UK–India Energy Policy

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UK – Issues

- Approaching energy deficit
- Current capacity unable to support decarbonisation of the economy
- High electricity prices
- Public perception
- Stringent emission targets
- Recovery from economic downturn
- Relatively inefficient renewable sources
India – Issues

- Centralised ownership
- Insufficient infrastructure
- Insufficient capacity
- Poor quality coal
- Lack of competition and private investment
- Insufficient personnel training (SEB)

- Geographical constraints
- Lack of energy education
- Lack of government incentive policies
- Reliance on coal imports
- Transmission and distribution losses
Solutions for the UK

DIVERSIFICATION

1. Foster Innovation

2. Promote Competition

3. Increase Energy Security
Foster Innovation

Biomass
- Large and small scale generation
- Cofiring
- Potential for CO$_2$ sink

CCS
- Gas
- Coal
- Biomass
- Oxy-fuel, PCC and Pre-C

Wind
- Onshore, offshore
- Storage
- Grid Connection
Promote Competition

- Government policies and market economics should act as drivers for new generation investment
  - EU NER300 competition, 9 UK projects to aid CCS development
    - 5 Pre-combustion
    - 3 Post combustion
    - 1 Oxyfuel combustion
  - Government Incentives
    - Feed in tariffs
    - ROCs
    - Set & implement carbon price
    - Green investment bank
    - ‘Green deal’ scheme
Increase Energy Security

- ‘DIVERSIFICATION’
  - Energy sources, fuels, suppliers and routes of import
- Smooth out demand fluctuations
  - Smart meters
  - Smart grid
- Increase energy storage
  - Pumped storage
  - Hydrogen
- Reduces costs
Education

- Emphasis immediate global warming over source availability
- Incorporation in education curriculum from an early age
- Government, industry, university and international collaboration
- Raise awareness of demand vs. supply
Solutions for India

DIVERSIFICATION

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Foster Innovation

**Microgeneration**
- Biomass gasification
- Biogas
- Solar

**Coal**
- Underground coal gasification
- Coal blending with biomass
- Coal cleaning processes

**Hydro**
- Large potential
- Small & large scale generation
Promote Competition

- Privatisation of energy sector, market economics drive down generation costs
- Encourage foreign investment
- Coherent government legislation and energy policy
- Government subsidies
  - Feed in tariffs
  - Tax reliefs
Increase Energy Security

- ‘DIVERSIFICATION’
  - Energy sources, fuels, suppliers and routes of import
- Reduces costs
- Increase natural gas usage
- Utilisation of hydro-power resources
- Aim to reduce reliability on imports
Education

- Training electricity production personnel
- Energy education for all generations
- Importance of waste management systems
- Increasing consumer awareness
Case Study: North East

- ~7.5mil population
- 24100 km²
- 312 people/km²

- ~38.8mil population
- 262 000 km²
- 148 people/km²
UK–India Similarities

- Large rural populations
  - Relatively less infrastructure
  - More suited for micro generation
- Located near to the countries oil & gas reserves
  - Transportation
  - Good economic potential
- Substantial coal reserves
  - Energy system reliance
  - CCS potential
- Reduce overall emissions
North East England: Issues

- Large Rural Population
  - No load shedding (to date)
  - Restricted access to gas
  - Costly to connect to grid

- Oil & Gas reserves
  - Access to north sea gas
  - Potential for EOR
  - Depleting reserves
  - High prices
  - Security of supply

- Coal reserves
  - Potential for coal bed methane recovery & UCG
  - Clusters of coal stations
North East India: Issues

- Large Rural Population
  - Regular load shedding
  - Insufficient infrastructure
  - Costly to connect to grid
  - Geographical restrictions, i.e. Mountains
  - Political restrictions

- Oil & Gas reserves
  - Connection to rest of India
  - Difficult transportation

- Coal reserves
  - Potential for coal bed methane recovery, UCG
  - Abundant supplies, limited mining
  - Poor quality coal with a high ash content
North East England: Solutions

- Small scale micro generation
  - Wind, solar, biomass, anaerobic digestion
- Personal use & feed in to the grid
  - Feed tariffs
  - Government subsidies
- Biogas generation
  - Farm wastes
- Development of CCS
  - Unproven on commercial scale
North East India: Solutions

- Small scale micro generation
  - Anaerobic digestion
  - Biomass
- Investment for infrastructure and capacity
- Access into the hydro-power industry
- Transition and distribution cost
- Develop the gas network
North East India: Solutions

- Effective utilization of natural resources like biomass, hydro power, natural gas and oil
- Increase in reliability of power supply
- Economy in operation and mutual support during contingencies
- Decentralized power generation using solar, biomass, small scale wind and micro-hydel
- Plantation of energy crops (Jatropha) in the hilly regions/waste lands
North East India: Solutions – Solar

- Solar Energy is one good option for NE India.
- Available solar radiation in NE: 4 – 5 kWh/sq.m
- There is a potential of deploying about 20 – 25 MW of Solar power in NE region.
- Rural lighting in this region is possible with the help of decentralised power production through PV plants.
## North East India: Solutions – Biomass Potential

<table>
<thead>
<tr>
<th>State</th>
<th>Biomass Class</th>
<th>Area (kHa)</th>
<th>Power Potential (MWe)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Arunachal Pradesh</td>
<td>Agro</td>
<td>208.5</td>
<td>9.2</td>
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<tr>
<td></td>
<td>Forest &amp; wasteland</td>
<td>5467.4</td>
<td>846.3</td>
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<tr>
<td>Assam</td>
<td>Forest &amp; wasteland</td>
<td>2676.8</td>
<td>339.4</td>
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<td></td>
<td>Agro</td>
<td>3460.3</td>
<td>283.9</td>
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<tr>
<td>Manipur</td>
<td>Agro</td>
<td>340.8</td>
<td>14.3</td>
</tr>
<tr>
<td></td>
<td>Forest &amp; wasteland</td>
<td>1260.9</td>
<td>116.8</td>
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<tr>
<td>Meghalaya</td>
<td>Agro</td>
<td>174.4</td>
<td>11.3</td>
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<tr>
<td></td>
<td>Forest &amp; wasteland</td>
<td>1532.6</td>
<td>157.6</td>
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<tr>
<td>Mizoram</td>
<td>Agro</td>
<td>19</td>
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<tr>
<td>Nagaland</td>
<td>Agro</td>
<td>179.6</td>
<td>10</td>
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<tr>
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<td>Forest &amp; wasteland</td>
<td>786.4</td>
<td>78</td>
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<tr>
<td>Sikkim</td>
<td>Agro</td>
<td>58</td>
<td>2.29</td>
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<td>Forest &amp; wasteland</td>
<td>372.8</td>
<td>49.1</td>
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<tr>
<td>Tripura</td>
<td>Agro</td>
<td>9.5</td>
<td>2.94</td>
</tr>
<tr>
<td></td>
<td>Forest &amp; wasteland</td>
<td>831</td>
<td>95.7</td>
</tr>
</tbody>
</table>

**Area**: 4450 kHa (agro); 14567kHa (Forest & Wasteland)  
**Power Potential**: 335 MWe(Agro); 1673MWe (F&W)
North East India: Solutions – Biomass

- Bio – diesel plants plantation in at least 5 – 10% of area.
- Common collection place and plant for a state
- Increase the employment for youth

Actual forest cover in NE India

<table>
<thead>
<tr>
<th>State</th>
<th>Dense forest</th>
<th>Open forest</th>
<th>Total forest cover</th>
<th>% of total area</th>
</tr>
</thead>
<tbody>
<tr>
<td>Arunachal Pradesh</td>
<td>57,756</td>
<td>11,091</td>
<td>68,847</td>
<td>82.2</td>
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<td>Assam</td>
<td>14,517</td>
<td>9,171</td>
<td>23,688</td>
<td>30.2</td>
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<td>Manipur</td>
<td>5,936</td>
<td>11,448</td>
<td>17,384</td>
<td>77.9</td>
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<tr>
<td>Meghalaya</td>
<td>5,925</td>
<td>9,708</td>
<td>15,633</td>
<td>69.7</td>
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<tr>
<td>Mizoram</td>
<td>3,786</td>
<td>14,552</td>
<td>18,338</td>
<td>87.0</td>
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<tr>
<td>Nagaland</td>
<td>5,137</td>
<td>9,027</td>
<td>14,164</td>
<td>85.4</td>
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<tr>
<td>Tripura</td>
<td>2,228</td>
<td>3,517</td>
<td>5,745</td>
<td>54.8</td>
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<td>Northeast India</td>
<td>95,285</td>
<td>68,514</td>
<td>163,799</td>
<td>64.2</td>
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<tr>
<td>India</td>
<td>377,358</td>
<td>255,064</td>
<td>637,293</td>
<td>19.4</td>
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</tbody>
</table>

Source: Indigenous forest stewarts of NE India, Mark Poffenberger et.al, 2007
Biomass gasifier of small capacities (1 – 5 KW) for community electricity production based on the available population

Community biogas digester for household purposes for cooking

Incentives for the people who use biomass/biogas for meeting their energy demands

Residue from the digester can be used as manure for the crops.
Conclusions

DIVERSIFICATION

India

- Privatisation
- Investment
- Local generation
- Education

UK

- Competition
- Investment
- Local generation
- Education