

## POLLUTANTS

- Primary pollutant: persist in form in which they are added to envi (DDT, Plastic, ash, smoke, CO, CO<sub>2</sub>, oxides of N<sub>2</sub> and Sulphur)
- Secondary pollutant: formed by interaction between primary pollutant (Ozone, SO<sub>2</sub>, PAN, Acid rain)

## SMOG

- Photochemical smog aka Oxidizing smog aka Los Angeles smog: VOCs + NO<sub>x</sub> + sunlight >>> Ozone
- Sulphurous smog aka London Smog: Due to SO<sub>2</sub> (from coal)

Fly Ash= SiO<sub>2</sub> + CaO + Al silicate

## GOVERNMENT INITIATIVES

### 1. National Air Quality Monitoring Programme (NAMP)

- By CPCB with help of SPCB and Pollution Control Committees (PCC), National Envi Engineering Research Insti (NEERI)
- 4 Pollutants identified for regular monitoring: Sox, NO<sub>x</sub>, SPM, RSPM (Respirable SPM)
- Monitoring air parameters is also included: Wind speed and direction, RH, Temp

### 2. National Air Quality Index (NAQI)- read from current affairs notes

### 3. National Ambient Air Quality Std (NAAQS)

- Set by CPCB, applicable nationwide
- 12 pollutants:  
NO<sub>2</sub>, SO<sub>2</sub>, PM<sub>10</sub>, PM<sub>2.5</sub>, O<sub>3</sub>, Lead, CO, Arsenic, Nickel, Benzene, Ammonia, Benzopyrene (BABAN)
- Types of radiation
  - Ionising- High penetration power and break the macro molecule  
E.g.- Gamma rays, X rays, higher UV spectrum, atomic radiation
  - Non-Ionising- Affects only those components which absorb them and have low penetrability  
E.g.- Lower UV radiation, Visible light (nearly all types of laser light), infrared, microwave and radio waves

INDUSTRY	POLLUTANTS
Iron and Steel Industry	1. CO <sub>2</sub> 2. SO <sub>x</sub>

	3. NO <sub>x</sub> 4. PM 5. CO
Paper Industry	1. SO <sub>2</sub> 2. NO <sub>x</sub> 3. PM
Cement	1. NO <sub>2</sub> 2. SO <sub>2</sub> 3. CO <sub>2</sub> 4. Methane 5. Fume 6. CO 7. PM 8. VOC
Thermal Power Plant	1. SO <sub>2</sub> 2. NO <sub>x</sub> 3. Fly ash 4. PM 5. Mercury
Nuclear Power Plant	Do NOT produce SO <sub>2</sub> , NO <sub>x</sub> , CO <sub>2</sub>
CNG	1. LOWER NO <sub>x</sub> 2. Lower Methane
LPG	CO <sub>2</sub>

PETROL	DIESEL
CO <sub>2</sub>	Less CO <sub>2</sub>
CO	NO CO
	More NO <sub>x</sub>
More Benzene	
	More SPM
Lead	

#### WATER POLLUTANTS AND DISEASE

Methyl Mercury (can be cured by use of <b>lime</b> )	Minamata disease
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Cadmium	Itai itai disease (aka ouch ouch disease)
Nitrate	Blue baby syndrome
Fluoride	Skeletal fluorosis
Arsenic	Black foot disease

#### AIR POLLUTANTS AND DISEASE

Sulfur oxide	Yokkaichi asthma
Coal Dust	Pneumoconiosis (Black lung disease) - Especially in Coal Miners
Smoking	Emphysema
Poor indoor air quality	Sick Building Syndrome

#### E-WASTE POLLUTANTS

1. Lead
2. Cadmium
3. Mercury
4. Hexavalent chromium
5. Brominated Flame Retardants (BFRs)
6. Barium
7. Beryllium
8. Toners
9. Phosphor

#### TREATMENT OF SOLID WASTE

Landfills	Pit dug in ground>>everyday covered with soil
Sanitary landfills	Constructed over impermeable soil, lined with impermeable materials
Incineration	Waste generated here can be <b>RECYCLED</b>
Pyrolysis	Combustion in <b>absence</b> of oxygen Yields Charcoal, methyl alcohol, acetic acid
Composting	<b>Microorganisms</b> degrade waste in <b>presence</b> of oxygen
Vermiculture	Earthworm farming

#### BIOREMEDIATION

- Use of microorg to degrade contaminants into **less toxic form**

Bioremediation strategies:

In-Situ-

1. **Bioventing**- supply of air and nutrients>>To stimulate growth of Bacteria
2. **Biosparging**- inject **high pr air** under watertable to increase GW oxygen concentration
3. **Bioaugmentation**- import of microorganisms

Ex-Situ

1. Landfarming- preparing and periodic tilling of contaminated soils a prepared bed
2. Composting- microorg in presence of O<sub>2</sub>
3. Biopiles- hybrid of landfarming and composting>> use of engineered cells to treat surface contamination with with petroleum hydrocarbons
4. Bioreactors- process thr engineered containment system

Genetic engineering approach

**Phytoremediation**- use of **plants** to remove contaminants

1. Phytoaccumulation/phytoextraction- plants accumulate contaminants in roots or elsewhere
2. Phytotransformation- transform in less toxic form thr plant metabolism
3. Phytostabilization- plants reduce mobility and migration of contaminants in soil
4. Phytodegradation/ Rhizodegradation- degrade thr activity in rhizosphere
5. Rhizofiltration- thr roots- water remediation: in wetlands and estuary

Mycoremediation

- Use of **FUNGI** to decontaminate area

Mycofiltration

- Use of **Fungal mycelia** to filter out toxic waste from water in soil

ACID RAIN

- 3 main compounds: 1.**Nitrogen**    2.**Sulphur**    3.**Formic acid** (Forest fires)
- Wet deposition- In wet areas
- Dry deposition-Acid particles incorporated in dust and smoke>>fall on ground

RENEWABLE ENERGY

- Mostly non polluting EXCEPT **Biomass energy**- which is major contributor of Indoor air pollution
- Installed renewable power capacity contribution: **74 GW- grid connected, 114 GW- total capacity**  
Wind (34 GW)>>>Solar(21.5 GW) >>> Biomass(8.7)>>>Small hydro power (4.5 GW)>> Waste to Energy (134 MW)

#### INTERNATIONAL SOLAR ALLIANCE

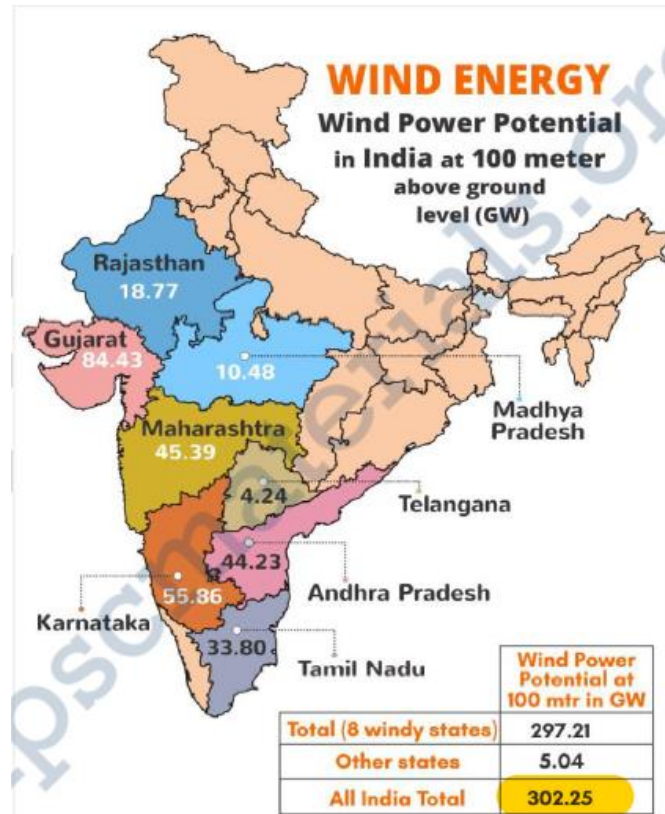
- International Agency for Solar Policy and Application (IASPA)
- By Modi + Francois Hollande @ COP 21, 2015 (+ @ India-Africa summit by Modi)
- Interim secretariat: NISE, Gurugram
- Objectives: 1. Force down prices by driving demand 2.bring std in solar energy 3.R&D
- More than 122 countries (China is member)>> Now extended to all members of UN
- Opened to signature @ Morocco COP (22)
- Partnered with WB to launch **Global Solar Atlas**
- India Energy Security Scenario (IESS) 2047- to explore potential of future energy scenarios- BY **NITI + UK DECC**

#### INTERNATIONAL RENEWABLE ENERGY AGENCY (IREA)

- 2009, HQ- **Abu Dhabi**
- Official UN observer
- Membership requirement: 1. UN member or 2. Member of Intergovt economic integration org
- ALL forms of renewable energy

#### WIND ENERGY

- Windfarms- More Efficient on sea level than on high levels due to **air density**
- **NIWE**- Wind Energy Resource Mapping of India at 100 metres ABOVE ground level
- **National Offshore Wind Energy policy, 2015**
  - MNRE- Nodal ministry for use of EEZ
  - NIWE- Nodal agency for **dev of offshore wind energy** + carry out allocation of offshore wind energy blocks
  - Targets- **5 GW** by 2022, **30GW** by 2030
  - 1<sup>st</sup> Offshore WF project being considered at Gulf of Khambat- 100MW



## WAVE ENERGY

- 1<sup>st</sup> plant: **Vizhinjam Plant**, Kerala

TIDAL- 1<sup>st</sup> plant: **Hanthal creek, Gulf of Kutchh**

## BIOMASS-

- Main diff betn Biomass and Fossil fuels: though both release same amount of CO<sub>2</sub>, but Biomass also absorbs CO<sub>2</sub> that it emits while its growth (thus Carbon neutral)

## FUEL CELL

- Electrochemical devices that convert chemical energy directly into electricity (DC) and heat
- Consist of 2 electrodes – oxygen passes over one and hydrogen over other
- Byproducts: Electricity, Water, Heat, CO<sub>2</sub>