Case studies of Technology Transfer Practices

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Global Environmental Change and Sustainability: Technology Transfer Needs for Asia and the Pacific

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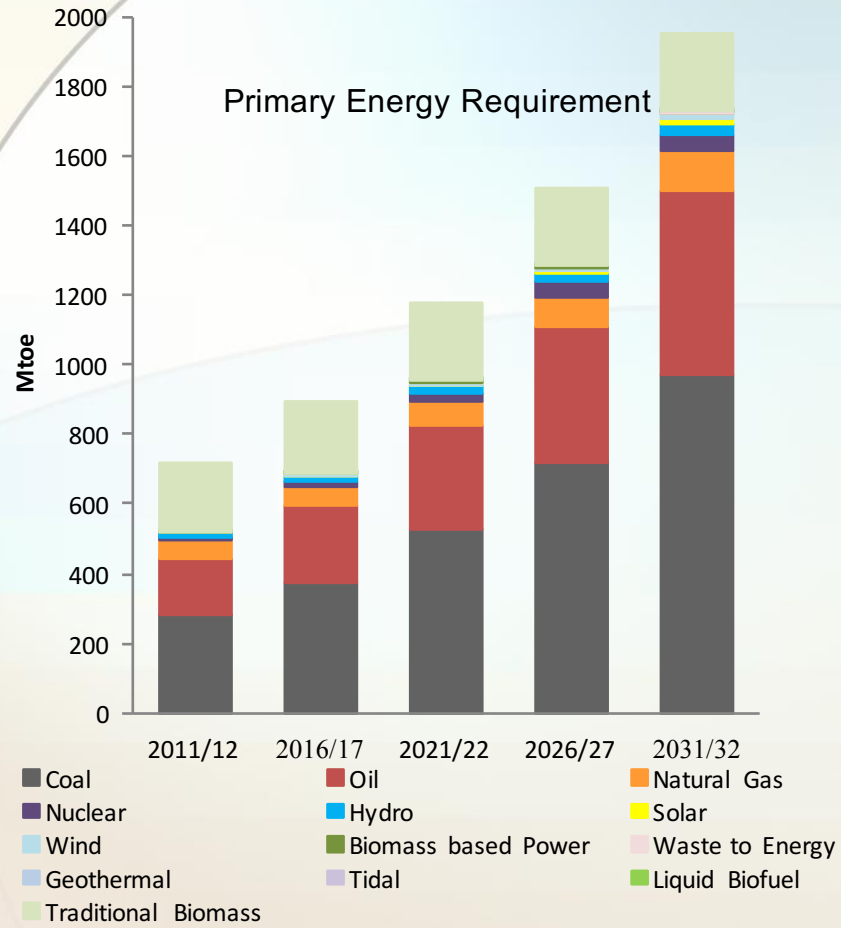
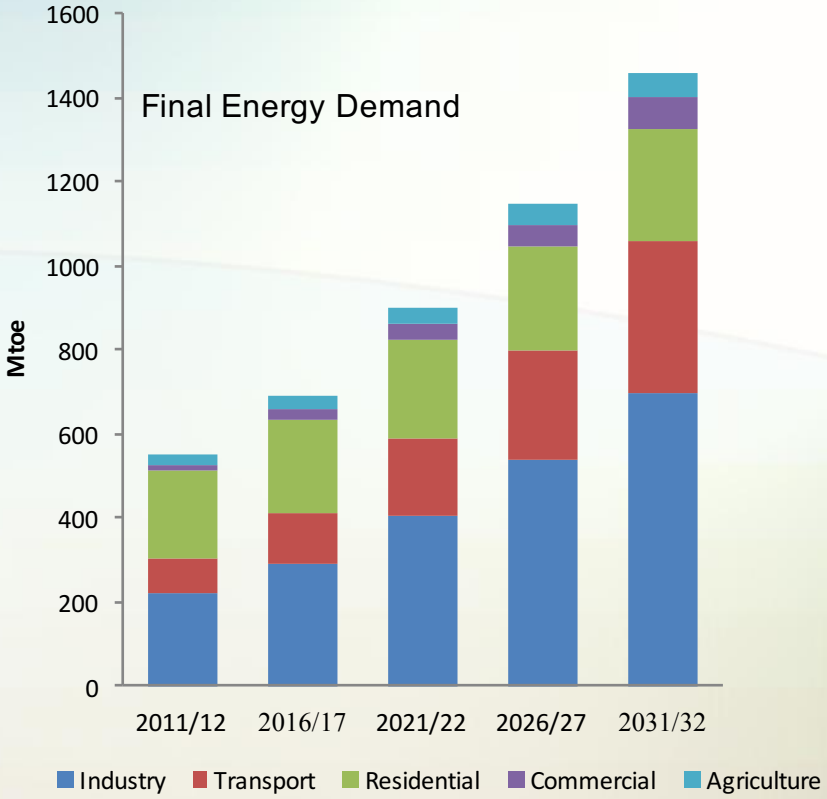
About TERI

- Independent not-for-profit research organization, pursuing activities related to energy, environment, and sustainable development
- HQ in Delhi (India) with regional centers in Bangalore, Goa, Mumbai and Guwahati, offices also in Gurgaon and Uttaranchal
- TERI University focusing on environmental and sustainability studies

Resource Efficient TERI Retreat for Environmental Awareness and Training
Retreat Green Building TERI

India Energy Sector – Present & Future



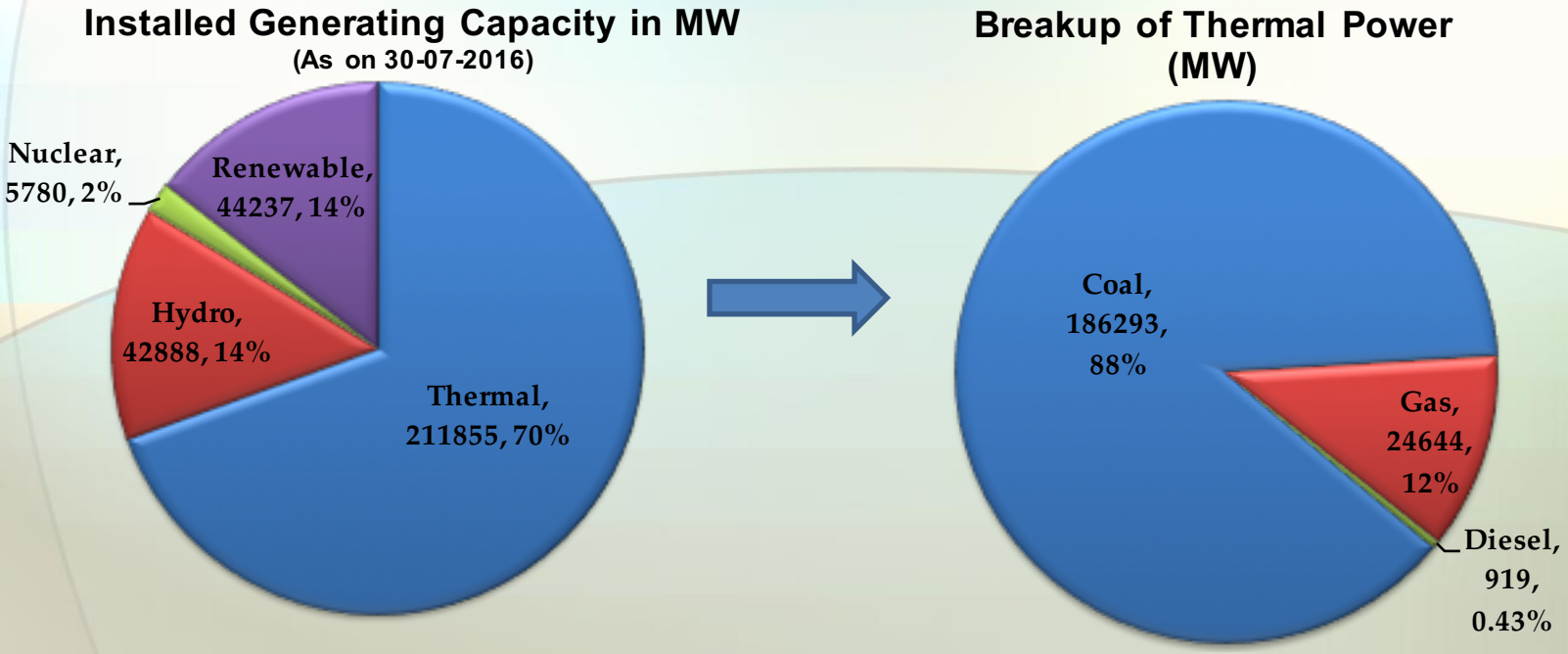


- Primary energy supply increases from 717 (2011/12) mtoe to 1950 mtoe (2031/32); coal followed by oil remain the two dominant energy sources
- Final energy demand rises from 549 mtoe (2011/12) to 1460 mtoe (2031/32), an increase of about 2.7 times in 20 years
- Industry sector continues to remain the major energy consumer (40%- 48%), and the share of transport sector rises from 16% (2011/12) to 25% (2031/32)

Source: TERI's MARKAL Model Results

Power generation mix in India

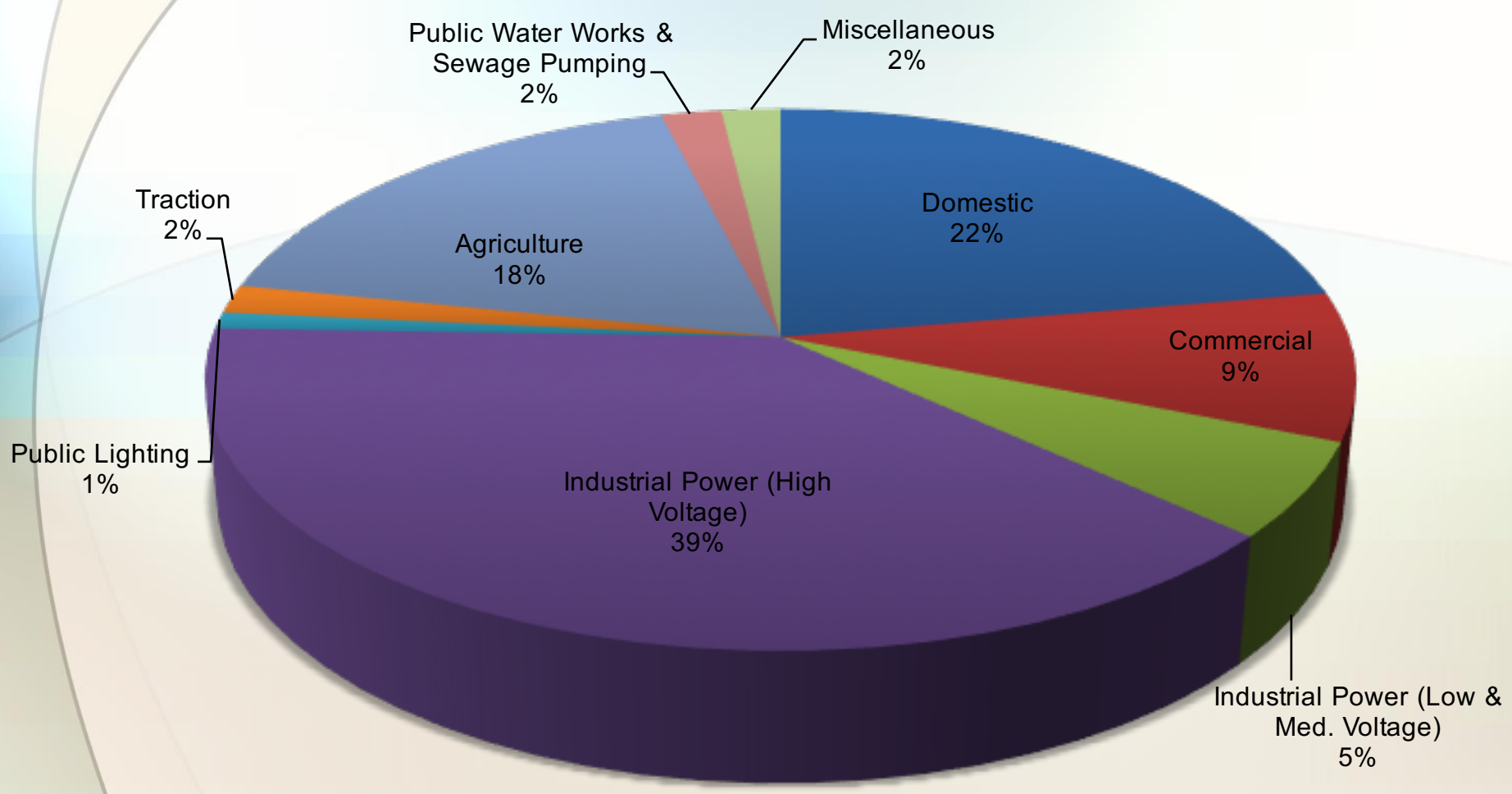
- Thermal power accounts for 70% of total generation
- Coal accounts for more than 85% of thermal mix



- Per capita consumption- 957 kWh/year for 2013-14
- Overall Deficit(2015-16): 2.1%
- Peak Deficit: 3.2%

Source: Energy Statistics 2016 & CEA

Energy Consumption (in GWh)



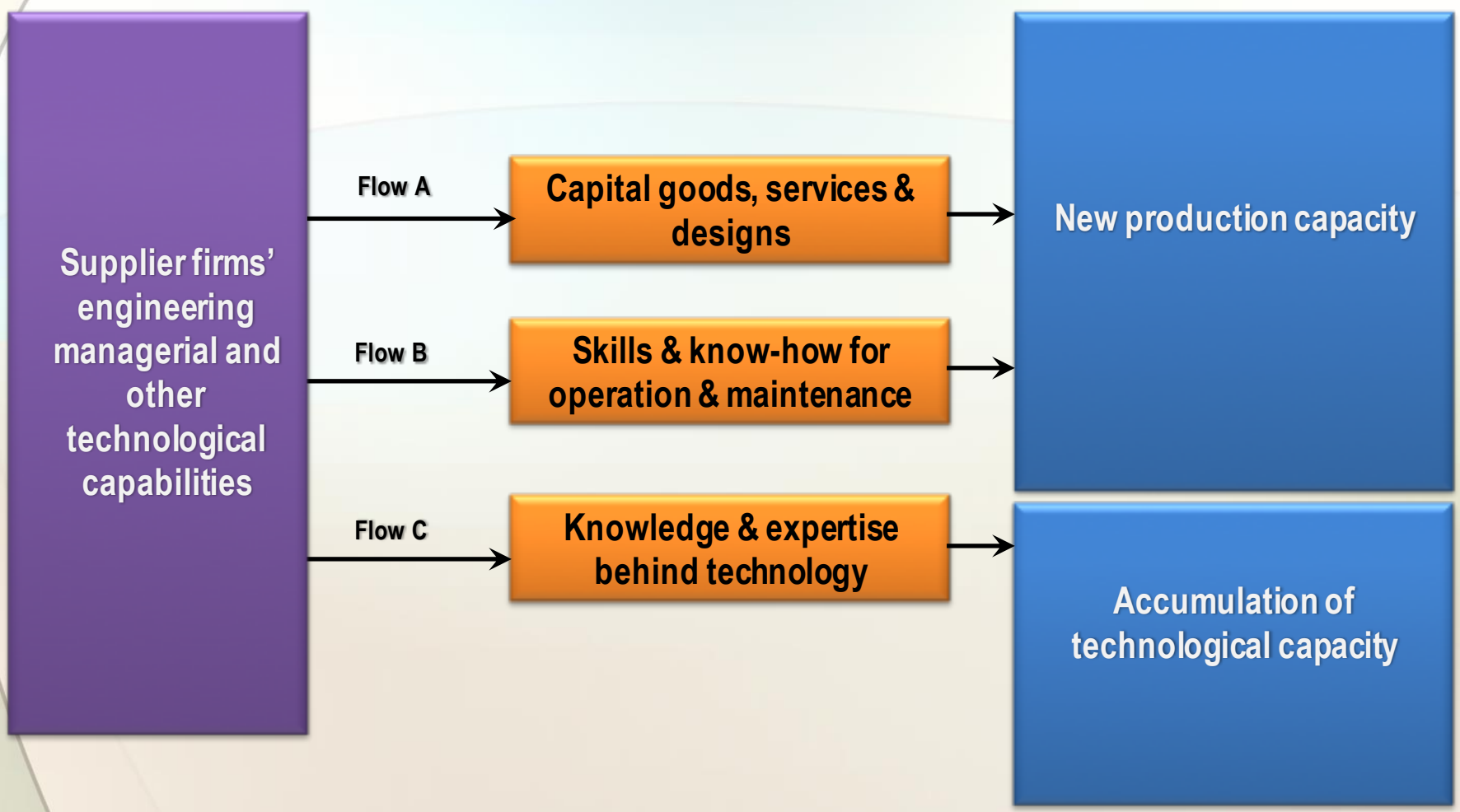
Agriculture- 18%, Buildings- 31%, Industries- 44%

Source:- CEA- All India Electricity Statistics- General Review- 2012-13

Technology transfer and technological capabilities

- Technology transfer takes place within the broader context of technological change
- Impact of technology transfer depends upon the technological capacity of recipient country. This capacity determines whether future innovation and adoption of the technology will take place in the recipient country
- Building technological capacity is most important in developing countries where long term economic development and poverty reduction are primary concerns
- Why focus on international collaborative RDD&D? Way in which to build technological capacity of developing countries and offer creative ways to address IPR issues

Technology Transfer: Essential knowledge flows



Case studies on technology transfer from India's industrial and power sector

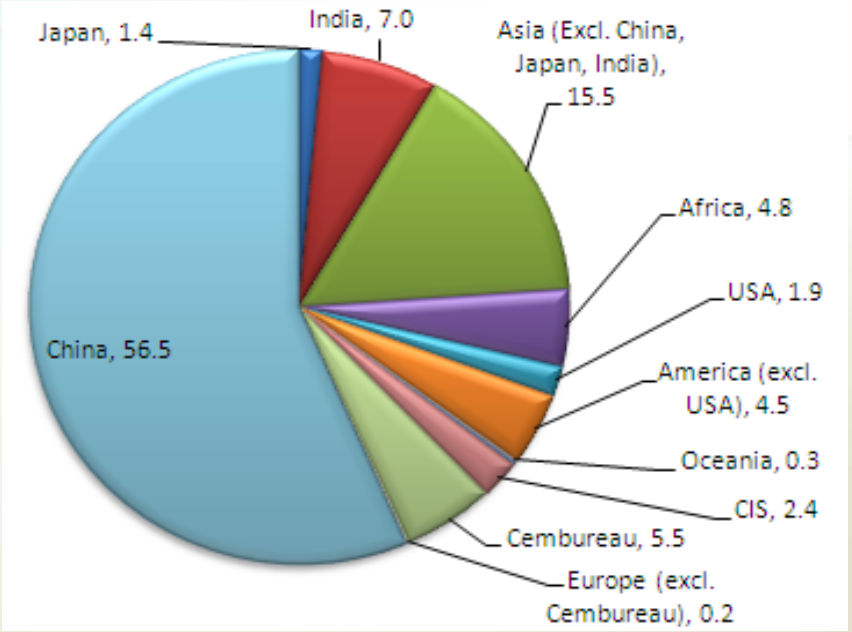
Indian industry sector - background

- Industry sector has been a major driver of growth
- Accounts for about 45% of total commercial energy consumption
- Consists of large industries like fertilizers, iron & steel, cement etc and a diversified MSME sector
  - Many large industries have adopted latest state of the art technologies available globally (examples: cement, fertilizers etc.)
  - MSME sector important from socio-economic perspective (employment generation, base for many large industries, engine for economic growth in peri-urban and rural areas)
- Rising investments in physical infrastructure – transportation, buildings, ports etc. leading to increased economic activity in the manufacturing sector
- 5-15% energy conservation potential depending upon various factors

Case study 1: Energy intensive large industries

Example: Indian Cement industry

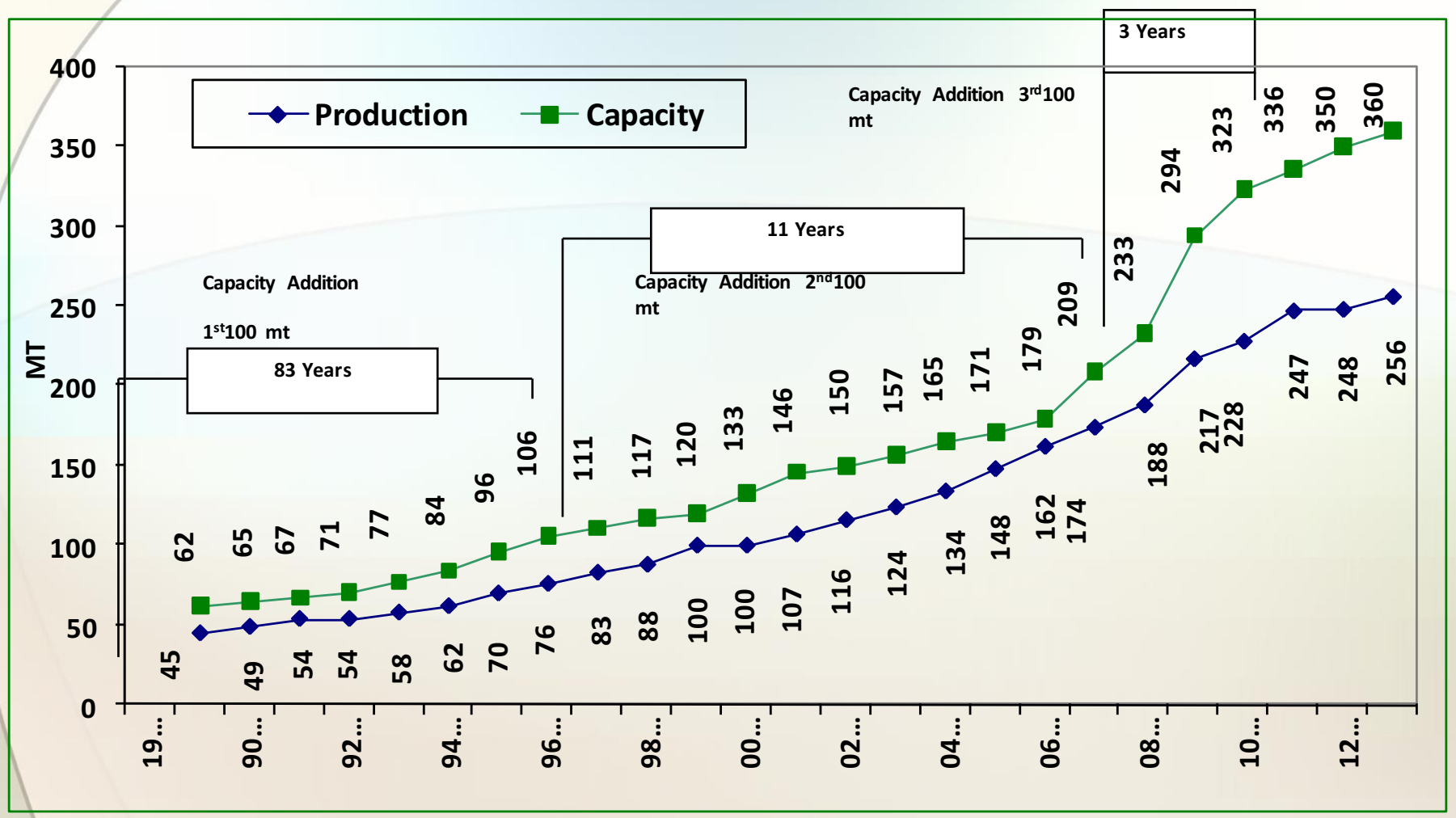
- Different types of cements:
  - Ordinary Portland cement
  - Portland Pozzolana cement
  - Special Cements
- Total installed capacity: 350 mtpa annum
- Total production : 256 mt (2013-14)



World cement production (2013)

Source: Cembureau

Cement industry: Growth trend



Source: Data analysis by NCCBM, 2014

Cement industry: Energy consumption comparison

Country	Overall SEC (kcal/kg cement)
India	788
Japan	733
Germany	872
China	932
UK	946
USA	1015

Source: Data analysis by NCBM, 2014

Key success factors for Low Carbon Technology Deployment in Indian Cement Sector

- Industry moved early from a controlled regime to open market competition
- Strong push by international technology suppliers from USA, Europe & Japan to market state of the art global technologies
- Acceptance of the new technologies by large domestic private companies (Aditya Birla Group, JK, Shree, ACC, etc)
  - Technology acquisition route: Commercial sale, technology tie-ups, etc
- Increasing presence of major global cement companies (Lafarge, Holcim, etc)
- Very few state owned companies
- Steady growth in infrastructure sector
- Trained human resources
- Availability of finance from domestic financial institutions
- Existing barriers to further technology up-gradation: WHR (high costs) and waste utilization (institutional and regulatory issues)

Case study 2. Small and Medium Enterprises: Indian Context

- 40 million units employing 100 million people
- Accounts for 45% of manufacturing output and 40% of India's total exports
- Manufacturing over 6000 products
- Many energy intensive sectors such as foundry and forgings, glass and ceramics, brick, textiles, dairy and food processing and so on
- Clustering of industry: over 200 energy intensive manufacturing clusters exist
- Deploy obsolete technologies and unskilled manpower
- Scope to save energy by adoption of Energy Efficient Technologies (EETs), Renewable Energy Technologies (RETs) and Best Operating Practices (BOPs)

Example 2a: Indo – Swiss Technology Cooperation for Promoting LCTs in SMEs

- Project facilitated by TERI and Sorane sa (1999-2010)
- Adoption of energy efficient glass melting furnace
  - Older technology based on coal, highly inefficient and polluting
  - Pilot plant installed in a glass melting unit in 2000 in Firozabad (UP)
    - ✓ Technology sourced through British Glass
    - ✓ Furnace and other parts developed in India based on designs by British/ Swiss experts
    - ✓ Technology transferred to local service providers
  - Benefits
    - ✓ Primary energy savings 30%-50%
    - ✓ Drastic reduction in air pollution
  - Present status:
    - ✓ Demo plant still operating
    - ✓ Around 80 additional replications
    - ✓ Key success factors:
      - High upfront cost of the demo technology cushioned through local customization in replications
      - Long term post implementation support by SDC to ensure success of the demonstrated technology

Demonstration unit: Recuperative natural gas fired Glass melting pot furnace

Example 2b: India-Japan Joint Project for Promoting Low Carbon Technology Transfer

- Project facilitated by TERI and IGES (2010-14), supported by JICA/JST
- Application of Electric Heat Pumps
  - Preheating of boiler feed water & precooling of process chilled water
  - Can be used in sectors like dairy, food processing, pharmaceutical, commercial buildings etc
  - Pilot plants installed in two milk dairies in 2014 in Chandigarh (Punjab) and Anand (Gujarat)
    - ✓ Technology supplier: A large private Japanese company
    - ✓ Hardware imported directly from Japan
  - Benefits
    - ✓ Reduction in fuel consumption in boiler and electricity in chiller
    - ✓ Primary energy savings 30%-40%
  - Present status:
    - ✓ Both demo plants running but no new replications
    - ✓ Barriers:
      - High upfront cost of the technology (No local customization)
      - Limited local support for replication and absence of a long term strategy

Demonstration unit of Electric Heat Pump (EHP) in a milk dairy

Case study 3: Smart Grid Demonstration in City Subdivision of Panipat (Haryana)

Supported by NEDO, Japan

Project Overview

Target country and areas : Republic of India, Haryana State, Panipat City

Distribution company : UHBVNL (Uttar Haryana Bijli Vitran Nigam Limited)

Demonstration period : September 2015 - February 2019

Demonstration scale : 4 feeders, 11,000 consumers

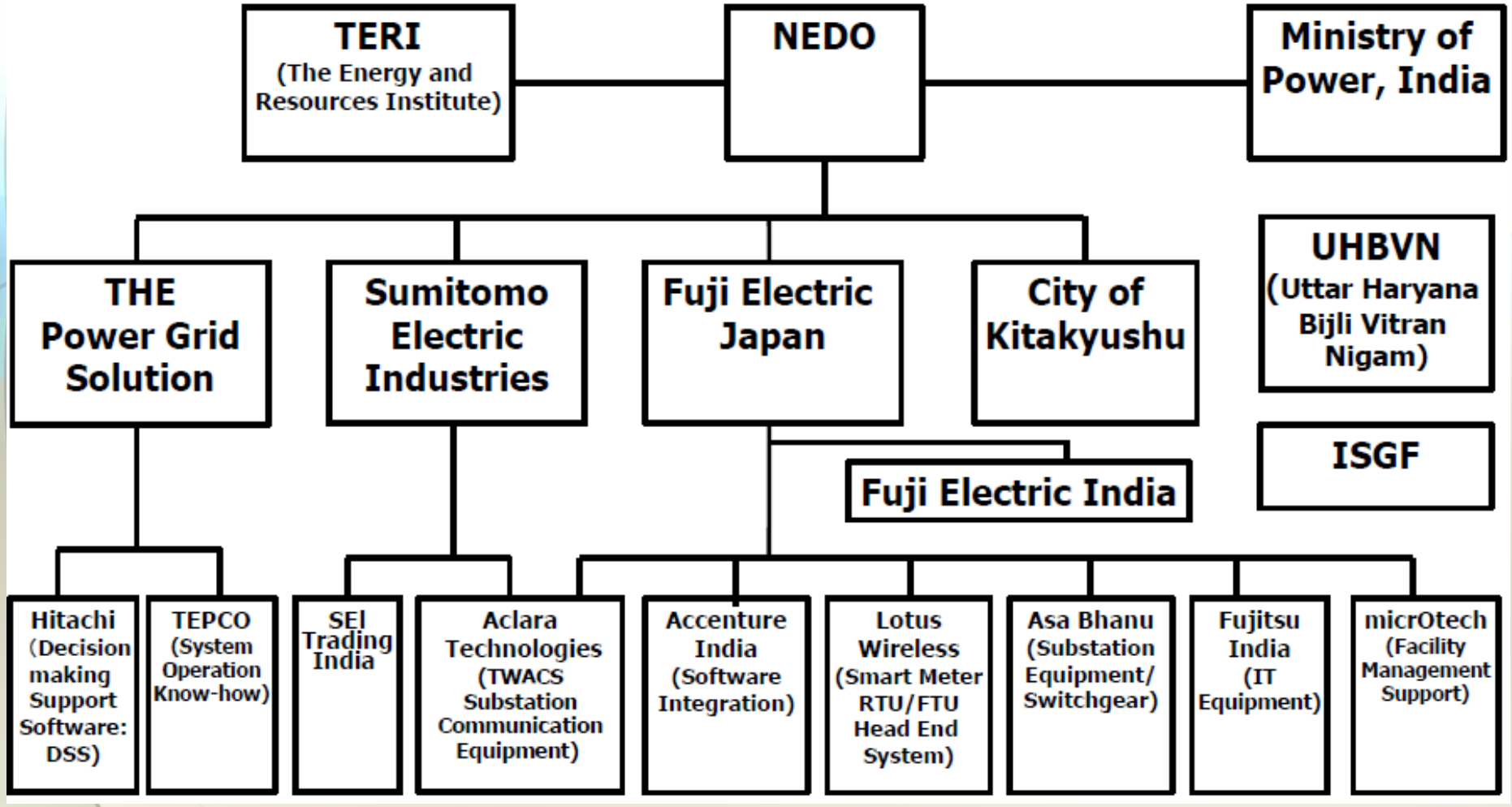
Key Objectives:

- ✓ Peak Load Reduction
- ✓ Better Reliability and Outage Management System
- ✓ Distribution System Monitoring and Control
- ✓ Power Distribution Loss Reduction

Key observations in existing system

- ❑ High AT&C loss
- ❑ High DTR failure rates
- ❑ Overloading of feeders
- ❑ Faulty and old meters
- ❑ Poor reliability indices

Consortium organization



Key features of the Project from Technology Transfer perspective

- A longer term vision of private partners from Japan to engage with the Indian power distribution sector right from the start
- Formation of a strong consortium with close involvement of many Indian organisations
- Developing specifications and systems keeping the local Indian needs and standards in mind
- Many parts being procured from Indian companies
- Overall technology and system integration support from Japanese companies
- A very strong capacity building component built into the project for long term sustainability of the project
  - Centre being set up at Chandigarh
  - On-site training as well training in Japan for DISCOM officials
  - Longer term post monitoring after the field installation

Key Lessons

- Transfer of commercially mature technologies happening
  - B2B route (Example: Cement sector)
  - Financial and technology related barriers (Cement – WHR and EHP examples)
  - However, most important factor for success of TT in the broader context for large developing countries :
    - ✓ The Process of Technology Transfer and Knowledge Flows (Need for a RDD&D approach - Swiss Example)
- Mitigation potential:
  - High potential for adoption of LCTs in developing countries like India
  - Existence of many LCTs in developed countries like Japan

    (JICA/JST Example)
- Suggestions to facilitate TT in developing countries
  - Focus on collaborative RDD&D (Swiss example)
  - Flexibility and need to adopt to local conditions and involvement of local players for longer term sustainability (NEDO and Swiss example)
  - Long term projects (Swiss Example)

Thank You

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