ENERGY TRANSITION IN INDIA –
ISSUES & CHALLENGES

Conserving Now, Preserving Future

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Conserving Now, Preserving Future

CHARACTERISTICS OF INDIAN POWER SYSTEM

From deficits to surplus...
Striving to wipe out energy deficits & moving towards a power surplus scenario

Economic growth still dependent on electricity...
India’s GDP growth not yet decoupled with electricity growth

Changing nature of demand...
Macroeconomic changes leading to changes in demand profile as well as changing nature of demand spatially/temporally

Inching towards 100% electrification...
Long strides taken towards attainment of Universal Energy Access- on the last lap of marathon
Rapid Urbanisation
- India witnessing rapid increase in urbanisation
- National Urban Mission

Energy Efficiency ("NEGA-WATTS")
- Adoption of efficient industrial processes (PAT Scheme)
- Efficient household equipment (Star rating of various appliances) & efficient lighting (LED bulbs)
- Installation of efficient agricultural pumps

Rise of ‘Pro-sumers’
- With increase in reliance on captive power generation by residential/industrial/commercial consumers, reduction in demand for grid based power may occur

Rise in Transportation & Industrial Demand Expected
- E-mobility
- Electrification of Railways
- Push to industrialization through Govt initiatives like Make in India
India’s target of deploying 175 GW of RE by 2022:

- Implies an unprecedented level of scaling up for a country of this size & level of development
- Driven by inherent logic: economic competitiveness, energy security, air pollution abatement and climate change concerns

...comes with its own challenges & issues
Electricity Price most dominant concern in Indian power sector as large segments of population have low paying capacity & are supported by large subsidies...

... even though RES (solar) has witnessed substantial price reduction in recent times, uncertainty over grid integration & storage costs for supporting large share of RES
Doubling of historical investment in clean energy projects required over the next 5 years to achieve 175 GW target by 2022...

... requires investment level similar to annual investment witnessed by coal based power projects over 2010-16 period
**Significant flexibility required** with increased share of RES based power in grid...

**Flexibility constrained** due to India’s installed fleet having a high proportion of small rating coal sets based on subcritical capacity

... incorporating sufficient flexibility would require incentives for provision of balancing and ancillary services, providing significant retrofits in thermal fleet to make them more flexible and additional infrastructure in Transmission & Distribution
## BALANCING SYSTEM IN HIGH RE SCENARIO (II)

### Short term

<table>
<thead>
<tr>
<th>Measure</th>
<th>Cost</th>
</tr>
</thead>
<tbody>
<tr>
<td>Improving load forecasting</td>
<td>Low</td>
</tr>
<tr>
<td>Improving VAR RE forecasting</td>
<td>Low</td>
</tr>
<tr>
<td>Improve use of central plants for balancing</td>
<td>Low</td>
</tr>
<tr>
<td>Flexibilization of existing plants</td>
<td>High</td>
</tr>
<tr>
<td>Improve allocation of gas for balancing purposes</td>
<td>Medium</td>
</tr>
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### Medium term

<table>
<thead>
<tr>
<th>Measure</th>
<th>Cost</th>
</tr>
</thead>
<tbody>
<tr>
<td>Increase balancing area and enhance interstate exchange</td>
<td>Low/medium</td>
</tr>
<tr>
<td>Improve usage of hydro for balancing</td>
<td>Low</td>
</tr>
<tr>
<td>Increase transmission capacity</td>
<td>Medium</td>
</tr>
<tr>
<td>DSM</td>
<td>Low</td>
</tr>
<tr>
<td>Establish new flexible resources</td>
<td>Medium</td>
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</table>

### Long term

<table>
<thead>
<tr>
<th>Measure</th>
<th>Cost</th>
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<tbody>
<tr>
<td>Battery storage</td>
<td>High, but falling</td>
</tr>
<tr>
<td>Sector coupling</td>
<td>High</td>
</tr>
</tbody>
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Source: adapted from GIZ, 2016
CONCLUSIONS & WAY FORWARD

• India’s power sector is undergoing numerous, large-scale transformations as the country develops from a low base

• Aided by political vision and recent substantial technology learning, the sector is poised to embark on an unprecedented pathway of RE-based growth for the coming 10 years. No other country has leapfrogged directly into modern RE to such a degree: a new model is being experimented.

• The transformation requires management of several transition issues, in addition to the ‘everyday’ challenge of power system management in a developing country with limited capacities, institutional efficiencies as they exist, and limited capacity to pay

• In the longer-term, deep decarbonization must entail deployment of highly innovative, new technologies, given the constraints and limitations of current generation of RE technologies.