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**Greening the Growth: Suggestions for Sustainable Consumption and Production (SCP) policy in India**

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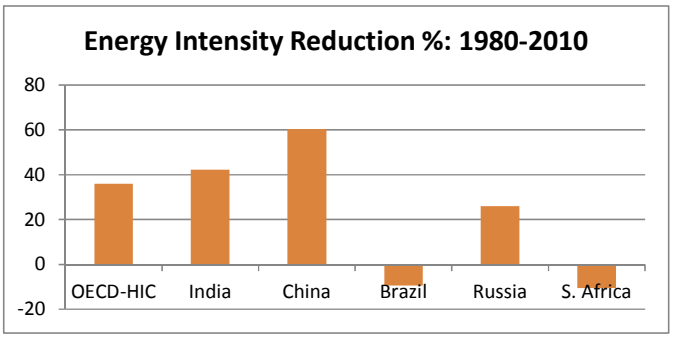



*Study report shared with UNEP WCMC SGA (Sub-global assessment network- www.ecosystemassessments.net) at*

*www.ccdgroup.org/sga/sdg-scp.pdf*

**EXECUTIVE SUMMARY**

a) **CONTEXT-**

Climate change & biodiversity loss are hot topics of environmental debate arising from the unsustainable consumption & production (SCP) patterns that also create problems such as citizen health, future energy crunch & agriculture productivity decline. Hence, promoting sustainable consumption & production is now the focus of the global environmental policy.

Increasing resource & energy efficiency are two key topics in SCP discussion. Recent rapid world economic growth (250% in the last 25 years) has increased the material consumption and energy use by over 50%. The rising consumption is causing resource scarcity, environmental problems like climate change & the local pollution, related health disorders, biodiversity loss etc. Growing scarcity has caused 4 times price rise of metals in the last decade. Similarly, food & energy prices have also increased greatly & are increasingly unstable due to its depleting resources. This has promoted the global SCP dialogue to ensure long term, stable & equitable growth.

India may be the world's 3$^{rd}$ largest economy by 2020 after China in 2030, from its current 4$^{th}$ rank. This paper analyses India's position vis a vis global trends & suggests its possible position in the 2015 global dialogue planned on the topic.

b) **CONSUMPTION**-

India's material consumption per capita is much lower than the industrial & many developing countries at 4.6 ton/year/capita, about 60% of the world average of 8 ton/ head/ year & 25% of OECD members average value. India's per capita consumption is amongst the lowest & its total consumption is just 10% of the global consumption. India's total consumption would not exceed 15 % by 2030 as per the projected economic growth rates (India- 6%, World- 3% annually). India has initiated sustainable consumption efforts in its own & the global interest, that can be strengthened.

c) **SUSTAINABILITY**-

India imports mainly crude oil & to some extent electronic goods, machinery, pulses & oil seeds but not bulk commodities like steel, cement, clothing etc. Its food production is growing at a healthy rate of 2.9% p.a. exceeding the population growth rate (2% p.a.). Pesticide consumption is also reduced 45% in the past 20 years, but can reduce further & fertilizer inputs can be reduced by promoting organic farming techniques more vigorously.

Similarly, steel, cement & other industries are also growing at healthy rates of 7-11% p.a. including. Many environmental laws, policies & code of good manufacturing or trade practices are established since 1990. The share of resource recycling, saving & renewable is growing fast with 15% of total energy share today, amongst top 5 countries. The resource scarcity risk in the medium (2030) term includes energy, where imports, including coal could rise beyond 70%. New resources such as gas hydrates are being explored for self-sufficiency.

d) **SCP INITIATIVES**-

India has initiated several sectoral programs/ steps for making the production process & consumption patterns sustainable by conserving the energy & exploring new resources, rather than a single law or policy, which gives it multi- faceted stability. Various initiatives include –

(i) Green stimulus - Integrated & no till farming, cottage industries, (eco-friendly goods), various new & renewable energy schemes including perform, achieve & trade (PAT)
(ii) Eco taxes - Coal tax, Pesticide tax, emission trading pilot scheme in 3 states
(iii) Eco-labeling - Organic certification, Eco-mark, Star-rating (energy appliances)
(iv) Emission trading- pilot scheme initiated (in Gujrat, Maharashtra & TN states)
(v) Green public procurement - Public Procurement Bill 2012 with environment friendly clause, Renewable Purchase Agreements (RPO), Sustainable public procurement of green goods through Village industries commission
(vi) Consumer awareness - Eco-clubs, media campaign across 0.6 million villages
(vii) Subsidy cuts- Price Deregulation of fossil fuels since 2011& Direct Cash Transfer (DTC- subsidy) targeted only for the poor families is initiated.

e) **EFFICIENCY**-

Indian cement sector is amongst the most efficient globally with amongst lowest resource & energy consumption, and is vigorously tapping alternate fuels (fly ash) /raw materials (urban waste). India's steel sector has cut its energy & water consumption by over 30% since 1980 due to improved technology & efficiency, but can improve further to match the global standards. These 2 sectors lead the industrial material & energy consumers.

Renewable energy has contributed 50% to the new capacity since a decade, with plans to raise it to 100 to 125 GW by 2030, to contribute about 25% of the energy basket. The national mission of energy efficiency aims at 10% saving by 2020. Key strategies for future may include (a) super efficient appliances (b) standby power cutoff (c) smart grid & (d) green buildings that could save about 30% of energy than today. Plans are made to cut over half the energy losses in the generation, transmission & distribution, that today amount up to 30% of the energy

produced. Energy Service Companies (ESCOs) are initiated for this purpose. India would need external investment of about $ 10 billion/ year, in the power & steel sector if it should double the share of renewable in the energy basket & double the energy efficiency rate by 2030, as aimed in the draft sustainable development goals by the high level panel.

**f) CHALLENGES**

Municipal waste recycling in India is improving, and some sectors such as paper & plastic show high recycling rates, but metals & construction-demolition waste recycling can improve greatly. Waste management is an emerging green business with 1-2 companies each active in the major metros & also in some secondary cities.

India has taken many steps for SCP but can strengthen the initiatives of organic farming, waste recycling, waste to energy projects, decentralized energy systems & green buildings certification. Besides promoting training in green jobs in youthful India can boost exports of goods & services in an ageing world by 2030, like the ICT sector proved in the recent past.

India can benefit by removing import duty on scrap, set up special waste processing zones & waste to energy as well as recycling projects & end of life recycling policy for metal goods & construction-demolition waste. India can also start recycling label & suggest a SDG target for it.

g) **GLOBAL ISSUES**-

The resource sustainability problem arise globally more due to the following economic distortions primarily in the industrial countries, than the growing consumption in the developing nations–

(a) Subsidy – Fuel &/or agriculture support in OECD nations exceeds 5% of GDP, much more than the others.
(b) Wastage - About 30% of food waste during consumption & also energy or materials due to “use & throw” culture.
(c) Import inefficiency- Majority of the resources imported from developing nations with low efficiency that reduces importer’s resource efficiency too, (called ‘ embedding’) but is often over looked. As china is leading exporter to major nations, their embodied energy intensity is more than their own domestic consumption by 22% (Netherlands) to 46% (Japan). India has only 14% such increase due to low dependence on Chinese imports.

h) **CONCLUSION**-

SDG (Sustainable Development Goals) can include the following SCP targets–

i) Resource cap – in conformity of with the 'planetary boundary' principle, recognize a resource cap of annually say 8 ton, comprising or 1 ton fossil fuel & 1.5 ton metals & a waste cap of 1 ton/ head/ year. This can make significant advancement towards sustainable development in the developing world like CDM triggered in the past decade, notwithstanding current dip in its market.

ii) SCP Indicators- Add to the national monitoring report indicators (a) % of materials recycled & (c) % of renewable energy as criteria in sustainability reporting to the UN CSD framework & also add share of technology imported/ exported at fair price to enhance international cooperation.

iii) Cap & trade- A system may be started to (a) Tax/ levy penalty on countries/agencies (states/ municipalities/ industries) that exceed certain reasonable resource/energy cap & (b) trading the surplus consumption by the countries to those below the global limit to improve their efficiency through 'green certificates' needs to be initiated.

## 1) INTRODUCTION

### AA) BACKGROUND

1) Rapid world economic growth observed in the 20th century was fuelled by of much increase in the material consumption and energy use. Such rising consumption is found to cause (a) resource scarcity, (b) consequent price rise & (c) environmental problems like climate change or local pollution, biodiversity loss, price rise (UNEP, 2011 a) that shows that the known balance stock of important metals that we consume today is only 17-81 years. Therefore the commodity price index of metals is rapidly soaring since the year 2005 at about 200 i.e. about 4 times its previous value (i.e. 50). This could be due to the growing resource scarcity & speculation of future high price rise.

2) The growing impact of ecological degradation on human health is another concern, depicted in the table 2. It shows that the air pollution related health disorders cost economy 1 to 5 % in various countries. In India, the cost is estimated at 3% of GDP by a World Bank study commissioned by MoEF, (Mani et al, 2012).
3) The above World Bank study estimates GOI ecosystem service loss in India is 6% GDP annually. Nearly half of it (3% of GDP) is health cost of which70% is due to the road pollution & 30% due to indoor (kitchen) smoke. Further, it says the cost of improving technology to avoid it would be below 1% of GDP.

4) The global ecological foot print (i.e. land needed to produce resources & absorb emissions) is rising fast. It exceeds 6 ha per head in industrial countries while 30% of it in the developing ones (2 ha), but just 15% in poor ones (1 ha). This analysis done by the World Wide Fund for Nature (WWF, 2010). It indicates that the world needs more than 1 earth to meet its growing needs due to its high & rapidly rising consumption.
5) Sustainable consumption & production (SCP) is recognized as key to reducing the environmental problems, including human health. It is thus an integral component of Agenda 21 and Rio accord in 1992. It was also underlined in the World Summit on Sustainable Development (WSSD), held at Johannesburg in 2002 (UNEP, 2008).

6) SCP principle requires countries to adopt policies, programs & schemes to
(a) encourage "consumption" of goods & services that reduce environmental damage in their life cycle &
(b) reduce the environmental impact in their "production" process.

Though need for SCP is long recognized, there has been limited political action across nations. Only few countries launched the 10 year framework program (10 YFP) such as Indonesia. Also, it took 20 years for the global policymakers to adopt 10YFP at Rio+ 20 conference in 2012, though it was mooted a decade ago at WSSD, 2002 in Johannesburg. Realizing the difficulty in implementation of SCP principles, UNEP (United Nations Environment Program) organized a meeting at Marrakech in 2003 to evolve national guideline & international task forces to gear up the work & UNEP also published guidelines for national programs & policies (UNEP, 2008). It recently conducted a review of status of national action initiated across the globe (UNEP 2012) as reported in the 5th chapter on the global actions & issues.

**B) BASIC CONCEPTS**

7) Sustainable consumption and production (SCP) is thus proposed as a key global strategy for well being. Developed countries are depending on raw material imports so are making strategies for the long term resource security abroad especially for the critical/ rare elements e.g. UK & some OECD nations including USA or Japan (Defra, 2012). The SCP theme is related to but different from the Climate Change (CC) theme under the international negotiations but SCP focuses more on managing the national resources sustainably with minimum impact on the resource health & public health. CC on the other had focuses more on emission reduction or adaptation to climate change impacts. Some issues are common to both such as energy intensity or waste reduction. These SCP strategies proposed by UNEP focus on

a. conserving/ saving resources (include all materials, including energy)
b. recycling available resources
c. identify substitutes/alternatives.

8) To reduce the growing resource needs & their environmental & socio-economic impacts, UNEP (2008) advises developing nations to promote the strategies below-

a. Clean production- Manufacturing processes with minimum environmental impact such as aid or water or soil pollution
b. Sustainable consumption- choice of goods/ services or their utilization methods that reduce the environmental impact e.g. shared systems (building, transport, marketing etc.)
c. Decoupling- achieve economic growth without substantially rising material/ energy consumption,
d. Leapfrogging- adopt from the developed nations clean, efficient technology, avoiding the long route & time they took for decoupling.

9) Decoupling is already in process globally due to the growth in services that need little material resources but this process needs to speed up & spread widely to the developing nations. The world economic output (top line) in the graph below grown faster than the resource extraction growth which parallels the population growth trend (the middle two lines). This is due to the rising efficiency & reducing resource intensity (bottom line).

10) Much of the global economic growth in the past 2 decades is attributed to the emerging economies, primarily China & India. They could soon dominate the world in terms of material and energy consumption accounting for 1/3$^{rd}$ of the global economy by 2030. India has much lower per capita consumption & income today than the developed nations. China's per capital consumption is also 2.5 times India & a considerable share of it is exported. China & India comprise 17 & 4% of the world economy today respectively & are projected to occupy 23% & 11% of the global economy in 2030 (OECD, 2012) as depicted in the fig. 4 below. Therefore ensuring SCP in these 2 nations is crucial for a global SCP policies regime, it is advocated. The growing middle class globally & in particular these 2 countries would be the largest in the world & pose a huge consumption and associated environmental risk, it is said.

**C) METHODOLOGY**

11) The purpose of this paper is to-
    a. Document the sustainability efforts in India's consumption-production patterns,
    b. Compare them with the global patterns & enlist areas for India's furtherance,
    c. Suggest possible SDG targets regarding SCP theme for India to propose globally.

Sustainable consumption & production is defined as "meeting the present needs without compromising those of the future generation" as the Bruntland commission report on "our common future" in 1986 quoted leading to the world commission on sustainable development (UNEP 2008). The same principal is also enshrined in the Agenda 21 that proposed the sustainable development goals (SGD) notion. Sustainability is considered to consist of the "triple bottom line" i.e.

a. environmental security,
b. economic viability.
c. social equity.

12) For this paper, the environment dimension is in focus while the rest 2 are referred as required. Environmental sustainability has 4 components as below-
   a) *Climate change impact*- % contribution to the climate change/ GHG emission.
   b) *Biodiversity impact*- Risk to the wildlife/ agri-diversity in its life cycle
   c) *Human heath impact*- recorded effects on human health
   d) *Natural resource health*- balance stock & quality of the resource considered.

   Ranking of key goods/ services based on these 4 criteria is proposed later in this report based on the literature survey. Various sectors of consumption & production are assessed here on the 4 criteria below to rank their sustainability. This is done at the national level for India first & then at the global level.

**D) DATA SOURCES**

13) The national level data are obtained from the annual reports of and 5 years plan documents of Govt. of India's Ministry of environment & forests, agriculture, steel, power, mining, urban development & renewable energy. At the global level, data set used include those of UN Food & Agriculture Organization (FAO), UNEP, UNDP & the World Bank (World Development Indicators). In addition, select documents of various national governments published on their website are also consulted & quoted e.g. reg. embedded emissions/carbon leakage in the U.K. vide its Parliamentary committee on the climate change.

14) Further, publications of regional associations of nations such as the European Union (EU) are also referred where necessary e.g. Lifestyles scenario for 2050 or "world in 2060" scenario vide OECD (Organization of Economic Cooperation Development or future energy scenarios by its International Energy Association (IEA). Finally, other publications are also referred such as –
   (a) By the research & development agencies e.g. Indian Council of Agriculture Research (ICAR).
   (b) business/corporate (e.g. World Business Council for Sustainable Development (WBCSD)
   (C) NGOs/independent experts.

E) **ANALYSES** METHODS

15) The trends are drawn from the data for the past on decadal or 5-6 year interval for 5-6 slots. Future projections are drawn only in the short term (2020) or medium term future (2030). For, reliable data are available for these periods and uncertainty or vulnerability to sudden shocks/ disaster/surprises is limited. Projections to 2050 or beyond are very uncertain being subject to

many unforeseen factors (e.g. German unification, Russian break-away etc.) so not attempted here. The main statements presented here are discussed with experts' feedback.

16) The following indicators (table 1) proposed by UNEP would most likely be used for national reporting on SCP. Of these, transport is referred here but not dealt in detail as another expert is reviewing it for MoEF in this SDG program. But more focus on it will be added as & if needed. This framework is adopted & discussed here. Other important indicators to add to may be discussed later viz. (a) per capita levels, (b) intensity of metals, & (c) recycling extent.

Table 1)- **Indicators of consumption-production (UN-CSD)-** SOURCE- UNEP, 2008.

| Parameter | Core Indicator | Other indicator |
|---|---|---|
| Material consumption | Material intensity | Domestic material consumption |
| Energy use | Annual consumption | Renewable share |
| | Intensity of energy, total & sectoral | |
| Waste | Hazardous waste | Waste generation |
| | Waste management | Radioactive waste management |
| Transport | Modal split- passenger | Modal split- freight |
| | | Energy intensity- transport |

17) Sectors or goods/ services of consumption & production sectors do not differ but their methodologies differ. The following dominant sectors discussed here, identified based on literature survey. For instance, the famous "Decoupling" report of the UNEP (2011-b, see Fig. 3) mentions the global resource extraction to be about 60 billion ton/ year, of comprises of

a. biomass (mainly crops)- 35%,
b. energy (coal, crude oil, gas)- 30%,
c. construction materials- 25%
d. minerals, incl. metals- 10%.

18) The rationale for choosing these 4 sectors was that these are quoted as such in the UNEP & other documents regarding SCP. All the consumption is classified in the 4 categories, as quoted by UNEP (Water is a topic discussed sometimes but not a major focus so not discussed here)-

s) Biomass (renewable),
b) Materials (non-renewable, excluding energy),
c) Energy (fossil- coal, petroleum, gas, renewable- biomass, solar, wind)
d) Waste (municipal, industrial, agricultural)

## 2) CONSUMPTION PATTERNS- INDIA

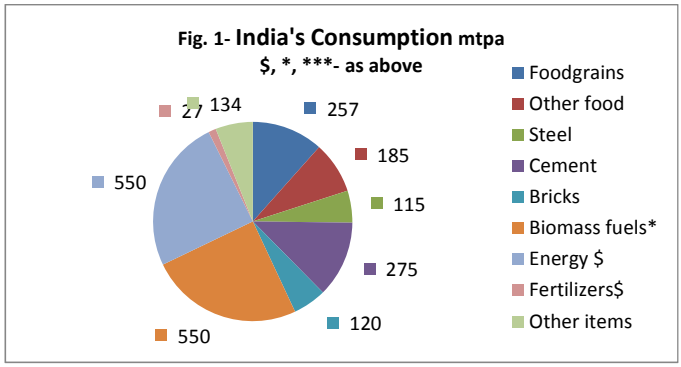
### A) CONSUMPTION PATTERN

19) India consumes 2.2 billion ton material annually as depicted in table 2 & fig. 5 below as seen in the India economic survey (IES, 2013, MoEF, 2012), with average of about 3 ton/ person/ year. It is possible that about 50% extra material is consumed indirectly such as fodder for the cattle or ore extracted for iron & other metals- about 1,000 million ton/ year or some unrecorded flow such as informal timber use for housing in forested areas.

**Table 2- India's Consumption Size- Million ton/ year**

| BULK ITEMS | | OTHER ITEMS | |
|---|---|---|---|
| NAME | Value | NAME | Value |
| Food grains | 257 | Clothes | 6 |
| Other food | 185 | Machinery** | 9 |
| Steel | 83 | Polymers @ | 7 |
| Cement | 230 | Paper | 11 |
| Bricks | 120 | Chemicals | 5 |
| Biomass fuels* | 550 | Wood $ | 20 |
| Energy $ | 620 | Bamboo | 14 |
| Fertilizers $ | 27 | TOTAL | 72 |
| Other items | 72 | | |
| sum-total | 2144 | | |

Other food includes fruits & vegetables (27 each), milk (100), sugar (25), beverages, spices etc.
* Includes fuel wood, cattle dung, grass/ weeds etc. **- Assumes 1 ton each, for 4 million commercial vehicles/ year, @- includes mainly plastic & 15% of total is rubber $- with substantial imports

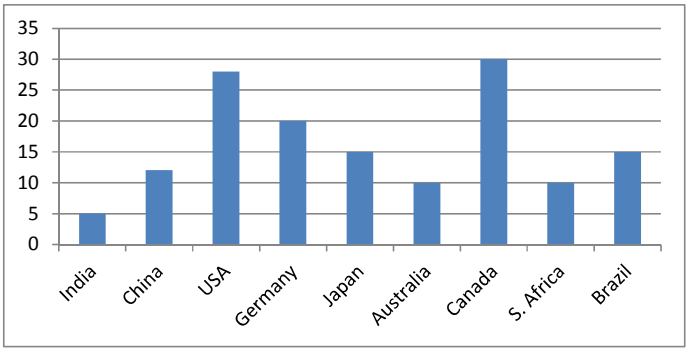



*Note- mtpa: million ton per annum*

*Source- IES, 2013, MoEF, 2010*

20) The above figure implies about 1.8 ton/ head/ year consumption (with 1.2 billion people) which is 40% of the estimate (4.5 ton) for India by the Sustainable Europe Research Institute (SERI, 2011), Vienna that studied global resource extraction (though termed consumption) patterns. This difference arises as SERI claims to compute overall resource extraction such as (a) ores required (3 times steel- 250 million ton/ year) to produce the metals used or (b) fodder (650 million ton/ year) required to produce milk & construction aggregates (250 million ton/ year). But even these add only 1.1 billion ton/year to Indian resource consumption, taking the total to 3.3 billion ton & 30% less than the SERI study that needs to provide million ton of food, fuel or minerals with source. Further, final product to raw material ratio used in the SERI study based on some patterns (agriculture, buildings etc.) in Vienna. So it needs be reassessed. Still, the SERI study also indicates that India's consumption level appear very low when compared to some leading nations as evident in the fig. 2 below showing total material consumption in t/head/year.

Fig. 2- **India's material consumption rate & other nations** (t/head/ yr)




Source- Krausmann et al. (2009)

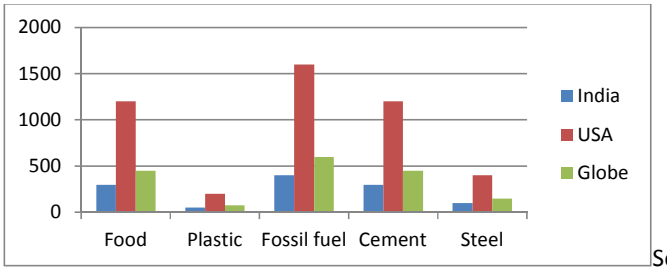
21) Table 3 & figure 3 on per capita consumption level of India in key material & energy are below global average & far below the industrial nations.

Table 3- **India's goods consumption compared to the world** (kg/year/capita)

| | India | USA | Globe |
|---|---|---|---|
| Food-grains | 300 | 1200 | 450 |
| Plastic/ paper/ clothing | 40 | 200 | 75 |
| Fossil fuel | 400 | 1600 | 600 |
| Cement | 200 | 1200 | 450 |
| Steel | 80 | 400 | 150 |

Source: World Bank, 2011- World Development Indicators, http://data.worldbank.org

Fig. 3- **India's goods consumption rate & the world** kg/year/person




Source- as above.

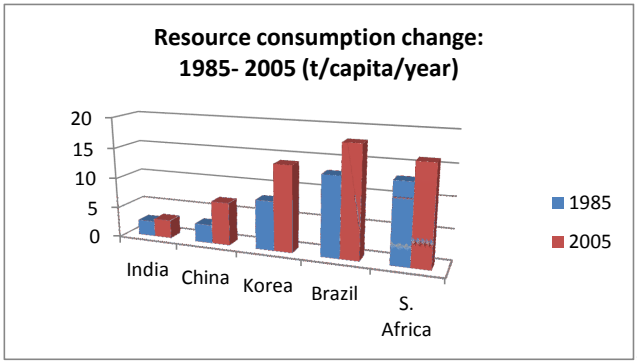
The pattern is similar when countries are grouped by consumption classes. The material consumption is the highest in the industrialized nations. The average per capita resource extraction in emerging economies in 2005 was 6.8 ton, with world average being 9 ton. The developed countries (with dispersed population) consume about 20-50 ton/year/person resources e.g. Australia, Canada, USA. The European countries with dense population consume little less: 15-20 ton/ year/ head (SERI, 2011). Some developing nations also consumed materials at 10-15 ton/ year/ head, including China. India & many developing/ least developed nations consume much less- about 5 tons/ year/ head or less. India showed little change during 1985 to 2005 in both income & resource consumption per capita compared to many other emerging nations, as table 4 & figure 4 below shows.

Table 4- **Emerging economies growth & consumption change**- per capita/year

| Country | DMC ton | | | GDP PPP | | |
|---|---|---|---|---|---|---|
| | 1985 | 2005 | % | 1985 | 2005 | % |
| India | 2.5 | 3 | 20 | 2500 | 3000 | 20 |
| China | 3 | 7 | 133 | 2500 | 7000 | 180 |
| Korea | 8 | 14 | 75 | 4000 | 14000 | 250 |
| Brazil | 13 | 18 | 38 | 3000 | 3600 | 20 |
| S. Africa | 13 | 16 | 23 | 3000 | 3000 | 0 |
| EE average | 4 | 8 | 100 | 4000 | 8000 | 100 |

Source- SERI, 2011.

Fig. 4- **Emerging economies growth & consumption change**-




Source: SERI, 2011.

22) The growing world economy would imply greater resource consumption in China, India & other emerging economies where resource consumption growth is fastest. However, the per capita resource consumption increased only slowly in these emerging economies from 4.4 ton in 1985 to 6.7 ton (50% increase) in 2005 and is still 20% below the global average of 8.5 ton. Today, these 16 countries, host 50% the world's population, consume about the same total quantity of materials as the OECD countries that have 14% of the world's population. Resource efficiency in emerging economies increased faster than the global average but from a much lower absolute level. Material extraction in the emerging economies doubled in the 20-year period (from 10 to almost 22 billion ton). Fig. 8 shows the growing resource consumption in the top emerging economies as example. India has the lowest level and little change during the 2 decades (1985-2005), it is seen. Some others increased much from already high levels e.g. Brazil (12 to 18/ ton/ year/ head) & S. Africa (12 to 15/ ton/ year/ head). The resoruce & energy consumption in the OECD nations is largely unchanged in this period, as seen in table 9 below. Hence, they are sugegsting that developing nations should reduce their ecological impact to save the world, but OECD should also reduce their consumption much further, and not just energy but also material resources.

Table 5- **Regional energy use and growth 1990-2008- Globe**

| | kWh/capita | | | Population (million) | | | Energy use (1,000 TWh) | | |
|---|---|---|---|---|---|---|---|---|---|
| | **1990** | **2008** | **Growth** | **1990** | **2008** | **Growth** | **1990** | **2008** | **Growth** |
| USA | 89,021 | 87,216 | 2% | 250 | 305 | 22% | 22.3 | 26.6 | 20% |
| EU-27 | 40,240 | 40,821 | 1% | 473 | 499 | 5% | 19 | 20.4 | 7% |
| Middle East | 19,422 | 34,774 | 79% | 132 | 199 | 51% | 2.6 | 6.9 | 170% |
| China | 8,839 | 18,608 | 111% | 1,141 | 1,333 | 17% | 10.1 | 24.8 | 146% |
| Latin America | 11,281 | 14,421 | 28% | 355 | 462 | 30% | 4 | 6.7 | 66% |
| Africa | 7,094 | 7,792 | 10% | 634 | 984 | 55% | 4.5 | 7.7 | 70% |
| India | 4,419 | 6,280 | 42% | 850 | 1,140 | 34% | 3.8 | 7.2 | 91% |
| Others* | 25,217 | 23,871 | -4% | 1,430 | 1,766 | 23% | 36.1 | 42.2 | 17% |
| The World | 19,422 | 21,283 | 10% | 5,265 | 6,688 | 27% | 102.3 | 142.3 | 39% |

Source: https:// www.oecd-ilibrary.org/energy/key-world-energy-statistics-2010

Energy use = kWh/capita* Mrd. capita (population) = 1000 TWh

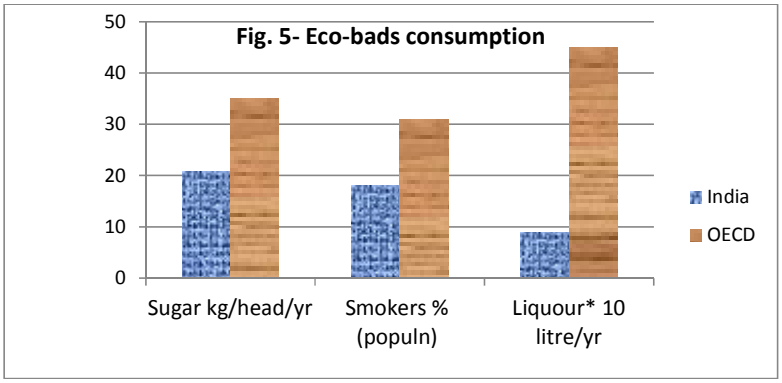
Others: Mathematically calculated, includes e.g. countries in Asia and Australia. The energy use varies amongst the "other countries": E.g. in Australia, Japan, or Canada energy it is much more than in Bangladesh/ Burma.

22) The low resource & energy consumption profile of India is due to low reach of the consumer durables that require electricity such as air conditioner & refrigerator as seen in table 6 below. This is 3-4 times below even the Chinese level. Electricity has reached 75% families & only 50% use it significantly. Notably, about 28% of Indians are still poor, unlike just 8% in China. Further, the consumption of products with larger negative environmental & health impacts in India is also 15-20% of the global average viz. Sugar, red meat, soft drinks, liquour, tobacco, plastic etc. (www.who.int) as seen in fig. 5 below.

Table 6- **Consumer durables penetration per 1,000 families** Source- NCAER, 2009.

| ITEM | 2000 | 2005 | 2010 |
|---|---|---|---|
| Car | 30 | 50 | 91 |
| Color TV | 145 | 213 | 314 |
| Refrigerator | 134 | 160 | 224 |
| White goods | 247 | 319 | 451 |

Note- white goods include air-conditioner, washing machine etc.

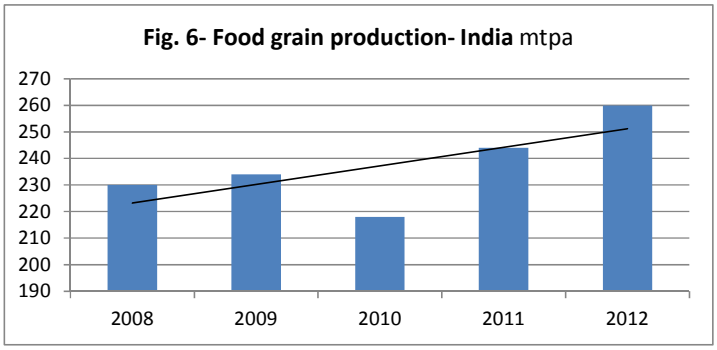



23) The claim of high consumption of the middle class is unfounded as explained below & also opined by the French study of Indian energy options for 2030 (Lesourne & Ramsey, 2009). Further, this fear appears misplaced as the middle class, comprising of 30% of the population consumes only 40% of the national resources, while the rich comprising just 10% of the population, consume another 30%, as shown by researchers at the India Gandhi Development Research Institute (IGIDR, Parikh, J. 2009) & Prayas NGO (Rao at al, 2009). They show that the poor, who comprise 60% of the population consume only 30% of the energy, which is 40% of the middle class per family level. Further, the study shows that the per capita resource consumption or carbon footprint of the middle class is only 20% that of the rich. Finally, the study shows how even the richest in India consume less than the global average & much below the USA average, yet need to be curtailed. Thus, fear of the rising middle class in India as a cause for the global concern is misplaced but the rich may need to be restrained. The high future projections also do not include uncertainty or derailing caused by the ethnic conflicts, war, natural disaster etc. The low carbon growth strategy report of the Indian planning commission (Parikh et al, 2011) indicates the possibility of about 10% energy savings from green building by 2030 & equal amount of saving from energy super-efficient appliances.

3) **PRODUCTION PATTERNS- INDIA**

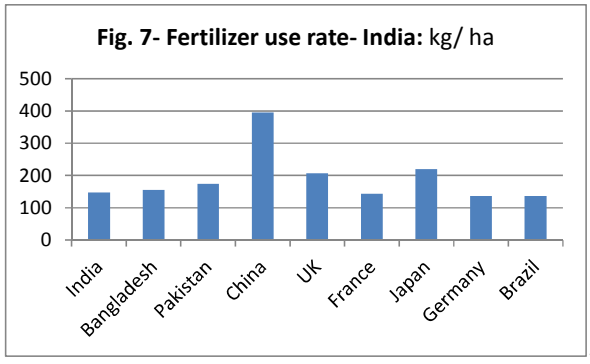
**4.A) FOOD**-

24) India is self sufficient in agriculture/ food sector with little imports (potash fertilizer). As the agriculture yield graph (Fig. 10) below shows, there is steady increase in the last 5 years with compound annual growth rate of 2.9% (MoA, 2013). This exceeds the population growth rate of 2% per year and so food shortage risk is low. India also has robust foreign exchange reserve to import food in case of need, as it does reg. oil & pulses to some extent. Indian industry is investing in Africa to produce & import food, like the fuel oil companies.




Source- MoA, 2013.

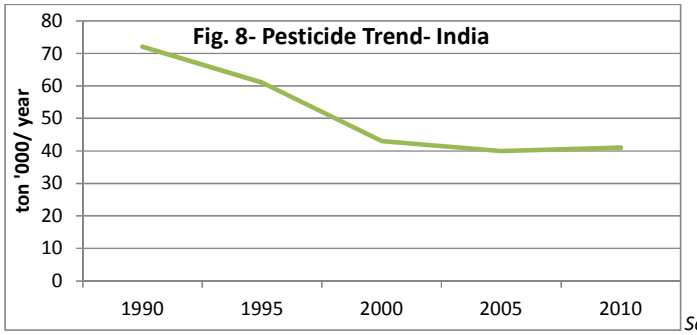
25) Indian agriculture is low chemical input type than many other nations as evident from fig. 7.




*Source: MoA, 2013.*

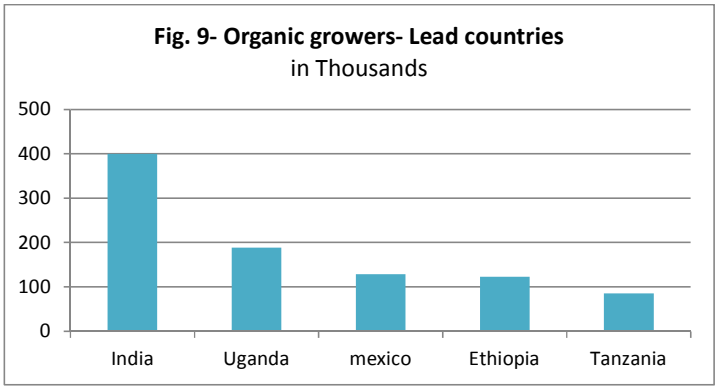
26) As per the annual report of the Agriculture Ministry (MoA, 2012), consumption of pesticide per ha in India is 381 g, while world average is 500 g. The government is promoting Integrated Pest Management (IPM) as the strategy for safe and judicious use of pesticides. IPM involves use of cultural, mechanical, biological methods and the use of pesticides as a last

resort for controlling insects-pests, diseases and weeds. This implies 45% reduction in 1990 to 2010 from 72.000 to 42,000 ton/ year (Fig. 8 below) as per the above report . It may be due to BT-cotton extent is 90% of Indian cotton as cotton consumes nearly 50% of the agro-chemicals. Yet, pesticide pollution had serious impacts in the past or in some places so their reduction through is necessary for safe environment & health.




*Source: MoA, 2012*

27) The number of organic farmers no. across countries shows India is the world leader (Fig. 13) with 400,000 (four hundred thousand) farmers (IFOAM 2012) i.e. about 0.3% of the farming population. This does not includes thousands of farmers engaged in the voluntary participatory guarantee system (www.pgsorganic.in), now spread across the country. Thus, a recent study by Oxford University confirms India as world leader in Organic farming, following Germany & superseding Denmark (Paull, 2012).




*Source: IFOAM, 2012*

28) Some agriculture practices have huge scope to reduce resource & energy intensity e.g. “no till” or “zero tillage” i.e. conservation agriculture, a theme supported by the Food &

Agriculture Organization of UN, amongst others (Anon, 2009). It conserves soil moisture, cuts both fuel use for soil work & human efforts. About 30% of farmers have adopted this new technique especially in the Ganga river plains that are India's 'wheat basket'. SRI (System of Rice intensification, www.sri-india.org) is also promoted widely in the eastern Indian states to reduce the water demand & methane emissions greatly.

29) Food processing industry in India has a small share (5%) in the agriculture sector unlike the developed countries (MoA, 2012). This also implies low energy & chemical inputs & thus low resource intensity. Further, the emerging industries in the sector are adopting high energy efficiency or resource/ standards due to cost cutting benefit regulation or consumer awareness its brand value. Power co-generation from bagass in the sugar industry is a good example this in the advanced states like Maharashtra or even in the backward states like Uttar Pradesh & Bihar the sugar industries are meeting their own power demand but also selling electricity to the national grid.

**4.B) ENERGY**

30) India's energy security till 2030 is an emerging concern. Further, Indian's energy efficiency is rising. Its intensity & global environmental impact would thus remain low, as its per capita energy consumption is much below the global average. Coal is the main & indigenous power source with no long term scarcity risk. Rising crude oil import is a matter of concern but being increasingly addressed both through the rising efficiency & options of source countries & technologies/ options. India now consumes about 650 mtOE (million ton oil equivalent) energy/ year & may need 2-3 times it in 2030 & the India is preparing to meet the growing demand efficiently (GoI & TERI, 2005, Parikh et al, 2011). Yet, imports can rise from 11% today to 30-60% in future & may include substantial dependence on Australia (Huges, 2013). Sudden development of unconventional resource like Gas hydrates (www.dghindia.org) can ease India's energy pressure like the shale gas development in the past decade in U.S.A. alleviating its energy import need as shown by Massachusetts Institute of Technology (MIT, Jacoby et al, 2012). Table 7 & fig. 14 below depicts that the Indian energy intensity reduced by 42% in the last 30 years (1980-2010) from 333 kgOE/$ PPP- 2005 & 35% in the last 15 years (275 to 192 kgOE/$ PPP-2005), based on data from World Development Indicator database (http://data.worldbank.org).

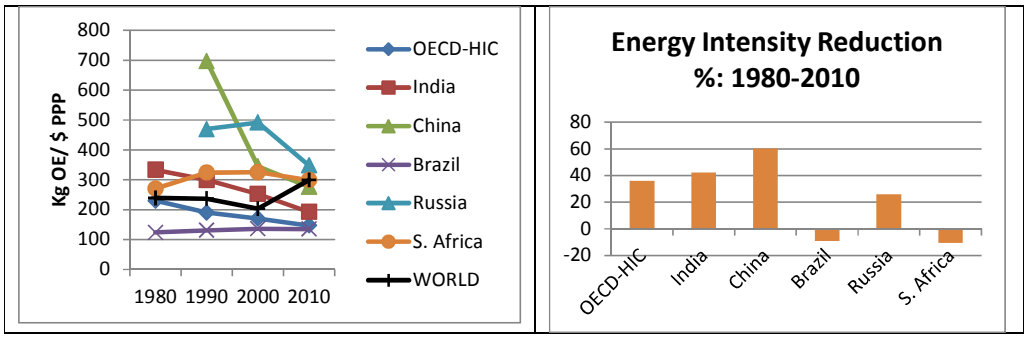
31) Moreover, the iron and steel sector, that accounts for over 30% of final energy use within industry in 2005, has reduced its specific energy consumption from 42 to 30 GJ/Ton (a decrease of 2.4 percent pa) over 1990-05 due to the technology improvement (Rao et al, 2009). Steel policy, 2012 aims energy 30% energy intensity cut by 2025 (from 6.3 to 4.5 G Cal./ tonne, http://steel.gov.in). Indian cement industry efficient is globally high (Trudeaue et al, 2011).

Table 7- **Energy Intensity Reduction trend- India & world**

Energy use (kg of oil equivalent) per $1,000 GDP (constant 2005 PPP), Source- http://data.worldbank.org

| COUNTRY | 1980 | 1990 | 2000 | 2010 |
|---|---|---|---|---|
| INDUSTRIAL NATIONS | | | | |
| EU | 186 | 168 | 141 | 123 |
| Euro Area | 172 | 150 | 134 | 122 |
| Europe & C- Asia (emerging) | | 405 | 306 | 225 |
| Europe & C Asia (All) | 300 | 237 | 185 | 160 |
| OECD-HIC | 230 | 190 | 170 | 147 |
| DEVELOPING NATIONS | | | | |
| India | 333 | 300 | 252 | 192 |
| China | | 697 | 345 | 276 |
| Brazil | 124 | 131 | 136 | 135 |
| Russia | | 470 | 491 | 348 |
| S. Africa | 271 | 324 | 325 | 299 |

Fig. 10- **Energy Intensity Reduction- India & world**




### 4.C) BUILDINGS

32) Cement and Iron are two main construction materials. India has done well to reduce specific energy consumption in these 2 sectors. Hence, India's per capita resource consumption & intensity is below the global average & tiny than the industrial ones. As an example, steel production in India is rising continually about 80 million tonne/year now. Similar trend is observed for cement. Future resource decline & social conflicts over mining & pollution is a risk (TERI & GIZ, 2013). Low carbon growth strategy paper of the Govt. of India's Planning Commission (Parikh et al, 2011) estimates minimum 20% of the buildings to be "green" by 2030, besides 20% retrofitted. But increasing the scope for green building certification & use of alternate/ biomass material such as bamboo, green roofing, biomass or plastic instead or aluminum can help the environment further, as the latter has high environment impact.

## 4.D) **WASTE**[1]

a) AIR POLLUTION-

33) India adopted policy for abatement of pollution in 1992 to prevent & regulate pollution, including recycling. Later, India adopted national environment policy (NEP) in 2006 to seek its coverage & fill gaps. Under the policy, the government runs a national network of 530 ambient air quality (AAQ) monitoring stations in 2011 cities across 26 states including 27 on continual, long term basis. National revised AAQ standards were published in 2009. Auto fuel policy was framed in 2002 to manage vehicular emission, including compliance with the Euro standards. Effluent treatment & abatement was ongoing since the Environment (protection) Rules, 1986. Central pollution control board (CPCB, www.cpcb.nic.in) is working at the national & all state level. Bharat stage III and IV norms (similar to Euro norms) for new vehicles also started after 2010, to reduce the air pollution.

34) Particulate Emission trading scheme for the now piloted by MoEF recently along with CPCB in Gujrat, Maharashtra & Tamilnadu states engage private sector in it. A charter on Corporate Responsibility for Environmental Protection (CREP) has been evolved since 2002-03, involving 17 highly polluting industrial sectors including Aluminum, Cement, Distilleries, Dye, Fertilizers, Iron & Steel, Oil refineries, Pesticide, Petro-chemicals, Pharmaceuticals, Pulp & paper & Thermal power.

b) INDUSTRIAL POLLUTION-

35) Nationwide, 43 critically polluted industrial clusters are assessed on Comprehensive Environmental Pollution Index (CEPI), developed by CPCB & Indian Institute of Technology, Delhi (IIT-D) of these, 25 are found heavily degraded & action plans for improving their environment are being rolled out.

36) Common effluent treatment plants (CETP) are being set up jointly in such clusters with Central Govt. subsidy & local co-funding. Inventive technology is also adopted such as reducing salt use in leather hide preservation & eliminate dissolved solids in tannery effluents, based the principle of sublimation. About 31% of the waste water is treated from the 38, 254 MLD generated annually. CPCB has started microbial consortia driven *'in situ'* treatment of drains for as interim remedy measures that reduces BOD, COD & suspended solids up to 80% & heavy metals other chemicals by 50%. Yet, many of the Indian rivers are polluted seriously. Efforts are initiated to reduce the industrial waste or reuse it, such as the target of the steel policy, 2012 to improve the slag utilization from 30% today to 100% by 2025. Red mud brick production is also initiating from aluminium industry waste (www.academia.edu/3882789/Development_of_Light_Weight_Foamed_Bricks_from_Red_Mud).

[1] ref. Ministry of Environment & Forests, GoI, Annual Report, 2011-2, pp 5-152 & Raina (2010).

Nations like Austria have achieved high recycling rates (60%), indicating much scope in India, through policy to use minimum % of recycled material in industries, reducing duty/ taxes on recycled materials, end of life (EOL) recycling responsibility of the metal good user etc. that would also save material cost. The recycling in the Indian metal industry is low & can be raised with policy for recycling & incentives, including tax or imports cuts/ special zones/ facilities/ technology incubation as suggested by the national Metal recycling association of India (MRAI, www.mrai.org.in), Mumbai. For, the raw material user industries should not oppose scrap reuse as some steel companies do today.

c) MUNICIPAL WASTE-

37) Solid waste management (SWM) is a promising business with corporate handling in some metros (http://www.ramkyenviroengineers.com) & also few secondary cities like Durg (e.g. Kivar Enviro-tech ltd., www.**kivarenviron**.com/). Earlier, about 0.1% of urban population depended on waste recycling. It is still a big, informal business in slums like at Dharavi in Mumbai metro. However, it raises health & human rights issues. It is slowly being commercialized. As per CPCB estimates, India generates around 57 million tons per annum of MSW (12th plan, Govt. of India), governed by SWM rules, 2000. Based on its physico-chemical characteristics, it is suitable for composting. About 50% urban MSW in India is organic matter & can be composted. The country today has only rated capacity of processing around 6,000 tons per day of mixed waste into compost i.e. 2.2 million ton/ year, leaving a huge gap. Sale of the manure on prior contract with horticulturists can be a future business but composting efficiency needs to improve. There are 79 centralized composting units in India, providing compost to city gardens. Recyclables are 17.5 % of the MSW and the rest 31% is inert waste. The average calorific value of urban MSW is 7.3 MJ/kg (1,751 Kcal/kg) and the average moisture content is 47%. Other than Composting, Waste to Energy technology & public private partnership (PPP) is promoted as per a finance ministry report (MoF, 2009). Energy generation technologies like biomethanation, Refused Derived Fuel (RDF), direct combustion/ mass burn and landfill gas recovery can reduce the waste by 91% as per a Colombia university study (Ranjith, 2013).

38) As per study by an NGO in New Delhi (www.chintan-india.org) on GHG from waste, rag-pickers collect 15% – 20% of Delhi's total waste by weight and recycle virtually all possible recyclable materials. Informal sector drives the city's recycling efforts, keeps the streets clean, and saves civic agencies huge sums of money. If the municipality paid minimum wage to an equal number of employees for this work, it would cost Delhi at least 15 million rupees per day ($307,000 USD/day) & Rs. 0.5 Billion/year i.e. $ 0.8. *48)* Recycling rates of papers, plastic in India are high- 60-70%, but only 10% of the MSW may be recycled as per the World Bank study (Zoo et al, 2011). This study shows that there is hardly 1.4% compliance with MSW,

2000 rules & 9% for processing, while 72% for streets sweeping & 52% for transport. Compliance is moderate (30-40%) regarding collection, segregation & storage.

d) HAZARDOUS WASTE-

39) About 6.5 million tone/ year hazardous tone hazardous is produced in India. Its management involves co-processing in cement, iron & steel &thermal power plants. Refuse derived fuel (RDF), tyres, sludge, spent-wash, oil spill etc. are also identified similarly. Besides, about 0.1 million ton of incinerable hazardous waste from about 3,100 units in 6 South Indian states are treated in 70 cement/steel units. Hazardous substance rules, 2011 (classification, packaging & labeling) are also notified. There are 27 common hazardous waste treatment, storage and disposal facilities, approved by CPCB, with secure landfill or incineration or both.

40) About 405 tonne/day of biomedical waste is generated across 0.129 million health facilities across the nation in all 292 tonne i.e. 72% of it is treated, primarily through incineration. Biomedical waste (management) Rules, 2011 are notified to replace the 1998 version. MoEF has also initiated a project to demonstrate the best practices in the topic in the states of Uttaranchal & Tamilnadu. Common treatment centers are being set up in addition to the 11,948 captive treatment and disposal facilities developed within some Health Care Facilities (HCFs), there are 177 Common Treatment and Disposal Facilities in operation in the country, mostly privately for small Health care units. There is a gap between the BMW treatment which needs to be filled by creating adequate infrastructure in the country (CPCB, 2011, Biomedical waste status report).

e) E-WASTE:

41) The e-waste (management) rules were framed on 2014. About 0.8 million tonne e-waste is estimated to be generated in India annually. About 66% of it is from 65 cities & 70% from 10 states. MoEF has notified e-waste (management) rules 2011 that include extended producer responsibility (EPR). There are 1905 major accident hazard (MAH) units in 304 districts across nation Manufacture, storage & impact of Hazardous chemicals (MSIHC) rules, 1989 & the Chemical Accident (Emergency Planning, Preparedness & Response) Rules, 1996 govern the chemical safety. There are 97 authorized E-waste recyclers, in 12 states, with capacity of 0.297 million tonnes per annum of E-waste, in India. Presently, these units reprocess mainly from industrial origin, Due to lack of proper collection system for residential E-waste, very less gets collected and processed at authorized E-waste recyclers, while most of it is recycled informally.

f) POLYMERS-

42) About 8 million tonne of plastic products are used in India annually. Nearly 70% of it is collected & recycled @15,342 tonne/day. New plastic waste (management) Rules, 2011

are notified, replacing the 1999 rules. Plastic carry bags cannot be thinner than 40 microns. The earlier rules prescribed 20 microns. Carry bags may not be freely given away by the traders. Municipal authority need to ensure their recycling. Biodegradable plastic invention in India also has much scope ahead (http://www.csir.res.in/external/heads/events/nclplastics.pdf).

### 4.E) **GREEN GROWTH OPTIONS**

43) MoEF may promoted research in Bamboo as roof & construction material. For, it has huge potential as green resource to reduce emissions & sequester. GoI has also launched Bamboo mission through Agriculture Ministry. Fly ash generation in India is about 150 mtpa & about 40% of it used in various industries viz. cement, brick, steel etc. after MoEF notification in 1999 reg. its disposal & proper use. Second amendments got issued in 2003.

44) MoF (2009) has allocated $ 40 billion for 5 year period to improve urban waste management as this work comprises about 25% budget of the municipal corporations & can be a future problem due to scarcity of landfill sites & per-urban conflicts emerging over it. Besides, Ministry of Finance had initiated project with UNDP for eco-friendly brick production that may also gain some support to be clarified as above. Its aim is to relieve the millions of brick workers strained by the recent regulation by MoEF to reduce pollution from this large of Indian industries in terms of volume or unorganized workers the rural areas. Interestingly, ACC cement company (www.acclimited.com), a large Indian industry has started "eco-bricks" production recently from fly ash. Housing policy proposed 2011 has proposed recycling of construction & demolition (C & D) waste, thereby reusing significant portion of waste that is unused today. Many corporate are now promoting Green building certification or such colonies or even net "zero" buildings, such as Tata & Godrej companies. Mud bricks are also initiated at Aurovillae, Pondicherry to avoid wood burning (http://www.aureka.com/eace/advantage.php?nav=advan).

### **4.F) CORPORATE INVOLVEMENT**

45) It is important to involve the business in the SCP efforts & initiatives in this direction have already begun. Chapter 4 mentions number of Indian initiatives in this direction especially in the waste management. Notable efforts in this direction are made by the World Business Council for Sustainable Development (WBCSD, www.wbcsd.org) & Global Reporting Initiative (GRI, http://www.globalreporting.org/), including some Indian involvement. Many Indian corporate such as Tata, Godrej & others are vigorously promoting green business (www.godrej.com/goodandgreen.aspx). India's corporate social responsibility (CSR) legal notification, 2013 permits large companies to include environment protection activities under CSR that may boost IT. Annual sustainability reporting is common too.

4) **SCP POLICY & PROGRAMS- INDIA**

**A. Green stimulus**-

46) GoI has also declared the following budget estimates (PC-GoI, 2012) for various schemes that can be considered as informal "Green stimulus". As these are 5 year budget estimates, it implies $ 51 billion/ year i.e. about 2.1 % of the GDP. Sector-specific initiatives are mentioned below. Safe food sector was described earlier.

Food security mission- $ 20 Billion#
Green India Mission- $14
National Mission on Bamboo, Horticulture & Medicinal Plants- $ 10 Billion
Ministry of New & Renewable Energy- $ 40 Billion
Bureau of Energy Efficiency- $ 10 Billion
Khadi (Cottage) & Village Industries Commission- $ 30 Billion
Urban waste management- $ 40 billion

TOTAL- $ 244 Billion

(#-organic/ integrated nutrient & pest management component)

47) Indian Government has also taken the following steps to enhance energy efficiency & promote renewable energy.

India has already embarked on the green growth path as evident from the fact that over 50% of the electricity generation capacity added in India is from renewable sources including hydro power (Rao et al, 2009). This trend would grow in the future. India has one of the lowest per capita levels of electricity consumption (600 units/ person year) in the world, with about 7% of the level of OECD countries (10,000 units). About 30% of the people still lack access to electricity. Demand is however rising quickly, driven by India's demographic and economic growth, modern, shining & wasteful lifestyles and higher electrification rates. This has concern due to the heavy imports of crude oil & gas.

48) India is therefore pursuing multiple policies to promote more efficient energy production and consumption. The Bureau of Energy Efficiency (BEE) has launched multiple policies addressing the main energy consuming sectors. Under the National Action Plan on Climate Change (NAPCC), India launched in 2010 the National Mission for Enhanced Energy Efficiency (NMEEE) to enhance energy efficiency using market mechanisms. Notably since 2011 under the Perform, Achieve, Trade (PAT) scheme, energy-efficiency improvement targets are assigned to the eight most energy-intensive industrial sectors, covering 65% of India's total industrial energy consumption. Industrial entities that exceed their benchmarks will be issued energy saving certificates which can then be sold to entities which fail to meet the set targets. Expected savings are 19 GW of energy (about 10% of generation today) and a reduction of emissions by 98 million tonnes a year (about 6% of the Indian present total), once the scheme

is implemented. Energy Conservation Building Code (ECBC), 2007 also aims at 20% reduction in the energy use.

49) Other policy initiatives aim to facilitate risk sharing and reduce the barriers for financing of energy efficiency investments through the creation of a partial risk guarantee fund and a venture capital fund. In addition, the "Energy Efficiency Services Limited Company" (ESCO) is tasked with developing a viable market for energy service companies to promote energy efficient technology, financing to various sectors and offering training and capacity building. (Singh et al, 2011), India had the world's 5$^{th}$ largest installed wind capacity in 2011 and its share of renewable in electricity generation (excluding hydro) reached about 12%. Balance renewable energy remains yet. The Electricity Act of 2003 introduced essential elements of a preferential tariff for renewable-based electricity and a mandatory renewable purchase obligation (RPO) for power utility companies. This led to the introduction of the Renewable Energy Certificate (REC) scheme in 2010 to enable state electricity distribution companies to fulfill their RPO by trading the RECs. The National Solar Mission was launched in 2010, setting out ambitious targets for expanding solar energy in India. The on-grid solar PV capacity increased significantly from 32 MW in January 2011 to 979 MW in May 2012. Besides there are several pilot initiative of Govt. of India & UNDP (www.undp.org.in) energy efficiency in commercial buildings, foundry industry & technologies such as solar concentrator, besides biogas, biogasification. World Bank has started power generation efficiency enhancement project. Studies by Indian Institute of Science (IISc) advocate decentralized, biomass based, decentralized energy systems as low cost, high efficiency (Hiremath et al, 2011). Smart grids, power-off mode energy saving & such futuristic steps can further save energy.

C. **Correct pricing-**

50) India has reduced greatly subsidy for fossil fuels since 2012 (India Budget, IES, 2013) & brought prices near to the global regime in a "deregulated" regime. Further, it has also started "direct cash transfer" (DTC) scheme to the needy & the poor families to subsidize their basic needs, rather than supporting the service provider companies. Finally, it has been allowed 4 years period to harmonize food prices with the global regime, at the WTO (World Trade Organization) meet at Bali in 2013 December given India's commitment of the minimum food price support to the poor. India has also started National Green Accounting (NGA) through ministry of statistics (www.mospi.gov.in), under the guidance of Sir Prof. Partha Dasgupta, University of Cambridge to improve the environmental care.

**D. Eco-taxes-**

51) Ministry of Coal, **G**ovt. of India has imposed a "coal tax" since 2010 that collected $ 1 billion in 2 years. The pesticide use in India reduced significantly after a pollution tax on it

imposed by the Finance Ministry around 1995 as ICAR mentioned (Birthal & Sharma, 2004). Madras School of Economies (MSE), a Centre of Excellence of MoEF, has mooted to GoI of environment tax amidst the Goods & Service Tax (GST, Srivastava et al, 2011).

52) A study by the Institute of Economic Growth, New Delhi (Pradhan & Ghosh, 2012) on compared tax vis a vis common but differentiated convergence (CDC). It suggested that CDC would not harm welfare significantly by 2030 & only 2% by 2040 while mere 1.6% by 2050 on the other hand, the carbon tax could harm welfare by 1.6% of GDP by 2030 & 6.35% by 2050. Energy intensity fall of 38% is predicted by 2050. Parikh & Parikh (2012) proposed a carbon tax globally as an effective tool to reduce emissions, using the "parking space" model (Parikh & Parikh, 2010) that could earn India about $ 10 billion annually for green development if it is adopted globally.

**E. Emission trading**

53) A pilot scheme on emission trading is initiated in 3 developed states (Gujarat, Maharashtra & Tamilnadu) from 2013 by CPCB. Perform, Achieve & Trade (PAT) schemes for energy efficiency initiated recently is also of a similar nature.

F. **Green Public procurement**-

54) Public procurement bill, 2012 is proposed in the India parliament in February 2014 that has a clause (no.21) reg. environment reference. Its details can be spelt out in the rules framing during 2015, after it may be passed later in 2014. Further, the national manufacturing policy (MoI, 2012 b) has mentioned both incentives for green industry as well requirement for green public purchase. Purchase of eco friendly foods like millets through rationing system is initiated recently, that would be very eco-friendly as such coarse grains consume little energy and are hardly provided any chemical inputs. India's public distribution system is the largest in the world. Renewable energy purchase obligation (RPO) mentioned before is another example of green public procurement. Khadi (Cottage) Village Industries Commission (KVIC) of the Indian government also purchases & sells eco-friendly goods such as hand made cotton clothes, other rural artifacts to the tune of Rs. 2.5 Billion annually. It is sustainable (social) public procurement, with green products being a large part such as handicrafts including hand woven textiles. Confederation of Indian Industries (CII) has established a Centre of Excellence in Green Business. Many pulp/ paper industries use "eco-mark" tag MoEF started in 1991, but this needs to be strengthened to cover the retail market.

**F. Labeling and certification**

55) The growth in organic farming & certification has much growth scope. “Energy star” system is common today for consumer products. Eco marks initiative of the Indian Government is 2 decades old but, its growth is slow & limited to paper industry etc. India is increasingly adopting Euro IV standard in vide its auto fuel policy. Green building alliance is started & growing rapidly in India, aligned with the International Green Building Consortium (www.igbc.in). It follows the LEED standards. India has also developed its own labeling system of eco-friendly housing termed as GRIHA (www.grihaindia.com). Many new constructions in metros abide by it due to the consumer demand & municipal regulations. Further, buildings in the industrial countries are more energy intensive & less climate friendly for the reasons below (Bhattacharji, 2010)-

a) Steel use 4-5 times per building than in India
b) More no. of rooms/built area per head (Many Indian houses are 1-2 room only)
c) Greater extent & use of electronic goods.

Certification of recycling % in the materials may be started & waste recycling targets may be set for municipalities, including energy projects. Vermi-compost from it may be supplied/ sold at concession to orchard owners. Construction & Demolition (C & D) waste reuse is due soon.

### G. Awareness building

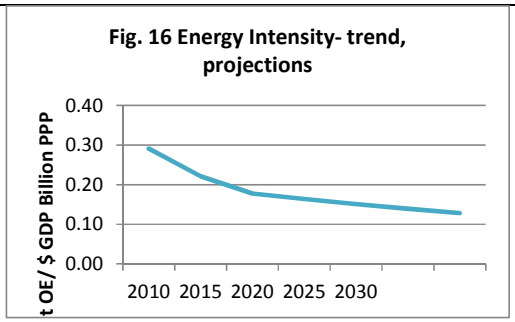
**56)** India has strong “save energy“ campaign. India also has amongst the largest network & outreach of “Eco-clubs” numbering 0.7 million across schools all over India (MoEF, 2013). This is the basis of its consumer awareness campaign, amongst others, in future. The results are impressive. The national geographic magazine survey found Indian consumers to be amongst the most knowledgeable, as per the greendex map below shows, India has amongst the most aware (55-60%) consumer population in the globe w.r.t. eco-friendly goods purchase. This exceeds U.S.A. (40-45), by 50% & many European nations (50-55) by 25%. This is impressive though there is much need & scope to grow so that the green efforts grow beyond tree planting, as the wide spread environment perception goes. As the greendex map shows (fig. 15), India has amongst the most aware (55-60%) consumer population in the globe w.r.t. eco-friendly goods purchase. This exceeds U.S.A. (40-45), by 50% & many European nations (50-55) by 25%. This is due to much awareness generation by the Govt. in schools through & consumer awareness campaign through the media.

57) With these trends, India can reduce its energy intensity by 30% from 2010 by 2030 & also double its share of renewable energy from 5 % presently to 10 % (from 5 to 20 mtOE). Annual economic growth rate is assumed here is 7% as in the past decade (IEA, 2012) unlike 8% or 9% rates used as upper bound by the Goi & TERI (2005) & Parikh et al (2011), who also indicate very low renewable share. Indian economic growth rate is about 6% /year since 2004 & it is used here (India Budget, 2014-5, www.indiabudget.nic.in). McKinsey reports (Gupta et al, 2009, 2012) also assume Indian GDP to grow at 7.5% till

2030 but it may be an over-estimate, as also its high energy projection (3,000 mtOE). India may find it hard to double the energy efficiency rates by 2030, as mooted in the High Level panel of UN for SDG 2015. For, this would require 60% energy intensity cut in the next 15 years, as India cut its intensity by 30% in the past 15 years (See table 13, fig. 16). But this is difficult as India can achieve 30% energy intensity reduction till 2030, so can continue but not be able to double the energy efficiency improvement rate. But India may meet the potential target of doubling the share of renewable in its energy basket by 2030, with foreign investment & technology.

Table 8 & fig. 11) **India's energy intensity projection- 2030**

| projections-UG | $ B GDP-7%pa | Energy KtOE-4%pa | Energy Intensity |
|---|---|---|---|
| 2000 | 1571 | 457 | 0.29 |
| 2005 | 2431 | 539 | 0.22 |
| 2010 | 4070 | 723 | 0.18 |
| 2015 | 5427 | 889 | 0.16 |
| 2020 | 7236 | 1094 | 0.15 |
| 2025 | 9647 | 1345 | 0.14 |
| 2030 | 12863 | 1655 | 0.13 |




58) India has established the national clean production centre (NCPC) relating to UN CPC program in the National Productivity Council (NPC), New Delhi since over a decade. Tourism & cooperation with Africa are also on Marrakech agenda but not significant in India yet, but may be important ahead. Indian food & oil companies are investing in Africa & India also gets African students to learn. This can be fruitfully expanded under "green growth" channel.

59) One SCP agenda is green investments. India has begun in this direction as noted in the 1st paragraph of this section named "green stimulus". There are schemes like Umbrella Program on Natural Resource Management (UPNRM) of National Bank for Agriculture & Rural Development (NABARD) to provide soft loan for organic or low input farming etc. that seem green investment. There is need for bank loan/ credit guarantee for renewable energy, energy efficiency technology, waste management/ energy projects or green education programs & this would benefit the economy & environment. Government needs to make it a priority like "poverty alleviation" was made in the 1970's 20-point program . Bamboo, for instance is

predicted to be compete with steel & be huge economic benefit (Datye, 1996, Borah et al, 2008). Such green material growth can shoot up with a SCP market mechanism. Annexure 3 describes innovative mini-refrigerator that consumes only 50% energy (Karunakaran et al, 2009). India has also launched the National Innovation Foundation (www.nifindia.org) to promote such grassroots, unaided innovations that could foster local sustainability while improving livelihoods. There are other inventive & efficient, local, commercial, rural energy systems such as rice husk power in Bihar, a backward state that could green India's future without much environmental damage (www.huskpowersystems.com).

## 5) **GLOBAL INITIATIVES & ISSUES**

### A) **INTRODUCTION**

60) SCP is proposed since Rio conference, 1992 but notable action began since then in Japan & Germany, amongst the developed world who acted strongly as below-

a. Japan- recycling based society law, eco labeling, sustainable procurement,
b. Germany- shift to renewable energy- 25% of national energy production.

Some countries with tiny consumption level globally have also started some action as below (UNEP, 2008), besides many European nation initiatives. These small countries as below make little global impact, though its good for their own future & also shows the way to others.

d. Cambodia- organic recycling ,
e. Ghana- national policy,
f. Mauritius- national programs.
g. Indonesia – 10 year framework program (This can be in the top 10 countries by 2030).

61) The above outlook indicates that some action is initiated by many of the above counties e.g. eco-labeling, whose impact is often not assessed in terms of penetration (% of population adopting) or energy/ material/ economic benefit. Other countries who took some action are listed below (UNEP, 2012), with its brief in tables 14 & 15 below & example of China in mentioned in annexure 4 as a model. Annexure 6 enlists the Indian SCP policies & compares them to other major nations. These resemble the Indian initiations mentioned here but India can strengthen consumer education, eco-labeling, recycling rates, energy efficiency & organic food, besides corporate engagement in environment protection, through targets & tracking.

h. Argentina,

i. Brazil,
j. Czechoslovakia,
k. Ethiopia,
l. Finland,
m. Jamaica,
n. Poland
o. S. Africa,
p. Senegal,
q. Sweden
r. Thailand,
s. United Kingdom
t. Vietnam

Table 9- **Important SCP Actions globally** (Source: UNEP, 2012)

INDUSTRIAL COUNTRIES

| COUNTRY | INITIATIVE | FOCUS |
|---|---|---|
| Canada | Eco Energy Efficiency Initiative, 2010 | Retrofitting of homes, small business premises & constructing new efficient building. Also reducing transport emissions & energy standards issued for appliances. |
| Germany | $CO_2$ emission tax 2009 & scrappage scheme 2010 | Tax on vehicles based on Co2 emissions & 21500 grant to trade vehicles elder than 9 years. |
| Japan | Eco-marks, Green purchase network (GPN-J) 2000 | Provides labels on 200 products to help consumers know its environmental impact. |
| U.K | Eco-design market transformation program | 2009 directive improve products environmental performance & reduce lifecycle impact – both electronic gadgets, furnace, transformer & building materials, zero energy buildings till 2016 |
| USA | Environment Protection Agency (EPA) partnership 2010. | Affordable & eco-friendly housing & transport through inter-agency & business partnership, 'smart-way' scheme aims at fuel saving, low emission technology, through partnerships with Dept. of Transport (DOT) & Dept. of Housing & Urban Development (HUD)- other agencies. |

DEVELOPING COUNTRIES

| | | |
|---|---|---|
| Mauritius | National on SCP 2008-13 | If has 25 projects with 14 agencies. It did energy audits for SME, grant holidays for energy saving devices & tax etc. with $ 30 million budget. Energy labeling & sustainable buildings done impressively |
| Morocco | Cement Industry agreement | Dust mission cut by 70%, So2 by 62%, $NO_x$ by 41% & $CO_2$ by 25% water reduction from 300 to 120 litre/t cement, heat consumption reduced/by 50% to 770 kCal/ clinker, electricity intensity cut 35% from 120 to 78 KWH/t cement. |
| S. Africa | Demand Side Management (DSM), 2010 | Eskon the leading electricity producer with Department of Minerals & Energy regulator has reduced peak demand by 2372 MW reduce water use by 10% from the current 1.35 litre/KWH & $CO_2$ emissions by 32% from the current 0.99 t/MWH. |
| Brazil | Sustainable Urban Housing Initiative (SUSHI) | USE of building materials & designs that improve energy efficiency & recycle water. Federal bank provides Gold, Silver or Bronze seal based on 46 conditions in 6 categories (design, comfort, materials, water, social: www.cbcs.org/br/sushi/) |

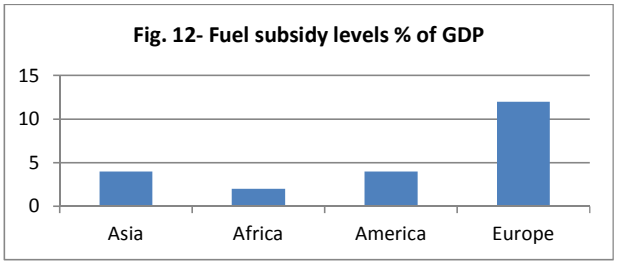
Table 10- **SCP initiatives by tools across nations** (UNEP, 2008)

| | Argentina | Czech | Finland | Japan | Thailand | U.K. |
|---|---|---|---|---|---|---|
| Food | - | + | + | + | - | - |
| Efficiency | + | + | + | + | + | + |
| Consumption patterns | + | + | | + | + | + |
| Energy | - | + | + | + | + | - |
| Transport | - | + | + | - | - | - |
| Waste | + | | + | + | + | + |
| Public procurement | + | + | + | + | - | + |

## 6.2) GLOBAL CHALLENGES

### A) SUBSIDY

62) High subsidy for agriculture and fuels is environmental harmful (IMF, 2012) and OECD should take lead in its cut (fig. 12) as they led the subsidized economy since long. There is global discussion or phasing out fossil fuel subsidy by 2020 & Europe/OECD members must act on it soon to reduce environmentally damaging consumption.




Source- IMF, 2012.

### 63) WASTE

63) Industrialized countries dominate the world consumption & trade usurping 60% of the global resources, with just 20% of the global population. They also thus produce over 50% of the global waste as shown below. In fact, industrialized nations produce over 2 kg/ waste/ head/ day, while India produces just 25% of it, as per a world bank report (Zoo et al, 2009). Per capita MSW generation in developed countries is higher than developing countries. Average per capita waste generation in India is 370 g/day, which is very less than that of Denmark (2000 g/day), US (2000 g/Day) and China (700 g/day), though it is growing at rate of 1.3%/ year. The Local bodies spend Rs. 500 – 1500 ($ 8-25) per MSW to manage it. It includes mainly collection (70%) and transportation (30%), and nothing is spent on treatment and disposal of MSW. Hence, smart MSWM planning is essential.

64) About 30% of food is wasted globally (fig. 13), requiring more production (WRI, 2011). So its saving can reduce future production needs. Same can hold true of energy also. In the industrial countries much of the food loss is at consumption level due to negligence while in the developing countries it is at the production level due to lack storage facilities. Thus, SDG/SCP trust fund can do well to fund via soft loan the infrastructure building in the developing & least developed nations (LDC).

Fig. 13- **Food lost globally by region** Kcal/ capita/ day (Source- WRI, 2011)


## C. FINANCE

65) SCP implementation needs investments from the developed world with Finance mechanism like the one found successful for implementing the Montreal treaty multi lateral fund (MLF). The industrial countries have failed to keep their commitment to carbon finance so any further deal on SCP would be futile without a strong finance mechanism and visible financial commitment. Countries such as Japan or Denmark etc. do finance material/ energy conservation/ green habitat or clean industry type projects in India bilaterally. But there is need for greater multi-lateral support/ soft loans. Innovative finance solutions are possible to promote sustainable consumption & production but these are ignored. Even 1% of GDP budget allocation for it would solve majority of the problems, it is said. But most OECD nations are spending little on this theme & much less than their defense budget or subsidy to agriculture or fossil fuels (fig. 19).

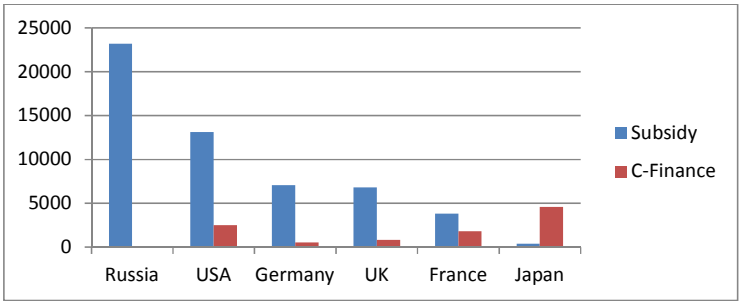
66) The total world climate finance needed is about $ 100 Billion annually, but only 10% of it is today available as below (OECD, 2010). This demand may be fulfilled by 2020. SCP would need additional budget due to non climate issues. Current finance windows

include Global Environment Program (GEF), United Nations Environment Program (UNEP) & United Nations Development Program (UNDP). These contribute about 60% of the present global clean development fund. About 97% of their contributions come from OECD & nearly 70 developing/least developed countries benefit from it. Similar pattern should continue to implement SDG or its SCP component too. GEF Poznon strategic program 2008 for technology transfer has $ 50 million budget & similar one is needed for SCP too but with larger size. GEF has adopted System of Transparent Resource Allocation (STAR) & similar one is required for SCP finance too. India would need $ 10 billion/ year & $ 100 billion till 2030 for green growth investments as per McKinsey green growth report (Gupta et al, 2012).

| **SOURCE** | **$ Billion** |
|---|---|
| GEF | 3 |
| CDM | 3 |
| MLF | 2 |
| W3/UN | 3 |
| Bilateral | 5-8 |
| Total | 14 – 21 |

Only $ 10-15 Billion are actually available of the above estimate.

Fig. 14- **Subsidy & climate Finance levels-** Industrial nations

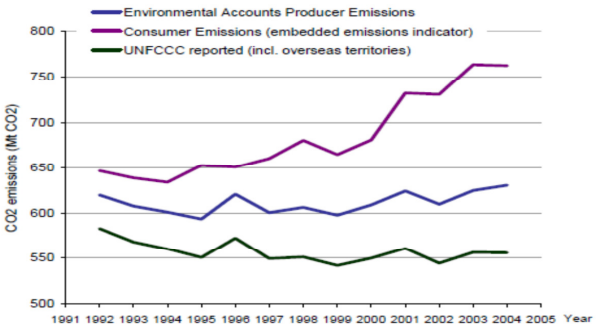



Source: IMF. 2012.

### D. EMBEDDED INTENSITY

67) High efficiency of OECD countries is partly by outsourcing resource/ energy industries/ imports (SERI, 2011). There is need to include export & import also in the "domestic material consumption"/ or include their embedded impacts on sustainability. For, as the research by UK's department of rural affairs showed, UK's imports cause 40% more GHG emissions (elsewhere) than its own production (Defra, 2012). This is an example of the high embedded energy intensity of the industrial nations (fig. 15).

Fig. 15- **Embedded GHG emissions of U. K**.



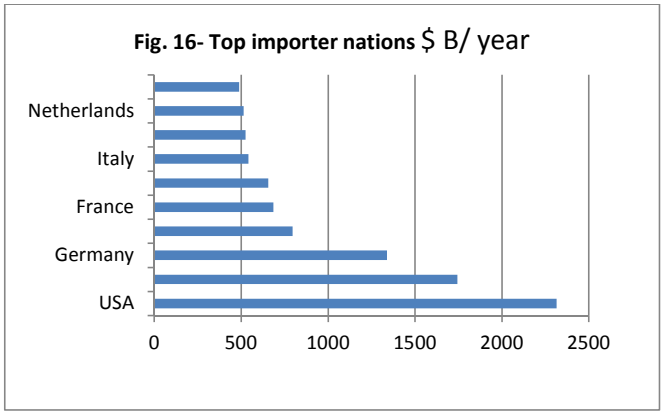

68) As USA imports many times materials than many other countries import, USA's environmental impact would be more than its domestic production alone. In fact, Table 16 & Fig. 21 below indicates the world's main importer countries. Of these, India & China are mainly fuel importers while other import manufactured goods/ services implying embedded intensity. In fact, China in main trading partner of majority of them, thereby implying that their embedded intensity would be lower than claimed for only domestic production as Chinese energy efficiency is low. So the energy intensity of OECD countries is reduced by 22-46% considering the "embedding" effect of their large imports (Pl. see table 11 & fig. 16).

Table 11- **Main importer countries & their partners** ($ Billion/ year)

| COUNTRY | Value | Main partners (%) |
|---|---|---|
| 1. USA | 2314 | China- 18, Canada- 14, Mexico- 12 |
| 2. China | 1743 | Japan- 12, S Korea- 9, USA- 7 |
| 3. Germany | 1339 | China- 10, Netherland- 9, |
| 4. Japan | 795 | China- 21, USA- 9, Australia- 7 |
| 5. France | 684 | Germany- 20, Belgium- 12, Italy- 8 |
| 6. UK | 655 | Germany- 13, China- 9, Netherlands- 8 |
| 7. Italy | 541 | Germany- 17, France- 9, China- 6 |
| 8. S Korea | 525 | China- 17, Japan- 13, USA- 8.5 |
| 9. Netherlands | 514 | China- 10, Belgium- 9, USA- 6 |
| 10. India | 488 | China- 17, UAE- 9, Saudi- 7 |

Source- World Bank, Development Indicators- 2011

(Note- Suppliers with low resource efficiency are in yellow).

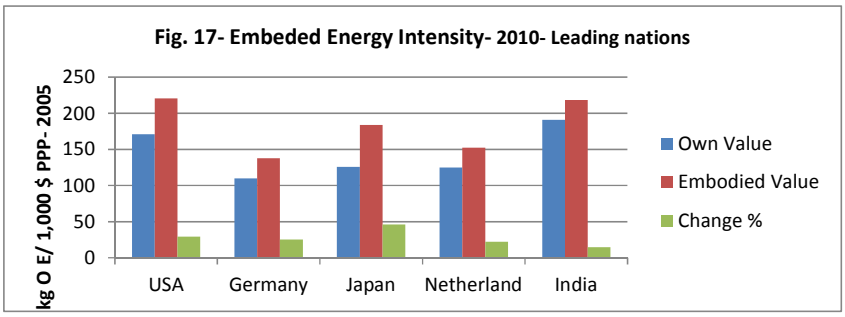



Source: Above.

Table 12- **Embedded Energy Intensity- Leading nations**
Unit- Energy Use Kg Oil Equivalent/ 1,000 $ PPP (2005)

| Country | Own Value | Embodied Value | Change % |
|---|---|---|---|
| USA | 171 | 221 | 29 |
| Germany | 110 | 138 | 25 |
| Japan | 126 | 184 | 46 |
| Netherland | 125 | 153 | 22 |
| India | 191 | 219 | 14 |

Note- The embodied energy intensity is computed by multiplying the import share with supplier country intensity. The main supplier country is China in all cases with own value 276 kgOE!.




## E. HOLLOW DEVELOPMENT INDICATORS

69) Measuring the progress in terms of economic growth (Gross Domestic Product in $) or even the human development index (HDI) as prevalent today, appears misplaced. For, HDI formula suffers from the internally correlated components. Further, more GDP has not ensured (a) better environment quality or (b) livelihood or (c) well being. The tables 13 & 14

below depict that the high development index nations have more no. of threatened species, more unemployment & greater suicide rates (especially of youth), based on nations from all the continents. Thus, another index to measure development is needed. Measuring efficiency in $ terms may be replaced by per capita use or by volume.

Table 13- **No. of threatened species**

INDEX of Environmental Impact- Endangered species- 2011 (more in developed nations)

| | |
|---|---|
| Very high human development | 13.6 |
| High human development | 11.4 |
| Medium human development | 12.8 |
| Low human development | 7.6 |

*Source- https://data.undp.org/dataset/Table-13-Environment/ki8j-r4i6*

Table 14- **HDI relation to unemployment, suicide rates**

| COUNTRY | Income- GNI/ head $ | HDI# | Unemployment** | Suicide*** |
|---|---|---|---|---|
| 1. Argentina | 15347 | 0.75 | 7.3 | 7.5 |
| 2. Australia | 34340 | 0.93 | 5.1 | 8 |
| 3. Brazil | 10152 | 0.73 | 0 | 4.5 |
| 4. Canada | 35339 | 0.91 | 7.2 | 11 |
| 5. China | 7945 | 0.69 | 0 | 13 |
| 6. Germany | 35431 | 0.92 | 6 | 11.5 |
| 7. Ghana | 1684 | 0.56 | 0 | NA |
| 8. India | 3285 | 0.54 | 3.8 | 10 |
| 9. Indonesia | 4185 | 0.7 | 6.5 | NA |
| 10. Italy | 26158 | 0.88 | 8.5 | 6.5 |
| 11. Japan | 32545 | 0.91 | 4.4 | 20 |
| 12. Kenya | 1541 | 0.52 | 0 | NA |
| 13. Korea | 28231 | 0.9 | 3.2 | 30.5 |
| 14. Mauritius | 13300 | 0.73 | 7.5 | 6 |
| 15. Nepal | 1137 | 0.46 | 0 | NA |
| 16. Russia | 14461 | 0.78 | 6.5 | 32 |
| 17. S. Africa | 9594 | 0.62 | 25 | 1 |
| 18. Philippines | 3752 | 0.65 | 7.2 | 2 |
| 19. Siwtzerland | 40527 | 0.91 | 4.5 | 18 |
| 20. Turkey | 13710 | 0.72 | 10 | NA |
| 21. UAE | 42716 | 0.82 | 0 | 0.1 |
| 22. UK | 48285 | 0.87 | 7.5 | 6 |
| 23. USA | 43480 | 0.93 | 8.8 | 10.5 |
| 24. Venezuela | 11475 | 0.75 | 8.5 | 3 |
| 25. Zimbabwe | 424 | 0.39 | 0 | 8 |

Note- Unemployment & suicide rates are low or nil in low HDI value nations such as Ghana, Kenya or Nepal but exceed 5 & 10 resp. in high HDI nations such as Japan, Germany & USA.

#- UN-HDI- https://data.undp.org/dataset/ **- data.worldbank.org

***- per 100,000 people: source http://www.who.int/mental_health/prevention/suicide_rates/en/

## F. GREEN ECONOMY

### A- Risks & Opportunities

70) Green growth may require the following changes to the current production & consumption pattern that implies certain costs/losses as indicated below in table 20. India is amongst the world leader in renewable energy & also has impressive record in exports of medicines, ICT (Information Communication Technology) etc. It can enhance the export share by adding 'green' label to it by making necessary policy & physical amendments in agriculture, energy & industry sectors. The costs would be outweighed by the impressive gains. Some lucrative sectors where India already has made impressive start include fruit, juice, pulp, spices, herbs, solar & wind energy, textiles, machinery, gadgets & services. India's export could rise to $ 1 trillion by 2020, i.e. 3 times today & 20% of GDP in 2020 as per commerce ministry (FIEO, Federation of Indian Export Organisations, www.fieo.org). A significant share of it could be from 'green goods/services' such as the above. Africa is the most potential market that companies like Tata & Reliance have already started exploring/ tapping significantly. Tata Solar Power company has already tapped export market of $ 16 billon/ year & Suzlon, an Indian giant, is leading wind power installations globally. Govt. of India also promotes African trade – partnership, that can boost in the green economy framework as African nation lack the capacity that India can provide at lower cost than European nations. Central & South Asian countries can be the next focus rather than S. E. Asia where China/ Japan/ Korea prevail. The focal sectors can be (a) fruit juices/ concentrates/ pulp, (b) organic grains, (c) renewable energy (d) heavy industry/ machinery & (e) green jobs/ education (http://greenjobs.itcilo.org).

Table 15- **Green Growth Risk-Benefits for India**

| SECTOR | GAIN POTENTIAL | RISK/LOSS/CHANGE SCOPE |
|---|---|---|
| AGRICULTURE/ FOOD | Africa & organic export, fruit processing | Less chemical input, low yield, import risk |
| BUILDINGS | Less cost due to less cost resource of C & D waste, energy savings | 10-15% more initial cost |
| ENERGY | Export to Africa, S. Asia | Shift to costly gas imports, renewable |
| WASTE | Savings, GHG reduction, improved health | Promote better waste collection, energy generation, recycling, commercialize |

71) India suffered heavy loss of exports & livelihoods when Germany prohibited Indian leather imports about 15 years ago due to the chemical used in its processing (Shankar et al, 2007). Similarly USA curtailed Indian Shrimp imports for non-installing turtle excluding devices (TED). However, in the past decade, India took necessary technology up gradation measures in both the sectors & with booming export results. This is brought out by the

studies of the Madras School of Economics. Similarly, India can benefit by the technology improvements & even tap the African or Central Asian markets for Green technology, rather than USA, EU or South-East Asia.

**C**- **Geopolitics**

72) OECD, including USA, could push for Green economy in SDG negotiations in 2015. China has started green economy initiatives in a big way both domestically though public procurement & eco-labeling as well as in exports & services. Brazil is comfortable on energy efficiency & renewable share & has started eco-labeling & few other steps. Only 2 major emerging countries may find its adoption bit difficult- A) Russia, that has reduced its energy intensity & emissions but is yet to adopt other clean production steps. B) South Africa, that just is about to start green growth steps.

73) Many other developing or even few least developed nations (LDC) have started green economy initiatives. So India could benefit by adopting the green economy standards & processes and tapping the export market in Africa and central Asia, as it does for education, agriculture & energy generation sectors in this region. China already has trade pacts using eco-labeling with many OECD nations (Annexure 4), and India needs to catch up or lose like before/ in other export sectors.

74) India successfully met before the environment/ development policy challenges below –
    a) World Trade Organization (WTO) membership, 1990
    b) Bio piracy of traditional knowledge, 1995
    c) GHG reduction targets at (Copenhagen meet, 2009)

India took up Patent Act Amendment, Biodiversity Law enactment & NAPCC respectively to meet these challenges. India is an important & decisive member of WTO, having successfully challenged even USA sometimes. Further, biopiracy cases globally declined after India refuted EUS industry IPR claim of turmeric powder for wound healing or Basmati rice growing in Arizona. India's GHG emission intensity cuts are healthy on the track of 20-25% reduction target voluntarily at Copenhagen meet in 2009. India has also reversed its deforestation trend prior to Rio, 1992 conclave & its growing forest area is now a net carbon sink, which is sought to be enhanced by the Green India Mission (MoEF, 2012). This may repeat with green growth too.

## 6) **CONCLUSIONS & RECOMMENDATIONS**

### a. INDIAN ROLE

75) India's role in the global consumption basket is small & its per capita values are 30-70% below the global average as evident from table 61.

Table 16- **India's small role in global consumption**

| PRODUCT | India's per capita consumption as share of the Global average | India's % share in the World consumption |
|---|---|---|
| Food | 0.6 | 12 |
| Fossil fuels | 0.3 | 4 |
| Cement | 0.3 | 8 |
| Steel | 0.25 | 5 |
| Polymers | 0.32 | 10 |

Source: World Bank, Development Indicators database .

76) India's resource intensity is declining and its efficiency is growing fast as pointed in chapter 3 & 4. Partly, this is due to the major role of service sector (54%) in its economic growth & in part due to the clean technology being promoted, including through stringent environmental regulation. India also has many SCP initiatives mentioned in section 4. Further, these are similar to or better than the other global initiatives in some cases. Finally, strategies proposed here match the gist of the 10-YFP & OWG (open working group) discussion (www.un-ngls.org).

### b. SDG RECOMMENDATIONS

**77) MATERIAL CAP-** SDG agreement on SCP could initiate tools similar to Clean Development Mechanism. Thus, it is proposed that a 'cap & trade' system as well as 'penalty/ tax' system be started under SCP component of SDG in 2015. The latter is missing in the Kyoto agreement. Some have argued that penalties are superior to trade system. It is proposed here to keep both. Penalties could be charged, such as heavy taxes or fines or enforce production cut etc., if the green trade also does not keep the consumption below the green limits. It is proposed that the total & green consumption limits be specified for nations such as 8 ton at the present rate. The countries exceeding the cap may be required invest by that proportion in promoting green technology or business in the developing nations so as to get green investment certificates to maintain their consumption quota.

**78)** A per capita resource consumption cap of 8 t/year is proposed, which is the current global average. India may not exceed it by even 2050. Further, any investments in the clean technology under CDM or possible SDG part in 2015 could further reduce India's resource intensity, making '8 tonne/year/head' of all materials (or 1 ton of metal/year/head or 2 ton/fossil fuel/head/year) a safe limit to negotiate globally. Further, this would even match the growing discussion in the EU to restrain resource cap at the present global level of 8 t/year/head (EU, 2012). The OECD nations may oppose this ambitious target, as it implies about 50%-70% cut in their current material consumption levels. Then, a target of 12 ton/ head/year resource consumption (including fossil fuel carriers) may be proposed, implying 30% cut for many OECD countries as it may seem more feasible. A target of 6 ton/ head/ year of material consumption may be proposed then for the developing countries, but Brazil, China, Russia & S. Africa could oppose it as they already exceed it. Further, metals or fossil fuel have large embedded energy due to their extraction from deep drilling & extensive transport, storage, industrial processing etc. It amounts to 25-100 times the energy embedded in the biomass/ other construction materials (bricks, concrete, cement). Thus, just restricting SCP ambit to metals & petroleum products is necessary & would not harm India's development.

**79) ENERGY**- Table 17 lists the energy targets listed by HLP (UN high level panel). India cannot probably accept doubling of the energy efficiency rates by 2030. For, this would imply 60% energy intensity cut in the next 15 years, as India cut its intensity by 30% in the past 15 years. India may accept 40% increase in the energy intensity cut due to its vigorous energy efficiency mission & scope for more service based exports especially green jobs/ goods. India may be able to meet the potential target of doubling the share of renewable in its energy basket, though ambitious, with foreign investment & technology aid. Various reports quoted here (TERI, IRADE, McKinsey & World Bank) suggest 20-25% share, due to high demand growth, that may be largely met by electricity & from coal. So 50% or 75% increase in the renewable share is more feasible for India than 100%. Universal access to modern energy services & phasing out subsidy, if proposed in the SDG draft, seem ambitious due to the high poverty levels & the slow rural change.

Table 17- **SDG energy targets & India's suitability**

| TARGET (HLP) | INDIA'S STATUS |
|---|---|
| 7a. Double the share of renewable energy in the global energy mix | Possible to raise with foreign investments |
| 7b. Ensure universal access to modern energy services | Difficult |
| 7c. Double the global rate of improvement in energy efficiency in buildings, industry, agriculture and transport | This is not possible as energy intensity can only reduce at 2% p.a.- the current rate, or max. 3% p.a., why tax those who are already fast in it? |
| 7d. Phase out inefficient fossil fuel subsidies that encourage wasteful consumption | Looks difficult, but efforts initiated DCT-LPG: Direct cash transfer of subsidy to poor families reg. LPG |

**80) WASTE**- India can accept some targets below in table 23 on waste reduction with some effort, as proposed by the HLP & UN Sustainable Development Solutions Network (SDSN). A global waste cap of 1 ton/ year/ head may also be proposed.

Table 18- **SDG waste targets & India's suitability**

| TARGET | INDIA's STATUS |
|---|---|
| HLP | |
| 5e. Reduce postharvest loss and food waste by x% | India has RIDF- Rural Infrastructure Development Fund, Agri-business scheme & many producer companies emerging, that can reduce this by 50%. |
| 7d. Phase out inefficient fossil fuel subsidies that encourage wasteful consumption | This would pressurize the OECD nations as they provide high subsidy & India will not be at risk like it passed the WTO 2013 negotiations with some amends, including the ambitious food security provisions. |
| SDSN | |
| Target 6a. Ensure sustainable food production systems with high yields and high efficiency of water, soil nutrients, and energy, supporting nutritious diets with low food losses and waste.* | India has many efforts initiated for this under National food security mission (NFSM). |
| Target 7b. Ensure universal access to a secure | Various housing, water & sanitation as well |

| | |
|---|---|
| and affordable built environment and basic urban services including housing; water, sanitation and waste management; low---carbon energy and transport; and mobile and broadband communication. | as renewable energy schemes of the government respond to these. |
| Target 8b. Reduce non---energy---related emissions of greenhouse gases through improved practices in agriculture, forestry, waste management, and industry.* | NFSM, Organic farming scheme, Green India Mission- GIM, CPCB- Central Pollution Control Board efforts respond to this. India has excluded targets on agriculture emissions in Climate talks. |

**81) RECYCLING**- India may beneficially add a target on recycled material % in the production sectors such as to double it or increase by 50% of the present share or 10% of all the material consumption or 50% of all the waste produced, whichever is minimum. India can benefit from it, as it can meet these 3 criteria with some efforts but will require more effort in the OECD nations where recycling rates are 30-40% or lower. Developing nations may be able to meet it like in India due to many vermi-composting or waste to energy projects like biogas from sewage started in S E Asia or Africa. A target on recycling can be India's addition to the SDG goal discussion as its missing in HLP & SDSN drafts of the SDG draft's background literature.

**82)** India is on track on meeting its self-declared, voluntary Copenhagen meeting target of 20-25% carbon emission intensity reduction by 2020 relative to 2005 (Hirst et al, 2012). So it can possibly meet the aforesaid SDG targets too.

**C. CAP & TRADE SYSTEM**

**83)** The carbon credit bilateral market in 2008-09 was 6 B $/year. IEA (2009) estimated incremental investment in CDM to be $ 189 for a 450 PPM scenario. UN (2010) too estimated similar amount, of which about 25% could be public fund, multilateral 15%, market 15% & private 45%. These projects could substantially boost the SCP activities. Launching a brand or label such as 'eco-friendly' or 'green' can help in it, such as the rapid growth in the 'organic' or 'fair-trade' labels recently globally.

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**Energy**- Mr Shantanu Dixit & Mr Ashok Srinivas, Prayas NGO, Pune
**Waste**- Dr. Rajesh Manerikar, Consultant, Pune.

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## REFERENCES

(All the papers quoted below are available on internet & can be found by google search)


1. Anon, 2009. Innovations for improving efficiency, equity & environment. Fourth World Congress on Conservation Agriculture, New Delhi. (https://www.fao.org/ag/ca/doc/wwcca-souvenir.pdf)

2. Bhattacharjee, B. 2010, Sustainability of concrete construction in Indian context. The Indian Concrete Journal. (http://icjonline.com/views/POV_B.%20Bhattacharjee.pdf)

3. Birthal, P. & Sharma O. P. (ed.), 2004. Integrated Pest Management in Indian Agriculture, National Centre For Agricultural Economics And Policy Research (NCAP), Indian Council Of Agriculture Research (ICAR), New Delhi. http://www.**ncap**.res.in/upload_files/workshop/wsp11.pdf

4. Borah D., Patahk, K. C., Deka, B,. Neog, D. & Borah, K. 2008. Utilization aspects of Bamboo & its market value. Indian Forester, 423-427 (March). http://www.indianforester.co.in/index.php/indianforester/article/view/727/652

5. CHINTAN, 2009, COOLING AGENTS- AN EXAMINATION OF THE ROLE OF THE INFORMAL RECYCLING SECTOR IN MITIGATING CLIMATE CHANGE, The Advocacy Project, Washington DC & Chintan, Delhi. (www.chintan-india.org)

6. Datye K. R. 1995. Banking on Biomass: A New Strategy for sustainable Prosperity Based on Renewable Energy and Dispersed Industrialization, Centre for Environment Education, Ahmedabad (www.ceeindia.org).

7. DEFRA, 2012. A Review of National Resource Strategies and Research, Department of Environment, Food & Rural Affairs, Govt. of U. K. (http://www.defra.gov.uk/environment/economy/)

8. EU, 2012. SPREAD- Scenarios for sustainable lifestyle- 2050: From global champions to local loops, with UNEP (www.sustainable-lifestyles.eu)

9. GoI & TERI, 2005, National Energy Map for India: Technology Vision 2030- Summary for policy-makers. Office of the Principal Scientific Adviser, Government of India, (www.psa.gov.in) & The Energy Research Institute (TERI, www.teriin.org).

10. Gupta, R., Sankhe S. & Sharma, S. 2009. Environment & energy sustainability: An approach for India. McKinsey, New Delhi. https:// (www.indiaenvironmentportal.org.in/files/India_Environmental_Energy_Sustainability_final.pdf

11. Gupta R., Mantry, S. & Srinivasan, G., 2012. India: Taking on the Green Growth Challenge. McKinsey, New Delhi. (http://mckinseyonsociety.com/india-taking-on-the-green-growth-challenge/, https://www.mckinsey.com/media/mckinsey/dotcom/client_service/Sustainability/PDFs/McK/2520on2520SRP/SRP_08_India.ashx)

12. Hiremath, R. B., Kumar, B., Balchandra, P. & Ravindranath, N. H. Implications of Decentralised Energy Planning for Rural India. Journal of Sustainable Energy & Environment 2 (2011) 31-40. (http://www.jseejournal.com/JSEE%202011/JSEE%20Vol%202%20Issue%201/12.%20Implications%20of%20p.31-40.pdf)

13. Hirst N et al., 2012. An assessment of India's 2020 carbon intensity target. Grantham Institute for Climate Change, Report GR4, Imperial College, London. (https://workspace.imperial.ac.uk/climatechange/Public/pdfs/Grantham%20Report/India_2020_Grantham%20Report%20GR4.pdf)

14. Huges, Lindsey, 2013. Meeting India's energy requirements in 2030. (www.futuredirections.org.au/files/sap/FDI_SAP-_Meeting_Indias_Energy_Requirements_in_2030.pdf)

15. IES, 2013. Indian Economic Survey- 2013, Ministry of Finance, Govt. of India, New Delhi. (http://www.indiabudget.nic.in/budget2013-2014/es2012-13/echapter.zip)

16. IEA. 2007. World Energy Outlook 2007 edition. International Energy Agency (IEA). Paris, France. (https://www.iea.org/textbase/npsum/weo2007sum.pdf)

17. IEA, 2008. Energy Technology Perspectives- Scenarios & strategies to 2050. International Energy Agency, Paris. (https:// www.iea.org/techno/etp/ETP_2008_Exec_Sum_English.pdf)

18. IEA, 2012. Understanding Energy Challenges in India- Policies, Players and Issues. (Sun-Joo Ahn and Dagmar Graczyk), https://www.iea.org/publications/freepublications/publication/India_study_FINAL_WEB.pdf)

19. IFOAM, 2012. The world of organic agriculture- Statistics & trends, 2012. Willer O & Kilcher, L., IFOAM (International Federation of Organic Agriculture Movements), Bonn, (http://www.organic-world.net/yearbook-2012.html)

*20.* IMF, 2012. *Fuel* Subsidies: Issues and Reform Options, International Monetary Fund, OECD, Paris. (http://www.imf.org/external/np/pp/eng/2013/012813.pdf)

21. Jacoby, H D, O'Sullivan, F M and Paltsev S, 2012. The Influence of Shale Gas on U.S. Energy and Environmental Policy *Economics of Energy & Environmental Policy*, Vol. 1, No. 1. Pp. 37-51.
22. (https://globalchange.mit.edu/files/document/MITJPSPGC_Reprint_12-1.pdf)Karunakaran, N, Prasad, A & Bhuria, R Microfinance- India's new retailers. *Outlook Business*, June, 11, 2009, www.outlookindia.com.

23. Krausmann et al. 2009, Growth in global materials use, GDP and population during the 20th century, *Ecological Economics*, 68. (https:// isites.harvard.edu/docs/icb.topic661271.files/EE-Krausmann_etal_MatsGDPPop_20thC-2009.pdf)

24. Lesourne J. & Ramsey W. 2009. Energy in India's Future: Insights. IFRI, Paris (www.ifri.org/downloads/energie7.pdf)

25. Mani, M., Markandya, A., Sagar, A. and Strukova, E., 2012, An Analysis of Physical and Monetary Losses of Environmental Health and Natural Resources in India, World bank, New Delhi. (elibrary.worldbank.org/doi/pdf/F10.1596/1813-9450-6219)

26. MoA, 2012- State of Indian Agriculture 2012, Ministry of Agriculture, Govt. of India, New Delhi. (https://agricoop.nic.in/sia111213312.pdf)

27. MoA, 2013- State of Indian Agriculture 2012-13, Ministry of Agriculture, Govt. of India, New Delhi. (https://164.100.47.132/paperlaidfiles/AGRICULTURE/State_of_Indian_Agriculture_2012-13_English_with_cover.pdf, https:// www.indiaenvironmentportal.org.in/content/373770/state-of-indian-agriculture-2012-13)

28. MoEF, 2009, India green house gas emission profile: Analysis of 5 scenarios, Ministry of Environment & Forests, Govt. of India, New Delhi. (https://moef.nic.in/downloads/home/GHG-report.pdf ).

29, MoEF, 2010. India's green house gas emissions- 2007. Ministry of Environment & Forests, Govt. of India, New Delhi. (http://moef.nic.in/downloads/public-information/Report_INCCA.pdf)

30 . MoEF, 2012, India's 2nd National Communication to the United Nations Convention on Climate Change (UNFCC), Ministry of Environment & Forests, Govt. of India, New Delhi. http://unfccc.int/resource/docs/natc/indnc2.pdf)

31 . MoF, 2009. The solid waste management sector in India. Department of Economic Affairs, Ministry of Finance, Govt. of India. (www.pppin**india**.com/.../ppp_position_paper_**solid_waste**_mgmt_112k9)

32. MoI 2012, Manufacturing policy, Ministry of Industries, Govt. of India, New Delhi.

(http://commerce.nic.in/ann/National_Manfacturing_**Policy**2011.pdf)

33. MoS, 2012. Steel policy, Ministry of Steel, Govt. of India, New Delhi. (https://steel.gov.in/06112012/National_Steel_Policy_Draft.pdf)

34. OECD, 2010 Development perspectives for a post 2012- Climate financing architecture, Paris. (www.oecd.org/dataoecd/47/52/47115936.pdf & http://www.oecd.org/environment/environment-development/47115936.pdf)

35. OECD, 2012. Looking to 2060: A Global Vision of Long-Term Growth, *OECD Economics Department Policy Notes,* No. 15, Paris. (www.oecd.org/eco/outlook/2060policynote.pdf)

36. Parikh, J. & Parikh K. 2010. A parking space model (for carbon ta*x). (*http://moef.nic.in/downloads/others/Parking_Space_Model-KParikh-28June2010.pdf)

37. Parikh K. et al, 2011 Low carbon growth strategies- Interim report. Planning Commission, Govt. of India, New Delhi. (https://.nic.in%2Freports/genrep/Inter_Exp.pdf)

38 Parikh J et al., 2009, Energy and its sustainable development for India, *Energy*, July. doi:10.1016/j.energy.2009.02.014, (https://www.irade.org/egy_2468.pdf)

37. Paull J. 2012. Organics Olympiad 2011: Global Indices of Leadership in Organic Agriculture. Journal of Social and Development Sciences, Vol. 1, No. 4, pp. 144-150. (http://orgprints.org/18860/1/**Paull2011OlympiadJ**SDS.pdf )

38. PC-GoI, 2012. Twelfth (12Th) Five Year Plan, Planning Commission, Govt. of India, New Delhi. (http://planningcommission.gov.in/plans/planrel/12thplan/pdf/12fyph_vol2.pdf)

39. Pradhan B. & Ghosh, J., 2012 The impact of carbon taxes on growth emissions & welfare in India CGE analysis. Institute of Economic Growth, Working Paper No. 315, Delhi.29. (http://www.ieg**india**.org/workpap/wp**315**.pdf)

40. Raina M, 2010. India Country Paper (draft). Fourth Regional 3R Forum in Asia- "3 Rs in the Context of Rio+20 Outcomes – The Future We Want" Ha Noi, Viet Nam, 18-20 March 2013. (http://www.uncrd.or.jp/env/spc/docs/130318India.pdf)

*41.* Ranjith K A, 2012, Sustainable Solid Waste Management in India, M Sc thesis, University of Colombia. (www.seas.columbia.edu/earth/wtert/sofos/Sustainable_Solid_Waste_Management_in_India_Final.pdf)

42. Rao. N., Sant, G. & Rajan, S. C., 2009. An overview of Indian Energy Trends: Low Carbon Growth and Development Challenges. (www.prayaspune.org. & www.climateworks.org/download/ an-overview-of-indian-energy-trends-low-carbon-growth-and-development-challenges)

*43.* SERI, 2011. Resource Use and Resource Efficiency in Emerging Economies: Trends Over the Past 20 Years. Sustainable Europe Research Institute, Working paper 12. Vienna. Dietrich *et al.* (*https://seri.at/wp-content/uploads/2011/SERI_WorkingPaper12.pdf )*

44. Shanker U et al, 2007. Trade & Environment: A case of India's Leather Exports. Madras School of Economics- ENVIS Newsletter Vol. 4 no. 2 pp 2-4, Chennai. (http://envis.mse.ac.in)

45. Singh, D., Sant, G., Bharvikar . Phadke, A., 2011. Using national energy efficiency programs with upstream incentives to accelerate market transformation for super-efficient appliances in India. In Energy efficiency first. The foundation of a low-carbon society: 2011: 377-384. (www.prayaspune.org/peg/publications/item/download/311_62c1204669cfad91e5d24a19dafdb288.html)

46. Srivastava, D K, Kavi Kumar, K S & Bhujang Rao, C, 2011. Coping up with pollution, Eco-taxes in GST regime. Madras School of Economics, Monograph no. 12/2011. (www.mse.ac.in/pub/Monograph%20-%2012.pdf)

47. TERI & GIZ, 2013. Resource Initiative- Leveraging efficiency to meet India's needs. TERI & GIZ, New Delhi (www.igep.in/hrdpmp/hrdpmaster/igep/content/48745/49028/e54881/54777/ResourceInitiativeEvent_BackgroundNote.pdf),

48. Trudeau N., Tam, C., Graczyc, D. & Taylor, P., 2011. Energy Transition For Industry: India And The Global Context. *International Energy Agency (IEA).* (*https://www.iea.org/publications/freepublications/publication/india_industry_transition_28feb11.pdf*)

49. UNEP, 2008. Planning for Change- Guidelines for National Program on Sustainable Consumption and Production (Matthew Bentley et al), Paris. www.unep.org/pdf/UNEP_Planning_for_change_2008.pdf

50. UNEP, 2011 a. Manufacturing: Investing in energy & resource efficiency- Towards a Green Economy, (Robert Ayers & Cornis Von der lugt), Paris. (www.unep.org/greeneconomy/Portals/documents/GER_7_Manufacturing.pdf; https://www.unep.org/greeneconomy/Portals/documents/ger_final_dec_2011%2F7.0-MAN-Manufacturing1.pdf)

51. UNEP, 2011- b- Decoupling natural resource use and environmental impacts from economic growth- Report Decoupling to the International Resource Panel. (Fischer-Kowalski et al), Paris. (www.unep.org/resourcepanel/decoupling/files/pdf/decoupling_report_english.pdf)

52. UNEP, 2012. Global Outlook on SCP Policies: taking action together. Paris. (www.unep.org/10YFP/Portals/downloads/publications/Global_Outlook/Global_Outlook_on_SCP_Policies_FULL.pdf )

53. UNEP, 2013. Recent trends in material flows and resource productivity in Asia and the Pacific, United Nations Environment Program, Bangkok. (www.unep.org/pdf/RecentTrendsAP(FinalFeb2013).pdf)

54. UNFCCC, 2012. The benefits of CDM (http://cdm.unfccc.int/about/dev_ben/ABC2012.pdf).

55. Whitley, s. 2013. Time to change the game: Fossil fuel subsidies and climate. Overseas Development Institute, U. K. (www.odi.org.uk/subsidies-change-the-game)

56. Worldwatch, 2009. State of the world, Washington. (https:// www.worldwatch.org/files/pdf/State_of_the_World_2009.pdf)

57. WRI, 2011. Reducing Food Loss and Waste, Lipinski, B. et al, World Resource Institute, Washington. (www.unep.org/wed/docs/WRI-UNEP-Reducing-Food-Loss-and-Waste.pdf)

58. WWF, 2010. Ecological Footprint in China. CCICED (China Council for International Cooperation on Environment and Development) & WWF, (Kitzes et al) Beijing, www.wwfchina.org (https://assets.wnf.nl/downloads/chna_footprint_report_final.pdf)

59. Zoo, D., Asnani, P. U., Zurbrugg, C., Anapolsky S., Mani, S. 2008. Improving Municipal Solid Waste Management in India *A Sourcebook for Policy Makers and Practitioners.* World Bank.(https://tn.gov.in/cma/swm_in_india.pdf)

**GLOSSARY**

Commodity price index – Variation over the years in traded goods price realtive to a baseline.
Consumption – Purchase, use (& disposal) of goods
Decoupling – Economic growth without proportionate in crease in resource consumption (including energy).
Domestic material consumption (DMC) – All the goods used in the country
Ecological footprint – Amount of land needed per capita to produce the resources needed & absorb emissions.
Economic growth – Increase in the value of annual national output (in dollars)/income
Eco-tax – Payments imposed to reduce environmentaly damaging activities e.g. chemical effluents.
Efficiency – Producing more economic output from material/energy input
Energy intensity – Energy input per unit economic output (k joules/$)
Energy efficiency – GDP $/energy k joule.
Gross Domestic Product (GDP) – The value of economic product in a nation ($)
Green Procurement – Purchase of eco-friendly goods/services (by the Govt.)
Green Stimulus – Economic incentive (tax cuts/support price/subsidy etc) provided for the production of eco-friendly goods/services
Leap frogging – Using sucessful technology evolved over course abroad, in a short span elsewhere to reduce the environmental impact.
Life cycle analysis (LCA) – estimate of economic/environment/social impact of goods/services from start to end i.e. raw material extraction, manufacturing, use & disposal.
Materials – All types of resources, including energy.
Material Intensity – Material use (in tonnes) per unit economic output in dollars)
Material productivity – Economic output per unit material input (relates to efficiency)$/ton.
Metabolic rate – Total material used (ac in to DMC)
PPP – a) Purchasing power farity (equality of value)
b) Public private partnership (for activities)
Production – Extraction & manufacturing of goods e.g. mining & industry.

Resource Intensity – Material ton/GDP $.
Resource Efficiency – more GDP $/material (ton).
Resource Productivity – GDP$/material (ton)

White goods – Consumer durable items such as washing machine, vacuum cleaner etc.

**Annexure 1- Stakeholder consultations**

| Sl.No | SDG Theme | Details of expert met | Summary of discussion & questions asked | Suggestions & opinion of expert |
|---|---|---|---|---|
| 1. | Food/ Agriculture | Dr. Gopi Ghosh, FAO representative, New Delhi | Is India's agriculture sustainable & continue so in the future? Can we obtain foreign technology at low cost or avoid it? | a) Subsidy to agro-chemicals has polluted environment & health in Punjab, with high cancer rates. Pesticide tax in 1990s by Finance ministry reduced its use. Peri-urban agriculture & marketing must be future focus.<br>b) Foreign technology cost may be imperative to benefit. |
| 2. | -"- | Dr. Sanjeev Saxena, Dy. Director, Indian Agri. Res. Inst., New Delhi | Is India's agriculture production sustainable & how will it be so in future? | a) India agro-chemical inputs are sub-optimal, not excess & reducing in the last 2 decades due to integrated nutrient & pest management (INPM) techniques promoted.<br>b) Indian Agri. Research Council has many inventive technologies to promote to meet the future challenge. |
| 3. | -"- | Mr. Ravindra Thakre, IAS, Addl. Commissioner, Amaravati circle & director, convergence in Agri. Project, Govt. of Maharashtra | Is agriculture sustainable in developed state like Maharashtra & Amaravati cluster where Cotton- highest pesticide consuming crop is common? What is the future policy for agri-sustainability? | a) We are implementing convergence in agriculture in Maharashtra (CAIM, http://caim.gov.in) project trying to promote agri-diversification, reducing chemical inputs & agri-processing- marketing for sustainability.<br>b) Chemical inputs in farming have reduced over 50% in the past decade due to shift away from Cotton, and we promote low external input farming through field schools. |
| 4. | Energy | Mr. Shantanu Dixit, Director, Prayas NGO, Pune & member of Planning Commission advisory group | Is India's energy growth sustainable in future & what is the export scope for renewable technology? | a) India's is world leader renewable energy & can export Solar technology (barring thin film imports) & wing energy as Tata Solar & Suzlon resp. show<br>b) India's future energy sustainability is a risk that needs serious action through super-efficient appliances, power-off mode consumption regulation, demand side management & decentralized systems. |
| 5. | -"- | Mr Sachin Joshi, Centre for Sustainability, Confederation on Indian Industry (CII), New Delhi & participant in MoEF SCP | a) What is industry view on green growth?<br>b) Can public procurement bill, 2012 help sustainability? | a) Industry is growing to catch the Green growth route with corporate like Tata, Godrej etc. in the lead in sectors such as housing, consumer goods tourism etc.<br>b) Public procurement bill 2012 has environment clause that needs green criteria & methods under rules. Indian public procurement is already sustainable in terms of |

| Sl.No | SDG Theme | Details of expert met | Summary of discussion & questions asked | Suggestions & opinion of expert |
|---|---|---|---|---|
| | | discussions | | purchase from women groups, cottage industry etc. |
| 6. | Buildings | Ms Tejswini Chitale, Envision Consultancy, Pune (Green building certifier) | a) Is green buildings a growing & significant trend in cities?<br>b) Is zero building concept only foreign? | a) Green buildings certification is actively adopted by many new building projects & emerging builders in emerging metros like Pune due to municipal rules & awareness.<br>a) Zero energy & zero waste campus is set up by Suzlon company near Pune & can grow in future. |
| 7. | -"- | Dr Shilpi Kapoor, TERI | a) Is GRIHA adoption growing? | a) GRIHA rating will enhance now with mandating by central public works dept. |
| 8. | Waste | Dr. Rajesh Manerikar, Consultant, Pune | a) Is waste management efficient & growing<br>b) Is industry recycling significant & growing? | a) Municipal solid waste management is not efficient & getting commercialized, including energy projects.<br>b) Industry recycling is high in paper & plastic but less in metals or glass & can grow with policy stipulation. |
| 9. | Policy | Dr. Jyoti Parikh, Director, IRADE NGO, New Delhi# | a) How can India finance its sustainable energy growth<br>b) What is scope for sustainable habitat? | a) India can only ask loan, not grant, to power sustainable future growth, with bankable projects like Delhi metro.<br>b) Green financing is needed as incentive for instance to pay high start up cost of green buildings. |
| 10. | -"- | Mr Ranjan Gandhi, SAG (Society in Action Group), Gurgaon & co-organizer of MoEF SCP consultations in 2006 & 2007, participant in 2010 & a UNEP expert | a) Is India on track in SCP strategy & policy globally?<br>b) What could be future SCP tools/ strategy? | a) Indonesia has started 10 year framework program (10-YFP) & India should not trail behind.<br>b) Green growth may not be constraint but opportunity through green goods like Bamboo furniture, roofing, matting etc. or waste plastic use in asphalting etc.<br>c) Solar energy is feasible in large, peri-urban schemes, not on individual housing schemes. |

# Also member, National Action Plan on Climate Change (NAPCC) advisory group