ENERGISING DATA-DRIVEN POLICY MAKING AND INVESTMENT IN RENEWABLE POWER:
Lessons from India

CSTEP: Key Research Areas

Energy
- Renewables, Nuclear
- Smart Grid, Energy Efficiency

New Materials
- Energy Storage
- Rare-earth Elements

Urban Infrastructure
- Smart Cities
- Sanitation

Security Studies
- Tools for Disaster Management

Climate Policy
- Adaptation
- Green House Gas Mitigation

Governance: Initiated

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CSTEP: Select Policy Impact Examples

NITI Aayog
- Expert Group on Renewable Energy
- Energy Modelling – Scenarios for India's Energy needs (IESS 2047)
- Rare Earth and Energy Critical Elements
- Knowledge Partner for Smart Cities

Ministry of New and Renewable Energy
- Re-assessment of India's Wind Potential
- GIS-based Assessment of Suitable Renewable Energy Zones

Bureau of Energy Efficiency
- National Mission for Enhanced Energy Efficiency: PAT Scheme for Industry
- PAT Sectors: Cement, Iron & Steel, Refineries, Railways, Discoms

Govt. of Karnataka
- Technology Resource Partner to Government
- Roadmap for Karnataka's Power Sector
- Rooftop PV for Bangalore

India's Power Sector Targets

- 175 GW of Renewable Energy (RE) Capacity by 2022
    - 100 GW Solar (60 GW utility scale, 40 GW of RTPV)
    - 60 GW Wind
- Electricity for all 1.2 Billion People by 2019
- 40% Energy from Fossil-Free Sources by 2030
- 33 – 35% Reduction in CO_2 Intensity

*Transition towards a new low-carbon energy infrastructure*

India's Unique Challenges

Challenges

- Land Availability
- Grid Infrastructure Issues
  - 23% T&D losses
  - Tower collapses
- DISCOM Financial Crisis
- Power Theft
- Social Programs
- Evolving Market Mechanism
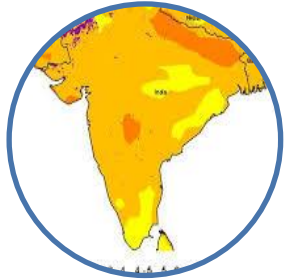
Power Sector Inefficiency

Power sector inefficiency: International comparison, 1980-2009

transmission and distribution losses as percent of power output
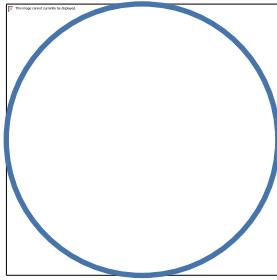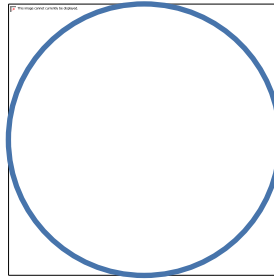

Source: World Bank, World Development Indicators
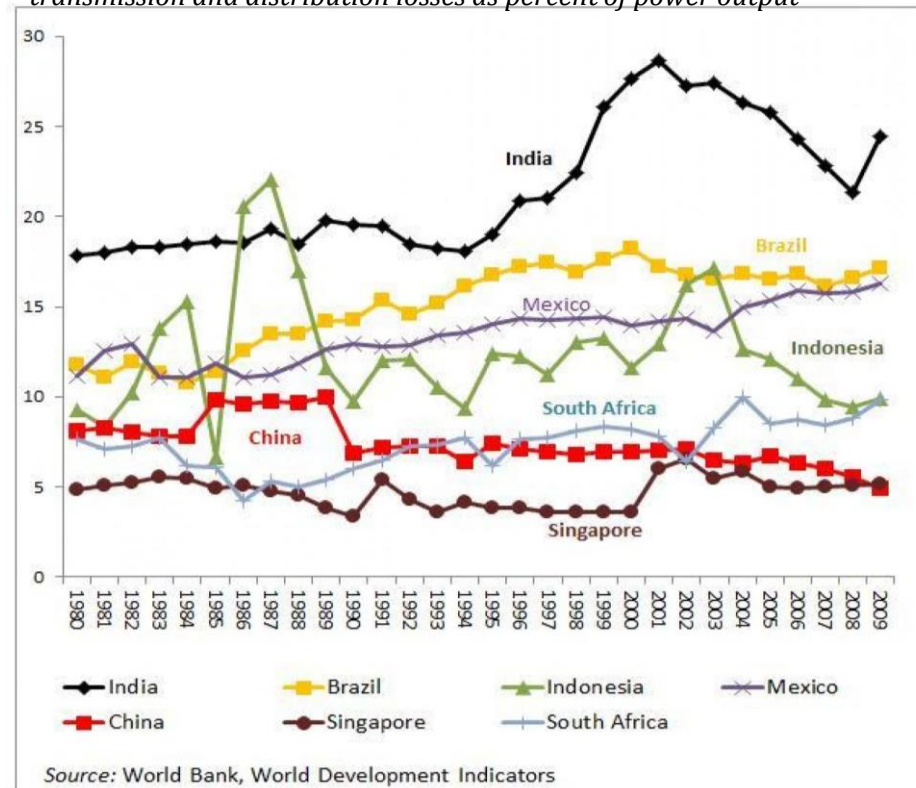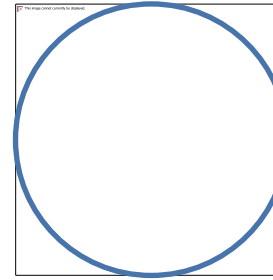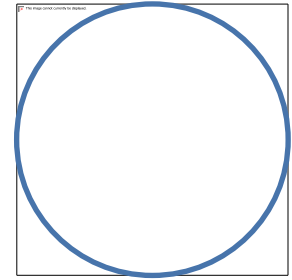
Resource Potential

Site Suitability

Evacuation Infrastructure

Intermittency & Storage

Engineering Economics

Opportunities in RE Planning

RE Planning

- Solar/Wind Estimated Outputs (Power and Energy)
- Co-location of Wind & Solar Sites for Hybrids
- Engineering-Economic Assessment of RE
- Power Flows and Visualization
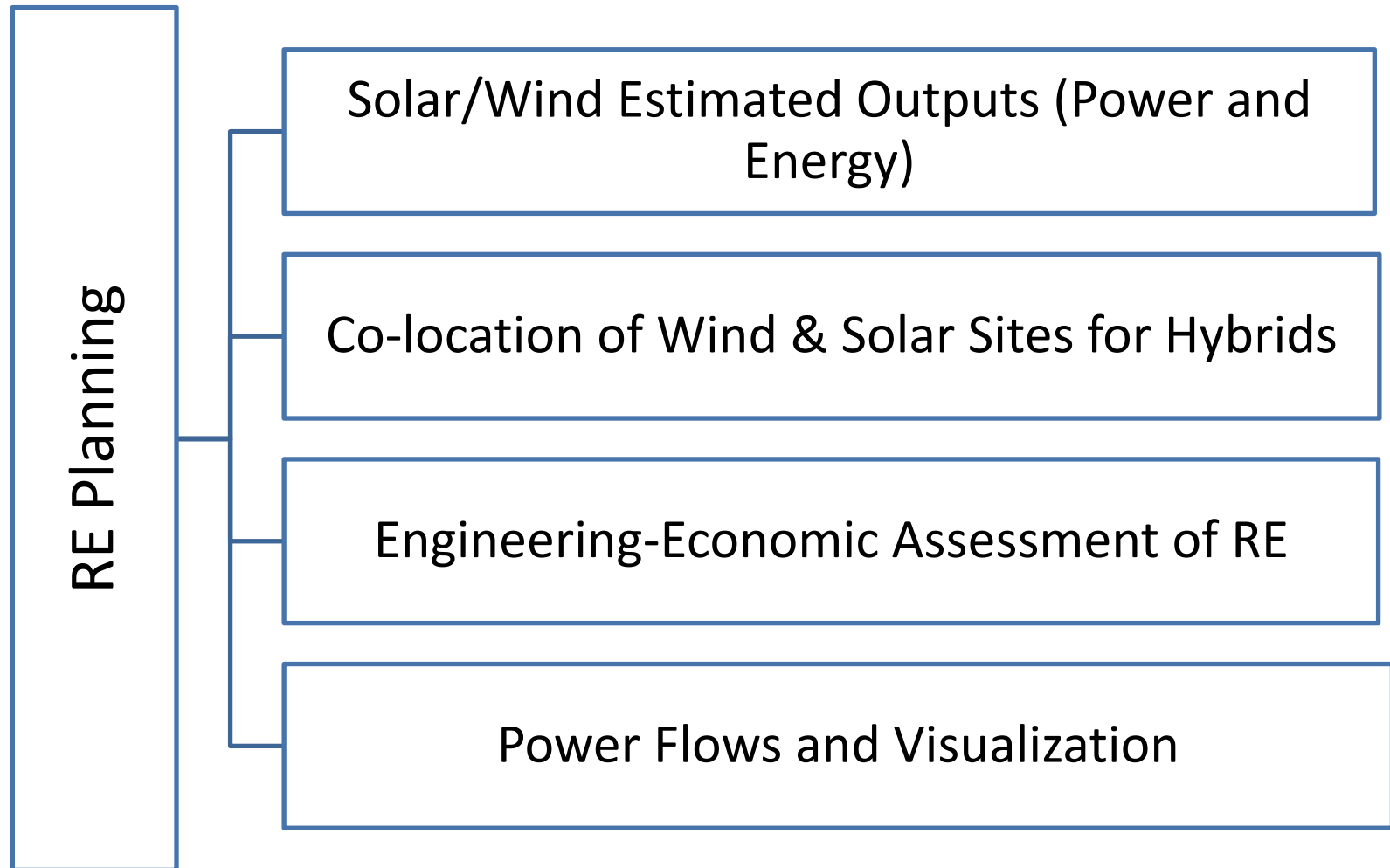
CSTEP's Site Selector for EGsT

Features

Illustration

Sensitivity Analysis

- Choice of Technology (PV/CSP)
- User Inputs
  - Capacity
  - Land utilization
- Choice of Sub-Technology
  - CdTe, Poly CSi, Cigs, Mono Csi
  - PT, ST, LFR

Location, site details

Plant layout

Weather inputs

Module datasheets

Financial inputs

PV model

Realistic solar power profiles

Plant area

Plant layout

Realistic CUF

Project cost, LCOE

# Utility Scale PV & Storage Analysis

- Analyse PV intermittency (site specific)

- Identify appropriate storage technology

- Calculate storage size
  - Adhering to CERC DSM regulations
  - Limit power fluctuations < ±15%

| Data analysis | PV plant modelling | Simulate PV power profiles | Choice of storage tech | Estimate storage size |
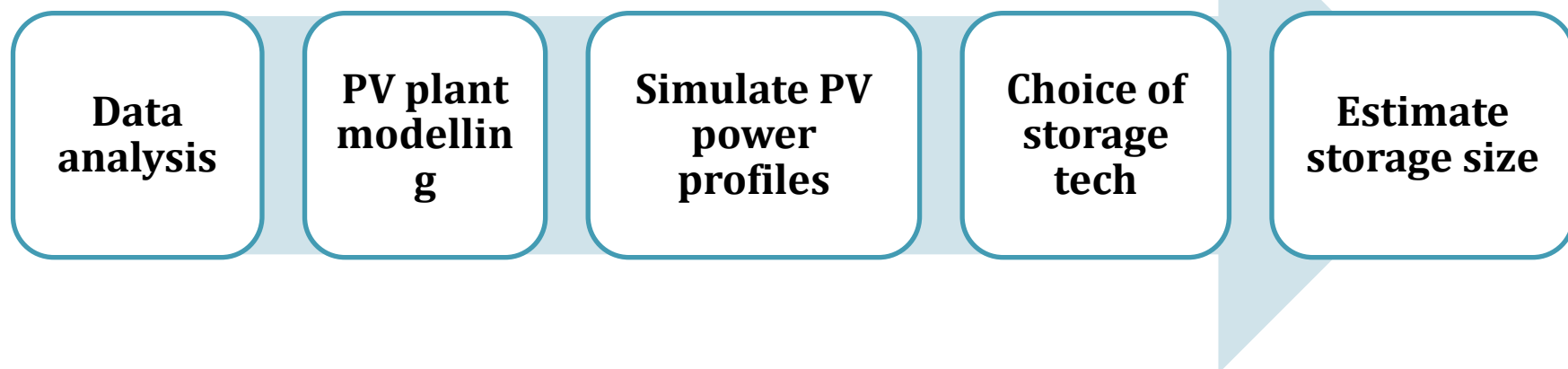
State/ National-Scale Energy Modelling

Supply-demand mismatch on sample days for the state of Karnataka, India
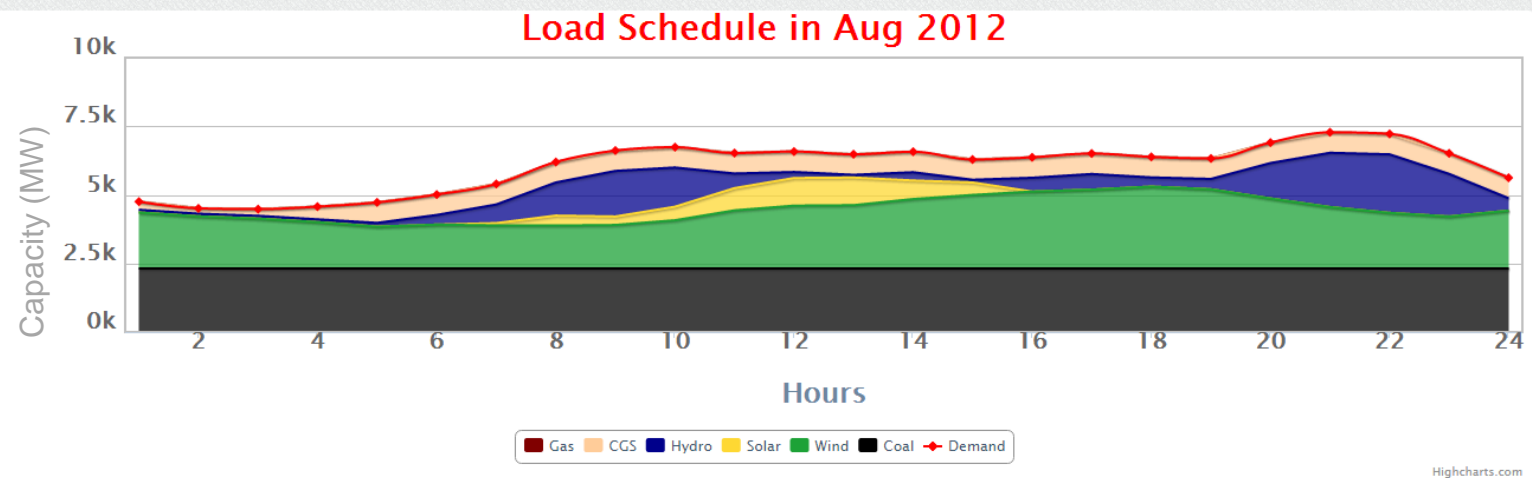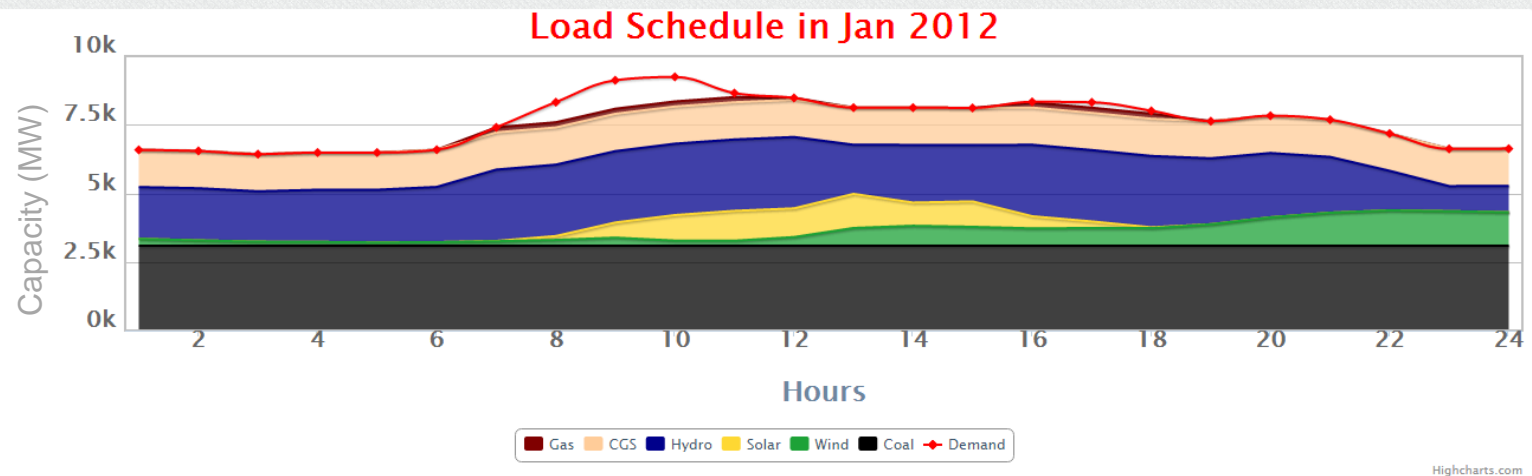
- ## Data Availability
  - Are the data required available? Are they cheap?
  - Has it been digitised?
  - Is it primary/secondary in nature?
- ## Data Quality
  - When were the data collected? Are they still valid?
  - Are the data accurate? Are they complete?
  - Are the data bankable?
- ## Data Maintenance
  - Collate from various sources
  - Convert into a meaningful database
  - Digitise and update the database

- Administrative Boundaries & PPAs
  - Deviation and payment settlement mechanisms have to be reworked
- Limited Information on Substation Capacities and Right of Way Access
- Incomplete Allocation Information
- Incorrect Topographical Analyses/Contour Mapping
  - Variation is high if incorrect

- Policy Impact
  - MNRE wind potential re-assessment
  - Offshore wind in India
  - RE Act and national wind mission
- Future Opportunities
  - Siting of RE micro-grids for remote/undeveloped villages
  - Electric vehicles: transport routes, power exchanges

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THANK YOU