BBA005 – ENERGY ENGINEERING AND MANAGEMENT

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INTRODUCTION TO ENERGY AND ENVIRONMENT

- Energy is usually defined as the ability to do work.
- However, it is a useful definition for engineering where the aim of machines is to convert energy to work.
- As a more general description, we would say that energy is a fundamental entity whose availability and flow are required for all phenomena, natural or artificial.

INTRODUCTION TO ENERGY AND ENVIRONMENT

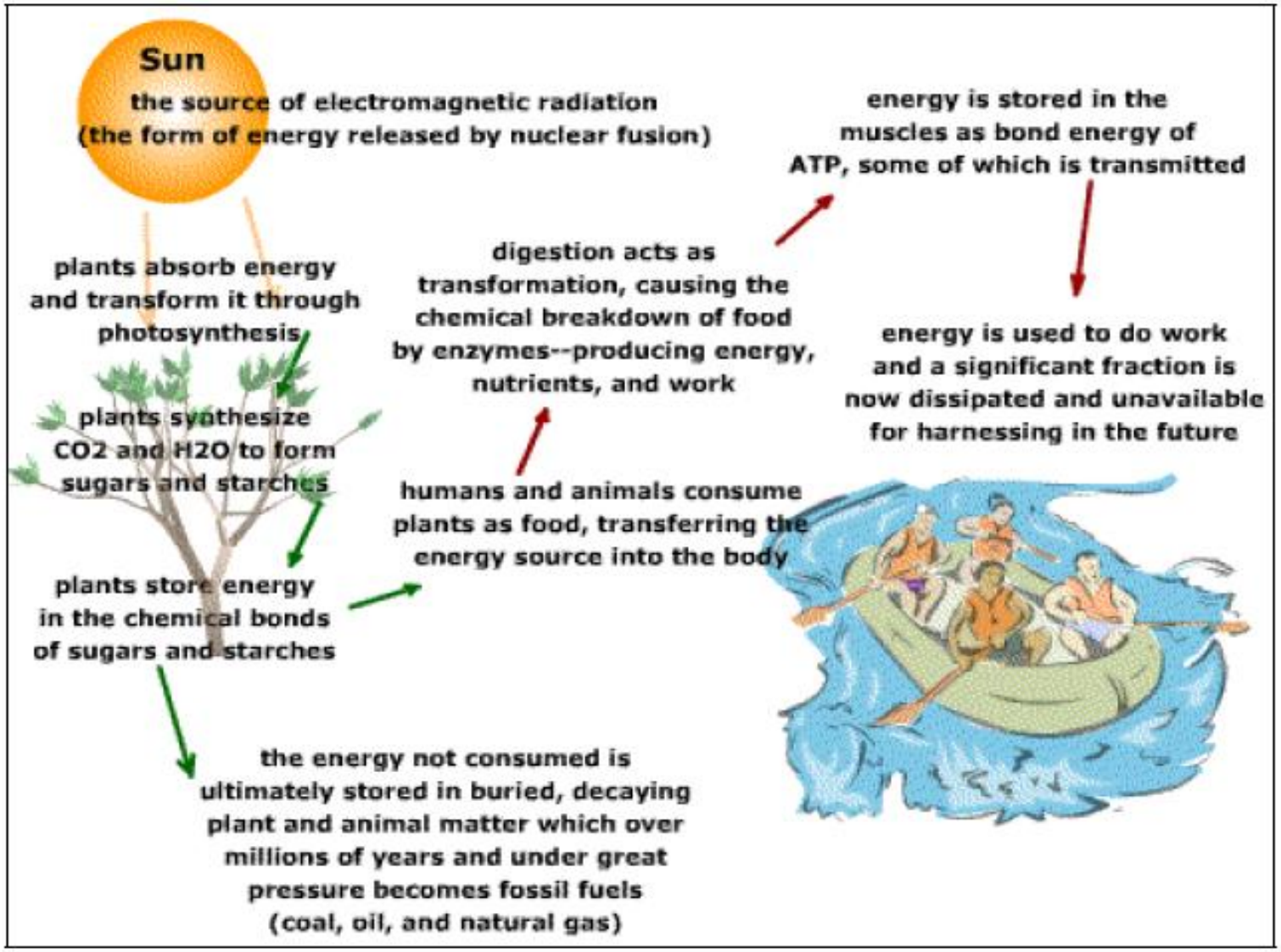

Figure 1: Natural Energy System.

INTRODUCTION TO ENERGY AND ENVIRONMENT

- The environment is something you are very familiar with.
- It's everything that makes up our surroundings and affects our ability to live on the earth—the air we breathe, the water that covers most of the earth's surface, the plants and animals around us, and much more.
- Environment is everything that is around us. It can be living or non-living things. It includes physical, chemical and other natural forces. Living things live in their environment. They constantly interact with it and adapt themselves to conditions in their environment.

INTRODUCTION TO ENERGY AND ENVIRONMENT
FOSSIL FUEL RESERVES

- Crude oil, coal and gas are the main resources for world energy supply. The size of fossil fuel reserves and the dilemma that “when non-renewable energy will be diminished” is a fundamental and doubtful question that needs to be answered.

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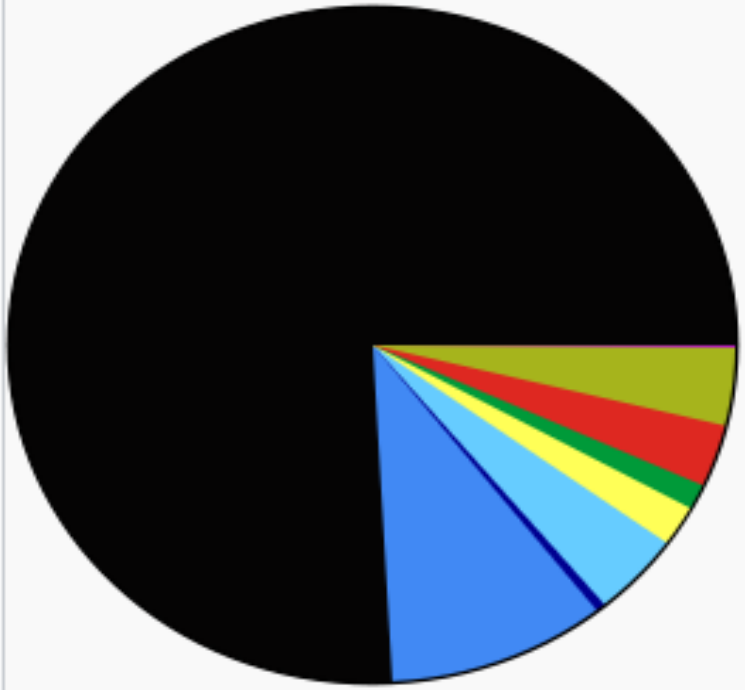
India: Electricity sector

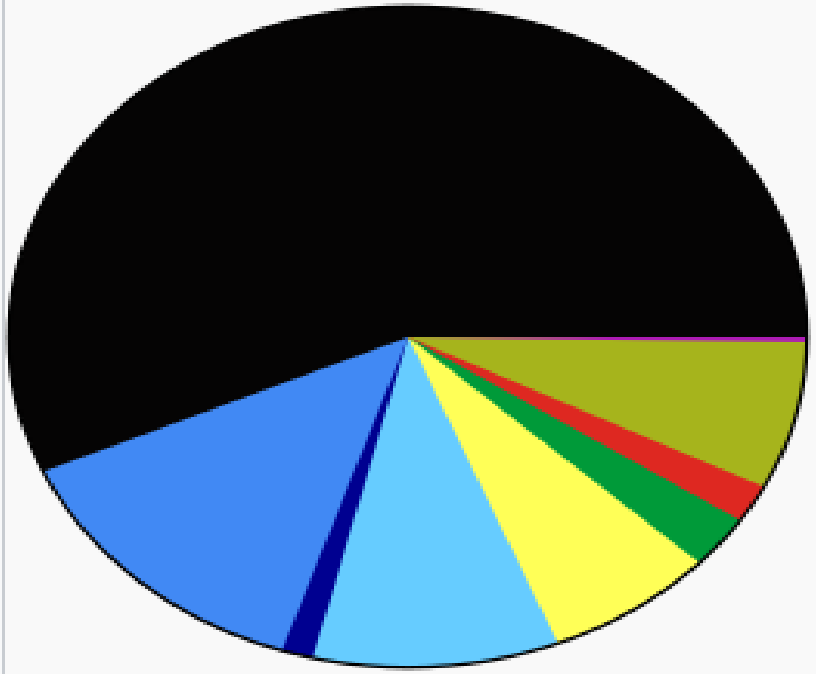
Data	
Electricity coverage	99% (31st Dec 2018)[1]
Installed capacity	346.62 GW[2]
Share of fossil energy	81.9%[3]
Share of renewable energy	15.3%[3]
GHG emissions from electricity generation (2015)	2066.01 $MtCO_2$[3]
Average electricity use (2017-18)	1,149 kWh per capita
Transmission & Distribution losses (2016-17)	21.42%[4]
Residential consumption (% of total, 2017-18)	24.20%[4]
Industrial consumption (% of total, 2017-18)	41.48%[4]
Agriculture consumption (% of total, 2017-18)	18.08%[4]
Commercial consumption	5.51%[4]
Traction consumption (% of total, 2017-18)	1.27%[4]
Services	
Share of private sector in generation	44% (January 2018)
Institutions	
Responsibility for policy-setting	Ministry of Power
Responsibility for renewable energy	Ministry of New and Renewable Energy
Responsibility for the environment	Ministry of Environment, Forest and Climate Change
Electricity sector law	Electricity Act, 2003

Electricity generation (utility sector) by source in India in FY 2017-18



- Coal: 986,591 GWh (75.9%)
- Large Hydro: 126,123 GWh (9.7%)
- Small Hydro: 5,056 GWh (0.4%)
- Wind Power: 52,666 GWh (4.0%)
- Solar Power: 25,871 GWh (2.0%)
- Biomass: 15,252 GWh (1.2%)
- Nuclear: 38,346 GWh (2.9%)
- Gas: 50,208 GWh (3.9%)
- Diesel: 386 GWh (0.0%)

Installed capacity by source in India as on 30 November 2018[37]



- Coal: 196,652.5 MW (56.7%)
- Large Hydro: 45,399.22 MW (13.1%)
- Small Hydro: 4,506.95 MW (1.3%)
- Wind Power: 34,615.1 MW (10.0%)
- Solar Power: 24,021.66 MW (6.9%)
- Biomass: 8,869.1 MW (2.6%)
- Nuclear: 6,780 MW (2.0%)
- Gas: 24,937.22 MW (7.2%)
- Diesel: 837.63 MW (0.2%)

Growth of Electricity Consumption in India[4]

Fiscal year ending on	Population (millions)	Consumption (GWh)	% of Total						Per-Capita Consumption (in kWh)
			Domestic	Commercial	Industrial	Traction	Agriculture	Misc	
31-Dec-1947	-	4,182	10.11%	4.26%	70.78%	6.62%	2.99%	5.24%	16.3
31-Dec-1950	-	5,610	9.36%	5.51%	72.32%	5.49%	2.89%	4.44%	18.2
31-Mar-1956	-	10,150	9.20%	5.38%	74.03%	3.99%	3.11%	4.29%	30.9
31-Mar-1961	-	16,804	8.88%	5.05%	74.67%	2.70%	4.96%	3.75%	45.9
31-Mar-1966	-	30,455	7.73%	5.42%	74.19%	3.47%	6.21%	2.97%	73.9
31-Mar-1974	-	55,557	8.36%	5.38%	68.02%	2.76%	11.36%	4.13%	126.2
31-Mar-1979	-	84,005	9.02%	5.15%	64.81%	2.60%	14.32%	4.10%	171.6
31-Mar-1985	-	124,569	12.45%	5.57%	59.02%	2.31%	16.83%	3.83%	228.7
31-Mar-1990	-	195,098	15.16%	4.89%	51.45%	2.09%	22.58%	3.83%	329.2
31-Mar-1997	-	315,294	17.53%	5.56%	44.17%	2.09%	26.65%	4.01%	464.6
31-Mar-2002	-	374,670	21.27%	6.44%	42.57%	2.16%	21.80%	5.75%	671.9
31-Mar-2007	-	525,672	21.12%	7.65%	45.89%	2.05%	18.84%	4.45%	559.2
31-March-2012	1,220	785,194	22.00%	8.00%	45.00%	2.00%	18.00%	5.00%	883.6
31-March-2013	1,235	824,301	22.29%	8.83%	44.40%	1.71%	17.89%	4.88%	914.4
31-March-2014	1,251	881,562	22.95%	8.80%	43.17%	1.75%	18.19%	5.14%	957
31-March-2015	1,267	938,823	23.53%	8.77%	42.10%	1.79%	18.45%	5.37%	1010.0
31-March-2016	1,283	1,001,191	23.86%	8.59%	42.30%	1.66%	17.30%	6.29%	1075
31-March-2017	1,299	1,066,268	24.32%	9.22%	40.01%	1.61%	18.33%	6.50%	1122
31-March-2018	1,353	1,130,244	24.20%	8.51%	41.48%	1.27%	18.08%	6.47%	1149

ENERGY POLICIES

- Energy policies are the actions governments take to affect the demand for energy as well as the supply of it. These actions include the ways in which governments cope with energy supply disruptions and their efforts to influence energy consumption and economic growth.

Energy Market Characteristics in India

Region/Country	GDP Per Capita-PPP (US $ 2000)	TPES Per Capita (kgoe)	TPES/GDP (kgoe/ $-2000 PPP)	Electricity Consumption Per Capita (kWh)	kWh/ $-2000 PPP
China	4838	1090	0.23	1379	0.29
Australia	28295	5630	0.20	10640	0.38
Brazil	7359	1094	0.15	1934	0.26
Denmark	29082	3852	0.13	6599	0.23
Germany	25271	4210	0.17	6898	0.27
India*	2732	439	0.16	553	0.20
Indonesia	3175	753	0.24	440	0.14
Netherlands	27124	4983	0.18	6748	0.25
Saudi Arabia	12494	5805	0.46	6481	0.52
Sweden	27869	5751	0.21	15397	0.55
United Kingdom	26944	3906	0.14	6231	0.23
United States	35487	7835	0.22	13066	0.37
Japan	26636	4052	0.15	7816	0.29
World	7868	1688	0.21	2429	0.31

TPES: Total Primary Energy Supply

ENERGY CONSERVATION

- Energy conservation is the effort made to reduce the consumption of energy by using less of an energy service. This can be achieved either by using energy more efficiently (using less energy for a constant service) or by reducing the amount of service used (for example, by driving less).

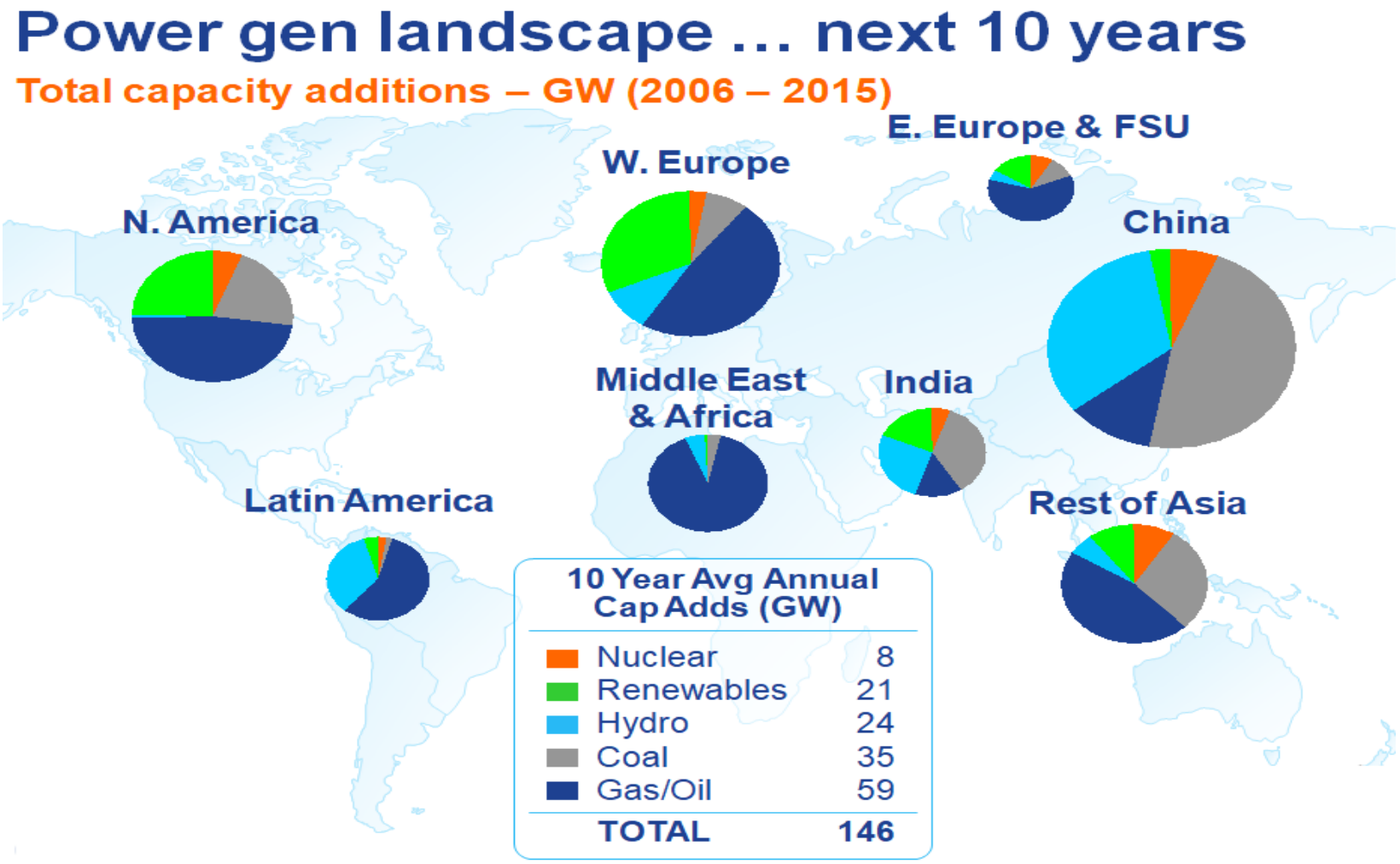
Global energy trends and challenges …

Population … more electricity demand everywhere

Security … heightened concerns

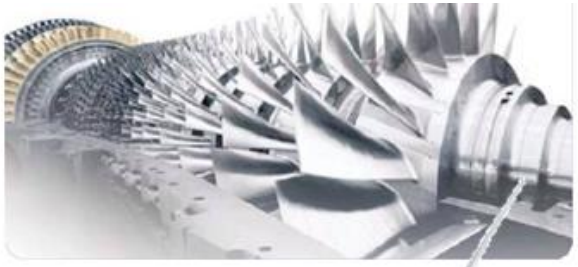
Environment … driving today's and tomorrow's decisions

Global energy trends and challenges..



This environment drives technology development

- High fuel prices … require higher efficiency
- Energy security … requires more diverse solutions
- More stringent environmental standards … require lower emissions, increased use of renewables and nuclear



Energy technology objectives

Diverse




Nuclear
Coal
Gas
Wind
Oil
Geothermal
Biomass
Hydro
Solar

+

Efficient

Efficiency
Reliability
Emissions

Driving cost of electricity down

Portfolio of affordable, reliable & environmentally responsible technologies

WHAT do we mean by energy?

- Direct
- Indirect
- Embodied
- Gas & Oil
- Electricity
- In everything we do

Energy Management System

- An energy management system (EMS) is a system of computer-aided tools used by operators of electric utility grids to monitor, control, and optimize the performance of the generation and/or transmission system. Also, it could be used in small scale systems like microgrids.
- The computer technology is also referred to as SCADA/EMS or EMS/SCADA. In these respects, the terminology EMS then excludes the monitoring and control functions, but more specifically refers to the collective suite of power network applications and to the generation control and scheduling applications.
- Manufacturers of EMS also commonly supply a corresponding dispatcher training simulator (DTS). This related technology makes use of components of SCADA and EMS as a training tool for control center operators.

Engineering Economics

- Engineering economics, previously known as engineering economy, is a subset of economics for application to engineering projects. Engineers seek solutions to problems, and the economic viability of each potential solution is normally considered along with the technical aspects.

COSTING TECHNIQUES

- **Uniform Costing: It is the use of same costing principles and / or practices by several undertakings for common control or comparison of costs.**
- **Marginal Costing**
- **Standard Costing**
- **Historical Costing**
- **Direct Costing**
- **Absorption Costing**

PROJECT MANAGEMENT

- **Project management is the practice of initiating, planning, executing, controlling, and closing the work of a team to achieve specific goals and meet specific success criteria at the specified time.**