

Current Research Trends Addressed in India

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Overview

- Introduction
- Current research trends in India
 - Electronics and ICT

Introduction

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- Indian citizen wants (which drive many R&D):
Good quality, durable and affordable (cost of device and operation) Systems
 - Above points are true for majority part of world

Introduction

- Scientific temper: is an attitude which involves the application of logic and the avoidance of preconceived notions. It is thus necessarily open — admitting every point of view. Elements of fairness, equality and if we want a better vibrant country, then each one of us have to have scientific temper built into our thought process.
- Looking forward to a better future, it is interesting to observe, "To develop scientific temper" it has been put into our fundamental duties of the Indian citizens, as per article 51A of the Constitution of India.

Research Trends in:
Electronics and Information
Communication Technology (ICT)

Electronics

- Govt. of India Revised its Electronics Policy in 2012 – to encourage R&D and Industry promotion
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- Some of the Key areas
 - Development in Nanotechnology,
 - Medical Electronics,
 - Microelectronics,
 - Industrial Electronics
 - Consumable electronics
 - Mechatronics (Robotics, Automobile, etc.)
 - IC Design
 - Embedded Systems

Electronics (Contd.)

- Govt. of India Revised its Electronics Policy in 2012 – to encourage R&D and Industry promotion
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- The major R&D Sections Under Electronics of Govt. of India
 - Nanotechnology
 - Electronics Systems Development & Application
 - Electronic Materials & Components
 - Microelectronics
 - Semiconductor ICs Layout Design

ICT Areas

- Organizations Requirement
 - Software Process Optimization
 - Hardware Process/Requirement Optimization
 - Testing
 - Low Powered and Cost communication/computing
 - Big data analysis, etc.

ICT (Contd.)

- National Information Infrastructure (NII 2.0):
 - We have existing Networks (NKN, SWAN, NICNET, etc.) and Databases (SDC, Different Depts. DBs, etc.)
 - Next Generation Networks: to integrate existing networks and make a Super Highway for Information
 - Integrate all the existing and futuristic Databases to make a Master Cloud (High Performance Computing and Communication)
 - How to populate UID-AI information in existing databases
 - Security and Privacy
 - IT Infra Management of NII 2.0

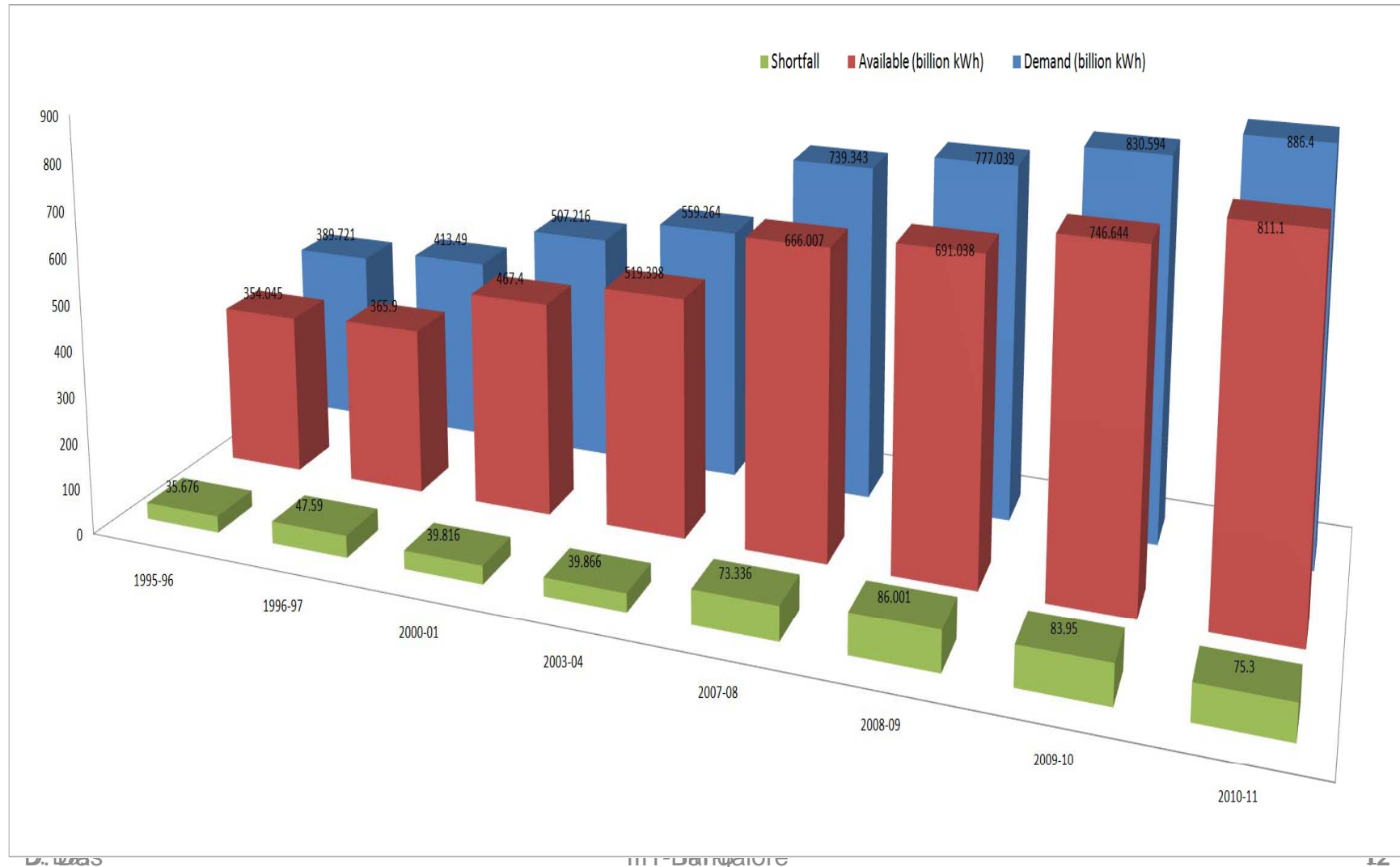
Convergence Communications & Broadband Technologies

- Mobile Penetration -- numerous services and applications would evolve around the following: Broadband Access Network, Mobile and Wireless Network, Broadband Transport Network, CPE & Terminals, Management of Services and Network, Multimedia & Content and Security

Convergence Communications & Broadband Technologies (Contd.)

- Software Defined Radio, Cognitive Radio including white spaces (Spectrum reuse)
- Femto Cell, Research in 4G/5G (for Rural and Urban Communication)
- Green Communication/Computing for ICT (for UE and Base Station, computing)
- Wireless sensor networks
- Software Defined Network (SDN) – Control Plane design and optimization, Management
- Machine to Machine (M2M) Communication: Standardization for heterogeneous communication
- Convergence of wireless networks – Performance during Mobility and Low Power Consumption
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- Localization of human or any object accurately by very low cost – Emergency call and disaster Management
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- Development of IP based products/services & Low Cost Broadband Internet access devices

Power Situation in India



Challenges of Power Saving in Base Station → With

Power Availability for Tower Sites

Cell Sites	EB Availability	Description
10%	>20 hrs	Mainly metro cities of Mumbai, Kolkota, Chennai, some cities of Gujarat, State of Chattisgarh, some cities of Punjab
20%	16-20 hrs	Covers most other major cities and towns in the rest of the country
30%	12-16 hrs	All semi-urban and small urban towns in all states
25%	8-12 hrs	Mostly rural areas
15%	<8 hrs Off grid	Mostly parts of Bihar and some towns of Assam, NE states, UP and J&K

Source: Intelligent Energy Limited



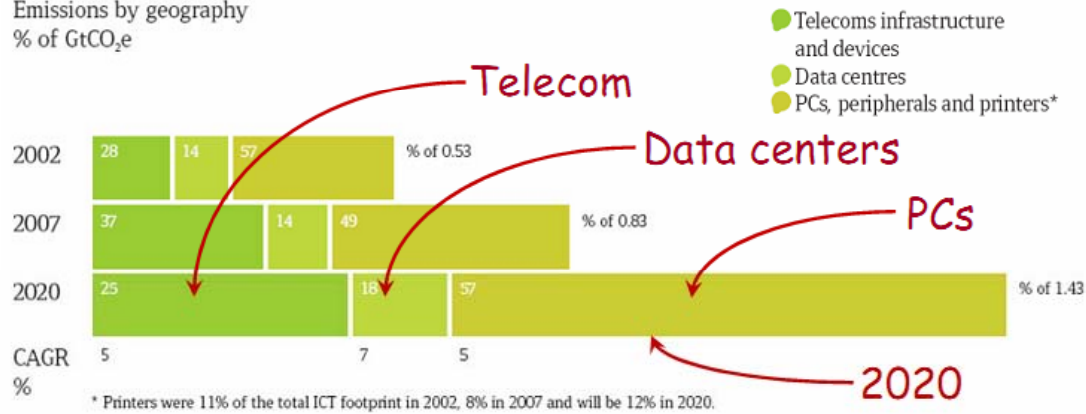
Can 4G Wireless Networks like LTE/WiMAX be powered with renewable sources ?

- 2 Billion Liters of diesel per year powering current networks in India
- To generate 3-4 KW of solar power per cell site would require 25 Sq. Meter space, valuable real estate per site
- Need for R & D in both reducing power consumption of base stations and decentralized architectures

Source: VNL's Solar powered 100W GSM station IIT-Bangalore

Fig. 2.3 The global footprint by subsector

Emissions by geography
% of GtCO₂e



S. No.	Network Elements	Total Carbon Emission (in Tonnes)	Total Carbon Emission (in Tonnes)
1	BTS	13 million	
2	BSC	1.3 million	
3	MSC	0.1 million	
4	Exchanges	6 million	
5	Network Controllers + Transmission	.08 million	
6	Core & Servers	.05 million	
	Total	20.5 million	1904 million
	% CO₂ emission of the total	1%	

Table 1.2 : % CO₂ emissions from the telecom Sector

Copenhagen Accord needs CO₂ emissions to be cut by 25%

Some Selected Recent Publications

- “Advanced Mechanisms for Sleep Mode Optimization of VoIP Traffic over IEEE 802.16m”, IEEE GLOBECOM-2010;
 - Part of this work selected for Final Draft of IEEE 802.16m Standard
- “VP8 Video: Performance Evaluation, Modeling and Frame Size Predication”, Best Paper Award at Post Graduate Student Paper contest IEEE Region 10 , Sept. 2011.
- “Joint Paging Area and Location Update Optimization for IEEE 802.16m Idle Mode”, Computer Networks, Elsevier, November, 2011.
- . “La VoLTE: novel cross Layer optimized mechanism of Video transmission over LTE for DRX”, IEEE VTC 2012-Spring

Other Areas of Works at IITB

- Multilayer Optimization for Short-TCP
- SDN
- Cognitive Radio
- MAC for QoS and Green of Broadband (UE & BS)

Other major ICT Challenges in India

- Multilingual systems
 - Machine Human Interface (usability, etc.)
- ICT applications in strategic sector with focus on security (cyber security of all kinds of IT infrastructure) and surveillance.
- Smart Grid (Multidisciplinary activities)
- Intelligent Transportation System (Railway, Truck and busses etc.)
- Distance education, telemedicine and other e-governance as well as Private Company applications

Other Major Areas of ICT Research – Use Cases

- ICT help to Green Revolution V2.0 – Agriculture (65% of our citizen Directly or Indirectly depends on this)
- ICT for Monitoring of Eco-Systems (Sea, Minerals, Jungle, Wild Animals, etc.)
- ICT for Defense
- ICT for Bio-Technology and other Science
- ICT for Medicine

Thank You!