BIO ECONOMY an INDUSTRIAL PERSPECTIVE

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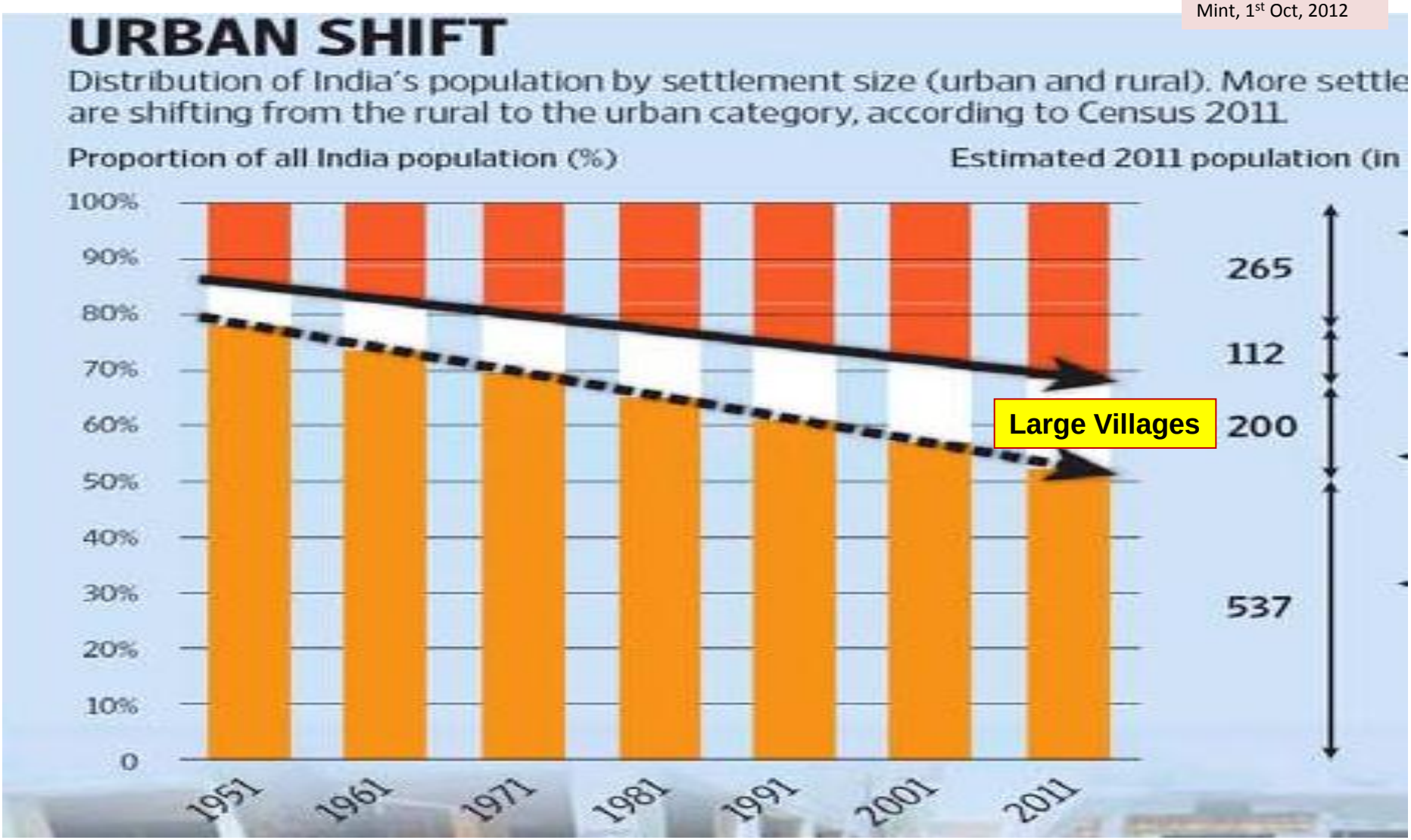
PRESSURES ON INFRASTRUCTURE TO ACHIEVE INCLUSIVE GROWTH

Category	Census figures			2021scenario (with 40% urban)	
	1991	2001	2011	Business as usual	Sustainable Development
Cities (>100,000)	142	211	265	400	340
Towns (<100,000)	76	75	112	140	200
Sub Total Urban	***218***	***286***	***377***	***540***	***540***
Rural	***629***	***743***	***833***	***810***	***810***
TOTAL	**846**	**1029**	**1210**	**1350**	**1350**

Rural infrastructure needs significant improvement to meet basic needs of the community & catalyse growth in "non farm" economic activity, for increasing rural H/H income

Shifts in Demographics (Rural/ Urban)

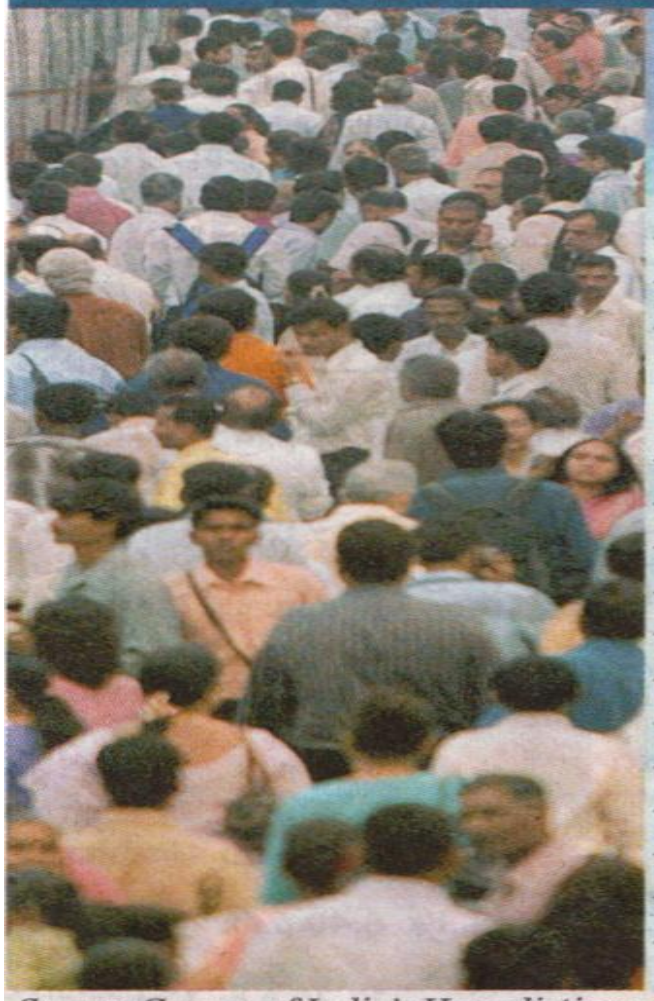
Mint, 1st Oct, 2012



Around 8,000 "Urban Centres" (including about 4,000 "Census towns"
660,000 villages : 63 -> 28% (<2,000 pop) ; 5 -> 17% (>5,000 pop) ; 1951 to 2011

UTILITY SERVICES TO RURAL HOUSEHOLDS IS VERY POOR

LIVE, CONNECT, MOVE



TOTAL HOUSEHOLDS

RURAL	URBAN	TOTAL
167,826,730	78,865,937	246,692,667

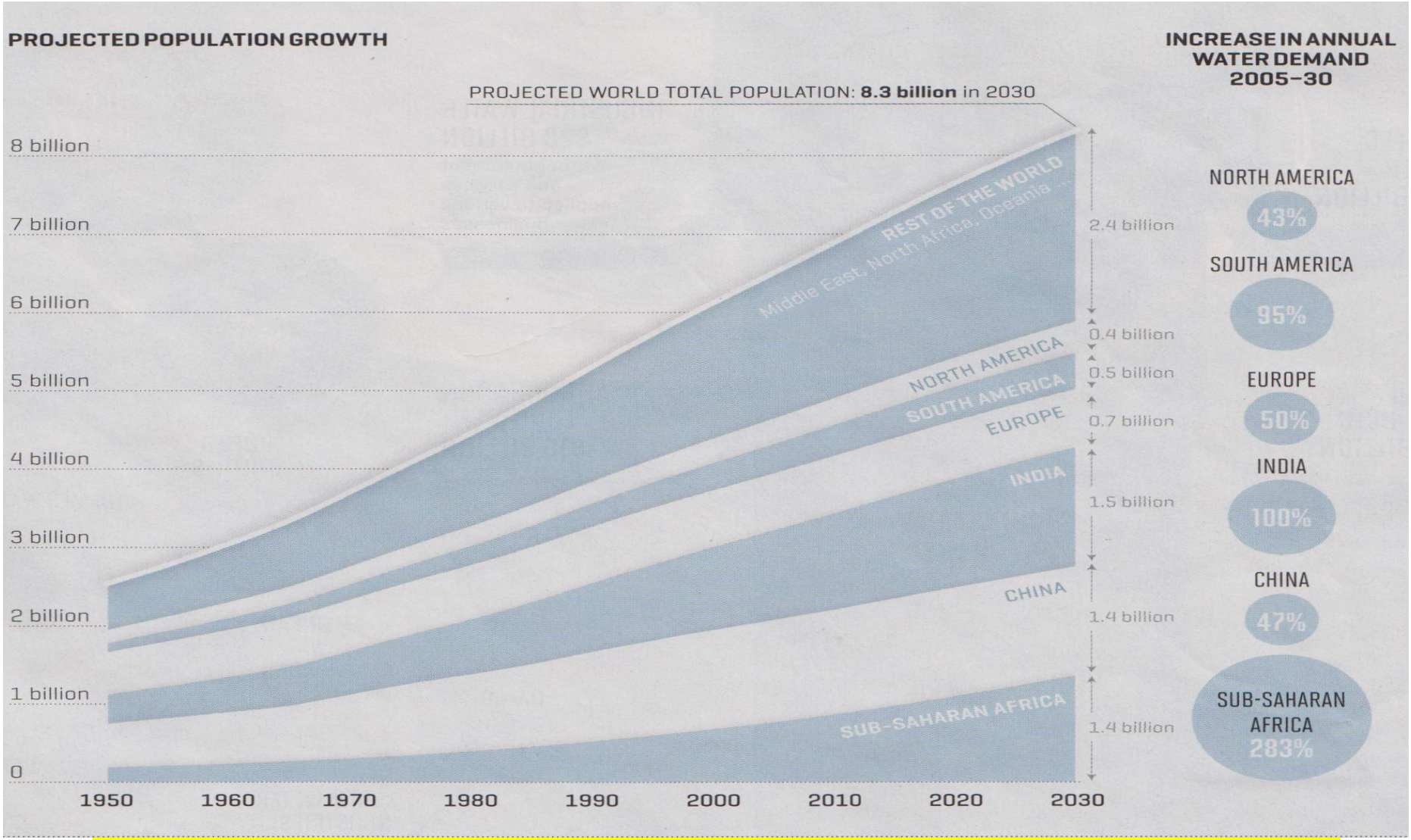
	Rural	Urban	Total
One-room households	39.4	32.1	37.1
Tap water from treated source	17.9	62	32
Electricity	55.3	92.7	67.2
Latrine facility in house	30.7	81.4	46.9
of which piped sewer system	2.2	32.7	11.9
of which no drainage	63.2	18.2	48.9
Firewood for cooking	62.5	20.1	49.0
LPG/ PNG for cooking	11.4	65.0	28.5
Availing banking services	54.4	67.8	58.7
Television	33.4	76.7	47.2
Computer (with Internet)	0.7	8.3	3.1
Computer (without Internet)	4.4	10.4	6.3
Telephone (Landline or mobile)	54.3	82.0	63.2
Telephone (Mobile only)	47.9	64.3	53.2
Bicycle	46.2	41.9	44.8
Scooter/ Motorcycle/ Moped	14.3	35.2	21.0
Car/ Jeep/ Van	2.3	9.7	4.7
None of the specified assets	22.9	7.0	17.8

Source: Census of India's Houselisting and Housing Census Data Highlights - 2011 *(figures in %)*

<18 % rural H/H have access to Tap water (nearly 30 mill rural H/H fetch water from > 500 m)

< 38 % rural H/H have access to assured quality cooking fuel & depend on firewood, cow dung

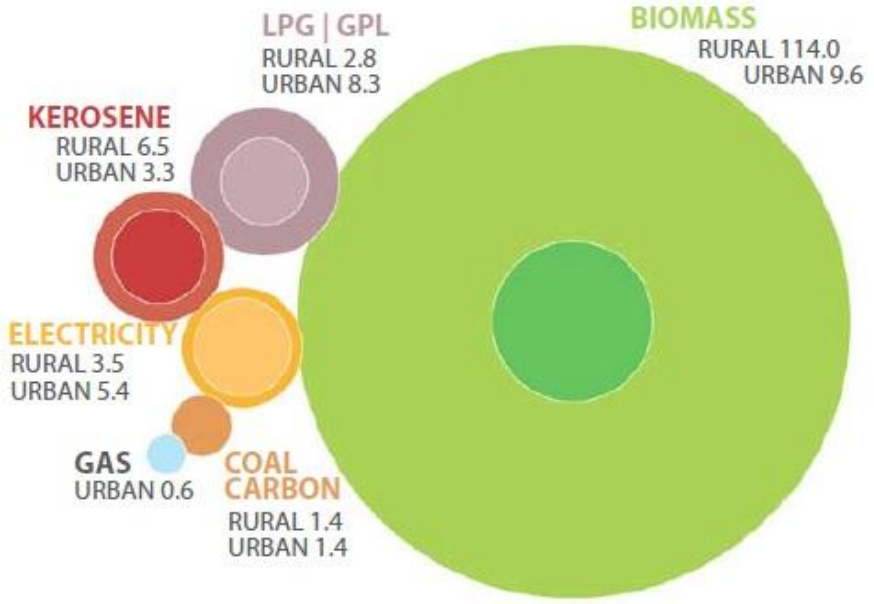
INCREASE IN WATER DEMAND



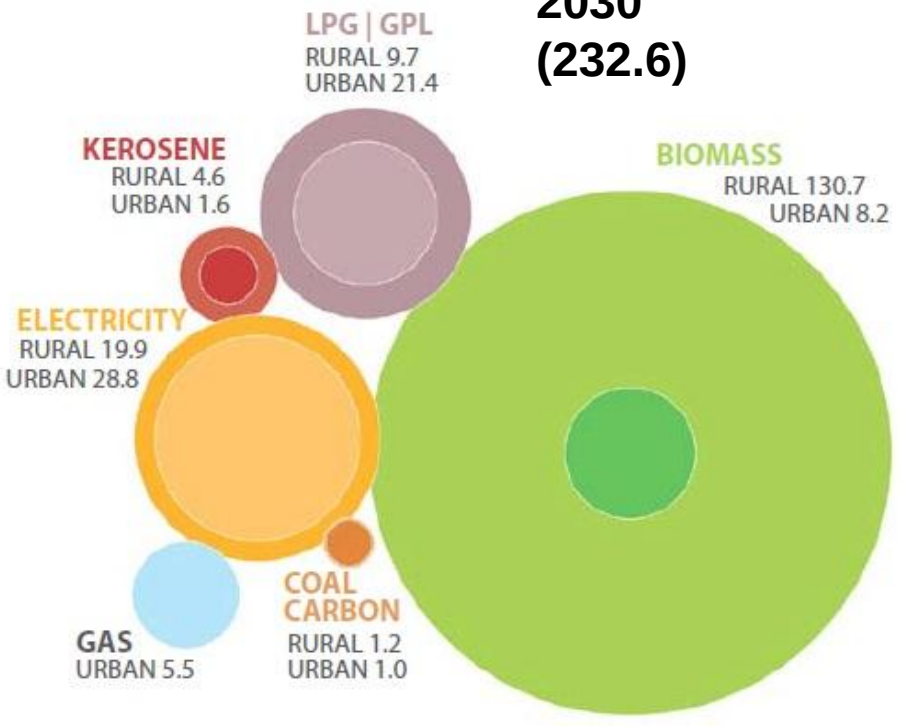
India's water demand will increase by 100 % in 2030, from 2005 level .. Conservation & Re-Use (post treatment) is mandatory

BIOMASS HAS VERY SIGNIFICANT CURRENT/FUTURE SHARE IN INDIAN HOUSEHOLDS ENERGY CONSUMPTION (mill TOE) NEED TO ENAHANCE EFFICENCY & OPTIMISE ENERGY YIELD

2005 (156.8)



2030 (232.6)



All H/H : Electricity : 8.9 -> 48.7; LPG/N.Gas : 11.7 to 36.6; Biomass : 123.6 -> 138.9

Rural H/H : Electricity : 3.5 -> 19.9; LPG/N.Gas : 2.8 to 9.7; Biomass : 114.0 -> 130.7

Bio energy, currently, contributes 23.5% of India's primary energy (750 mill TOE) & can grow to 40%.

Source: International Development Policy: Energy and Development, 2011
Data: IEA, World Energy Outlook 2007

Confederation of Indian Industry

“INDIA BIO ENERGY MISSION”

OVERVIEW

- **With rising energy prices & growing concern over environmental & ecological issues, adoption of Renewable Energy is primary objective of Industry and Governments.**

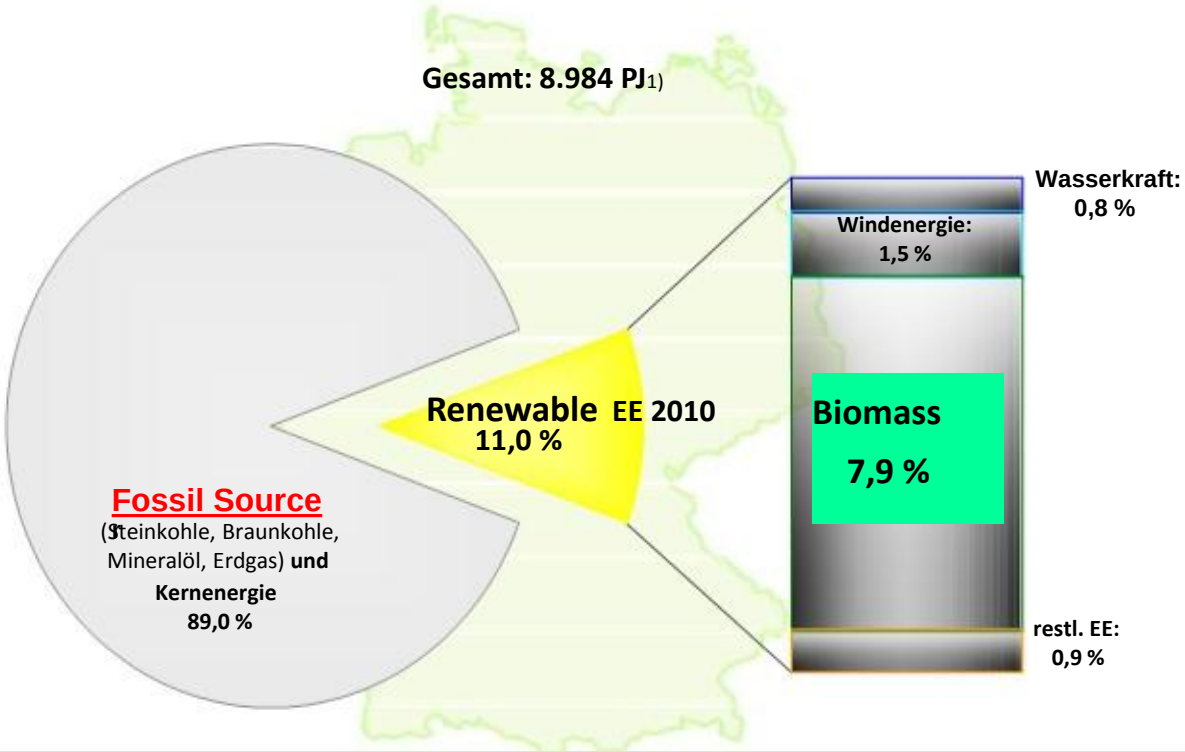
- **Replacement of fossil energy is achieved, easily, through Bio Energy since they have similar characteristics.**
  - **"Energy on Demand", through ease in storage**
  - **Addresses needs of diverse applications viz. electricity, cooking/heating, transportation, etc.**

- **Even in Germany, global technology leader in wind and solar, out of 8.984 PJ primary energy used in 2010, Bio Energy constitutes 7.9% (with overall renewable energy share being 11.0%).**

Replacement of fossil fuels - The German example

… zu den Fakten **(PRIMARY ENERGY)**

Anteil erneuerbarer Energien am Endenergieverbrauch in Deutschland



Renewables constitute 11 % of total Primary energy in 2010

Bio- energy constitutes 7.9 % of total Primary energy

Bio energy constitute 72 % of total Renewable energy

NEED FOR BIO ENERGY MISSION

- ***High Cost of Imported Fossil Fuels***:

(i) CRUDE OIL - India's crude oil import bill for year 2011 is expected to reached at 100 Billion USD. Import bill for crude oil is expected to reach upto 300 Billion USD by 2020.

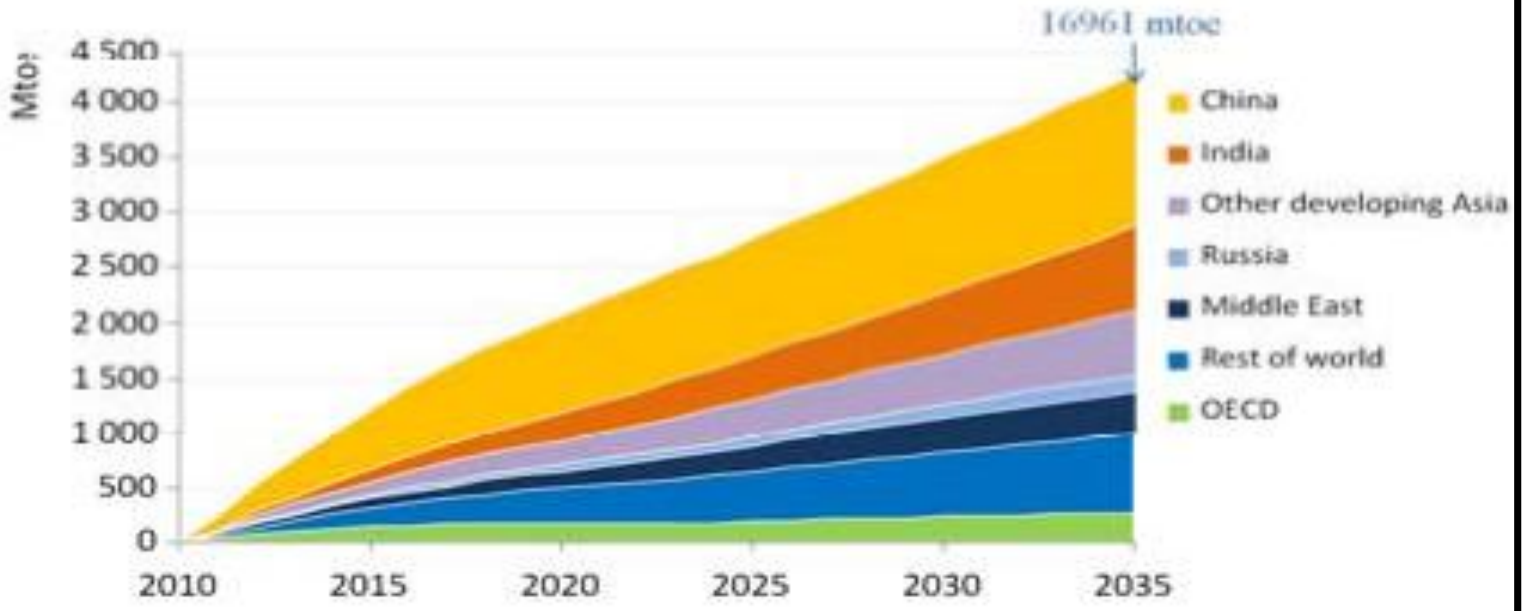
(ii) COAL – Current imports stand at 142 Million MT and import bill is expected to reach at 7 Billion USD and expected to rise upto 300 Million MT by 2020, raising import bill to the level of 40 Billion USD.

Australian coal, FOB prices are anticipated to be around $140/ton. Indonesia Law, now mandates that coal exports must be at market based prices.

(iii) NATURAL GAS - The situation is similar for imported natural gas, Government of India has offered $12.67/million BTU for Turkmenistan gas, aligned to anticipated price of $ 14-15/million BTU for imported LNG from Ras Gas.

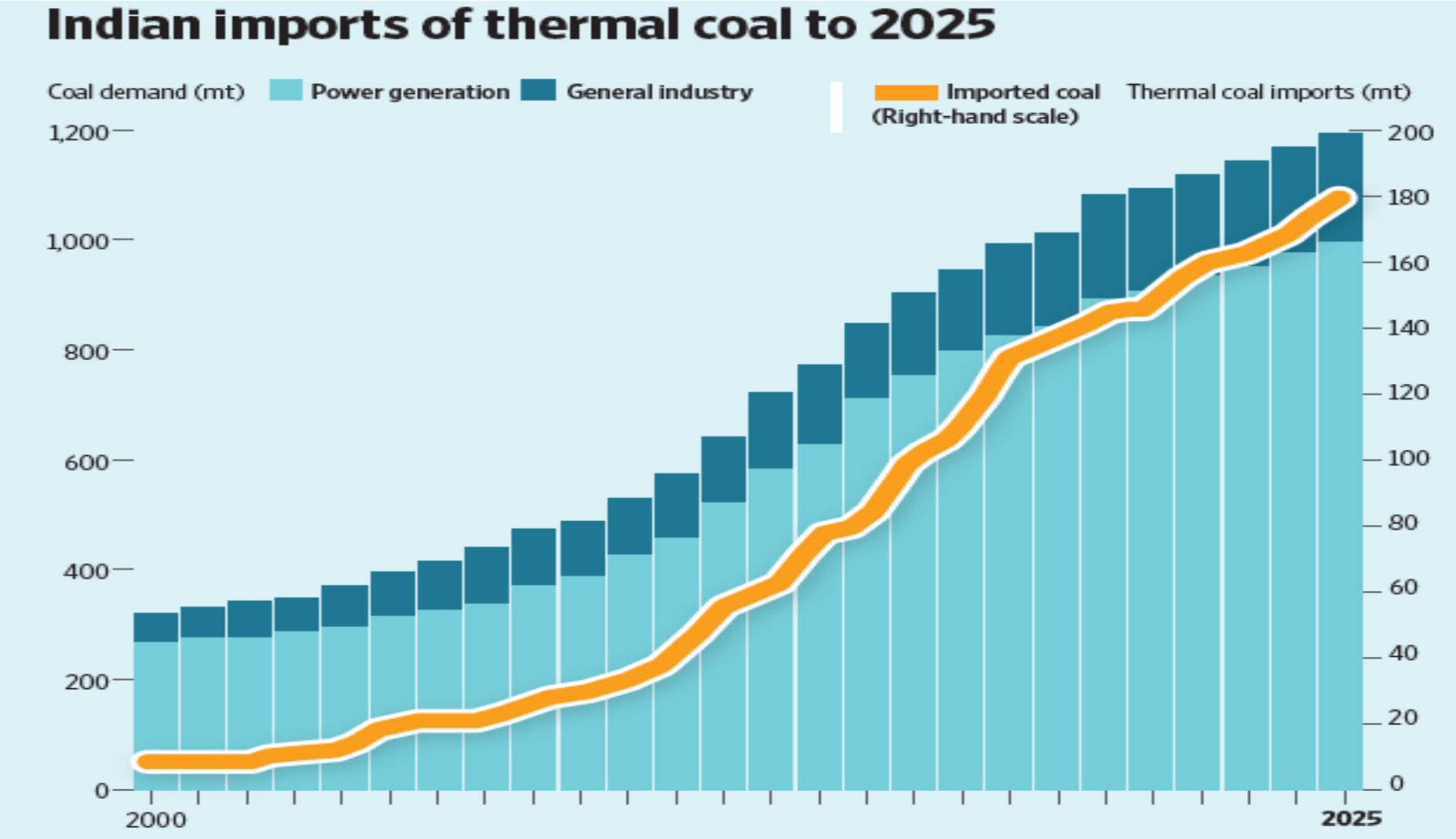
IEA – GROWTH IN GLOBAL ENERGY DEMAND

Emerging economies continue to drive global energy demand



- Global energy demand increases by one-third from 2010 to 2035, with China & India accounting for 50% of the growth

Indian Coal Imports are increasing significantly



Coal fired power plants will face "inputs" constraints → Fuel + Cooling Water
Hence, DISCOM's will find it increasingly difficult to ensure access & reliability

Replacement of fossil fuels - The Chinese example

Energy Type	2005 Actuals (RE share = 7%)	2020 Target (RE share = 15%)
Large Hydro	117 GW	300 GW
Small Hydro	38 GW	85 GW
Wind	1.3 GW	100 GW
Solar PV	0.07 GW	20 GW
Biomass Power (Forestry/Agri residue)	**2 GW**	**30 GW**
Biogas	**7.3 bill cum**	**44 bill cum (14 bill cum > 50 cum biogas/day)**
Bio Ethanol	**1 mill ton**	**10 mill ton**
Bio Diesel	**0.05 mill ton**	**2 mill ton**

Biomass as replacement for Coal (imported)

Biogas as replacement for CNG/ LPG

2nd Generation Biofuels as replacement for Gasoline/ Diesel

SOCIAL & ENVIRONMENTAL BENEFITS of BIO ENERGY PROJECTS

- **ENVIRONMENTAL POLLUTION MITIGATION** : through processing of bio waste,mitigate ground water contamination, health hazards, soil fertility loss, etc
- **RELIABLE ELECTRIC SUPPLY**: reliable electricity (80 – 90%PLF) in rural Electric Networks, which will enhance grid stability and, more importantly, meet power needs of small enterprises & create jobs.
- **CBG (COMPRESSED BIOMETHANE GAS)**: can displace Commercial LPG and provide "renewable CNG" as alternative to Petrol.
- **ORGANIC FERTILISER** : assured quality compost (>75% dry solids) along with liquid fertiliser (with suspended solids < 40 ppm, to enable integration with drip/ sprinkler irrigation systems), which enables sustainable soil fertility management.
- **JOBS CREATION**: Create many rural jobs in feedstock supply chain, bio energy plant operations, biomass depots/silage cum compost yards operations.
- **ECONOMIC BENEFITS TO SMALL FARMERS**: Increased incomes for small farmers, where Bio energy Projects would be located.
- **DISPLACE FOSSIL FUEL IMPORTS** : alternative to imported Coal, LNG, LPG and, in the future, petroleum products.

Bio Energy - linkage with GoI strategy of "targeted subsidies"

The government has proposed an ambitious implementation framework for direct cash transfers of subsidies for three major subsidised items. To be carried out as pilots conducted over phases, ET looks at the road ahead:

LPG

PHASE I Govt will cap consumption of subsidised cylinders per household

PHASE 2 All consumers start buying LPG at market rates. Cash subsidy comes into bank accounts linked with UID

PHASE 3 Govt identifies specific segments to be targetted slimming down subsidised beneficiaries

Challenge Capping subsidised cylinders will require political will

₹16,000cr annually spent as subisidy

FERTILISER

PHASE I Create software capability & technological support to track movement of fertiliser from retailers to farmers

PHASE 2 Set up infrastructure to facilitate direct cash transfer to bank accounts of retailers

PHASE 3 Enable system where farmers buy at market rates from retailers and get cash transfers to UID linked accounts

Challenge Govt will have to track fertiliser and subsidy movement

₹50,000cr subsidy provisional for '10-11

KEROSENE

PHASE I States purchase kerosene at market rates. Centre transfers cash based on actual offtake of kerosene

PHASE 2 Consumers buy kerosene at market rates, state govt transfers cash to UID linked "kerosene" accounts

Challenge Highly centralised system , state will have to struggle to get cash. Good UID spread essential

₹20,000cr annually spent as subsidy

BIO RESOURCES AVAILABILITY

- Total Bio Resources availability may be broadly grouped as
  - Linked to Land& Coastline
  - Agricultural and Forest Residue
  - Manure& Food Industry waste
  - Sewerage & organic municipal solid waste

Contd..

BIO RESOURCES AVAILABILITY

- **Sustainable Bio Resources, linked to land & coastline are summarized in chart below**

SOURCE	AVAILABILITY (million hectares)	BIO RESOURCE	APPLICATIONS
Forests Land	70.0 overall 28.8 open forest	(a) Fast growing bamboo/tree species (under National Mission for Greener India) (b) Forest residues, lantana, etc., that can be sustainably harvested/collected	(i) Cooking/Heating fuel (ii) Feedstock for Boilers/Gasifiers (iii) Pyrolysis for Liquid BioFuels
Agriculture Land	141.0 nett cropped ≅ 200.0 gross cropped ≅ 55.0 lying fallow for 6 months.	(a) 120 million tons of Agro Processing units residues (bagasse, husk) …… (b) 600 million tons of agricultural residues (c) Short cycle leguminous/silage crops cultivated when land is fallow.	(i) Feedstock for Boilers/Gasifiers …….. (ii) Pyrolysis for Liquid BioFuels …… (iii) Feedstock for Bioethanol/Biogas Plants.
Grazing/Fallow Land	≅ 50.0 overall	(a) Non edible oil seeds (b) Algae with high lipid content …… (c) Appropriate species of bamboo/trees …… (d) Short cycle leguminous/silage crop (e) Algae which gives high Biomass yield	(i) Production of SVO/Bio diesel …….. (ii) Cooking fuel (iii) Feedstock for Gasifier/Boilers …….. (iv) Feedstock for Bioethanol/Biogas Plants. …… (v) Pyrolysis for Liquid BioFuels
Coastline	7517 km (including Islands)	Algae with high lipid content or with high biomass yield.	(i) Production of Biofuels through Bio Ethanol Refineries or Hydro treatment. …… ii) Pyrolysis for Liquid BioFuels

INDIA – POTENTIAL for PLANTATIONS

- ***State of Forest Report 2009***
  - Out of India's 70 million hectares forest land, about 28.83 million hectares is "open" forest lands (tree cover of canopy density, between 10-40%) &
  - 0.28 million hectare of scrub land (tree cover of canopy density less than 10%).
- **National Mission for Greening India**
  - Aims at increasing forest / tree cover on 5 million hectare forest / non forest lands and
  - improves quality of forest cover on another 5 million hectare which will be taken up on degraded forest land.

- Therefore, identifying **2.0 million hectare** lands, for "Plantations", may not be a major constraint, subject to enabling policy guidelines framed by the Ministry of Environment & Forest and Ministry of Rural development.

Case Study – “Beema” Bamboo

The bamboo is now cultivated from tissue culture and then micro propagated. As a result, each tissue culture sapling is identical, asexual, non evasive, non flowering and has a density a density of 5 times greater than any other species of bamboo. It can be cultivated in all types of soil and requires 20 litres of water per day.

12 week old saplings

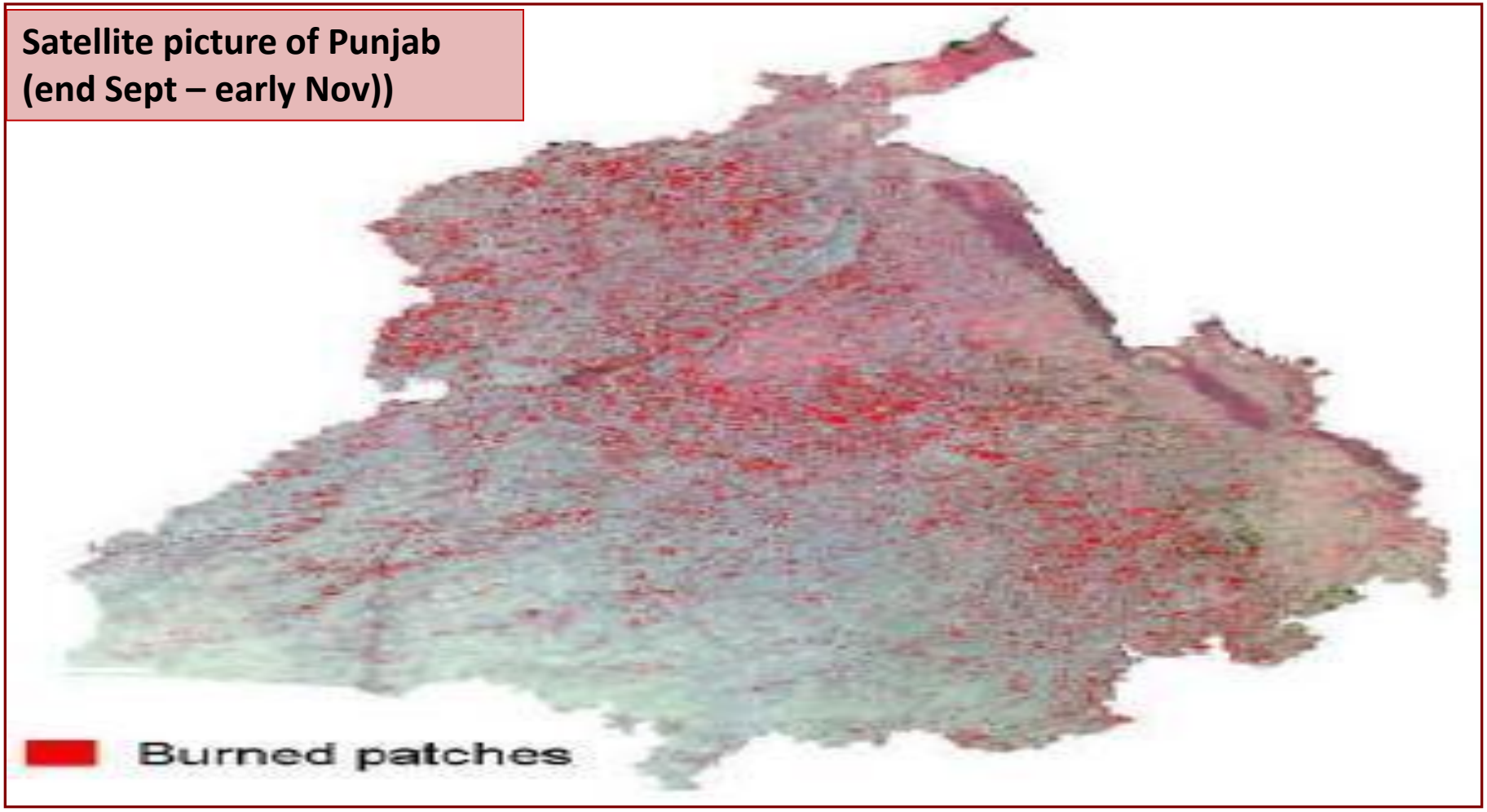
One Year old

Two Year old

Four Year old
(12 poles - 25ft High)

Case study - Agri Residues – burnt on fields

Satellite picture of Punjab (end Sept – early Nov))



Potential for 50 million MT/ year Briquettes, from 80 mill MT/yr Cane trash/ Paddy straw, currently burnt in fields and causing significant environmental pollution

Biomass Chips – replacement of Wood

Biomass Briquettes – replacement of Coal

Indian Coal
GCV : < 4000 Kcal/Kg
Ash : >35%
Moisture : <10%

Indonesian Coal
GCV : 5300 Kcal/Kg
Ash : 5.6%
Moisture : 28%

Agri residues Briquettes
GCV : > 4000 Kcal/Kg
Ash : <10%
Moisture : <10%

Manure Management Systems

India has 283 million bovine animals, India, annually, produces 120 mill tons Milk → 200 mill tons (by 2020)

India has 500 million poultry birds, with high CAGR (eg Namakkal district)

(in lakhs)

Average strength of layer birds in Namakkal zone in the last 10 financial years

2000 - 01	171.18
2001 - 02	212.71
2002 - 03	225.42
2003 - 04	219.19
2004 - 05	234.49
2005 - 06	307.34
2006 - 07	339.79
2007 - 08	367.35
2008 - 09	398.62
2009 - 10	407.34
2010 - 11	447.19
2011 - 12	500*

*average strength after expansion

1250 million tons/year manure (18% DS)

10 million tons/year dry manure (75% DS)

Horticulture linked Bio waste processing

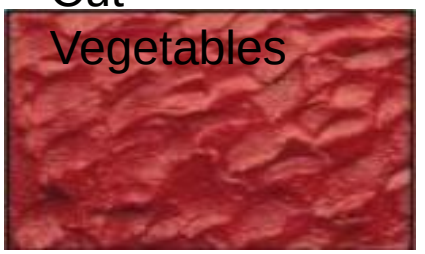
India's Horticulture output is 210 mill MT against NHM target of 350 mill MT → waste (30 to 40% of output, which can be processed to produce biogas + organic fertiliser)

China's vegetable output is 330 kg per capita (> 3 times Indian output & twice world average)

Cold

- **Indian farmers tend to cultivate grains (even with sub optimal returns, rather than vegetables) as they are not perishable.**
- **Food Processing/Preservation infrastructure would (a) stimulate non grain farming (b) enhance farmers income (c) meet nutrition needs of the community (d) open up significant opportunities for exports**
- ***CHP schemes, firing biogas, provide the energy component, which is a key deterrent for establishment of "Cold Chain"***
- ***Organic fertliser is well accepted in horticulture sector & will increase yield***

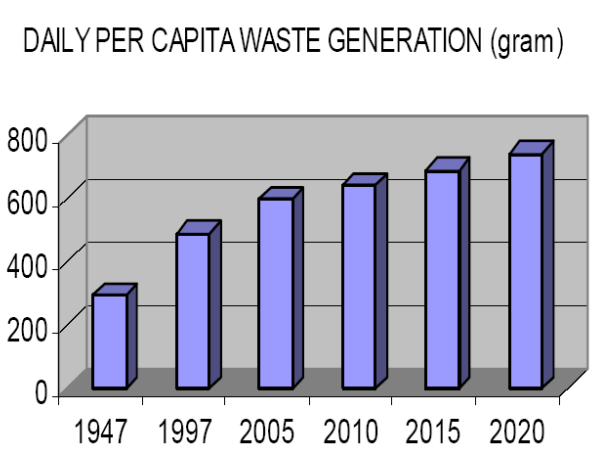
Cut Vegetables

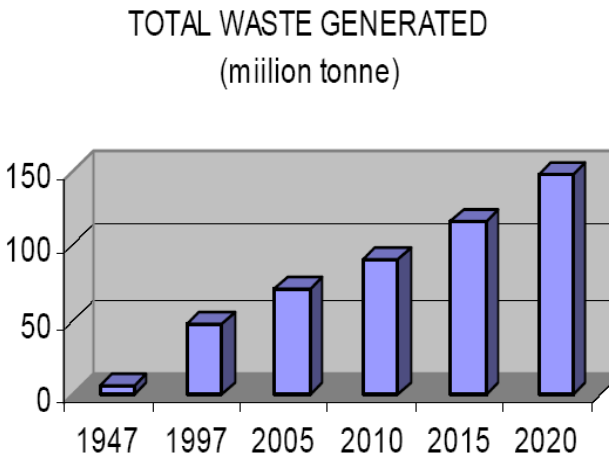


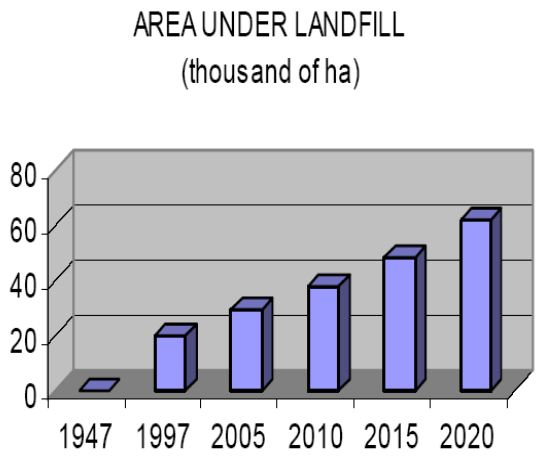
Tomato Puree

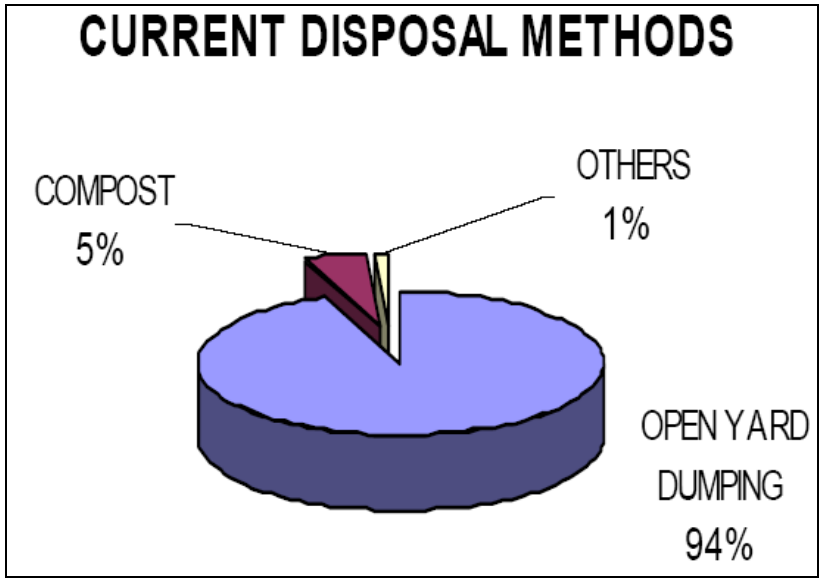
Mango Pulp

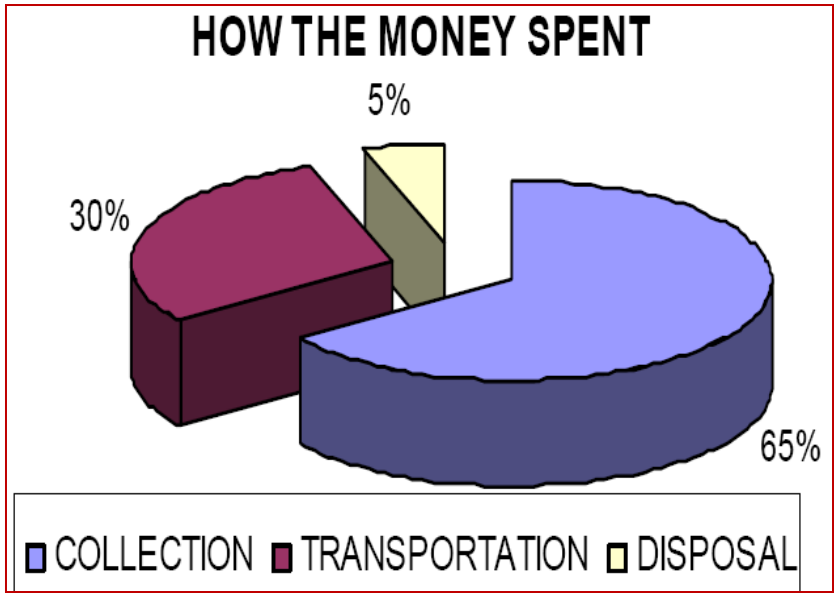
MUNICIPAL SOLID WASTE … Indian Scenario











- Energy content in waste is not being used
- No creation of new jobs

→ **negative added value!!!**

Sewage Treatment

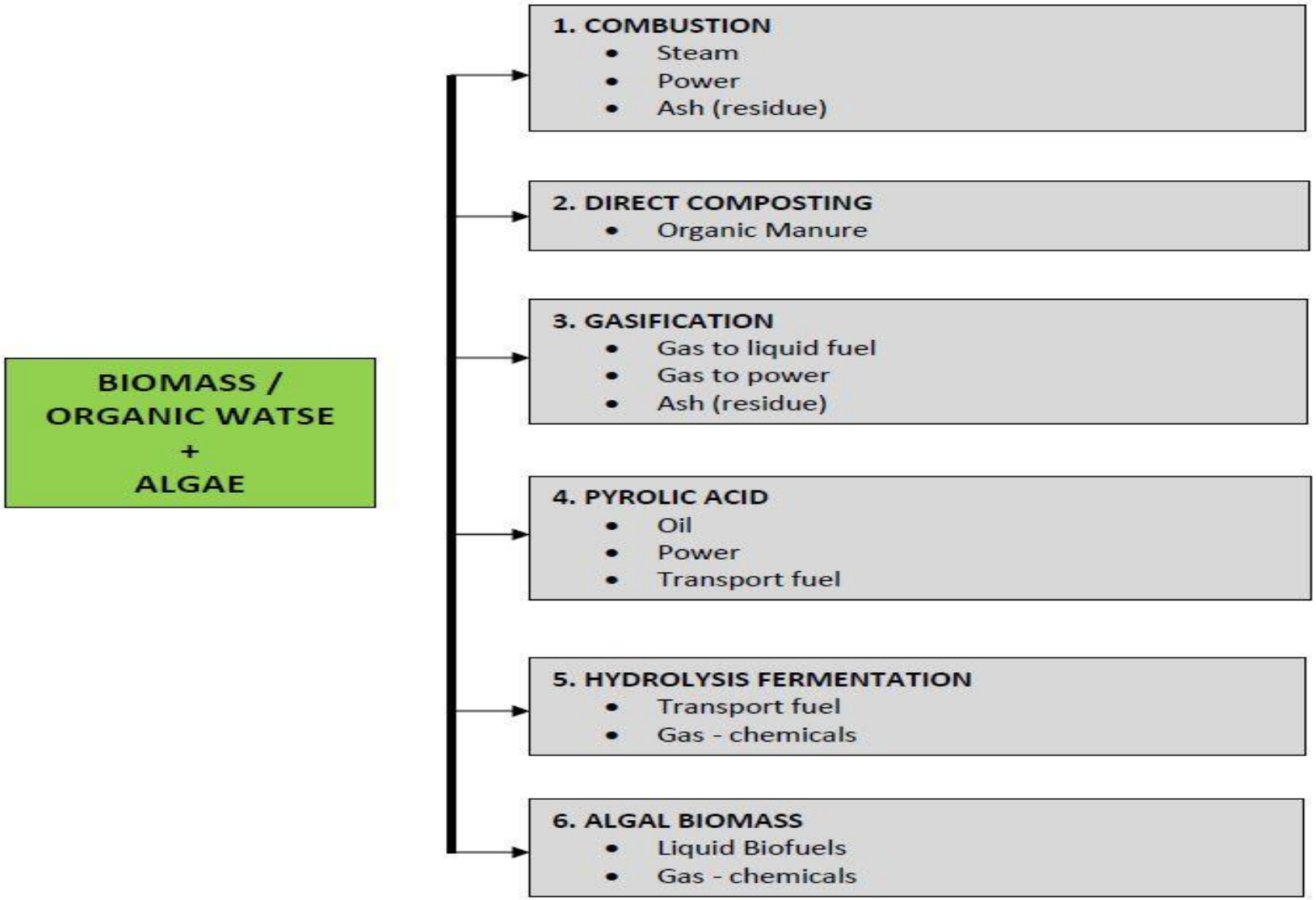
- Sewage in Urban areas, estimated to be 37,700 MLD and anticipated to grow to 50,000 MLD by 2020.. Higher if Industrial effluents is added. CAGR of 1.60%

- Presently, only 34% being treated
- Contamination of ground water/ water bodies,
- Results in health and hygiene issues.

- Among multiple treatment technologies,

  anaerobic treatment is preferred choice
  - **Since it uses minimal energy**
  - **Produce energy rich biogas**
  - **Produces sludge to compost**

BIOMASS PROCESSING TO BIOENERGY



KEY FACTORS CONSTRAINING BIO ENERGY GROWTH

- ***Low Feed-in Tariffs/Procurement Prices***: **electricity tariffs for Biomass/Biogas Power Plants and Cogeneration schemes, are low and inhibit investments, at times, lower than that from utility range Power Plants firing imported Coal/LNG.**

  Likewise, for Government fixed prices for Bio diesel/2nd Generation Bio ethanol.

- ***Inadequate focus on Biomass Supply Chain***: **Feed-in tariffs/procurement rates for biofuels, capital subsidies, project financing are all designed for integrated projects which combine the Biomass Supply Chain with the Bio Energy production unit.**

  The net result is that many projects suffer from inadequacies in Biomass Supply Chain and this leads to the perception that Bio Resources are not available on sustainable and reliable basis.

- ***Inadequate appreciation of Social & Environment Benefits***: **Bio Energy projects contribute significantly to sustainable socio-economic development of rural communities. Furthermore, collateral benefits, which provide definitive economic value in**

  - **Mitigation of Environment pollution**
  - **Production of assured quality organic fertilizer**
  - **Combined heat & power options (thermal cycle efficiency > 60 %)**

POLICY INTERVENTIONS NEEDED

- ***Resources Availability Studies***: comprehensive study of current/potential availability of sustainable Bio Energy resources needs to be carried out, which should address the entire spectrum of Bio resources.

  Such a report would require significant efforts and hence needs to be carried out by a consultant with significant resources and organization bandwidth to carry out an all India exercise.

  The study could be carried out in phases, perhaps creating a long list of potential districts, which through desk analysis, is reduced to multiple shortlists for phased implementation of the study.

  While MNRE should be the nodal agency for carrying out the study, there should be a group of Bio Energy experts who would assist MNRE in preparing Terms of Reference for appointment of Consultant as well as in evaluating the Consultant's reports.

POLICY INTERVENTIONS NEEDED

- ***Tariffs/Procurement Prices***: **MNRE and Ministry of Power should interact closely with "Forum of Regulators" to ensure that Biomass/Biogas tariffs fixation is in context to "displaced costs" of electricity generation firing imported coal/LNG.**

  CERC norms for Biomass Price escalation needs to be adopted by all SERC's.

  Furthermore, the benefits of DDG should be reflected through computing transmission & distribution costs from 765/400 KV bus to 11 KV bus.

  Similar approach needs to be adopted for 2nd generation Bioethanol/Bio diesel by benchmarking their procurement price with forecasted prices for gasoline/diesel.

  Apart from the economic analysis, as above, there should be the perspective of ensuring long term energy security for the country through optimal utilization of locally available bio resources.

POLICY INTERVENTIONS NEEDED

- ***Capital Subsidy:*** **It is required for emerging technologies; in particular 2nd Generation Biofuels and Algae based Biofuels for research & development, setting up of demo and pilot plants and providing proof of concept.**

- ***Production based Subsidy*****: Production based subsidy in the form of incentives or excise duty exemption or tax relief should be offered to make biomass based biofuels more viable and sustainable in longer run.**

  This needs to be dovetailed with the National Biofuels Policy.