# Climate risk management in the power sector in India

## Learning from international practices

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**Acclimatise**

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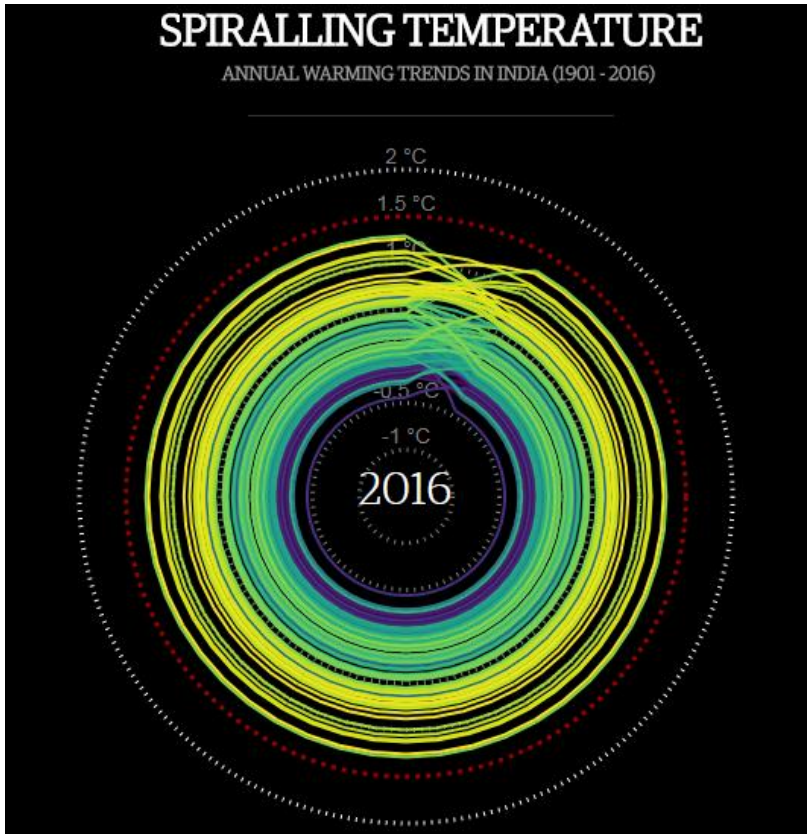
# Annual Warming Trends in India (1901-2016)




***Source: Centre for Science and Environment***

# Impact of climate change on the power sector

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Climate change can affect every aspect of the power sector value chain:

- Fuel extraction/production
- Transportation
- Electricity generation
- Transmission and distribution

Impacts on:

- Energy load trends
- Reliability of production and transmission
- Consumer demand
- Costs
- Valuation and viability of the sector

# Impact of climate change on the power sector

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**Rising temperature (and/or droughts)**

Increase in demand for cooling; impact on peak loads

Decreased water resource availability, affecting power production

Decreased efficiency of power generation

Uncertainty in generation from RE

Impact on minimum flow for run of the river hydel

Lower solar cell efficiency

**Extreme weather events: floods, landslides**


Damage to energy infrastructure and assets

Disruption in transportation of fuel (road and rail systems, pipelines)

Disruptions in transmission and distribution

Flooding of coal mines

**Erratic precipitation, runoff, increased siltation**

Reliability of hydropower generation

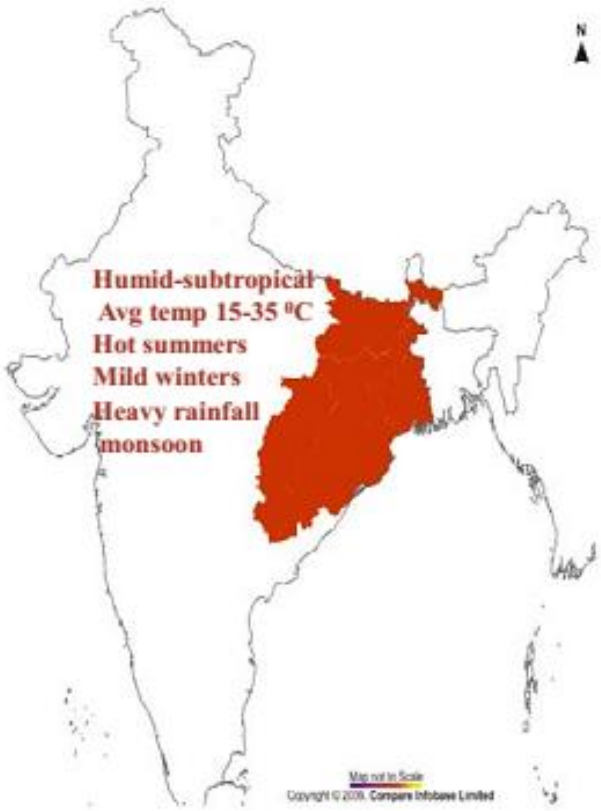
**Increased supply-demand gap requiring additional investments in energy assets and operations to maintain energy reliability**

# **Energy demand:** Changing seasonality

**Eastern India-Bihar (B), Jharkhand (J),West Bengal (WB) , Orissa (O) And Chhattisgarh (C)**

**Domestic** 18.8%

B-34%
J-10%
WB-26%
O-15%
C-9.3%




**Industry** 61%

B-31%
J-81%
WB-48%
O-74%
C-73%

**Commercial** 5.5%

B-8%
J-1.7%
WB-11.9%
O-4%
C-1.7%

**Agriculture** 5.6%

B-15.5%
J-0.4%
WB-3%
O-1%
C-8.7%

**Source:** *The Effect of Development on the Climate Sensitivity of Electricity Demand in India, Eshita Gupta, 2014. Indian Statistical Institute*

# Energy and water stress

With renewable water resources of some 1 130 cubic metres per capita in 2013, **India has now passed the defined threshold for 'water stress'**

- Major implications for the energy sector:
  - More than 70% of India's power plants are located in areas that are water stressed or water scarce (WRI, 2014)
  - India's warm temperatures and the poor quality coal used in the bulk of its power plants add to their cooling requirements.
  - Global climate change could exacerbate these stresses.

***Source:*** *Charles K. Ebinger, 2016. India's Energy and Climate Policy Can India Meet the Challenge of Industrialization and Climate Change? Brookings Policy Brief*

# Making a case for more investments in climate risk resilience in the power sector

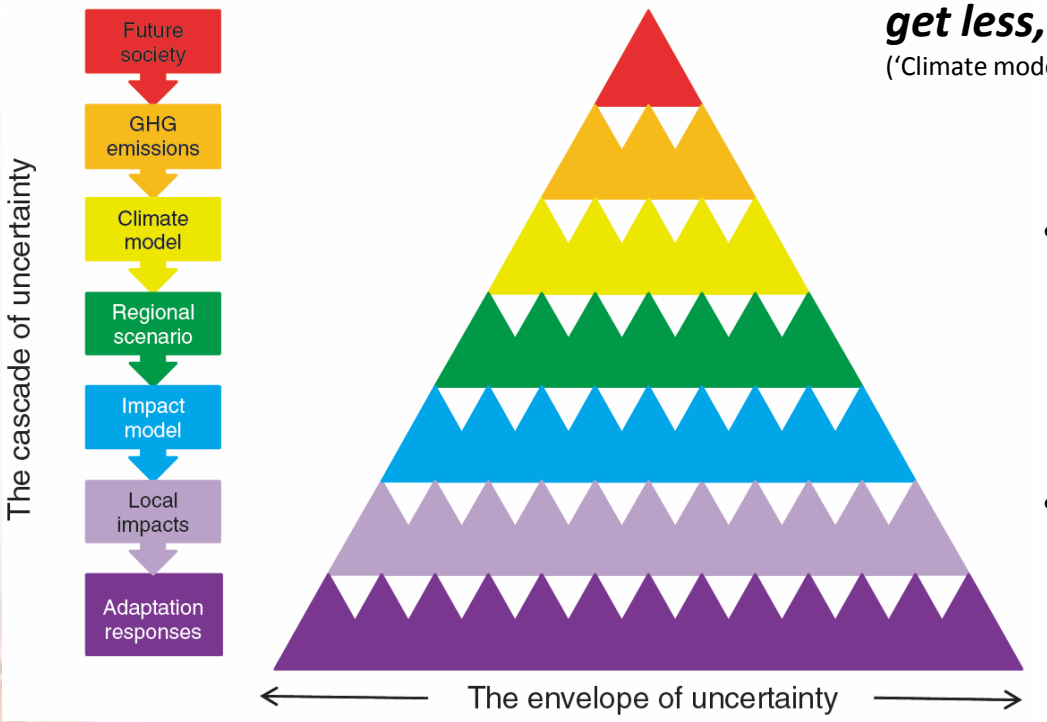
Estimated capital expenditure for climate change adaptation [since 2000 and planned to 2020s] for 6 large global power utilities = **$ 1.5 Billion**

- *China Light and Power (China)*
- *Electricité de France (France)*
- *E-ON (Germany)*
- *ESKOM (South Africa)*
- *Hydro-Québec (Canada)*
- *National Grid (United Kingdom)*

Estimates of repair costs for hurricane Isaac which hit United States in energy sector in four states (Arkansas, Louisiana, Mississippi and New Orleans) = **$400 million**

**Source: '**Climate Risk Management Approaches in the Electricity Sector: Lessons from Early Adapters' By Pierre Audinet, Jean-Christophe Amado and Ben Rabb

# Design for robustness against climate change uncertainties




***"Estimates of climate change impacts will get less, rather than more, certain".***

('Climate models at their limit?' Nature, Vol: 486)

- Designs should focus on robustness to today's and tomorrow's potential climate – not necessarily the 'optimal' solution
- Optionality is key

*Source: (Wilby and Dessai, 2010)*

# Planning for robustness against uncertainties

The development of flexible adaptation pathways, or “optionality” is very important. This includes identifying the following types of actions:

| | |
|---|---|
| No regret | Measures that are worthwhile now, delivering net socio-economic benefits which exceed their costs, and that continue to be worthwhile irrespective of the nature of future climate |
| Low regret | Measures for which the associated costs are relatively low and for which the benefits under future climate change may potentially be large |
| ‘Win-win’ | Measures which have other environmental, social or economic benefits as well as managing climate change |
| Flexible or adaptive | Measures that can be implemented incrementally, rather than through the adoption of ‘one-off’ costly adaptation solutions |

# Building resilience:

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- **Integrate climate resilience at policy and planning level**: Design and safety standards; permissions, siting and zoning; research and development; linking climate impacts with EIAs
- **Review of operations and contingency planning**: Thermal production, coal mining, hydropower, transportation
- **Climate resilient design and engineering**: While upgrading T&D infrastructure, construction of new plants
- **Diversify supply** of generation technologies
- **Improve efficiency** of generation, transmission & distribution
- Coordination between sector agencies and meteorological agencies to develop high-quality and tailored **climate data and information**.
- Improve **water-use efficiency** and management
- Build **institutional capacity**

# Incorporating climate risk management in business decisions and practices

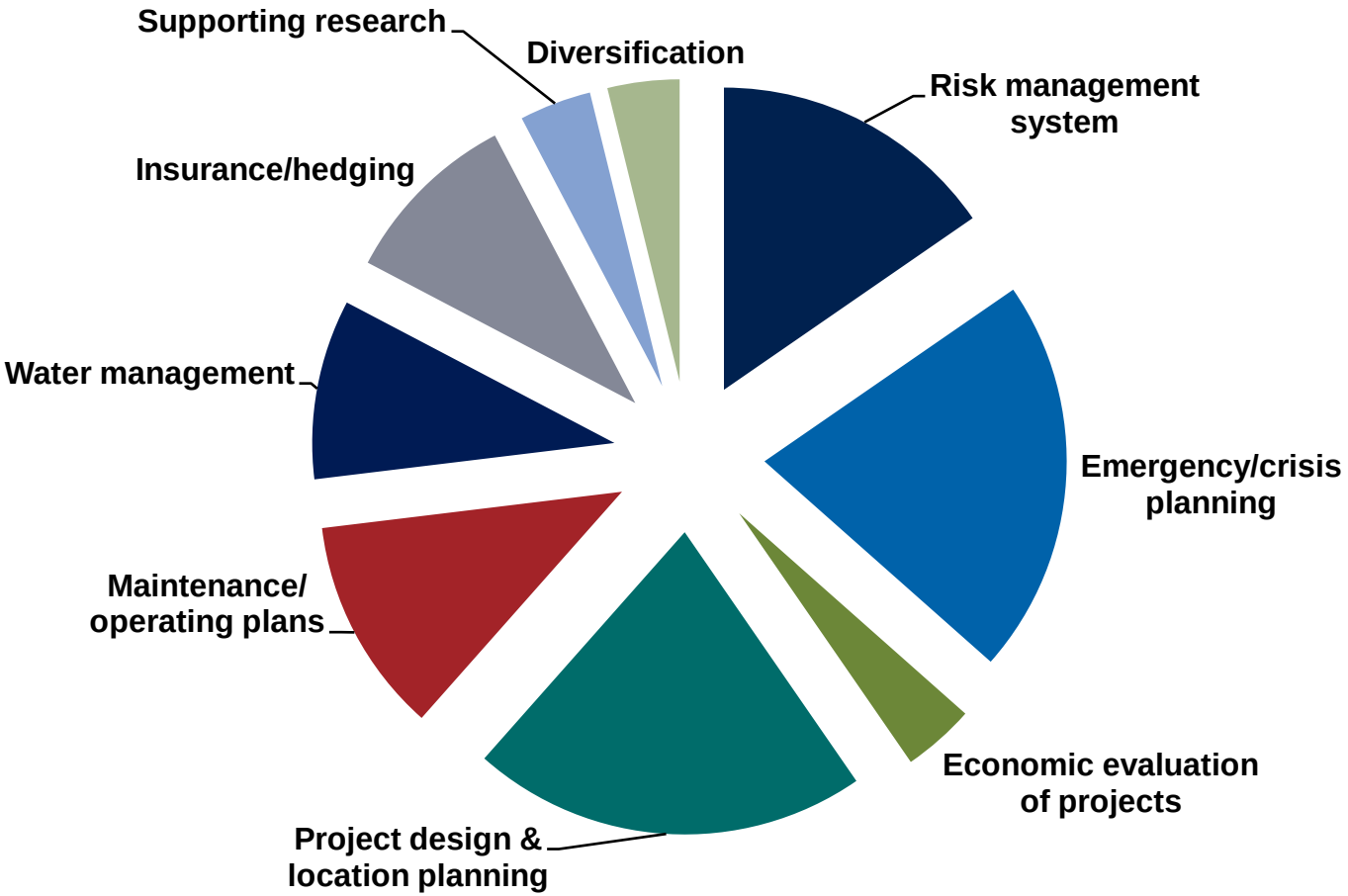
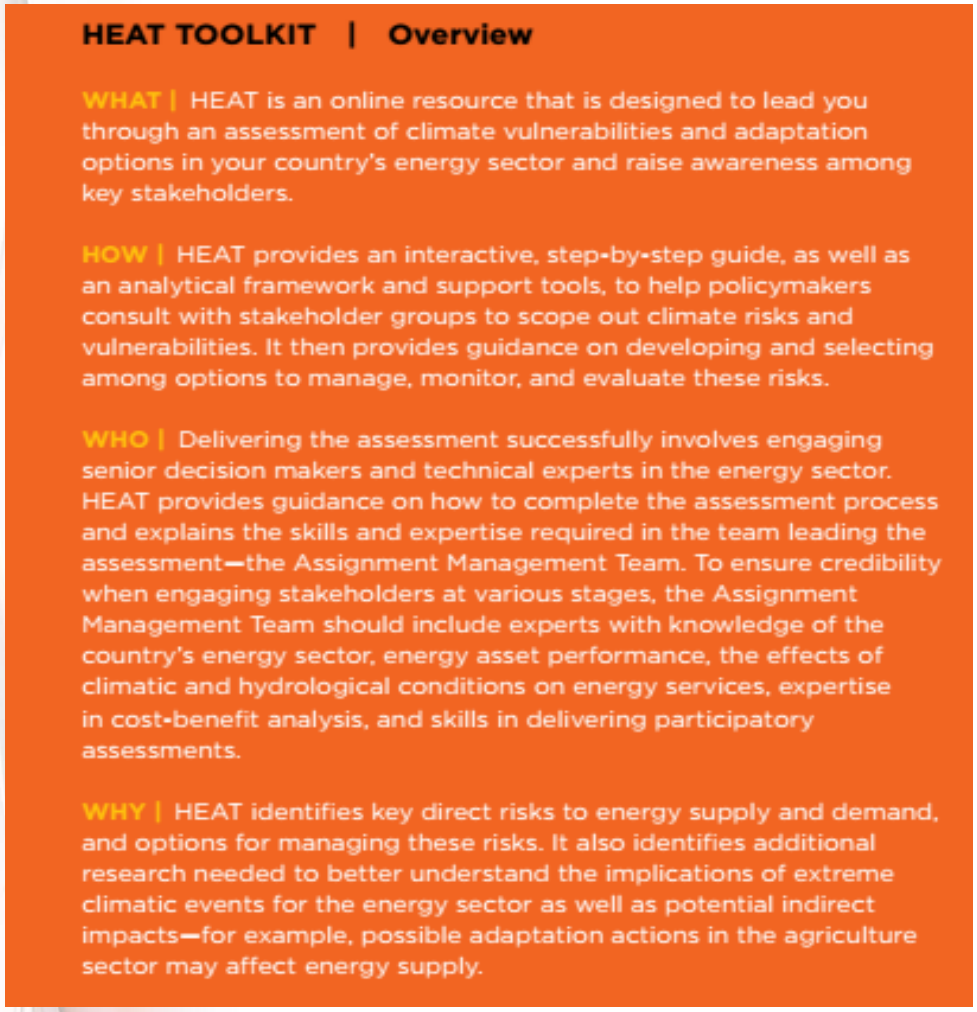



*Chart source: Michelle O'Keeffe, CDP, IPIECA workshop, 9 Oct 2012*

# Global interventions in the energy sector

## HEAT | Hands-On Energy Adaptation Toolkit



**HEAT TOOLKIT | Overview**

**WHAT |** HEAT is an online resource that is designed to lead you through an assessment of climate vulnerabilities and adaptation options in your country's energy sector and raise awareness among key stakeholders.

**HOW |** HEAT provides an interactive, step-by-step guide, as well as an analytical framework and support tools, to help policymakers consult with stakeholder groups to scope out climate risks and vulnerabilities. It then provides guidance on developing and selecting among options to manage, monitor, and evaluate these risks.

**WHO |** Delivering the assessment successfully involves engaging senior decision makers and technical experts in the energy sector. HEAT provides guidance on how to complete the assessment process and explains the skills and expertise required in the team leading the assessment—the Assignment Management Team. To ensure credibility when engaging stakeholders at various stages, the Assignment Management Team should include experts with knowledge of the country's energy sector, energy asset performance, the effects of climatic and hydrological conditions on energy services, expertise in cost-benefit analysis, and skills in delivering participatory assessments.

**WHY |** HEAT identifies key direct risks to energy supply and demand, and options for managing these risks. It also identifies additional research needed to better understand the implications of extreme climatic events for the energy sector as well as potential indirect impacts—for example, possible adaptation actions in the agriculture sector may affect energy supply.

- Climate Resilience in the **Power Sector: Turkey** - Risk Assessment and Investment Needs
- National Climate Change Adaptation Strategy and Action Plan – **Energy Sectoral Assessment for Bulgaria**
- Adapting vulnerable **energy infrastructure** to climate change in **Albania** and **Uzbekistan**
- Climate change **strategy review** for **ESKOM**, **South Africa**
- Climate risk and adaptation support for a global energy corporate
- Building climate resilience in **Mozambique's energy sector**
- Climate risk screening and management framework for **BP**
- Analysis of the vulnerability of energy infrastructure to the effects of climate change in **Kazakhstan, Kyrgyzstan** and **Turkmenistan**
- **Climate Change Risk Screening Tool** for an oil & gas major
- **Guidelines for project managers**: Making vulnerable investments climate resilient for the European Commission
- High-Level **Critical Infrastructure Risk Assessment** for the World Bank

# Initiatives for corporate disclosure of climate risk information

**Task Force on Climate-related Financial Disclosures** (TCFD)

1. Set up by the G20
2. Developed a voluntary framework for companies to disclose the financial impact of climate-related risks and opportunities
3. Support from more than 100 companies with $11 trillion of assets.
4. Demand from global investors, shareholders, and lenders for more meaningful and transparent climate-related financial information.
5. Recommendations for improving voluntary, consistent climate-related financial risk disclosures
6. Mainstream climate risk analysis and disclosure reporting requirements across all financial asset classes - and force a focus on climate resilience for underlying assets
(corporations, energy, agriculture, real estate, cities etc.)

# Context in West Bengal:

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- Energy demand is estimated to increase exponentially *(WB SAPCC)*:
  - 2.5 times by 2021
  - 3.5 times by 2031.
  - Peak demand is likely to increase by 1.5 times by 2031
- 96% of the current electricity generation is coal-based
- PFA Action plan '15-'19:
  - New projects in the pipeline *(pre-permit development/ construction stages)*
  - Repair & Maintenance of old generation units
  - Intra-state transmission projects
  - Energy efficiency plans
  - RE expansion

# Impact of climate change on electricity sector in WB

| Climate Change Indicators | Impacts on the Electricity Sector |
|---|---|
| Hydrological Variability (greater seasonal and year-to-year variability in | Variability in Hydropower generation |
| | Variability in water availability for Thermal |
| precipitation, more frequent and prolonged extreme events like drought or heavy rainfall) | Generation |
| | Biomass availability vulnerable to water cycle impacts affecting household energy security |
| | Could impact renewable generation potential, especially solar |
| | Threat of damage to infrastructure from extreme events |
| Increased Temperature | Impacts Hydropower generation in summer months |
| | Increased requirements of water for cooling in Thermal generation |
| | Increased need of energy in household sector for cooling |
| | Could impact renewable generation potential, especially solar |

# Impact of climate change on electricity sector in WB

- **Risk Assessment of energy sources, infrastructure and demand** – hydro, coal, gas, solar, wind, biomass, etc. – in anticipated climate change situations (variable rainfall, temperature, extreme events)

- **Identification and prioritization of adaptation strategies,** desilting in dams, relocation of selected infrastructure, strengthening

- **Include risk reduction elements as components of energy planning**, implement and review in real-time events; retrofit existing infrastructure

- **Incentives for off-grid** and standalone Decentralized Generation systems

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