

EEE-102 Basic Electrical Engineering

Spring 2024-25

Instructors: Anubrata Dey (Coordinator), Sohom Chakrabarty, Jeevanand S & Parikshit Pareek

Department of Electrical Engineering, IIT Roorkee

Course Overview

- ▶ Basics of Generation Transmission & Distribution
 - ▶ Basics of Control Systems
 - ▶ Direct Current (DC) Circuit Analysis
 - ▶ Network Theorems
 - ▶ Alternating Current (AC) Circuit Analysis
 - ▶ Basics of Measurement
 - ▶ Direct Current (DC) Machines
 - ▶ Alternating Current (AC) Machines
- **Practical Sessions:** Room 111, Electric Science Lab, Ground Floor, EE Building
 - Let's ensure we wear **SHOES** in the lab.

Evaluation Policy

Type	CWS	PRS	MTE	ETE
Total Marks	15	20	25	40
Components	Final Quiz	Final Quiz	Written	Written
	Classroom Conduct	Lab Attendance	–	–
	Individual Faculty Components	Lab Viva & Reports	–	–

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- Each 'Instructor' will announce — Individual Faculty Components if any
- Rest components remain same for entire course.

Logistics– Generation, Transmission & Distribution (GTD) Part

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- ▶ Mode of Teaching: Slides + Board
- ▶ **Note: Not everything will be on slides.**

Prerequisites

- ▶ High School Physics– NCERT 12th Class Physics I
- ▶ Common Sense!

Why Should I Study EEE102 as a Non-EE B.Tech Student?

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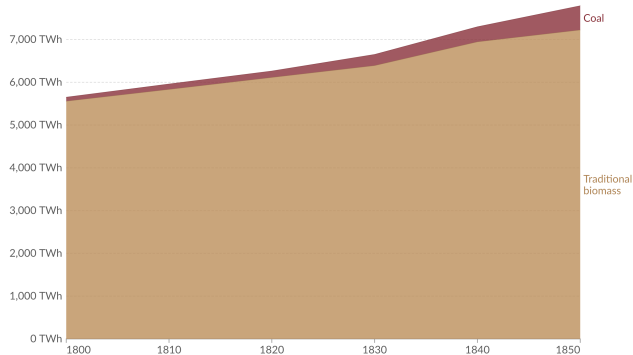
Note

This is not a Physics course but an **Engineering Class**, where the focus is primarily on **Systems & their Applications/Implications**, rather than delving deeply into first principles.

Why we need Energy? And How Much?

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To Run Our Lives, To Get Work Done



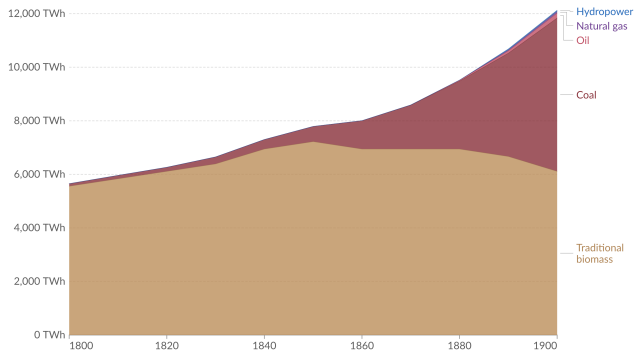
Data source: Energy Institute - Statistical Review of World Energy (2024); Smil (2017)

OurWorldinData.org/energy | CC

Note: In the absence of more recent data, traditional biomass is assumed constant since 2015.

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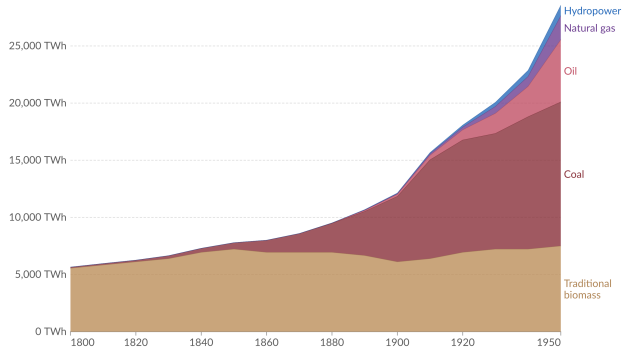
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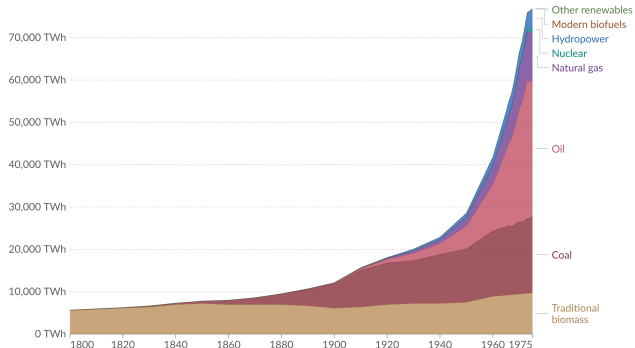
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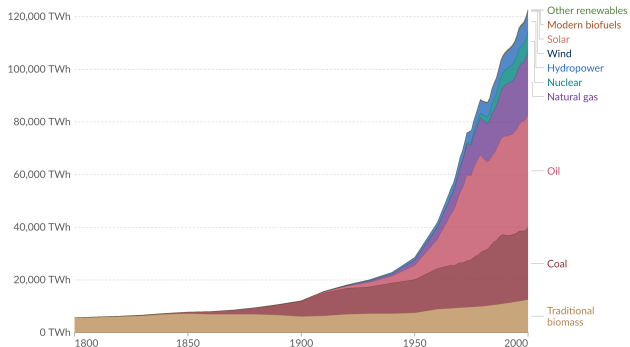
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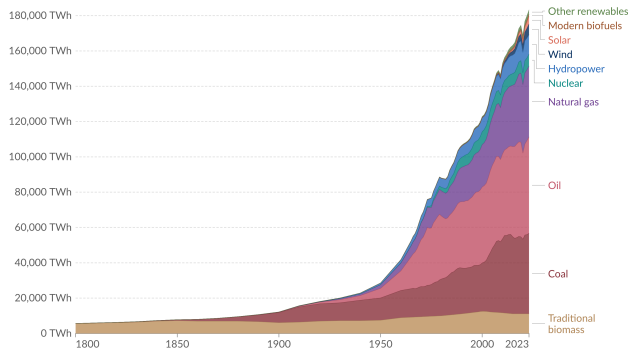
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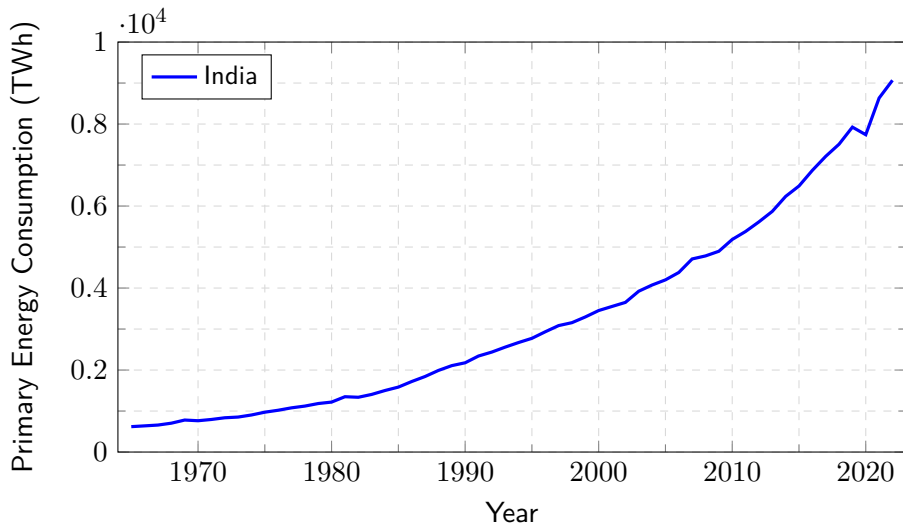


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Indian Story: Primary Energy



Electricity - A Versatile Energy Currency

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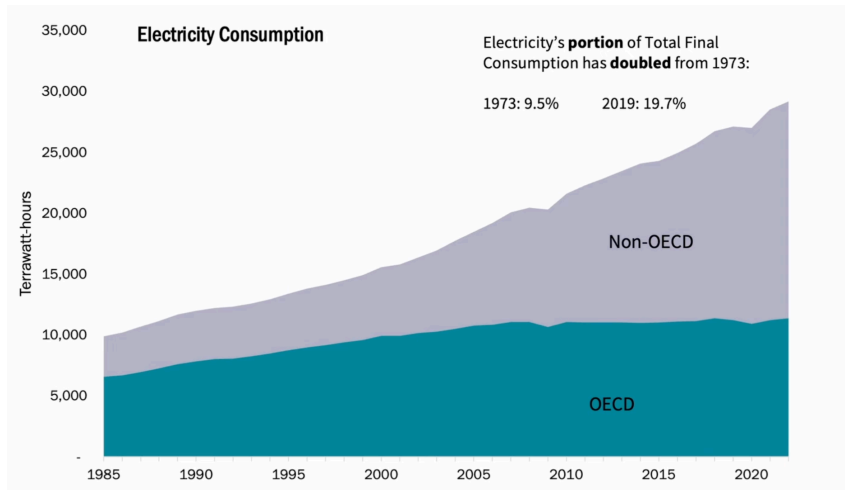
Real-time Balance

Limited Storage

Need for Reserves & Backup

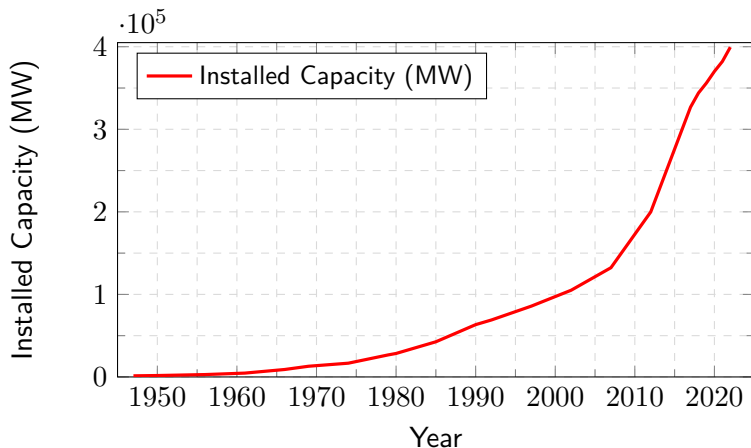
Value Beyond Cost

Growth of Electricity Consumption



Source: Energy Institute Statistical Review of World Energy, 2023

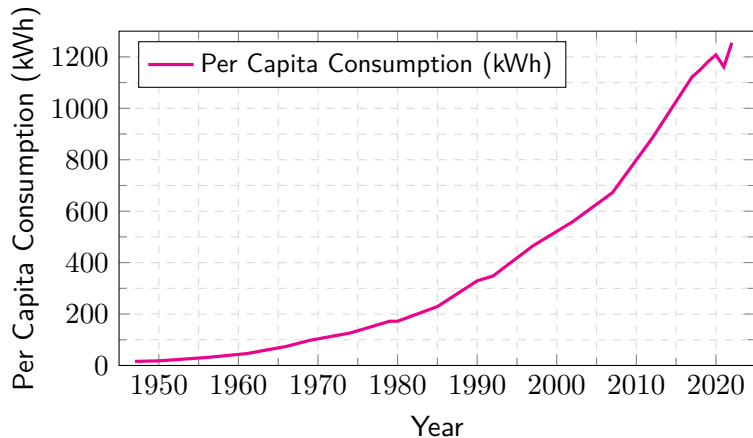
Indian Story: Electrical Energy



Data Source:

https://cea.nic.in/wp-content/uploads/pdm/2023/02/Growth_Book_2022_PDF.pdf

Indian Story: Per Capita Consumption



What does Per Capita Consumption Tells Us?

Nation's Economic Prosperity \propto Per Capita Consumption

Timeline of Energy Developments

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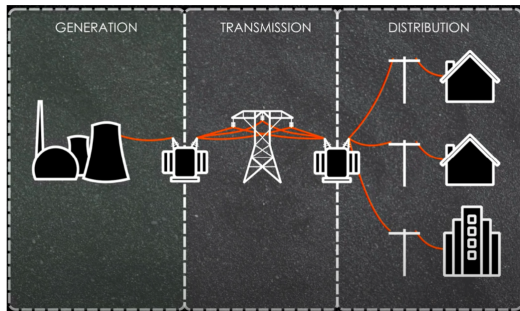
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- 2015 GE set 61.4% efficiency in combined-cycle power (592 MW).
- 2024 Siemens achieved 64.18% efficiency in combined-cycle power plants, new record.

The Grid

- ▶ Power grid is a system that makes sure electricity travels safely & reliably over long distances to reach everyone who needs it.
- ▶ A giant network of wires & equipment that brings electricity
From where it's made—like power plants or solar farms – **Generation**
To our homes, schools, and businesses – **Demand**



Generation

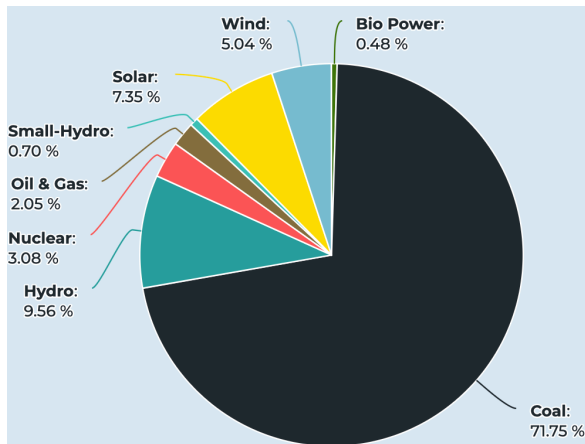


Figure: India's Power Generation Source Mix with Total 1231BU (as of 30th November)

Recap: Faraday's Law

- Change in Magnetic Flux induces in Electric Field or EMF.
- Check out these if you need to.
- https://phet.colorado.edu/sims/html/faradays-law/latest/faradays-law_en.html
- <https://www.youtube.com/watch?v=Y86JAdBnqZA>

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Reversible Means of Energy Flow via Magnetic Field

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- ▶ ElectroMechanical Conversion
 - Electrical Energy \Longleftrightarrow Mechanical Energy
 - Reversible Means of Energy Flow via Magnetic Field
- ▶ Generic Electric Power Generation Process



Homework- Part of Syllabus

- ▶ Go through Indian Grid Numbers:
<https://iced.niti.gov.in/energy/electricity/generation>
- ▶ Try and identify one interesting data point related to your home state's power generation data
- ▶ Reading about energy losses across supply chain and solve substitution method numerical– [Document on Course Webpage](#).
- ▶ Watch this coal power plant video:
<https://www.youtube.com/watch?v=2IKECt4Y3RI&t=1s>

Additional Readings- Not Part of Syllabus

- Read [History of Electric Power in India \(1890 – 1990\)](#)