

United Nations Symposium on Hydropower & Sustainable Development

# The Way Forward For Hydropower Development: Perspectives from India

By

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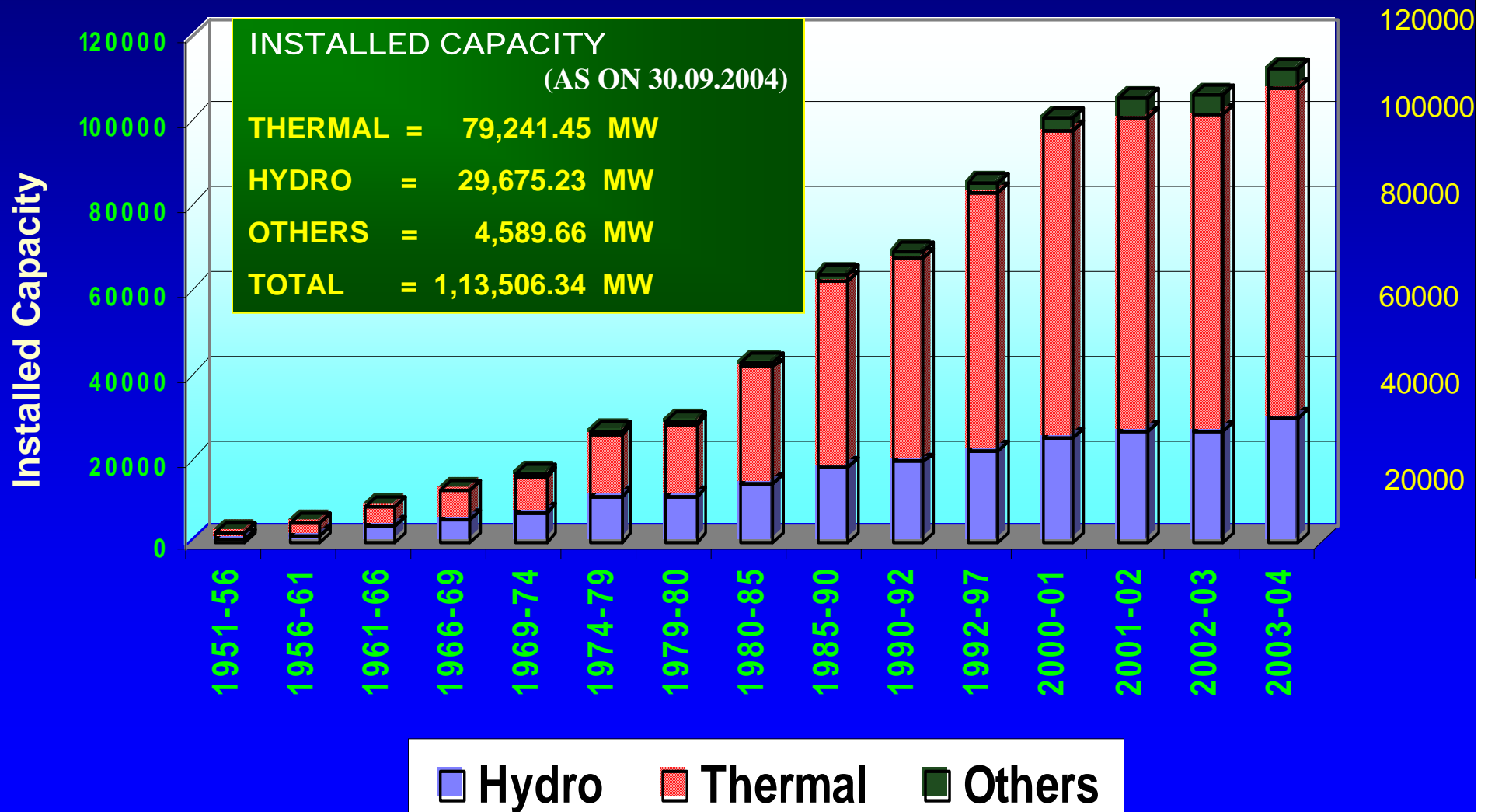
27<sup>TH</sup> OCTOBER 2004, BEIJING, CHINA

# INDIAN POWER SCENARIO

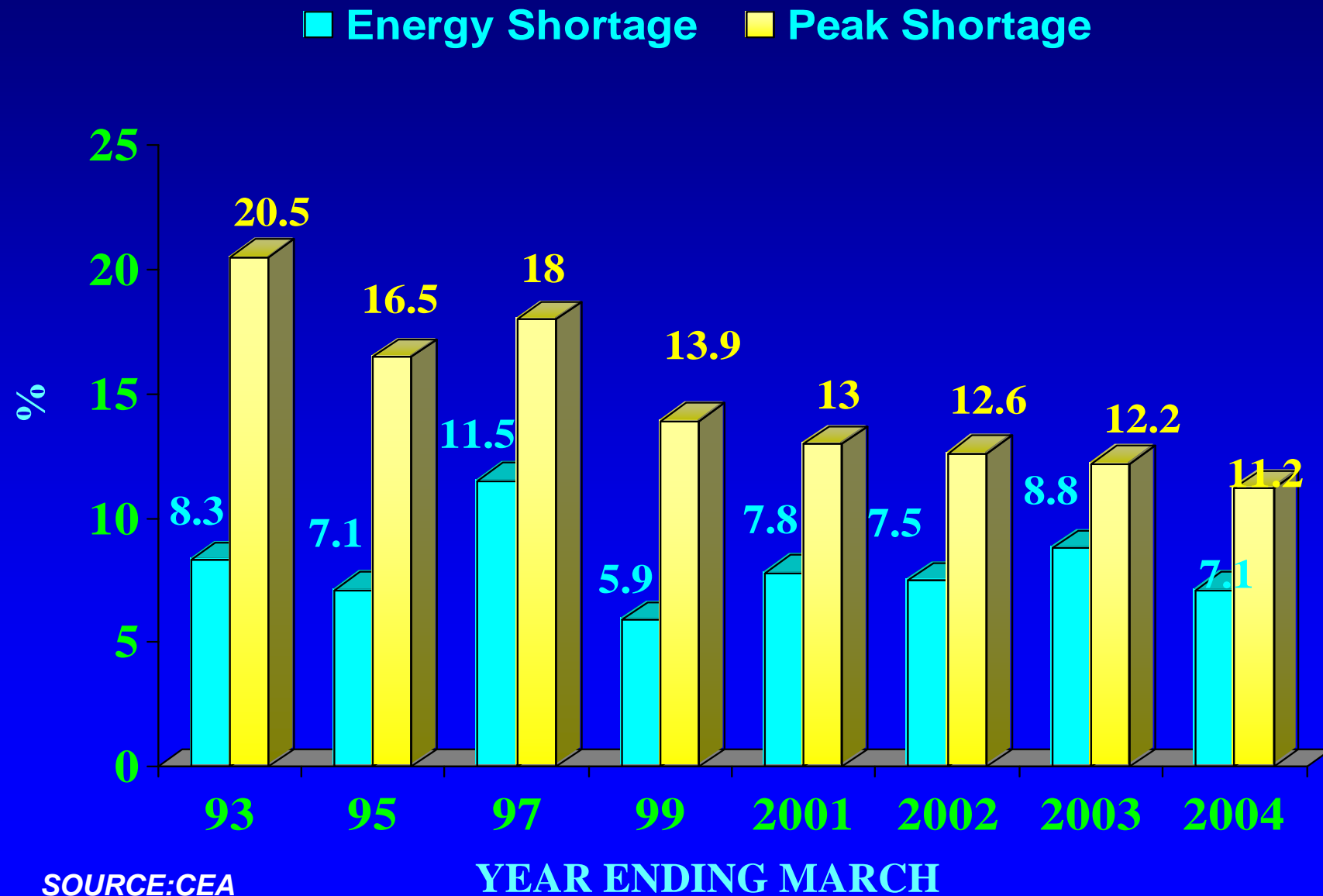
(AS ON 30.09.2004)

- **INSTALLED CAPACITY**    **1,13,506.34 MW**
- **GROSS GENERATION**    **519.398 BUs**  
(April 2003 - March 2004)
- **PEAKING DEMAND**        **84,574 MW**  
(2003-2004)
- **ENERGY SHORTAGE**        **7.1%**  
(2003-2004)
- **PEAKING SHORTAGE**       **11.2%**  
(2003-2004)

# GROWTH PROFILE OF INDIAN POWER SECTOR



# ALL INDIA DEMAND AND SUPPLY GAP



A scenic landscape featuring a calm lake in the foreground, reflecting the vibrant autumn foliage of a forest on the opposite bank. The trees display a mix of green, yellow, and orange hues. The sky is clear and bright. The overall scene is peaceful and picturesque.

# **Hydropower Development in India: A National Priority**

**Why?**

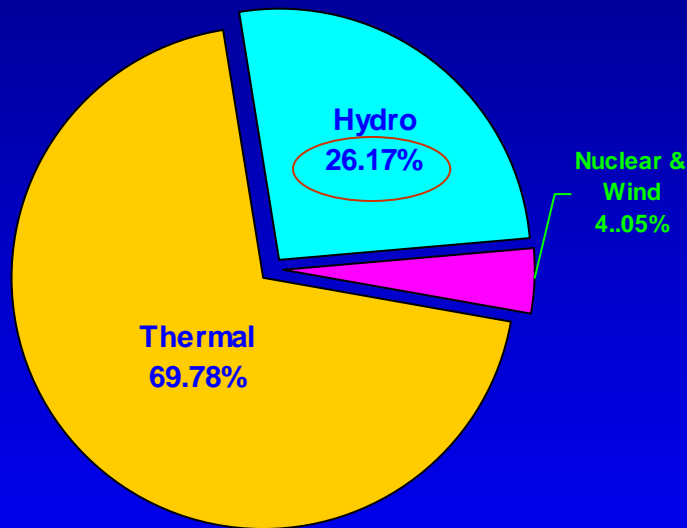
# PROJECTED POWER DEMAND IN INDIA RISING SHARPLY

REGION	ENERGY REQUIREMENT (Mkwh)		PEAK DEMAND (MW)	
	2006-07 End of 10th Plan	2011-12 End of 11th Plan	2006-07 End of 10th Plan	2011-12 End of 11th Plan
<b>NORTHERN REGION</b>	<b>220820</b>	<b>308528</b>	<b>35540</b>	<b>49674</b>
<b>WESTERN REGION</b>	<b>224927</b>	<b>299075</b>	<b>35223</b>	<b>46825</b>
<b>SOUTHERN REGION</b>	<b>194102</b>	<b>262718</b>	<b>31017</b>	<b>42061</b>
<b>EASTERN REGION</b>	<b>69467</b>	<b>90396</b>	<b>11990</b>	<b>15664</b>
<b>NORTH-EASTERN REG.</b>	<b>9501</b>	<b>14061</b>	<b>1875</b>	<b>2789</b>
<b>A&amp;N ISLANDS</b>	<b>236</b>	<b>374</b>	<b>49</b>	<b>77</b>
<b>LAKSHADEEP</b>	<b>44</b>	<b>70</b>	<b>11</b>	<b>17</b>
<b>ALL INDIA</b>	<b>719097</b>	<b>975222</b>	<b>115705</b>	<b>157107</b>
<b>INSTALLED CAPACITY REQUIRED (MW)</b>			<b>165293</b>	<b>224439</b>

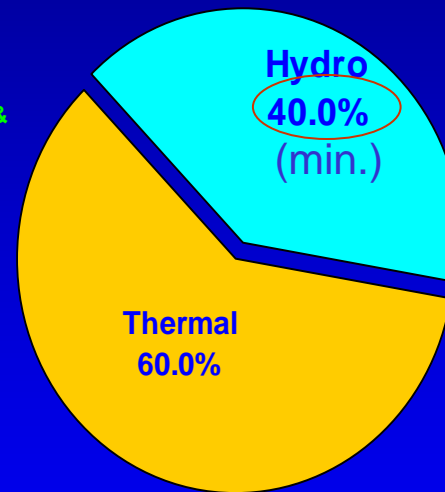
**SOURCE : 16<sup>TH</sup> EPS**

# POOR GENERATION MIX

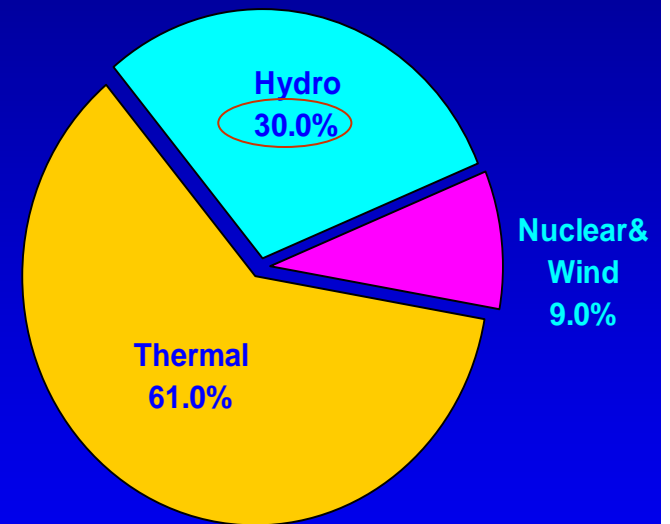
Today



Optimal



Year 2012



# IMPACT OF ADVERSE GENERATION MIX

- **PEAK SHORTAGES**
- **SYSTEM UNRELIABILITY / GRID INSTABILITY**
- **FREQUENCY EXCURSIONS**
- **FAST DEPLETING FOSSIL FUEL**
- **ENVIRONMENTAL ISSUES : CO<sub>2</sub> EMISSIONS**
- **FREQUENCY VARIATION DAMAGES THERMAL TURBINE PARTS AND ELECTRICAL APPLIANCES**



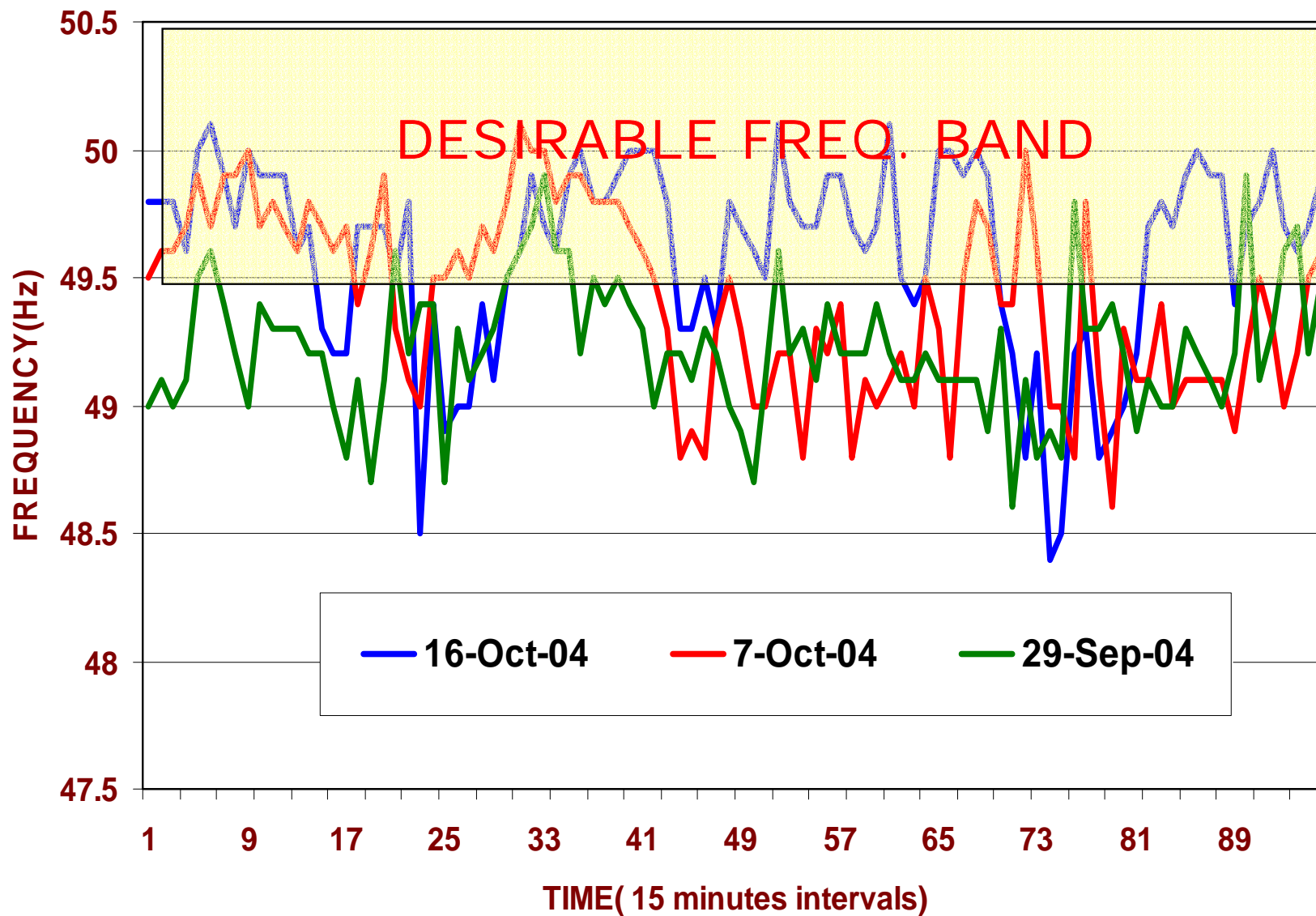
# FREQUENCY : FEATURES

- **RATED FREQUENCY OF POWER SUPPLY IN INDIA IS 50 Hz.**
- **FREQUENCY DEPENDENT ON LOAD CONNECTED TO GENERATION**
  - **OVER GENERATION LEADS TO “OVER FREQUENCY”.**
  - **OVER DRAWAL LEADS TO “UNDER FREQUENCY”.**
  - **FREQUENCY EXCURSION IN REGIONAL GRID “HIGH”**
  - **QUICK GENERATION ADJUSTMENT POSSIBLE IN HYDRO GENERATION.**
  - **THERMAL AND NUCLEAR STATIONS IDEALLY SUITABLE FOR BASE LOAD.**

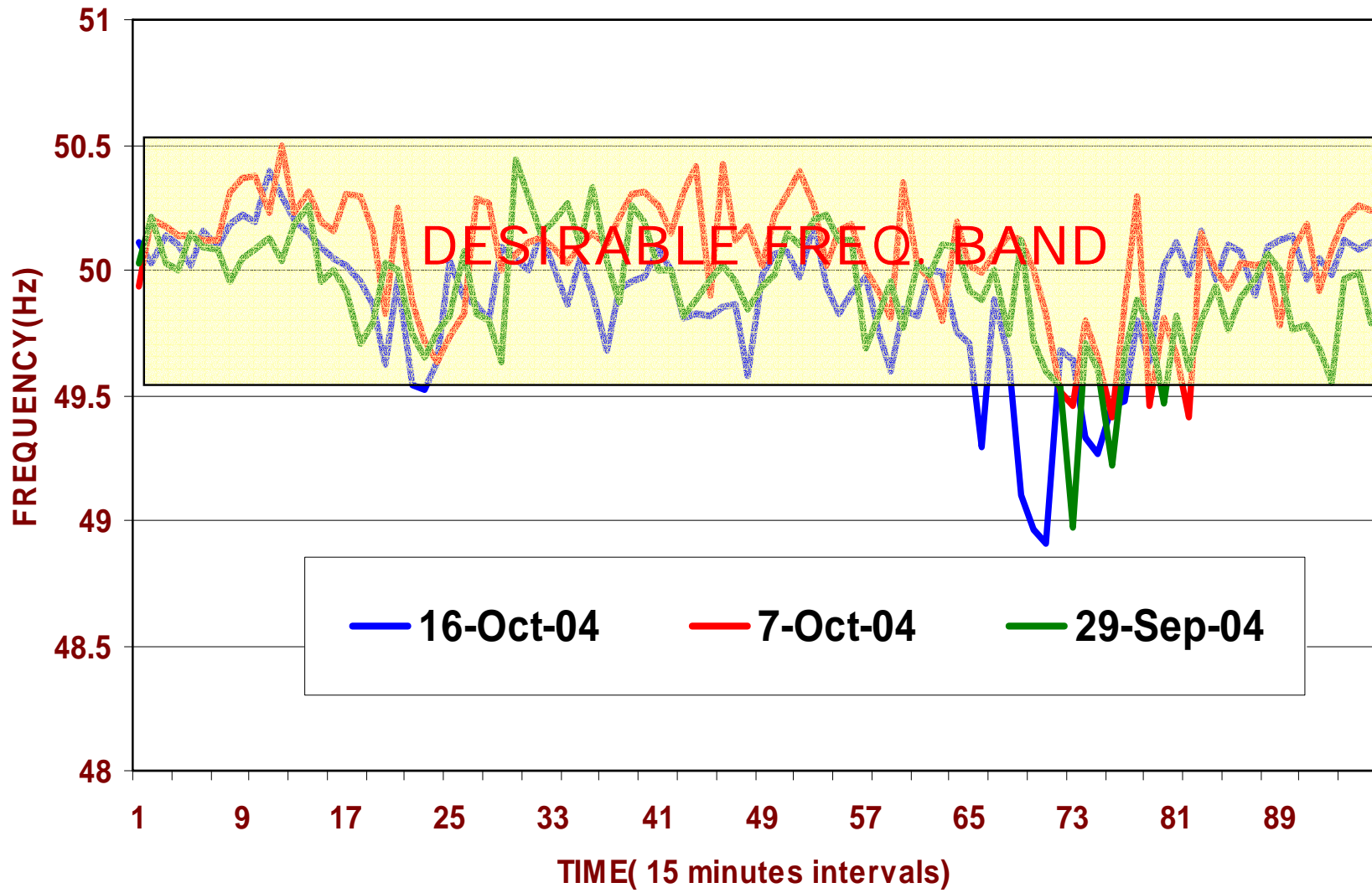
# FREQUENCY VARIATION : EFFECTS

- **EQUIPMENT FORCED TO WORK BEYOND ITS PERMISSIBLE OPERATING PARAMETERS.**
- **REDUCTION IN EFFICIENCY AND LIFE SPAN OF THERMAL GENERATION EQUIPMENTS.**
- **FREQUENT BREAKDOWNS AND HIGHER MAINTENANCE EXPENDITURE IN CASE OF THERMAL GENERATING EQUIPMENT.**
- **DAMAGE TO TRANSFORMERS.**
- **DAMAGE TO CONSUMER EQUIPMENTS.**
- **TRIPPING OF THERMAL MACHINES LEADING TO CASCADING AND EVENTUAL GRID FAILURE.**

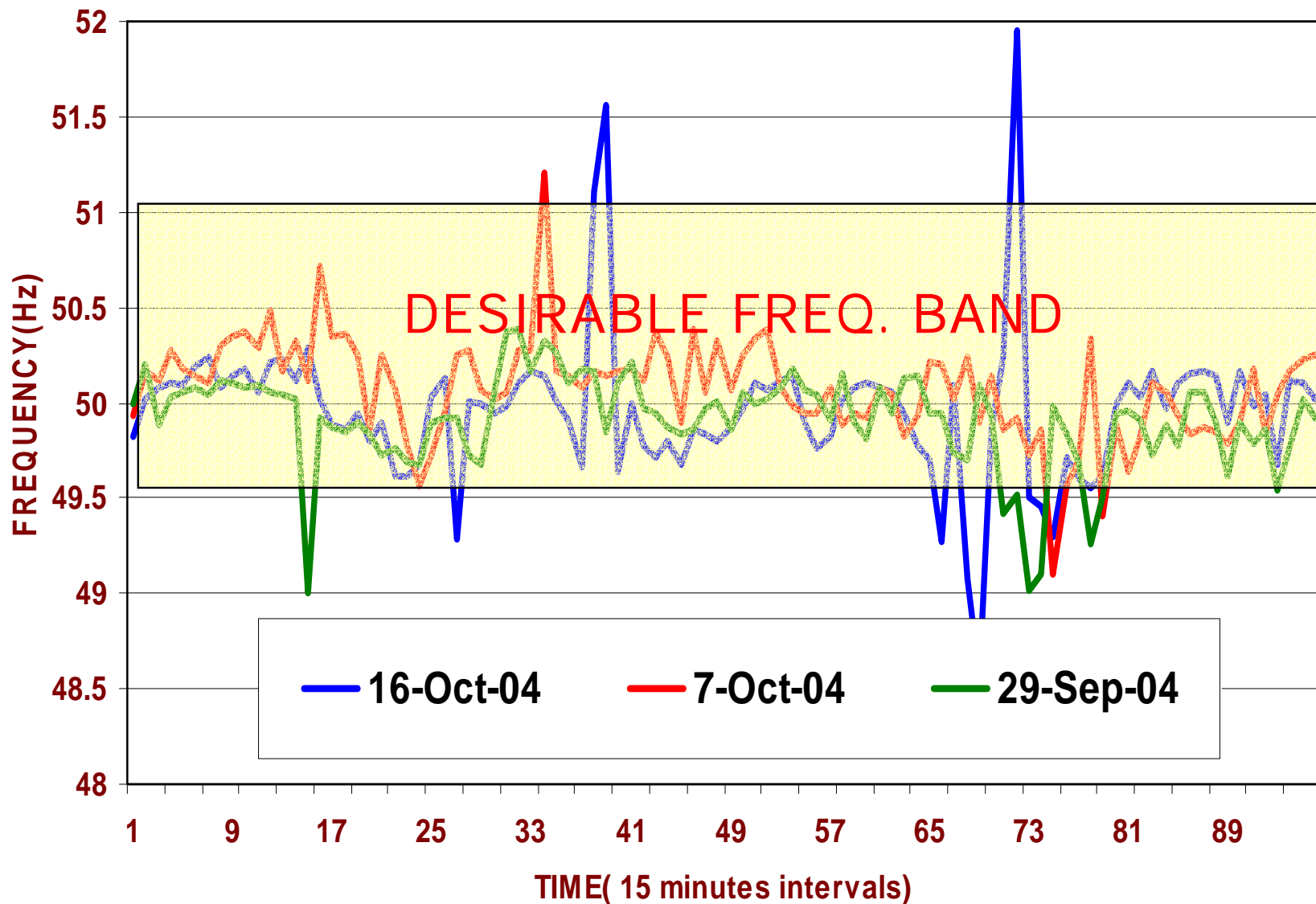
# FREQUENCY CURVES ON TYPICAL DAYS FOR NORTHERN REGION



# FREQUENCY CURVES ON TYPICAL DAYS FOR EASTERN REGION



# FREQUENCY CURVES ON TYPICAL DAYS FOR NORTHEASTERN REGION



# UNDER DEVELOPMENT OF HYDRO POWER SO FAR

As on 30.09.2004

Less than 20% of the total hydro potential developed so far.

## TOTAL POTENTIAL ASSESSED BY CEA

A)	AT 60% LOAD FACTOR	: 84,044 MW
	AS INSTALLED CAPACITY	: 1,48,701 MW
B)	PUMPED STORAGE SCHEMES	: 93,920 MW
C)	SMALL HYDRO	: 6782 MW
	<b>TOTAL</b>	<b>: 2,49,403 MW</b>
	<b>INSTALLED CAPACITY DEVELOPED</b>	<b>: 29,675.23 MW</b>
	<b>UNDER DEVELOPMENT</b>	<b>: 12,928.00 MW</b>

SOURCE: CEA

# REGION-WISE HYDRO POTENTIAL & DEVELOPMENT

As on 30.09.2004 (In MW)

REGION	POTENTIAL ASSESSED	POTENTIAL DEVELOPED	BALANCE %
North Eastern	58596	1133.93	98.06
Northern	53405	10596.57	80.16
Eastern	10965	2459.51	77.57
Western	8928	5152.13	42.85
Southern	16446	10327.84	37.20
<b>Total</b>	<b>148700</b>	<b>29675.23</b>	<b>80.08</b>

SOURCE : CEA

\* Besides this A&N island is having an installed capacity of 5.25MW



The Changing Scenario:

Brightening future of  
Hydropower  
Development in India

min



# INITIATIVES FOR HYDRO POWER DEVELOPMENT

- **OPENING OF POWER SECTOR FOR PRIVATE PARTICIPATION IN 1991.**
- **TARIFF ORDER OF 1992 AND SUBSEQUENT AMENDMENTS**
- **CENTRAL ELECTRICITY REGULATORY COMMISSION (CERC) ACT 1998**
- **ANNOUNCEMENT OF FIRST HYDRO POLICY IN 1998.**
- **RANKING STUDY BY CENTRAL ELECTRICITY AUTHORITY (CEA) IN OCT' 2001, PRIORITIZING HYDRO SCHEMES**
- **INTRODUCTION OF THREE STAGE CLEARANCE PROCEDURE FOR FASTER IMPLEMENTATION.**

# INITIATIVES FOR HYDRO POWER DEVELOPMENT

- **IMPLEMENTATION OF AVAILABILITY BASED TARIFF (ABT) FROM DEC' 2002.**
- **ENACTMENT OF THE ELECTRICITY ACT 2003.**
- **50,000 MW HYDRO POWER DEVELOPMENT INITIATIVE LAUNCHED BY GOVT. OF INDIA IN MAY 2003.**
- **NATIONAL POLICY FORMULATED TO STREAMLINE THE RESETTLEMENT & REHABILITATION (R&R) ASSOCIATED WITH HYDRO PROJECTS.**

# HYDRO POWER POLICY

## – HIGH SPOTS

- **EMPHASIS ON BASIN DEVELOPMENT**
- **RATIONALISATION OF HYDRO TARIFF:**
  - ✓ **SALE RATE OF SECONDARY ENERGY AS THAT OF PRIMARY**
  - ✓ **NORMATIVE MACHINE AVAILABILITY REDUCED TO 90%**
  - ✓ **PROPOSAL TO ALLOW PREMIUM ON SALE RATE OF PEAK POWER**
- **SURVEY & INVESTIGATION ADOPTING MODERN TECHNIQUES & PREPARATION OF BANKABLE DPRs**
- **DEEMED GENERATION ALLOWED LIMITED TO DESIGN ENERGY**
- **SIMPLIFIES PROCEDURE TO TRANSFER CLEARANCES OF APPROVED PROJECTS IN FAVOR OF IPPs**
- **COMPENSATION TO DEVELOPER FOR INCREASE IN COST DUE TO GEOLOGICAL SURPRISES BASED ON RECOMMENDATION OF EXPERT COMMITTEE**
- **RESTART AND ACTIVATE LANGUISHING HYDRO POWER PROJECTS**

# ACCELERATED HYDRO DEVELOPMENT THROUGH THREE STAGE CLEARANCE

- **Three Stage development introduced to reduce time and cost overrun, and better project management.**
- ✓ **Stage – I : Survey & Investigation and Preparation of Pre-feasibility Report.**
- ✓ **Stage – II : Preparation of Detailed Project Report, Environment Clearance, Development of Infrastructure.**
- ✓ **Stage – III: Investment decision, Actual implementation of the project.**

# 50,000 MW HYDROELECTRIC INITIATIVE

- **During May 2003, Government of India took major initiative to develop the vast unharnessed hydro potential available in the country.**
- **50,000 MW Hydro Initiative was launched under which 162 schemes spread across 16 states of India were identified for PFR preparation by central agencies.**

# 50,000 MW HYDROELECTRIC INITIATIVE

## *STEPS INVOLVED FROM SUBMISSION OF PFRS TO EXECUTION STAGE*

- **Approval of CEA on PFR/Viability of Project**
- **Agency to Prepare DPR**
- **DPR to be approved**
- **Selection of Executing Agency**
- **Approvals/Clearances**
- **PIB/CCEA**
- **Execution/Financing – Average completion time 5 Years.**

# HYDRO POWER DEVELOPMENT IN INDIA – OTHER INITIATIVES

- **Hydropower has been accepted as national priority due to poor hydro:thermal mix.**
- **Special Emphasis on development of huge unharnessed hydro potential in the socio-economic backward area of North eastern India.**
- **Mega Project policy in place for reducing capital cost of hydro project of more than 500 MW capacity.**
- **Government has appointed high level committee headed by Hon'ble Prime Minister of India for monitoring of all infrastructure projects and resolving inter-ministerial bottlenecks.**

# HYDRO POWER DEVELOPMENT IN INDIA – OTHER INITIATIVES

- **Central Electricity Authority, out of prepared Preliminary Feasibility Reports (PFRs) of 147 hydroelectric projects located in 16 states with total installation of 40,427 MW have identified 68 hydro electric projects with an aggregate installation of 26,819 MW with tariff below Rs.2.50 per unit (5.43 Cents/Kwh). These projects are to be taken up for implementation on priority basis.**
- **World bank keen on funding of hydro Projects in India viewing efficient execution of projects by Indian Central Sector Companies like NHPC.**
- **Ratio of Hydro:thermal mix is expected to become 29:71 by the year 2017.**





**Enhancing Economic  
Viability of  
Hydropower Schemes  
through various  
Initiatives**

## Steps towards Enhancing Economic Viability of Hydro Schemes

- **Government keen on private sector participation in funding & execution of hydro projects- Policy initiatives underway.**
- **Benefits of mega power policy extended to all hydro projects which was earlier limited to projects above 500 MW.**
- **Reduction of Excise duty on steel and cement.**
- **Policy decision regarding rationalization of wheeling charges for North-eastern region projects.**

# Steps towards Enhancing Economic Viability of Hydro Schemes

- **Restructuring hydropower tariff for better incentive.**
- **Continue budgetary support for hydropower projects.**
- **More emphasis for clearance of projects within a stipulated time frame and strict monitoring mechanism in place ensuring no Time & cost Overruns.**

## Steps towards Enhancing Economic Viability of Hydro Schemes

- **Separate funding mechanism for various stages of hydropower project development to attract private investment.**
- **Financial restructuring of state electricity boards for ensuring timely returns.**
- **More public awareness about benefits of hydropower development to avoid any delay due to conflicts with locals.**

# FUTURE HYDRO POWER CAPACITY ADDITION PLAN IN INDIA

PLAN	TOTAL ADDITION (MW)	HYDROPOWER CONTRIBUTION (MW)	FUND REQ. (MILLION USD)
10 <sup>th</sup> Plan (2002-07)	41110	14393	14393
11 <sup>th</sup> Plan (2007-12)	66653	20000	20000
12 <sup>th</sup> Plan (2012-17)	58000	26000	26000
<b>TOTAL</b>	<b>165763</b>	<b>60393</b>	<b>60393</b>

- Of the Total Capacity Addition more than 36% will be in the form of Hydropower
- Cost of capacity addition is taken as approximately 1.00 Million USD per MW

# CONCLUSION

- *Need has been recognized for accelerated hydropower development in India.*
- *80% of the existing hydro potential is still unharnessed.*
- *Major Indian hydropower companies like NHPC, NHDC executing world class hydro projects ahead of Schedule.*
- *Financing of hydro projects has become comparatively easier with better credit ratings for hydro companies.*
- *Hydropower development is the most effective tool for the Indian grid to meet the growing energy demand and enhance system stability.*

THANK YOU