GREEN NORMS FOR RENEWABLE ELECTRICITY

Potential Impacts and the status of Green Norms
• Installation of grid connected RE (excluding large hydro) grew from 3.5 GW in March 2002 to 28 GW in March 2013 – **annual growth rate of 23%**

• March, 2013, **RE (excluding large hydro) constituted 12.5%** of installed capacity

• **51.23 billion kWh** of electricity generated in 2011-12 – annual requirement of **60 million people**

**Grid Connected Renewable Power**
<table>
<thead>
<tr>
<th>Technology</th>
<th>Capacity (GW)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Wind</td>
<td>100-1,000</td>
</tr>
<tr>
<td>Small Hydro</td>
<td>15</td>
</tr>
<tr>
<td>Solar</td>
<td>Unlimited (30 MW/km²)</td>
</tr>
<tr>
<td>Biomass/Bagasse/Waste</td>
<td>25 (excluding plantation-based biomass power)</td>
</tr>
</tbody>
</table>
• Linear fragmentation and impacts on wildlife, forest ecology and water bodies
• Impacts on birds and bats (few studies)
• Noise and shadow flicker: magnitude and impacts depends on many variables such as distance of human settlement, local topography, weather, background sound levels etc.
• Local Impacts – aesthetics, tourism, land acquisition etc.

Wind: Environmental Impacts
<table>
<thead>
<tr>
<th>Time period</th>
<th>Wind power capacity Installed (MW)</th>
<th>Forest area cleared (hectares)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Till March 2006</td>
<td>4351</td>
<td>478</td>
</tr>
<tr>
<td>April 2006 to March 2013</td>
<td>14701</td>
<td>3454</td>
</tr>
</tbody>
</table>

- Total 3932 ha diverted for 72 projects
- 88% diverted in Karnataka (57%) and Maharashtra (31%)
- Average diversion: about 0.5 ha/MW
- About 8500 MW or 45% of total wind power installed in forest areas

Wind in forest areas
Hilltops in forest areas cut for windmill installation
LINEAR FRAGMENTATION: Access roads and transmission lines to and from multiple wind projects lead to forest fragmentation – isolation of species and disruption of the movements of animals. Increase in human-animal conflict
Massive soil erosion and land degradation

Approx. 10 - 40 ft land mass removed for road construction on Contours
Wind: Existing Green norms

- No EIA
- Categorized in the "green" category: No permits required for noise, shadow flicker or waste oil disposal
- Guidelines by the MOEF exist as for how to handle forest diversion for wind power, but:
  - Without proper impact assessment these cannot be implemented
  - Special concession – half the amount of Net Present Value is added to CAMPA funds
  - Quick clearance – average 7.5 months till final clearance; in-principle clearance in many cases in less than a month (the lowest being 10 days)
• **Multiple impacts on the local environment and ecology**
  - **Ecological** - Aquatic flora and fauna specifically impact on fish
  - **Physical** – Flow of the river, Water quality, sediment carrying capacity, erosion, ground water quality and recharge, climate, soil and geology
  - **Humans** - Interference with drinking and agriculture water availability, solid waste and socio-economic factors
  - **Cumulative impact and Ecological Flow**

**SHP: Environmental Impacts**
• Analysis of 138 SHP projects
• Average diversion: 1 ha/MW
• 2 months for in-principal approval;
• 6.5 months for final approval from date of application
Hydro power projects in the Alakananda and Bhagirathi river basins

Legends
- Commissioned hydropower projects
- Under construction hydropower projects
- Town
• The impact is cumulative with many other development projects in terms of forest use and linear intrusion from roads and power lines.

• Cascade operation of small hydro power stations leads to almost drying up of the natural channel of the stream during low flow periods.
• No EIA; no cumulative impact assessment

• Himachal Pradesh - Only state to come up with norms for environmental flow - **15 % of the average** of the three leanest months – **3% of the high flow**

• **Forest Clearances** required, but poorly assessed (without EIA)

• Different pollution control boards treat SHPs differently – most green, one even red

**SHP: Existing Green norms**
• 1 MW of Solar Power needs 2.5-3.0 hectares of land; land acquisition is an issue
• Impact on ecology if the land is large and in eco-sensitive areas
• Solar Thermal uses water for cooling at about the same rate as a coal thermal power plant.
• Battery Disposal & E-Waste Management

Solar: Environmental Impacts
• No EIA for any size
• No Objection Certificate needed for solar thermal plants
• Solar-cells and modules not covered under the E-Wastes (Management and Handling) Rules of 2011
• For Solar Thermal plants "Approval from state/local authority" for the water needed

Solar: Existing Green norms
• **100 GW of wind power** is approximately **50,000 new wind-turbines**, which will require thousands of hectares of forest land and thousands of hectares for roads and linear intrusion

• **11.5 GW of Small Hydro** may leave a combined stretch of **2,300 km of rivers** dry, or nearly dry (assuming average size of the project to be 10 MW) and will need thousands of hectares of forest land

• India should achieve **500 GW of Solar Power** by the end of 2050.
  • This would require approximately **1.25 million hectares of land**.
  • The total land leased for mining in India is about **0.7 million hectares**

• **25 GW of Biomass** plant will use **7.5 million hectares** of plantation land - forest and non-forest land

---

**RE’s Land Impacts**
‘Bottom-up’ study to understand the potential to reduce GHG emissions in five most emissions-intensive industrial sectors and the power sector

• Benchmarking energy and GHG emissions with Best Available Techniques (BAT)

• Researching technology options; round table with industries to understand their future technology deployment pathway, limitations, dis/advantages

Low carbon study
• Two pathways projected till 2030-31
  • Business As Usual (BAU): Changes that industry is making or will make on its own to reduce energy consumption -- high cost of energy is the main driver of change. Promises made by the government in NAPCC included in this scenario; changes due to environmental regulations also included
  • Low Carbon (LC): Policy push required to mainstream emerging, not yet commercialized technologies. In many sectors, it is also a ‘leap into the unknown’. Combating climate change is the main driver of change.

Low carbon study
Land

Resource impacts
Land: 2008-09

Land currently occupied by six sectors (million ha):

- Mine, 0.4
- Plant, 0.3

- Coal mining 19%
- Power plant 35%
- Limestone mining 19%
- Iron ore mining 19%
- Bauxite mining 5%
- Aluminium plant 1%
- Cement plant 1%
- Paper and pulp plant 1%
- Fertilizer (urea) plant 3%
Additional land required (million hectares) excluding land required for biomass

- **2008-09**: 0.7 million hectares
- **2030-31 BAU**: 1.0 million hectares
- **2030-31 LC**: 1.3 million hectares

Additional land required
• Land issues at the center of all protests against development projects in India; protest against solar projects in Rajasthan and wind projects in many parts of India
• Reduce land use (solar rooftops) and allow multiple use (multiple land-use in wind farms)
• Win-win deal with the local community – benefit sharing -- land rent, profit sharing, resource rent (rent per unit of power produced) etc.

Land
• Need to take into consideration environmental impacts of RE development

• Little regulations exist presently and whatever exits are either ineffective or inconsequential or poorly implemented

• Green norms are needed. Will help the industry in long run.

• Similarly, RE industry need to view land differently than conventional industry -- huge potential to provide win-win solution

Way ahead