UK-India Energy Policy

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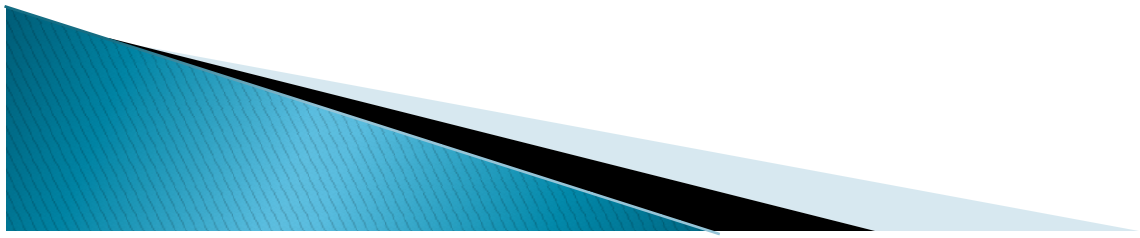


UK – Issues

- 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

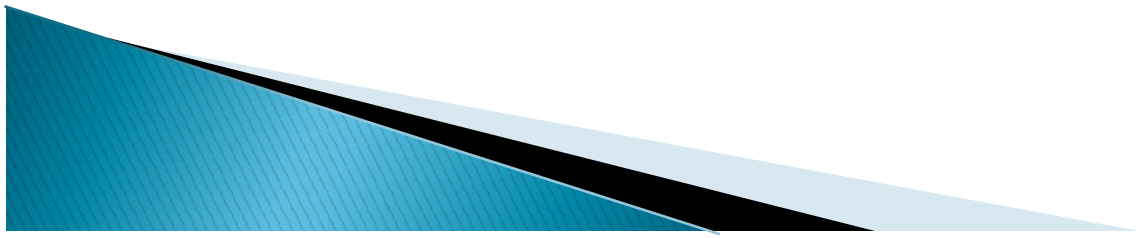
Solutions for the UK

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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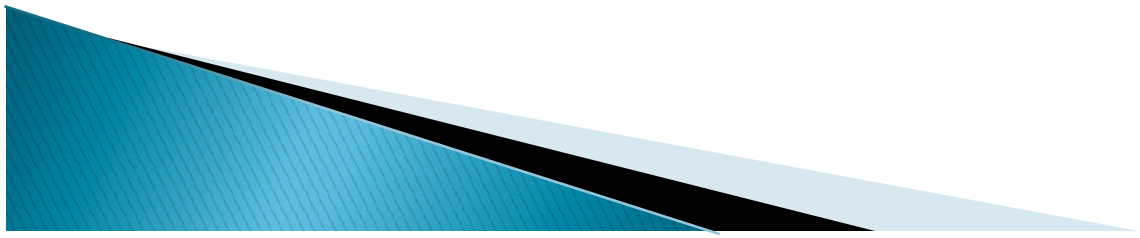


Foster Innovation

Microgeneration

- Biomass gasification
- Biogas
- Solar

Coal

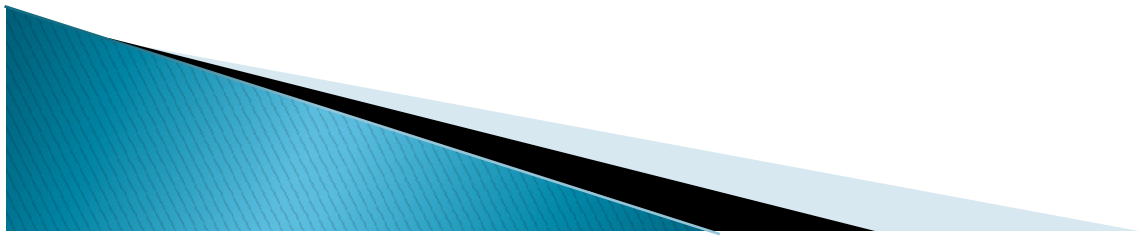
- Underground coal gasification
- Coal blending with biomass
- Coal cleaning processes

Hydro

- Large potential
- Small & large scale generation

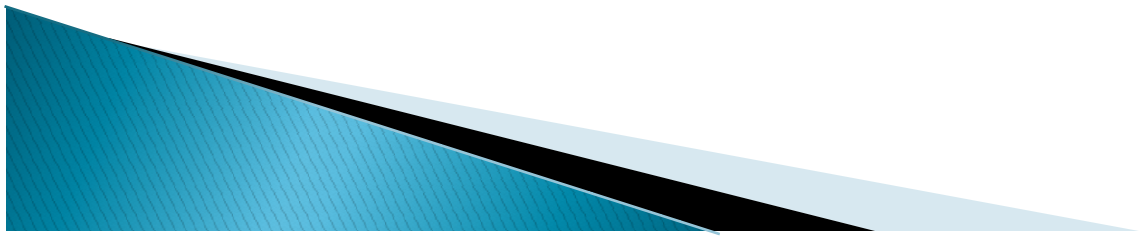
Promote Competition

- 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



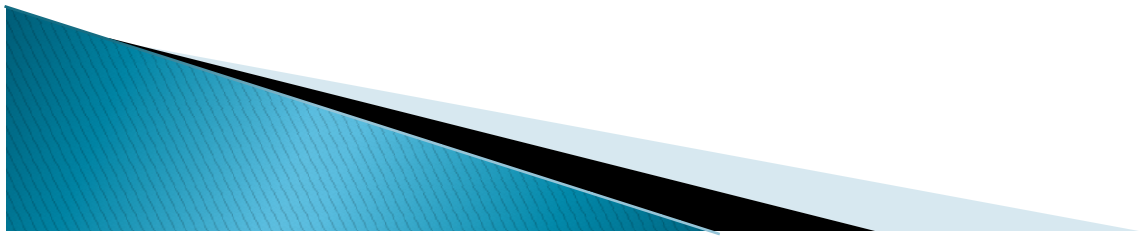
Increase Energy Security

- ‘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

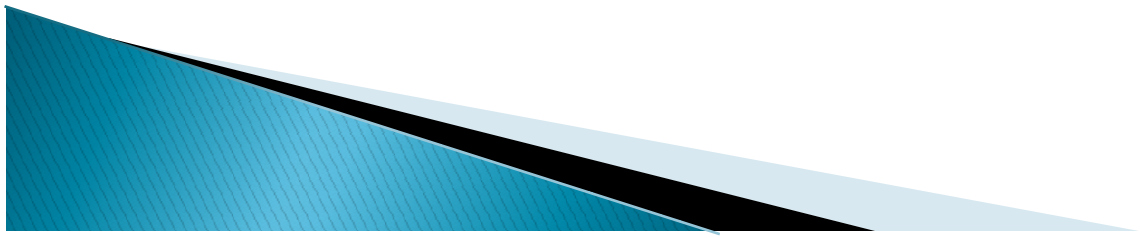
- ~38.8mil population
- 262 000 km²
- 148 people/km²

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

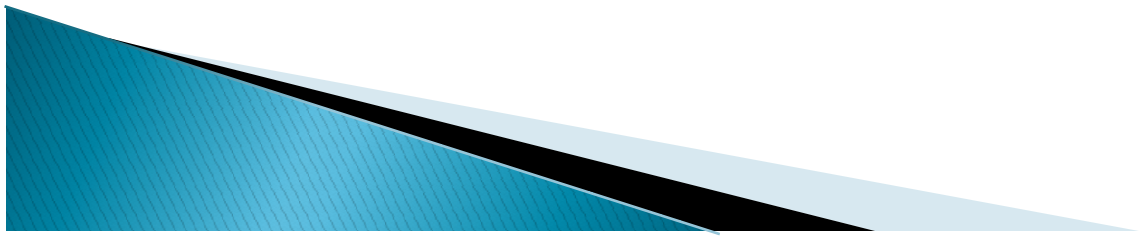
North East England: Issues

- 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



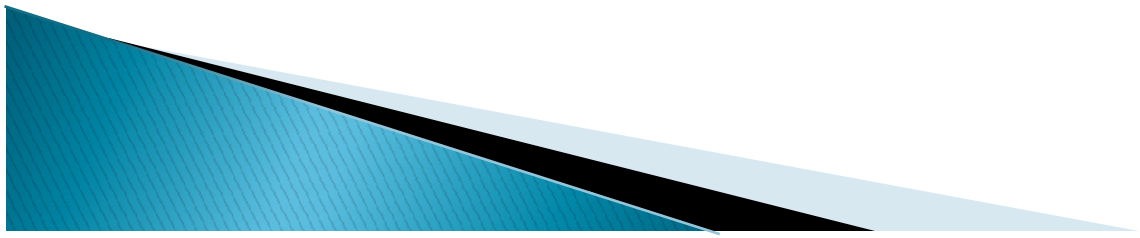
North East India: Issues

- 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



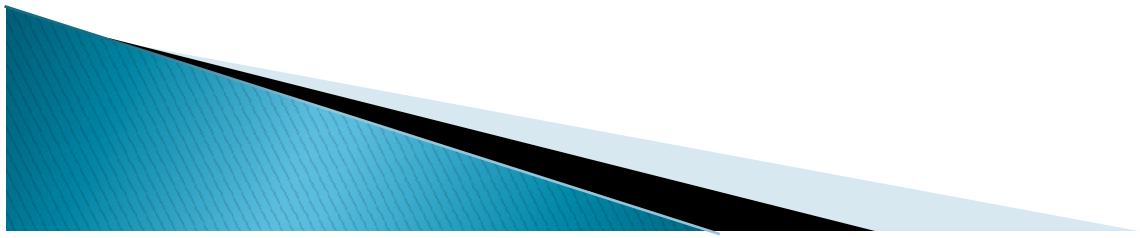
North East England: Solutions

- 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

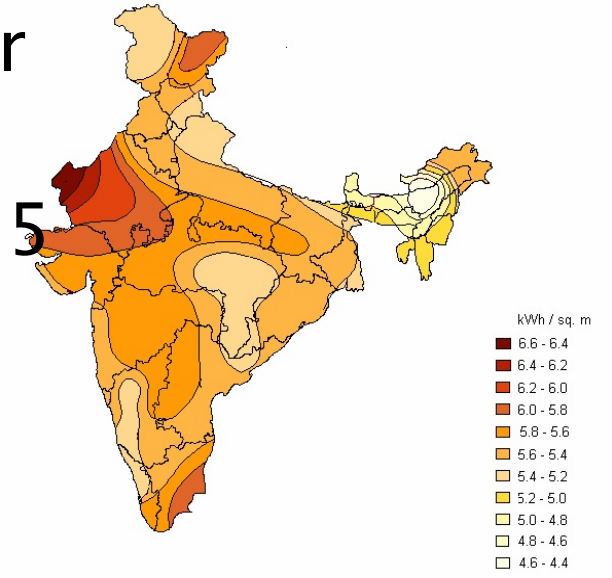


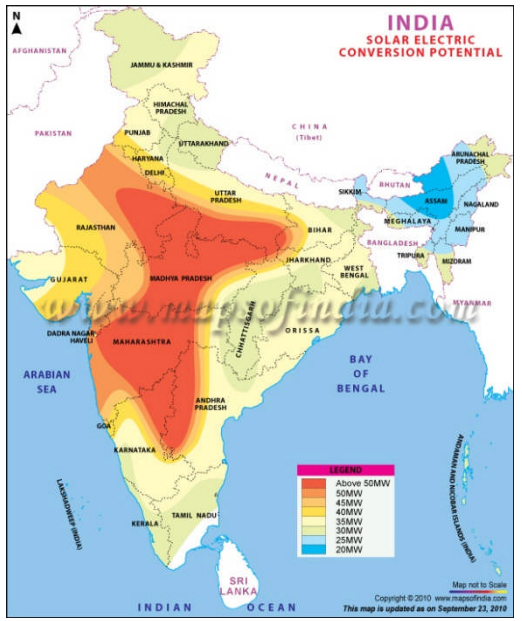
North East India: Solutions

- 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 (Jatropa) 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

State	Biomass Class	Area (kHa)	Power Potential (MWe)
Arunachal Pradesh	Agro	208.5	9.2
	Forest & wasteland	5467.4	846.3
Assam	Forest & wasteland	2676.8	339.4
	Agro	3460.3	283.9
Manipur	Agro	340.8	14.3
	Forest & wasteland	1260.9	116.8
Meghalaya	Agro	174.4	11.3
	Forest & wasteland	1532.6	157.6
Mizoram	Agro	19	1.12
	Forest & wasteland	1638.8	147
Nagaland	Agro	179.6	10
	Forest & wasteland	786.4	78
Sikkim	Agro	58	2.29
	Forest & wasteland	372.8	49.1
Tripura	Agro	9.5	2.94
	Forest & wasteland	831	95.7

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

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

Source: Indigenous forest stewarts of NE India, Mark Poffenberger et.al , 2007

North East India: Solutions – Biomass

- 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

India	UK
DIVERSIFICATION	
Privatisation	Competition
Investment	Investment
Local generation	Local generation
Education	Education