



# Sustainable Energy Engineering ‘SEE’

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# Sustainable


- ▶ Oxford English Dictionary:
  - ▶ *Keep going overtime or continuously*

# Energy

- ▶ *The strength and vitality required for sustained activity*
- ▶ *Power derived from physical or chemical resources to provide light and heat or to work machines*
- ▶ *The property of matter and radiation which is manifest as the capacity to perform work*

# Engineering

- ▶ *The branch of science and technology concerned with the design, building, and use of engines, machines and structures.*
- ▶ *The practical application of scientific ideas and principles*
- ▶ *A field of study or activity concerned with modification or development in a particular area*

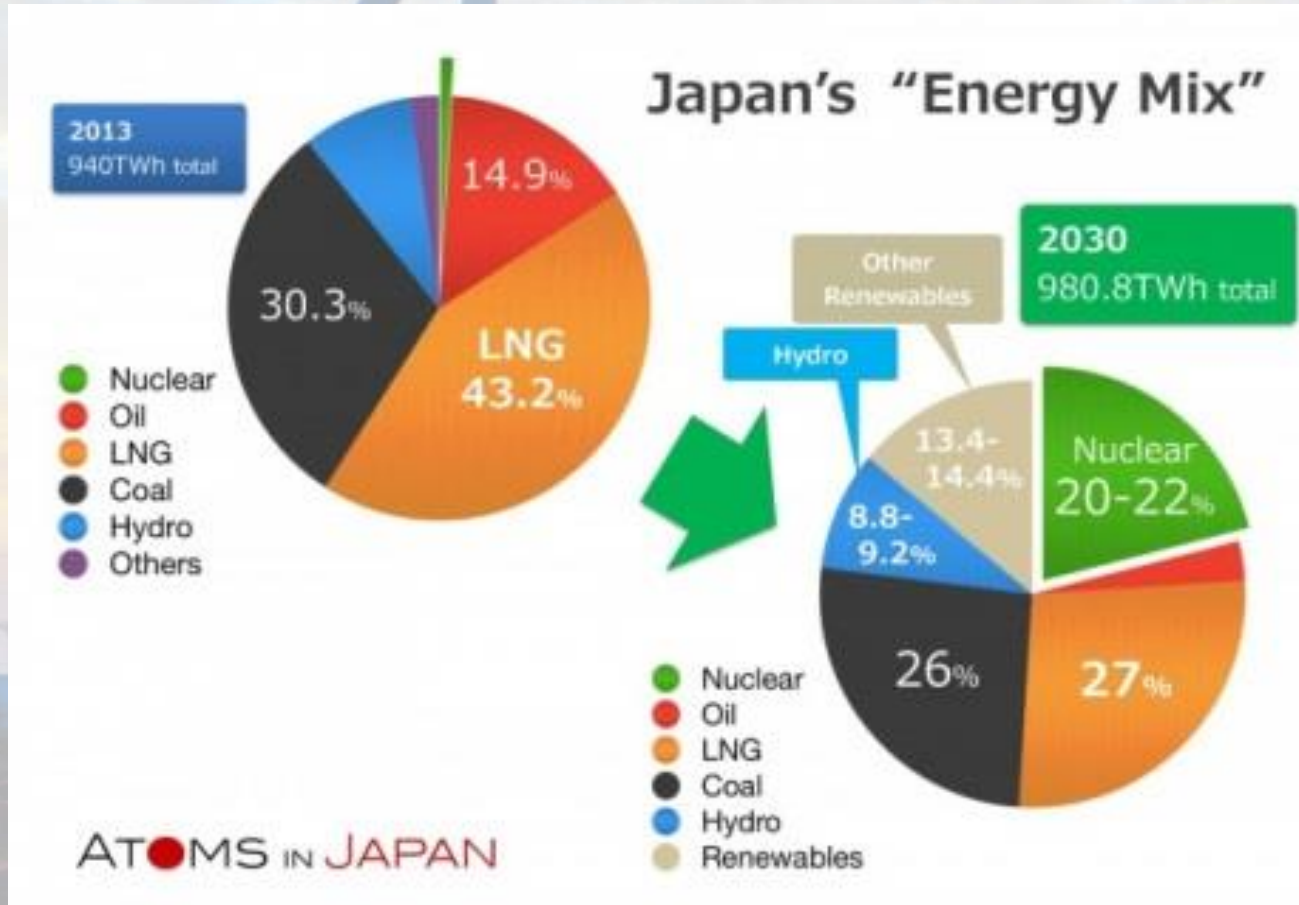


# **SUSTAINABLE ENERGY ENGINEERING**

# THE PRESENT PROBLEM

- ▶ ANNUAL INCREASE IN POPULATION OF 2-3 MILLION INHABITANTS
- ▶ IMPROVEMENT OF LIVING STANDARDS REQUIRES EXTRA AMOUNTS OF ENERGY GENERATION
- ▶ POLITICAL AND GEOGRAPHICAL CHALLENGES FOR EXISTING WATER RESOURCES REQUIRED FOR HUMANS, ANIMALS, AND IRRIGATING AGRICULTURE
- ▶ >95 % DEPENDENCE ON FOSSIL FUELS IN OUR PRESENT 50 GW CAPACITY WHICH IS DEPLETING
- ▶ CO<sub>2</sub> EMISSIONS TO THE ENVIRONMENT

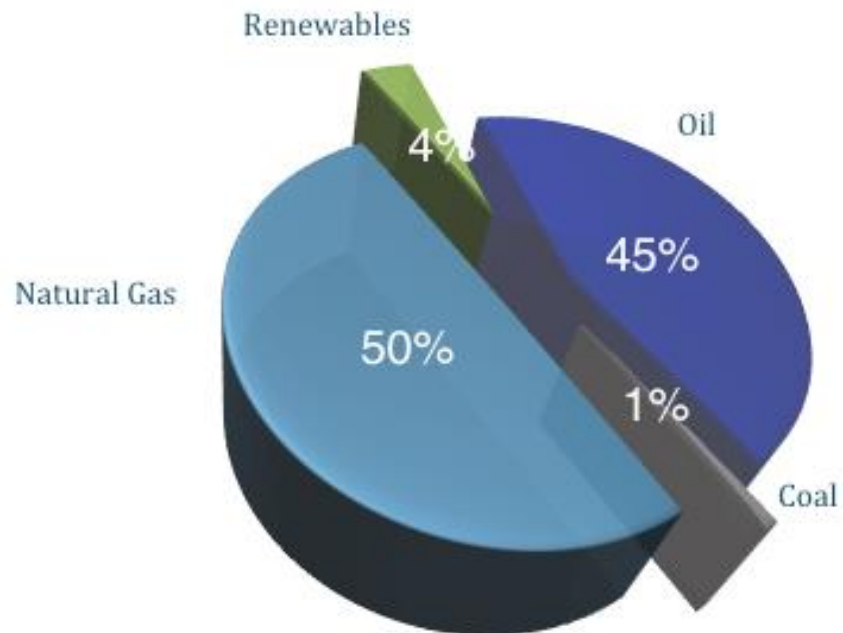
# Energy Mix





# Egypt Energy Mix

Graph 1: Primary Energy Mix - Egypt



ECEGA Graphs 2017, Data sourced from the BP Statistical Review of World Energy 2016

# Why Sustainable Energy



- ▶ Pollution Problem
- ▶ Clean Energy
- ▶ Alternatives to Fossil Fuels
- ▶ Fresh water shortage
- ▶ Development from what we have
- ▶ Above 80 similar programs in the USA and Europe.

# Importance of SEE

- ▶ Vision 2030:

- ▶ Expansion in Total Energy Generation from 50 GW to 120 GW
- ▶ New and Renewable Energy Component to reach 35%
- ▶ Solar and wind energy to reach 42 GW

- ▶ International Standards:

- ▶ Each new MW create between 5 to 15 job opportunities
- ▶ Assuming 1/3 of created job opportunities are for Energy Engineers there is a need of 140,000 Energy Engineers

# Examples of Potential Job Opportunities for SEE Graduates

- ▶ Ministry of Electricity and Energy
- ▶ New and Renewable Energy Authority
- ▶ Holding Company For Water & Wastewater
- ▶ Compounds and Tourist Resorts
- ▶ Factories working in the field of HVAC
- ▶ New Cities Authority
- ▶ Universities and Schools and Educational Institutions
- ▶ Heavy and light Industries (Energy Intensive Industries)
- ▶ Private Sector working in the field of renewable energy
- ▶ Energy Service Companies
- ▶ Energy Managers in every factory according to new electricity law

**MTHN001**  
Intr. To linear Alg  
& analytic geom.  
3 5

**MTHN002**  
Calculus I  
3 5

**PHYN001**  
Mech, Osci, Wav  
& Thermo  
3 5

**MDPN001**  
Engineering  
Graphics  
3 5

**MECN001**  
Mechanics-I  
2 4

**GENN004**  
Computers for  
Engineers  
2 4

**GENN005**  
Technical Writing  
2 2

**MTHN003**  
Calculus II  
3 5

**PHYN002**  
Electricity and  
Magnetism  
3 5

**CHEN001**  
Chemistry  
3 5

**MDPN002**  
Fund of Manuf.  
Engineering  
3 5

**MECN002**  
Mechanics-II  
2 4

**GENN003**  
Basic Eng. Design  
2 2

**GENN001**  
History of science  
and Eng.  
1 1

**MTHN102**  
Calculus & Linear  
Alg  
3 5

**MEPN101**  
Fundamentals of  
Thermodynamics  
3 5

**MDPN132**  
Material Science  
3 5

**MEPN202**  
Fluid Mechanics  
for Mech. Eng. I  
3 5

**MDPN161**  
Stress Analysis  
2 3

**GENN102**  
Fundamentals of  
management  
2 2

**GENN201**  
Comm. and  
Present. Skills  
2 2

**MTHN103**  
Differential  
Equations  
3 5

**MEPN103**  
Engineering  
Thermodynamics  
3 5

**GENN210**  
Risk Manag. and  
Environment  
2 2

**MEPN224**  
Fluid Mechanics  
II  
3 5

**EPMN101**  
Electrical Eng.  
Fundamentals  
3 5

**CVEN125**  
Civil Engineering  
3 5

**MTHN201**  
Numerical  
Analysis  
3 5

**MEPN203**  
Fundamentals of  
Combustion  
Systems  
2 4

**EPMN293**  
Industrial  
electronics  
2 2

**MEPN301**  
ICE (Theory and  
development)  
3 5

**MEPN302**  
Applied Control  
Technologies for  
Energy System  
2 3

**MDEN280**  
Engineering  
Seminar  
1 1

**MCNN326**  
Heat Transfer  
3 5

**MDEN281**  
Industrial  
Training-1  
1 1

University Courses

College Courses

Discipline Courses

Major Courses

# Available Infrastructure and laboratory facilities and additional needs and requirements

- ▶ Flat plate solar water heater simulator with a USB connection to PC.
- ▶ Parabolic trough solar thermal concentrator (with PV tracking) connected to water heat exchanger and controlled by PC.
- ▶ Permanent magnet 1500 Watt wind turbine installed on the building roof and connected to control box and battery at the Laboratory.
- ▶ Wind turbine test bench including 500 W wind turbine and air blowers with inverter, measurement, battery and control modules.
- ▶ PV/fuel cell/electrolyser unit for measuring characteristics and system efficiency.
- ▶ PV module with solar simulator and PV panels of different types

# Available Infrastructure and laboratory facilities and additional needs and requirements

- ▶ Heat transfer bench for measurement of conduction, convection and thermal radiation on flat plates and cylindrical shells.
- ▶ Meteorological stations for solar and wind resources assessment.
- ▶ Biodiesel fuel production unit from used vegetable oils.
- ▶ Parabolic Trough Concentrator Prototype Loop.
- ▶ Evacuated Tube Solar Water Heater with Heat Pipe
- ▶ Heat Exchanger Laboratory







# Overview of the courses offered

Category	Freshman	Sophomore	Junior	Senior-1	Senior-2	Total Credits	%
Humanities and Social Sciences	3	2	6	0	2	13	7.6
Basic Sciences	22	9	4	2	0	37	21.7
Engineering Sciences	5	18	16	20	0	59	34.7
Computer and Computer Applications	3	2	4	5	3	17	10.0
Applied Engineering Sciences	0	0	0	6	23	29	17.1
Project and Practice	0	4	4	3	4	15	8.9
<b>Total</b>	<b>33</b>	<b>35</b>	<b>34</b>	<b>36</b>	<b>32</b>	<b>170</b>	<b>100</b>
University Requirements	5	4	8	2	0	19	11.2
College Requirements	28	9	4	0	4	45	26.5
Discipline Requirements	0	22	22	28	0	72	42.3
Major Requirements	0	0	14	6	28	34	20.0
<b>Total</b>	<b>33</b>	<b>35</b>	<b>34</b>	<b>36</b>	<b>32</b>	<b>170</b>	<b>100</b>

# Conclusion

- ▶ Need for Program in the labor market has been demonstrated
- ▶ Existing image and strong brand for the Faculty of Engineering of Cairo University in the field
- ▶ Infrastructure to start the program today is available and potential to further development is possible
- ▶ Best team of Professors and Lecturers in Egypt and the region.



Thank you