Smart Motor Systems	• ICT smart motor system • ICT-driven automation of industrial processes	1 Gt CO_2e	$107 billion
Dematerialization	• Online-media, e-commerce, e-paper, • telecommuting	1 Gt CO_2e	N/A

* Figures extracted from the Smart 2020 report – The Climate Group - GeSI

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Gujarat Clean Energy Generation:

Gujarat has taken several initiatives successfully for enhancing clean energy components of total generation capacity in the state. In addition to harnessing Narmada project for producing clean hydro power (benefiting even neighboring state of Madhya Pradesh); multiple solar power projects are being commissioned all through the state.

Gujarat's Emergency Sufficiency leads to Low usage of DG:

Diesel generators are a major source of pollution but unfortunate – use of diesel generators face weak environmental regulations in India due to various reasons. Compounding emissions trends is the tendency for generators to run more often in the summer, when urban smog is most likely to form. Other environmental dangers from diesel include fine particulates, water pollution from diesel fuel spills, and occupational hazards. Surprisingly – a gallon of diesel burnt produce about 22.2 gallon of CO2. Major mega cities and towns in India with good industrial base and commercial activities (viz – Delhi, Bangalore, Pune, Mumbai, Kolkatta, and Jaipur) are infected with diesel Generator to support operations and activities during frequent power outages.

By offering -steady, reliable and continuous power to all categories of consumers Gujarat state not only synergizing industrial productivity but also minimizing GHG contribution with – minimal or nil usage of Diesel Generators for continuity of

operation (COP).This is a unique “relative advantage” Gujarat offers to citizens, industries and environment.

In my view – National industry policy should insert a clause saying that – “availability of adequate power generation capacity” is mandatory requirement for allowing new industries in specific state” and that state would prove that they have their own captive resources for producing and distributing reliable energy.”

Gujarat’s Smart Transportation – BART and Metro projects:

According to The Climate Group and GESI (2008), global goods transport and logistics are inherently inefficient, e.g. vehicles often carry little or nothing on return journeys. At the same time, they are increasingly under pressure to become more efficient as fuel costs and taxes rise and as the risk for increased costs from carbon regulation increases.

The transport sector is a large and growing emitter of GHGs, responsible for 14 percent of global GHG emissions. Optimizing logistics using ICT could result in a 16 percent reduction in transport emissions and a 27 percent reduction in storage missions globally.

Emergency efficient - Public transportation using modern technology tools (smart transportation system) can help reduce GHG to a great extent. Gujarat state has successfully deployed BART system in the state’s largest city of Ahmadabad. The metro system planned by the state will further add positive value to state’s productivity and reduce GHG, at the same time. BART and Metro projects conceived, planned and augmented (under augmentation) by the Gujarat state are intended to help improve carbon foot prints.

Gujarat Smart City Initiatives:

Buildings, as one of the largest urban energy consumers, offer a significant energy and carbon reduction opportunity. Smart connection between buildings and other critical urban infrastructure components (e.g. utilities, transportation, government services) can create "smart city" solutions. Based on the combined use of software systems, server and network infrastructure, and customer devices, such solutions enable optimised energy flows throughout an entire city and envision new ways of urban life.

GIFT (Gujarat International Finance Tech) city projects and other similar endeavors conceived and planned by the state will directly help in improving not only the economy of the state but also the carbon foot prints.

Gujarat Urban Planning:

Cities are not only centers of growth for population, buildings, infrastructure and

demand for services and materials, they also have the potential to develop a leadership role in promoting ICT-based low-carbon innovations and low-carbon living. The way in which Gujarat adopt new urban solutions will shape this development, not only in the state but also Nationally and regionally.

Gujarat's Smart Irrigation System:

Sardar Sarover Narmada Canal project is, perhaps, largest lined canal project in the world. Gujarat has number of active ports (kandla etc) used for International trade. For effective operation of the canal to manage equitable distribution of water through command area – State Government has planned a huge canal automation system. The automation once implemented will enhance irrigation productivity and control GHG (emissions produced by DG pump sets to take out water from canal) to a greater extent.

ICT-based Approaches to Land-use Change and Forestry Emissions

ICTs can help monitor land-use change and deforestation and enhance data collection on the condition of forests. Satellites are now able to take images through clouds and at night making remote sensing applications a critical and effective tool in monitoring deforestation and illegal logging.

Gujarat state is using satellite imagery data and GIS for forest management effectively.

Conclusion:

Gujarat state has become the first state to - Establish best practice projects to benchmark and showcase the potential of smart ICT solutions to climate change mitigation in emerging economies. The state's thrust to identify new opportunities and endeavor new avenues are helping improve "quality of life" – which is visible all around.

The credit goes to – far sightedness of administration combined with strong positive political and administrative will for improving conditions for one and all.